

**EFFECTIVENESS OF DIGITAL EDUCATION APPROACHES
TO IMPROVE KNOWLEDGE, ATTITUDE, AND PRACTICE
TOWARDS SALT INTAKE IN A SAMPLE OF UNITED ARAB
EMIRATES POPULATION**

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Dedication

*This thesis is dedicated to the soul of my daughter, the angel "Dana" in
Heaven.... May Allah unite us with her in Heaven.... (16.02.2018)*

Amen



Acknowledgments

“No duty is more urgent than that of returning thanks.” James Allen (1864 – 1912)

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List of Abbreviations

AMI	Acute myocardial infarction
AMDR	Acceptable Macronutrient Distribution Range
BMI	Body mass index
BP	Blood Pressure
CDC	Centres for Disease Control
CHD	Coronary heart disease
CRD	Chronic respiratory diseases
CVD	Cardiovascular Diseases
CVI	Content validity index
CVR	Content validity ratio
DAGs	Dietary Guidelines for American for food groups
DALYs	Disability-adjusted life years
DI	Daily intake
EMR	Eastern Mediterranean Region
EMRO	Eastern Mediterranean Region Office
ESMA	Emirates Authority for Standardization & Metrology
FDA	Food and Drug Administration
FFQ	Food frequency Questionnaire
GBD	Global Burden of Disease
GCC	Gulf Cooperation Countries
GRAS	Generally recognized as safe
HTN	Hypertension
ICP-OES	Inductively Coupled Plasma/Optical Emission Spectrometry
IOM	Institute of Medicine
KAB	Knowledge, Attitude, and Behaviour

KAP	Knowledge Attitude Practice
KSA	Kingdom of Saudi Arabia
LASH	Lebanese Action on Sodium and Health
LMICs	low- and middle-income countries
MENA	Middle East and the North African
MOHAP	Ministry of Health and Prevention
NCD	Non-Communicable Diseases
NDNS	National Diet and Nutrition Survey
PABA	Para-aminobenzoic acid
PAHO	Pan American Health Organization
PPE	Personal protective equipment
REC	Research ethics committee
RR	relative risk
SD	Standard deviation
SDG	Sustainability Development Goal
SE	Standard error
SPSS	Statistical Package for the Social Sciences
TRIPS	Trade-related aspects of intellectual property rights
UAE	United Arab Emirates
UAEU	United Arab Emirates University
UK	United Kingdom
UOS	University of Sharjah
UREC	University research ethics committee
WHO	World health organization

Glossary/Definitions

Arabic/Pita bread	Is a family of yeast-leavened round flatbreads baked from wheat flour, common in the Mediterranean, Middle East, and neighbouring areas. It includes the widely known version with an interior pocket, also known as Arabic bread. ingredients include flour, yeast, salt and sugar.
Basmati rice	Is a variety of long, slender-grained aromatic rice which is traditionally grown in India, Pakistan, and Nepal.
Chicken stock cubes	Also, sometimes called chicken bouillon cubes, are small blocks of dried, highly concentrated chicken stock which can be rehydrated for use in recipes that call for liquid stock. In addition to chicken extract, stock cubes also usually contain salt and various seasonings. Usually amount of sodium per one serving size of 1 cube (4g) ranged 800-950 mg.
Iranian bread	Also, known as Persian bread or Taftoon bread, is a leavened flour bread from Iranian and common in Afghanistan and Pakistan ingredients include flour, yeast, salt and sugar.
Manakish	Is a popular Levantine food consisting of dough topped with thyme, cheese, or ground meat, similar to a pizza, it can be sliced or folded, and it can be served either for breakfast or lunch.
Egyptian rice	A common name in Arabian Gulf countries for short slender-grained rice which is traditionally grown in Egypt.

Preface

Published Works

I- From Ph. D. study

- Jarrar, A. H., Al Dhaheri, A. S., Lightowler, H., Cheikh Ismail, L., Al-Meqbaali, F., Bataineh, M. F., Alhefeiti, A., Albreiki, M., Albadi, N., Alkaabi, S., & Thondre, P. S. (2022). Using Digital Platform Approach to Reduce Salt Intake in a Sample of UAE Population: An Intervention Study. *Frontiers in public health*, 10, 860835. <https://doi.org/10.3389/fpubh.2022.860835>

II- Related to the methodology of the Ph.D. study

- Jarrar, Amjad H., Lily Stojanovska, Vasso Apostolopoulos, Leila Cheikh Ismail, Jack Feehan, Eric O. Ohuma, Ala Z. Ahmad, Asma A. Alnoaimi, Latifa S. Al Khaili, Najah H. Allowch, Fatima T.A. Meqbaali, Usama Souka, and Ayesha S. Al Dhaheri. (2020). "Assessment of Sodium Knowledge and Urinary Sodium Excretion among Regions of the United Arab Emirates: A Cross-Sectional Study" *Nutrients* 12, no. 9: 2747. <https://doi.org/10.3390/nu12092747>
- Cheikh Ismail, L., Hashim, M., H Jarrar, A., N Mohamad, M., T Saleh, S., Jawish, N., Bekdache, M., Albaghli, H., Kdsi, D., Aldarweesh, D., & S Al Dhaheri, A. (2019). Knowledge, Attitude, and Practice on Salt and Assessment of Dietary Salt and Fat Intake among University of Sharjah Students. *Nutrients*, 11(5), 941. <https://doi.org/10.3390/nu11050941>

Conference Presentations

- 6th Dubai International Nutrition Congress on 24th October 2020 (oral presentation). Title of presentation “Piloting, Translation and Validation of the

Knowledge, Attitude and Practice (KAP) Questionnaire toward Salt Intake-Arabic Version”.

- 12th Virtual Asia Pacific Conference on Clinical Nutrition on 18 December 2020 (oral presentation). Title of presentation “Knowledge, Attitude, and Practice on salt and urinary sodium excretion among a sample of UAE population- Cross sectional study”.
- 7th Dubai International Nutrition Congress on 5th November 2021(oral presentation). Title of the presentation “Using Social media Approach to reduce salt intake in a sample of UAE population: Intervention study”

Awards

- Second prize for “Poster presentation year 2” 2019 Postgraduate Research Student Symposium-Oxford Brookes University, Oxford, United Kingdom, £100.

Abstract

Background: According to the World Health Organization (WHO), total deaths due to Cardiovascular diseases (CVDs) recorded are ranged 24-46 % in the Gulf Cooperation Council (GCC) countries. High blood pressure ($\geq 130/80$ mmHg), is considered one of the major risk factors for CVDs and salt reduction is an effective strategy to prevent adverse risk. This doctoral work aims to translate and validate the original validated- Knowledge attitude and practice (KAP) questionnaire toward salt into Arabic, to assess intake of sodium and potassium in healthy United Arab Emirates (UAE)-residents using 24-hour urinary sodium excretion which is considered the gold standard method recommended by WHO, to estimate salt intake, alongside their (KAP) toward salt. It also aims to evaluate the effectiveness of digital intervention approaches to deliver educational material regarding salt intake.

Methods: KAP questionnaire for salt intake was translated to Arabic and validated for the UAE population with 156 participants. Then, a cross-sectional study with 191 UAE participants evaluated the KAP towards salt intake along with measuring 24-hour urinary sodium and potassium. Food records were used to identify the highest sodium food sources consumed by participants. The effectiveness of digital educational material to reduce salt intake delivered via weekly short WhatsApp messages versus fortnightly brochure email attachment was tested in a randomised controlled parallel study (N= 121). Forty participants from the two intervention groups were later interviewed retrospectively to provide insights into the educational material and their delivery methods.

Results: The internal reliability for the Arabic KAP questionnaire was confirmed with Cronbach's α exceeding 0.7 and validity was confirmed by content validity ratio and construct validity. The mean urinary sodium and potassium were 2816.2 ± 675.7 and

1948.7± 473.1 mg /day, respectively, which were significantly higher in sodium and lower in potassium compared with the WHO recommendation. Compared to the control, sodium intakes decreased significantly in both the WhatsApp and e-mail groups with improvements in salt intake-specific food and health related knowledge. Qualitative analysis revealed that 95% of the interviewees preferred receiving digital education through WhatsApp over the email. Nonetheless, 35 out of 40 identified benefits from the educational material but pointed to the lack of low-salt bakery product in the market and recommended having dedicated low-salt aisles or labels for low-salt products.

Conclusion: The Arabic KAP questionnaire is a valid tool to assess KAP towards salt intake and this is the first study used validated Arabic KAP questionnaire. Two-thirds of the study population exceeded WHO recommendation for salt intake with poor food-related knowledge. Digital platforms could be an effective tool for providing awareness on salt intake in the UAE region with WhatsApp being preferable over email communication. The lack of low salt alternatives was indicated as the main barrier for lowering salt intakes. Salt alternatives, their visibility and availability can be recommended in future studies to measure their effectiveness in salt reduction in this part of the world. This study also highlighted important of nutrition education to improve KAP toward salt intake and reduce intake if salt intake in sample of UAE population.

Keywords: Digital education platform, 24-hour urinary sodium and potassium, KAP questionnaire, United Arab Emirates, Validity and Reliability

Chapter 1

Introduction & Review of Literature

1.1. Introduction

The World Health Organisation (WHO) defined Noncommunicable diseases (NCDs), as chronic diseases, that tend to be of long duration and are the result of a combination of genetic, physiological, environmental, and behavioural factors (WHO, 2021; Al-Jawaldeh *et al.*, 2021). The main types of NCDs are cardiovascular diseases (such as heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), and diabetes. The NCDs contribute to more than 30 million deaths annually (WHO, 2010).

The principal risk factor for cardiovascular diseases (CVDs) is high blood pressure (HBP) ($\geq 130/80$ mmHg), (WMA, 2020), with excessive sodium intake being recognized as a significant contributor to both HBP and CVDs mortality (He, Li and MacGregor, 2013b). Based on the recent Global Burden of Disease (GBD) study, HBP was found to account for 10.4 million deaths and 218 million disability-adjusted life years (DALYs) in 2017, while excess sodium intake contributed to 3.2 million deaths and 70 million DALYs in the same year (Afshin *et al.*, 2019; IHME, 2017).

The Eastern Mediterranean Region (EMR) showed that CVDs contributed to the loss of nearly 33 million years of life due to premature mortality or disability, and more than 1.3 million deaths, thus accounting for approximately one-third of all deaths in the region (IHME, 2017). HBP ($\geq 130/80$ mmHg) was the most important risk factor for CVDs in the EMR and that high sodium intakes were amongst the leading dietary risk factors. Salt intake in the EMR is high, with an average intake of >12 g per person

per day (Alhamad *et al.*, 2015), which is above than WHO recommendation of sodium intake.

According to the World Health Organization (WHO), total deaths due to CVDs recorded are 46 percent in the Kingdom of Saudi Arabia (KSA), 41 percent in Kuwait, 33 percent in Sultanate of Oman, 30 percent in the UAE, 26 percent in Bahrain, and finally 24 percent in Qatar (Alhamad *et al.*, 2015). Various risk factors can contribute to CVDs such as smoking, alcohol, inactivity, obesity, family history, stress, HBP, and diet (Wilson, 2018).

Salt reduction appeared to decrease CVDs risk, meta-analysis with Thirty-four trials (3230 participants) (He, Li and MacGregor, 2013b), showed that the mean reduction in urinary sodium (reduced salt v usual salt) with -4.4 g/day salt, was associated with the mean change in blood pressure of -4.18 mm Hg (95% confidence interval -5.18 to -3.18 , $I^2=75\%$) for systolic blood pressure and -2.06 mm Hg (-2.67 to -1.45 , $I^2=68\%$) for diastolic blood pressure. While a reduction in 24-hour urinary sodium of -6 g/day salt was associated with a fall in systolic blood pressure of 5.8 mm Hg (2.5 to 9.2 , $P=0.001$).

Population salt reduction is considered a ‘best buy’ intervention for the prevention of NCDs (Sarmugam and Worsley, 2014).

Sodium is a chemical element (mineral) and one of the two components of sodium chloride “table salt” with approximately 40% as sodium (Elliot and Brown, 2006). WHO reported the main source of sodium in our diet is salt, although it can come from other sources, such as sodium glutamate, used as a condiment in many parts of the world (WHO, 2020). Salt is also added to food during cooking (bouillon and stock cubes) or at the table (soy sauce, fish sauce and table salt) (WHO, 2020). Furthermore, WHO recommended 24-hour urinary sodium excretion as a golden

method to estimate sodium intake since 95% of consumed sodium is excreted in urine.

According to WHO, the recommended daily salt intake is <5 g for adults (equivalent to 2 g/day of sodium), while, the recommendation for potassium intake from food is 3510 mg/day for adults according to WHO (WHO, 2012c; WHO, 2012b). Moreover, WHO suggests an approximately one-to-one ratio of sodium to potassium, which is considered beneficial for health to reduce high blood pressure ($\geq$ 130/80 mmHg), and the risks of CVDs (WHO, 2020)

WHO/PAHO, proposed a new global target for 2022 and 2025 targets reflect an approximate 15% and 30% reduction in the sodium content of food products, respectively (PAHO 2021). This a 2022 goal was generated to encourage incremental reductions in the sodium content of foods, enhance consumer acceptance of lower sodium products, and allow time for research and development related to food product reformulation (PAHO 2021).

To date, there is only one cross sectional study that used 24-hour urinary sodium excretion as a tool to assess salt intake in UAE in 2015/16 (Jarrar et al., 2020) with no intervention studies to reduce salt intakes in the Arab world, the GCC, or the UAE. Therefore, this study aimed to measure sodium and potassium intakes using the PAHO/WHO protocol (Campbell et al., 2010) along with an Arabic-KAP questionnaire, among a group of healthy residents of the United Arab Emirates. In addition to assessing the effectiveness of using digital education materials as intervention approaches for 6-weeks to reduce salt intakes, using weekly short WhatsApp messages versus fortnightly brochure email attachment. Study objectives are:

- Validate Arabic version of the KAP questionnaire and calculate both internal and external reliability of the Arabic KAP questionnaire

- Measure 24-hour urinary sodium and potassium excretions along with KAP questionnaire according to PAHO/WHO protocol.
- Measure effectiveness of digital educational material to reduce salt intake and increase potassium intake delivered via weekly short WhatsApp messages versus fortnightly brochure email attachment.
- Individual in-depth interviews, for the intervention groups to assess the benefits of educational material, preferred Digital platform, feasibility of implementation/barriers to reducing salt intake, and interviewee's suggestions.

1.2. Review of literature

1.2.1. NCDs, prevalence's and risk factors

People of all age groups, regions, and countries are affected by NCDs, although, these conditions are often associated with older age groups. However, evidence shows that NCDs have attributed to more than 15 million of all deaths, which occurred between the ages of 30 and 69 years between 1990 to 2015 as reported by Global Burden of Disease Study (GBD) in 2015 (IHME, 2017; WHO, 2021). Of these "premature" deaths, 85% are estimated to occur in low- and middle-income countries. Children, adults, the elderly are all vulnerable to the risk factors contributing to NCDs, whether from unhealthy diets, physical inactivity, exposure to tobacco smoke, or the harmful use of alcohol (WHO, 2021). Modifiable behaviours, such as tobacco use, physical inactivity, unhealthy diets, and the harmful use of alcohol, all increase the risk of NCDs.

About 4.1 million annual deaths have been attributed to excess salt/sodium intake globally (IHME, 2017). More than half of the 3.3 million annual deaths attributable to alcohol use are from NCDs, including cancer and 1.6 million deaths

annually can be attributed to insufficient physical activity (IHME, 2017). Metabolic risk factors contribute to four key metabolic changes that increase the risk of NCDs

- Raised blood pressure
- Overweight/obesity
- Hyperglycemia (high blood glucose levels)
- Hyperlipidemia (high levels of fat in the blood)

In terms of attributable deaths, the leading metabolic risk factor globally is elevated blood pressure (to which 19% of global deaths are attributed) (IHME, 2017), followed by overweight and obesity, and raised blood glucose. Despite the rising risk factor exposure and NCD mortality across the Middle East and the North African (MENA) region, the responses from public health policy entities in these countries have been slow and appear discordant with the social, economic, and political circumstances in each country (Aggarwal *et al.*, 2020).

NCDs such as cardiovascular diseases, cancer, and diabetes represent up to one-third of the current disease burden in the MENA region. The CVDs burden has remained relatively stable between 2000 and 2015 rising from 17.5% of all DALYs to 18.9% (Aggarwal *et al.*, 2020). The burden of CVDs is twice that of Cancer, the burden of the latter has increased from 8.6% to 10.2% of all DALYs in the same period (Aggarwal *et al.*, 2020). Diabetes rose from 2.5% in 2000 to 4.3% of all DALYs in 2015 (Aggarwal *et al.*, 2020).

1.2.2. Nutrition transition and NCDs in the Gulf Cooperation Council (GCC) and the United Arab Emirates (UAE)

The Gulf Cooperation Council (GCC) includes six countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. These countries, have experienced a rapid

transition from a traditional semi-urbanized life to a modern and urbanized society following major discoveries of oil since the 1960s (International Monetary Fund 2009). Dietary changes were among them and included frequent snacking (Amine and Samy 1996; Musaiger and Radwan 1995; Ng et al., 2011), the replacement of traditional foods with energy-dense fast foods, and water with soft drink (Amine and Samy 1996; Kerkadi 2003; Musaiger and Abuirmeileh 1998; Ng et al., 2011; Alhamad *et al.*, 2015) and low fruit and vegetable consumption (Rabbia et al 2004, UAE-GSHS 2005, Ng et al., 2011). In addition, reduced physical activity due to inactive occupations, rare participation in sports and sedentary leisure have been blamed (Rabbia et al 2004, UAE-GSHS 2005, UAEHALS 2000, Wasfi et al 2008)

Factors such as population's sedentary lifestyle, high blood pressure ($\geq 130/80$ mmHg), (Figure 1.1) and obesity (Figure 1.2) are known to be major contributing risk factors to NCDs (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). Thus, it is not surprising that CVDs is the main cause of morbidity and mortality in the Gulf region. The estimated total deaths in GCC countries caused by NCDs range between 65% and 78%, with the highest estimates in Bahrain and Saudi Arabia and the lowest in Oman and Qatar (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). In the Kingdom of Bahrain, according to the WHO, CVDs account for 26% of the total deaths (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). While in Kuwait WHO reported that CVDs account for 41% of total deaths (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). In the Sultanate of Oman, according to the WHO, CVDs account for 33% of total deaths (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). Furthermore, in Qatar, CVDs account for 24% of total deaths according to WHO (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015). While CVDs account for 46% of the total deaths in Saudi Arabia and 30% of the total deaths in the UAE according to WHO (WHO, 2017d; WHO, 2018b; Alhamad *et al.*, 2015).

In 2014, the GCC Executive Board of Health Ministers meeting convened in Kuwait to discuss reducing the growing burden of NCDs in the region. The main risk factors addressed were reducing salt and fat intake to meet the 2025 targets set by WHO. This meeting urged countries in the region to develop a framework of action with indicators that can be adopted, implemented, monitored, and evaluated. The main outcome of this meeting was the release of the Kuwait Declaration for the Control of Non-Communicable Diseases (WHO, 2017d) in which the Member States agreed to commit to its recommendations. The main two actions adopted were to reduce salt content of bread gradually by 20-30% and to build a partnership with the private sector to facilitate salt and fat reduction in the GCC.

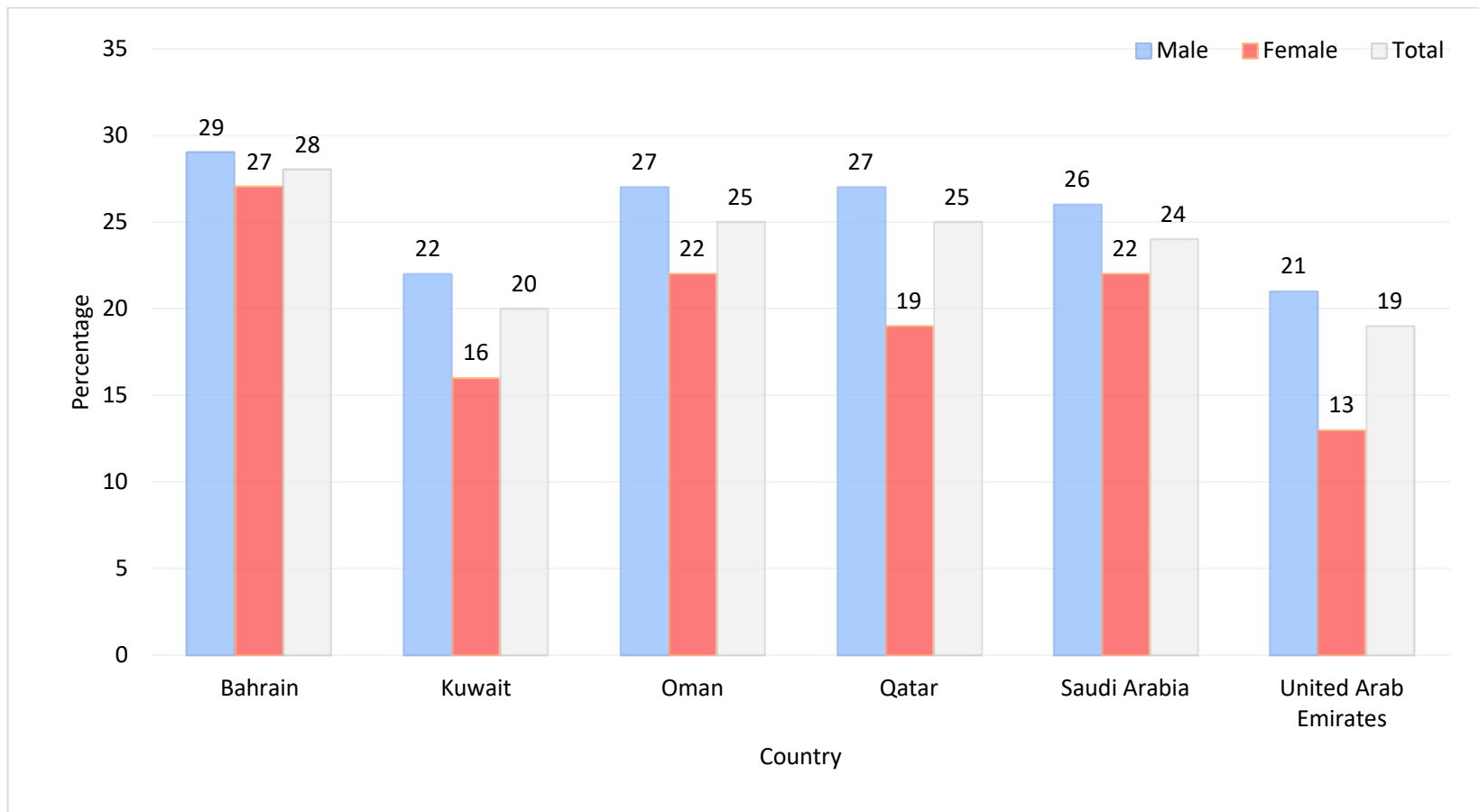


Figure 1. 1 Prevalence of high blood pressure in GCC countries. (GCC: Gulf Cooperation Council), (Alhamad et al., 2015)

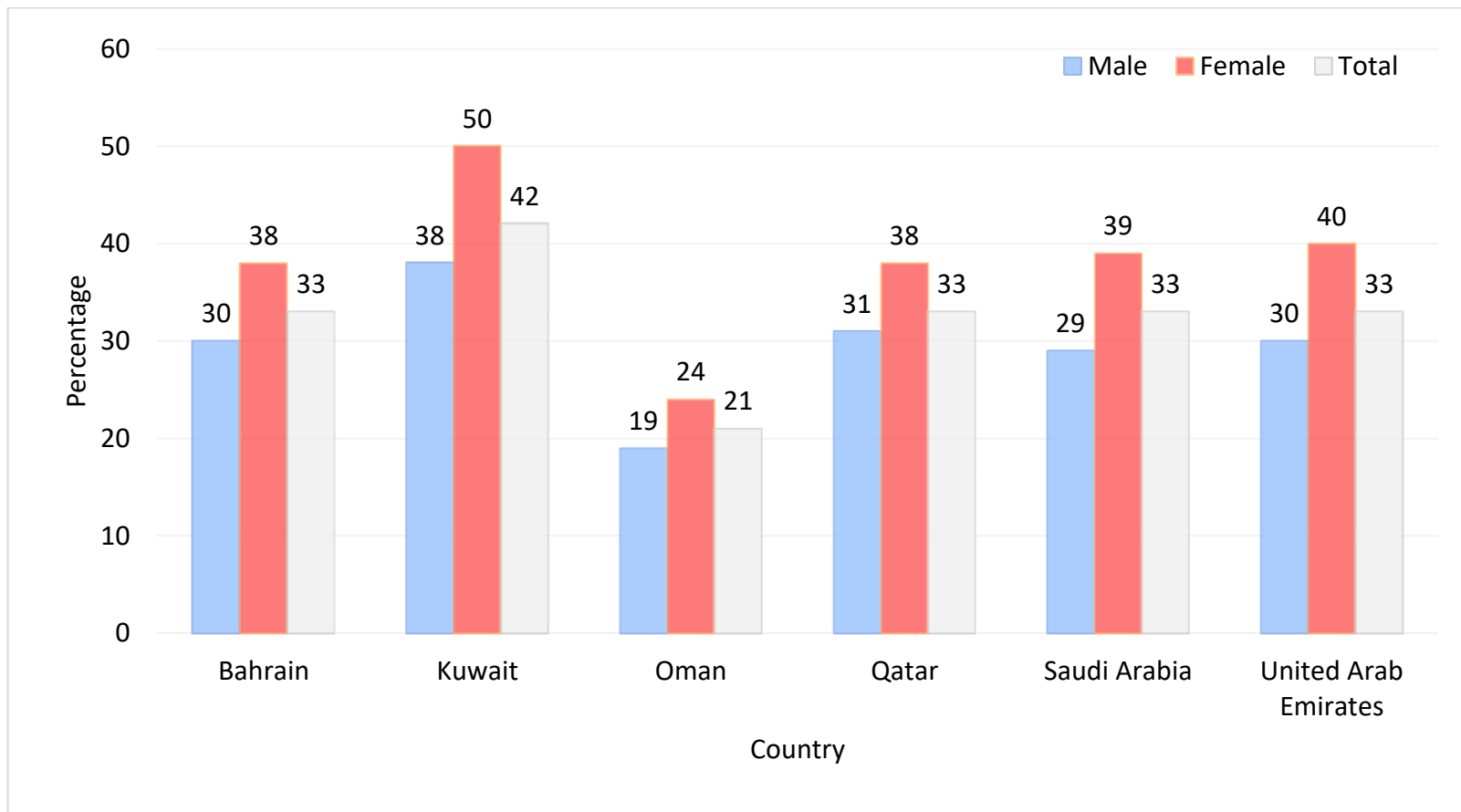


Figure 1. 2 Prevalence of obesity in GCC countries. (GCC: Gulf Cooperation Council), (Alhamad et al., 2015)

1.2.2.1. Hypertension and NCDs in UAE

The United Arab Emirates is a federation of 7 Arab states often abbreviated as the UAE. The country lies along the Arab Gulf, and is neighboured by Oman and Saudi Arabia. (Worldometers.info, 2021). UAE can be divided into three geographical zones/area; Northern part which includes 6 Emirates (Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah), Western part Abu Dhabi and Eastern part Al Ain (UAE Population Statistics 2022). It is worth mentioning that the Emirate of Abu Dhabi accounts for approximately 87% of the total land area of UAE (UAE Population Statistics 2022).

The increasing burden of NCDs in the UAE constitutes a huge public health challenge, and it is associated with tremendous social, economic, and developmental impact. NCDs – mainly cancer, diabetes, and chronic respiratory disease – attribute to 77% of all deaths in the UAE, and the likelihood of dying prematurely (before the age of 70) from NCDs with 17% (WHO, 2018b). Moreover, a report on the mortality statistics for the UAE indicated that CVDs accounts for more than 25-29% of all deaths in the Emirate of Abu Dhabi (Loney *et al.*, 2013).

Bhagavathula *et al.* (2021) a systematic review and meta-analysis were conducted to summarize the existing knowledge regarding the prevalence, awareness, treatment, and control of hypertension in the UAE. Relevant published articles from 1 January 1995 to 31 August 2021 were included. Population-based prospective observational studies conducted among healthy adult subjects living in the UAE that defined hypertension using the guidelines-recommended blood pressure (BP) cut-offs $\geq 130/80$ mmHg or $\geq 140/90$ mmHg were considered. Of 1038 studies, fifteen cross-sectional studies were included for data extraction involving 139,907 adults with a

sample size ranging from 74 to 50,138 and with cases defined as blood pressure $\geq 140/90$ mmHg as shown in Table 1.1. The pooled prevalence of hypertension was 31%, and a higher prevalence was observed in Dubai 37%, than in the Abu Dhabi region 29%, and in multicenter studies 24%. The level of awareness was only 29%, 31% for treatment, and 38% had controlled BP ($< 140/90$ mmHg). Conclusion: This study revealed a high prevalence of hypertension with low awareness and suboptimal control of hypertension.

Table 1. 1 Blood pressure categories in UAE¹

Blood pressure categories	Description
Normal	Less than 120/80 mm Hg
Elevated	Systolic between 120-129 mm Hg and diastolic less than 80 mm Hg
Stage 1	Systolic between 130-139 mm Hg or diastolic between 80-89 mm Hg
Stage 2	Systolic at least 140 mm Hg or diastolic at least 90 mm Hg

¹ (Bhagavathula *et al.*, 2021; Cheikh Ismail *et al.*, 2019)

A study conducted by Al-Maskari *et al.* in 2007 on the UAE population reported that the prevalence of hypertension was about 35%, with 34% having dyslipidaemia (Al-Maskari, El-Sadig and Norman, 2007). In addition, a report by the

The Ministry of Health and Prevention (MOHAP) in UAE revealed that CVDs are the leading cause of mortality in the UAE (Razzak *et al.*, 2018b). The UAE has one of the highest age-standardized death rates for CVDs, at 204 in females and 309 in males per 100,000 (Loney *et al.*, 2013), when compared to North America at a rate of 143 in females and 204 in males per 100,000, and Western Europe at a rate of 132 and 187 per 100,000 in females and males, respectively (Roth *et al.*, 2017). UAE response to NCD

The Ministry of Health and Prevention (MOHAP) in UAE, in partnership with national stakeholders, and with technical support from international partners, such as WHO, WHO/EMRO, and GCC, developed and implemented the National Agenda Targets 2021 and National Multisectoral NCDs Action Plan (Fadhil, Belaila and Razzak, 2019). The UAE, adopted a multidimensional approach to NCDs prevention and control, with active stakeholder participation (Fadhil, Belaila and Razzak, 2019).

The UAE National Agenda 2021 emphasizes the importance of prevention to reduce NCDs morbidity and mortality and to promote a healthy lifestyle (Fadhil, Belaila and Razzak, 2019). The agenda has a set of performance indicators and targets for each of the six priority areas:

- A 25% relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases.
- A 10% relative reduction in prevalence of insufficient physical activity
- A 30% relative reduction in mean population intake of salt/sodium
- A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years
- A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure according to national circumstances
- Halt the rise in diabetes and obesity

1.3. Sodium & potassium: types, content and WHO recommendations

1.3.1. Sodium and food sources

Sodium is the principal cation in extracellular fluid in the body and is an essential nutrient necessary for the maintenance of plasma volume, acid-base balance, transmission of nerve impulses, and normal cell function (Strazzullo *et al.*, 2014). In healthy individuals, nearly 100% of ingested sodium is absorbed during digestion, and urinary excretion is the primary mechanism for maintaining sodium balance (Holbrook *et al.*, 1984). Therefore, WHO considered the 24-hour urinary sodium excretion as the gold standard method to estimate sodium intake (Sadler *et al.*, 2011; Othman *et al.*, 2019).

Sodium and chloride are the chemical components of common table salt and the percentage of sodium reached to 38-40% of tables salt with equivalency 2.5 (Elliot and Brown, 2006). However, sodium can be found in other forms, and the primary contributors to dietary sodium consumption depend on the cultural context and dietary habits of a population (Brown *et al.*, 2009). Sodium is found naturally in a variety of foods, such as milk, meat, and shellfish.

It is often found in high amounts in processed foods, such as bread, crackers, processed meats, and snack foods (FAO, 1972; Blair *et al.*, 2011). Moreover, the sodium contents of foods may change according to the processing of the food (Table 1.2).

Table 1. 2 Sodium content of some foods in unprocessed and processed forms

Food item ¹	Description	Sodium content (mg/100 g)
Beef	Topside, roast, lean, and fat	48-63
Corned beef	Canned	950
Lamb	Roasted, lean and fat	71
Chicken	Roasted	78
Sausages and luncheon meat	Beef	1026
Pita bread		536-589
Iranian bread		1200-1588
Bran flakes	Bran flakes	1,000
Cheese	Cream regular, low and free fat	300-531
	Feta	1053
	Halloumi	1200
Fruits	Banana, dates, grapes	1.8-6
Chick-peas	Chick-peas dried, boiled in unsalted water	5
	Canned, re-heated, drained	220-291
New potatoes	Raw, boiled in unsalted water	9
	Canned, re-heated, drained	250
Peanuts	Plain	2
	Dry roasted	790
	Roasted and salted	400
Peas	Peas Raw, boiled in unsalted water	7
	Canned, re-heated, drained	250
Potato chips	Potato chips Homemade, fried in blended oil	12
	(French fries) Oven chips, frozen, baked	53
Salmon	Raw, steamed	110
	Canned	570
	Smoked	1,880
Sweet corn	On-the-cob, whole, boiled in unsalted water	1
	Kernels, canned, re-heated, drained	270
Tuna	Tuna Raw	47
	Canned in oil, drained	290
	Canned in brine, drained	320

¹ (Elliot and Brown, 2006; Gebhardt and Robin, 2002)

1.3.2. Potassium and food sources

Potassium is an essential nutrient needed for the maintenance of total body fluid volume, acid and electrolyte balance, and normal cell function (Young, 2012).

Normally, most ingested potassium is excreted via the urine, therefore the 24-hour urinary excretion is considered the recommended method to estimate potassium intake by WHO (Sadler et al., 2011; WHO 2020).

Potassium is commonly found in a variety of unrefined foods, especially fruits and vegetables (Table 1.3). Food processing reduces the amount of potassium in many food products, and a diet high in processed foods and low in fresh fruits and vegetables is often lacking in potassium (Webster, Dunford and Neal, 2010).

Table 1. 3 Examples of foods that contain potassium, and their approximate potassium content¹

Food group	Examples	Approximate potassium content (mg/100g)
Beans and peas	Cowpeas, pigeon peas, lima beans	700-1300
Cheese	Cream regular, low and free fat	121-167
	Feta	60
	Halloumi	88
Nuts	Hazelnuts, walnuts, cashew nuts, brazil nut	500-600
Green vegetables	Spinach, cabbage, parsley	550
Root vegetables	Carrots, onions, beetroot	200-250
Other vegetables	Tomatoes, cucumbers, lemon	150-300
Fruits	Bananas, dates, grapes	186-600
Lamb	Roasted, lean and fat	304
Chicken	Roasted	227
Sausages and luncheon meat	Beef	166
Pita bread		120
Iranian bread		220

¹ (Webster, Dunford and Neal, 2010; Gebhardt and Robin, 2002)

1.3.3. WHO recommendation for sodium and potassium intake

The recommended daily salt intake target is < 5 g for adults (equivalent to 2 g/day of sodium) while, the WHO recommendation for potassium intake from food is 3510 mg/day for adults to reduce high blood pressure ($\geq 130/80$ mmHg), and the

risks of CVDs, stroke, and coronary heart disease in adults (WHO, 2012c; WHO, 2012b). Moreover, WHO suggests an approximately one-to-one ratio of sodium to potassium, which is considered beneficial for health (WHO, 2020).

In 2012, the WHO recommended a 30% reduction in population salt intake as one of the global targets to reduce premature mortality from NCDs by 25% by 2025 (WHO, 2012c).

1.4. Salt intake

1.4.1. Methods for estimation of dietary sodium intake

Dietary sodium intake can be estimated by either dietary estimation or biochemical estimation (Aparna et al., 2020).

1.4.2. Dietary and biochemical estimation methods of sodium intake

24-hour dietary recall or food record method is designed to collect all food and drinks consumed in a period of 24-hour (Nieman, 2019). Food frequency questionnaire includes a limited list of foods and beverages and responses to indicate how often each item was consumed over a specified period of time. FFQ can capture typical intakes rather than a single day of intake (Nasreddine et al., 2014; Aparna et al., 2020). In general, FFQ does not include questions about salt added in cooking or at the table. A food record is a detailed description of the types and amounts of foods, beverages, and supplements consumed over a specified period of time (Nieman, 2019). It is more reliable but requires a high level of knowledge and motivation. It may require training about accurate record intakes (Nieman, 2019).

24-hour urine collection was used in this study. In healthy individuals, nearly 95-100% of ingested sodium is absorbed during digestion, and urinary excretion

is the primary mechanism for maintaining sodium balance (Holbrook et al., 1984). Therefore, WHO considered the 24-hour urinary sodium excretion the gold standard method to estimate sodium intake (Sadler et al., 2011; Othman et al., 2019). This method requires the collection of 24-hour. Comparably, spot urine collection uses spot urine and a specific equation to estimate 24 h sodium excretion (Brown et al., 2013; Tanaka et al., 2019). The variables used in these equations are age, weight, height, sex, spot urine sodium, spot urine potassium, and spot urine creatinine. (Brown et al., 2013; Tanaka et al., 2019; Aparna et al., 2020).

Perin et al. systematically reviews 124 articles on the methods used to estimate salt intake in different study designs. Of them, 60.5% used only biochemical measures, the 24-hour urinary sodium excretion was the predominant biochemical method (79.1%). While dietary assessment method was 26.6% with 36.4 % for FFQ and 12.9% reported the combined use of both methods. Interventional studies used mostly 24-hour urinary sodium excretion; while longitudinal studies used dietary assessment method (Perin et al., 2020).

1.4.2.1. Limitations of dietary sodium and biochemical estimation methods

Dietary estimation methods are considered to be more practical for conducting field surveys. However, there are certain limitations which include: quantifying accurately the amount of sodium chloride added during cooking (including at restaurants) and at the table (Aparna et al., 2020). Variation in the proportion of salt added during cooking that is retained by the food and variation in the sodium content of manufactured foods and in the sodium concentration of local water supplies (Aparna et al., 2020).

24-hour urinary sodium excretion has become the preferred method of obtaining data on sodium intakes in population surveys, but this method relies on

complete 24-hour urine excretion (Aparna et al., 2020; Sadler et al., 2011). Although spot urine is considered less burdensome and more visible, these equations are still relatively new and need more investigation, especially that the validity of these equation was performed on a specific population (Brown *et al.*, 2013; Tanaka *et al.*, 2019).

1.4.2.2. Assessing the adequacy of 24-hour urine collection

Different methods were used to assess the adequacy or completeness of 24-hour urine collections. These include urinary para-aminobenzoic acid (PABA), urinary creatinine, and self-reports (John *et al.*, 2016). The WHO/PAHO protocol for 24-hour urinary sodium excretion does not require any test to confirm the completeness of 24-hour urine collection, except self-report (Campbell *et al.*, 2010b). Self-report includes complete detailed data procedures, such as complete and detailed written and verbal instructions, starting and stopping collection of urine, reported missing urine, in addition, the total urine volume should be $\geq 500\text{ml}$ (Cogswell *et al.*, 2015). The most common biomarkers used to measure the completeness of 24-hour urine collection are PABA and creatinine (endogenous).

The PABA was first introduced as an excretion marker for the completeness of 24-hour urine in 1983. Bingham and Cummings in 1983 found that 93% of ingested PABA was recovered in 24-hour urine on average, when a single 80 mg PABA pill was taken with each main meal (Bingham and Cummings, 1983). Although PABA is considered the golden method for the completeness of 24-hour urine, it is often ignored in favour of other methods, because it requires taking pills on three occasions, knowing that many people do not like to take them. Even if knowing they are safe, they may not comply with taking the three pills. In addition, people who are on some medications or who use sunscreens cannot be part of the study since

PABA is known as a sunscreen agent in cosmetics and may give false recovery or increase excretion of PABA in urine (SCCP, 2006; Flindt-Hansen, Nielsen and Thune, 1988; Arancibia *et al.*, 1981). Arancibia and colleagues found that when PABA was given orally, 6-hours after administration, 66.9% of the administered dose had been excreted. While, 50.5% to 83.1% was excreted as an acetylated derivative (Arancibia *et al.*, 1981). However, when the sunscreen was applied with oral intake of PABA, the level of acetylated PABA excreted fluctuated between 69.1% and 90.2%. This means that the skin absorption of PABA corresponds to 1.6 to 9.6% in the urine output, which may differ according to the percentage of PABA in sunscreen that acts as a UV filter in cosmetic products (Flindt-Hansen, Nielsen and Thune, 1988). Moreover, amine-containing drugs such as sulphonamides, folic acid, paracetamol, phenacetin, and furosemide can also be detected and affect urinary excretion of PABA (Bingham and Cummings, 1983), in addition to age that may affect PABA urinary excretion. Jakobsen and colleagues found a gradual decline in PABA recovery with age, which cannot be overcome by advancing the dosage schedule (Jakobsen, Pedersen and Ovesen, 2003). The low PABA recovery in the elderly may cause rejection of the results (false negatives). Furthermore, with the currently recommended dosage schedule (PABA taken with the main meals) the risk of false-positive 24-hour urine collections prevails.

On the other hand, urinary creatinine does not require the participants to take pills to assure adequacy of 24-hour urine collection, such as in the case of PABA. A recent study conducted in the UK in 2018/19 among 565 participants using two methods to measure adequacy of 24-hour urine PABA recovery and consent of complete 24-hour urine (Ashford *et al.*, 2020). For participants who refused to take PABA tablets, a consent to complete 24-hour urine was sufficient to include them in

the study (Ashford *et al.*, 2020). Urinary sodium concentrations were affected by different analytical methods using PABA as a tool to measure the completeness of 24-hour urine. This included an adjustment using factors based on specific analytical methods used to measure PABA and its recovery percentage (Bates *et al.*, 2016), Many factors may affect urinary creatinine excretion such as gender, age, lean body mass, urine volume, physical activity, and protein intake. Therefore, the reference range for urinary creatinine is wide and reach 500 to 2000 mg/day, which is equivalent to 9 -26 mg/kg of body mass for females and 13-29 mg/kg of body mass for male (Chernecky and Berger, 2012; Goldman and Schafer, 2011). These reference ranges take into consideration gender, age, and body weight. Daily variation of protein intake contributes to 4-8% variation in 24-hour urinary creatinine (Mansuri and Moorjani, 2019).

The 24-hour urinary creatinine was almost similar among 8 volunteers, who consumed the same diet with differences reaching up to 4% (Bingham and Cummings, 1985). However, when the participants consumed 260 g of cooked meat per day, the urinary creatinine excretion increased by 23% (Bingham and Cummings, 1985). Moreover, Neubert and Remer reported that animal protein intake of 1.1 g/kg body weight may increase creatinine excretion by 5-9% (Neubert and Remer, 1998). All these studies confirmed that high protein intakes can affect 24-hour urinary creatinine. However, it is not a common practice to consume 260g cooked meat per day or consume 1.1g/kg body weight as animal protein, which may cause this increase in creatinine excretion. Therefore, it is better to advise the study population to maintain same food habits during the time of collecting urine samples. Moreover, when the vascular volume is low, such as in the case of dehydration, creatinine secretion increases in urine more than that predicted by the glomerular filtration rate, while

sodium reabsorption will increase and only a little will be excreted relative to the glomerular filtration rate (Titze, 2014; Wielgosz *et al.*, 2016). The differing regulation of creatinine and sodium urinary excretion makes creatinine at best a crude method of correcting a 24-hour urine estimate of sodium excretion for lost or excess urine collection (Titze, 2014; Wielgosz *et al.*, 2016).

The accuracy and usefulness of creatinine-based criteria to evaluate the completeness of 24-hour urine collection have been systematically reviewed (John *et al.*, 2016). The sensitivity of urinary creatinine can improve by combining creatinine excretion with body weight according to the sex. Moreover, the sensitivity of PABA can improve by measuring PABA by HPLC instead of the colorimetric method and making sure PABA pills are taken every 8 hours exactly within 24 hours.

In conclusion, most of the recent studies used urinary creatinine excretion as a tool to measure the adequacy of 24-hour urine. This method is easy and for most participants, it will not require any additional procedures or efforts. Moreover, most of the recent studies used this method to validate the use of spot urine to measure 24-hour urinary sodium excretion (Ardissino *et al.*, 2021; Mann and Gerber, 2019).

1.4.3. Global salt intake

A systematic review and meta-analysis included studies between 1989 and 2015 on the Australian population (n= 16836 participants) (Land *et al.*, 2018). All studies that used 24-hour urinary sodium excretion and dietary questionnaires as a tool to estimate sodium intake were included (Land *et al.*, 2018). They found that the mean salt intake was 8.7 g/day, while males tend to consume 10.1g/day and females 7.43 g/day. Salt consumption by Australian adults exceeds the WHO recommendation of 5 g/day.

A systematic review aimed to estimate the mean intake of salt in India during the period of 1986 to 2014 (Johnson *et al.*, 2017a). Different tools were used to collect the data for mean or median dietary salt intake in Indian adults aged 19 years and older. 18 cross-sectional surveys (n=225,024), 2 randomised trials (n=255); and 1 case control study (n=270) were included. The reported mean salt consumption in India was 10.98 g/day (95% CI 8.57-13.40), which is almost double the WHO recommendation for salt intake. Moreover, there was no evidence of a change in the intake of salt over time (p trend=0.08).

Thout *et al.* (2019) conducted a review aimed to identify the studies that have assessed salt intake among adult populations based upon the 24-hour urine collection. Studies published from January 2011 to September 2018 were searched for from MEDLINE, Scopus, and Embase databases using relevant terms. Of the 115 identified studies assessed for eligibility, 13 studies were included: Four studies were from Europe, and one each from the United States, Canada, Benin, India, Samoa, Fiji, Barbados, Australia, and New Zealand. Mean daily salt intake ranged from 6.75 g/d in Barbados to 10.66 g/d in Portugal, mean intake for these countries exceeded WHO recommendation for salt intake, Figure 1.3.

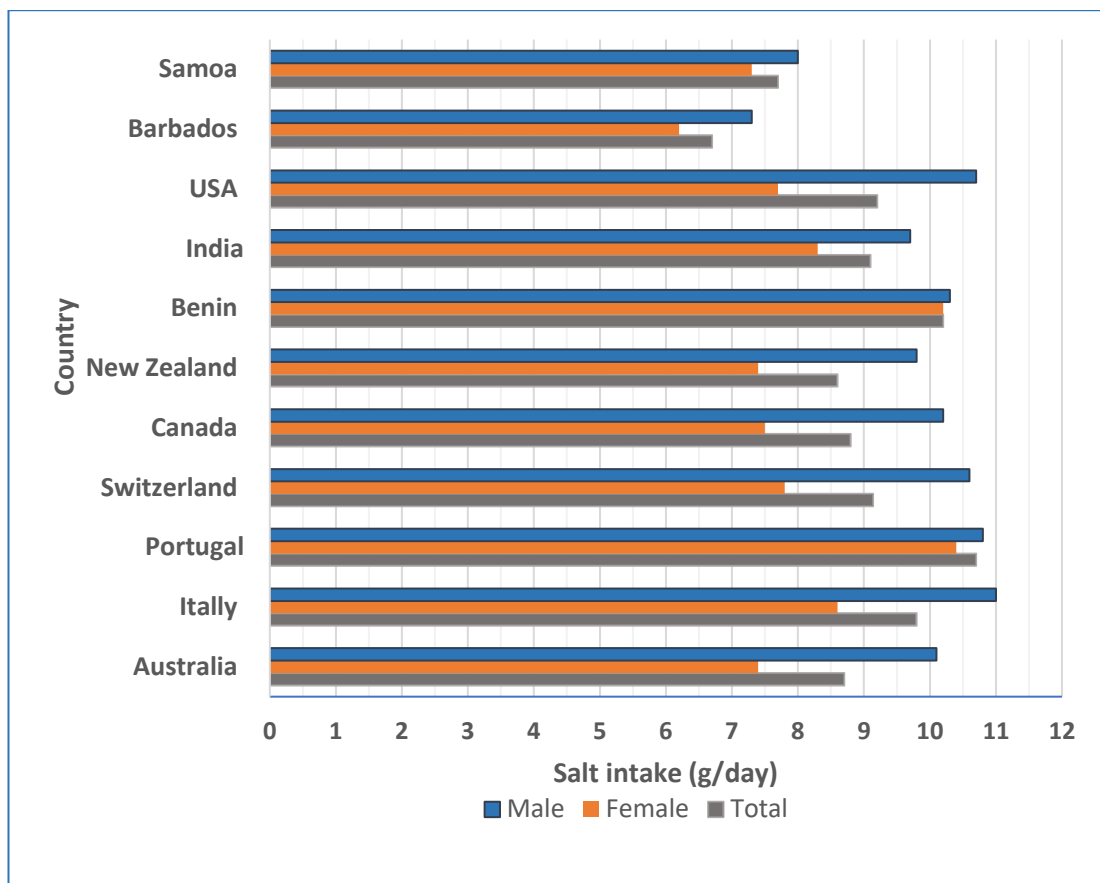


Figure 1. 3 Estimated salt intakes at the global level ((Thout et al., 2019)

When analysing urinary sodium excretion data, the 2018/19 report from the National Diet and Nutrition Survey (NDNS) in the UK showed an 8.4 g/day salt intake for adults aged 19 to 64 that is 40% higher than the government recommended maximum of 6 g/day (Ashford et al., 2020). Men were estimated to consume 9.2 g/day as opposed to 7.6 g/day for women (Ashford et al., 2020). No statistically significant changes in salt intake were seen between 2014 and 2018/19 and no significant overtime change ($p = .09$) since NDNS's first report (Ashford et al., 2020).

1.4.2. Salt intake in the Middle East

Powel's *et al.* (20013) conducted a systematic analysis of sodium intake levels worldwide, based on reported 24-hour urinary sodium excretion and dietary surveys.

Sodium intakes in countries of the Middle East and North Africa (MENA) region were high, ranging between 2.1 and 5.4 g/person/day for sodium which is equivalent to 5.25–13.5 g/person/day as salt. These levels exceed the levels reported from North America, Western Europe, Australia, sub-Saharan Africa, and Latin America. Based on this study, the countries with the highest levels of sodium intakes in the MENA region were Bahrain, the Islamic Republic of Iran, Jordan, Libya, Morocco, Qatar, Syrian Arab Republic, and Tunisia. While the lowest intakes were reported for Djibouti, Somalia, and Sudan. The average estimated sodium intake for the region was 3.9 g/person/day (9.75 g/person/day as salt), which is almost double the maximum intake level recommended by WHO.

Several studies were conducted in the Arab world to measure sodium and salt intakes. A study conducted by Al-Mawali et al. in Oman, which is one of the GCC countries, aimed to measure urinary sodium and potassium among 569 participants (193 men, 376 women) aged 18 years and older (Al-Mawali *et al.*, 2020). The mean salt intake for the population was 9.0 ± 4.9 g/day (9.6 ± 5.5 g/day for men and 8.7 ± 4.6 g/day for women), which is above the WHO recommendation for salt intake.

Almost 78% of the study population exceeded the WHO recommendation for sodium intake while for 24-hour urinary analysis, potassium was 2.36 ± 1.46 g/day (2.53 ± 1.45 g/day for men and 2.27 ± 1.46 g/day for women), which was lower than the WHO recommendations. The risk factor for CVDs for the Omani population is high due to the high intake of sodium and low intake of potassium.

Moreover, a cross-sectional study was conducted by Hanbazaza and Mumena in 2020, in two big cities in Saudi Arabia (Madinah and Jeddah) (Hanbazaza and Mumena, 2020). The study included 467 healthy participants aged 20-50 years, food

frequency questionnaire (FFQ) was used to estimate salt intake for the participants. The median sodium and salt intakes were 4.3 g/day and 10.7 g/day, respectively, which is almost double the WHO recommendation for salt intake. However, the main limitation of this study is the use of an FFQ instead of 24-hour urinary sodium excretion analysis, which is considered the golden standard method for sodium determination and is the acceptable tool according to the WHO (WHO, 2012c).

A study conducted in the UAE reported mean 24-hour urinary sodium and potassium excretion of 2713.4 ± 713 mg/day and 1803 ± 618 mg/day, respectively, which is significantly higher than the WHO recommendations for sodium (2300 mg/day) and lower for potassium (3150 mg/day) (Jarrar *et al.*, 2020). Moreover, two-thirds (67.4%) of the study participants exceeded the sodium guidelines, with males 2.6 times more likely to consume sodium excessively compared to females (Jarrar *et al.*, 2020).

A cross-sectional study was conducted in Jordan and included 103 participants aged 20 to 60 years (Alawwa *et al.*, 2018). The study results showed that the mean urinary sodium excretion was 4.1 g/day, (4.0 g/day for females and 4.3 g/day for males), which are equivalent to 9.8 g/day salt (9.6 for females and 10.3 for males). All sodium and salt readings were significantly above the current WHO recommendations (Alawwa *et al.*, 2018). Another study conducted in Iran included data from 30 provinces (Rezaei *et al.*, 2018). Spot urine was used as a tool to assess sodium/salt intake in Iran. The mean salt intake among the Iranian population was 9.52 g/day (95% confidence interval: 9.48–9.56). In this study, 41.2% of the population had salt intake at least two times higher than the level recommended by the WHO for adults (Rezaei *et al.*, 2018).

Two other studies were conducted in two North African Arab countries both studies used 24-hour urinary sodium excretion as a tool to assess sodium and potassium intakes. A study conducted in Tunisia in 2015 aimed to evaluate the sodium and potassium intake levels of the Tunisian population aged 25-64 years (Doggui *et al.*, 2021). The mean salt intake was 8.1 ± 2.7 g/day and more than 87.1% of the participants (89.8% for men vs. 84.9% for women; $p = 0.31$) exceeded the WHO recommendation of 5 g/day. Moreover, Na: K ratio for the study population was 2.4 ± 0.9 . Both high intake of sodium and high Na: K ratio increase the risks of CVDs (Doggui *et al.*, 2021). A cross-sectional study conducted in Morocco included 132 participants (Derouiche *et al.*, 2016). The mean urinary sodium, potassium, and creatinine excretions were 2779.1 ± 1334.9 mg, 1350.0 ± 642.8 mg, and 820.3 ± 381.2 mg, respectively. Data analysis revealed that 71.2% of the participants exceeds WHO recommendation.

All the studies conducted in GCC, and other Arab countries in Asia and Africa, in addition to Iran, showed the salt intake for these countries exceeded the WHO recommendation for salt intake (Table 1.4).

Table 1. 4 Estimated salt intake for some of the Middle East Countries

Country	Author	Mean salt intake (g/day)
Oman¹	Al-Mawali <i>et al.</i> , 2020	9.0
Jordan ¹	Alawwa <i>et al.</i> , 2018	9.8
UAE ¹	Jarrar <i>et al.</i> , 2020	6.8
Saudi Arabia (Madinah and Jeddah) ²	Hanbazaza and Mumena, 2020	10.7
Iran ¹	Rezaei <i>et al.</i> , 2019	9.5
Tunisia ¹	Doggui <i>et al.</i> , 2021	8.1
Morocco ¹	Doggui <i>et al.</i> , 2021	6.9

¹ Sodium assessed by 24-hour urinary sodium excretion

² Sodium assessed by Food Frequency questionnaire

1.5. Salt and CVD

A meta-analysis was conducted to estimate the effect of high sodium intake on CVD, using a random-effects model (Wang et al., 2020). A total of 616,905 participants were included from 30 reports, and 20 of these reports were also used for a dose-response meta-analysis. The risk of cardiovascular disease was used and adjusted by comparing individuals with low sodium intake and individuals with high sodium intake (Rate ratio: 1.19, 95% confidence intervals = 1.08–1.30). The finding of this meta-analysis suggested that there is a significant linear relationship between dietary sodium intake and CVDs risk. The risk of CVDs increased up to 6% for every 1 g increase in dietary sodium intake (Wang et al., 2020). The study concluded that a low-sodium diet should be encouraged and education regarding reduced sodium intake should be provided (Wang et al., 2020).

A systematic review and meta-analysis aimed to test the dose-response association of dietary sodium and sodium-to-potassium ratio with risk of stroke in adults aged 18 years or older included prospective and retrospective observational studies reporting risk estimates of stroke for three or more quantitative categories of dietary sodium or sodium-to-potassium ratio (Jayedi et al., 2019). Pooled relative risk (RR) was calculated using a random-effects model. Publication bias was tested. The pooled RRs of stroke were 1.06 (95%CI: 1.02, 1.10; I² = 60%, n = 14 studies) for a 1 gr/d increment in dietary sodium intake, and 1.22 (95%CI: 1.04, 1.41; I² = 60%, n = 5 studies) for a one-unit increment in dietary sodium-to-potassium ratio (mmol/mmol).

The risk of stroke increased linearly with increasing dietary sodium intake, and along with the increase in dietary sodium-to-potassium ratio. No evidence of a J/U-shaped association was found in the analyses of total stroke, stroke incidence, and

stroke mortality. In conclusion, higher sodium intake and higher dietary sodium-to-potassium ratio were associated with a higher risk of stroke. Reducing the dietary sodium-to-potassium ratio can be considered a supplementary approach in parallel with the decrease in sodium intake in order to decrease stroke risk (Jayedi et al., 2019).

1.6. Knowledge, attitude, and practice/ behaviour towards salt

1.6.1. Global knowledge, attitude, practice, and behaviour towards salt

A cross-sectional survey was conducted in 2015 among urban slum population of North India to measure knowledge, attitude, and practice (KAP) towards salt intake. This study included 300 participants aged 18-69 years using a standardized questionnaire (Bhattacharya, Thakur and Singh, 2018). Most of the study population (95%) consumed processed foods and 99% were not worried about salt levels in the food. About 31% of the participants reported that they always add salt before eating the food. Almost 85% of the participants reported that they always added salt during preparation and cooking of foods. The majority of participants (75.4%) reported “they just consumed right amount of salt”. Many participants (43%) did not know about the harmful effects of excess dietary salt. and 64% considered that lowering salt in their diet is not important. The research team reported very poor awareness toward salt intake among slum population of North India (Bhattacharya, Thakur and Singh, 2018).

A study was conducted among students of six universities in Europe and Asia in which 2459 students in total (42.7% males, median age 21 years) participated (Marakis *et al.*, 2021). This study aimed to assess and compare KAP related to salt and iodine among students, by using a self-administered questionnaire. The study included four universities from Europe (Germany, Greece, Poland, and Slovenia), and two universities from Asia (Sri Lanka and Taiwan). Although, participants from Europe

scored more regarding the salt recommendations for adults than those from Asia (7.9% vs. 3.6%, with $p < 0.05$), only 6.5% of all participants knew the correct salt recommendations. Moreover, 7.9% of participants added and/or used sauce and table salt with the significantly highest score for students from Greece and Sri Lanka. About, 38% of the students reported that they always add salt during cooking, and Sri Lanka university students reported significantly highest response (62.2%). Most of the students (68.1%) were able to identify high salt intake as a risk factor for hypertension, with the German university students scoring significantly highest (84.6%). Only 12.6% of all students were able to recognise processed foods as a major source of salt intake, with significant differences between European and Asian students (17.7% vs. 2.3%; $p < 0.001$). Most of the university students reported they rarely or never check food labels on the food package.

A systematic review collected information regarding KAP, and customer behaviour toward salt intakes (Sarmugam and Worsley, 2014). Most of the studies included were conducted in developed countries, mainly Australia, Canada, the USA, and the UK. While only three of the included studies were conducted in developing countries. In this review, many studies reported low knowledge of salt intake recommendations and low knowledge about the salt content of commonly consumed foods, except for knowledge of the diet-disease relationship. Several studies reported that participants believed that their salt intakes are equal or lower than national recommendations (Zhang *et al.*, 2013; Land *et al.*, 2018; Webster *et al.*, 2010) or were satisfactory (Newson *et al.*, 2013), despite the strong evidence that salt intake of most populations usually exceeds the recommended levels of salt intake. In addition, most of the participants in these studies were able to identify processed foods as having high

salt contents; however, almost less than 15% of them were able to recognize bread and cereals as high sources of sodium (Sarmugam and Worsley, 2014).

Moreover, several studies reported that not adding salt during food preparation, or at the table is an approach to reduce salt intake (Arcand *et al.*, 2016; Research, 2009). WHO adopted several strategies to regulate sodium intake (WHO, 2012c; WHO, 2013a):

- Dietary counselling- Individuals/Worksite/ Community.
- Mass media campaigns.
- Voluntary reformulation.
- Mandatory reformulation.
- Taxation or subsidies

According to WHO reports, the first step of any successful salt reduction campaign should include sufficient information about the local community to monitor and follow up progress of salt reduction (WHO, 2013a; WHO, 2020).

1.6.2. Knowledge, attitude, and practice/ behaviour toward salt in Arab countries

A cross-sectional study was conducted among 401 students from the University of Sharjah in the UAE, to assess KAP related to dietary salt intake (Cheikh Ismail *et al.*, 2019). Findings showed that most of the students were able to correctly describe the relationship between high salt intake and hypertension, cardiovascular diseases, water retention, and renal diseases. Furthermore, over 84% of study participants recognised that reducing salt intake would help improve both overall health status and blood pressure. Less than one-third of the students were able to correctly recognise pita bread, Iranian bread, and corn flakes as high sources of salt (23.4%, 30.7%, and 30.4%, respectively). While around 70% of the students were able to recognise

cheddar cheese, pickles, chicken cubes, and instant noodles as high sources of salt. Almost 40% of the University of Sharjah students reported that they tried to reduce salt before, and the same percentage reported that they used salt substitutes such as lemons and herbs. This study showed that students had poor knowledge related to food sources of sodium (Cheikh Ismail *et al.*, 2019).

Another study was conducted in the UAE and included 477 participants with a mean age of 37.31 ± 12.5 years (Jarrar *et al.*, 2020). This study aimed to measure KAP toward salt intake among the UAE population. Although two-thirds of the study population exceeded the WHO recommendation of salt intake, 62% reported that they just consumed the right amount of salt. The majority of the participants added salt during cooking (82.5%) and while eating (66%), and 75% identified processed food as a high source of salt. The results suggested that practices to reduce salt intake in the UAE population were poor.

Another cross-sectional study was conducted in Saudi Arabia in the two cities of Madinah and Jeddah in the Western region (Hanbazaza and Mumena, 2020). This study included 494 healthy participants aged between 20 and 50 years. The majority of the participants (95.0%) were able to identify that high salt intake adversely affects health; females scored higher than male participants with $p < 0.002$. In addition, most of the participants (91.0%) were able to recognise high salt intake as a risk factor of hypertension. However, only 9% of the participants were able to recognise correctly the WHO recommended amount of sodium intake. The majority of the participants (95%) added salt during cooking, while only 20% used table salt while eating. Although 45% of the participants reported that they tried to reduce salt intakes, only 3% tried to use alternatives for salt (Hanbazaza and Mumena, 2020).

In another Arab country, a cross-sectional study included 442 participants from nine supermarkets in Beirut-Lebanon by Nasreddine and colleagues (Nasreddine *et al.*, 2014). The gap between knowledge and attitude was documented with only 22.6% of participants identifying processed foods as the main source of salt, 55.6% discerning the relationship between salt and sodium, almost one-third of the participants recognised the daily limit of salt intake, and 44.7% reported being concerned about the amount of salt in their diet. Over 38% of the participants reported checking salt label content, while 43.7% reported that their food purchases are influenced by salt content, and 38.6% tried to buy low-salt foods. Most participants showed behavioural practices that increase salt intake with limited nutritional knowledge (Nasreddine *et al.*, 2014).

These studies, which were conducted in Arab Gulf and other Arab countries showed limited knowledge of food sources high in salt among participants, especially bread, cereals, in addition to some local foods. This highlights the need for intervention plans to increasing visibility and availability of low salt foods, as well as involving both community and industry in intervention plans to reduce salt intakes.

1.7. Initiatives to reduce salt consumption and their effectiveness

The WHO reported key measures to reduce salt consumption at the population level as below (Al Jawaldeh, Rafii and Nasreddine, 2018)

- To Identify the baseline level and main contributor of sodium/salt intake of the population.
- To set a national target for sodium/salt intake in line with the global target as part of a national multisectoral salt reduction plan.
- To establish sodium/salt reduction targets for each category of food and prioritizing the ones that contribute most to population intake.

- Working with food manufacturers to progressively reduce sodium/salt incrementally in their products, in line with agreed food group targets; working with restaurants and catering services to reduce the addition of salt during meal preparation.
- Establishing national food-based dietary guidelines that incorporate sodium reduction.
- Implementing information campaigns to raise consumer awareness of the need to reduce salt intake, and social marketing to impact consumers' behaviour.
- Creating an enabling environment for salt reduction through local policy interventions and promotion of “healthy food” in settings such as schools, workplaces, communities, and cities.
- Monitoring population sodium intake, sodium content of manufactured products, sources of sodium/salt in the diet, and consumer knowledge, attitudes and behaviours relating to the consumption of products containing sodium/salt, to inform policy.

Laura and colleagues summarize different strategies to lower sodium intake in the general population (Cobb, Appel and Anderson, 2012). While all these strategies have the potential to be effective on their own, a multi-factorial effort that includes several component strategies will have the greatest impact.

1.7.1. Strategy 1: Public education

The use of public education is not new, it was used as a tool to reduce the risk of blood pressure since the 1970s (IOM, 2010; Wyness, Butriss and Stanner, 2012). Awareness regarding the connection between sodium and high blood pressure increased from 12% in 1979 to 48% in 1984 (Cobb, Appel and Anderson, 2012). These

gains were sustained; however, by 2002, awareness declined to 39%, then to 33% by 2013 (Cobb, Appel and Anderson, 2012). The effectiveness of educational campaigns can be improved when conducted in conjunction with other intervention tools or strategies as done in the United Kingdom (UK), Finland, and the United State of America (USA). In the UK, the government launched an extensive education campaign in conjunction with the food industry focusing on the sodium content of packaged food. This combined volunteer work increased the number of people who reduce sodium intake by a third and the number of people checking labels for sodium doubled (Wyness, Butriss and Stanner, 2012).

Public education is one of the easiest strategies to implement; it does not require regulatory or legislative action, is relatively inexpensive, and is generally uncontroversial. However, given the pervasive high levels of sodium in the food supply, achieving sodium intake reduction is important for public health.

1.7.2. Strategy 2: Dietary counselling (DC)

It is one of the old approaches and is a common practice among physicians and healthcare providers. In the past, this practice was mainly for patients to help them manage responses to the disease (Appel *et al.*, 2003; Cabezas *et al.*, 2011). DC is not limited to patients, nor is counselling just limited to disease; it has also become a prevention tool and includes different techniques and approaches. New approaches include assessment of barriers, goal setting for dietary changes, and assessment of patients' readiness for behavioural change (Sarmugam, Worsley and Flood, 2014).

1.7.3. Strategy 3: Food labelling

Food labelling is used to help consumers choose healthier foods, particularly low sodium foods. However, consumers with low literacy and low nutritional knowledge often find these labels confusing (Rothman *et al.*, 2006).

In Finland, high salt warning labels were effective in the sodium reduction initiative. In addition, FOP was used to label foods with high-salt content, if the sodium levels are over a specified threshold. Daily sodium intake in Finland has been reduced by almost 1250 mg since 1979 (Pietinen *et al.*, 2008). Moreover, the use of the FOP labelling system in the UK targets salt and a few other nutrients of concern. A traffic light symbol indicates levels of fat, saturated fat, sugars, and salt with green (low), amber (medium), and red (high) color-coding for each nutrient (FSA, 2007). In the US, there is an increased interest in the FOP labels. The US Congress commissioned the Institute of Medicine (IOM) that reported in 2011, *“Despite the lack of conclusive evidence, FOP labels would encourage healthier choices than the current Nutrition Facts Panel and would be easier to understand”*. The Food and Drug Administration (FDA) mandated a system that lists calories and then rates products from zero to three stars, based on the levels of sodium, saturated fat, trans fat, and added sugar (IOM, 2010). It is worth mentioning that the UAE Cabinet approved the voluntary use of the Traffic light system in 2019, to be adopted mandatory in 2022. However, to reduce the economic burden of food companies as a result of the COVID 19 epidemic this was kept voluntary. According to state news agency WAM, <https://wam.ae/en/details/1395302785763>

In summary, food labels help consumers choose packaged foods with lower sodium, but the labelling system can be improved. Labels that are prominently placed and consistent have the potential to influence consumer decisions in positive ways.

1.7.4. Strategy 4: Coordinated voluntary reductions

In the US, calls for voluntary industry action related to sodium reduction have been historically unsuccessful (IOM, 2010). The average reduction in sodium content for packaged foods from 1983 to 2004 was only 5% as reported by the Center for Science in the Public Interest (Sadler *et al.*, 2011). However, evidence indicates that coordinated voluntary action that holds companies accountable for their pledges and is backed by authoritative bodies can be more successful (FSA, 2007; Sadler *et al.*, 2011).

Lowering the sodium content of packaged and restaurant foods is possible without limiting consumer choice and acceptance in addition to adapting over time to a lower salt taste (Drake and Drake, 2011). The model of coordinated voluntary sodium reductions has been adopted by the National Salt Reduction Initiative (NSRI), led by the New York City Department of Health and Mental Hygiene in 2010. It aimed to reduce sodium intake by 20% and sodium in packaged and restaurant foods by 25% by 2014 (IOM, 2010).

1.7.5. Strategy 5: Procurement policies

Procurement policies with specific sodium standards are a relatively new phenomenon and it is used to control or reduce salt intake. This practice is used by the US government and other governmental entities (IOM, 2010). In 2008, New York City Agencies ordered more than 260 million meals and snacks with specific sodium

contents of 480 mg of sodium and meals no more than 900 mg of sodium, with lower limits for specific food categories such as bread, canned fish, meat, and cereal (IOM, 2010). The Centres for Disease Control and Prevention (CDC) encourages local and state health departments to enact similar guidelines (CDC, 2010). Procurement policies increase the demand for healthy low sodium food, making it worthwhile for the food industry to produce and market these items.

1.7.6. Strategy 6: Regulation of sodium levels in food

Salt is classified as GRAS, generally recognised as safe, since 1958, when FDA began to regulate food additives and before knowing the health hazards of high sodium intake (IOM, 2010). Therefore, in 2010, the IOM recommended that the FDA regulates the salt content of both restaurant and packaged food to reduce sodium intake. The IOM specifically recommended that the FDA modify salt from GRAS status to set a safe level (IOM, 2010). Although this approach is very important to regulate salt intake, unfortunately, it is not easy to set a specific level or recommend a specific upper level of sodium in packaged or restaurant food. Therefore, this good strategy needs more than one strategy to reduce salt intake, which will be more effective and more visible (IOM, 2010; Cobb, Appel and Anderson, 2012).

Most countries were found to implement multifaceted salt reduction intervention plans, characterized by a combination of two or more implementation strategies. The least common implementation strategy was taxation, while the most common was reformulation (100%), followed by consumer education (77%), initiatives in specific settings (54%), and FOP labelling (46%). Monitoring activities were conducted by a few countries (27%). Egypt, Iran, Tunisia, and the UAE adopted

a 30% relative reduction in salt intake, while Morocco adopted a 10% reduction (Al-Jawaldeh *et al.*, 2021).

1.8. Conclusion

This literature review included the prevalence of sodium intake at global level and most of countries consumed sodium beyond the WHO recommendation. There was a strong relationship between high sodium intake with hypertension and cardiovascular diseases. A meta-analysis revealed that the risk of CVDs increased to 6% for every 1 g increase in dietary sodium intake. In addition, different intervention approaches, such as education, food labelling, reformulation of sodium contents, and taxation of high salt foods aimed to reduce salt intake. These approaches can reduce sodium intake and when combined they can achieve better results in lowering sodium intake.

It is worth mentioning that the prevalence of hypertension ($\geq 130/80$ mmHg) in UAE reached 31% and UAE has one of the highest age-standardized death rates for CVDs when compared to North America and Western Europe. CVDs account for 30% of total death in UAE.

However, it was clearly noticed that there is very limited or even no intervention studies to reduce salt intakes in the Arab world, the GCC, or the UAE. Arab countries were not addressed in the literature review due to very limited or even no published intervention studies. Therefore, this study will be the first study conducted in UAE, exploring the use of digital media approaches as intervention tools toward salt reduction intake in UAE using reliable methods to estimate sodium intake and to assess Knowledge attitudes and practice (KAP) toward salt intake

The aim of the Ph.D. study was as follows:

- Chapter 2 (study one) aimed to translate and validate KAP questionnaire toward salt intake from English into Arabic.
- Chapter 3 (study two) aimed to assess sodium intakes using 24-hour urinary sodium excretion along with KAP towards salt intake in a sample of UAE population.
- Chapter 4 (study three) aimed to measure effectiveness of using digital approaches as educational tools to reduce sodium intake in a sample of UAE population.
- Chapter 5 (study four) aimed to assess population perceptions regarding salt reduction approaches in educational material, delivery approach, visibility and obstacles regarding implementation and suggestions to facilitate salt reduction was measured

This Ph.D. study will provide a complete picture and good database about:

- Mean sodium intake in a sample of UAE population.
- Effectiveness of using digital approach as intervention tools for sodium intakes.
- Participants responses toward this intervention approach including strength, obstacles, and suggestions to improve salt reduction approach.
- This study will highlight if the sample of UAE population ready to change or response positively to reduce sodium intake.

This database will help the decision maker in UAE such as Emirates Authority for Standardization and Metrology (ESMA) and Ministry of Health and Prevention as government entities with food industry to build an initiative or a strategy to reduce salt

intake. Moreover, the outcome of this study can be used as a roadmap for the decision maker to build a common headline to reduce salt intake in UAE and this model can be used by other countries.

Chapter 2

Piloting, Translation and Validation of the Knowledge, Attitude, and Practice - Arabic Version of the Questionnaire

Abstract: Study 1

Background: Using existing validated questionnaire will save time and resources, translated versions of questionnaires are needed to collect data among respondents who speak other languages. To compare responses across populations of different languages and/or cultures, the translated questionnaires must be able to cover all steps needed to ensure that the validity and reliability of the questionnaire remain intact when translating a questionnaire originally developed in another country and culture. This study aimed to translate a validated KAP questionnaire toward salt intake from English version into Arabic and to measure its reliability and validity. This questionnaire was adapted from WHO/PAHO regional expert group for CVD.

Methods: A random sample of 154 participants were recruited from the United Arab Emirates University (UAEU) population in addition to nine experts in the field of Human Nutrition from the UAEU and the University of Sharjah (UOS) who were involved in performing the questionnaires translation. Internal and external reliability, content validity ratio (CVR) and construct validity for each section of KAP questionnaire was measured.

Results: After performing two stages of translation; forward and backward translation, the expert panel approved the Arabic version of the KAP questionnaire. The reliability of the KAP questionnaire was confirmed, using measures for internal consistency with Cronbach's alpha exceeding 0.7 in all individual sections and overall and the test-retest

approach for external reliability. The experts found all 45 items of the questionnaire essential and CVR for KAP questionnaire confirmed. Moreover, for construct validity, the independent t-test for the two distinct groups in nutritional knowledge showed a significant difference on the three components of KAP questionnaire with all $p < 0.05$, which indicates that the KAP questionnaire for salt intake-Arabic version is a good tool to measure the theoretical construct it is intended to measure.

Conclusion: The KAP questionnaire for salt intake- Arabic version was highly reliable and valid. Therefore, can be used in the UAE or and other Arabic speaking countries with similarities to the UAE culture.

2.1. Introduction

Cost-benefit analyses have demonstrated that the reduction of dietary salt is a cost-effective measure to reduce the disease burden associated with CVD (D'Elia *et al.*, 2019). Although more than 75 % of dietary salt comes from processed foods (Sarmugam and Worsley, 2014), consumer knowledge and education are important tools to empower consumers to make the right choice or to choose products with lower salt content and reduce the amount of discretionary salt intake and enable consumer to decipher the sodium content in a product as shown in Table 2.1.

Table 2. 1 Sodium/salt claims in food products¹

Salt	What it means
No-Salt Added	Products contain no sodium chloride, and if any sodium found, will come from the natural ingredients
Sodium-Free	Less than 5 mg of sodium per serving
Very Low Sodium	35 mg of sodium or less per serving
Low Sodium	35 mg of sodium or less per serving
Reduced (or Less) Sodium	At least 25% less sodium than the original or a competitor's product
Light in Sodium	At least 50% less sodium than the original or a competitor's product

¹FDA website at <http://www.fda.gov/educationresource/library>

Therefore, improving the knowledge of the consumers may reflect positively on attitude and practice (Sarmugam and Worsley, 2014). Thus, understanding and evaluating the consumer's knowledge, attitude and practice (KAP) with regards to salt has been recommended as one of the key components for a successful salt reduction programmed (Sarmugam, Worsley and Flood, 2014; D'Elia *et al.*, 2019). KAP survey is defined as a quantitative method (predefined questions formatted in standardized questionnaires) that provides access to quantitative and qualitative information (Campbell *et al.*, 2010). As data obtained from KAP studies are fundamental in assessing the need, planning and implementing public health programs or needs, it is of paramount importance to use reliable and valid instruments in order to ensure a good outcome (Haron *et al.*, 2021). Moreover, although using an existing validated questionnaire will save time and resources (Tsang, Royse and Terkawi, 2017) most of these questionnaires were, initially developed in one language (e.g., English when developed in English-speaking countries (Lexell and Downham, 2005). However, translated versions of questionnaires are needed for the researchers who intend to collect data among respondents who speak other languages (Guillemin, Bombardier and Beaton, 1993; Tsang, Royse and Terkawi, 2017).

To compare responses across populations of different languages and/or cultures, researchers should assure that the translated questionnaires are assessing the equivalent construct with an equivalent metric. In addition, the translation process must be able to cover all steps needed to ensure that the validity and reliability of the questionnaire remain intact when translating a questionnaire originally developed in another country and culture (Danielsen *et al.*, 2015).

The purpose of the current study was to translate the validated KAP questionnaire adopted from the WHO/PAHO protocol (Campbell *et al.*, 2010) from

English into the Arabic language, to assess its content and construct validity in the Arabic context, and to evaluate its internal and external reliability.

Hypothesis of the study: KAP-Arabic version questionnaire is reliable and a valid tool to assess KAP toward salt intake in UAE.

2.2. Materials and Methods

2.2.1. Ethical approval

Ethical approval for the study protocol was obtained from the Research Ethics Committee at Oxford Brookes University (UREC), Number: 191337 ([Appendix 1](#)) and from the Research Ethics Committee at the United Arab Emirates University (UAEU) (Reference No DVRGS/ 36), ([Appendix 2](#)). All subjects provided a written informed consent to participate. An example of the consent form used for this study is displayed in [Appendix 3](#).

2.2.2. Piloting, translation, and validation of the KAP questionnaire

2.2.2.1. KAP-questionnaire

The questionnaire used in the current study to assess KAP in UAE was adopted from the WHO/PAHO protocol (Campbell *et al.*, 2010). It was used to assess KAP towards salt intake in many other studies outside UAE (Papadakis *et al.*, 2010; Grimes, Riddell and Nowson, 2009; Nasreddine *et al.*, 2014) and among university student in the UAE (Cheikh Ismail *et al.*, 2019; Jarrar *et al.*, 2020). The KAP questionnaire consists of 45 items ([Appendix 4](#)) and it is divided into three components; (i) knowledge; (ii) attitude and (iii) practice.

(i) Knowledge

The knowledge component includes 28 questions, and it is divided into two sections. Section I consists of questions to measure knowledge related to the sodium contents of 22 food items. Section II measures health-related knowledge, such as the

relationship between high salt intake and specific health conditions (hypertension, CVDs, fluid retention, fever, renal diseases, and diabetes). The section also inquires if participants think that reducing salt intake would improve their blood pressure and overall health (response options “yes”, “no”, “I don’t know”) (Cheikh Ismail *et al.*, 2019; Jarrar *et al.*, 2020; Campbell *et al.*, 2010b).

(ii) Attitude

The attitude component of the questionnaire includes 5 questions. Four questions inquired if the participant is concerned about the amount of salt/sodium in his/her diet (response options “yes”, “no”) and the last question was about the amount of salt he/ she thinks they consume (response options “too much”, “just the right amount”, “far too little”).

(iii) Practice

The practice component of the questionnaire includes 12 questions and it contains questions about the use of food labels, if the information on salt on food label affects purchasing decisions, and if participants check labels specifically for salt/sodium content. Five questions inquiring about the frequency of adding salt or stock cubes during cooking and whether the participants add salt to food prior to tasting or at the table. Responses for practice related questions included “never”, “sometimes” and “often”. The last question inquired if the participants tried to reduce salt intake before and if spices were used as an alternative to reduce salt addition (response options “yes”, “no”, “I don’t know”).

Scoring of the KAP questionnaire

Each question (scale) was scored based on the type of items included. For the knowledge section, questions with single response were coded into 0 and 1 for

wrong/do not know and correct answers respectively. The health-related questions consisted of a composite score for each item (yes/no and do not know). The yes and no responses for these questions were coded into 0 and 1 respectively based on the correct answer. The same applied for practice and attitude scales, each correct answer was scored with 1. All the final scores for each component of the KAP questionnaire were totaled and converted to 10.

Translation of KAP questionnaire

The translation process consists of four stages: forward translation, backward translation, expert panel, and piloting. Forward translation, the initial translation from the English language to the target language (Arabic), was performed by Amjad Jarrar (PhD student) and another faculty member from Department of Food, Nutrition and Health (DFNH)-UAEU. Both are native in Arabic, proficient in English, and have a good understanding of the questionnaire's concept.

The translated questionnaire was shared and checked by Dr. Ayesha Al Dhaheri (academic supervisor of Amjad Jarrar), who is also proficient in English/Arabic languages to check for any variations in the translation. After that, the two-initial translators with Dr. Al Dhaheri checked the translated questionnaire (Arabic version) against the original questionnaire (English version), to make sure it resembled the same concept with the original questionnaire.

The second step was backward translation, which was performed by two Arab faculty members from DFNHD, one of whom completed his Ph.D. study in Canada and the other (an Arab Canadian) earned her Ph.D. from the United Kingdom (UK). They were asked to translate the Arabic version of the questionnaire into English

(backward translation). Then the two English versions of the questionnaire were shared with Dr. Leila Cheikh Ismail (academic supervisor of Amjad Jarrar) (Figure 5.1).

The third step was the formation of a small committee known as (an expert panel) consisting of five members including Amjad Jarrar Ph.D. student, Dr. Ayesha Al Dhaheri (academic supervisor), Dr. Leila Cheikh Ismail (academic supervisor), Dr. Johaina Idriss (backward translation) and Dr. Mo'ath Bataineh (forward translation). The committee reviewed all versions of the translations - Arabic and English - in order to determine whether the translated and original versions achieve semantic, idiomatic, experiential, and conceptual equivalence (Beaton *et al.*, 2007; Tsang, Royse and Terkawi, 2017). After this discussion, the committee approved and accepted the Arabic version of the KAP questionnaire.

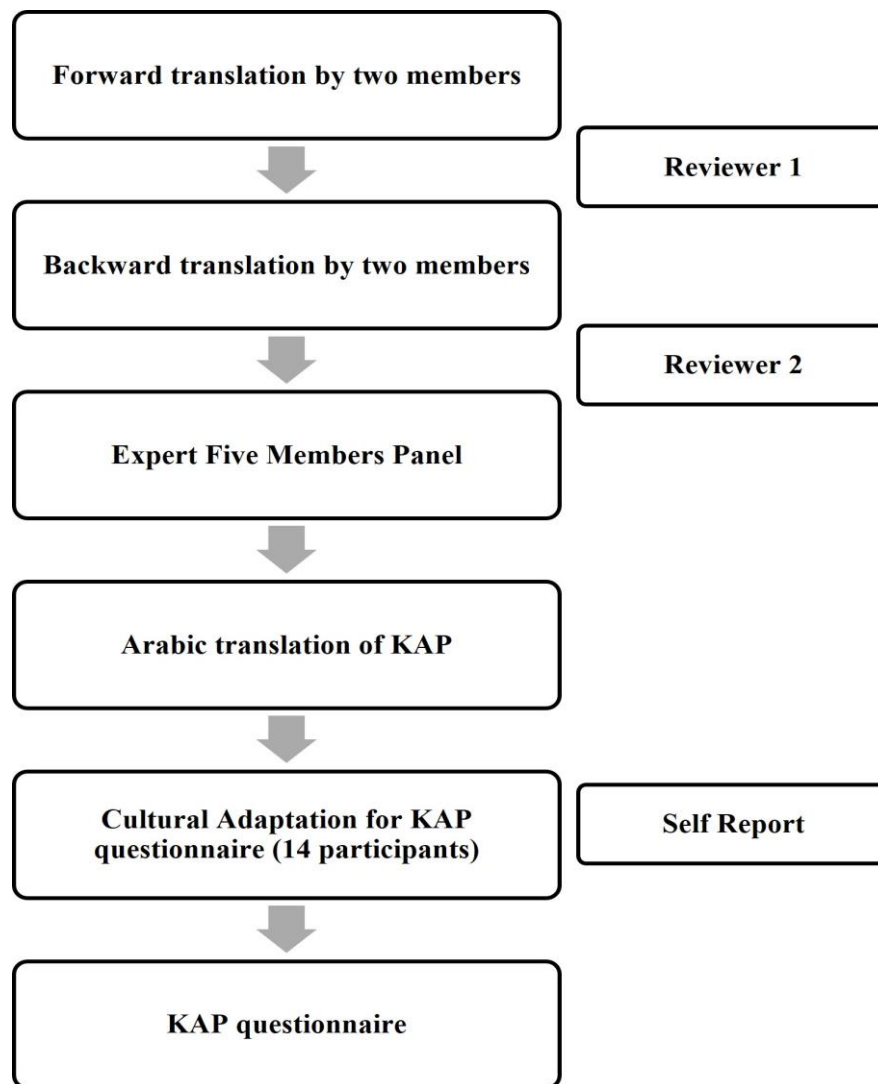


Figure 2. 1 Flow chart for Translation process for KAP questionnaire

Piloting was performed on 14 Arab participants from the UAEU population with different education levels and various employment sectors (security guards, drivers, staff, students, and faculty members). Participants were asked to complete the survey (self-reported), then each participant was interviewed individually (face to face) by Amjad Jarrar to elaborate about their thoughts regarding the clarity of the questionnaire components and the meaning of their corresponding response (Guillemin, Bombardier and Beaton, 1993; Tsang, Royse and Terkawi, 2017). Figure 2. 1. shows the flow chart for translation process for the KAP questionnaire.

Reliability and validity

The psychometric properties of the KAP-Arabic questionnaire were examined through reliability and validity.

(i) Measurement of reliability

The consistency of the KAP questionnaire was measured using two tools, internal reliability, and external reliability. The Internal consistency reflects the extent to which the questionnaire items are inter-correlated, or whether they are consistent in measurement of the same construct over the time. Measuring coefficient alpha is commonly used to assess internal consistency (Cronbach, 1951), which is also known as Cronbach's alpha. Given a questionnaire x, with k number of items, alpha (α) can be computed as:

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma_x^2} \right),$$

Where, σ_i^2 is the variance of item i, and σ_x^2 is the total variance of the questionnaire. Cronbach's alpha ranges from 0 to 1 (when some items are negatively correlated with other items in the questionnaire, it is possible to have negative values of Cronbach's alpha). If Cronbach's $\alpha = 0$ indicates no internal consistency, which means none of the questionnaire items are correlated with one another. Whereas $\alpha = 1$ reflects perfect internal consistency for the questionnaire items which means the items are perfectly correlated with one another. In practice, Cronbach's alpha of at least 0.70 has been suggested to indicate adequate internal consistency (Tsang, Royse and Terkawi, 2017; Nunnally, 1978). Participants (non-nutrition major) were recruited from UAEU to assess the internal reliability (Cronbach's alpha) of the questionnaire.

The external reliability of the questionnaire over time was examined using a test-retest approach. Participants from the UAEU (non-nutrition major) were asked to complete the questionnaire twice with two weeks gap. A dependent t-test was then used to assess if there is a difference between the two responses. If the analysis showed no significant differences between the two times, this would indicate strong external reliability, meaning that the questionnaire is less likely to be attributable to changes in the individuals' responses over time (Tsang, Royse and Terkawi, 2017; Shultz, Whitney and Zickar, 2020). Moreover, intraclass correlation coefficient (ICC) between time 1 and time 2 with one to two weeks interval was calculated and a value of 0.7 or above is generally regarded as demonstrating greater reliability (Sasanfar *et al.*, 2019; Putnoky *et al.*, 2020).

(ii) Measurement of Validity

Validity of the KAP- Arabic version was assessed to make sure the questionnaire measures what it is intended to measure or in other words, whether the inferences and conclusions made based on the results of the questionnaire valid (Murphy and Davidshofer, 2005). In this study two major types of validity were performed: content validity and construct validity.

Content validity refers to the extent to which the items in a questionnaire are representative of the entire theoretical part, which is assessment of knowledge, attitude, and the practice of participants (Shultz, Whitney and Zickar, 2020). The Content Validity Ratio (CVR) was used according to the recommended methodology described by Lawshe (1975) (Lawshe, 1975), which indicates that all items should be analyzed by a group of experts, each expert having the possibility to describe the item

as: 1= Irrelevant, 2= relevant, but not essential and 3=Essential. The formula to calculate the ratio is:

$$CVR = \frac{2 Ne}{N} - 1,$$

Where Ne – number of experts who considered the item to be “Essential” or “relevant”, while N is the number of expert committee members. CVR values range from –1 to +1, where a value inclining toward +1 shows the mutual agreement of the experts on the respective item. On the other hand, a negative CVR value may be obtained when less than half of the experts indicate the item as “essential” (Cohen, 2013; Ayre and Scally, 2013).

The content validity index (CVI) was calculated for each form of a test. The content validity index is the mean of the content validity ratios for each item on the form. The formula for calculating the CVI is:

$$CVI = \sum CVR / N CVR$$

If the CVI is > 0.79, the item is relevant/essential, while CVI values between 0.70 and 0.79 indicate the item needs revisions, unless if the minimum number of experts required to agree that the item is essential should be 7 out of 9 (Wilson, Pan and Schumsky, 2012), in this case will be essential. While if the CVI value is below 0.70, the item should be eliminated.

An expert committee formed from nine experts in the field of Human and clinical Nutrition, five of them from the department of Food and Nutrition at the UAEU, UAE, and four from the department of Clinical Nutrition at the University of Sharjah (UOS), UAE, measured the CVR for the Arabic version of KAP questionnaire.

For measuring construct validity, two distinct groups of participants known to be differing in nutritional knowledge were used to examine the construct validity through completion of the questionnaire. Participants from fourth-year students majoring in Nutrition/Dietetics and the same number of participants from Arabic language major were recruited. Students in Arabic major were recruited assuming that they had minimal nutritional information in comparison with Nutrition/Dietetics students. A t-test $p < 0.05$, with significant differences between two groups indicates that questionnaire is likely to be a good tool to distinguish between the two groups (Cohen, 2013).

2.2.3. Study design and participants

A sample of 154 participants were recruited from the UAEU population for piloting, reliability, and validity of Arabic version for KAP questionnaire study. In addition, an expert committee formed from nine experts in the field of Human and clinical Nutrition from UAEU and UOS making a total sample of 163 participants performed the piloting, reliability, and validity. The 154 participants included: 14 Arab participants for piloting the translated Arabic version of KAP questionnaire, and 140 Arab students to measure the reliability and validity of the questionnaire. Moreover, a sample of 80 out of 140 participants was recruited to assess internal and external reliability, and a sample of 60 participants was recruited to assess construct validity, and nine experts in the field of Human and clinical Nutrition from UAEU and UOS performed content validity index (CVI), as shown in figure 2.2.

Several different methods were used for recruitment: email circulation to student, staff and faculty members of UAE University. In addition, posters were

displayed in different units and colleges in UAEU. All participants were provided written informed consent forms to participate in the study.

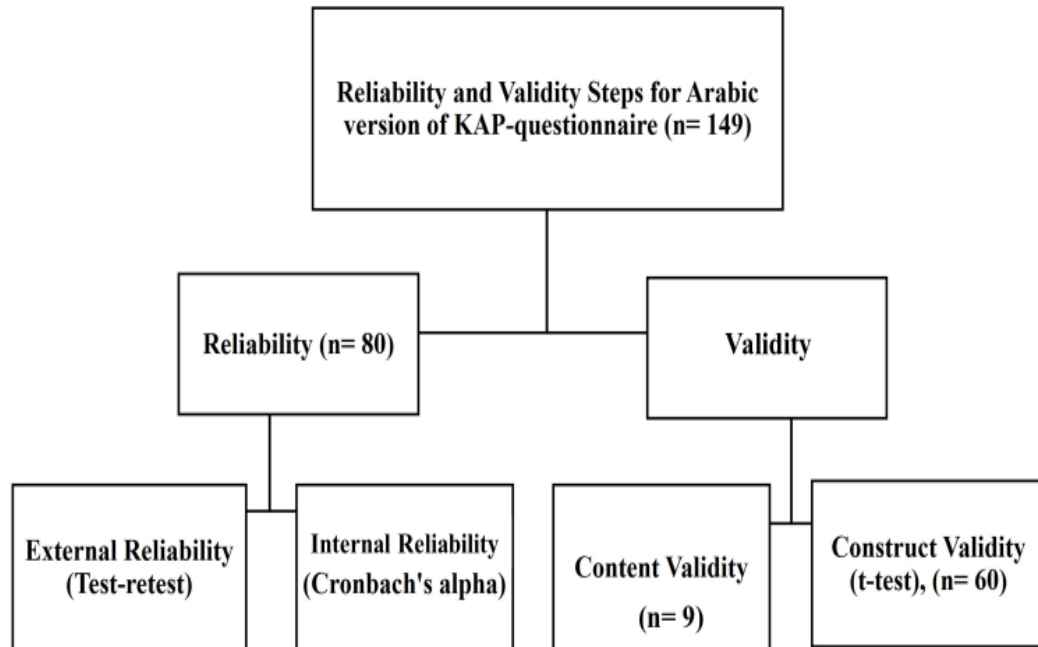


Figure 2. 2 Reliability and validity steps for Arabic version of KAP-questionnaire

2.3. Power of analysis

A power of analysis was performed using G* Power software (version 3.1.9.2; HHU, Germany (Faul *et al.*, 2009). For internal reliability Cronbach's alpha was obtained and for external reliability both intra-class correlation coefficients, and dependent samples t-test were used to detect lack of differences between time 1 and time 2. Minimum required sample size for reliability test was calculated based on the requirement to detect a large effect size, with significance level set at $P < 0.05$ and power as 0.95 ($n=76$). Construct validity was assessed by using dependent samples t-test to detect significant differences between the two groups (nutrition vs. Arabic major students). The minimum required sample size for the Construct validity study was

calculated based on the requirement to detect a large effect size, with significance level set at $P < 0.05$ and power as 0.80 ($n=42$).

2.4. Statistical Analysis

Statistical analysis was carried out using SPSS software for Windows “Statistical product and Service Solutions (SPSS Inc., Chicago, IL, USA), version 24.0. Data from the KAP questionnaire were coded and entered as frequency and scores according to categories of the questionnaire. The number of total correct answers in the practice and attitude had a total score out of 17, while knowledge had a total score out of 28.

For internal reliability, Cronbach’s alpha was obtained and for external reliability both intra-class correlation coefficients, and dependent samples t-test were used to detect lack of differences between time 1 and time 2. Two distinct groups of participants known to differ in nutritional knowledge were used to examine the construct validity through completion of the questionnaire. A dependent samples t-test was used to detect equal or higher than $p=0.05$, with significant differences between the two groups indicating that the questionnaire is likely to be a good tool to distinguish between the two groups.

2.5. Results

2.5.1. Translation and piloting of KAP questionnaire

After performing the two stages of translation (forward and backward) there was no disagreement and the expert panel approved the Arabic version of the KAP-questionnaire. Piloting was performed in 14 Arab participants from the UAEU population, with a mean age of 31.7 ± 10.8 years old (Table 2. 2). Almost 57% of the

sample were females and 50% of the participants were married. The majority had university level education (undergraduate) and 57% were employed (Table 2. 2).

Table 2. 2 Demographic characteristics of participants used for piloting of the KAP questionnaire (n=14)

Variables		n (%)
Gender	Female	8 (57.1)
	Male	6 (42.9)
Marital status	Single	6 (42.9)
	Married	7 (50.0)
	Widow	1 (7.1)
Educational Level	School level	3 (21.4)
	University level (undergraduate)	10 (71.4)
	University level (graduate)	1 (7.1)
Employment status	Student	6 (42.9)
	Employed	8 (57.1)

All the components of the questionnaire were clear and related to the study except two out of 45 items, which required more clarification regarding the bread and rice. Most of the participants asked about the type of the bread if it were pita bread (Arabic) or other breads, such as Iranian bread, which is also a commonly consumed bread in the UAE and other Arab Gulf countries.

The second food item was rice, participants were not sure about the type of rice, whether it is Basmati or Egyptian rice. Moreover, the common name for rice by Emirati Accent is (Aish). Therefore, in the Arabic version of the KAP questionnaire, these points have been taken into consideration. To make it easy and to remove any confusion on the questions related to food-related knowledge, Arabic bread and Iranian bread were included as two separate items and replaced the original item “bread”. Basmati Rice and Egyptian rice were also included as separate items and replaced the original item “rice” in food-related knowledge. Thus, the translation of Arabic version

of KAP questionnaire completed four stages of translation: forward translation, backward translation, expert panel approval and piloting.

2.5.2. Assessment of Internal reliability and external reliability of KAP questionnaire

A sample of 80 participants from the UAEU population with mean age of 31.1 ± 12.5 years were used for determining the internal and external reliability of the KAP questionnaire per each section and in total. As shown in Table 2.3, 45% of the study population were from the East region (Alain), 33.7% were aged 20-29.9 years, almost 50% of the sample had university level education, and 56% were females.

Table 2. 3 Demographic characteristics of participants used to test the reliability of the KAP questionnaire (n=80)

Variables		Mean $\pm$ SD ^a
Age (Years)		31.1 $\pm$ 12.5
BMI (kg/m ²)		26.2 $\pm$ 7.7
		n (%)
Geographic regions	West region (Abu Dhabi)	20 (25.0)
	East region (Al Ain)	36 (45.0)
	North region (Dubai, Sharjah, Ajman, Umm Al Quian, Ras Al Khaimah)	24 (30.0)
Age groups	20-29.9	27 (33.7)
	30-39.9	19 (23.8)
	40-49.9	18 (22.5)
	$\geq$ 50	16 (20.0)
Marital status	Single	41 (51.3)
	Married	37 (48.7)
	Divorced	2 (2.5)
Gender	Female	45 (56.2)
	Male	35 (43.8)
Educational level	Undergraduate university level	55 (68.8)
	School level (Intermediate or lower)	11 (13.8)
	Postgraduate level	14 (17.5)
Employment status	Student	29 (36.2)
	Unemployed	19 (23.8)
	Employed	32 (40.0)

^a Data presented as Mean $\pm$ standard deviation.

Internal reliability, which measures the degree of correlation between different items of the questionnaire, was assessed for the general population sample ($n = 80$) by Cronbach's alpha. The questionnaire had an overall alpha value of 0.75, larger than the threshold of 0.7 (Table 2.4). Sections 1 (attitude and practice) and 2 (knowledge) had larger Cronbach's alpha values than the threshold with value of 0.77 for each section (Table 2. 4). External consistency (or test–retest) was assessed on the sample ($n = 80$). The interclass correlation coefficient ranged between 0.75 and 0.77 for individual sections and overall (Table 2. 4). Furthermore, there were no significant differences between test (time 1) and re-test (time 2) after two weeks for the overall KAP questionnaire with $p=0.129$, while for section 1 (attitude and practice) was $p=0.137$ and section 2 (knowledge) with $p= 0.172$ (Table 2. 4).

Table 2. 4 Internal reliability and external reliability of KAP questionnaire

Reliability	KAP sections (maximum possible score)		
	Overall questions in KAP questionnaire (45 ¹)	Questions related to attitude and practice (17)	Questions related to health and food related knowledge (28)
Internal reliability (n=80)			
Cronbach's α	0.75	0.77	0.77
External reliability (n=80)			
Time 1 ²	30.5 (0.86)	12.6 (0.62)	17.9 (0.62)
Time 2 ³	31.1 (0.85)	13.0 (0.57)	18.1 (0.62)
P-value⁴	-1.538 (0.129)	-1.508 (0.137)	-1.384 (0.172)
ICC ⁵	0.9	0.88	0.93

¹ Number of the questions ² Difference between time 1 and time 2 is a minimum 1 week.

³ paired t-test according to time of measurements within the same group. ⁴ $P < 0.05$

⁵ Intraclass correlation coefficient

2.5.3. Assessment of content validity ratio

The CVR calculations for 43 food items were 1.00, which means the entire expert panel found these items essential as shown in Table 4. All items achieved a CVR value of 1 except two items that only reached a value of 0.777. The two food items that scored <1.00 were item number 5 on the attitude part and item number 6 on the practice part. This means that 8 out of 9 panelists found that item essential and only one panelist found that item related but not essential. The CVI calculations for the relevancy for each part of the KAP questionnaire are in Table 2. 5. ([Appendix 22_Table 2.5](#)). The CVI for the KAP questionnaire ranged from 0.955 and 1.00, with 0.955 for the attitude part, 0.981 for the practice part, and 1.00 for the knowledge part. Results revealed that all items were relevant and essential for the Arabic version of the KAP questionnaire.

Table 2. 5 Internal reliability and external reliability of KAP questionnaire content validity for the KAP questionnaire items (Appendix 22_Table 2.)

2.5.4. Assessment of construct validity

For measuring construct validity, two distinct groups of participants from UAEU, known to be differing in nutritional knowledge were used to examine the construct validity. Sixty senior undergraduate female students were recruited from two UAEU programs with a mean age and BMI of 21.0 ± 1.9 years old and 23.3 ± 4.7 kg/m², respectively (Table 2.6). Thirty senior Dietetic/Nutritional science students (year three and above) participated in this study. In addition, thirty senior humanities/Arabic Language major students (year three and above) participated in this study (Table 2.6).

Table 2. 6 Demographic characteristics of participants used for construct validity of the KAP questionnaire (n=60)

Variables		Mean $\pm$ SD ^a	
		Dietetic/Nutritional science student ^b (n=30)	Humanities students ^b (n=30)
Age (years)		21.9 $\pm$ 1.5	19.8 $\pm$ 1.7
BMI (Kg/m ²)		23.0 $\pm$ 4.6	23.6 $\pm$ 5.0
		n ^c (%)	n (%)
Geographic regions	West region (Abu Dhabi)	6 (20.0)	4 (13.3)
	East region (Al Ain)	7 (50.0)	16 (53.3)
	North region ^d	9 (30.0)	10 (33.3)
Marital status	Single	22 (73.3)	20 (66.7)
	Married	8 (26.7)	10 (33.3)

^a Data presented as Mean $\pm$ standard deviation ^b Third year and above ^c Number

^d (Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah)

In the construct validity assessment, only female students were included, because Nutrition science and Dietetic programs are only offered to female student and this group of students will be known as the group of good KAP toward salt intake since the construct validity test to distinguish between two groups according to knowledge.

An independent t-test analysis showed significant differences for scores on attitude ($p=0.007$), practice ($p= 0.02$), diet- related knowledge ($p <0.001$) and health-related knowledge ($p<0.001$) between the two groups of students. Moreover, nutrition students scored significantly higher than non-nutrition students in all sections of the KAP questionnaire (Table 2.7).

Table 2. 7 Assessment of construct validity for the KAP questionnaire (n= 60)

	Major	N	Mean± SD ^a	t-test value	p-value ^b	Cohen's d
Health related Knowledge (total score out of 10¹)	Nutrition and Health	30	9.56 ± 0.67	4.522	0.001	2.1
	Humanities-Education	30	6.40 ± 2.31			
Food related knowledge-(total score out of 10¹)	Nutrition and Health	30	8.75 ± 1.28	6.955	0.001	2.3
	Humanities-Education	30	4.74 ± 2.24			
Practice score-(total score out of 10¹)	Nutrition and Health	30	6.04 ± 1.81	2.421	0.02	0.8
	Humanities-Education	30	4.70 ± 1.68			
Attitude score-(total score out of 10¹)	Nutrition and Health	30	7.00 ± 2.62	2.837	0.007	0.9
	Humanities-Education	30	4.67 ± 2.57			

^a Standard deviation ^b Independent t-test ¹Score out of 10

2.4. Discussion

The translation of the original English KAP questions was carried out in accordance with the standard procedures detailed in the translation guidelines (Guillemin, Bombardier and Beaton, 1993; Beaton *et al.*, 2007). Moreover, the clarity and understanding of the written language, language barriers, cultural considerations and construction of items were successfully addressed in translating and piloting of the original KAP questionnaire into Arabic as carried out in similar studies that translated original questionnaires into other languages (Alotaibi 2010; El Hachem *et al.*, 2019; Mallah *et al.*, 2022). The expert panel approved the KAP Arabic questionnaire after adding more clarifications to the bread and rice to avoid any negative influence on the food related knowledge part of the KAP questionnaire, in addition, to identify whether the common type of bread and rice consumed make a different level of sodium/salt according to the participants.

The content validity ratio (CVR) of the questionnaire was examined by nine experts, who found all the 45 items of the questionnaire essential and showed mutual agreement on the respective item. Eight out of nine in the expert panel found these two items essential except one expert, who found these two items related but not essential since both questions may serve the same purpose such as “Does the sodium contents affect purchase decision, while the other question was asked about salt contents instead of sodium”. Therefore, all items achieved mutual agreement according to Ayre and Scally (2013) and Wilson, Pan and Schumsky, (2012).

For construct validity, the detection of significant differences shows that the KAP questionnaire is a good tool to measure the theoretical construct it is intended to measure knowledge, attitude, and practice. This finding was similar to other studies conducted to assess CVR for an attitude questionnaire, and to developing a questionnaire to assess KAP towards whole-grain intake among Malaysians (Koo, Poh and Ruzita, 2016) .

Itani et al., reported mutual agreement for the CVR and CVI for the translated Arabic version questionnaire to assess psychosocial determinants of eating behaviour among adolescents (Itani *et al.*, 2017). The construct validity for the Arabic version of the KAP questionnaire, was able to differentiate between two distinct groups of participants from UAEU. This indicates that each component of the Arabic version of the KAP questionnaire has an appropriate sample of items for the construct being measured (Polit, Beck and Owen, 2007; Tsang, Royse and Terkawi, 2017). This finding was similar to a study conducted by Sarmugam et al., who developed and validated salt knowledge questionnaire which showed a significant differences in salt knowledge among two groups of participants (Sarmugam, Worsley and Flood, 2014).

The reliability of the Arabic version of the KAP questionnaire was confirmed using measures for internal consistency and the test-retest approach. The KAP scale scores were considered sufficiently reliable for group comparisons as the internal consistency assessed using Cronbach's alpha exceeded 0.7 in all individual sections and overall (Nunnally, 1978). The 45-items of the KAP questionnaire consisted of two parts, the first part (practice and attitude) consisted of 17 items of questions and the second part (knowledge) consisted of 28 items. The two parts gave an internal consistency of more than 0.7, thus were considered reliable as confirmed by internal consistency criteria (Tsang, Royse and Terkawi, 2017; Sasanfar *et al.*, 2019; Putnoky *et al.*, 2020). Further, the test-retest consistency (external reliability) was also examined to assess consistency over time (Putnoky *et al.*, 2020; Sasanfar *et al.*, 2019). Nevertheless, our results confirm the adequacy of internal consistencies of the scales and high test-retest reliability of the KAP- Arabic version questionnaire. The measurements of internal and external reliability were one of the tools in addition to CVR and CVI to prove validity and reliability for the translated Arabic version questionnaire for eating behaviour (Itani et al., 2017).

To the best of our knowledge, this is the first study to assess the reliability and validity of the Arabic version of the KAP questionnaire in a sample of the UAE population. The study results demonstrated that the three components of the Arabic version of the KAP questionnaire in the UAE were highly reliable and valid and are still intact with the original KAP questionnaire. Therefore, the Arabic version of the KAP has the potential to be used in all 22 Arab countries and serving a total population across the population of over 423 million (*Arab Countries*, 2021). Moreover, this can be used as a starting point for developing and strengthening the food related knowledge

part of KAP questionnaire by introducing more Arabic foods and to verify its reliability and validity.

A limitation of our study is the construct validity was tested and confirmed by only female students.

2.5. Conclusion

The Arabic version of the KAP questionnaire is likely to be a useful tool for researchers who aim to measure KAP towards salt intake among Arabic speakers.

Chapter 3

Assessment of knowledge, attitudes, and practice related to sodium intake with 24-hour urinary sodium excretion for a sample of the UAE Population: A cross-sectional study

Abstract: Study 2

Background: Hypertension, is a major risk factor in the development of CVDs, which is responsible for 62 % of stroke and 49 % of coronary heart disease (CHD) worldwide. High sodium (>2 g/day) and insufficient potassium intake (< 3.5 g/day) contribute to high blood pressure ($\geq 130/80$ mmHg), and increase the risk of heart disease. In 2015, WHO reported that CVDs account for 30 % of the total deaths in the UAE. This study aimed to estimate sodium and potassium daily intakes along with KAP towards salt intake in a group of healthy Arab residents in UAE.

Methods: A random sample of 190 healthy individuals with a mean age of 38.6 ± 12.5 years, were recruited from the UAE. Participants were divided into four age groups, 20 to 29.9, 30 to 39.9, 40.0 to 49.9 and ≥ 50 years with female to male ratio of 1.02:0.98. Data on demographic information, lifestyle, past medical history, medication, and current health status were collected. Urinary sodium, potassium and creatinine excretions were measured using a single timed 24-hour urine collection. 24-hour dietary record was collected on the same day of 24-hour urine collection and analysed using Food Processor®. In addition, the Arabic version of the KAP questionnaire for salt intake was administered.

Results: The mean urinary sodium was 2816.2 ± 675.7 mg /day and the potassium excretion in urine was 1948.7 ± 473.1 mg/day, which were significantly different than

the WHO recommended thresholds ($p < 0.001$). Two-thirds of the participants had a sodium excretion above the WHO recommendation. Moreover, 19.2% of males reported that they often add salt before tasting foods compared with 5.2% of females ($P=0.001$). Participants knowledge classification for medical related issues was fair compared to poor classification for food related knowledge with $P=0.001$.

Conclusion: Most of the study population consumed sodium above the levels recommended by WHO with lower intakes of potassium levels compared with WHO recommendations. These findings may suggest an increase in the risk of hypertension in the UAE population. Moreover, participants showed poor knowledge related to salt contents of food. Furthermore, the results of this study agree with the levels of salt consumption found by the 2020 study by Jarrar and colleagues. This indicates that there was no change in these levels between the two studies.

3.1. Introduction

Hypertension, which is increased blood pressure (BP), is a major risk factor in the development of CVDs, which is responsible for 62 percent of stroke and 49 percent of coronary heart disease (CHD) worldwide (He, Burnier and MacGregor, 2011). Hypertension is a common medical condition; its prevalence increases with age (Wu *et al.*, 2020) and is estimated to affect 65% of those ≥ 60 -years-old (Wu *et al.*, 2020). The global population is aging. By 2030, an estimated 20% of the global population will be ≥ 65 -years-old (Wu *et al.*, 2020). Therefore, the impact of high BP on mortality among older adults is expected to grow over the coming decades. According to the WHO, CVDs account for 46 percent of the total deaths in the Kingdom of Saudi Arabia (KSA), 41 percent of the total deaths in Kuwait, 33 percent of the total deaths in Sultanate of Oman, 30 percent of the total deaths in the UAE, 26

percent of the total deaths in Bahrain, and 24 percent of the total deaths in Qatar (Alhamad *et al.*, 2015).

Salt is an ionic compound of sodium and chloride. Sodium is an essential nutrient necessary for the maintenance of certain body functions, such as keeping fluid balance and maintaining muscle and nerve functions. However, according to WHO, adults should consume less than five g (just under a teaspoon) of salt per day (WHO, 2020). High sodium (>2 g/day or >5 g salt/day) and insufficient potassium intake (<3.5 g/day) contribute to high blood pressure ($\geq 130/80$ mmHg), and increase the risk of heart disease and stroke (WHO, 2018b). In the Eastern Mediterranean region, current salt intake is high, with an average intake of >12 g per person per day (Alhamad *et al.*, 2015).

Some studies showed that a decrease in salt intake to 6 g predicted a fall in blood pressure of $\sim 7/4$ mm Hg in hypertensive individuals and of $\sim 3.5/2$ mm Hg in normotensive individuals (Wang *et al.*, 2020). This decrease in blood pressure was predicted to lead to a 14 % reduction in stroke deaths and a 9 % reduction in coronary artery disease deaths in hypertensive people, as well as a 6 % reduction in stroke deaths and a 4% reduction in coronary artery disease deaths in normotensive people (Wang *et al.*, 2020). Population salt reduction is considered a ‘best buy’ intervention for the prevention of NCDs (Wang *et al.*, 2020).

To date, there is only one study that used 24-hour urinary sodium excretion as a tool to assess salt intake in UAE in 2015/16 (Jarrar *et al.*, 2020). Therefore, this study aimed to measure urinary sodium and potassium excretions using PAHO protocol for urine assessment, along with KAP towards salt intake in a sample of the UAE

population (Campbell *et al.*, 2010a). As well as, measuring the relationship between urinary sodium and potassium excretions and KAP towards salt intake.

Hypothesis of the study: sodium intake among a sample of UAE populations exceeds WHO recommendation along with poor food related knowledge toward sodium sources

3.2. Materials and Methods

3.2.1. Ethical approval

Ethical approval for the study protocol was obtained from the Research Ethics Committee at Oxford Brookes University (UREC): UREC Registration No: 181168 ([Appendix 1](#)), the Research Ethics Committee at the United Arab Emirates University (Reference No DVRGS/ 36) ([Appendix. 2](#)), and the Research Ethics Committee at the University of Sharjah (REC-18-03-09-01-S) ([Appendix. 5](#)). All subjects provided a written informed consent to participate ([Appendix 3](#)). An example of the consent form used in this study and the participant information sheet are presented in [Appendix. 6](#).

3.2.2. Study design and participants

A cross-sectional study was conducted from October-2018 - March 2019 in the UAE. A random sample of 210 healthy individuals aged between 20 and 60 years were recruited to participate in the study from the seven Emirates (Western region: Emirate of Abu Dhabi: including Abu Dhabi and Al-Dhafra districts, Northern region: Dubai, Sharjah, Ajman, Ras Al Khaimah, Fujairah and Umm Al Quwain and Eastern region: Al Ain), Recruitment criteria took into consideration age groups and gender ratio 1:1 for female and male participants

Participants were divided into four-age groups, 20 to 29, 30 to 39, 40 to 49, and 50 and above. Several different methods were used for recruitment: email circulation to student, staff and faculty members of UAE University, posters displayed (shopping malls, health centers, hostels, and various national universities in the country), social media including snapchat and WhatsApp. All participants provided written informed consent to participate in the study.

A screening questionnaire was designed to collect data regarding, demographic information, lifestyle habits, past medical history, medication, and current health status. The exclusion criteria at screening were those with chronic diseases (i.e., heart disease, hypertension with medications, renal failure, liver disease), pregnant and lactating women, those on diuretics, and women who had their menstrual cycle during the time of urine collection. Inclusion criteria at screening were participants aged 20 to 60 years for both genders, non-pregnant and non-lactating, no known chronic kidney disease, renal failure, hypertension with medications and liver diseases, no medical condition(s) or medication(s) known to affect urination, and ability to collect 24- hour urine.

Exclusion criteria after urine collection included; those that were unable to collect adequate urine within the 24-hour time period (i.e. volume < 500 ml), creatinine level reference range 500 to 2000 mg/day, which is equivalent to 9 -26 mg/kg of body mass for female participants and 13-29 mg/kg of body mass for male participants (Chernecky and Berger, 2012; Goldman and Schafer, 2011).

3.2.3. Anthropometric and blood pressure measurements

Anthropometric measurements are one of the indicators of nutritional status at both the individual and population levels (Nieman, 2019). All anthropometric

measurements were taken by the researcher (Amjad Jarrar), with participants wearing light clothes and no shoes.

Body weight and height were measured for each participant and their body mass index (BMI) was calculated. Height was recorded to the nearest centimetre (1 cm), using a stadiometer (Seca Ltd, Germany), with subjects standing erect and without shoes. The subjects were asked to stand straight with their head in the Frankfurt plane, feet together, knees straight, and heels, buttocks, and shoulder blades in contact with the vertical surface of the stadiometer (Nieman, 2019). Body weight was recorded to the nearest 0.1 kg using a balance (Seca Ltd, Germany), with subjects wearing light clothing and no shoes. The subjects were asked to stand unassisted on the weighing platform (Nieman, 2019).

BMI cut-off values for normal weight, overweight and the various levels of obesity in adults, published by the World Health Organization (James *et al.*, 2004), were used as shown in Table 3.1.

Table 3. 1 WHO cut-off points¹ for the classification of overweight and obesity

BMI (kg/ m ²)	WHO Classification
<18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
≥ 30.0	Obesity

¹(James *et al.*, 2004)

Systolic and diastolic blood pressures were measured in triplicate after five minutes of resting in a seated position using a calibrated digital automated blood pressure monitor (Omron HEM-907-E7, Japan). The readings were repeated at three-minute intervals and the mean of the last two readings was recorded. Participants were

categorized as hypertensive if blood pressure was $\geq 130/80$ mmHg (Bhagavathula *et al.* 2021). Blood Pressure measurements were performed by a licensed nurse.

3.2.4. Assessment of food intake

The aim of collecting food record on the same day of 24-hour urine collection is to estimate participants' protein intake and compare it with 24- hour urinary creatinine excretion, as well as to assure adequacy of 24-hour urine sample. In addition, it aimed to identify the most frequent high salt foods consumed on the same day of urine collection. In this study 24- hour urinary sodium excretion was determined by 24-hour urinary sodium excretion as recommended by PAHO/WHO protocol which is considered the gold standard of measuring sodium intake (Campbell *et al.*, 2010).

Participants were asked to record their food intake (Food record [Appendix 7-a](#)) on the same day of the urine collection using a 24-hour record. In food records all food and beverages consumed (without including leftover) with detailed information (and if included, supplements), such as brand name, preparation method such adding salt, and cooking method, were recorded using guidelines mentioned in (Nieman, 2019) and used in (Pengpid and Peltzer 2019; Jarrar *et al.*, 2019), [Appendix 7-b](#).

In addition to recording the quantities of food intake, participants were asked to record the use and the quantities of chicken cubes, monosodium glutamate, or any other sauces and dressing oils ([Appendix 7-a](#)).

All participants were given verbal and provide with written instructions on how to determine food portion size. Food photographs with different portion sizes were used to aid participants to estimate the correct portion size consumed (Food record [Appendix 7-a](#) and portion size [Appendix 7-c](#)).

In this study the food record was preferred over the 24-hour recall to give flexibility for the participants to choose suitable time for them to collect 24-hour urine, and to record the food intake at the same time of consumption to reduce the burden of remembering food intakes. Although the limitation of dietary approach still exists as mentioned in section [1.4.2.1](#).

The Food Processor® Nutrition and Fitness Software-ESHA food analysis program (version 10.4) and the Kuwaiti Food Composition database, were used to analyze the energy and macronutrient contents of foods (carbohydrate, protein, and fat) (Dashti *et al.*, 2001; *ESHA's Food & Nutrition Database*). Many previous studies conducted in UAE and Gulf Arabian area used ESHA food analysis program (version 10.4) and the Kuwaiti Food Composition database as a tool for the estimating macro and micronutrients of food intakes (Ali *et al.*, 2012; Zaghloul *et al.*, 2013; Jarrar *et al.*, 2019; Alomirah, 2008b; Jarrar *et al.*, 2019; Cheikh Ismail *et al.*, 2019).

All the food record data entry in the food analysis program, Food Processor®, was performed by the PhD student/Amjad Jarrar.

3.2.5. Knowledge, attitude, and practice (KAP) questionnaire

Participants were asked to complete a self-reported questionnaire developed to assess the participants' KAP using Arabic version regarding salt consumption and information ([Appendix 4](#)). The questionnaire solicited nutritional knowledge in relation to salt and health outcomes, frequency of consumption, and practices related to salt intake. The questionnaire was described in details in Section [2.2.2.1 KAP questionnaire](#).

3.2.6. 24-hour urine collections and analysis

A single-timed 24-hour urine collection was obtained for the estimation of sodium, and potassium according to PAHO/WHO protocol (Campbell et al., 2010), in addition to creatinine excretion. Participants were provided with a 5-L coded plastic container that contained 1g of boric acid to preserve the collected urine sample (Slot, 1965). An instructions sheet ([Appendix 8](#)) on how to collect 24-hour urine and how to fill the 24-hr urinary collection sheet was also provided. All the urine preparations and analysis took place at the College of Foods and Agriculture (CFA) laboratories, UAEU ([Appendix 9](#)).

A urine sample of 50 ml was taken and mixed with 200 µl of 1% Nitric acid solution. These urine samples were stored at -20°C for analysis. All analyses for sodium and potassium were performed within three days of sample collections. An analytical solution was introduced to Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)-Varian ICP-OES model 710-ES for sodium and potassium measurements (Dolan and Capar, 2002). A 2 ml urine sample was collected in an Eppendorf tube and stored at -80°C. Amjad Jarrar (Ph.D. student), was responsible to distribute and collect plastic urine containers among participants among the UAEU populations ([Appendix 9](#) a).

Participants from the UAEU community took containers from Amjad Jarrar (Ph.D. student) to Al-Ain and other cities based on their residents locations in the UAE. Moreover, it was the responsibility of the participants to return containers to the UAEU, through a free shuttle bus provided by the UAEU to all Emirates. Mr. Amjad Jarrar coordinated with participants to take and return plastic containers. During the analysis and handling of urine samples and urine containers, protective clothing (lab coat),

glasses, masks, and gloves were always worn, and waste was kept in special containers (red) for biological waste and disposed of according to Khadamat's Waste Management Strategies for the UAEU Shared Labs Protocols and Requirements <http://studylib.net/doc/5573759/hazardous-waste-collection---khadamat-facilities-management>. ([Appendix 9](#) b).

3.2.7. Determination of sodium and potassium in urine by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)

Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) is an analytical technique used for the detection of chemical elements. It is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element.

Urine samples were diluted with ultra-pure deionized water and treated with acids to destroy the organic matter and solubilize the recoverable elements. The recommended procedure by (Dolan and Capar, 2002; Krejčová, Černohorský and Čurdová, 2001). Was followed to measure urinary sodium and potassium ([Appendix 10](#)). All the measurement of ICP was performed by PhD student under the supervision of the lab technician (Mr. Flex) from CFA laboratories.

3.2.8. Creatinine analysis

The 24-hour urinary creatinine was measured using ab204537 Creatinine Assay Kit based on colorimetric Assay (Bowers and Wong, 1980) with UV-Visible spectrophotometer (Multiscan Go, Thermo-Fisher Scientific, MA, USA). The assay relies on Jaffe` reaction (Slot, 1965). Creatinine (2-amino-1-methyl-5H-imadazol-4-one) is a metabolite of phosphocreatine (p-creatine), a molecule used as a store for

high energy phosphate that can be utilized by tissues for ATP production. Creatine either comes from the diet or is synthesized from the amino acids arginine, glycine, and methionine. This occurs in the kidneys and liver, although other organ systems may be involved, and species-specific differences may exist. All the measurement was performed by Ph. D student.

3.3. Power of analysis

The sample size has been determined based on the WHO Eastern Mediterranean Region Office (WHO-EMRO) protocol published in 2010 for 24-hours urine collection and analysis (Campbell *et al.*, 2010a). To be able to detect 10 mmol/day of sodium (approximately 0.5 g of salt) with 30-mmol standard deviation, the sample size needed for each age stratum is 46 participants from both genders (alpha = 0.05, power = 0.83). Participants were divided into four age groups (20.0-29.9, 30.0-39.9, 40.0-49.9, ≥ 50 years old). Therefore, for the four age groups, 188 participants were required. In this study 190 participants were recruited with a ratio of 1:1 male to female (alpha= 0.05, power =0.83), following age and gender strata recommended by the WHO/PAHO protocol (Campbell *et al.*, 2010a). Therefore, an equal number of males and females was targeted for each age group and recruitment continue until a minimum of 23 per gender and age group was reached. however, recruitment continued to account for future participants dropout.

3.4. Statistical analysis

Data were recorded and analyzed using the Statistical Package for Social Sciences (SPSS) software, version 25 (SPSS, Chicago, IL, USA). Normality of data across combination of independent variables was tested using Shapiro Wilks. Continuous variables were presented as mean $\pm$ standard deviation and categorical

variables were expressed as numbers and percentages. Descriptive statistics were used to summarize the baseline characteristics of the study participants. Two-way ANOVA test was performed to assess the main effects of gender and age groups on 24-hour urinary sodium, potassium, and creatinine excretions.

For interaction analysis, One-way ANOVA, followed by Bonferroni post-hoc test, and independent t-test were used to compare dependent variables according to gender and age groups. One-sample t-test was used to compare the mean urinary sodium and potassium excretions with the recommended dietary allowance, and assessment was carried out based on gender. The effect size was calculated as Cohen d for t-test are: 0.2 (small effect), 0.5 (moderate effect) and 0.8 (large effect) (Cohen 1998; Navarro 2015), and partial eta-squared (η^2) for ANOVA. P-values < 0.05 were considered statistically significant.

3.5. Results

3.5.1. Demographic data of the study population

A total of 210 participants provided urine specimens out of which 3 participants were excluded due to limited urine sample collection (<500 ml urine), and 17 participants were excluded due to creatinine levels below 500 mg /day in the urine allowing a final sample size of 190 participants (alpha = 0.05, power = 0.83) (Figure 3.1). The mean age of the participants was 38.6 years (standard deviation (SD) = 12.5, range 20-60), out of which 50.5% were females (Table 3. 2).

The mean BMI for participants was 25.4 ± 4.8 kg/m² and 50% of the study population had normal blood pressure (Table 3. 2). The prevalence of normal weight, was 45.4%, 3. About 59% of participants were non-Emirati Arabs (Table 3. 2).

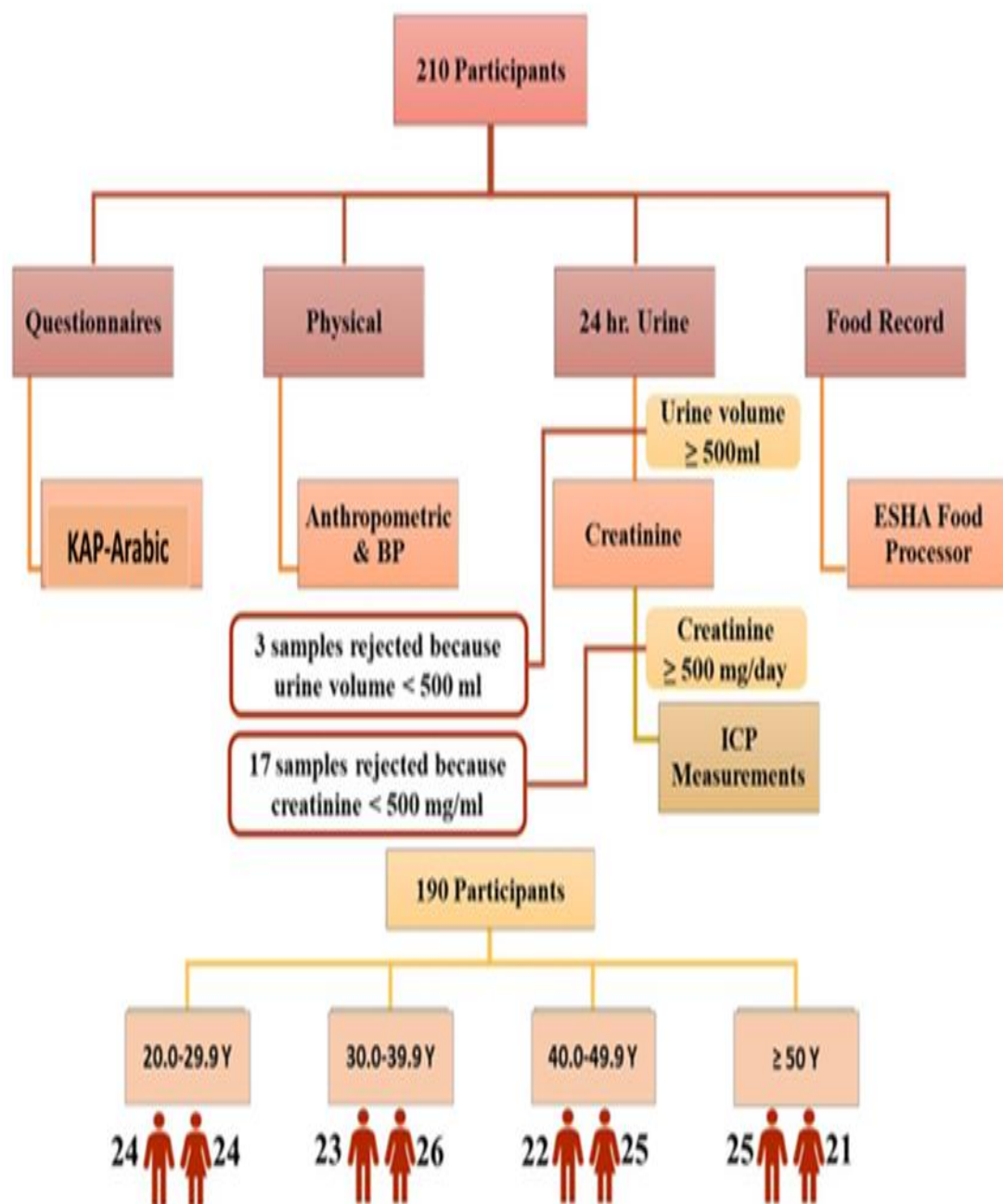


Figure 3. 1 Flow chart of the study

KAP-Arabic: Knowledge, attitude, and practice- Arabic version; Inductively coupled plasma; Y: Year

Table 3. 2 Socio-demographic and physical characteristics of study participants

Characteristics	n (%)	Mean $\pm$ SD ^a
Age (Y)	190 (100)	38.6 $\pm$ 12.5
20-29.9	48 (25.3)	22.2 $\pm$ 2.3
30-39.9	49 (25.8)	33.1 $\pm$ 2.6
40-49.9	47 (24.7)	44.9 $\pm$ 3.0
$\geq$ 50	46 (24.2)	54.7 $\pm$ 3.4
Gender n (%)	Female	Male
	96 (50.5)	94 (49.5)
	n (%)	Mean $\pm$SD^a
Emirati	78 (41.1)	
Arabs	112 (58.9)	
Educational Level	n (%)	
Undergraduate university level	104 (87.4)	
School level (Intermediate or lower)	8 (6.7)	
Postgraduate level	7 (5.9)	
Employment status	n (%)	
Student	51 (42.8)	
Unemployed	19 (16)	
Employed	49 (41.2)	
Body Mass Index (kg/m²)	n (%)	25.4$\pm$4.8
Underweight (18.5)	9 (7.6)	17.6 $\pm$ 0.5
Normal weight (18.5-24.9)	54 (45.4)	22.0 $\pm$ 2.1
Overweight (25-29.9)	39 (32.8)	27.1 $\pm$ 1.2
Obese	17 (14.3)	33.1 $\pm$ 2.7
Blood Pressure (mm Hg)	n (%)	
Normal (< 120/80)	100 (52.6)	
Elevated (systolic 120–129 and diastolic <80)	46 (24.2)	
High Blood Pressure (systolic 130–139 or diastolic 80–89)	44 (23.2)	

^a Data are presented as mean $\pm$ standard deviation for continuous variables or number (%) for categorical variables

Participants from Eastern regions accounted for 35.8 % of total participants (Figure 3.2).

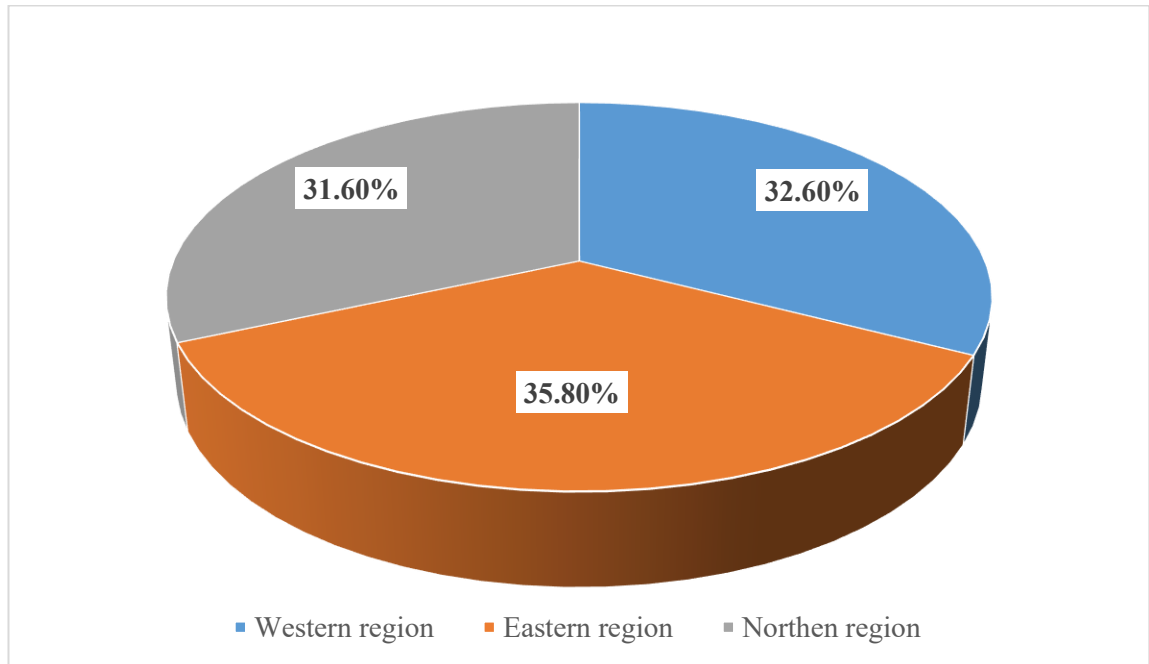


Figure 3. 2 Geographic distribution of the participants by region

3.5.2. Urinary sodium, potassium and creatinine excretion

The main effects of age groups and gender as independent variables were tested with 24- hour urinary sodium, potassium, and creatinine excretion, as the dependent variables. A two-way ANOVA analysis, followed by the Bonferroni test revealed the main effect for age groups on 24-hour urinary sodium excretion, $F(3, 182) = 14.704$; $p < 0.001$; $\eta_p^2 = 0.195$. In addition, there was a significant main effect for gender on 24-hour urinary sodium excretion, $F(1, 182) = 13.061$; $p < 0.001$; $\eta_p^2 = 0.067$. Moreover, the interaction between age groups and gender significantly affected the 24-hour urinary sodium excretion, $F(3, 182) = 2.957$; $p < 0.034$; $\eta_p^2 = 0.046$.

The main effects of age and gender as independent variables were tested with 24- hour urinary potassium excretion as the dependent variables. Age-groups revealed

a main effect on 24-hour urinary potassium excretion, $F(3, 6.931) = 2.957$; $p < 0.001$; $\eta_p^2 = 0.103$. Moreover, gender revealed a main effect on 24-hour urinary potassium excretion, $F(3, 8.108) = 2.957$; $p = 0.005$; $\eta_p^2 = 0.043$. However, age groups and gender interaction did not reveal an effect ($p = 1.00$) on 24-hour urinary potassium excretion, $F(3, 0.005) = 2.957$; $p = 1.000$; $\eta_p^2 = 0.000$. The main effects of age and gender as independent variables were tested with 24-hour urinary creatinine excretion as the dependent variables. Gender revealed a main effect on 24-hour urinary excretion, $F(1, 153.891) = 2.957$; $p < 0.001$; $\eta_p^2 = 0.458$. However, age groups ($p = 0.964$), and interaction between gender and age groups ($p = 0.231$) did not show any effect on 24-hour creatinine excretion.

The mean $\pm$ SD sodium excretion in urine was 2816.2 ± 675.7 mg/day, which is equivalent to 7040 ± 1689.3 mg/day salt. The mean value for sodium excretion in urine exceeded the WHO recommendations and the Recommended Dietary Allowance (RDA) for sodium intake of less than 2300 mg (Figure 3.3).

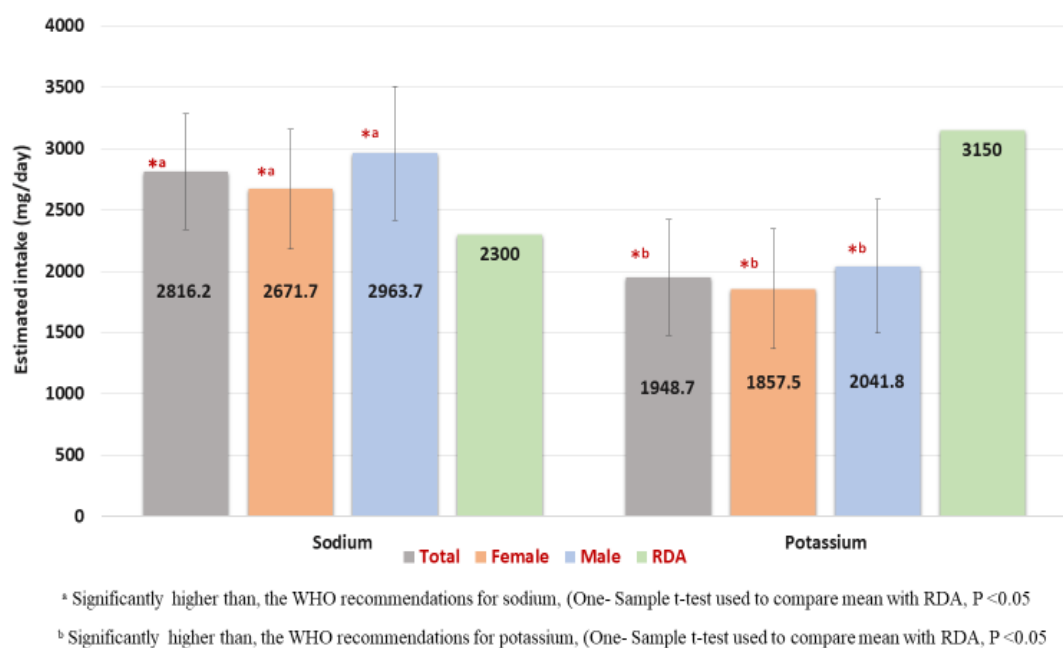


Figure 3. 3 Urinary sodium and potassium excretions compared with WHO recommendation intakes

Of the 190 participants, 131 (68.9%) had sodium excretion above the WHO recommended level of 2300 mg. There was a significant difference ($t = -3.042$, $p = 0.001$) in mean urinary sodium excretion for male participants compared with female participants, as shown in (Table 3. 3) .

Mean urinary excretion for potassium was 1948.7 ± 473.1 mg/day which is lower than the WHO recommendations of 3510 mg/day (Table 3.3 and Figure 3.4). There was a significant difference ($t = -4.741$, $p = 0.007$) in urinary potassium excretion between male and female participants (2041.8 ± 488.9 mg and 1857.5 ± 440.8 mg, respectively), (Table 3. 3).

Mean 24-hour urinary creatinine excretion for females and males were 1223.9 ± 225.8 mg and 1621.7 ± 254.6 , respectively, which is within the normal range of 24-hour creatinine excretion (500-2000 mg) (Chernecky and Berger, 2012; Goldman and Schafer, 2011).

Table 3. 3 Urinary (24- hour) sodium, potassium, and creatinine excretions

Variables	Df	Mean $\pm$ SD ^a			f-value	t-value	P-value ^b
		Total (n=190)	Female (n=96)	Male (n=94)			
Urinary Sodium (mg)	188	2816.2 ± 675.7^b	2671.7 ± 545.3^b	2963.7 ± 761.9^b	11.939	-3.042	0.003
Salt (mg)	188	7040 ± 1689.3	6679.3 ± 1363.3	7409.3 ± 1904.9	11.939	-3.042	0.003
Urinary Potassium (mg)	188	1948.7 ± 473.1^d	1857.5 ± 440.8^d	2041.8 ± 488.9^d	1.452	-4.741	0.007
Creatinine (mg/kg/24hr.)	188	18.1 ± 3.2	16.1 ± 2.6	20.6 ± 3.5	16.241	-2.728	0.001

^a Data presented as Mean $\pm$ standard deviation. ^b Independent-Samples T-test used to assess significance according to gender ($p < 0.05$).

The maximum urinary sodium excretion detected among male participants was 3567.3 ± 851 mg/day at age group of 20-29.9 years, while the minimum urinary sodium

excretion detected in male participants was 2523.7 ± 527.6 mg/day at age group of ≥ 50 years ([Appendix 22 Table 3.4](#)). Moreover, the maximum urinary sodium excretion detected in female participants was 2836.5 ± 685.3 mg/day at age group of 30-39.9 years, and the minimum urinary sodium excretion was 23505 ± 364.6 mg/day at age group of ≥ 50 years ([Appendix 22 Table 3.4](#)).

Table 3. 4 Urinary (24-hour). sodium, potassium, and creatinine excretions according to gender and age groups (n=190) ([Appendix 22 Table 3.4](#))

3.5.3. Salt-related knowledge, attitudes and practices

Participants reported higher scores for health-related knowledge with score of compared with foods related knowledge ($p=0.001$), as shown in ([Appendix 22 Table 3.5](#)). However, this score was classified as fair for health-related knowledge and poor for food-related knowledge ([Appendix 22 Table 3.5](#)).

Table 3. 5 Food and health related knowledge scores and classifications for study population ([Appendix 22 Table 3.5](#))

Female participants showed higher scores for health and food related knowledge compared with male participants ($p=0.009$). The highest score for female participants was at age of ≥ 50 years, for foods-related knowledge score (6.2 ± 2.2) and health-related knowledge score (7.3 ± 2.8). The male participants scored highest for food-related knowledge (5.2 ± 2.3) at age of ≥ 50 years and health-related knowledge score (6.2 ± 3.5) at age of 40-49.9 years ([Appendix 22 Table 3.5](#)). Moreover, the main effects of age groups and gender as independent variables were tested with food and health related knowledge, as the dependent variables. A two-way ANOVA analysis, using post-hoc analyses using the Bonferroni test was performed.

Age-groups revealed a main effect on food-related knowledge, $F(3,182) = 2.680$; $p < 0.048$; $\eta_p^2 = 0.042$ (Table 3.5, data not shown in table). In addition, gender revealed a main effect on food related knowledge, $F(1,182) = 8.711$; $p < 0.004$; $\eta_p^2 = 0.046$. There was no age-groups-gender interaction effect either on food related $P > 0.05$, or on health-related knowledge ($P > 0.05$) (data not shown in table).

Almost, 65% of the study population exceeded WHO recommendation of sodium intake; of which 69.1% were males and 61.5% were females (Figure 3.4).

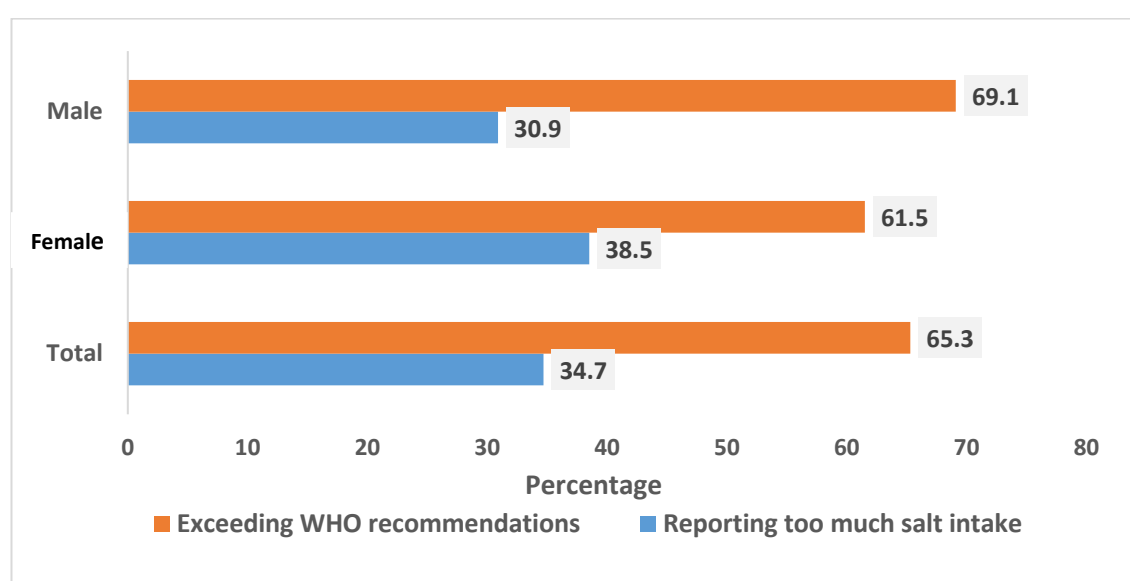


Figure 3. 4 Actual urinary sodium excretion showing percentage of participants exceeding WHO recommendation for sodium intake compared with percentage of participants reporting excess sodium intake.

About 71% of the participants reported that they consumed just the right amount of salt and only 20% reported “too much salt intake” ([Appendix 22 Table 3.6](#)). Moreover, only 21% of the study population had concerns about the amount of salt/sodium in their diet and 25% agreed on the importance of reducing adding salt to the food ([Appendix 22 Table 3.6](#)). Only 15.8% of the study population tended to check food labels often, with a higher percentage of female participants than males (P -value=

0.008; [Appendix 22 Table 3.7](#)). Out of the 15.8% checking food labels, only 8% reported checking sodium contents of the food often.

Table 3. 6 Salt-related attitudes among study population by gender (n=190) ([Appendix 22 Table 3.6](#)).

The majority of the study population (60%) reported that they often add salt during cooking, with 17% often using chicken cubes during cooking, and 12% often adding table salt as shown in [Appendix 22 Table 3.7](#). Almost 19% of male participants often add salt before tasting the food which was significantly higher than female with $p=0.001$ ([Appendix 22 Table 3.7](#)).

Table 3. 7 Salt-related practices among study population by gender (n=190) ([Appendix 22 Table 3.7](#)).

Most of the study sample failed to identify Arabic/ Iranian bread and corn flakes as sources of high salt/sodium, only 1/3 were able to identify these foods correctly (Table 3.8). Moreover, most of them failed to identify fresh red meat as a low source of sodium. While almost more than 60% were able to identify instant noodles, chicken cubes, cheddar cheese, salad dressing, tomato paste, canned-vegetable foods, and pickles as sources of high salt/sodium (Table 3.8). Female participants showed better scores in identifying foods with high sodium contents such as cheddar cheese, ketchup, tomato paste, and corn flakes ($p<0.05$: Table 3.8).

Table 3. 8 The number and percentage of participants who answered correctly on food related knowledge

Sodium contents of selected foods ^a	Total n (%)	Female n (%)	Male n (%)	P-value ^c
Arabic bread (High)	66 (34.7) ^b	35 (36.5)	31 (33.0)	0.219
Iranian bread (High)	68 (35.8)	38 (39.6)	30 (31.9)	0.302
Rice- Egyptian (Low)	100 (52.6)	54 (56.3)	46 (49.0)	0.107
Rice-Basmati (Low)	106 (55.8)	60 (62.5)	46 (49.0)	0.018
Milk/yoghurt (Low)	100 (52.6)	56 (58.3)	44 (46.8)	0.07
Fresh red meat (Low)	66 (34.7)	29 (30.2)	37 (39.4)	0.721
Fresh poultry (Low)	95 (50.0)	43 (44.8)	52 (55.3)	0.533
Fruits (Low)	132 (69.5)	70 (72.9)	62 (66.0)	0.182
Fresh vegetables (Low)	135 (71.1)	69 (71.9)	66 (70.2)	0.622
Canned vegetables (High)	119 (62.6)	67 (69.8)	52 (55.3)	0.058
Cheddar cheese (High)	137 (72.1)	77 (80.2)	60 (63.8)	0.016
Pickles (High)	141 (74.2)	74 (77.1)	67 (71.3)	0.484
Olive oil (Low)	101 (53.2)	48 (50.0)	53 (56.4)	0.271
Salad dressing oil (High)	126 (66.3)	69 (71.9)	57 (60.6)	0.198
Ketchup (High)	113 (59.5)	64 (67.3)	49 (0.52)	0.032
Tomato paste (High)	123 (64.7)	69 (71.9)	54 (57.4)	0.009
Corn flakes (High)	50 (26.3)	32 (33.3)	18 (19.1)	0.015
Chicken cubes (High)	115 (60.5)	63 (65.6)	52 (55.3)	0.083
Instant noodle (High)	110 (58)	60 (62.5)	50 (53.2)	0.087

^a The correct answers are provided in brackets next to each variable, each correct answer earns 1 score.

^b Data presented as number and frequencies of the correct answer. ^c Independent-Samples T-test used to assessed Significance at $p < 0.05$ for variable according to gender.

3.5.4. Macronutrient intakes for study population

Table 3.9 presents macronutrient intake among the study sample (n=190). The percentage of energy from carbohydrate, protein and fat was within the Acceptable Macronutrient Distribution Range (AMDR) for study population, which was within 45-65% for carbohydrate, 10-35% for protein, and 25-35% for fat (IOM, 2005) (Table 3.9).

Table 3. 9 Energy and macronutrient intakes of the study population

Variables	Df	Mean $\pm$ SD ¹					
		Total	Females (n=96)	Male (n=94)	f-value	t-value	P-value ²
Calories (Kcal)	188	1850.8 $\pm$ 33.8 ^a	1816.0 $\pm$ 38.5	1918.2 $\pm$ 55	1.339	-1.310	0.833
Carbohydrate ³	188	232.0 $\pm$ 6.4	228.2 $\pm$ 8.5	238.2 $\pm$ 9.6	0.331	-0.971	0.851
Protein (g)	188	74.5 $\pm$ 1.1	70.9 $\pm$ 1.1	79.7 $\pm$ 1.9	0.131	-0.396	0.667
Fat (g)	188	69.3 $\pm$ 1.8	67.0 $\pm$ 2.6	71.9 $\pm$ 2.5	0.112	-0.226	0.633
Fiber (g)	188	15.1 $\pm$ 0.9	13.9 $\pm$ 1.1	16.4 $\pm$ 1.4	1.076	-1.398	0.181

¹ Data presented as Mean $\pm$ Standard deviation ³ Data displayed in grams.

² Independent-Samples T-test used to assess significance at $p < 0.05$ for variable according to gender.

Table 3.10, shows protein intake as gram protein intake per body weight (kg) for the study population according to gender and age groups. There was a significant difference with $p = 0.001$ for protein intake per body weight according to gender, the intake of males more than female (Table 3.10).

Table 3. 10 Protein intakes for participants as gram per kilogram body mass

Variables	Mean ± SD ^a					
	20-29.9 Years				P- value ^c Compared with RDA for protein intake ^c (0.83 g protein/kg)	
Protein intake g/ Kg body mass	Females (24)	Males (24)	P-value ^b	Total (48)		
	1.00±0.21	1.13 ± 0.22	0.186	1.06±0.22		
	30-39.9 Years					
	Females (26)	Males (23)	P-value ^b	Total (49)		
	0.97±0.22	1.10 ±0.20	0.031	1.03±0.22		
	40-49.9 Years					
	Females (25)	Male (22)	P-value ^b	Total (47)		
	0.98 ±0.17	1.10±0.19	0.010	1.03±0.22		
	≥ 50 Years					
	Females (21)	Male (25)	P-value ^b	Total (46)		
0.91 ± 0.19	0.97±0.21	0.573	0.95±0.21			
	All age groups				Female ^c	Male ^c
	Female (96)	Male (94)	P-value ^b	Total (190)		
	0.97 ±0.20	1.07 ±0.21	0.001	1.02±0.21	0.001	0.001

^a Data presented as Mean $\pm$ standard deviation. ^b Independent-Samples T-test used to assess significance at $\alpha = 5\%$ for variable according to gender. ^c Recommended dietary allowance (RDA), (IOM, 2005).

^e One- Sample t-test used to compare mean with RDA, ($p < 0.05$).

A partial correlation analysis showed that there was no significant correlation between 24-hour urinary creatinine excretion and urine volume with protein intake and protein intake as gram/kg body weight (Table 3.11).

Table 3. 11 Correlation between 24- hour creatinine urinary excretion and total protein intake and relative protein intake, while controlling for urine volume

Variables		Creatinine 24-hour. (mg)	Protein intake (g)	Protein intake (g/kg BW)
Creatinine 24- hour. (mg)	Correlation ^a		-0.058	0.104
	P-value		0.425	0.154
	df ^b		188	188
Protein intake (g)	Correlation ^a	-0.058		0.275
	P-value	0.425		0.001
	df ^b	188		188
Protein intake (g/kg body weight)	Correlation ^a	0.104	0.275	
	P-value	0.154	0.001	
	df ^b	188	188	

^a Pearson correlation (1st order), ^b Degree of freedom

According to the 24-hour food record obtained on the same day of urine collection, 70% reported that they consumed breads with mean sodium intake of 735.2±317.2 mg followed by Cheese and Manakish (Table 3.12, Figure 3.5). Breads showed a significant difference according to gender with $p=0.039$, as shown in (Table 3.12).

Table 3. 12 Mean sodium intake (mg/day) for the most frequent food items consumed using food record^a

Food items	Df	Mean ± SD ^b					
		Total (n=190)	Females (n=96)	Male (n=94)	f-value	t-value	P-value ^c
Breads (g)	188	735.2±317.2	610.5±299.6	861.9±343.7	15.631	-2.077	0.039
Cheese (g)	188	145.7±110.6	142.4±108.3	149.8±112.0	8.033	-1.657	0.773
Manakish (g)	188	124.3±95.2	107.8±90.3	140.4±102.3	0.024	-0.289	0.335

^a Food record obtained on the same day of the 24-hour urine collection. ^b Data presented as Mean ± Standard deviation ^c Independent-Samples T-test used to assessed significance at $p<0.05$ according to gender.

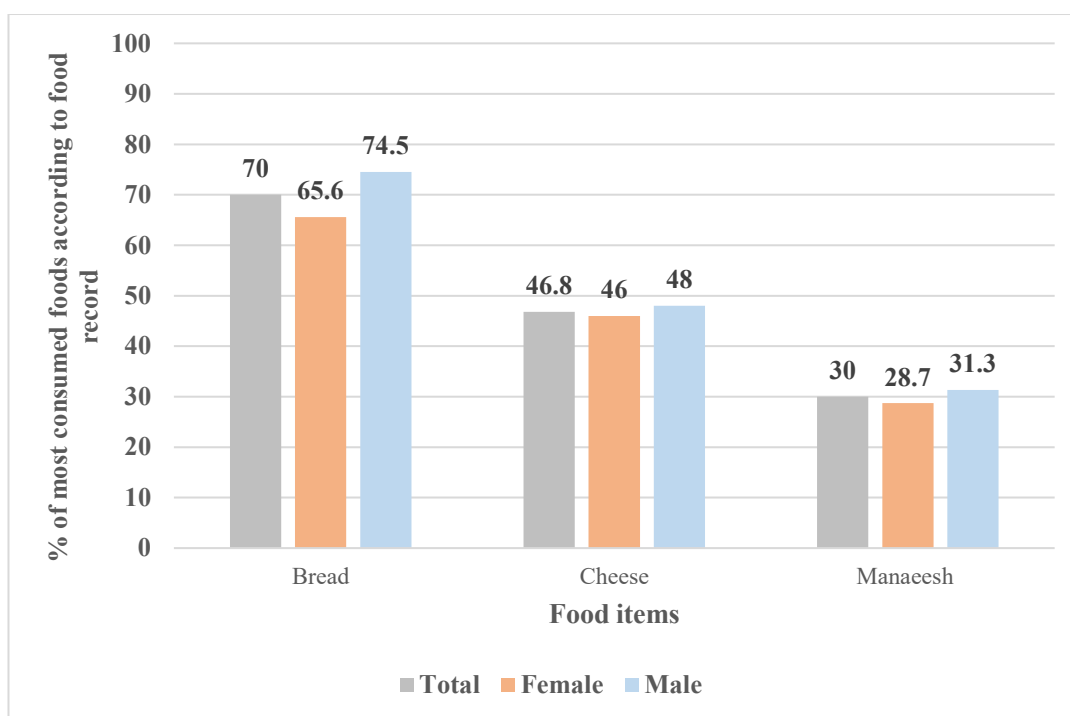


Figure 3. 5 Most frequent high sodium foods consumed using food record

3.5.5. Step wise multiple regression to assess predictors of Urinary sodium and potassium excretions

Table 3. 13, shows the association between KAP-total with urinary sodium and potassium excretion. A two-stage stepwise multiple regression analysis revealed a negative relationship between KAP and urinary sodium excretion. In the first model (step 1), four variables including age, gender, marital status and caloric intake were entered. Age and gender were good predictors of urinary sodium excretion ($p < 0.05$), however, marital status ($p = 0.175$) and caloric intake ($p = 0.672$) were not significantly associated with urinary sodium excretion. The four variables in step 1 explained 22.4% ($F(4, 185) = 13.356, p < 0.001; R^2 = 0.224, p < 0.001$). of the variance in urinary sodium excretion. In step 2, KAP-total variable was entered while controlling for age, gender, marital status, and caloric intake. Adding KAP-total variable significantly explained

an additional 2.4% of the urinary sodium excretion variance (R^2 change= 0.024, $p=0.017$). Overall, the five variables explained 24.8% ($F(5, 184) = 12.113$, $p < 0.001$) of the variance in the urinary sodium excretion. In step 2, when all of the five variables were in the final model, two variables failed to predict urinary sodium excretion, marital status ($p = 0.104$) and caloric contents ($p = 0.844$), while age ($B = -25.040$, $p < 0.001$, $r = -0.435$), gender (males) ($B = 349.094$, $p < 0.001$, $r = 0.281$) and KAP ($B = -6.840$, $p < 0.017$, $r = -0.174$), as shown in Table 3. 13-A, were predictors for urinary sodium excretions. These results showed a negative correlation between KAP with urinary sodium excretion. Furthermore, age was inversely associated with urinary sodium excretion. Males were more likely to show higher urinary sodium excretions than females.

A two-stage stepwise multiple regression analysis was conducted (Table 3. 13--B) to assess the association of urinary potassium excretion with KAP after controlling for the influence of age, gender, marital status and caloric intake. Age and gender had well predictions of urinary sodium excretion ($p < 0.05$) except for Marital status ($p = 0.058$) and caloric contents ($p = 0.319$). The four variables in step 1 explained 13.3% ($F(4, 185) = 7.109$, $p < 0.001$) of the variance in urinary potassium excretion. In step 2, KAP variable was added as predictors of urinary potassium excretion in addition to: age, gender, marital status and caloric intake. The added KAP-total variable did not significantly provide additional explanation of the variance in the urinary potassium excretion ($p = 0.147$). In the final model, both caloric intake ($p = .0392$) and KAP-total ($p = 0.147$), failed to predict urinary potassium excretion. While Age ($B = -12.663$, $p < 0.001$, $r = -0.311$), gender (males) ($B = 210.683$, $p < .001$, $r = 0.230$) and marital status ($B = 109.724$, $p < 0.041$, $r = 0.150$) were predictors for urinary potassium excretions.

Table 3. 13 Step wise multiple regression to assess predictors of Urinary sodium and potassium excretions

Model	A- Urinary sodium excretion				
	Variables	B ¹ (CI 95%) ²	S.E. ³	R	P-value
1	Age	-24.245 (-31.848, -16.642)	3.854	-0.420	<0.001
	Gender	317.957 (143.946, 491.968)	88.202	0.256	<0.001
	Marital status	97.838(-43.848, 239.523)	71.817	0.100	0.175
	Caloric intake	0.035 (-0.129, 0.199)	0.083	0.031	0.672
2	Age	-25.040 (-32.576, -17.504)	3.820	-0.435	<0.001
	Gender	349.094 (175.381, 522.807)	88.048	0.281	<0.001
	Marital status	116.679 (-24.075, 257.433)	71.342	0.120	0.104
	Caloric intakes	0.016 (-0.146, 0.179)	0.082	0.015	0.844
	KAP-Total	-6.840 (-12.461, -1.220)	2.849	-0.174	0.017
B- Urinary potassium excretion					
1	Age	-12.303 (-17.930, -6.677)	2.852	-0.302	<0.001
	Gender	196.585 (67.820,325.349)	65.268	0.216	0.003
	Marital status	101.193 (-3.651, 206.037)	53.143	0.139	0.058
	Caloric intake	0.061 (-0.060, 0.183)	0.061	0.073	0.319
2	Age	-12.663 (-18.294, -7.033)	2.854	-0.311	<0.001
	Gender	210.683 (80.885,340.480)	65.789	0.230	0.002
	Marital status	109.724 (4.553, 214.894)	53.307	0.150	0.041
	Caloric intakes	0.053 (-0.069, 0.174)	0.062	0.063	0.392
	KAP-Total	3.097 (-1.103, 7.297)	2.129	0.107	0.147

¹ Standardized regression ²Confidence intervals ³ Standard error

3.6. Discussion

To our knowledge, this is the first study in the UAE to report 24-hour urinary sodium excretion levels using WHO/PAHO protocol (Campbell *et al.*, 2010a) along with KAP toward sodium intake. The 24-hour urinary sodium excretion is considered the gold standard method to estimate sodium intake (Sadler *et al.*, 2011; Othman *et al.*, 2019). A 24-hour collection period is necessary to capture the marked diurnal variation in sodium, chloride, and water excretion. Electrolyte excretion in healthy individuals normally reaches the maximum at or before mid-day and the minimum at night towards the end of sleep (Wesson Jr, 1964; Othman *et al.*, 2019).

In the current study, several methods were used to confirm the adequacy of 24-hour urine collection, including the inclusion criteria recommended by the WHO/PAHO protocol, such as urine log sheet and urine volume, as well as the creatinine levels as recommended by the WHO and other studies (Campbell *et al.*, 2010a; Land *et al.*, 2014a; Derouiche *et al.*, 2017; Chen *et al.*, 2018; Mansuri and Moorjani, 2019; Othman *et al.*, 2019; Jarrar *et al.*, 2020).

The result of the current study showed a constant in salt consumption in a sample of the UAE population compared with a study conducted in 2015 (Jarrar *et al.*, 2020), which showed that the level of salt intake was 6.78 g, showing a minor increase by 3.6%. Moreover, these findings indicate there is no change or reduction in the salt intake in the UAE population since 2015. Similar findings on high salt intake were reported in Morocco with an intake of 7.1 g/day (Derouiche *et al.*, 2017).

A study conducted in Eastern Saudi Arabia presented the mean intake of sodium assessed by a 24-hr sodium excretion to be 3.2 ± 1.1 g/day (8.0 g salt/day) (Alkhunaizi, Al and Al, 2013). In Jordan, a study using 24-hr urinary sodium excretion reported an average sodium intake of 4.1 g/day (10.4 g/day salt) which is double the current the WHO recommendations for sodium intake (Alawwa *et al.*, 2018). Likewise, a study conducted in Oman using the National Nutrition Survey based on a 24-hr dietary recall, noted the average intake of salt was 11-12 g/day (Al-Ghannami and Atwood, 2014), which is also significantly higher than the WHO recommendations. Two further studies analyzing food consumption in Kuwait (Zaghloul *et al.*, 2013; Alomirah, 2008a) reported an average salt intake within 8-10 g/day. Both studies in Oman and Kuwait recommended using the 24-hr urinary sodium excretion method to have accurate results of sodium and salt intakes in the population. Globally, the mean intake of sodium is high in East Asia, Central Asia, the Eastern Europe, Central Europe,

and Middle East/North Africa ranging between 3.9-4.2 g/day, which is equivalent to 9.75-10.5 g/day of salt (Mozaffarian *et al.*, 2014). These results exceed the WHO recommendations, which are similar to our findings. Moreover, mean urinary sodium excretion in Japan and United Kingdom was 4.47 ± 1.6 g/day and 3.9 ± 1.3 g/day respectively, which was attributed to the high intake of canned and processed foods (Anderson *et al.*, 2010; Sadler *et al.*, 2011).

In the current study, the salt intake for males was significantly higher than females, but this finding is not limited to the current study. Similar findings were reported in other studies conducted in Saudi Arabia and Malaysia (Othman *et al.*, 2019) (Alkhunaizi, Al and Al, 2013). In addition, several studies conducted in Europe showed mean sodium intake for males higher than females (Commission, 2012; Chen *et al.*, 2018). Also a study conducted among adult population in USA confirmed same finding (Cogswell *et al.*, 2018). This finding was discussed and explained by two studies (Frye and Demolar, 1994; Verma *et al.*, 2005), as they reported that females preferred unsalted foods during the menstrual phase more than the luteal phase. Studies revealed significant differences in the preference of foods between the menstrual phase and the other two phases, but there was no significant difference in preference between the luteal and follicular phases (luteal and follicular phases), this may contributed to reduce salt threshold, which may contributed to reduce salt intake compared with males (Frye and Demolar, 1994; Verma *et al.*, 2005).

High dietary sodium and low dietary potassium intakes are associated with high BP ($\geq 130/80$ mmHg) levels and increased risk of CVDs and consequently, this may contribute to the risk of developing NCDs (Land *et al.*, 2018; He, Burnier and MacGregor, 2011). In the current study, the 24-hr urinary potassium excretion was significantly lower than the amount recommended by the WHO (3.510 g/day of

potassium) (WHO, 2012b). Moreover, the sodium to potassium ratio in the current study was 1.50 ± 0.40 , thus, suggesting that not only did sodium intake exceed WHO recommendations but also potassium intake. These finding were supported by other studies in the 2005 UAE GSHS, which reported that the incidence rate of insufficient fruit and vegetable consumption was significantly high and further increased into 2016 (Pengpid and Peltzer 2019). Moreover, a study included 620 participants from UAE found that only 28% of them met the recommended daily fruit and vegetable intake (Makansi *et al.*, 2018), and that the low intake of fruit and vegetables contributed to low potassium intake in UAE.

Moreover, the 24-hour urinary potassium excretion is correlated with dietary potassium intake (Taylor *et al.*, 2010; Chen *et al.*, 2018). High urinary sodium to potassium ratio can be an indicator of the need for reducing sodium intake and increasing potassium intake (Campbell *et al.*, 2010a). Therefore, WHO has suggested sodium: potassium ratio of approximately 1.00, which will be associated with low risk for development of CVDs (WHO, 2012c; WHO, 2012b).

In the current study, 65.3% of the participants exceeded the WHO recommendations of salt intake while only 20% of them reported that they exceed WHO recommendations. This indicates that around 45% of the participants were not aware that their consumption was beyond the recommended amount. This was supported by the findings of the current study, which showed that most participants had limited knowledge related to the main foods that contribute to salt in the diet. The findings regarding both the health and food related knowledge were similar to a study conducted in Canada, which showed that less than 50% of the participants had food knowledge related to salt content and could identify right salt content in many food items such as processed cheese and canned vegetables (Papadakis *et al.*, 2010).

However, 70% of the participants in the Canadian study could identify the health issues and diseases related to salt consumption (Papadakis *et al.*, 2010), which was similar to the finding of this study, this may be because most of the awareness campaigns and educational tools focused on health hazards of high sodium/salt intakes rather than identifying food sources of high sodium/salt especially home prepared foods, restaurants, and local foods (Dong 2018).

In the current study, the ability of participants to identify some of the processed foods as high sources of sodium and failure to recognize bread and corn flakes as high sources of salt were similar to another study conducted among university students in Sharjah, UAE (Cheikh Ismail *et al.*, 2019).

In the current study, 70% of the study sample reported consuming bread on the same day of 24-hour urine sample collection. The study showed that the sodium content of the consumed bread had the maximum value of the sodium intake obtained through the food record. This finding was reported in other Arab studies, which found bread to be the major contributor of sodium in the Gulf diet (Alhamad *et al.*, 2015) and Arab world diet. These reported that sodium contents of different types of bread among 8 Arabian countries showed mean average sodium contents of 0.43 to 1.27 g /100 g bread (Al Jawaldeh and A, Al-Khamaiseh, 2018). Moreover, in Kuwait bread was identified as the second main source of salt after homemade Kuwaiti composite dishes (Alhamad *et al.*, 2015). Similarly, in Qatar the government found that the main source of salt in the Qatari diet was from bread and other baked products (Alhamad *et al.*, 2015). In the current study, most of the participants reported that they consumed bread (a staple food in the UAE and in many Arab countries) and 30% consumed Manakish and pastries (which also contains bread) on the day of 24-hour urine collection, indicating that bread is a major contributor for salt intake in the UAE. It is worth to

mention that obtaining a three-day food record is a better approach to give a better understanding of the food consumption pattern (Nieman, 2019).

The current study suggests that one of the main reasons behind high salt intake was low knowledge toward sodium/salt contents of foods, particularly bread (Arabic/Iranian). In addition to using and adding salt at the table, the addition of salt before tasting the food is also considered one of the factors that contribute to the high salt intake in the UAE population. This indicates that education and public awareness programs are required to increase awareness about salt intake, salt content of staple foods, processed foods, and other foods in general.

A recent systematic review and meta-analysis determining consumer acceptance of reformulated food products showed that salt could be reduced by about 40% in bread and approximately 70% in processed meat without significantly affecting consumer acceptability (Jaenke *et al.*, 2017). This can be used as an initiative in the UAE to reduce salt intake effectively. Moreover, the results of the current study indicated very high sodium with low potassium intakes within the general population of the UAE. This would consequently increase the risk of hypertension, CVD and other NCDs, which accelerates the need to initiate salt reduction programs to reduce the risks of NCDs.

Despite the significant findings, a limitation of this study was that urinary sodium was assessed by a single 24-hr urine collection and this may not represent the average sodium intake in a person due to the daily individual variability. However, a single urine measurement is considered a more accurate measure of sodium intake at a population level but possibly less accurate for individuals (Chen *et al.*, 2018; Othman

et al., 2019; Luft, Fineberg and Sloan, 1982). In addition to the use of single food record to identify most food contributing to salt intake is not the best approach.

3.7. Conclusion

The result of the current study showed a constant in sodium consumption in a sample of the UAE population compared with a study conducted in 2015. The mean 24-hour urinary sodium excretion for the current study is significantly ($p < 0.05$) above the WHO recommendation and significantly ($p < 0.05$) below the WHO recommendation for potassium. Arabic bread and bakery products considered one of the major contributors to the daily sodium intake in UAE. Food and health related knowledge for the participants was classified as poor and faire respectively.

suggesting that the problem is not limited to the high intake of sodium but also the low intake of potassium.

The finding of this study emphasizes the need to establish education and public awareness programs focusing on food related knowledge and to increase awareness of salt portion sizes and the salt content of staple foods, processed foods, drinks, and other foods in general. In addition, there is a need to establish regulations aiming to reformulate foods, particularly staples such as bread.

Chapter 4

Using Digital platform approach to reduce salt intake in a sample of the UAE

population: An intervention study

Abstract: Study 3

Background: The World Health Organization (WHO) has flagged population salt reduction as one of the five priority interventions to prevent noncommunicable diseases. The WHO has adopted a global target of 30% reduction in the mean salt intake by the population until 2025. As a response to limited or even no intervention studies to reduce salt intakes in the Arab world, the GCC, or in UAE, this study aimed to measure effectiveness of using digital platforms as a tool to deliver educational material related to salt reduction in a sample of the UAE population.

Methods: A controlled parallel intervention study was conducted in October-2020 to January-2021. A sample of 121 participants with mean age of 28.5 ± 5.7 years completed the study with female to male ratio of (0.95:1.05). Participants were distributed randomly into three groups Control group, WhatsApp group and electronic brochures group. Educational material was distributed among participants of WhatsApp and electronic brochures groups for 6-weeks. Educational material aimed to identify foods rich in sodium and potassium, how to read the food label, how to reduce salt intake, and salt alternatives. Information from the Weqaya program, HAAD-UAE, CDC and outcome of study-1 (chapter 3) were used to develop educational-material. The 24-hour urinary excretion for sodium and potassium, were measured along with using the Arabic-KAP and food frequency questionnaires on two occasions at baseline and endpoint.

Results: Both intervention groups showed a reduction in sodium intake with 278 mg ($p<0.001$) for WhatsApp group ($n=41$) and 169 mg ($p<0.018$) for electronic brochure-email group ($n=41$) after intervention and there was a significant difference between three-groups at Intervention with $p=0.046$. Moreover, the percentage of participants exceeding the WHO recommendations of sodium intake for total population was 77.7% at baseline and was reduced to 71.1% at the end. A significant reduction in the practice towards adding salt during cooking, use of table salt, adding salt before tasting the foods, and using of chicken stocks for both intervention groups was noted (all $ps<0.05$). Both intervention groups showed a significant improvement in food and health related knowledge ($p<0.001$) at the endpoint.

Conclusion: Providing educational material through digital platforms was associated with improving KAP towards salt intake and lowered salt intake. This study showed that the UAE study-population is ready to reduce salt intake with appropriate educational material and easy delivery approach. In addition, this study is the first intervention study in UAE using digital approaches as intervention tool to reduce salt intake

4.1. Introduction

A diet high in sodium is ranked as the leading dietary risk factor for deaths and disability-adjusted life years (DALYs) globally, and habitual consumption of excessive sodium—most commonly through the consumption of salt—predispose individuals to hypertension (Afshin *et al.*, 2019). Dietary interventions, including limiting sodium consumption from all sources, are an important approach to address key risk factors for CVDs (Ide *et al.*, 2020; WHO, 2018b). Therefore, World Health

Organization (WHO) has flagged population salt reduction as one of the five priority interventions to prevent noncommunicable diseases (Silva-Santos et al., 2022).

A key factor in the success of efforts to reduce sodium intake is that salt (sodium chloride), the primary source of sodium in the diet—has desirable characteristics from a culinary perspective. Added salt improves the sensory properties of foods that humans consume, and it is inexpensive. Moreover, dietary sodium is typically consumed from three distinct sources: sodium added to packaged food during manufacturing, sodium added to food consumed outside home, and sodium added at home, either during cooking or while eating (also known as discretionary sources) (Ide *et al.*, 2020).

Many Asian countries that have documented sodium sources consume most of their sodium from discretionary food sources, accounting for most dietary sodium intake. In the People's Republic of China, most (76%) dietary sodium was from salt added in home cooking, about 50% less in southern than northern areas of the country. In Japan, most (63%) dietary sodium came from soy sauce (20%), commercially processed fish/seafood (15%), salted soups (15%), and preserved vegetables (13%) (Anderson *et al.*, 2010). In the United States, the United Kingdom, and Australia most (95%) of dietary sodium came from processed foods, including bread/cereals/grains (Bhat *et al.*, 2020).

A public health awareness campaign in the United Kingdom was successful in decreasing salt intake by 1.4 g per day, or 15%, reducing mean blood pressure by 3.0/1.4 mmHg, as well as decreasing mortality from stroke by 42% and ischemic heart disease by 40% between 2003/2004 to 2011 (He, Brinsden and MacGregor, 2014). Meanwhile, in South Korea, campaigns focused on the development of low-sodium

recipes for food prepared at home. This ended up with a 23.7% reduction in population sodium intake, significant decreases in hypertension prevalence between 2010 and 2014 in adults above 30 years (men from 33.5% to 26.0%, and women from 25.2% to 21.7) (Park *et al.*)

WHO has recommended different strategies to reduce salt intake at country levels, these include consumer education and awareness, food reformulation, front-of-pack labeling, and salt taxation (Trieu *et al.*, 2015; Ide *et al.*, 2020). The number of countries that have national sodium reduction strategies doubled from 2010 to 2014 (Trieu *et al.*, 2015; Ide *et al.*, 2020). As of 2016–2017, 89 countries have national policies that support sodium reduction (WHO, 2018b; Ide *et al.*, 2020). Although the specific strategies vary, almost all take a multi-component approach. Consumer education is the most common intervention, although an increasing number incorporate a regulatory approach as well (Trieu *et al.*, 2015; Ide *et al.*, 2020).

Two cross sectional studies were conducted in UAE, one among adult population (Jarrar *et al.*, 2020) and another among University students (Cheikh Ismail *et al.*, 2019). Both studies showed KAP toward salt intake was poor and most of the participants failed to recognize foods with high salt contents. Consumer awareness strategy considered one of the strategies recommended by WHO for salt reduction (Ide *et al.*, 2020; Al Jawaldeh, Rafii and Nasreddine, 2018), to promote Social Cognitive Learning Theory, which acknowledges the constant interaction that exists between the individual and his or her environment, both structural and social, to shape behavior (Trieu *et al.*, 2020; Campbell *et al.*, 2010a).

Strategies should be appropriate to the local context in terms of the sources of dietary sodium, existing regulatory mechanisms, and access to resources. No single

strategy is enough to reach the WHO goal of a 30% reduction in sodium intake by 2025 (Ide *et al.*, 2020). Therefore, given the overwhelming evidence linking high salt intake to CVDs and a range of other illnesses, the World Health Organization (WHO) has identified population salt reduction as a priority intervention for ameliorating the global burden of NCDs.

Social media approach including WhatsApp was used in several studies as platform for education for school, university and health issues (Ajayi and Olajide 2022; Pereira *et al.*, 2020). UAE Social Media Statistic 2022 (<https://www.globalmediainsight.com/blog/uae-social-media-statistics/#>), reported 98.98% of the UAE population remain active on social media. WhatsApp is the most popular chat application in the UAE. WhatsApp has 7.97 million users in the UAE, which is 80.20% of the country's total population. Many studies found traditional and electronic brochures an effective tool to promote health education by promoting health knowledge and awareness (Rodriguez 2014; Al Bardaweel, and Dashash 2018).

To date, there are no published intervention studies conducted in the UAE that have used urinary sodium excretion and KAP to assess salt intake before and after an educational intervention. Therefore, this parallel study aimed to assess the effectiveness of two different intervention approaches for 6-weeks, using digital educational material to reduce salt intake delivered via weekly short WhatsApp messages versus fortnightly brochure email attachment. Three groups were included in the study: Control group, WhatsApp group, and brochure group. The objectives of this study were:

- To assess sodium and potassium intake in the participants using 24-hour urinary excretion before and after 6-weeks of the intervention.

- To assess KAP related to salt of population before and after the intervention.
- To measure the effectiveness of two intervention tools using Digital platform approach to deliver educational material through WhatsApp and Electronic brochures.
- To identify the most effective tool for sodium reduction.

Hypothesis of the study: digital educational material is an effective approach to reduce sodium intake and improve KAP toward salt intake in a sample of UAE population.

4.2. Materials and Methods

This parallel intervention study included three groups; control group, WhatsApp group and brochure group, and the intervention phase lasted for six weeks. All the measurements of the study were taken two times in each group, at baseline and at endpoint after 10-weeks (6- weeks of educational intervention).

As a response to COVID 19 pandemic, all the safety precautions were implemented including wearing personal protective equipment (PPE), maintaining social distance, reduced lab capacity, facemask, face shield, gloves, and gown. In addition, a negative COVID 19 test result for 30 days was required by the UAEU regulation to enter or use the UAEU facilities. Therefore, all potential participants were required to download and use Alhosn App for monitoring recent COVID-19 test (<https://www.alhosnapp.ae/en/>). In addition, there were specific requirements implemented by the UAEU and UOS such as checking body temperature prior to entering nutrition clinics and health clinics, physical distancing, and space capacity management according to UAEU policy ([Appendix 11](#) and [12](#)).

4.2.1. Ethical approval

Ethical approval for the study protocol was obtained from the Research Ethics Committee at Oxford Brookes University (UREC), Number: 191337 ([Appendix 13](#) and [14](#)), and the Research Ethics Committee at United Arab Emirates University (UAEU) (ERS_2020_6107). All subjects provided a written informed consent to participate. An example of the consent form used for this study is given in the appendix ([Appendix 15](#)) and information sheet [Appendix 20](#).

4.2.2. Study design and participants

The present study was a controlled parallel design intervention comparing the efficiency and effectiveness of two different educational intervention approaches (WhatsApp and electronic brochures) to reduce sodium intake, with a control group receiving no educational material for the intervention period. The primary outcomes of the study were urinary sodium, potassium, anthropometric measurement, KAP questionnaire, and physical activity. All these outcomes were measured on two occasions at baseline and at endpoint after 10-weeks (6 weeks of educational intervention), except anthropometric measurements which were only measured at baseline.

The parallel intervention study was conducted from October 2020–January 2021 in the United Arab Emirates. A random sample of 148 healthy individuals aged between 20 and 40 years were recruited to participate in the study from the three geographical areas of UAE (Western, Northern, and Eastern region).

Participants were randomly distributed into the three groups (Control, WhatsApp, and Electronic Brochure) using Altman and Bland (1999) procedure.

RAND () function was generated according to gender-age group and the three intervention groups.

Several methods were used for recruitment: email circulation to students, staff and faculty members of UAE University, and social media approaches such as WhatsApp and Instagram. All participants provided a written informed consent to participate in the study, and all the communications were conducted online as a response to the COVID 19 pandemic. A self-administrated online questionnaire was designed using Google Forms in Arabic to collect data regarding demographic information and lifestyle habits, past medical history, medication, and current health status.

The exclusion criteria at screening were those with chronic diseases (i.e., heart disease, hypertension on medications, renal failure, liver disease), positive COVID 19 test, pregnant and lactating women, those on diuretics, and women who had their menstrual cycle during the time of urine collection. Moreover, participants who did not follow the safety precautions including wearing personal protective equipment (PPE) such as facemask, face shield, gloves and gown, participants who did not follow physical distancing, safety procedure and regulations by UAEU, were not allowed to take part in the study. UAEU responses to COVID 19 are shown in ([Appendix 11](#) and [12](#)).

Inclusion criteria at screening were participants aged 20 to 40 years for both genders, no medical condition(s) or medication(s) known to affect urination and ability to collect 24- hour urine or any point mentioned in exclusion criteria.

Exclusion criteria after urine collection included those unable to collect adequate urine within the 24-hr period (i.e., volume < 500 ml). In addition, creatinine level of the reference range 500 to 2000 mg/day was used in the current study, which

is equivalent to 9 -26 mg/kg of body mass for female participants and 13-29 mg/kg of body mass for male participants (Chernecky and Berger, 2012; Goldman and Schafer, 2011; Jarrar *et al.*, 2020). Participants were given full details of the study protocol with the opportunity to ask questions after which online informed consent to participate was sought. Each participant was allocated a personal identification number to sustain anonymity and data confidentiality.

4.2.3. Anthropometric measurements

The anthropometric measures were taken in two clinics, UAEU – Department of Nutrition and Health clinic and UOS-clinic. All measurements were taken according to appointment with timetable, which included time of entrance to the UAEU- clinic or UOS-Clinic. Each participant was given two weeks to choose his/her time to perform the measurements, each slot lasted for 30 min for anthropometric measurements including measuring blood pressure by a registered Nurse from UAEU-clinic or UOS-clinic. All precautions implemented by the UAEU and the UOS were performed on the participants and the researchers, including checking body temperature prior to entering nutrition clinics, physical distancing, and space capacity. In addition, a valid negative test for COVID-19 within 30 days was required.

4.2.4. Food frequency questionnaire (FFQ)

The FFQ was adopted and obtained from previous studies (Campbell *et al.*, 2010a; Nasreddine *et al.*, 2014; Alhamad *et al.*, 2015). The main purpose of the FFQ, was to identify the most frequent foods consumed by the UAE community in addition to investigating whether the intervention for 6- weeks made any changes on the frequency of food consumption and to assess the changes in the participant's food habit

regarding food choices and sodium-rich foods. Therefore, some of the food items that are common in local UAE community were part of the knowledge section in the KAP questionnaire such as pita and Iranian bread.

The participants were asked to report the frequency of consumption of approximately 49 items over the last week ([Appendix 16](#)). Each item was defined by a series of foods or beverages, which were categorized into 6-major food groups: bread and cereals, fruits (fresh/processed), vegetables (fresh/ processed), cheese and dairy products, meat and meat products, and miscellaneous. The participants reported the frequency of consumption of each food group based on 3 levels of frequencies: rarely or never; one to three times a week; or four to seven times a week.

Scoring system was matched to the frequency, for never-frequency: zero score was given, for frequency of 1-3 times per week: score 1 was given, and for frequency of 4-7 times/week: score 2 was given. The result was presented in the form of frequencies and scores to measure responses similar to previous study conducted on KAP using food frequency questionnaire (Nasreddine *et al.*, 2014). Moreover, several studies used scoring system with food frequency questionnaire and data presented in form of frequency and score for food items (Jeżewska-Zychowicz *et al.*, 2018; Suliga *et al.*, 2020). As a response to the COVID-19 pandemic, FFQ was emailed to participants and responses were received through emails or WhatsApp application. The FFQ was introduced on two occasions for the three groups (control, WhatsApp, and electronic brochure) at baseline and after 10-weeks (including 6 weeks of educational intervention).

4.2.5. KAP questionnaire

Participants were asked to complete the self-reported questionnaire on two occasions, one at baseline and after 10-weeks (including 6- weeks of educational intervention). The questionnaire was developed to assess the participants' KAP regarding salt consumption and information. The questionnaire solicited nutritional knowledge in relation to salt and health outcomes, frequency of salt consumption, and perceived salt consumption. For more information refer to Section [2.3.1 KAP questionnaire](#). Due to the COVID-19 pandemic, KAP questionnaire was emailed to participants and responses were received through emails or WhatsApp application.

4.2.6. Educational Material

In the intervention stage, educational material was shared with the two-intervention groups, aimed to improve the knowledge of the participants to reduce salt intake, highlight the health hazards of high salt intake, importance of checking food labels, and alternatives for salt. The educational material (intervention) were delivered through WhatsApp application and electronic brochures to the intervention groups, whereas the control group received no educational material for the intervention period.

Educational material were developed using information from the Weqaya program- Health Authority of Abu Dhabi -HAAD-UAE, <https://weqaya.doh.gov.ae/>, Central for Disease and Control Prevention (CDC – Salt <https://www.cdc.gov/salt/index.htm>). In addition, the information obtained from the outcome of study 1 (UREC Registration No: 181168), in terms of medical and dietary knowledge were used to develop the educational material. For the WhatsApp group, every 7-days a new message was delivered for 6 weeks, with a new topic every week.

In WhatsApp group a new message was delivered every week and repeated by the third day, to make sure that participants received the educational material and to avoid overlapping with the new message. (Figure 4.1, [Appendix 17](#)).

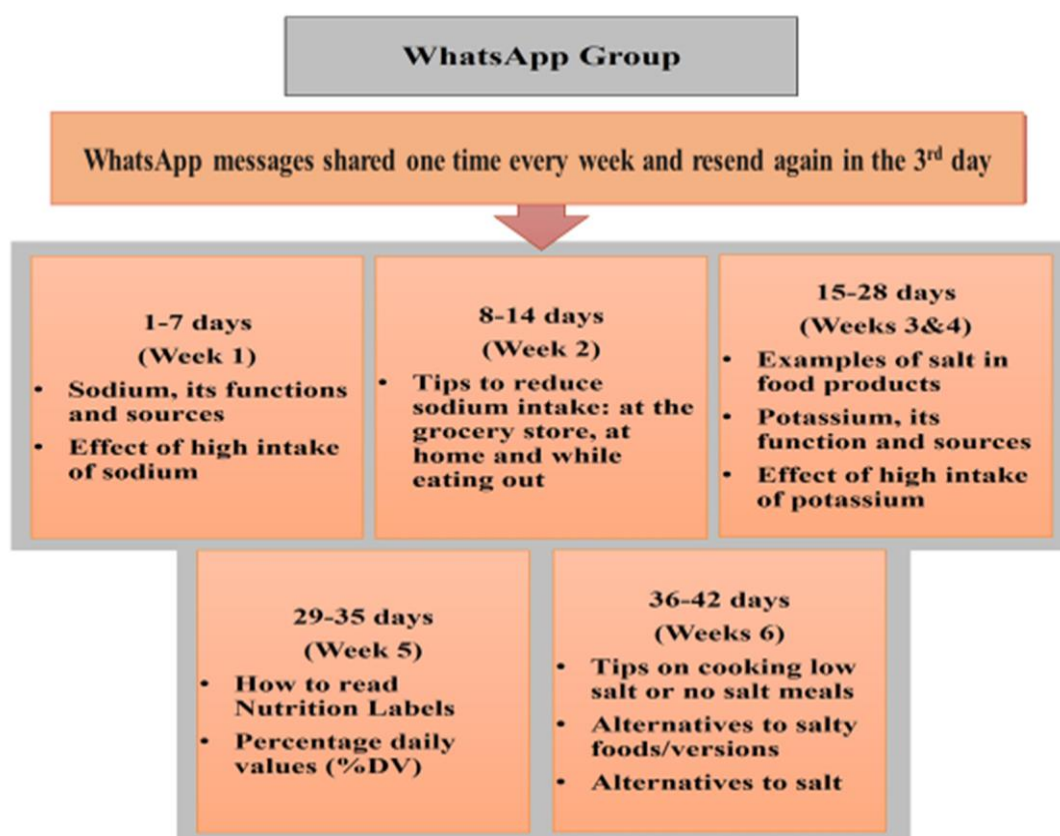


Figure 4. 1 Flow chart showing the delivery of WhatsApp messages to the WhatsApp group

In the WhatsApp group, the education material was delivered using WhatsApp communications. The WhatsApp communication was between the PhD researcher and the participants on an individual basis, not as a group.

For the Electronic brochure group, the educational material with a new topic was shared by email every two weeks. The same emailed-electronic brochure was resent at the beginning of the second-week to make sure that participants received the

material and to avoid overlapping with the new material. as shown in Figure 4. 2. For the control group, no educational material was provided.

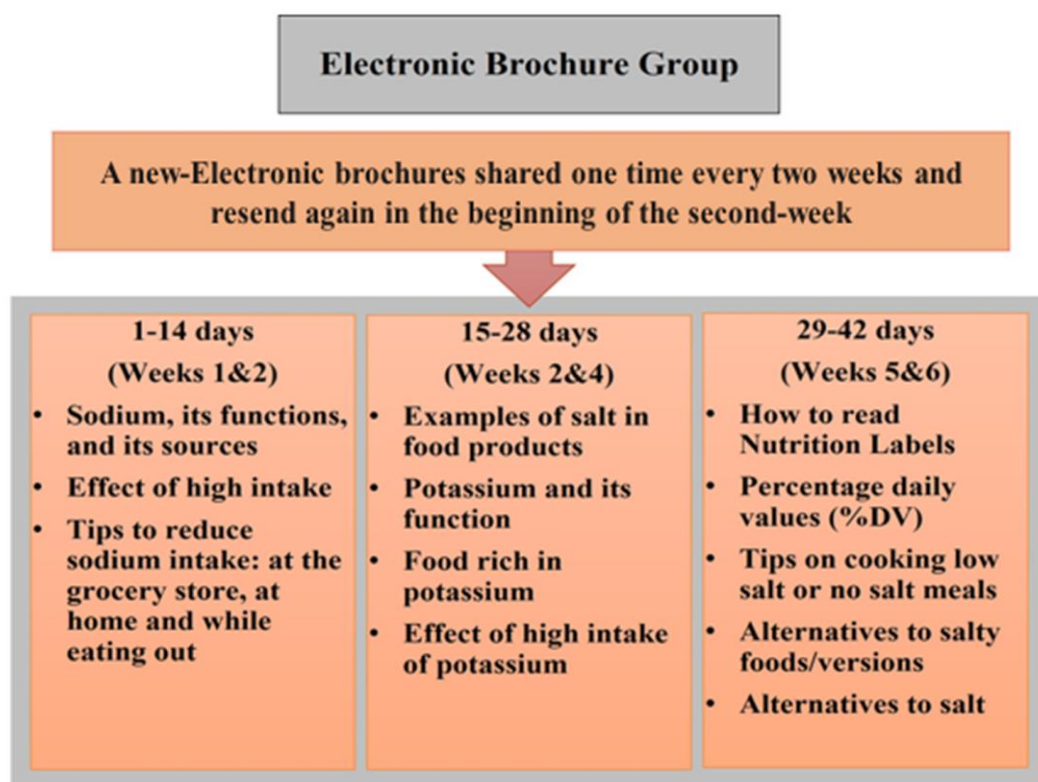


Figure 4. 2 Flow chart of delivery of Electronic Brochure to the brochure group.

By the end of intervention period (6-weeks), both digital approaches delivered same amount of educational information for the corresponding intervention group. The only differences were the frequency of delivery without compromising their distinct characteristics nor the content of the educational material, (Figure 4.3).

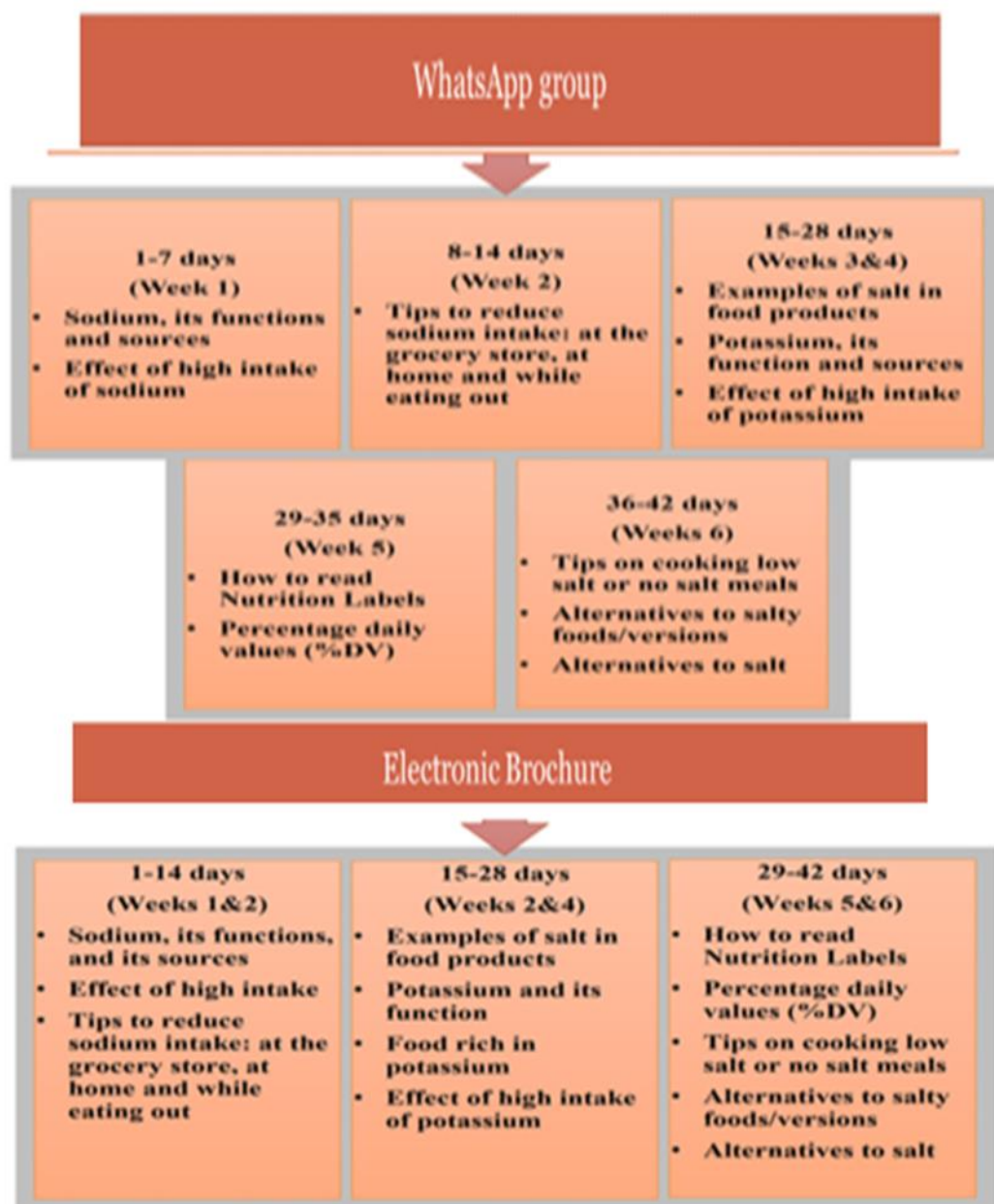


Figure 4. 3 Flow chart of delivery approach for intervention groups

4.2.7. 24-hour urine collections and analysis

A single timed 24-hour urine was collected in two occasions at baseline within the first two week of participation and after 10 weeks (including 6-weeks of educational material). For more details refer to [Section 3.2.6](#).

As a response to COVID 19 pandemic, all the safety precautions were implemented as follows. All the urine containers (samples) were received and taken to UAEU from Al Ain gate, where the samples were sterilized by the services company (Khadamat) responsible for the sterilization process ([Appendix 18](#)) and the samples were delivered to the E-3 Laboratory building, lab No (0010). All the urine preparations and analysis were performed at the College of Foods and Agriculture laboratories, UAEU.

4.2.7.1.Determination of sodium and potassium in urine by inductively coupled plasma-optical emission spectroscopy (ICP-OES)

Urine samples were measured in two occasions at baseline and after 10 weeks (including 6-weeks of educational material). For more details refer to [Section 3.2.7](#).

4.2.7.2.Creatinine analysis

The 24-hour urinary creatinine was measured using (ab204537 Creatinine Assay Kit) based on colorimetric Assay (Bowers and Wong, 1980) using UV-Visible spectrophotometer (Multiscan Go, Thermo-Fisher Scientific, MA, USA). The measurements were taken on two occasions at baseline and after 10 weeks (including 6-weeks of educational material), for more details refer to [Section 3.2.8](#).

4.3. Power of analysis

This study is a parallel controlled intervention study; the sample size was determined based on the WHO Eastern Mediterranean Region Office (WHO-EMRO) protocol published in 2010 for 24-hours urine collection and analysis (Campbell *et al.*, 2010a). Participants were divided into two age groups, 20 to 29.9, and 30 to 40. To be able to detect a difference in 20 mmol/day of sodium (approximately 1 g of salt) with 25 mmol standard deviations, the sample size needed for each age stratum was 32

participants from both genders. Therefore, for the three intervention groups, 96 participants, ($\alpha = 0.05$, power = 0.80), were recommended. To account for attrition – e.g. non-participation, incomplete collection, or implausible values – which may be as high as 20%, up to 115 participants from all age and gender strata should be recruited (Campbell *et al.*, 2010a).

4.4. Statistical analysis

Data were recorded and analyzed using the Statistical Package for Social Sciences (SPSS) software, version 25 (SPSS, Chicago, IL, USA). Normality of data across combination of independent variables was tested using Shapiro Wilks. Homogeneity of data was tested using Leven's test. Continuous variables were presented as mean $\pm$ standard deviation and categorical variables were expressed as numbers and percentages. Descriptive statistics were used to summarize the baseline characteristics of the study participants.

Mixed repeated measures ANOVA test was performed to assess the main effects of time (baseline vs endpoint) and intervention groups (Control, WhatsApp, and Electronic Brochures) on 24-hour urinary sodium and potassium, and creatinine excretions. For interaction analysis, One-way ANOVA, followed by Bonferroni post-hoc test, and dependent t-test were used to compare dependent variables according to time and intervention groups. One-sample t-test was used to compare the mean urinary sodium, salt and potassium excretions with the recommended dietary allowance, and assessment was carried out based on gender using independent t-test. The effect size was calculated as Cohen d for t-test and partial eta-squared (η^2) for ANOVA. P-values < 0.05 were considered statistically significant.

4.5. Results

A total of 148 participants agreed to participate in the study, out of which 6 participants did not answer the phones or messages, and 8 participants were excluded due to creatinine levels below 9-mg/kg body weight for females and < 13 mg/kg body weight for males (Chernecky and Berger, 2012; Goldman and Schafer, 2011; Jarrar *et al.*, 2020), in the urine sample at baseline (4- samples from North Emirates, 3-samples from Abu Dhabi and 1- sample from Alain) as shown in Figure 4.6. After 10-weeks (6 weeks of educational intervention), 6 participants were excluded because they did not respond to phone calls to arrange delivery of the urine samples in the agreed time (4 out of 6 from North Emirates and other two participants from Abu Dhabi-West area). Moreover, 7 participants were excluded due to creatinine levels below 9-mg/kg body weight for females and < 13 mg/kg body weight for males (Chernecky and Berger, 2012; Goldman and Schafer, 2011; Jarrar *et al.*, 2020), in the urine at the end of the intervention stage, leaving a final sample size of 121 participants as shown in figure 4. 4.

At the end of the study, 121 participants completed the study and fulfilled the creatinine inclusion criteria - 39 participants were in the control group with female to male ratio (0.95:1.05), while in WhatsApp group, 41 participants completed the study with a female to male ratio of 0.95:1.05 and for in the electronic brochures group, 41 participants completed the study with a female to male ratio of 1.05:0.95 as shown in Figure 4.4.

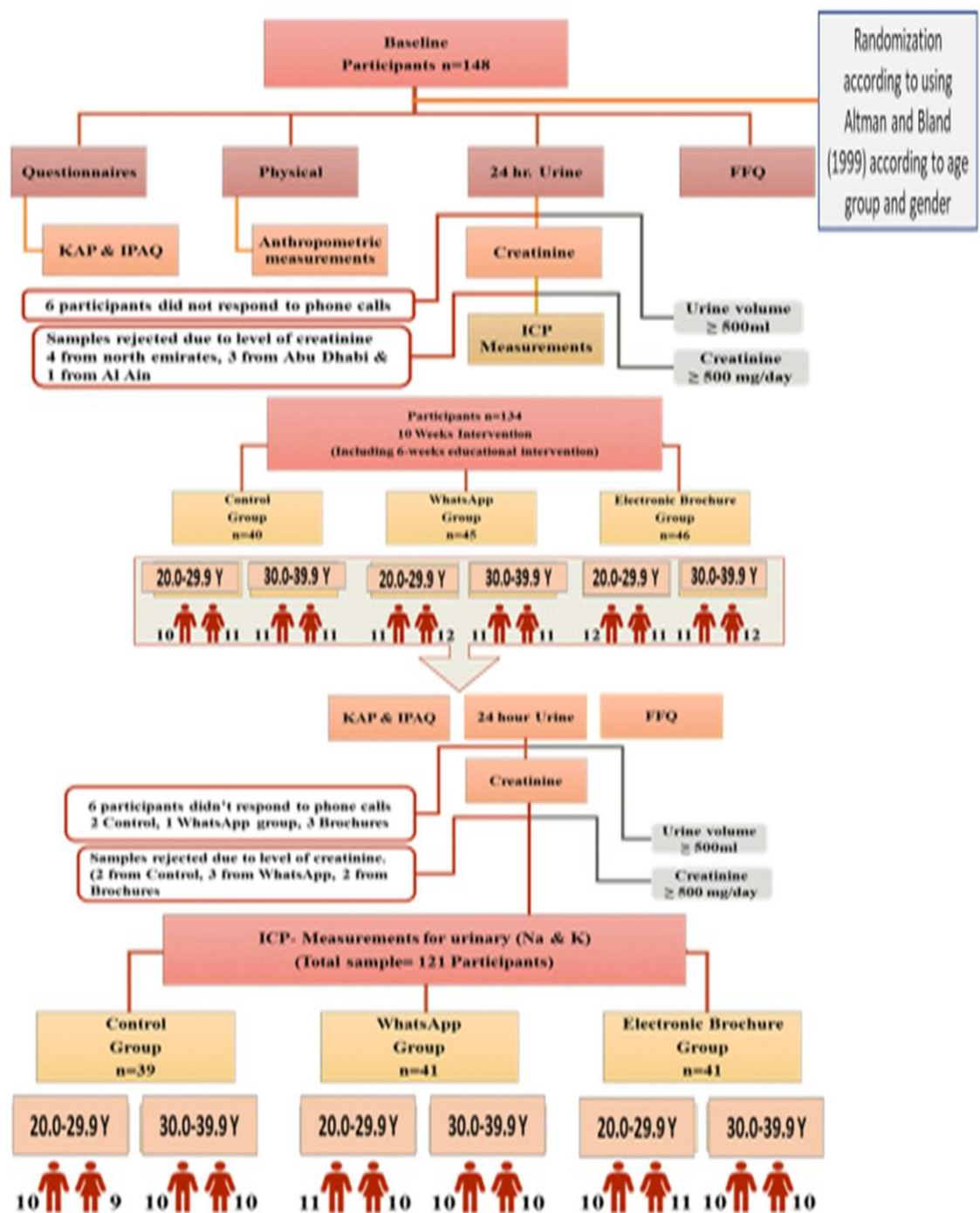


Figure 4. 4 Study flow chart to facilitate salt reduction in UAE using educational material.

KAP: Knowledge, attitude and practice; IPAQ: International physical activity questionnaire; ICP: Inductively coupled plasma; FFQ: Food frequency questionnaire; Y: Year

Most of the study population were Emirati (67.8 %). Almost half of the study population were singles and around 75.0% of them were with university degree - educational status. Moreover, more than 50% of them were employed (Table 4.1).

Table 4. 1 Demographic data of the study population

Characteristics	Total (n=121) Mean $\pm$ SD ^a	Female (n=60) Mean $\pm$ SD	Male (n=61) Mean $\pm$ SD
Age (Years)	28.5 $\pm$ 5.7	28.3 $\pm$ 5.9	28.7 $\pm$ 5.5
BMI (kg/m ²)	26.0 $\pm$ 4.6	25.6 $\pm$ 4.2	26.4 $\pm$ 4.8
BMI Classification	n (%)	n (%)	n (%)
Underweight (<18.5)	5 (4.1)	3 (5.0)	2 (3.3)
Normal weight (18.5 to24.9)	49 (40.5)	23 (38.3)	26 (42.6)
Overweight (25 to 29.9)	49 (40.5)	25 (41.7)	24 (39.3)
Obese class I (30 to 34.9)	16 (13.2)	9 (15.0)	7 (11.5)
Obesity class II (35 to 39.9)	2 (1.7)	0	2 (3.3)
Nationality			
Emirati	82 (67.8)	42 (70.0)	40 (66.7)
Arabs	39 (32.2)	18 (30.0)	21 (34.4)
Marital Status			
Single	63 (52.1)	23 (38.3)	40 (55.7)
Married	51 (42.5)	33 (55.0)	19 (31.6)
Divorced	6.0 (5.0)	4 (6.7)	2 (3.3)
Educational Level			
Undergraduate university level	73 (60.3)	39 (65)	34 (55.7)
School level (Intermediate or lower)	31 (25.6)	14 (23.3)	17 (27.9)
Postgraduate level	17 (14.0)	7 (11.7)	10 (16.4)
Employment status			
Student	29 (24.0)	21 (35.0)	8 (13.1)
Unemployed	24 (19.8)	18 (30.0)	6 (9.8)
Employed	68 (56.2)	21(35.0)	47(77.0)

^a Data presented as Mean $\pm$ standard deviation.

Most of the participants were from Eastern region (Abu Dhabi) with 41.3%, as shown in Figure 4.5.

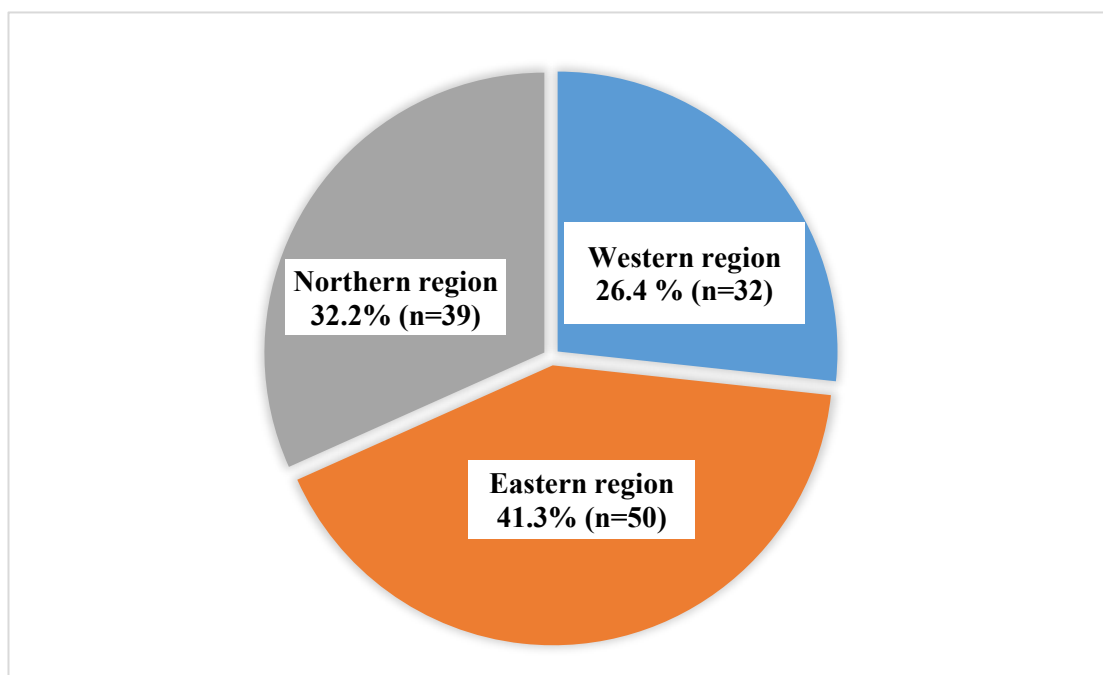


Figure 4. 5 Participants geographic distribution in the study population

4.5.1. Mean 24-hour urinary sodium, potassium, and creatinine

The mean urinary sodium, salt, and potassium excretion per 24-hour for the study population are shown in Table 4. 2. Urinary sodium and salt excretion per 24 hours for males were significantly higher compared with females ($P=0.001$), (Table. 4. 2). Moreover, mean urinary excretion for creatinine was 1379.7 ± 339 mg/day, with significant differences between gender ($P=0.001$). In addition to that, 24 -hour urinary sodium excretion for total sample and according to gender ($P=0.001$; Table. 4. 2), were significantly higher than WHO recommendation for sodium intake which is less than 2300 mg/day. Moreover, 24-hour urinary potassium excretion for total sample and according to gender ($P=0.001$; Table. 4. 2), were lower than WHO recommendation for potassium intake which is 3520 mg/day.

Table 4. 2 Baseline urinary sodium, potassium and creatinine excretion per 24-hours

Characteristics	Total (n=121) Mean $\pm$ SD ^a	Female (=60) Mean $\pm$ SD	Male (=61) Mean $\pm$ SD	P-value ^b
Sodium (mg)	3040.8 $\pm$ 665.3	2836.7 $\pm$ 497.3	3244.8 $\pm$ 721	0.001
Salt (mg)	7601.9 $\pm$ 1635.7	7091.7 $\pm$ 1243.3	8112.1 $\pm$ 1822.4	0.001
Potassium (mg)	1984.4 $\pm$ 654.3	1907.3 $\pm$ 608.5	2061.4 $\pm$ 701.5	0.201
Creatinine (mg/kg/day)	19.8 $\pm$ 4.0	18.1 $\pm$ 3.6	21.4 $\pm$ 3.8	0.001

^a Data presented as Mean $\pm$ standard deviation. ^bIndependent-Samples T-test used to assessed Significance at $\alpha=5\%$ for variable according to gender.

In the control group, there were no significant differences between baseline and endpoint of 10-weeks (6- weeks of educational intervention) for urinary sodium and salt (P= 0.055; Table. [Appendix 22_Table. 4. 3](#)), and the sodium intake was more by almost 100 mg compared with baseline readings. Participants in the WhatsApp group showed a significant reduction in 24-hour urinary sodium and salt after 10-weeks (6 weeks of educational intervention) (with P=0.001 for ([Appendix 22_Table. 4. 3](#))).

The participants in the electronic brochures group showed also a significant difference in 24-hour urinary sodium excretion and salt between baseline readings and endpoint after 6- weeks of education with P=0.018 ([Appendix 22_Table. 4. 3](#)). With respect to 24-hour urinary excretion for potassium, WhatsApp group showed a significant improvement in potassium intake compared with baseline readings (P=0.033; [Appendix 22_Table. 4. 3](#)), while the control and electronic brochures groups did not show any differences.

Table 4. 3 24-hour urinary excretion for sodium, potassium, creatinine, and salt ([Appendix 22_Table. 4. 3](#))

Moreover, a 2 x 3 Mixed repeated measures ANOVA (time vs group) revealed a significant main effect for time on 24- hour urinary sodium excretion ($F(1, 117) = 11.812$; $p = 0.001$; $\eta^2 = 0.092$), and for interaction between time and group ($F(2, 117) = 10.093$; $p < 0.001$; $\eta^2 = 0.147$), No significant effect was detected for group ($F(2, 117) = 0.590$; $p = 0.556$; $\eta^2 = 0.010$). One-way ANOVA, followed by the Bonferroni test performed for intervention groups; control, WhatsApp and Electronic-Brochures, revealed a significant difference between control with WhatsApp and Electronic-Brochures with $p < 0.001$ (Table 4. 4). While there were no significant differences between WhatsApp and Electronic-Brochures.

Table 4. 4 Mean change in 24-hour urinary excretion for sodium among intervention groups

Dependent Variable	Group		Mean Difference (I-J)	Std. Error	P-value ¹	95% Confidence Interval	
	(I)	(J)				Lower Bound	Upper Bound
Sodium	Control (n=39)	WhatsApp	419.34715*	86.55860	0.001	209.1060	629.5883
		Brochure	310.07678*	86.55860	0.001	99.8356	520.3180
	WhatsApp (n=41)	Control	-419.34715*	86.55860	0.001	-629.5883	-209.1060
		Brochure	-109.27037	86.55860	.628	-319.5116	100.9708
	Brochure (n=41)	Control	-310.07677*	86.55860	0.001	-520.3180	-99.8356
		WhatsApp	109.27038	86.55860	.628	-100.9708	319.5116

* The mean differences are significant at the 0.05 level

¹ One-way ANOVA, followed by the Bonferroni test, $p < 0.05$ considered significant difference

A 2 x 3 Mixed repeated measures ANOVA (time vs group) revealed no significant main effect for group ($p = 0.863$), time ($p = 0.259$), or interaction between time and group ($p = 0.170$) on 24- hour urinary potassium excretion.

A 2 x 3 Mixed repeated measures ANOVA (time vs group) revealed no significant main effect for group ($p=0.351$), time ($p=0.990$), or interaction between time and group ($p=0.479$) on 24-hour urinary creatinine excretion.

The percentage of participants exceeding WHO recommendation of sodium intake for total population was 77.7% at baseline and became 71.1% at the end of the intervention period, with a significant reduction ($P=0.004$, [Appendix 22 Table. 4. 5](#)). In the WhatsApp group, the percentage of participants exceeding WHO recommendation of sodium intake was 79.5% and became 65.8% with reduction of 13.7% after intervention ($p=0.023$). For the electronic brochure, there was no significant change from 75.6% into 70.7% after 10-weeks (6-weeks of educational intervention) ($p=0.160$, [Appendix 22 Table. 4. 5](#)).

Table 4. 5 Percentage of participants exceeding WHO recommendation of Sodium intake before and after 6-weeks of intervention ([Appendix 22 Table. 4. 5](#))

4.3.2. Salt-related knowledge, attitudes and practices

4.3.2.1. Food and Health related knowledge among study population

Food related knowledge was improved for both intervention (WhatsApp and electronic brochures) groups from poor to good after 10-weeks (6-weeks of educational intervention) with $P=0.001$ as shown in (Table. 4. 6.).

Health related knowledge was improved for both intervention groups after 10-weeks (6-weeks of educational intervention) from fair to good with $P=0.001$, as shown in (Table. 4. 6.).

Table 4. 6 Food and Health related knowledge for the study population (n=121)

Variables	Mean $\pm$ SD ^a					
	Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
Knowledge	Baseline	End	Baseline	End	Baseline	End
Food related	3.8 $\pm$ 1.8	4.4 $\pm$ 1.5	3.5 $\pm$ 2.8	8.5 $\pm$ 1.9	3.7 $\pm$ 2.5	8.9 $\pm$ 1.6
P-value ^b	0.142		0.001		0.001	
Classification ^c	Poor	Poor	Poor	Good	Poor	Good
Medical related	6.9 $\pm$ 1.9	7.0 $\pm$ 2.0	6.4 $\pm$ 3.0	9.3 $\pm$ 1.3	6.7 $\pm$ 2.7	8.9 $\pm$ 1.4
P-value ^b	0.604		0.001		0.001	
Classification	Fair	Fair	Fair	Good	Fair	Good

^aData presented as Mean $\pm$ standard deviation. ^bpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

^c Score percentage for Knowledge < 6 classified as “Poor”, 6–7 classified as “Fair”, >7 classified as “Good” (Haron *et al.*, 2021; Jarrar *et al.*, 2022)

Most of the study population failed to identify food rich in sodium, about 20 to 26% were able to recognize Arabic and Iranian bread as high sodium sources at baseline ([Appendix 22 Table. 4. 7](#)). However, after 6-weeks of educational intervention, 80-95% of participants in the WhatsApp and electronic brochures groups were able to recognize Arabic and Iranian bread as high sodium sources (p=0.001) as shown in [Appendix 22 Table. 4. 7](#)

After 6-weeks of educational intervention using WhatsApp and electronic brochures, the majority of the study population were able to recognize corn flakes as a rich source of sodium (p=0.001) ([Appendix 22 Table. 4. 7](#)). At the end of Intervention, the WhatsApp group showed a significant difference compared with baseline for 19 food items out of 19 with 100% improvement compared with baseline. Similarly, the electronic brochures group showed a significant difference compared with baseline for 18 food items out of 19 with 94.7% improvement.

Table 4. 7 The number and percentage of participants who correctly answered the questions on food related knowledge ([Appendix 22 Table. 4. 7](#))

4.3.2.2. Salt-related attitudes among the study population

Although 77.7% of the study population exceeded WHO recommendation of sodium intake according to 24-hour urinary excretion, around 60.0% of the study population thought they just consumed the right amount at baseline (Table. 4. 8). After 6- weeks of intervention, 71.1% of the study population exceeded WHO recommendation of sodium intake according to 24-hour urinary excretion, while around 65% believed that they just consumed the right amount of salt according to the KAP questionnaire response (Table. 4. 8). With respect to the attitude of the study population, the WhatsApp group was significantly more concerned ($p=0.012$) about the amount of salt intake after 10-weeks (6- weeks of educational intervention) compared with baseline (Table. 4. 8).

Table 4. 8 Salt-related attitudes among study population by intervention groups

Variable ¹		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	End	Baseline	End	Baseline	End
How much salt do you think you consume (Just the right amount)	(n, %) ^a	24 (61.5)	25 (64.1)	27 (65.8)	31 (70.6)	24 (58.5)	27 (65.8)
	Mean $\pm$ SD ^b	0.62 $\pm$ 0.51	0.64 $\pm$ 0.42	0.66 $\pm$ 0.43	0.71 $\pm$ 0.35	0.59 $\pm$ 0.40	0.66 $\pm$ 0.33
	P-value ^c	0.323		0.133		0.099	
Are you concerned about the amount of salt/sodium in the diet (Yes)	(n, %) ^a	6 (15.4)	6 (15.4)	4 (9.7)	9 (22.0)	5 (12.2)	7 (17.1)
	Mean $\pm$ SD ^b	0.15 $\pm$ 0.49	0.15 $\pm$ 0.49	0.01 $\pm$ 0.45	0.22 $\pm$ 0.32	0.12 $\pm$ 0.48	0.17 $\pm$ 0.46
	P-value ^c	1.00		0.012		0.160	
Reducing added salt to foods is important to you (Agree)	(n, %) ^a	10 (25.6)	11 (28.2)	9 (22.0)	22 (53.7)	10 (24.4)	29 (70.7)
	Mean $\pm$ SD ^b	0.26 $\pm$ 0.35	0.28 $\pm$ 0.32	0.22 $\pm$ 0.30	0.54 $\pm$ 0.42	0.24 $\pm$ 0.31	0.71 $\pm$ 0.33
	P-value ^c	0.323		0.001		0.001	
Reducing consumption of processed foods is important to you (Agree)	(n, %) ^a	15 (38.5)	14 (35.9)	10 (24.4)	28 (68.3)	13 (31.7)	30 (73.1)
	Mean $\pm$ SD ^b	0.39 $\pm$ 0.47	0.36 $\pm$ 0.49	0.24 $\pm$ 0.31	0.68 $\pm$ 0.48	0.32 $\pm$ 0.41	0.73 $\pm$ 0.36
	P-value ^c	0.802		0.001		0.001	
Reducing your sodium intake is important to you (Agree)	(n, %) ^a	12 (30.8)	14 (35.9)	10 (24.4)	25 (61.0)	14 (34.1)	19 (46.3)
	Mean $\pm$ SD ^b	0.31 $\pm$ 0.36	0.36 $\pm$ 0.30	0.24 $\pm$ 0.31	0.61 $\pm$ 0.38	0.34 $\pm$ 0.39	0.46 $\pm$ 0.42
	P-value ^c	0.785		0.001		0.012	

¹Attitude was assessed based on a three-point Likert scale but only answers of “agree” are presented, each agree answer earned 1 score, while the other zero, to estimate mean and perform paired t-test.

^aData presented as number and frequency. ^bData presented as Mean $\pm$ standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

4.3.2.3. Salt-related practices among study population

After 10-weeks (6- weeks of educational intervention), the intervention groups (WhatsApp and Electronic Brochures) showed a significant increase ($P < 0.05$), in the percentage of participants checking food labels often ([Appendix 22 Table. 4. 9](#)). In addition to that, there was a significant increase ($p < 0.05$) in checking labels specifically for salt/sodium content (often) and more participants reported that salt/sodium content on the label affects purchasing decisions (often) ($p < 0.05$; [Appendix 22 Table. 4. 9](#)). However, the WhatsApp intervention group significantly improved the practice of buying “low salt” foods ($p = 0.002$) as shown in Table [Appendix 22 Table. 4. 9](#).

Practices towards adding salt during cooking, at the table, before tasting foods and using Stock Cubes during cooking were significantly reduced with ($p < 0.05$), in both intervention groups after intervention ([Appendix 22 Table. 4. 9](#)). Moreover, there was a significant increase in using spices, herbs, and lemons as alternative of salt in both intervention groups at the end of intervention ([Appendix 22 Table. 4. 9](#)).

Table 4. 9 Salt-related practices among study population by intervention groups (n=121) ([Appendix 22 Table. 4. 9](#))

4.3.3. Food frequency for study population

4.3.3.1. Food frequency questionnaire for bread and bread products

The intervention groups (WhatsApp and electronic brochure), showed a minor reduction in the frequency of intake of Arabic bread in the category of more than one

time per day but this ended up with increase in the frequency of 4-7 times/week ([Appendix 22 Table. 4. 10](#)). After 6-weeks of intervention there was no significant reduction for study groups for Arabic, Iranian, Toasted, Sponge, Regag bread, and Manakish cheese and thyme, ([Appendix 22 Table. 4. 10](#)).

Table 4. 10 Food frequency questionnaire for Bread and bread products for study population ([Appendix 22 Table. 4. 10](#))

4.3.3.2. Food frequency questionnaire for cheeses and butter milk

The intake of salted cheese and dairy products such as Cheddar cheese, Haloumi cheese, Feta cheese, and Butter milk for both the intervention groups (WhatsApp and electronic brochures) showed a non-significant reduction in the frequency of intake of 4-7 times/week after intervention. ([Appendix 22 Table. 4. 11](#)). However, the intake of cream cheese showed a significant reduction ($p<0.05$), in both intervention groups after intervention. While the control group showed a significant increase in the intake of butter milk ($p=0.044$) at endpoint compared with baseline, as shown in [Appendix 22 Table. 4. 11](#).

Table 4. 11 Food frequency questionnaire for Cheeses and Buttermilk for the study population ([Appendix 22 Table. 4. 11](#))

4.3.3.3. Food frequency questionnaire for the intake of processed foods

The intake of Indomi (instant noodles), canned vegetables, dressing oil, tomato paste, and pickles particularly in the frequency of 4-7 times/week, showed non-significant reduction ([Appendix 22 Table. 4. 12](#)). There was a significant reduction in the intake of chicken cubes (regular salt) and Ketchup in the intervention groups ($p<0.05$). There was non-significant improvement in the frequency of the intake of chicken cubes (low salt), as shown in [Appendix 22 Table. 4. 12](#)).

Table 4. 12 Food frequency questionnaire for the intake of processed foods
([Appendix 22 Table. 4. 12](#))

4.3.3.4. Food frequency questionnaire for the intake of fast foods and processed meats

There was no significant reduction in the intake of pizza, fast foods (MacDonald's, KFC, Hardee's, and Shawarma), and processed meat, after 10-weeks although the frequency reduced ([Appendix 22 Table. 4. 13](#)).

Table 4. 13 Food frequency questionnaire for the intake of Fast foods and processed meats ([Appendix 22 Table. 4. 13](#))

4.3.3.5. Food frequency questionnaire for the intakes of table salt and salt substitutes

The intake frequency for table salt showed a significant reduction in the intervention groups (WhatsApp and electronic brochures) with almost 13.5% reduction after 10-weeks (6- weeks of educational intervention) ($p < 0.05$). The use of spices and herbs and lemon increased in the intervention groups, however this increase was significantly high ($p > 0.05$) in WhatsApp group, as shown in ([Appendix 22 Table. 4. 14](#)) and ([Appendix 22 Table 4.15](#)).

Table 4. 14 Food frequency questionnaire for the intakes of table salt ([Appendix 22 Table. 4. 14](#))

Table 4. 15 Food frequency questionnaire for the intakes of salt substitutes
([Appendix 22 Table 4.15](#))

4.3.3.6. Top ten food items with high salt contents consumed according to FFQ

Two food items from the bread group, Pita bread (Arabic) and toasted bread scored first and third based on the FFQ, while cream cheese was the second scored item with high salt contents as shown in (Table. 4. 16).

Table 4. 16 Most frequent foods high in sodium obtained from food frequency questionnaire

	Frequency	Total sample (n=121)	Rank ^c
Pita (Arabic) bread	1-3 times/week (n) ^a	32	1
	4-7 times/week (n)	32	
	> 1 time/day (n)	55	
	Score ^d -Mean± SD ^b	3.14±0.92	
Cream Cheese	1-3 times/week (n)	46	2
	4-7 times/week ((n)	35	
	> 1 time/day (n)	10	
	Score -Mean± SD	1.96±1.27	
Toasted bread	1-3 times/week (n)	54	3
	4-7 times/week (n, %)	36	
	> 1 time/day (n)	0	
	Score -Mean± SD	1.78±1.13	
Fast Foods	1-3 times/week (n)	69	4
	4-7 times/week (n, %)	20	
	> 1 time/day (n)	1	
	Score -Mean± SD	1.67±1.06	
Tomato paste	1-3 times/week (n)	49	5
	4-7 times/week (n)	25	
	> 1 time/day (n)	6	
	Score -Mean± SD	1.63±1.28	
Butter milk	1-3 times/week (n)	40	6
	4-7 times/week (n, %)	22	
	> 1 time/day (n)	10	
	Score -Mean± SD	1.54±1.39	
Chicken cubes (Regular salt)	1-3 times/week (n)	37	7
	4-7 times/week (n, %)	31	
	> 1 time/day (n)	0	
	Score -Mean± SD	1.38±1.28	
Cheddar Cheese	1-3 times/week (n)	58	8
	4-7 times/week (n)	9	
	> 1 time/day (n)	5	
	Score -Mean± SD	1.35±1.20	
Haloumi Cheese	1-3 times/week (n)	45	9
	4-7 times/week (n)	13	
	> 1 time/day (n)	4	
	Score -Mean± SD	1.20±1.25	
Manakish Zaatar (Thyme with bread)	1-3 times/week (n)	44	10
	4-7 times/week (n)	10	
	> 1 time/day (n)	0	
	Score -Mean± SD	0.98±1.18	

^a Data presented as number and percentage. ^b Data presented as Mean ± standard deviation. ^c Ranking of foods in ascending order according to the scores obtained from FFQ. ^d Each food frequency match with specific score; 1-3 times/week earn score 2, 4-7 times/week earn score 3, and > 1 time/day earn score 4.

4.3.4. Physical activity of the study population before and after intervention

Physical activity of the study population was measured using 7-days self-reported short IPAQ for the three groups at baseline and intervention. ([Appendix 22 Table. 4. 17](#)), showed that the mean $\pm$ standard error for low intensity, moderate intensity, and high intensity physical activity for control group showed no significant differences at baseline and after 10-weeks (6- weeks of educational intervention). Moreover, both intervention groups did not show any significant differences between baseline readings and after intervention, as showed in ([Appendix 22 Table. 4. 17](#)).

Table 4. 17 Physical activity for study population using IPAQ questionnaire ([Appendix 22 Table. 4. 17](#))

4.6. Discussion

To our knowledge, this is the first study in the UAE, GCC, and Arab countries aimed to measure the effectiveness of educational material using digital platforms such as WhatsApp and electronic brochures for 6-weeks with the use of 24-hour urinary sodium excretion levels to monitor salt reduction. Out of 148 participants, 121 participants completed the study according to urine volume and creatinine levels based on several studies (Chernecky and Berger, 2012; Goldman and Schafer, 2011; Land *et al.*, 2014b; Derouiche *et al.*, 2017; Chen *et al.*, 2018; Mansuri and Moorjani, 2019; Othman *et al.*, 2019; Jarrar *et al.*, 2020).

The urinary sodium excretion in the current study was significantly higher than the WHO recommendations, which is 2300 mg/day and significantly lower for potassium (3150 mg/day). The results of the current study showed an increase in salt consumption by 12% in a sample of the UAE population compared with the study conducted in 2015, which showed level of salt intake around 6783.5 mg (Jarrar *et al.*,

2020). Furthermore, the current study showed an increase in salt intake by 8% compared with the study conducted in 2018/2019 and reported in chapter 3. It is worth noting that the age group in the current study is up to 40 years, while both studies conducted by Jarrar et al. 2020 and the study reported in chapter 3 included participants up to 60 years old.

With reference to the study conducted in 2018/2019 (chapter 3), the highest urinary sodium excretion was reported in age groups 20-29.9 and 30-39.9 years old compared with age groups 40-49.9 years and above and 50 years old and above. Therefore, the difference in the age group may explain the differences in salt intake between the current study and the previous two studies. Nevertheless, the common result between the three studies is that the mean urinary sodium excretion indicates higher than the WHO recommendations for salt intake.

There are several salt reduction strategies or approaches all over the world, these strategies were implemented as one strategy, or a combination of two or more strategies, or as comprehensive strategies (Hyseni *et al.*, 2017; WHO, 2018b). These reduction strategies or approaches for salt intake may include one or more of the following such as educational approaches (individual/ group). Generally, most of the intervention's strategies were based on education or counselling lasting for two weeks to less than twelve months (Enkhtungalag *et al.*, 2015; Hyseni *et al.*, 2017; Eyles *et al.*, 2017; Riches *et al.*, 2019). The duration of the intervention varies according to the aim of the study, some interventions lasted for 2 weeks (Enkhtungalag *et al.*, 2015), or 6- week (Riches *et al.*, 2019). Others have used smartphone apps as tools for educational intervention and behavioural change for 4-weeks (Eyles *et al.*, 2017; Ipjian and Johnston, 2017; Ahn, Bae and Kim, 2016). Some studies have used short SMS

messages and pamphlets as tools to deliver educational material for 30-days (Nundy *et al.*, 2013; Golshahi *et al.*, 2015) or three months (Yu *et al.*, 2013).

In the current study, after 10-weeks (6- weeks of educational intervention) the intervention groups (WhatsApp and electronic brochure) showed a significant reduction in salt intake compared with baseline. In the WhatsApp/ intervention group, the reduction was 695.1 mg (-9.2%) compared to baseline, and the reduction in salt intake for the electronic brochure group was 421.9 mg (-5.4%).

Many other studies that used the educational approach as an intervention tool showed similar results. A smartphone application (app) was used as an intervention tool for 4 weeks. The app tool enabled shoppers to scan the barcode of packaged foods and receive an immediate, interpretive, traffic light nutrition label on the screen, along with suggestions for lower salt alternatives, resulting in a significant salt reduction (~0.7 g) compared with baseline (Eyles *et al.*, 2017).

Another study was conducted using smartphone technology aiming to reduce salt intake and make healthy dietary changes among adults for 4-weeks (Ipjian and Johnston, 2017). It showed a significant reduction in salt intake (approximately 838 mg) with smartphone technology compared with a control group (Ipjian and Johnston, 2017). A meta-analysis (11 studies included), aimed to assess the long-term effects of advice to restrict dietary sodium in adults with and without hypertension where salt intake was measured by urinary sodium excretion (Hooper *et al.*, 2002). It found reductions in the salt intake at both intermediate (<12 months) (2.8g/day) and late follow up (13–60 months) (2.0g/day) (Hooper *et al.*, 2002).

Anderson *et al.* reported a reduction of 1.2g/day in 24-hour urinary sodium excretion for intervention group using multicomponent-behavioral interventions for 6

months (Anderson *et al.*, 2010). Moreover, He et al. conducted a cluster-randomized clinical trial to determine whether an education program delivered to primary school children as part of the usual curriculum could lower salt intake in children and their families (He, Brinsden and MacGregor, 2014). The mean salt intake reduction as measured by urinary excretion in children was 1.9 g/day while for families it was -2.9 g/day.

Another Community based open randomized-controlled crossover trial in Japan aimed to assess whether dietary intervention in free-living healthy subjects is effective in improving blood pressure levels and reducing salt intake (Takahashi *et al.*, 2006). The main finding showed that mean salt intake was reduced by 2.8 g/day in the intervention group and at follow-up after 1-year, the salt intake was -2.0 g compared with baseline.

Another study conducted by Yanek et al., aimed to test the impact on cardiovascular risk profiles after one year of participation in one of three church-based nutrition and physical activity strategies (Yanek *et al.*, 2016). The mean salt reduction using 24-hour urinary sodium excretion was significantly different compared with baseline (-0.4 g/day). To sum up, education/counselling approach was found effective for reducing salt intake with range various from 0.4 to 2.9 g/day (Takahashi *et al.*, 2006; He, Brinsden and MacGregor, 2014; Ipjian and Johnston, 2017; Hooper *et al.*, 2002; Anderson *et al.*, 2010).

However, many studies reported that the commitment toward salt reduction was mainly reliant on the education of the participants and the continuation of education strategies about the importance of reducing salt intake (He, Brinsden and MacGregor, 2014; Ipjian and Johnston, 2017). Moreover, Intervention approaches/ strategies using

three approaches such as education, reformulation, and taxes showed a significant reduction in salt intakes of approximately 4g/day in Finland and Japan, a 3g/day in Turkey, and a 1.3g/day in the UK (Hyseni *et al.*, 2017).

In the current study, the reduction in salt intake in the intervention groups was associated with improvement in food and health-related knowledge. In food-related knowledge, the WhatsApp group showed 2.4 times improvements in scores compared with baseline after 10-weeks (6- weeks of educational intervention), while the electronic brochure group showed 2 times improvement compared with baseline.

The health-related knowledge improved by 1.4 times in the intervention groups compared with baseline. Moreover, this improvement in food and health-related knowledge is reflected in an improvement in the attitudes and practices towards the selection and purchasing of low salt foods. Although this improvement increased the recognition of bread as a high source of salt, the intake of Arabic bread was reduced only by 4% which is the lowest compared with other food items that reached 10 to 30% reduction. Pickled foods showed the highest reduction after 10-weeks (6- weeks of educational intervention) with almost 32% reduction, followed by chicken cubes with 22% reduction. Moreover, instant Indomi (instant noodles) showed a reduction of 20%, cheeses intake was reduced by 10-20%, while tomato paste showed only 8% reduction after 10-weeks (6- weeks of educational intervention).

The improvement in the knowledge and attitude for intervention groups in this study translated into significant improvements into practice toward reading food labels, trying to buy low salt foods, reduce adding table salt before tasting the food, choosing low salt foods and increase of use lemons, spices and herbs instead of salt. All this improvement in KAP was translated with salt reduction by intervention group.

This finding in improvement in KAP toward salt intake and reducing salt intake was also reported by other studies, Haron et al. (2020), reported a positive correlation between high knowledge scores and better control in blood pressure. Another study intervention study conducted in Iran, using educational material for two months showed an improvement in KAP and 20% reduction in salt intake for the intervention group compared with control (Layeghiasi et al., 2020).

The intake of stable high salt foods (such as bread and other baked goods) was not reduced. This may suggest the need for food reformulation to reduce salt content in such foods. This was also reported by other studies conducted in the Arab Gulf Countries such as Qatar and Kuwait (Alhamad *et al.*, 2015). Bread and bakery products are considered as a staple food in the UAE, Arab Gulf Countries, Arab World, and most of the Middle East countries (Alhamad *et al.*, 2015). It is not easy to reduce the intake of bread and other baked products even if it is one of the main sources of salt in the diet. However, reduction of salt content in bread could contribute to reducing salt intake (Alhamad *et al.*, 2015).

A study conducted in Jordan aimed to measure salt contents of Arabic bread in 68 bread samples that were collected from 13 different bakeries from Amman (Hussain and Tahruri, 2016). The mean salt content was 1.19 ± 0.21 g /100 g bread, while other local bread “Shrak” was 2.06 ± 0.19 (Hussain and Tahruri, 2016). Therefore, one of the best approaches to reduce salt intake would be to provide low salt bread or place a regulation standard to control salt in the bread. The Emirates Authority for Standardization & Metrology’s (ESMA) initiative for voluntary salt reduction in bread began in Feb 2020 and it will be obligatory in 2022, this aimed to reduce 50% of salt content in the bread “Arabic” to be 500 g salt/100 g of bread.

The current study showed that Arabic bread and toasted bread were among the top 10 food items consumed among the study population. Arabic bread was ranked as the most consumed food item while toasted bread was the third most consumed food item along with Manakish Zatar (thyme with bread). Thus, bread is among the main contributing sources of salt in the diet of people living in the UAE, which is also similar to findings in Kuwait, Jordan, and Qatar (Hussain and Takruri, 2016; Alhamad *et al.*, 2015).

Table salt use can be reduced by increased use of salt substitutes such as herbs, lemons, and potassium chloride, which contain less sodium compared with sodium chloride (He, Brinsden and MacGregor, 2014; Ipjian and Johnston, 2017; Layeghiasi *et al.*, 2020). Another major contributor to salt in the current study was cheese (cream, Cheddar, and Haloumi) and buttermilk. This requires several strategies and innovations for reduction and replacement of salt in cheese manufacturing without seriously affecting the quality, microbial safety, and sensory properties of cheeses (Bae *et al.*, 2020). Therefore, a direct coordination with food industry is required to find the best approach to control or use a ceiling for sodium contents in cheese products.

In this study, another contributor of salt was processed products such as tomato paste and chicken cubes. This finding is similar to other studies conducted in the United States, the United Kingdom, and Australia, which reported that 95% of dietary salt came from bread, cereals, and processed foods such as cheeses and canned foods (Bhat *et al.*, 2020). Both the United Kingdom (UK) and South Korea's salt reduction programs achieved major reductions in the population's sodium intake (15% in UK adults and 24% in South Korean adults) through multi-component programs (consumer awareness campaign, increased availability of low-sodium foods at school,

worksite, and restaurants, voluntary reformulation of processed foods to lower the sodium content) (Ide *et al.*, 2020; He, Brinsden and MacGregor, 2014).

Sodium reduction in South Korea reached to 24% from 2012 to 2020 (Ide *et al.*, 2020). This was associated with reduced hypertension prevalence for adults above 30 years in South Korea (men from 33.5% to 26.0%, and women from 25.2% to 21.7%). In the UK, salt intake decreased by 1.4 g per day, or 15%, between 2003/2004 and 2011 (He, Brinsden and MacGregor, 2014). Moreover, mean blood pressure reduced by 3.0/1.4 mmHg, as well as mortality from stroke and ischemic heart disease decreased by 42% and 40%, respectively (He, Brinsden and MacGregor, 2014). Moreover, Bhat *et al.* conducted a systematic review including 80 studies from 34 countries between 1975 and 2018 which showed that reduction in the intake of processed foods was associated with low salt intake (Bhat *et al.*, 2020).

Many international companies in the food and beverage industry have already started voluntary salt reduction in food product portfolios to promote healthier diets (Jaenke *et al.*, 2017; Kloss *et al.*, 2015). Nestlé removed almost 7,500 tons of sodium from their products since 2005 (Kloss *et al.*, 2015). Unilever screened more than 16,000 of their products and subsequent food reformulation resulted in a reduction of over 3,000 tons of sodium (Kloss *et al.*, 2015). The sodium content of Knorr dry soups was reduced by 10%. Kellogg's reported a sodium reduction of 38% in many cereals during the last decade (CIAA 2010; Kloss *et al.*, 2015). Salt was reduced by 10–40% in many food categories including bread, breakfast cereals, processed meat, cheese, chips, soups and sauces as well as cakes and biscuits (Kloss *et al.*, 2015; Jaenke *et al.*, 2017). To make salt reduction feasible and effective, food industries and governmental entities should work together to decide the percentage of salt reduction in food products, taking into consideration properties of the food (Jaenke *et al.*, 2017).

Therefore, any reduction in the percentage of salt in that food should not negatively affect product palatability and consumer acceptance (Kloss *et al.*, 2015; Jaenke *et al.*, 2017). This approach is supported by new, proposed target for 2022 and 2025 of 15% and 30% reduction in the sodium content of food products, respectively (PAHO 2021). This a 2022 goal was generated to encourage incremental reductions in the sodium content of foods, enhance consumer acceptance of lower sodium products, and allow time for research and development related to food product reformulation (PAHO 2021). This new target highlights the facts that food industries are a contributor factor to improve health and consumer acceptance is an important factor for the success for any initiative for salt reduction.

The current study proved that improving KAP through providing educational material was associated with lowering salt intake in a sample of UAE population. Moreover, the digital approach using WhatsApp and electronic brochures were effective in terms of salt reduction. This is considered the first step or one single element of a comprehensive approach starting with educational material, which aimed to facilitate consumer awareness regarding low and high salt foods. In addition, reformulation of staple foods (particularly bread) to reduce salt content, building a good environment for the food industry to be part of this initiative to reduce salt intake is important in the UAE and the region. Including the study population's suggestions in making the proper decisions on the best approaches and tools to reduce salt intake is also important to make the process of salt reduction more visible and applicable.

Despite the significant findings of this study, it could be of a better value if there were more than one follow-ups in the study to measure the participants' responses toward salt reduction for a longer period. Moreover, measuring salt reduction along with blood pressure readings would give a better understanding of the effect of the

intervention on the blood pressure of participants. In addition, including a more diverse sample in terms of age groups for the KAP part of the study might be useful to study the effect on a wider age range.

4.7. Conclusion

This study proven that using digital approach as intervention tool to reduce salt intake in sample of UAE population was associated with improvement in food and health related knowledge, practices toward salt intake and reduction in sodium/salt intake. However, this study also highlighted the fact that, it was difficult to reduce intake of from staple foods such as Arabic bread and some processed foods.

The outcome of this study can be used by decision maker in UAE including governmental entities and food industry to provide low salt foods/products and encourage the reformulation of some staple foods such as bakery products, particularly bread to support low sodium intake in UAE population.

This is the first intervention study conducted in the UAE that used digital platforms to reduce salt intake along with KAP questionnaire, FFQ, and 24- hour urinary sodium, potassium, and creatinine excretion as tools for assessment.

Chapter 5

Consumer perceptions regarding a salt reduction approach using digital platforms in the UAE: a qualitative study

Abstract: Study 4

Background: WHO adopted several strategies to reduce sodium intake. One of these strategies was to promote the education approach. However, understanding of the stakeholders' perceptions is crucial to the development, implementation and sustainability of any salt reduction approach. Therefore, the aim of the study was to measure participants' perception on using digital platforms to deliver educational material about salt reduction in a sample of the UAE population **Methods:** A qualitative study design was deployed to elicit the participants in a sub-sample of the RCT reported in Chapter 4. Participants (n= 40, 1:1 WhatsApp group to Electronic-brochure group and females to male ratios) were asked to give their feedback regarding, the benefits, barriers and feasibility of implementing the educational material, their preferred communication tool, and suggestions to facilitate salt reduction.

Results: The participants reported that the greatest benefits from educational material were with regards to reading food labels, identifying salt content of foods, finding salt alternatives, and realizing health hazards of high salt intake and positive effects of potassium intake on blood pressure. About 95% of all the participants preferred WhatsApp with short messages as a platform for delivering educational material compared with Electronic-brochure. With respect to feasibility, 50% of participants reported that they can simply implement what they learned if low salt products were

available with distinguished colour or in a specific section in the market. With respect to barriers, most of the participants reported that outdoor food (restaurant) does not provide information on the amount of salt in the dishes or their food labels, and low salt food/products are not easily available in the local market.

Conclusion: This study highlighted the acceptance and usefulness of digital platforms as tools of educational intervention toward salt intake. In addition, it shows the difficulty of finding low salt bread and difficulty of identifying low-salt products

5.1. Introduction

Many studies have shown a direct relationship between high salt intake and hypertension (Arcand *et al.*, 2016; Johnson *et al.*, 2017b). Numerous systematic reviews have concluded that a reduction in salt consumption causes a dose-dependent reduction in blood pressure (Newberry *et al.*, 2018). Moreover, a decade ago, the Prospective Studies Collaboration conducted a meta-analysis of 61 observational studies on blood pressure and vascular disease in adults and found that for each 2 mmHg decrease in systolic blood pressure, stroke mortality and CVDs mortality decreased by 10% and 7%, respectively, an effect that was observed in reductions of systolic blood pressure levels up to 115 mmHg (Newberry *et al.*, 2018).

This indicates that small changes in blood pressure at the population level could result in large public health gains. Therefore, WHO and other leading health and scientific organizations recommend that adults and children should lower their salt consumption (Lichtenstein *et al.*, 2006). Digital platform approach such as social media can play a major role in behavioural changes, to educate the public on a specific

topic (e.g., dangers of high sodium consumption), or they may be part of a broader strategy to build support for or educate about the broader intervention (e.g., educating consumers on a recently enacted nutrition policy) (Ide *et al.*, 2020). With more than 4 billion users worldwide and a projected yearly growth of 7% (Simeon *et al.*, 2020), the internet has become a central means of delivering health promotion interventions (Welch *et al.*, 2016). In particular, the advent and widespread use of social media has fostered a novel setting in which to deliver public health and health equity-oriented interventions (Welch *et al.*, 2016; Simeon *et al.*, 2020).

Intervention approaches greatly differ in their aims such as improving mental health, increasing physical activity, diet modifications, smoking cessation, and vaccination (Cao *et al.*, 2017; Glanz *et al.*, 2017; Ramo *et al.*, 2015; Cavallo *et al.*, 2012; De Choudhury and Kiciman). Social media enable participants to share information, knowledge, and opinions using conversational media which can make it possible to create and easily transmit content in the form of words, pictures, videos, and audios (Simeon *et al.*, 2020). Moreover, any strategy or strategies implemented should be appropriate to the local context in terms of the sources of dietary sodium and educational material about the health hazards of high salt intake.

Health aspect may consider one of the reasons that drive the consumer to buy low salt food/products or to eat low salt foods. However, there are other reasons may affect purchasing or commitment to low salt food intake such as price and taste which is considered also important factors (Kloss *et al.*, 2015; Jaenke *et al.*, 2017). Therefore, food industry and catering services are searching for means to reduce the salt content in their products with maintaining participants acceptance of the products

(Kloss et al., 2015; Jaenke et al., 2017). Although WHO goal to reach 30% reduction in sodium intake by 2025, this needs a multiple strategy or a multi-component package to achieve this goal. Therefore, WHO/PAHO proposed a new target for 2022 and 2025 of 15% and 30% reduction in the sodium content of food products, respectively (PAHO 2021). This will enhance consumer acceptance of lower sodium products, and allow time for research and development related to food product reformulation (PAHO 2021). This approach will improve commitment to low salt intake by gradual reduction of salt intake with maintaining same properties of taste. In addition, highlighting the important role of participants acceptance for any initiative for salt reduction. Therefore, this study aimed to measure participants perceptions regarding a salt reduction approach using digital platforms.

The current study objectives to:

- Measure the effectiveness of educational material, by obtaining feedback from participants.
- Identify best platform approach to deliver educational material (WhatsApp or electronic brochures)
- Identify any obstacles that may affect the salt reduction approach.
- Collect suggestions to improve educational material or approaches for salt reduction.

Hypothesis of the study: availability of low salt foods with distinguished symbols is one of the main limiting factors for maintaining low salt intake in sample of UAE population.

5.2. Materials and Methods

A qualitative research design was deployed to elicit the stakeholder's perspectives (participants) on salt reduction using the social media approach for delivering educational material to a sample of UAE population, using individual in-depth interviews.

5.2.1. Interview questionnaire

In-depth interviews were conducted with participants from the intervention groups (WhatsApp and Electronic-brochures), which started with 10 participants until data saturation was reached. Participants' perspectives on the limitations and strength of the educational material were explored. The interviewer aimed to identify the main obstacles that faced the intervention group in implementing the salt reduction plan.

The primary advantage of the in-depth interviews was to provide much more detailed information than what was available through other data collection methods, such as surveys. The interviews were conducted to understand perceived barriers, enablers, and opportunities. Further, it provided a range of important insights and recommendations to overcoming barriers identified to strengthen the intervention implementation (Figure 5.1). They also aided in exploring the appropriateness of the intervention approach and its impact. As a response to the COVID-19 pandemic, all communication was performed online. Therefore, participant interviews were conducted individually by phone, on zoom, or on Microsoft Teams.

5.2.2. Ethical approval

Ethical approval for the study protocol was obtained from the Research Ethics Committee at Brookes University (UREC), Number: 191337 ([Appendix 13](#) and [14](#)) and from the Research Ethics Committee at United Arab Emirates University (UAEU) (ERS_2020_6107). Prior to the interview, all subjects provided a written informed consent to participate and they were provided with an information sheet ([Appendix 20](#)). An example of the consent form used for this study is shown in [Appendix 19](#).

5.2.3. Study design and participants

A qualitative research design was used on the intervention group that used educational material through two different approaches, WhatsApp and electronic brochures, which aimed to help participants to reduce salt intake. After completing the intervention study (see chapter 4), an in-depth individual interview was conducted in the UAE during the period of January to February 2021, according to the Proposed Schedule for Individual interview ([Appendix 21](#)). A random sample was recruited from the intervention study participants (chapter 4) with a ratio of 1:1 from the WhatsApp and the electronic brochure groups.

All interviews were conducted in Arabic and recorded on Microsoft-teams and telephone. The range interview time was 15- 23 minutes with the mean of 19.4 ± 1.8 minutes for 8 questions (Figure 5.1). The PhD student conducted the interviews with most of the participants, based on a pre-prepared schedule ([Appendix 21](#)). A research assistant (female) from UAE University conducted interviews with some female

participants who preferred female interviewers. These interviews took place in the presence of the Ph.D. student.

Participants answered a set of questions to express their opinions and to give their feedback on the educational material, as well as their opinions on the best approach to deliver the educational material. Figure 5.1. shows a list of the questions presented to the participants for answering.

All the audio recorded interviews were transcribed and translated into English by the Ph.D. student. Back translation to Arabic was performed by Dr. Johaina Idriss and the translation of both interviews was cross checked Dr. Mo'ath Bataineh. The three translators reviewed all versions of the translations - Arabic and English (Tsang, Royse and Terkawi, 2017). Subsequently, the transcripts in English were suitable.

All the data analysis was performed manually in Microsoft Excel using the method outlined by Ose (2016). All the Word documents transcripts were transferred into Excel sheet, each answer was given a specific code, and similar answers were given the same code. Codes were refined until a hierarchy of conceptual codes and sub-codes emerged. This coding framework was finalized once no new concepts emerged. Common codes were mapped to pre-set group of themes, while sub-codes were placed under each theme.

In-depth individual interviews will be conducted using a semi-structured interview guide.

Key questions will be related to:

1. What was, the most useful or new information you learned from the educational material?
- 2- Do you think social communications apps such as WhatsApp; can be a good tool for education?
- 3- Which method you prefer to receive the educational materials in the future WhatsApp with small messages or electronic Brochures or handout brochures and why?
4. Can you apply what you learned for a longer period?
5. What are the obstacles or difficulties that can limit your application to this information on your Daily life?
6. What you would like to see to make it easier to reduce your intake of salt...
7. Do you wish to see products or foods with low salt in the market?
8. Do you want to see foods or products that are "low on salt" known or distinctive in a certain color or plate that distinguish them from other foods? Do you think that will help you to reduce your salt intake?

Figure 5. 1 In-depth- individual interview for a sample of intervention group

5.3. Power of analysis

To calculate a sample size for this qualitative study with a theme (idea/ code), which is considered to have a prevalence of 20% of the population with 90% confidence of finding at least one occurrence of this theme, the following formula was used, where 'ln' denotes natural logarithm, which will provide the minimum number of informants required to conduct the study (Viechtbauer *et al.*, 2015):

$$n = \ln (1 - .90) / \ln (1 - .20) = 10 \text{ participants.}$$

An initial sample size of 10 participants for each intervention group, with a total of 20 participants, was used. Additional two to four participants were recruited for each group, to check the data saturation point (no new ideas). If participants reached data saturation, no additional participants were included. However, if data saturation was not reached and the participants provided new ideas, additional participants were recruited until saturation was reached (Francis *et al.*, 2010; Sim *et al.*, 2018).

5.4. Statistical analysis

An inductive approach was employed, and a thematic content analysis method was used to evaluate the interview transcripts using Microsoft Excel (2019) and IBM® Statistical Package for Social Sciences (SPSS) software, version 25 (SPSS, Chicago, IL, USA), was used to present sub-code variables as frequency and percentage.

5.5. Results

5.5.1. Demographic data of the study population

Mean age of the study population was 28.1 ± 5.3 years with the ratio 1:1 female to males (Table. 5.1). Around 60% of participants were Emiratis and the rest were Arab citizens. 50% the participants were from Alain, (Table. 5.1). Almost 50% of the study population were singles, 45% with university level education, and more than 50% were employed (Table. 5.1).

Table 5. 1 Socio-demographic and physical characteristics of individual interview participants (n = 40)

Variable	Total (n=40) ¹		WhatsApp (n=20)		Brochure (n=20)	
Age (Y)	28.1 ± 5.3		28.1 ±5.8		28.1 ±4.8	
Age categories	Female	Male	Female	Male	Female	Male
20-29.9	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)
30-39.9	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)
BMI (kg\m²)	25.1 ± 4.0		25.3± 4.6		24.8± 3.4	
Nationality	n (%)					
Emirati	24 (60)		13 (65.0)		11 (55.0)	
Arabs	16 (40)		7 (35.0)		9 (45.0)	
City (%)	n (%)					
West region (Abu Dhabi)	9 (22.5)		5 (25.0)		4 (20.0)	
East region (Alain)	20 (50.0)		9 (45.0)		11 (55.0)	
North region (other)	11 (27.5)		6 (30.0)		5 (25.0)	
Marital status (%)	n (%)					
Single	22 (55.0)		10 (50.0)		12 (60.0)	
Married	16 (40.0)		9 (45.0)		7 (35.0)	
Divorced	2 (5.0)		1 (5.0)		1 (5.0)	
Educational level (%)	n (%)					
Undergraduate	0 (0)		0 (0)		0 (0)	
University level	19 (47.5)		9 (45.0)		10 (50.0)	
School level	15 (37.5)		8 (40.0)		7 (35.0)	
Postgraduate level	6 (15.0)		3 (15.0)		3 (15.0)	
Employment (%)	n (%)					
Student	10 (25.0)		5 (25.0)		5 (25.0)	
Unemployed	9 (22.5)		5 (25.0)		4 (20.0)	
Employed	21 (52.5)		10 (50.0)		11 (55.0)	

¹ Data presented as mean ± standard deviation

5.5.2. Main questions for interviewees

Participants were asked to give their feedback regarding five main areas ([Appendix 22 Table 5.2](#)). These areas were: benefits of educational material; preferred communication tool (WhatsApp or Electronic brochures); feasibility of implementing what they learned; barriers to reducing salt intake; and interviewees suggestions. ([Appendix 22 Table 5. 2](#)). shows a summary of the feedback obtained from the intervention group regarding the main educational material, preferred social communication apps, feasibility of implementing what was learnt, and barriers to reducing salt.

Table 5. 2 Summary tables for themes and sub-themes of the feedback of intervention group ([Appendix 22 Table 5. 2](#))

5.5.3. Most useful or new information learnt from the educational material

Most of the participants, reported that they learned how to identify foods which are high and/or low in salt from the educational material “*Identify food high/ low in salt such as Bread (Arabi/Iranian, rice, vegetable, Indomie instant noodles, and Corn flakes*” ([Appendix 22 Table 5.2](#) and Figure 5. 2).

Around 1/3 of participants reported “*health hazard of high salt intake*” as useful information in the educational material. Other participants reported:

“*reading food label.... helped them to identify low and high salt foods*”.

“*Salt alternatives such “Health hazard of high salt intake....”*.”

“*Positive effect of potassium intake on blood pressure/ CVD....*”,

“potassium rich”, and “soak and wash canned vegetables before using.....” to be useful, as shown in (Figure 5. 2).

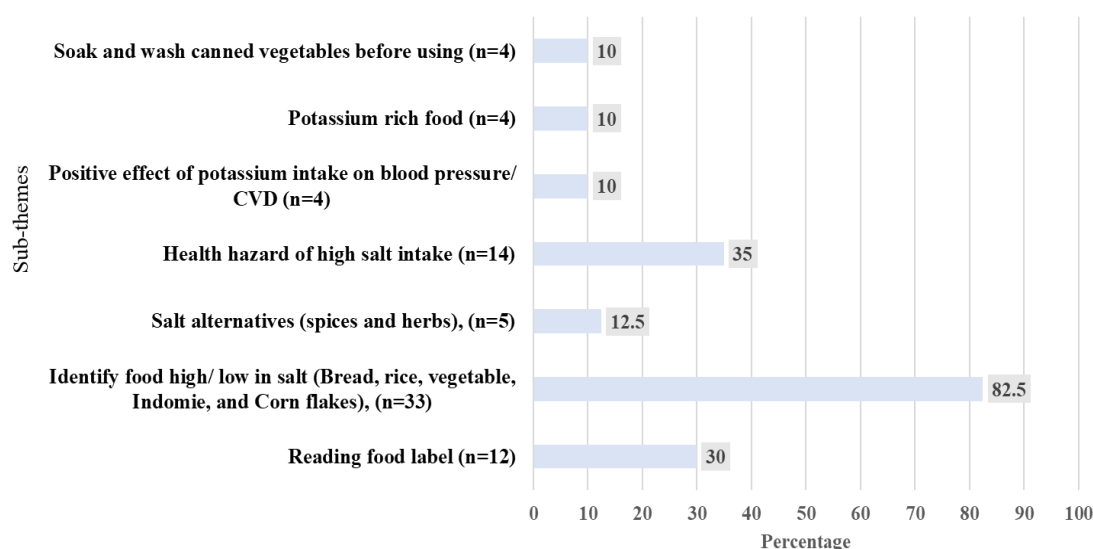


Figure 5. 2 Most useful information from educational material according to in-depth individual interview

Preferred digital platform/ communication Tool

The majority of the participants reported they preferred *“WhatsApp tool as platform for receiving educational material....”*. 38 participants out of 40 (95%) reported they preferred WhatsApp. While, only two reported they preferred *“electronic brochures as platform for receiving educational material....”*.

5.5.4. Sub-Sub-Themes-Preference Reason

Participants reported three reasons for preferring WhatsApp as the platform for receiving educational material regarding salt reduction; *“the most commonly used application by different age groups....”*. Second reason was *“short WhatsApp*

messages are easy to be saved, read, resend, and searched for". Third reason was *"it is easy to access anytime, anywhere, and create groups"*, as shown in Figure 5.3.

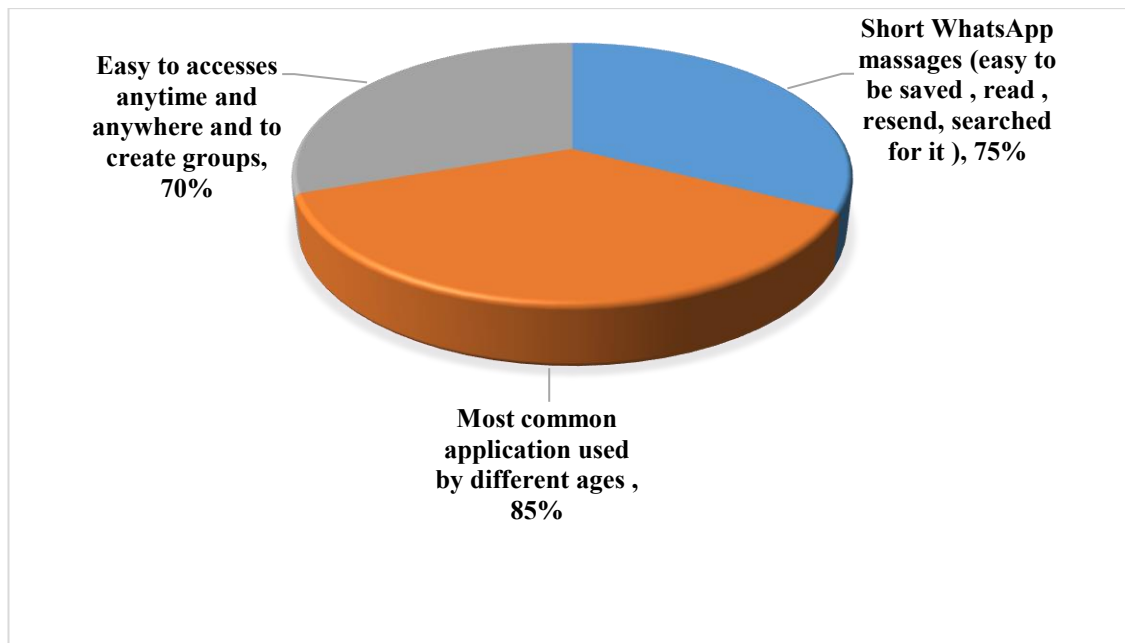


Figure 5. 3 Reasons of preferring WhatsApp as a platform for receiving educational material

5.5.5. Feasibility of implementing education material for a long term

Most of the participants reported that it would be “easy and simple to implement, if low salt products are available with distinguished colour or placed in different sections in the market”. half of participants reported that they can implement the strategies; however, they linked the implementation of low salt choices with the availability of different tools in the market to distinguished low from high salt products.

A quarter of participants reported “manageable to choose low salt foods”. While other participants reported that “they can start gradually...”. While only one

participant reported that “he is not sure if he can implement what he learned from the *educational material*”, as shown in (Figure 5. 3).

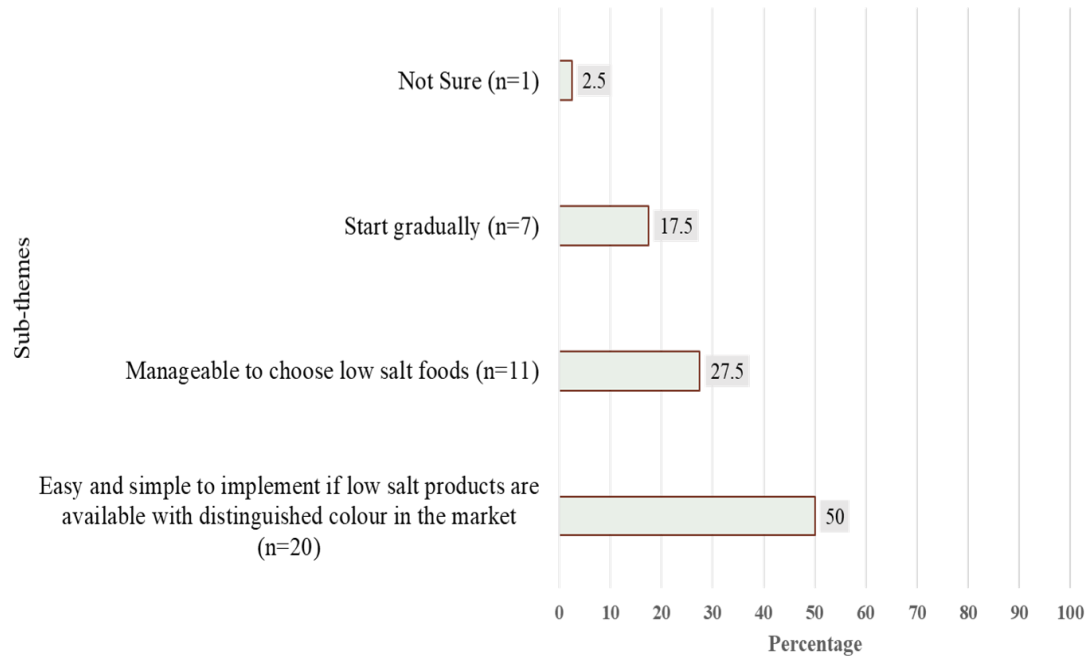


Figure 5. 4 Feasibility of implementing education martial for a long term

5.5.6. Barriers for implementing salt reduction

Participants reported several barriers for implementing salt reduction strategies such as:

“Outdoor food (restaurant) doesn’t provide information on the amount of salt or food labels of dishes”.

“limited availability of low salt bread and bakery products”. “low salt food or products are not easily available in local market, such as low salt bread and dairy products such as cheese and Labaneh (yoghurt cheese)”. *“our traditional foods*

including preparation, cooking, and presentation does not support providing low salt foods or different dishes with low salt alternatives”.

“Not easy to accept low salt food”. “Cannot easily differentiate between high and/or low salt products”. “Concerns about the price of healthy and low salt foods”, as shown in Figure 5. 5.

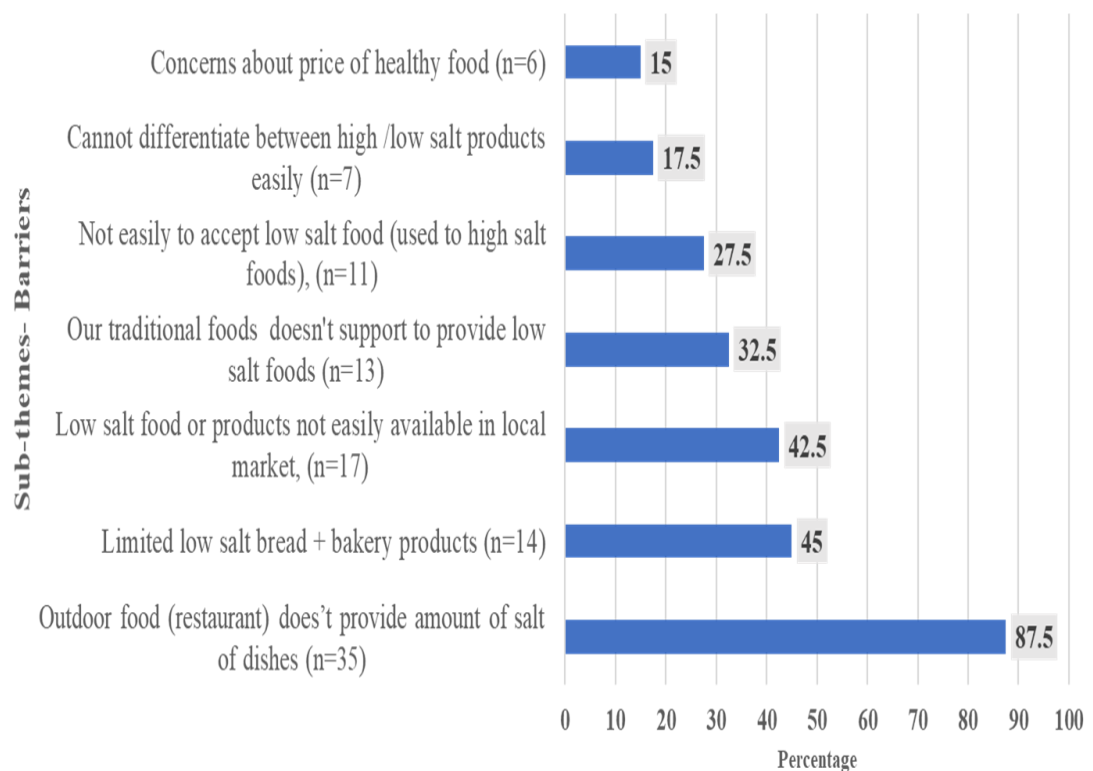


Figure 5. 5 Barriers toward implementing low salt reduction in UAE

5.5.7. Interviewees’ suggestions to facilitate implementation of salt reduction strategies

Participants reported several suggestions to facilitate implementation of salt reduction strategies. The majority of participants, suggested that it would be beneficial

“to distinguish low salt food with special colour or symbols or label”. Similarly, they reported that it would be useful *“to allocate a special section for low salt foods/products”*, as shown in Figure 5.6.

Around more than 50% of the participants reported that it would be useful to *“to update restaurant menus with low salt food and provide food labels in restaurant menus”*.. Almost 50% of the participants reported that it might be useful *“to have low salt bread and low salt bakeries”*. While other participants suggested that:

“To promote nutritional education through social media that can facilitate salt reduction”. *“Affordable prices for low salt food”*, as shown in Figure 5.6.

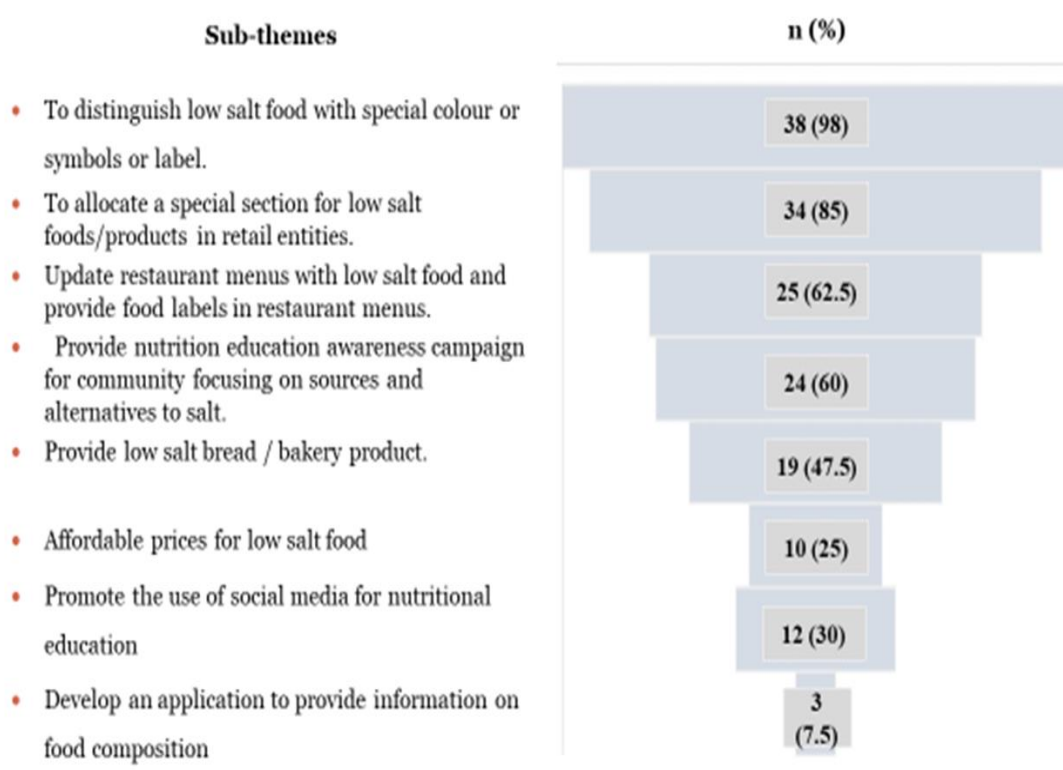


Figure 5. 6 Suggestions to facilitate implementation of salt reduction in UAE

5.6. Discussion

To the best of our knowledge, this is the first study to examine key stakeholders' (participants) perspectives regarding a potential salt reduction strategy in the UAE. The findings highlight the major strategies and challenges that needs to be considered when developing a salt reduction strategy for implementation in the UAE and how to improve effectiveness of salt reduction in the UAE population. There is a relative increase of 28% from 2014 to 2019, in the number of countries adopting strategies to reduce their population-level salt intake (Santos *et al.*, 2021). However, despite the increase in the number of countries adopting salt reduction strategies, none have yet met the targeted 30% relative reduction in salt intake, which was set to be achieved by 2025 (Santos *et al.*, 2021).

Many studies reported processed foods recognized as contributing about 75% of the daily salt intake in many high-income countries (Brown *et al.*, 2009; Stuckler *et al.*, 2012; Santos *et al.*, 2021). Moreover, salt added by the consumer during cooking or at the table is common in many low- and middle-income countries (Webster *et al.*, 2014; Regan *et al.*, 2017; Hyseni *et al.*, 2017). Therefore, consumer's feedback regarding the best approach to reduce salt intake is considered one of the key points for any successful program to reduce salt intake. In the current study, most of the participants highlighted that they not only learned about the health hazards of high sodium intake, but they were also educated regarding different ways in which food with less salt can be prepared, the correct amount of salt to be consumed daily, and practical steps that can be taken to reduce individual salt intake.

In the current study, we explored participants suggestions on promoting low salt food choices. Although 25% of the participants reported that they were willing to follow and maintain a low salt diet, over 50% linked the continuity to reducing salt intake with the availability and visibility of low-salt foods in shops. This means that there are multiple factors in the environment, including individual environment factors such as hard to identify low/high salt foods and unable to judge the right amount of salt intake (Figure 5.7). In addition to the social environmental factors such as not easy to accept low salt foods and most of the traditional foods containing high amount of salt. This means the need for gradual reduction in salt contents in staple foods and creative approaches to reduce salt in traditional foods with increase the use of salt alternatives to maintain same quality of food taste and this process will be required continues education and time to adapt the new salt threshold (Figure 5.5).

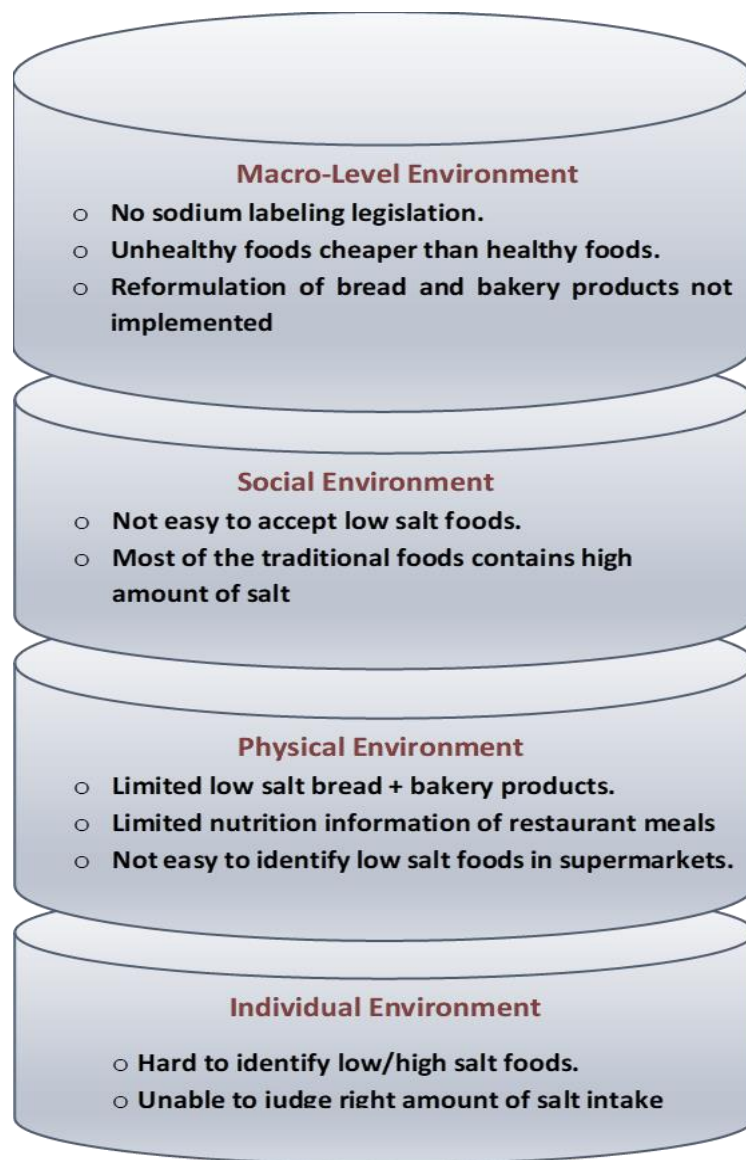


Figure 5. 7 Flow charts for individual, social, physical, and macro-level environment

Other environmental factors are physical and macro-level since both are involved in reformulation of staple foods such as bread and other food products, limited availability of low salt bread and bakery products, lack of clear legislation regarding sodium contents of food labels, and limited nutrition information of restaurant meals (Figure 5.7). Delivering educational material can improve and create

a behavioural change towards reducing salt intake for the participants/consumers, which includes individual and social environment factors. However, without improving the physical and macro-level environment, the extent and sustainability of low salt intake will be affected. Therefore, a second step require collaboration between food manufactures and governmental and non-governmental agencies to find the best approach to increase visibility to reduce salt intake in UAE, similar to what happened in South Korea and United Kingdom (Ide *et al.*, 2020; Bhat *et al.*, 2020; He, Li and MacGregor, 2013a). In South Korea and United Kingdom, they implemented multicomponent approach which includes; consumer education, food industry reformulation, government legislation and awareness campaigns to promote for low salt intake (Ide *et al.*, 2020; Bhat *et al.*, 2020; He, Li and MacGregor, 2013a).

The participants of this study made suggestions for promoting low salt intake in the context of the social ecological theoretical framework for health promotion similar to (Caperon *et al.*, 2019), Figure 5.8. At the organizational/institutional level, the participants suggested environmental and policy changes to reduce salt intake, such as increasing the availability of low salty foods especially bread and bakery products and ability to distinguish low/high salty foods such as by providing an easy tool as a colour or symbol to be used as indicator of low salt foods and providing a separate section for healthy or low salty foods in super/hyper markets. The traffic light approach was successful and effective in reducing salt and fat intakes among Canadian (Emrich *et al.*, 2017). These suggestions would require adoption of additional policies targeting to improve physical and macro-level environment, which requires working closely with food manufactures to increase the availability of low-salt food choices.

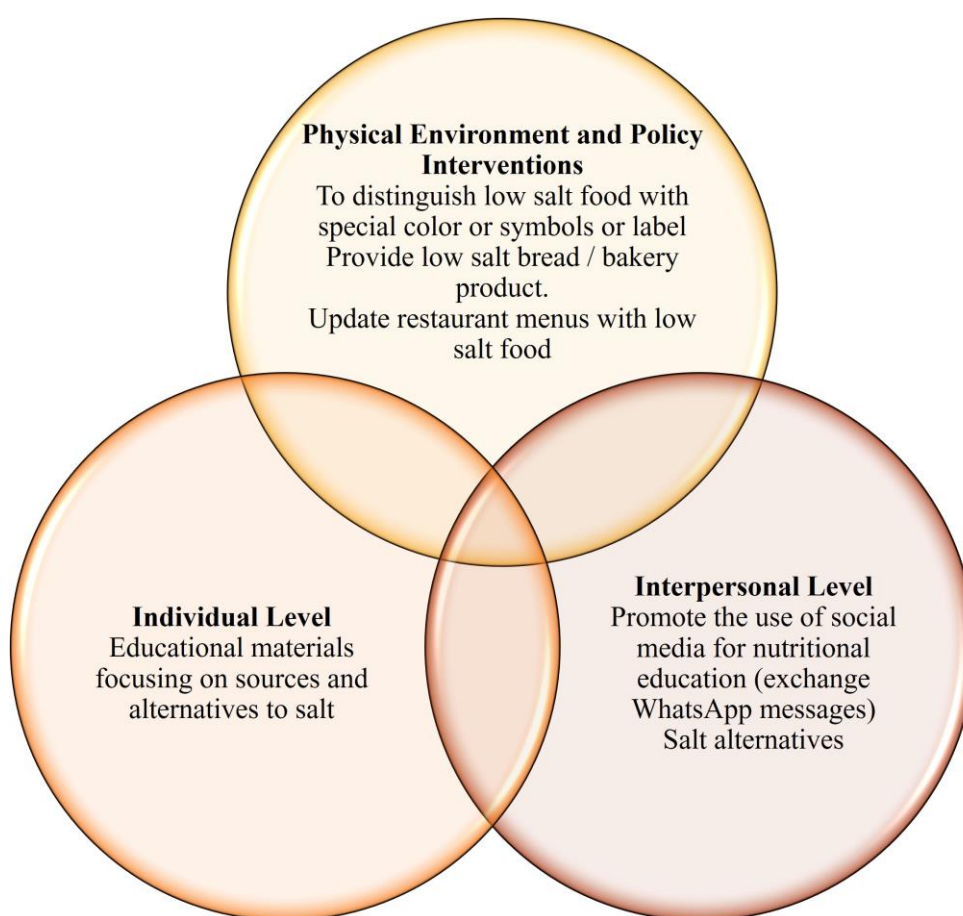


Figure 5. 8 Conceptual framework to improve low salt intake

Many studies have shown positive effects of food reformulation on reducing salt intake and providing a positive environment for low salt (Ide *et al.*, 2020; Hyseni *et al.*, 2017; Bhat *et al.*, 2020). Other organizational-level suggestions included providing posting nutrition fact or labels or statement for restaurant menus. Moreover, participants reported any low salt food products or alternative for low salt foods should be affordable in term of price. Several studies conducted to measure price unit of healthy foods compared with other foods, found mixed results depending on healthy food competition and taxes imposed by countries (Derek *et al.*, 2019; Vandevijvere *et al.*, 2018). However, a study conducted in USA, using price unit per same serving of

healthy foods compared with unhealthier foods and found healthier foods cost nearly twice as much as unhealthier foods per serving (Kern et al., 2017). Moreover, Yin (2021) reported that one of the main barriers toward salt reduction in China is the price of reduced salt foods. This point highlighted the fact that even if the reduced/low salt foods are available, the price of these foods is a determining factor to the success of low salt reduction approaches.

Therefore, in order to complete the cycle, different approaches are needed to reduce salt intake starting with education, strengthening and supporting it with reformulation, and making low salt food easy to distinguish with affordable prices. Many studies showed that Stakeholders' (Food manufactures) are willing to be part of any effort to facilitate salt reduction approaches and ready to cooperate with governmental entities to provide low salt foods (Yin *et al.*, 2021; Gupta *et al.*, 2019).

Finally, the participants in this study preferred the use of digital platform especially WhatsApp to conduct nutrition education activities because, this App is available with most of the population, free, easy to manage and can be shared with many people, short messages with short information length this finding was supported by other studies used WhatsApp as platform to delivered awareness campaigns (Herri *et al.*, 2021) or for educational purposes (Durgungoz *et al.*, 2021).

In addition to the nature and contents of the educational material, which should focus on alternatives of salt and high sources of salt in traditional and western foods.

At the interpersonal level, the study participants mentioned the influence of digital platform such as social media on their food choices. Education approaches

using peer education and support may be more effective in influencing participants' food choices especially toward low salt foods or ability to identify high salt foods, in addition to alternatives of salt. The busy lifestyle of the community requires innovative methods of nutrition education. The utilization of digital platform such as social media approach can be used as a platform to deliver educational material with minimum financial cost with more visibility, circulating and reachable (Layeghiasi *et al.*, 2020; Klassen *et al.*, 2021). Moreover, digital platform approaches increase interaction among families, friends, and others.

5.7. Strengths and Limitations of the Study

The main strength of the study was that participants involved in the interview had the chance to go through the educational material for 6- weeks and were a part of intervention and implementation of low salt intake for 10 weeks. They were able to highlight the obstacles that they faced throughout the study. Moreover, they gave suggestions on how to make it more visible and easier to implement it in the future.

5.8. Conclusion

In conclusion, the findings of the present study can be useful in developing population-based health promotion activities for salt reduction in the UAE, including nutrition education and modifying the food environment. The study may also have implications for nutrition education strategies including the use of digital platform as a tool to deliver educational material as platforms. Future work may focus on implementing participants' suggestions for nutrition education and improving the availability and visibility of low salt food items in UAE. Furthermore, this study

highlighted that the studied sample of UAE-population is ready to change behaviour towards low salt intake but require the support of the environmental factors, such as a clear policy from the governmental and nongovernmental sectors, in addition to the involvement of food industries aiming to facilitate low salt intake in UAE.

Chapter 6: Summary, outcome and future prospects of the thesis

6.1. Summary of the Thesis

This thesis consists of four studies. The main objectives of the thesis were to measure the 24-hour urinary sodium and potassium excretions, as well as the KAP toward salt intake, in healthy UAE-residents. In addition, it aims to evaluate the effectiveness of digital intervention approaches as platforms to deliver educational material to help participants control their salt intake.

For the first study, a KAP questionnaire was translated from English to Arabic. The Arabic version's reliability and validity were evaluated before use. The evaluation demonstrated that the three components of the Arabic KAP questionnaire were highly reliable and valid for use in the UAE. Therefore, it can be used in future studies to be conducted in the UAE and other Arabic speaking countries with similarities to the UAE culture.

The second was a cross sectional study, aimed to measure urinary sodium and potassium excretions along with KAP towards salt intake in a sample of UAE population. PAHO protocol for urine assessment (2010) were used as a guidance for sample size calculation, age groups, and female to male ratio. Single 24- hour urine collection was used for measuring sodium and potassium, as it is considered the standard and golden method. The study revealed that the mean salt intake was approximately 7.0 g/day, which is above the WHO recommendation for sodium intake, and was exceeded by 65.3 % of the participants. It also showed salt intake for male participants was significantly higher ($p=0.003$) than female. Moreover, it highlighted

that the problem is not limited to the high intake of sodium, but also to the low intake of potassium.

Participants showed poor food-related knowledge, such as the ability to identifying high/low sources of sodium foods. Only half of the participants were able to identify or recognize those foods. Furthermore, only one-third of the participants were able to recognize bread (Arabic/Irani) and corn flakes under this category. The study showed that the commonly consumed foods in the UAE residents' diet, Arabic bread, cheese products and pastries, are the main source of sodium/salt.

The third study was a controlled parallel intervention study. It aimed to measure effectiveness of using digital platforms to deliver educational material to facilitate salt intake reduction in a sample of UAE population. Participants were distributed randomly into three groups – Control, WhatsApp, and electronic brochures. Educational material was distributed among participants of the WhatsApp and electronic brochures groups for 6-weeks. A 24-hour urinary excretion of sodium, potassium, and creatinine were measured. In addition, participants completed KAP and food frequency questionnaires on two occasions, at baseline and endpoint after 10-weeks, including the 6-weeks of educational intervention. Sodium intakes decreased significantly in both WhatsApp and electronic brochure groups with improvements in food and health related knowledge after the intervention. Improvement was reflected in participants checking food labels information, which affected purchasing decisions. This study proved that both digital platforms are good tools for increasing awareness. Furthermore, this study proves that the subjects were ready to reduce salt intake when exposed to the appropriate education material with an easy delivery approach.

To have a comprehensive understanding and in order to complete the picture, a fourth study was conducted. A qualitative research design was used with a subsample of participants in the intervention study to elicit the stakeholders' perspectives on salt reduction using the digital/social media approach for delivering educational material to the UAE population. The study used individual in-depth interviews as a data collection tool. Participants reported that the greatest benefit from educational material was in reading food labels, identifying foods high/low in salt, salt alternatives (spices and herbs), health hazards of high salt intake, and positive effects of potassium intake on blood pressure. 95% of the interviewees reported that they preferred WhatsApp with short messages as a platform for delivering educational material. 50% recommended having dedicated low salt aisles or distinguishable color codes for low-salt products and indicated the lack of low-salt bakery product in the market. In the end, all participants linked their commitment to choose low salt foods/products with its availability on the local market in affordable prices.

This study confirmed that delivering educational material via digital platform/social media was effective in improving knowledge, attitude, and practice toward salt intake. However, it showed that increasing potassium intake required extra efforts and involved improving fruits and vegetables intakes. Furthermore, to improve and maintain low salt intake for a longer period, another intervention method or methods may be required.

6.2. Limitation of the thesis

There are multiple limitations to acknowledge as part of this thesis.

Study 1 (chapter 2), the research team used the same KAP questionnaire used by PAHO and the translation to Arabic followed all the required guidelines. However,

only two food items were explored in more details, namely bread (Arabic and Iranian) and rice (Basmati and Egyptian). The research team didn't include more cultural foods to reflect the UAE culture at this stage. Including more food items that reflect UAE food culture will increase visibility of the KAP questionnaire-Arabic version.

In the construct validity assessment, only female students were included, because the nutritional science and dietetic programs are only offered to female students. Although construct validity was used to distinguish between two groups according to knowledge, not including male students is considered a limitation.

In study 2 (chapter 3), the sample size has been determined based on the WHO Eastern Mediterranean Region Office (WHO-EMRO) protocol published in 2010 for 24-hours urine collection and analysis (Campbell et al., 2010a). This study included 190 participants ($\alpha = 0.05$, power = 0.83), distributed into four age groups with female to male ratio 1:1. Participants recruitment was according to the Geographic distribution of UAE. Although, participants Geographic distribution for three regions was relatively equal but it will give more strength to the study if the criteria of WHO Eastern Mediterranean Region Office (WHO-EMRO) protocol was performed for each Geographic region separately and then collected to have more representative sample of UAE.

Food records were obtained on the same day of 24-hour urine collection, mainly to estimate participants' protein intake and assure adequacy of 24-hour urine collection. Further, it aimed to identify foods contributing to sodium intake on the same time of 24- hour urinary. However, this method is not a representative method to have a better picture about food intake patterns and foods contributing to sodium intake in UAE.

In study 3 (chapter 4), food frequency questionnaire was used instead of food record to have a better picture about common food contributing to sodium intake and to measure effect of intervention on food intakes. Although food frequency was a better option to identify these foods, However, the limitation in this study was limiting age groups to 40 years. It might have been better to include age group up to 60 years similar to the age groups in study 3.

In study 4 (chapter 5), in depth individual interviews were used to collect feedback of the participants. The outcome of the study would be more valuable if followed by a group in-depth interview to have more discussions and outcomes on visibility, obstacles and suggestions toward salt reduction.

6.3. Thesis-outcomes toward salt reduction initiative in UAE

1. The use of creative methods to deliver educational material, such as digital platforms/WhatsApp with short messages, among other social media approaches.
2. To include a list of foods with high and low sodium/salt contents in any educational material or awareness campaigns, as well as including local foods on the list.
3. Promote fruit and vegetable intakes in different and attractive ways in the campaign, as well as including a list of potassium rich foods.
4. Encourage the implementation of traffic light system or similar methods to distinguish foods with low, medium, or high salt contents, in addition to using friendly methods to help people in their choices.
5. Increase the availability and feasibility of low salt breads on the local markets

6. Encourage the collaboration between food industries and governmental entities to set regulations and promote reformulations to reduce sodium/salt contents in foods, while maintaining palatability and consumer products acceptance.

Finally, implementing these recommendations in the proposed sequence will facilitate reduction of salt intake in UAE. These recommendations focused on education, increasing visibility of low salt foods and increase consumption of fruits and vegetables. In order to increase sustainability of low salt intake a collaboration between food industries and governmental entities.

6.4. Future studies in this area

Despite the important findings of this thesis, validating the Arabic KAP questionnaire can be improved further by:

- Including more local or Arabic foods.
- Including more knowledge questions related to sodium and potassium of Emirati food sources.
- Conduct study uses FFQ to identify most foods contributing to salt intake in UAE population with age groups up to 60 years old.
- Use other digital platforms using the same delivery methods and same properties such as WhatsApp, Telegram, Instagram, and Bottom.
- Currently, the 24-hour urinary sodium excretion is the recommended method to estimate sodium and potassium intakes by WHO. However, spot urine is a candidate tool to estimate 24-hour urinary sodium excretion, once it is approved by PAHO/WHO.

- For future studies, it is recommended to increase the follow-up time for salt reductions approaches, and to measure participants acceptance for low salt bread and other products.

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Appendices

[Appendix 1](#); OBU Ethical Approval for Study 2



Dr Helen Lightowler
Director of Studies
Department of Sport, Health Sciences and Social Work
Faculty of Health and Life Sciences
Oxford Brookes University
Headington Campus

25 April 2018

Dear Dr Lightowler

UREC Registration No: 181168

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in the UAE

Thank you for your email of 11 April 2018 outlining your response to the points raised in my previous letter about the PhD study of your research student Amjad Jarrar and attaching the revised documents. I am pleased to inform you that, on this basis, I have given Chair's Approval for the study to begin.

The UREC approval period for the data collection phase of the study is two years from the date of this letter, so 25 April 2020. If you need the approval to be extended please do contact me nearer the time of expiry.

Should the recruitment, methodology or data storage change from your original plans, or should any study participants experience adverse physical, psychological, social, legal or economic effects from the research, please inform me with full details as soon as possible.

Yours sincerely

A handwritten signature in blue ink, appearing to read "S Quinton", with a stylized flourish at the end.

Dr Sarah Quinton
Chair of the University Research Ethics Committee

cc: Ayesha Al Dhaheri and Leila Cheikh Ismail, Supervisory Team
Amjad Jarrar, Research Student
Roger Ramsbottom, Research Ethics Officer
Jill Organ, Research Degrees Team
Louise Wood, UREC Administrator

Appendix 2: UAEU Ethical Approval Study 2

Social Sciences Research Ethics Committee -Approval-

Proposal number: 36

Title of Project: Assessment of salt intake among UAE population using 24 hour urine analysis

PI: Ayesha Salem Al Dhaheri

Co-PI: Amjad Jarrar

The above proposal has been reviewed by:

- ☒ one member of the Social Sciences REC
☐ two members of the Social Sciences REC

And the decision is:

- ☒ Favourable
☐ Favourable with Additional Conditions
☐ Provisional Opinion
☐ Unfavourable Opinion
☐ No Opinion (Proportionate Review* only)

Reason:

After evaluating this proposal, we see no major ethical concerns. Therefore, the proposal is approved. In the future, please submit all human tissue related research to the Human Ethics Committee.

Name Clara Morgan
(Chair or designee):

Clara Morgan

Signature

May 4, 2018
Date

Appendix 3: Consent Form Study 2



UREC Registration No: 181168

CONSENT FORM

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in the UAE

Mr. Amjad Jarrar (Student MPhil/PhD), Department of Sport, Health Sciences & Social Work, Oxford Brookes University

Tel: 00971 553710322

Email: amjadj@uaeu.ac.ae / 16111505@brookes.ac.uk

Dr Helen Lightowler, RNutr (Project-Supervisor), Department of Sport, Health Sciences & Social Work, Oxford Brookes University

Tel: +44 (0)1865 483245

Email: hlightowler@brookes.ac.uk

Dr Ayesha Al Dhaheri (Project Co-Supervisor), Department of Nutrition and Health, College of Food and Agriculture, UAE University.

Tel: 009713 7134539

Email: ayesha_aldhaheri@uaeu.ac.ae

Dr Leila Cheik Ismail (Project Co-Supervisor), Clinical Nutrition and Dietetics Department, College of Health Sciences, University of Sharjah, UAE.

Tel. 00971561914363

Email: lcheikhismail@sharjah.ac.ae

Please **INITIAL** the appropriate box

	Yes	No
I confirm that I have read and understand the information sheet for the above research project.	☐	☐
I confirm that I have had the opportunity to ask questions and have received satisfactory answers to all my questions.	☐	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, and to request for any unprocessed data previously supplied to be withdrawn.	☐	☐
I understand that confidentiality of information provided can only be protected within the limits of the law.	☐	☐
I agree to take part in the above research.	☐	☐
I agree to provide a 24 hour urine sample	☐	☐

Name of Participant Date
.....

(block capitals)

Signature

Contact number: email:

.....

Name of Researcher Date

(block capitals)

Signature

Appendix 4: KAP Questionnaire



UREC Registration No: 181168

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in the UAE

Participant Code			
Age			
Date of Birth			
Weight (kg):	Height (cm):	BMI (kg/m ²):	
Blood Pressure	Systolic (mmHg):	Diastolic (mmHg):	

Gender:

- ☐ Male
☐ Female

From which City/Emirate?

- ☐ West region (Abu Dhabi)
☐ East region (Ajman)
☐ North region (Dubai, Sharjah, Ajman, Umm AL Queen, Ras Al-Khaimah)

Nationality:

-
- ☐ UAE citizen ☐ Arab ☐ East Asia
(India/Pakistan/ Bangladesh/Philippine)
☐ Westerns (Europeans, USA.....) ☐ African

Marital status:

- ☐ Single ☐ widow
☐ Married ☐ Divorced

Educational Level:

- ☐ Illiterate (Intermediate or lower)
- ☐ School level
- ☐ Undergraduate university level
- ☐ Postgraduate level

Employment status

- ☐ Student
- ☐ Unemployed
- ☐ Employed

Most of your meals are..

- ☐ Homemade
- ☐ Restaurants (fast foods-Western foods)
- ☐ Restaurants (fast foods-Meditations/Asian foods)

Attitude toward salt in the last 3 months

1. Are you concerned about the amount of salt/sodium in the diet

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

2. How much salt do you think you consume?

- ☐ Too much
- ☐ Just the right amount
- ☐ Far too little

3. Reducing the amount of salt you add to foods is definitely important to you

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

4. Reducing the amount of processed foods you eat is definitely important to you

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

5. Reducing your sodium intake is definitely important to you

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

II- Practice toward salt in the last 3 months

6. Do you Check food labels

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

7. The information on food labels affects purchasing decisions

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

8. Do you check labels specifically for salt/sodium content

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

9. Salt/sodium content indicated on label affects purchasing decisions

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

10. Try to buy "low salt" foods

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

11. Try to buy "no added salt" foods

- ☐ Never/rarely
- ☐ Sometimes
- ☐ Usually/always

12. Do you add salt to food during preparation or cooking?

- ☐ never/rarely
- ☐ sometimes
- ☐ usually/always

13. Do you use Stock Cubes during cooking?

- ☐ never/rarely
- ☐ sometimes
- ☐ usually/always

14. Do you add salt to food at the table?

- ☐ never/rarely
- ☐ sometimes
- ☐ usually/always

15. Do you add salt before tasting

- ☐ never/rarely
- ☐ sometimes
- ☐ usually/always

16. Did you try to reduce salt intake before

- ☐ Yes
- ☐ No
- ☐ I don't know

17. Did you try to use spices to reduce salt

- ☐ Yes
- ☐ No
- ☐ I don't know

18. Which bottle water do you drink most of the time

- ☐ Regular filtered water
- ☐ Low sodium filtered water
- ☐ I don't know

Knowledge scale of participants

		20%	40%	60%
1	How much the percentage of sodium in salt			
	Sodium content in the following foods considered	Low	High	I don't know
2	Pita bread			
3	Iranian bread			
4	fruits, considered			
5	Canned fruits			
6	Fresh vegetables			
7	Frozen vegetables			
8	Canned vegetables			
9	Cheddar cheese			
10	Pickles			
11	Olive oil			

12	Basmati rice			
13	Egyptian rice			
14	Milk, yoghurt			
15	Salad dressing oil			
16	Ketchup			
17	Tomato paste			
18	Red meat			
19	Poultry			
20	Corn flacks			
21	Chicken cubes			
22	Andomi noddle's			
23	Water, filtered			
	High salt intake may increase risk factors for....			
23	Hypertension			
24	Cardiovascular diseases			
25	Diabetes			
26	Fever			
27	Water retention			
28	Renal diseases			
	If I reduce salt intake this will.....	Yes	No	I don't know
29	Improve my health			
30	Improve my blood pressure			

Preferred educational methods

1. Are you willing to reduce your salt intake?

- ☐ Yes
- ☐ No
- ☐ I don't know

2. What is the preferred way you want to read and receive information about salt reduction?

- ☐ Flayer or brochure
- ☐ WhatsApp
- ☐ link or website
- ☐ Text message
- ☐ Attending regular presentations
- ☐ Electronic Brochure
- ☐ Others

Other plz mention

.....

3. Do you want to participate in the intervention study

- ☐ Yes
- ☐ No
- ☐ I don't know

دراسة مستوى الوعي بالذغوى لى اسرل ولى ات الصىة ولام لمرسات ال خاص قبلست مال ك
ال مل حلدى عنة من سلكن دولة الامارات العربىة المتحدة

لكودال خاص بالمشارك			
ال عمر		Age	
تواى التهمى الد		Date of Birth	
ال طول:	ال وزن:	مؤشر لكل فى جسم:	
ض غطال دم	ض غطال دم ال قىضى:	ض غطال دم الفس اطي:	

لجنس

○ ذكر

○ أنثى

أى امارة او عىن فى الامارات

○ المنطقة لاغرىة أبوظبى

○ المنطقة لشرقىة العىن

○ المنطقة لشرقىة العىن (بى الى شارقة و عجمان و رأسالخمىمة و الملق عىن)

الجنسرىة

○ أم ارئى

○ عربى

○ جنسرىة أخرى

الالة ال عىم اعىة

○ أعزب

○ متزوج

○ أرمل

○ طلق

لامستوى لك عىمى

○ عىمى علم

○ متعلیم مرسى

- مت عليهم جام عيبك الوريوس)
- مت عليهم جام عي الخالي)
- لاحالةالوظيفية
 - طالب
 - غير موظف
 - موظف
- معظم ألعمةالتقاولة من
 - الازل
 - أعمة سريعة)أطعمه غوية)
 - أعمة سريعة)أطعمتش روية أوأسيوية)

السبب في انقراض السم إلى الثالث تقاسم: الوعي فيسلكيات والامارساتلمتعلقة بتن اولالحج.

أولاً:- لمرصات اللطهكية تجاه لالحفي الشدثلثة للمضي :

- اهل تشوع بالقلق من لعمية للحج /الصوي وفي نظامك لاغظي ؟
- ☐ بلدا /ن ادرا
 - ☐ أمجلأ
 - ☐ طمأ

2 كم لعمية لالحفي تعلقكنتتن اوله ؟

- ☐ لكشر منلالزم
- ☐ لكهيةلالزم
- ☐ قهيل جدا

3 هل تقبل لعمية للحج لنقيض فيه لى لطعام هو أمرمهم ليس بةلك ؟

- ☐ بلدا /ن ادرا
- ☐ أمجلأ
- ☐ طمأ

4. هل لحد من لعمية الطعمه من عقتي تأكله هو أمرمهم ليس بةلك ؟

- ☐ بلدا /ن ادرا
- ☐ أمجلأ
- ☐ عادة / طمأ

5. هل لحد من تن اولالصويوم/ لمح لطعام لخص بك هو أمرمهم ليس بةلك ؟

- ☐ بلدا /ن ادرا

☐ أحياناً
☐ عادة / طمأ

شأنه: - لم يدرس الاستهلاك في الدليل في الشهر ال 3 للضيعة

6. هل تعتقد من أو تقرأ لمصرقات لم علوم التغذية في شيء ألعمة (لبطولة غذائية) ؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

7. هل وثبتت إننا لبطولة غذائية على قرارك في شراء منتجات ج؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

8. هل تعتقد من لم علومات لغذائية على ألعمة (معرض ألعفة مضموى للمح / لصويوم؟
☐ بلداً / نادرأ
☐ عادة / طمأ
☐ أحياناً

9. هل مضموى للصويوم / للمح لمشاركتي في لم علوم التغذية في وثق على قرارك الشرائكي؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

10. هل تقوم بشراء ألعمة ذات "للمح لمنخفض"؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

11. هل تقوم بشراء ألعمة التي ال مضموي شيء للمح لمضاف؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

12. هل يفي للمح لى لطف أثناعلمضير أو لطهي ؟
☐ بلداً / نادرأ
☐ أحياناً
☐ طمأ

13. هل تستخدمكعبات مرقة الحجاج أو نكهة لخطا المصنع أثناع لطهي ؟
☐ بلداً / نادرأ

- ☐ أمجلأ
- ☐ طأمأ

14. هل يفضي لملح لاي لطعام على طاولة لطعام ؟

- ☐ بلأدأ / نأدرأ
- ☐ أمجلأ
- ☐ طأمأ

15. هل يفضي لملح بلتذوق لطعام ؟

- ☐ بلأدأ / نأدرأ
- ☐ أمجلأ
- ☐ طأمأ

16. هل ح اولتتقيل لملح مقلبل ؟

- ☐ نعم
- ☐ ال
- ☐ نأأ ال أعرف

17. هل ح اولتتستخد لملح وابل للحد أولتتقيل ملس تخلم الم ملح ؟

- ☐ نعم
- ☐ ال
- ☐ نأأ ال أعرف

18. لم نوع لملح تشرب هام عظم لوقت ؟

- ☐ المء المء دن يفلل لرمثل مء افي، ال عي، ببي، الواح، أروى.... إلخ.
- ☐ المء المء دن يلفل لرق ليل الصويوم
- ☐ ال أعرف

ثلاثاً: هئاس مءفة لملح الرلحون هئع علامءة هئى وبع اءللك

		20 %	40%	60%	ال أعلم
1	م ن س بة لملح وافي لملح ؟				
	محتوى للصويوم في الألعمة الهئاة لتعبر:	نخفض	رتفع		ال أعلم
2	خبز عربي				
3	خبز إيراني				

4	هواكه			
5	لاخضراوات لطازجة			
6	خضراوات مجمدة			
7	خضراوات ملعبة			
8	جبن شريدر			
9	لمخالت			
10	زيتون			
11	زأبس متي			
12	ألرز لصري			
13	لخيب ولبادي			
14	صلصات لسلطة			
15	للقتشاب			
16	معجون لطم اطم			
17	للحوم لحمراء			
18	لدواجن			
19	حب وبلال فطار (كون فيكس)			
20	كعبات لدجاج			
21	اندومي			

	يتفادع لثمية للمحتج يئود من عوامل الخطر ل؟	نعم	ال	ال أعلم
23	يتفادع ض غط لدم	1		
24	أمراض لقلب والوعية الدموية	1		
25	للسكري		1	
26	حمى (توفاع حرار قلاج سم)		1	
27	حتباس لماء	1		
28	أمراض للثلى	1		
	اذقل لنتخدامي للمحسني ودي لك لى .. ؟	نعم	ال	ال أعلم
29	حسني حلتا لخط حية	1		
30	سني ض غط لدم	1		

بالموس اوال ت علمي قل لمفضل لة:

1- هل أنت على استعداد لعدد من تزلول الدم لح؟

☐ نعم

☐ ال

☐ أنا ال أعرف

2- ما هي لطول لقتاي لمفضل هالاحصول على معلومات حول تخفيض أول لثقل من تزلول الدم لح؟

☐ لثبات

☐ اللواتس أب

☐ لوال شيك هال لثباتي (القرنت) ربلط أوموقع

☐ رسال نصية

☐ حضور الم حضرات والندوات

☐ أخرى :

- **Date:** 22 / 04 / 2018
- **Reference number:** REC-18-03-09-01-S
- **Title of the research:**
Assessment of Salt intake and Attitudes using 24h urine collection among University of Sharjah Community
- **Name of the principle investigator:** Dr. Leila Cheikh Ismail

Dear Dr. Leila,

The Research Ethics Committee has reviewed the above application, and has voted in favor of approving it from an ethical perspective.

Kindly note that this approval is based on the conditions that,

1. the research is executed according to the research protocol described in the application form, and/or its subsequent modifications, if those modifications were requested by the Research Ethics Committee
2. the information sheet and/or informed consent are those approved by the Research Ethics Committee
3. the research tools are those approved by the Research Ethics Committee

Please note that it is your responsibility, as the principle investigator, to immediately inform the Committee of any changes in the research protocol and/or the research methodologies, should the need for those changes arise prior to or during the conduct of this research study.

On behalf of the Research Ethics Committee, I wish you and your team success in your research project.

Sincerely,



Dr. Suhail Al-Amad
Chair, Research Ethics Committee
University of Sharjah

Appendix 6: Participant Information Sheet



UREC Registration No: 181168

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

Chronic diseases, such as cardiovascular diseases (CVD), cancer, chronic respiratory diseases (CRD), and diabetes are increasing worldwide and are considered the leading causes of death. In the United Arab Emirates (UAE), CVD accounts for more than 25% of all deaths countrywide and 29% of all deaths in the emirate of Abu Dhabi. The aim of this study to assess your sodium intake by measuring **24-** hour urinary sodium, potassium and creatinine excretion. In addition to identify your main food sources of sodium intake. The result of this study will give a better idea about the quantity of sodium compared with World Health Organization (WHO) recommendations.

Why have I been invited to participate?

A random sample of 140 UAE adult residents of both genders, aged 20 to 60 years, will be recruited to participate in the study. Participants will be recruited from different Emirates,

The exclusion criteria for participating in the study are:

- diagnosis with renal failure
- hypertensive on medication
- pregnant, lactating
- menstruating female during the period of urine collection
- use of diuretic medication
- unable to collect adequate urine (less than 500 ml)

Do I have to take part?

It is up to you to decide whether to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time, without giving a reason, and to withdraw any unprocessed data previously supplied. If you are involved in a dependent relationship (i.e. Teacher\student) with the project, principle investigator (PI), your involvement in the study will not affect your grades, assessments, or future studies.

What will happen to me if I take part?

You will answer questionnaire, which includes questions related to demographical data, attitudes of salt intake, preference toward purchasing foods with high or low salt, and knowledge of identifying salty foods. This will take only 30 minutes of your time.

You will be asked to provide a single timed 24-hour urine in any day you wish, instruction sheet on how to collect single timed 24-hour will be provided to you, instruction includes when to start to collect urine and how to record start time, end time of 24-hour and miss urination time in container. to record start day, date and end date. In the same day of urine collection, you will asked to record your food intake and you will be provided with access to Rashakaty (fitness for me) <http://rashakaty.com/>. To help you with the estimation of portion size and how to record food intake.

What are the possible benefits of taking part?

You can find out how much salt you consumed and main sources of salt in your diet. This can help from where to start if you want to control or reduce your salt intake.

At the population level, your contribution in this study will give a better understanding about quantity and sources of salt consumed in UAE and main sources of it. Decision maker in UAE can use result of this study to plan intervention approaches.

Will what I say in this study be kept confidential?

Many steps will be taken into account to maintain and enhance participants confidently. Such as, participant names will be replaced with Codes, codes will be used in all papers, lab work, food analysis software and statistical work among research team.

All the data stored in laptops and other devices will be protected by password and access will be given to PIs of the study. In addition, all the data generated in the course of the research must be kept securely in paper or electronic form for a period of ten years after the completion of a research project.

What should I do if I want to take part?

If you wish to be part of this study, or for more information you can communicate with research team through any phone number listed in the flyer or even by sending WhatsApp message. Feel free to communicate with any member of the research team to participate or for more information. After reading information sheet and understand what on it, sign consent form and this case you will be part of this study.

You will be provided with questionnaire including questions related to demographical data, some questions related to salt intake, selection of foods and knowledge of salty foods. In addition to that you will be asked to provide

What will happen to the results of the research study?

Ultimately, the results of the study will be written up as part of a PhD thesis. In addition, the results will be published in peer-reviewed journals and presented at meeting and conferences. Participants will not be identified in any publications. Participants which to obtain a copy of the published research, they can communicate with research team to be provided with a link.

Who is organising and funding the research?

This is a research student project (MPhil/PhD) at Oxford Brookes University, Department of Sport, Health Sciences & Social Work, Faculty of Health and Life Sciences at Oxford Brookes University. This project is self-funding; Nutrition and Health Department- College of Food and Agriculture, UAE University will provide all consumable material.

Who has reviewed the study?

This research has been approved by the University Research Ethics Committee, Oxford Brookes University.

Contact for Further Information

If you have any questions regarding this study, you can contact either the Project PI or Project Co-PI:

Mr. Amjad Jarrar (Student MPhil/PhD)

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Tel: 00971 553710322

Email: amjadj@uaeu.ac.ae / 16111505@brookes.ac.uk

Dr Helen Lightowler, RNutr (Director of Study/ Director of the Oxford Brookes Centre for Nutrition and Health(, Department of Sport, Health Sciences and Social Work ,Oxford Brookes University

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Dr Ayesha Al Dhaheri (Project Co-Supervisor), Department of Nutrition and Health,
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If you have any questions regarding the Ethical Approval or any issues / problems
related to this study, please contact: the Chair of the University Research Ethics
Committee on ethics@brookes.ac.uk.

Thank you

For taking time to read the information sheet.

Date: Data collections, will start on 15/4/2018 until 15/6/2018

الفئة فعليّة خطط لتدخل لمختلفة لتس فيل خفض لمت هالك ل لم ح

ففى الامارات لعربية لتحدة

نتقدم دعتك لمشارك في واس قبليّة قبل أقرر ما إذا كنت تستشارك أم ال فمّن لم مهال سب ذلك لتف ممل ماذي جري
البحث وما سوف تنطوي عليه. يرجى تخصيص بعض الوقت لقراءة التعليمات التالية بعناية.

م ١ هولا غرض من لدراسة؟

تزداد الأمراض المزمنة (غير المعدية)، وخاصة أمراض القلب والأوعية الدموية والسرطان، وأمراض الجهاز الهضمي
المزمنة، وداء السكري في جميع أنحاء العالم، ويعتبر الأسباب الرئيسية لوفيات في الإمارات العربية
للمتحدة مثل أمراض القلب والأوعية الدموية والسرطان من 25 % من جميع الوفيات على مستوى البلاد و 29 % من مجموع الوفيات
في الإمارات العربية المتحدة.

الغرض من الدراسة:

- 1- قياس مدى الوعي بالمرض في عينات بول لمجموعة على مدار 24 ساعة في عينات من سكان الإمارات.
- 2- تقييم مدى الوعي بالمرض في عينات بول من الصويوم من خلال استكمال الطعام لتناول أول 24 ساعة السابقة.
- 3- التعرف على مصادر المعلومات في يوم في الغداء.

لماذا دعتك لمشاركة؟

سيتم إشراك عينات عشوائية من 140 مقيماً من الإمارات العربية المتحدة من كبار السن الذين يتراوح أعمارهم
بين 20 و 60 عاماً للمشاركة في الدراسة. سيتم اختيار المشاركين من خلال طرق مختلفة من مختلف الإمارات وذلك
من خلال المقابلات وجهاً لوجه وإلّا عن طريق الهاتف. سيتم اختيار المشاركين من خلال الجملعة التمثيلية في الإمارات
للعربية المتحدة والمناطق الصحية ولمجموعات والنزل والعيادات المتنقلة ونس أبو سوف يتم استخدام وحدات
التسليح في لاج اماتل متق طلة المشاركون.
مخطط الدراسة للمشاركين هي التقييمات في وقت مبكر، واستخدم الدواء لعلاج وابتداء غط الدم والحوامل،
المرضى وألحاض الإناث خلال الفترة من ١٠ إلى ١٢ من الشهر، واستخدم الدواء في وقت مبكر أو المشارك لا يفرق أدر على جمع
عق بول لغاية (١٠ من 500 مل)

مل يجب على المشارك؟

قرار المشاركة من عدمه متروك لك. إذا قررت المشاركة، سيتم إعطائك ورقاً دائماً ومات هذا عرفت بوضوح
و من ثم سيتم طلب في وقت مبكر من نموذج المصلحة. إذا قررت المشاركة، يجب عليك أن تكون في وقت، دون إبداء
الأسباب، وسحب أي بيانات غير متصلة مسبقاً. إذا كنت ترغب في المشاركة / الطالب (مطلوب أن يرفق
فإن لم مشارك من عدمه في طلب بحث لتقرر على درجتك أنت في ذلك و دراستك

ماذا سيحدث لي إذا شاركت؟

إذا شاركت سيتم إجراء الاختبار في أي وقت تيسر لك، وسوف يطلب منك أن تملأ استبياناً عن حياتك
السابقة المرفقة والمصرف وممارسك إلى الملح ومعرفة الطبيب في وقت مبكر أو الاشتراك في فاسيت هالك الملح
بالإضافة إلى بعض العينات التي موزعة، وهذا يعني أنك سوف تفرق 30 في وقت مبكر من وقتك وسوف يطلب في وقت مبكر بول

Appendix 7-a: 24-hour Dairy Record

24-hour Dairy Record

Code		Age	Gender		Height (cm)	Weight (Kg)
			M	F		
Meal	Timing	Food consumed/ drinks	Description of consumed foods/ drinks	Quantity	Place of food intakes	Code for EISHA
☐ Breakfast ☐ Lunch ☐ Dinner ☐ Snack					☐ Home ☐ Restaurant ☐ Work ☐ Relatives ☐ School/University ☐ Car	
☐ Salt*						
☐ Breakfast ☐ Lunch ☐ Dinner ☐ Snack					☐ Home ☐ Restaurant ☐ Work ☐ Relatives ☐ School/University ☐ Car	
☐ Salt						
☐ Breakfast ☐ Lunch ☐ Dinner ☐ Snack					☐ Home ☐ Restaurant ☐ Work ☐ Relatives ☐ School/University ☐ Car	
☐ Salt						
☐ Breakfast ☐ Lunch ☐ Dinner ☐ Snack					☐ Home ☐ Restaurant ☐ Work ☐ Relatives ☐ School/University ☐ Car	

☐ Salt						
☐ Breakfast ☐ Lunch ☐ Dinner ☐ Snack					☐ Home ☐ Restaurant ☐ Work ☐ Relatives ☐ School/University ☐ Car	
☐ Salt						

☐* Salt: Added salt, how many time you sprinkled salt in your foods.

استذكارتعام ليوم لسبق (24 ساعة)

للنود	لعمر	لأجنس	لطول)سم(	لوزن كجم(
		ذكر انثى		

لأجبة	لوقت	الطعام لأول	وصف لأول	لرمز	لأسمي	مكان لأول الطعام		
☐ فطور ☐ غداء ☐ عشاء ☐ سناك						☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز		
☐ فطور ☐ غداء ☐ عشاء ☐ سناك						☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز		
☐ فطور ☐ غداء ☐ عشاء ☐ سناك						☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز		
☐ فطور ☐ غداء ☐ عشاء ☐ سناك						☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز ☐ لخبز		
☐ لخبز								

*الطعام: كم مررتش ملح الطعام

Appendix 7-b: Instructions for recording Food Record

Instructions for recording Food Record in same day of urine collection

التعليقات الصالحة للتحليل لطعام في فمك مرة لطعام خالٍ ويجمع عينات لبول

A food diary should include the following:	يجب أن تتضمن من فمك مرة لطعام أهلي:
What are you eating? Write down all the food and beverage consumed and how it is prepared (baked, broiled, fried, etc.). Include any chicken cubes sauces, condiments, dressings, or toppings.	ماذا تأكل؟ اكتب جميع الأطعمة والمشروبات المستهلكة وكيف هي (مخبوزة، مشوية، مقوية، إلخ). اكتب أي صلصات دجاج، صلصات متبيلة، أو إضافات.
How much are you eating? List the amount in household measures (cups, teaspoons, tablespoons) or in ounces. If possible, it is best to weigh and measure your food. Estimated portion size only included consumed amount without leftover	كم تأكل؟ اكتب الكمية في قوائم المائدة المنزلية (أكواب، مالح، صغرة، مالح، إلخ) أو أوبال. الوزن المثالي يريش مالفق طال وزن البنية أول وليس مالفق الوزن المثالي من الطعام أو الغيرة بنية أول.
If you are away from home, do your best to estimate the portion.	إذا أمكن فمألففضل أن تزن وقياس طعامك. إذا لم تكن، فمألففضل أن تزن وقياس طعامك.
In case if you faced any difficulty in recording a food or estimate the food, feel free to text on WhatsApp 00971553710322	في حال واجهتك أي صعوبة في تسجيل طعامك أو تقديره، لا تتردد في إرسال رسالة نصية على WhatsApp 00971553710322
Attached file below may help you to estimate correct quantities	الملف المرفق قد يساعدك في تقدير الكميات

Appendix 7-c: Portion size estimation





**How to estimate portion size
and examples of different
Portion Size for different food**

كيف تقدر الكميات و امثله على بعض اوزان
الأطعمة المختلفة

FOOD	SYMBOL	COMPARISON	SERVING SIZE	الحصة أو الوزن (التكثيري)	التشبيه أو الرمز
Dairy: Milk, Yogurt, Cheese					
Cheese (string cheese)			Pointer finger	1½ ounces	حجم الاصبع (الشاهد)
Milk and yogurt (glass of milk)			One fist	1 cup	قبضة اليد الواحدة
Vegetables					
Carrots			One fist	1 cup	قبضة اليد الواحدة
Kale			Two fists	2 cups	
Fruits					
Apple			One fist	1 medium	قبضة اليد الواحدة
Peaches			One fist	1 cup	قبضة اليد الواحدة
Grains: Breads, Cereals, Pasta					
Cereal (bowl of cereal)			One fist	1 cup	قبضة اليد الواحدة
Noodles, rice, oatmeal (bowl of shredded wheat)			Handful	½ cup	قبضة يد بحجم باطن اليد
Slice of whole-wheat bread			Flat hand	1 slice	خبز توست بحجم كف اليد
Protein: Meat, Beans, Nuts					
Chicken, beef, fish, pork (chicken breast)			Palm	3 ounces	حجم كف اليد
Peanut butter (spoon of peanut butter)			Thumb	1 tablespoon	حجم الإبهام



Small Finger Roll

خبز سمون = 30 جم



Al Noor Modern Bakery Bread

مخبز النور الحديث

خبز عربي

ساج = 124 جم

خبز عربي كبير =

140 جم

خبز عربي صغير =

41 جم



Saj Bread:
Diameter: 3.5 cm * 2 = 7 cm
Weight: 124 grams



Big bread:
Diameter: 3 * 2 = 6 cm
Weight: 140 grams



Small Bread:
Diameter: 7 * 2 = 14 cm
Weight: 41 grams

Brown Bread

خبز اسمر = 50 جم



Reqaq Bread

خبز ارقاق = 26 جم



خبز ایرانی
رغیف واحد = 240 غم



Iraian Bread 1 Loaf = 240 g

مناقیش

مناقیش زعتر = 160 غم

مناقیش جبنة = 160 غم

Mankesh-Zaatar
مناقیش زعتر

1 piece
١ حبة



Mankesh-Cheese
مناقیش جبن

1 piece
١ حبة



أرز بسمتي كوب بحجم كف اليد = 160 غم أرز مصري بحجم كف اليَد = 175 غم	Basmati rice أرز بسمتي	1 cup ١ كوب	
	Egyptian rice أرز مصري	1 cup ١ كوب	

معكرونة 1 كوب =
130 جم

سباغيتي 1 كوب =
190 جم



1 cup of macaroni = 130 g



1 cup of spaghetti = 190 g

جبنة فيتا مكعب =
30 غم

لبنه 2 ملعقة طعام =
60 غم

Feta cheese
جبنة فيتا

1 oz
أونصة



Labneh
لبنه

2 tablespoons
2 ملعقتين طعام



جبنة شذر شريحة واحدة = 30 غم جبنة حلوم شريحة واحدة = 30-25 غم جبنة كريم = 25 غم	Cheddar cheese جبنة شيدر	1 piece/ 1 oz ١ شريحة/ الواحدة	
	Halloumi cheese جبنة حلوم	1 slice ١ شريحة	
	Cream cheese جبنة كريم	1 tablespoon ١ ملعقة طعام	

كوب منسف

1 كوب = 225 جم




Fermented salted yoghurt (Mansaf)= 1cup=225 g

1 كوب حليب = 240 ملم 1 كوب لبن = 240 غم	Butter milk لبن	1 cup ١ كوب	
	Milk, yoghurt حليب، زبادي	1 cup/ 8 fl oz ١ كوب / ٨ أونصات سائلة	

اللحوم الحمراء = 90 غم صدر دجاج مشوي = 90 غم	Red meat اللحوم الحمراء	3 oz ٣ أونصات	
	Poultry الدواجن	3 oz/ Chicken breast (boneless, skinless) ٣ أونصات/ صدر دجاج منزوع العظم والجلد	

نقانق = 30 غم فرانكفورت متوسط = 30 غم مرتديلا شريحتين = 15 غم	Hot dog/ sausage chicken نقانق الدجاج	1 frankfurter ١ إصبع	
	Hot dog/ sausage beef نقانق اللحم	1 frankfurter ١ إصبع	
	Mortadella مرتديلا	2 slices ٢ شريحتين	

كباب مشوي 10 حبات مشوية = 275 جم	Kebba	
	 10 pieces of kebab (Grilled) 275 grams	

بطاطا مقلية

الوزن 41 جم

Potatoes fries



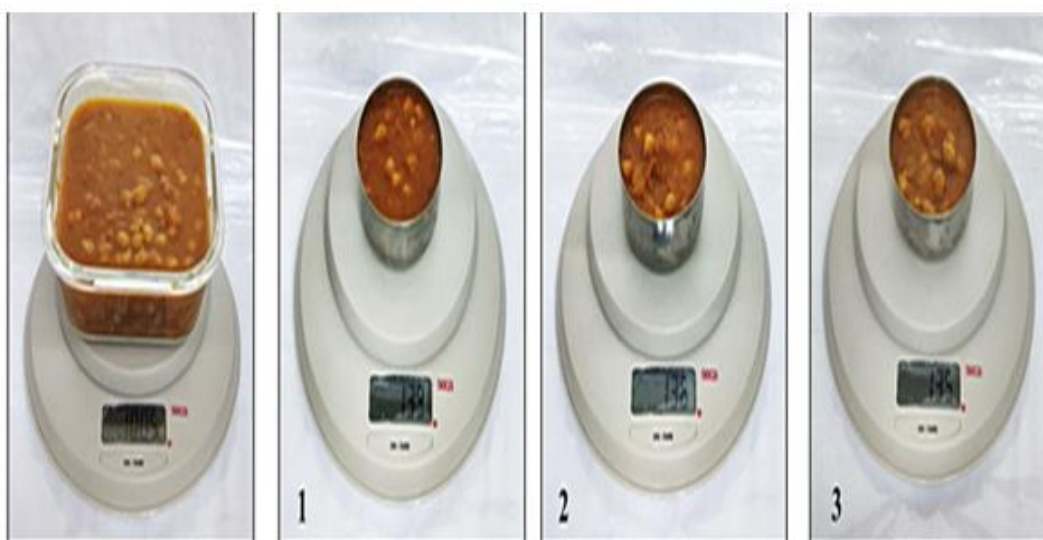
After frying: 41
grams

قطايف محشية جوز

4 قطع = 200 جم

4 pieces of Qatayef
: 200 grams





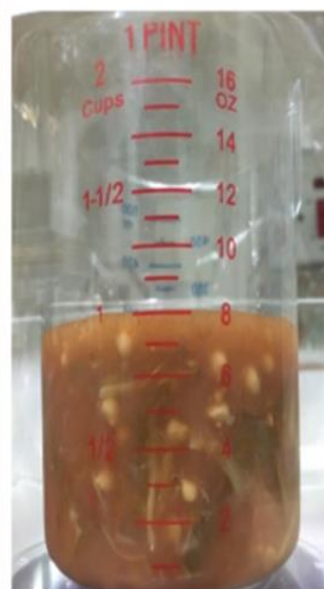
Weighing Recipe yield

Weighing portion size (in triplicates)

متوسط الوزن 135-139 غم

وعاء كبير 1005 غم

يخنة بامية
1 كوب (215 جم)



Okra stew with tomato sauce

المادة	الوزن
زيت القلي	30 غم
حبتيين بصل	90 غم
3 حبات طماطم	150 غم



زيتون أخضر
12 حبة = 25 غم



12 olives pickled in salty water 25 grams

كنافة نابلسية
قطعة واحدة 87.5 جم



1 piece of kunafa from quwaider al nabulsi 87.5 grams

سمبوسك خضروات
مقلية
الوزن = 25 جم



Vegetable samboosa after frying in corn oil = 25 grams

مكسرات مملحة كف
يد=30 غم
مكسرات غير مملحة كف
اليد=30 غم

Salted nuts
مكسرات مملحة

1 oz
١ أونصة (حفنة يد)



Unsalted nuts
مكسرات غير مملحة

1 oz
١ أونصة (حفنة يد)



Appendix 8: Instruction for 24-hour urine collection

Instructions on how to collect 24-hour urine

Code	Age	Gender		Height (cm)	Weight (Kg)
		M	F		

A 24-hour urine sample can be obtained as following:

- On day 1, urinate into the toilet when you get up in the morning.
- Afterward, collect all urine in a special container for the next 24 hours.
- On day 2, urinate into the container when you get up in the morning.
- Cap the container. Keep it in the refrigerator or a cool place during the collection period.
- See example (1) below to write start time and finished time

Example (1)			
Date started	10/02/2018	Date Finished	11/02/2018
Time started	10:30 am	Time Finished	10:30 am
Study			
Date started	--- /---/2018	Date of finished	--- /---/2018
Time started	---:--- am	Time finished	---:--- am

- In case if you forget to urinate in provided container, please write down time

Forgetting		
Time Forgot	-----:----- am- pm	-----:----- am- pm
Time Forgot	-----:----- am-pm	-----:----- am- pm

تعليقات حول كيفية جمع البول على مدار 24 ساعة

الأكود	لعمر	لجنس	لطول (سم)	لوزن (كجم)
		ذكر	انثى	

يمكن الحصول على عينة البول على مدار 24 ساعة عن طريق حل التالي:

- في اليوم المتبول في المرحاض على السقيق اظلي صباح.
- بعد ذلك يجب جمع كل البول في حاوية خاصة الم مقدمة من البحث (لمدة ال 24 ساعة لقا ادم).
- فعلي اليوم 2 متبول في حاوية عند السقيق اظلي صباح
- قمت بخلي فال حاوية. اخذ ظهري الى لاجه أو مكان بارد خال لفترة جمع غل عينة.
- منظر ال (الرقم 1) أن الى لفترة وقت البدء والوقت النهائي

مثال 1)			
تاريخ لبدأ	2018/2/10	تاريخ النتهاء	2018/2/11
وقت لبدأ	10:30 صباح	وقت النتهاء	10:30 صباح
لهراسة			
تاريخ لبدأ		تاريخ النتهاء	
وقت لبدأ		وقت النتهاء	

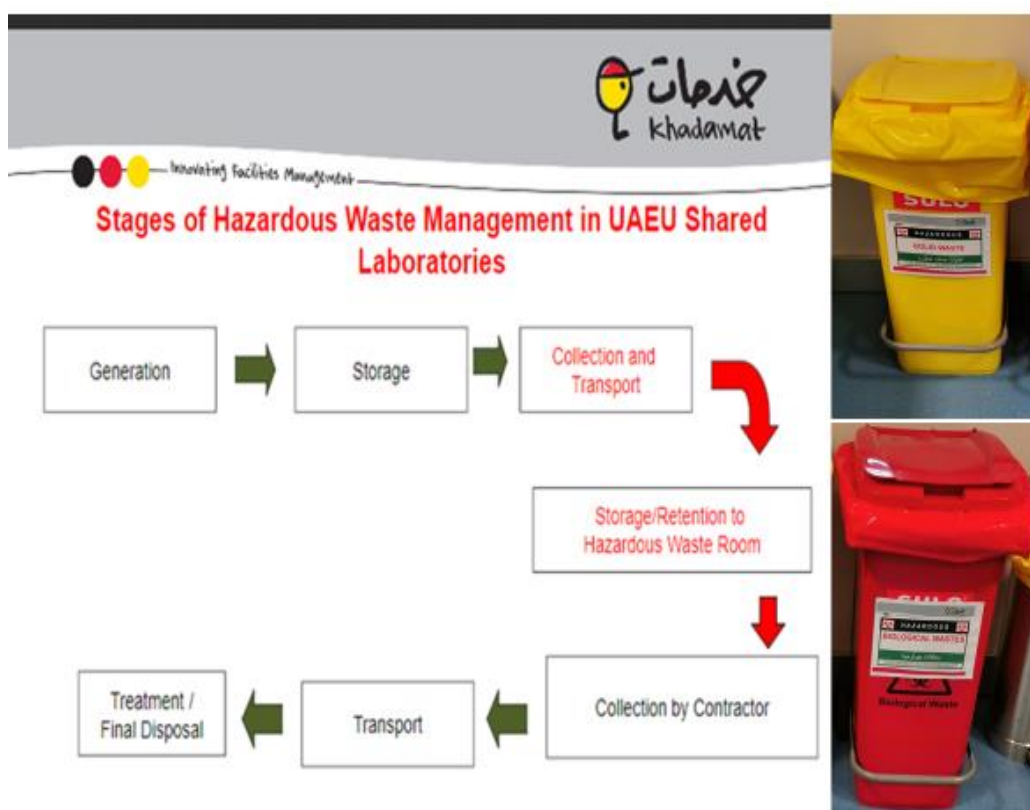
في حال قمتي بجمع البول في لوعاء خاص في البحث، القتل بالوقت

نسي ان للتلقي في ل حاوية		
وقت تلقي نسي ان	صباح/مساء	صباح/مساء
وقت تلقي نسي ان	صباح/مساء	صباح/مساء

Appendix 9 a: Plastic containers (urine bottles) distribution and collection



Appendix 9 b: Stages of hazardous waste management in UAEU Shared Laboratories.



<http://studylib.net/doc/5573759/hazardous-waste-collection---khadamat-facilities-management>.

Khadamat Facilities Management: 1. Collects and transfer the hazardous waste (except Mercury and radioactive waste) from each laboratory room to designated hazardous waste room. 2. Facilitate collection of hazardous wastes by UAEU's hazardous waste contractor from designated hazardous waste room to appropriate treatment/ disposal facility. 3. Ensure that all waste management activities are following UAE Regulations being implemented by Environmental Authority and Centre for Waste Management.

Appendix 10: Determination of sodium and potassium in urine by ICP-OES

College of food and Agriculture



جامعة الإمارات العربية المتحدة
United Arab Emirates University

UAEU Faculty of Food
and Agriculture

Animal Nutrition Laboratory

ANL-SOP-ICP-04

Determination of Sodium and Potassium in Urine by ICP-OES

Title

Simultaneous determination of Sodium and Potassium in Urine by ICP-OES.

Purpose

To determine the Sodium and Potassium level in urine samples.

Principle

A known quantity of sample is acidified and diluted and the solution is aspirated into the plasma generated by inductively coupled plasma source. The atomized elements produce characteristic emission spectral lines, which are separated by a simultaneous optical spectrometer. The concentration of the elements in the solution is derived from the calibration curve of each element.

Summary of method

An amounts of urine samples are diluted with ultra-pure deionized water and treated with acids to destroy the organic matter and solubilized the recoverable elements. The sample solution is aspirated through nebulizer and the resulting aerosol is transported to the plasma torch where excitation occurs. Element specific emission spectra are produced by radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and intensities of the line spectra are monitored at specific wavelengths by a charged coupled detector. A fitted background correction is used to correct the blank signal and matrix effect. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result.

Safety and Warning

- Laboratory is a high-risk area; proper care shall be taken while handling the chemicals, reagents etc. Each chemical shall be regarded as a potential health hazard and exposure to these compounds should be as low as reasonably achievable. Use proper protective equipment.
- Always wear laboratory coat, safety glasses for eye protection and acid protecting face mask.

- Use chemical resistant gloves when handling concentrated acids and standards.
- The addition of acids in the standards and the samples must be done in fume hood.
- Avoid ICP-Plasma radiation by wearing safety goggles.
- Never touch the areas with highly electrical charge components that exist in the instrument which are not intended for access by the instrument operator.

Reagents and Materials

- All acids used in the preparation of standards and samples must be high purity grade.
- Concentrated nitric acid.
- Deionized water: Millipore integral 5 or equiv.
- Argon gas (99.999 purity or more)
- Volumetric pipettes (1.0 ml) calibrated.
- Volumetric Tubes (50 ml).
- Standard solutions (1000 mg/l): K and Na. (Merck)
- Mixed calibration checks standard solution, 100 mg/l (Romil).

Experiment

Instrumentation:

Varian ICP-OES model 710-ES simultaneous axially viewed plasma with full PC control of instrument settings and compatible accessories was used for the analysis. They feature an innovative megapixel detector designed especially for ICP-OES and provide complete wavelength coverage from 177-785 nm.

ICP-OES Instrument Operating Parameters:

Conditions

Power - 1.1 KW

Plasma gas flow - 15 L /min

Auxiliary gas flow - 1.5 L/min

Spray chamber type - Glass cyclonic (single pass)

Nebulizer Flow - 0.75 L/min

Nebulizer type - OneNeb

Pump rate - 15 rpm

Sample Uptake delay - 30 sec.

Replicate read time (S) - 10 sec.

Number of replicate - 3

Rinse Time - 10 sec.

Instrument stabilization delay - 15 sec.

Quality Control

Preparation of calibration standards: (*Linearity*) stock 1000 mg/l standard solution (*Merck Brand*):

- Mixed standards stock Solution (**50 µg/ml**): Pipette 25 ml each from 1000µg/ml individual standard solution into a 500 ml volumetric flask and make up to volume with 1% nitric acid solution. Transfer the solution in to a screw capped plastic bottle and store in a refrigerator. The solution is stable for 6 months.
- Mixed standard Intermediate Solution-1 (**10 µg/ml**): Pipette 20.0 ml from 50µg/ml stock solution into a 100 ml volumetric flask and make up to volume with 1% nitric acid solution. Transfer the solution in to a screw capped plastic bottle and store in a refrigerator. The solution is stable for 6 months.
- Mixed standard Intermediate Solution-2 (**1.0 µg/ml**): Pipette 10.0 ml from 10µg/ml stock solution into a 100 ml volumetric flask and make up to volume with 1% nitric acid solution. Transfer the solution in to a screw capped plastic bottle and store in a refrigerator. The solution is stable for 1 month.
- Mixed standard Intermediate Solution-2 (**0.1 µg/ml**): Pipette 10.0 ml from 1µg/ml stock solution into a 100 ml volumetric flask and make up to volume with 1% nitric acid solution. Prepare fresh prior to use.
- Prepare the calibration standard solutions in 1% nitric acid as shown in the table below. Transfer the mixed standard solutions into a screw capped plastic container and store in a refrigerator at 2 - 8 °C. For some trace elements linearity range is less than 50 (µg/ml), the analysis of samples shall be carried out within the linear range for such elements.

Std. No.	Conc. of Std. (µg/ml)	Volume taken (ml)	Volume made up (ml)	Conc. of calibration Std. (µg/ml)	Shelf life of Standard (Months)
5	50	-	-	50	6
4	50	20	100	10	6
3	10	10	100	1.0	1
2	1.0	10	100	0.10	Prepare fresh
1	0.10	10	100	0.01 (optional)	Prepare fresh

Preparation of calibration check standard: (*Linearity check*) stock 100 mg/ml mixed check standard solution (*Romil Brand*)

- Calibration check standards shall be prepared by an independent analyst.
- Mixed calibration checks standard solution (**5 mg/l**): Pipette 5.0 ml from 100µg/ml calibration check standard solution into a 100 ml volumetric flask and make up to volume with 1% nitric acid solution
- Transfer the solution in to a screw capped plastic bottle and store in a refrigerator. The solution is stable for 3 months.

Preparation of Blanks:

- **The calibration blank (CB):** CB is prepared by diluting 1 ml of concentrated nitric acid in 100 ml deionized water. Prepare sufficient quantity to be used to flush the system between standards and samples.
- **The reagent blank (RB):** RB shall contain the same volumes of all reagents used in the processing of the samples. The reagent blank shall be carried through complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis.

Sample Preparation: (Sample dilution)

For high concentration levels of matrix elements, another way to overcome the matrix problem is by simple dilution of the sample. The dilution is a simple and cheap method of sample preparation, but every sample needs to be diluted, and each determined element requires its own calibration set. Overcoming the matrix effect is very easy in the case of the main elements like Sodium and Potassium, because they are present at high concentration levels in urine samples. **Fifty-fold urine** dilution is a simple way to overcome the matrix problem, if determination of matrix elements only is required.

Note: This developed method was used as a significant part of the automated complex method of urine analysis. However, for trace element determination with low concentration, sample dilution is not suitable.

Construction of calibration curves:

- A suitable program was built using ICP Expert software selecting the analyte elements with respective wavelengths, sensitivities, interferences and linear regression equation.
- Aspirate the prepared mixed calibration standard solutions (Merck) to construct calibration curves for each element.
- Aspirate deionized water to remove the memory effects.

Checking calibration curves with calibration mixed standards

- Aspirate calibration check standard solution (Romil) and record the value. The calibration check standards shall read 5.0 ± 0.1 ug/mL. In case of any deviation, construct the calibration curve again. If the deviation persists, construct a new calibration curve with freshly prepared standards.

Analysis of samples

- Aspirate prepared sample solutions and determine the concentration from the calibration curve.

Quality Assurance

Precautions and controls:

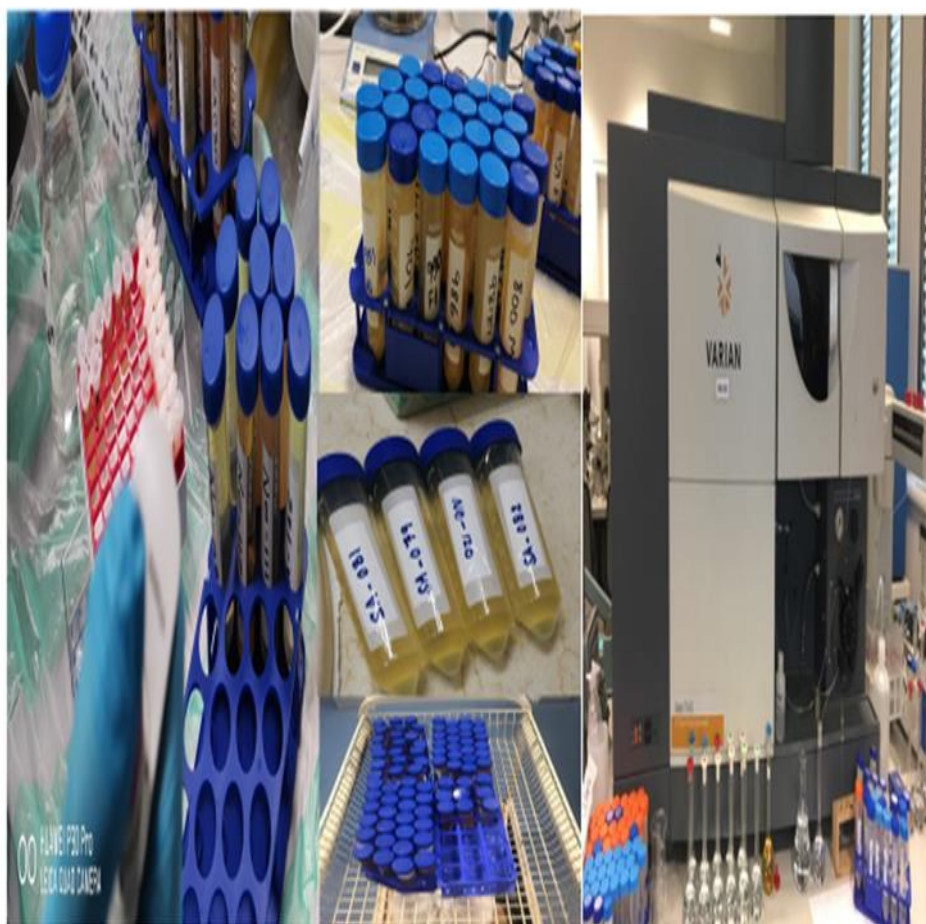
- Glassware shall be thoroughly cleaned, rinsed with water, 1% nitric acid and deionized water prior to use.

- Standards and sample may easily get contaminated. Proper care shall be taken during their preparation and storage.
- Samples containing high dissolved solids may have different viscosity than that of standards and have a different nebulization rate which affects the results. In such cases, the samples shall be diluted.

References:

- Agilent Technologies, ICP-OES application Notes on Determination of trace and major elements in urine and seawater.
- Journal of Analytical Atomic Spectrometry, Determination of sodium, potassium, magnesium and calcium in urine by inductively coupled plasma atomic emission spectrometry. The study of matrix effect.

3- Handling urine samples for ICP- measurements



Appendix 11: UAEU response to COVID-19

Available at <https://www.uaeu.ac.ae/en/news/2020/april/uaeu-emergency-responses-to-covid-19-pandemic.shtml>



FALL 2020 REOPENING PLANS

Appendix 12: FAGHR Guidelines for office and workplace environment during emergency conditions

Available at <https://www.fahr.gov.ae/Portal/Userfiles/Assets/Documents/5a449ee9.PDF>

الهيئة الاتحادية للموارد البشرية الحكومية
Federal Authority For Government Human Resources



The Guidelines for Office and Workplace Environment during Emergency Conditions

www.fahr.gov.ae

هيئة اتحادية | Federal Authority



Appendix 13: Oxford Brookes University conditional ethical approval notification



Dr Sangeetha Thondre
Director of Studies
Faculty of Health & Life Sciences
Oxford Brookes University

21st October 2019

Dear Dr Thondre,

UREC Registration No: 191337

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

Thank you for your email of 10th October 2019 outlining your response to the points raised in my previous conditional approval letter about the PhD study of your research student, Amjad Jarrar, and attaching the revised documents. I am pleased to inform you that, on this basis, UREC is happy to grant full approval for this study.

The UREC approval period for the data collection phase of the study is two years from the date of this letter, so until 21st October 2021. If you need the approval to be extended please do contact me nearer the time of expiry.

Should the recruitment, methodology or data storage change from your original plans, or should any study participants experience adverse physical, psychological, social, legal or economic effects from the research, please inform me with full details as soon as possible.

Yours sincerely

A handwritten signature in blue ink, appearing to read "S Quinton", with a long horizontal flourish extending to the right.

Dr Sarah Quinton
Chair of the University Research Ethics Committee

cc Dr Ayesha Al Dhaheri, Supervisor
Dr Leila Cheikh Ismail, Supervisor
Amjad Jarrar, Research Student
Dr Adam Bibbey, Research Ethics Officer
Jill Organ, Research Degrees Team

Appendix 14: Oxford Brooks University amendment to ethical approval application



Dr Sangeetha Thondre
Director of Studies
Faculty of Health & Life Sciences
Oxford Brookes University

8th October 2020

Dear Dr Thondre,

UREC Registration No: 191337
Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

Thank you for your email of 6th October 2020 requesting an amendment to the original study of your research student, Amjad Jarrar approved by UREC on 21st October 2019, as a result of the current Covid-19 pandemic.

You have requested approval for replacing face-to-face interviews for the intervention group with interviews via telephone, online Zoom meeting or Microsoft team meetings and emailing the questionnaire. Additionally you have adapted the study to incorporate safety measures such as social distancing and the use of personal protection equipment, along with updating the exclusion criteria to include Covid-19 symptoms. On the basis that there are no other changes to the study Chair's approval is granted and remains valid until 21st October 2021.

Should the recruitment, methodology or data storage change from your original plans, or should any study participants experience adverse physical, psychological, social, legal or economic effects from the research, please inform me with full details as soon as possible.

I wish you continued success with your research.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "SQ", with a long horizontal flourish extending to the right.

Dr Sarah Quinton
Chair of the University Research Ethics Committee

cc Dr Ayesha Al Dhaheri, Supervisor
Dr Leila Cheikh Ismail, Supervisor
Amjad Jarrar, Research Student
Dr Adam Bibbey, Research Ethics Officer
Jill Organ, Research Degrees Team

Appendix 15: Consent Form Study 3



CONSENT FORM

UREC Registration No: 191337

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in sample of UAE population

Mr. Amjad Jarrar (Student MPhil/PhD), Department of Sport, Health Sciences & Social Work, Oxford Brookes University

Tel: 00971 553710322

Email: amjadj@uaeu.ac.ae / 16111505@brookes.ac.uk

Dr P. Sangeetha Thondre (Director of Study); Research/ Lead, Oxford Brookes Centre for Nutrition and Health (OxBCNH), Department of Sport, Health Sciences and Social Work, Oxford Brookes University

Tel: +44 (0)1865 483988

E-mail: pthondre@brookes.ac.uk

Dr Ayesha Al Dhaheri (Project Co-Supervisor), Department of Nutrition and Health, College of Food and Agriculture, UAE University.

Tel: 009713 7134539

Email: ayesha_aldhaheri@uaeu.ac.ae

Dr Leila Cheik Ismail (Project Co-Supervisor), Clinical Nutrition and Dietetics Department, College of Health Sciences, University of Sharjah, UAE.

Tel. 00971561914363

Email: lcheikhismail@sharjah.ac.ae

**Please
initial box**

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

☐

3. I agree to take part in the above study.

☐

4. I agree to provide a 24-hour urine sample

☐

Name of Participant

Signature Date

Name of Researcher

Signature Date

Appendix 16: Food frequency questionnaire

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

Food Frequency Questionnaire

	Food items	Estimated portion size	Estimate weight (g)	Never	Not everyday		Everyday		
					1-3 times per week	4-6 times per week	1 time a day	2 times a day	+3 times a day
Bread, cereals/products									
1	Pita bread (Arabic bread)	Small	60						
		Medium	90						
		Large	150						
2	Iranian bread	large	240						
3	Samoon (rolls) bread	1 slice	86						
4	Regag bread	1 large	35						
5	Manakish-Zaatar	1 piece	61						
6	Manakish-Cheese	1 piece	81.6						
7	Toasted bread	1 slice	17						
8	Pizza with cheese/meat/veg	1 slice	79						
9	Pasta with cheese	1 cup	188g						
10	Indomi noddle’s	1 Paquet	40						
11	Cereals (e.g. corn flakes)	1 cup	28						
12	Basmati rice	1 cup	158						
13	Egyptian rice	1 cup	205						

<u>Fruits/products</u>									
<u>14</u>	<u>Fresh fruits / fresh juices</u>	<u>1 cup</u>	<u>248</u>						
<u>15</u>	<u>Fruits, dried</u>	<u>1 oz</u>	<u>28.35</u>						
<u>16</u>	<u>Canned fruits</u>	<u>1 cup</u>	<u>245</u>						
<u>Vegetables</u>									
<u>17</u>	<u>Fresh vegetables</u>	<u>1 cup</u>	<u>103</u>						
<u>18</u>	<u>Frozen vegetables</u>	<u>1 cup</u>	<u>225</u>						
<u>19</u>	<u>Canned vegetables</u>	<u>1 cup</u>	<u>182</u>						
<u>20</u>	<u>Vegetable-juices</u>	<u>1 cup</u>	<u>253</u>						
<u>Cheese, Dairy products</u>									
<u>21</u>	<u>Cheddar cheese</u>	<u>1 piece/ 1 oz</u>	<u>28</u>						
<u>22</u>	<u>Halloumi cheese</u>	<u>1 slice</u>	<u>33</u>						
<u>23</u>	<u>Cream cheese</u>	<u>1 tablespoon</u>	<u>14</u>						
<u>24</u>	<u>Feta cheese</u>	<u>1 oz</u>	<u>28</u>						
<u>25</u>	<u>Labnah</u>	<u>2 tablespoons</u>	<u>30</u>						
<u>26</u>	<u>Butter milk</u>	<u>1 cup</u>	<u>240</u>						
<u>27</u>	<u>Milk, yoghurt</u>	<u>1 cup/ 8 fl oz</u>	<u>245</u>						
<u>Meat, Meat products</u>									
<u>28</u>	<u>Red meat</u>	<u>3 oz</u>	<u>85</u>						
<u>29</u>	<u>Poultry</u>	<u>3 oz/ Chicken breast (boneless, skinless)</u>	<u>85</u>						
<u>30</u>	<u>Hot dog/ sausage chicken</u>	<u>1 frankfurter</u>	<u>45</u>						
<u>31</u>	<u>Hot dog/ sausage beef</u>	<u>1 frankfurter</u>	<u>52</u>						
<u>32</u>	<u>Mortadella</u>	<u>2 slices</u>	<u>30</u>						
<u>33</u>	<u>Fast food meals (KFC/ McDonalds/ Hardees/etc.)</u>	<u>1 hamburger</u>	<u>105</u>						
<u>Miscellaneous</u>									

<u>34</u>	<u>Salad dressing oil</u>	<u>1 tablespoon</u>	<u>15</u>						
<u>35</u>	<u>Olive oil</u>	<u>1 teaspoon</u>	<u>4.5</u>						
<u>36</u>	<u>Ketchup</u>	<u>1 teaspoon</u>	<u>5</u>						
<u>37</u>	<u>Tomato paste</u>	<u>1 tablespoon</u>	<u>16</u>						
<u>38</u>	<u>Pickles</u>	<u>1 medium</u>	<u>65</u>						
<u>39</u>	<u>French fries-homemade</u>	<u>10 strips</u>	<u>50</u>						
<u>40</u>	<u>French fries (Burger king/McDonalds/Hardees)</u>	<u>Medium size</u>	<u>117</u>						
<u>41</u>	<u>Maggi chicken cubes (low salt)</u>	<u>(Diluted)1/4 cube</u>	<u>1/4g</u>						
<u>42</u>	<u>Maggi chicken cubes (Regular)</u>	<u>(Diluted)1/4 cube</u>	<u>1/4g</u>						
<u>43</u>	<u>Salt</u>	<u>1 teaspoon</u>	<u>6</u>						
<u>44</u>	<u>Spices, Herbs (not salt)</u>	<u>1 teaspoon</u>	<u>1.3</u>						
<u>45</u>	<u>Lemons</u>	<u>1 medium</u>	<u>84g</u>						
<u>46</u>	<u>Filtered water</u>	<u>1 cup</u>	<u>250</u>						
<u>47</u>	<u>Salted nuts</u>	<u>1 oz</u>	<u>28</u>						
<u>48</u>	<u>Unsalted nuts</u>	<u>1 oz</u>	<u>28</u>						
<u>49</u>	<u>Chips</u>	<u>1 pack</u>	<u>28</u>						

Appendix 17: Educational Materials

 **UAEU** كلية الطب والعلوم الصحية
College of Medicine and Health Science

**OXFORD
BROOKES
UNIVERSITY**

For first 7-days (message send every 3-days)
0-7 Days



What is Sodium & Where can it be found?

The main source of sodium in our diet is salt, of which one teaspoon of salt provides 2000 mg of sodium.



Sodium is a mineral that can be found naturally in food or is added during manufacturing.

World Health Organization suggests that reducing sodium intake to less than 2300 mg/day (equivalent to one teaspoon of salt/day) will reduce the risk of diseases.



What are the functions of Sodium and the effect of high intake?

Functions of Sodium

	Key for water balance	Conduct nerve impulses	
	Participate in nutrient absorption	Participate in muscle contraction	
	Affect heart health and blood pressure		

Effects of high intake of Sodium

	High blood pressure	Edema and fluid retention	
	Kidney stones & kidney disease	Heart disease, heart failure, & stroke	



Sources of Sodium in food

	Salt 1 Teaspoon contains: 2000 mg		Ketchup 1 Tablespoon contains: 160 mg		Cheddar cheese 1 Tablespoon contains: 50 mg
	Egg 1 Large contains: 62 mg		Meat 3 Ounces contains: 50 mg		Chicken ½ Breast contains: 70 mg
	Rice 1 Cup contains: 0 -1 mg		Cereal 1 Cup contains: 204 mg		Apple & Banana 1 Medium contains: 0 – 1
	Processed meat 1 Slice contains: 370 – 1580 mg		Instant noodles 1 Pack contains: Up to 890 mg		Arabic bread 1 Large contains: 500 - 1000 mg
	Milk 1 Cup contains: 120 mg		Soup 1 Cup contains: 700 – 1260 mg		Pickles 1 Spear contains: 326 mg
	Soda 1 Cup contains: 10 – 35 mg		Potato chips 1 Regular bag contains: About 270 mg		Stock cubes 1 Cube contain: 600 mg
					

Salt content in food products

Low Salt



Eggs



Fresh fruits



Fresh vegetables



Unsalted nuts

High Salt



Cheeses



Chicken broth cubes



Chips



Mayonnaise



Canned food



Breads



Canned Tuna



Soup packets



Corn flakes



"جامعة المستقبل"
"The University of the Future"

Monosodium glutamate (MSG)

Monosodium glutamate is a flavor enhancer in food, and it occurs naturally in certain foods, including tomatoes and cheeses.

One teaspoon of monosodium glutamate contains 600 mg of sodium.

Food that commonly contain MSG:



Processed meats



Fast food



Soups



Chips & snack



Seasoning blends



Condiments



Instant noodle



Frozen meals



"جامعة المستقبل"
"The University of the Future"

Myth & facts about salt



• Myth: No salt in sodium-free or salt-free products

Fact: According to federal guidelines, products are labeled as sodium-free or salt-free contains less than 5 mg of sodium.



• Myth: Himalayan salt is better than regular table salt

Fact: Compared with regular table salt, Himalayan salt almost the same amount of sodium with a ratio of 1:1. While it has 5 times more potassium than table salt. However, Himalayan salt cannot be considered as the major source of potassium.



• Myth: Sodium intake is low if you don't salt your food

Fact: Even without adding salt to the food, up to 80% of the salt is already consumed in everyday food such as bread, cheese, and sauces.



• Myth: Food is salty because it tastes salty

Fact: Food such as breakfast cereals, bread, biscuits, and cakes contains high salt content. Such food have other ingredients that balance the saltiness, so the salt is effectively hidden and cannot be tasted.



For first 7-days (message send every 3-days)

8- 14 Days



Tips to reduce Sodium intake (1) At the Grocery Store



Tip 1



Choose **fresh** meats instead of processed meats

Tip 2



Choose **fresh** fruit and vegetables instead of canned and frozen

Tip 3

المعلومات الغذائية	
حجم الحصة كوب واحد (228 جم)	
المحتوى في الحصة الواحدة	
السمات	سمات الدهون
110	250
المحتوى في الحصة الواحدة	
12 جم	الدهون الكلية
3 جم	الدهون المشبعة
3 جم	الدهون المتحولة
10 ملجم	الصوديوم
470 ملجم	السكر
10 جم	البروتينات الكلية

Read food labels especially for Sodium

Tip 4

Nutrition Facts	
Serving size 1 cup (228g)	
Calories 160	
% Daily Value	% Daily Value
Total Fat 12g	Total Fat 12g
Sodium 10mg	Sodium 10mg
Sugar 470mg	Sugar 470mg
Protein 10g	Protein 10g

Compare many brands of the same food item and select the lowest sodium item

Tip 5



Choose food labeled " **low sodium**, **reduced sodium**, **no salt** " if available



Tips to reduce Sodium intake (1) At Home



Tip 1



Eat more **fresh** fruits and vegetables

Tip 2

Reduce salt as possible during cooking

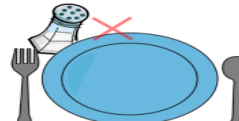


Tip 3



Rinse canned food containing Sodium before using it

Tip 4



Remove salt mill from the dining table

Tip 5



Reduce portion size; less food means less sodium

Tip 6



Replace salt by other things: lemon, herbs, spices



"Jalimul Saifu"
"The University of the Future"

For first 7-days (message send every 3-days)

15- 21 Days



"Jalimul Saifu"
"The University of the Future"

Tips to reduce Sodium intake (1) When dinning out



Tip 1



Ask for nutrition information before you order if available and select a lower sodium meal.

Tip 2



Order vegetables and salads with no salt added

Tip 3



Share the meal with a friend or family member; less food means less sodium



How to read the Nutrition Facts label ?

1- Start with the Serving Size

- Look for both the **serving size** (the amount people typically eat at one time) and the **number of servings** in the package.
- Compare your **portion size** (the amount you actually eat) to the **serving size** on the panel

2- Check the Total Calories

- Check how many **calories** are in one serving

3- Check the Percent Daily Values

- Let the **Percent Daily Values** be your guide while you are choosing the product

Nutrition Facts	
4 servings per container	
Serving size 1 1/2 cup (208g)	
Amount per serving	
Calories	240
% Daily Value*	
Total Fat 4g	5%
Saturated Fat 1.5g	8%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 430mg	19%
Total Carbohydrate 46g	17%
Dietary Fiber 7g	25%
Total Sugars 4g	
Includes 2g Added Sugars	4%
Protein 11g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 6mg	35%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



What are the Percentage Daily Values (%DV)?

- Percent DV is to help evaluate how a particular food fits into your diet.
- Percent DV are **for the entire day**, not just one meal or snack.
- 5% or less consider low** and it is the aim for Saturated fat, Trans fat, Cholesterol and Sodium.
- 20% or more consider high** and it is the aim for Potassium, Vitamins, Minerals and Fiber.

Nutrition Facts	
4 servings per container	
Serving size 1 1/2 cup (208g)	
Amount per serving	
Calories	240
	% Daily Value*
Total Fat 4g	5%
Saturated Fat 1.5g	8%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 430mg	19%
Total Carbohydrate 46g	17%
Dietary Fiber 7g	25%
Total Sugars 4g	
Includes 2g Added Sugars	4%
Protein 11g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 6mg	35%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



For first 7-days (message send every 3-days)

22- 28 Days



High Sodium content in some of the food products



Nutrition Table		
Serving size: 100g (Chicken Stock)		
	Per 100g	%DV*
Calories	298	-
Fat (g)	21.8	1
of which saturated fat (g)	14.6	3
Cholesterol (mg)	2.9	0
Sodium (g)	19.1	25
Carbohydrates (g)	13.0	0
Dietary Fiber (g)	7.2	0
Total Sugar (g)	8.2	0
Added Sugar (g)	7.4	0
Protein (g)	5.0	0

19.1 g | 25%

Nutrition Table		
Serving size: 100g (Chicken Stock)		
	Per 100g	%DV*
Energy (kcal)	334	11
Protein (g)	5.5	0.2
Carbohydrates (g)	22.3	0.7
of which sugars (g)	9.2	0.3
Fat (g)	24.7	0.8
of which saturated fat (g)	16.8	0.5
Sodium (g)	12.2	0.48

12.2 g | 17%

Nutrition Table		
Serving size: 100g (Vegetable Stock)		
	Per 100g	%DV*
Calories	298	-
Fat (g)	22.3	1
of which saturated fat (g)	12.9	3
Cholesterol (mg)	0	0
Sodium (g)	20	28
Carbohydrates (g)	17	0
Dietary Fiber (g)	3.0	0
Total Sugar (g)	11.8	1
Added Sugar (g)	11.8	1
Protein (g)	6.5	0

20 g | 28%

Use the DV% to determine if a serving of food is high or low in sodium. **5% DV or less** of sodium per serving is considered **low**, and **20% DV or more** of sodium per serving is considered **high**.

High salt

Low sodium stock cubes has 36% less sodium than the chicken stock cubes, and 39% less than the vegetables stock cubes.



High Sodium content in some of the food products



الحقائق الغذائية	
Servings per container	1
Serving size	75 g
Amount per serving	
Calories	353
% Daily Value (DV)	% القيمة اليومية
Total Fat	18 g 36%
Saturated Fat	7 g 14%
Trans Fat	0 g 0%
Cholesterol	0 mg 0%
Total Carbohydrate	54 g 18%
Dietary Fiber	3 g 6%
Total Sugars	4 g 8%
Includes added sugars	0 g 0%
Protein	6 g 12%



معلومات الغذائية	
Serving per package : 1	الحصة لكل تغذية
Serving size : 75 g	حجم الحصة : 75 غرام
Amount per serving	كمية لكل وحدة
Energy (Kcal/Cal)	455 200
Total Fat (g)	18 18 13 13
Saturated Fat (g)	7 7 5 5
Trans Fat (g)	0 0 0 0
Protein (g)	10 10 8 8
Cholesterol (mg)	0 0 0 0
Total Carbohydrates (g)	64 64 48 48
Sugars (g)	4 4 3 3
Dietary Fiber (g)	4 4 3 3
Sodium (g)	1.7 1.7 1.3 1.3



الحقائق الغذائية	
Servings per container	1
Serving size	1 (85 g)
Amount per serving	
Calories	404
% Daily Value (DV)	% القيمة اليومية
Total Fat	12 g 24%
Saturated Fat	6 g 12%
Trans Fat	0 g 0%
Cholesterol	0 mg 0%
Total Carbohydrate	54 g 18%
Dietary Fiber	3 g 6%
Total Sugars	4 g 8%
Includes 3 g added sugars	0 g 0%
Protein	6 g 12%

High Sodium content in some of the food products



الحقائق الغذائية	
Servings per container	1
Serving size	1 (80 g)
Amount per serving	
Calories	365
% Daily Value (DV)	% القيمة اليومية
Total Fat	15 g 30%
Saturated Fat	7 g 14%
Trans Fat	0 g 0%
Cholesterol	0 mg 0%
Sodium	1130 mg 49%
Total Carbohydrate	43 g 16%
Dietary Fiber	2 g 8%
Total Sugars	3 g 6%
Includes 3 g added sugars	0 g 0%
Protein	6 g 12%



Nutrition Facts	
Valeur nutritive	
Per 1/2 package (37g) / Par 1/2 paquet (37g)	
Amount	% Daily Value
Calories	% Valeur Quotidienne
Calories 170	34%
Fat	5 g
Saturated	2.5 g 13%
Trans	0 g 0%
Cholesterol	0 mg 0%
Sodium	680 mg 28%
Carbohydrates	23 g 8%
Fiber	1 g 4%
Sugars	1 g
Protein	4 g
Vitamin A	4%
Vitamin C	0%
Calcium	0%
Iron	8%



معلومات الغذائية	
Serving per package : 1	الحصة لكل تغذية
Serving size : 80 g	حجم الحصة : 80 غرام
Amount per serving	كمية لكل وحدة
Energy (Kcal/Cal)	475 198
Total Fat (g)	21 21 17 17
Saturated Fat (g)	9 9 7 7
Trans Fat (g)	0 0 0 0
Protein (g)	10 10 8 8
Cholesterol (mg)	0 0 0 0
Total Carbohydrates (g)	62 62 49 49
Sugars (g)	8 8 6 6
Dietary Fiber (g)	4 4 3 3
Sodium (g)	1.0 1.0 0.8 0.8

For first 7-days (message send every 3-days)

29- 35 Days



Potassium

What is it ?

Mineral that found naturally in many plant-based food. We need more potassium than sodium each day.

Functions:

Similar functions as Sodium:

- Role in body water balance
- Role in muscle contraction
- Conduct nerve impulses
- Affect heart health and blood pressure



Sodium & Potassium

- High salt/ sodium intake increases blood pressure & risk of heart disease
- High potassium intake can help decrease blood pressure



How to increase Potassium intake?

1

Eat more fresh vegetables and fruits

2

Eat more nuts, seeds and legumes

3

Eat lean meat, poultry and fish

Potassium rich food:



For first 7-days (message send every 3-days)

36- 42 Days



Creative tips for cooking with low or no salt

Salad



- ✓ Fresh vegetables
- ✓ Fruits
- ✓ Dressing on the side



- ✓ Salty nuts
- ✓ Seeds
- ✓ Salt
- ✓ Dressings on salad

Biryani



- ✓ Fresh vegetables
- ✓ Chicken
- ✓ Spices



- ✓ Oil
- ✓ Salt



"The University of the Future"

Good matches instead of salt

Pizza



- ✓ Vegetables
- ✓ Fruits
- ✓ Oregano



- ✓ Extra cheese
- ✓ Pepperoni

Pasta



- ✓ Vegetables
- ✓ Chicken
- ✓ Tomato sauce



- ✓ Cheese
- ✓ Sausage

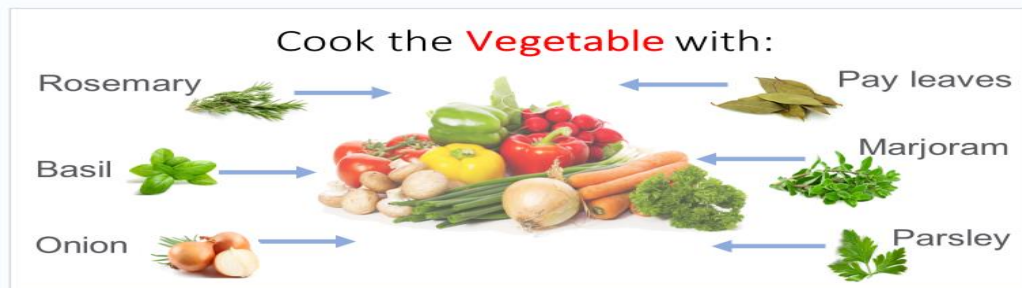


"The University of the Future"

Good matches instead of salt



Good matches instead of salt



Arabic version
For first 7-days (message send every 3-days)
0-7 Days
النسخة العربية





ما هو الصوديوم ؟
و أين يمكن أن يوجد ؟



المصدر الرئيسي للصوديوم في نظامنا الغذائي هو الملح ، حيث توفر ملعقة صغيرة من الملح 2000 مجم من الصوديوم.

الصوديوم معدن يمكن العثور عليه بشكل طبيعي في الطعام أو يتم إضافته أثناء التصنيع.

تشير منظمة الصحة العالمية أن تقليل تناول الصوديوم إلى أقل من 2300 مجم / يوم (ما يعادل ملعقة صغيرة من الملح / يوم) سيقلل من مخاطر الإصابة بالأمراض.



ما هي وظائف الصوديوم؟ وما هي الآثار الناتجة عن كثرة تناوله؟

وظائف الصوديوم

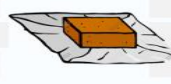
	توصيل التيارات العصبية	أساسي لتوازن السوائل في الجسم	
	يساهم في انقباض العضلات	يساهم في امتصاص المواد الغذائية	
		يؤثر على القلب وضغط الدم	

الآثار الناتجة عن كثرة تناوله

	احتباس السوائل	ارتفاع ضغط الدم	
	أمراض القلب، السكتة القلبية والجلطة الدماغية	حصى الكلى وأمراض الكلى	



مصادر الصوديوم في الطعام

	الملح 1 ملعقة صغيرة تحتوي على: 2000 mg		كاتشاب 1 ملعقة كبيرة تحتوي على: 160 mg		جبنة الشيدر 1 ملعقة كبيرة تحتوي على: 50 mg
	البيض 1 كبيرة يحتوي على: 62 mg		اللحم 3 أونصات يحتوي على: 50 mg		الدجاج 1/2 صدر يحتوي على: 70 mg
	الأرز 1 كوب يحتوي على: 0 - 1 mg		حبوب الإفطار 1 كوب يحتوي على: 204 mg		الموز والتفاح 1 متوسط يحتوي على: 0 - 1
	اللحوم المصنعة 1 شريحة يحتوي على: 370 - 1580 mg		الشعيرية سريعة التحضير 1 علبة يحتوي على: Up to 890 mg		الخبز العربي رغيف كبير يحتوي على: 500- 1000 mg
	الحليب 1 كوب يحتوي على: 120 mg		الشورية 1 كوب يحتوي على: 700 - 1260 mg		المخلل 1 قطعة يحتوي على: 326 mg
	الصودا 1 كوب يحتوي على: 10 - 35 mg		الشيبيس 1 كيس يحتوي على: 270 mg حوالي		مكعبات المرققة 1 مكعب يحتوي على: 600 mg

كمية الصوديوم في بعض المنتجات الغذائية



المكسرات الغير مملحة



الخضروات الطازجة



الفواكة الطازجة



البيض

قليلة
الملوحة



الأطعمة المعلبة



المايونيز



الشيبس



مكعبات الدجاج



الأجبان



رقائق الذرة



الشوربات المعلبة



التونة المعلبة



الخبز

عالية
الملوحة



الغلوتامات أحادية الصوديوم (MSG)

الغلوتامات أحادية الصوديوم هي مُحسِّن للنكهة في الطعام ، وتوجد بشكل طبيعي في بعض الأطعمة ، بما في ذلك الطماطم والجبن.

تحتوي معلقة صغيرة من الغلوتامات أحادية الصوديوم على 600 مجم من الصوديوم.

الأطعمة الذي تحتوي بالعادة على مادة MSG:



اللحوم المصنعة



الوجبات السريعة



الشوربة



الوجبات الخفيفة



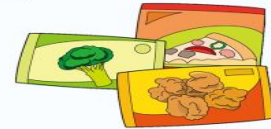
خلطات البهارات



التوابل والصلصات



المعكرونة الفورية



اللحوم المجمدة



خرافات وحقائق عن الملح



• **خرافة:** لا يوجد ملح في المنتجات الخالية من الصوديوم أو الخالية من الملح
الحقيقة: وفقًا للإرشادات الفيدرالية ، تم تصنيف المنتجات على أنها خالية من الصوديوم أو خالية من الملح تحتوي على أقل من 5 ملغ من الصوديوم.



• **خرافة:** ملح الهيمالايا أفضل من ملح الطعام العادي
الحقيقة: بالمقارنة مع ملح الطعام العادي ، فإن لمالح الهيمالايا تقريبًا نفس كمية الصوديوم الموجودة في ملح الطعام العادي بنسبة 1:1 ، بينما يحتوي على 5 أضعاف البوتاسيوم من ملح الطعام. ومع ذلك ، لا يمكن اعتبار ملح الهيمالايا المصدر الرئيسي للبوتاسيوم.



• **خرافة:** يكون تناول الصوديوم منخفضًا إذا لم تقم بالملح في طعامك
الحقيقة: حتى بدون إضافة الملح إلى الطعام ، تصل نسبة استهلاك الملح لـ 80٪ حيث يتم استهلاكه بالفعل في الأطعمة اليومية مثل الخبز والجبن والصلصات.



• **خرافة:** الطعام مالح لأن طعمه مالح
حقيقة: تحتوي أطعمة مثل حبوب الإفطار والخبز والبسكويت والكعك على نسبة عالية من الملح. حيث تحتوي مثل هذا الأطعمة على مكونات أخرى توازن الملوحة ، لذلك يتم إخفاء الملح بشكل فعال بحيث لا يمكن تذوقه.



For first 7-days (message send every 3-days)

8- 14 Days



نصائح لتقليل تناول الصوديوم (1) في محل البقالة



نصيحة 2



اختر الفواكه والخضروات الطازجة
بدلاً من المعلبة والمجمدة

نصيحة 1



اختر اللحوم الطازجة بدلاً من اللحوم المصنعة

نصيحة 4

Nutrition Facts	Nutrition Facts
Calories 160	Calories 160
% Daily Value*	% Daily Value*
Total Sodium 250mg	Total Sodium 250mg
50%	50%

قارن بين العديد من العلامات التجارية لنفس العنصر
الغذائي وحدد عنصر الصوديوم الأقل

نصيحة 3

المعلومات الغذائية
حجم الحصة كوب واحد (228 جم)
المحتوى في الحصة الواحدة
السعرات 260 - 110 سعرات الدهون
المحتوى اليومي %
الدهون الكلية 12 جم
الدهون المشبعة 3 جم
الدهون المتحولة 3 جم
الكوليسترول 40 ملجم
الصوديوم 470 ملجم
البروتينات الكلية 31 جم

اقرأ ملصقات الطعام الخاصة بالصوديوم

نصيحة 5

اختر طعاماً مكتوباً عليه "منخفض الصوديوم ، منخفض
الملح ، بدون ملح" إذا كان متاحاً



نصائح لتقليل تناول الصوديوم (2)

في المنزل



نصيحة 2



قلل الملح قدر الإمكان
أثناء الطهي

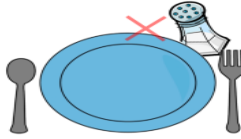
نصيحة 1

تناول الكثير من
الفواكه والخضروات
الطازجة



نصيحة 4

قم بإزالة المملحة
من طاولة الطعام



نصيحة 3

اغسل المعلبات التي
تحتوي على الصوديوم
قبل استخدامها



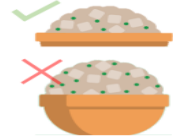
نصيحة 6

استبدل الملح بأشياء
أخرى: ليمون ،
أعشاب ، بهارات



نصيحة 5

قلل من حجم حصة
الطعام. طعام أقل يعني
صوديوم أقل



"جامعة المستقبل"
"The University of the Future"

For first 7-days (message send every 3-days)

15- 21 Days

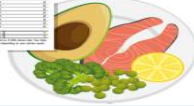


"جامعة المستقبل"
"The University of the Future"

نصائح لتقليل تناول الصوديوم (3) عند تناول الطعام في الخارج



نصيحة 1



اسأل عن المعلومات الغذائية قبل الطلب ، إذا كانت متوفرة ، واختر الوجبة منخفضة الصوديوم.

نصيحة 2



اطلب الخضار والسلطات بدون ملح مضاف

نصيحة 3



شارك الوجبة مع صديق أو أحد أفراد الأسرة ، فكلما قل الطعام يعني صوديوم أقل



كيف تقرأ ملصق الحقائق الغذائية؟

1- ابدأ بحجم الحصة

- ابحث عن حجم الحصة (serving size) (الكمية التي يأكلها الناس عادة في وقت واحد) وعدد الحصص (number of serving) في العبوة.
- قارن حجم حصتك (الكمية التي تتناولها فعليا) بحجم الحصة على الملصق

2- تحقق من إجمالي السعرات الحرارية

- تحقق من عدد السعرات الحرارية في الحصة الواحدة

3- تحقق من النسبة المئوية للقيم اليومية

- اجعل النسبة المئوية للقيم اليومية دليلك أثناء اختيارك للمنتج

قائمة الحقائق الغذائية		
حجم الحصة الواحدة: إصبع واحد (55غ) عدد الحصص في العبوة: 2		
الكمية للحصة الواحدة		
السعرات الحرارية 250		
110	السعرات القادمة من الدهون	18%
12 غم	الدهون الكلية	15%
3 غم	دهون مشبعة	10%
30 ملغم	كوليسترول	20%
470 ملغم	صوديوم	10%
31 غم	كربوهيدرات (نشويات)	0%
5 غم	سكر	0%
0 غم	ألياف غذائية	4%
5 غم	بروتين	2%
1	فيتامين	20%
3	فيتامين	4%
كالمسيوم		
حديد		
تستند نسب القيم اليومية إلى غذاء يعطي 2000 سعرة حرارية. قد تكون القيم اليومية المربعية الخاصة بك أقل أو أكثر طبقاً لإحتياجاتك من الطاقة.		
2,500	السعرات الحرارية	2,000
80 غم	الدهون الكلية	65 غم
25 غم	الدهون المشبعة	20 غم
300 ملغم	الكوليسترول	300 ملغم
2400 ملغم	الصوديوم	2400 ملغم
375 غم	الكربوهيدرات الكلية	300 غم
30 غم	الألياف الغذائية	25 غم



كيف تستفيد من الأرقام في قائمة الحقائق الغذائية (% DV)؟

قائمة الحقائق الغذائية		
حجم الحصة الواحدة: إصبع واحد (55غ) عدد الحصص في العبوة: 4		
الكمية للحصة الواحدة	السعرات الحرارية 250	
السعرات القادمة من الدهون 110		
18%	الدهون الكلية 12 غم	
15%	دهون مشبعة 3 غم	
10%	كوليسترول 30 ملغم	
20%	صوديوم 470 ملغم	
10%	كربوهيدرات (نشويات) 31 غم	
	سكر 5 غم	
0%	ألياف غذائية 0 غم	
	بروتين 5 غم	
4%	فيتامين 1	
2%	فيتامين 2	
20%	كالسيوم	
4%	حديد	

تستند نسب القيم اليومية إلى غذاء يعطي 2000 سعرة حرارية. قد تكون القيم اليومية المرجعية الخاصة بك أقل أو أكثر قليلاً لاحتياجاتك من الطاقة.

السعرات الحرارية	2,500	2,000
الدهون الكلية	أقل من 65 غم	أقل من 80 غم
الدهون المشبعة	أقل من 20 غم	أقل من 25 غم
الكوليسترول	أقل من 300 ملغم	أقل من 300 ملغم
الصوديوم	أقل من 2,400 ملغم	أقل من 2,400 ملغم
الكربوهيدرات الكلية	أقل من 300 غم	أقل من 375 غم
الألياف الغذائية	أقل من 25 غم	أقل من 30 غم

• تهدف النسبة المئوية DV للمساعدة في تقييم مدى ملاءمة طعام معين لنظامك الغذائي.

• نسبة DV مخصصة ليوم كامل، وليست فقط لوجبة واحدة أو وجبة خفيفة.

• تعتبر نسبة 5٪ أو أقل من القيمة اليومية منخفضة، وهذا هو الهدف من الدهون المشبعة والدهون المتحولة والكوليسترول والصوديوم.

• نسبة 20٪ أو أكثر تعتبر عالية، وهي الهدف اليومي للبوتاسيوم والفيتامينات والمعادن والألياف.



For first 7-days (message send every 3-days)

22- 28 Days



كميات الصوديوم العالية الموجودة في بعض المنتجات الغذائية



Nutrition Table		
Serving size: 107g Chicken Stock		
	Per 100g	%DV*
Calories	269	-
Fat (g)	21.6	1
of which saturated fat	14.4	3
Cholesterol (mg)	2.9	0
Sodium (g)	19.1	25
Carbohydrates (g)	13.0	0
Branched Chain Amino Acids (g)	7.2	1
Total Sugar (g)	8.2	-
Added Sugar (g)	7.4	0
Protein (g)	5.0	0

19.1 g | 25%

Nutrition Table			
Serving size: 107g Chicken Stock			
	Per 100g	Average per serving (107 ml)	%GDA*
Energy (kcal)	334	11	1
Protein (g)	5.5	0.2	0
Carbohydrates (g)	22.3	0.7	0
of which sugars (g)	9.2	0.3	0
Fat (g)	24.7	0.8	1
of which saturated fat (g)	16.8	0.6	3
Sodium (g)	12.2	0.40	17

12.2 g | 17%

Nutrition Table		
Serving size: 107g Vegetable Stock		
	Per 100g	%DV*
Calories	298	-
Fat (g)	22.3	1
of which saturated fat	12.9	3
Cholesterol (mg)	0.1	-
Sodium (g)	20	28
Carbohydrates (g)	17	0
Branched Chain Amino Acids (g)	3.9	0
Total Sugar (g)	11.8	-
Added Sugar (g)	11.8	1
Protein (g)	6.5	0

20 g | 28%

استخدم نسبة %DV لتحديد ما إذا كانت حصة الطعام عالية أو منخفضة في الصوديوم. تعتبر 5% DV أو أقل من الصوديوم منخفضة، بينما 20% DV أو أكثر من الصوديوم لكل حصة تعتبر مرتفعة.

عالية الملوحة

تحتوي مكعبات مرق الدجاج منخفضة الصوديوم على 36% أقل من الصوديوم مقارنة بمكعبات مرق الدجاج العادي، و 39% أقل من مكعبات مرق الخضار.



كميات الصوديوم العالية الموجودة في بعض المنتجات الغذائية



الحقائق التغذوية		Nutrition Facts	
Servings per container: 1		1	
Serving size: 75 g		75 g	
Amount per serving		Amount per serving	
Calories 353		Calories 353	
Daily Value (DV)		Daily Value (DV)	
Total Fat	35 g	Total Fat	35 g
Saturated Fats	6 g	Saturated Fats	6 g
Trans Fats	0 g	Trans Fats	0 g
Cholesterol	0 mg	Cholesterol	0 mg
Total Carbohydrate	40 g	Total Carbohydrate	40 g
Dietary Fiber	3 g	Dietary Fiber	3 g
Total Sugars	4 g	Total Sugars	4 g
Includes added sugars	0 g	Includes added sugars	0 g
Protein	8 g	Protein	8 g



معلومات الغذائية		NUTRITION INFORMATION	
Serving per package: 1		100 (g)	
Serving size: 75 g		Per serving	
Amount per serving		Amount per serving	
Energy (Kcal/Cal)		455	
Total Fat (g)		18	
Saturated Fat (g)		7	
Trans Fat (g)		0	
Protein (g)		10	
Cholesterol (mg)		0	
Total Carbohydrates (g)		64	
Sugars (g)		4	
Dietary Fiber (g)		4	
Sodium (g)		1.7	



الحقائق التغذوية		Nutrition Facts	
Servings per container: 1		1	
Serving size: 85 g		85 g	
Amount per serving		Amount per serving	
Calories 404		Calories 404	
Daily Value (DV)		Daily Value (DV)	
Total Fat	17 g	Total Fat	17 g
Saturated Fats	6 g	Saturated Fats	6 g
Trans Fats	0 g	Trans Fats	0 g
Cholesterol	0 mg	Cholesterol	0 mg
Total Carbohydrate	54 g	Total Carbohydrate	54 g
Dietary Fiber	3 g	Dietary Fiber	3 g
Total Sugars	6 g	Total Sugars	6 g
Includes added sugars	0 g	Includes added sugars	0 g
Protein	8 g	Protein	8 g



كميات الصوديوم العالية الموجودة في بعض المنتجات الغذائية

Instant Noodles
شعيرية مقلية
بصلصة اللحم المتبلية
Spicy Beef Flavour
Fried Noodles
1130 mg | 49%

الحقائق التغذوية	
Amount per serving	
Serving size 1 (80 g)	
Calories	365
Daily Value (bV)	Units %
Total Fat	15g 21%
Saturated fats	7g 36%
Trans fats	0g 0%
Cholesterol	0 mg 0%
Sodium	1130 mg 49%
Total Carbohydrate	43g 16%
Dietary fibres	2g 9%
Total sugars	3g 9%
Includes 1g added sugars	3g 3%
Protein	6g

Instant Noodles
شعيرية
دجاج خاصة
Special Chicken
Flavour
680 mg | 28%

Nutrition Facts		Valeur nutritive	
Amount per serving		Per 1/2 package (37g) / Par 1/2 paquet (37g)	
Serving size 1 (80 g)			
Calories	170	% Daily Value	% Valeur quotidienne
Fat	5 g	10%	10%
Saturated	2.5 g	5%	5%
Trans	0 g	0%	0%
Cholesterol	0 mg	0%	0%
Sodium	680 mg	28%	28%
Carbohydrates	23 g	8%	8%
Fiber	1 g	4%	4%
Protein	4 g	8%	8%
Vitamin A		4%	4%
Vitamin C		0%	0%
Calcium		0%	0%
Iron		0%	0%

Instant Noodles
شعيرية مقلية
Fried Noodles
800 mg | 34.7%

شعيرية سريعة التحضير المنتجة بالآلي		Fried Process Instant Noodle	
Nutrition Information		100g (g)	
Serving per package : 1		Per serving	
Serving size : 80 g		Per serving	
Energy (Kcal/Cal)	475	117	117
Total Fat (g)	21	5.3	5.3
Saturated Fat (g)	9	2.3	2.3
Trans Fat (g)	0	0	0
Protein (g)	8	2	2
Cholesterol (mg)	0	0	0
Total Carbohydrates (g)	62	15.5	15.5
Sugars (g)	8	2	2
Dietary Fiber (g)	4	1	1
Sodium (g)	1.0	0.8	0.8

UAEU كلية الطب والعلوم الصحية
College of Medicine and Health Science

OXFORD
BROOKES
UNIVERSITY

For first 7-days (message send every 3-days)

29- 35 Days

303

البوتاسيوم

ما هو ؟

معدن يتواجد بشكل طبيعي في العديد من الأطعمة النباتية ،
نحتاج إلى البوتاسيوم أكثر من الصوديوم كل يوم.

الوظائف ؟

وظائف مماثلة للصوديوم:

- يشارك في توازن السوائل في الجسم
- يشارك في انقباض العضلات
- يوصل التيارات العصبية
- يؤثر على صحة القلب وضغط الدم



الصوديوم والبوتاسيوم:

- كثرة تناول الملح/ الصوديوم يزيد من ضغط الدم وخطر الإصابة بأمراض القلب
- يمكن أن يساعد تناول كميات كبيرة من البوتاسيوم في خفض ضغط الدم



كيف تزيد من استهلاك البوتاسيوم؟

1 تناول المزيد من الخضار والفواكه الطازجة

2 تناول المزيد من المكسرات والبذور والبقوليات

3 تناول اللحوم والدواجن والأسماك الخالية من الدهون

الأطعمة الغنية بالبوتاسيوم:



For first 7-days (message send every 3-days)

36- 42 Days



نصائح إبداعية للطهي باستخدام ملح قليل أو بدون ملح

البرياني

- ✓ خضروات طازجة
- ✓ دجاج
- ✓ بهارات



- ✓ زيت
- ✓ ملح



السلطة

- ✓ خضروات طازجة
- ✓ فواكه
- ✓ الصلصات على الجانب



- ✓ مكسرات مالحة
- ✓ الحبوب
- ✓ الملح
- ✓ الصلصات على السلطة



خيارات جيدة بديلة عن الملح

الباستا

- ✓ خضروات
- ✓ دجاج
- ✓ صلصة طماطم



- ✓ جبن
- ✓ سجق



البيتزا

- ✓ خضروات
- ✓ فواكه
- ✓ اوريغانو



- ✓ الجبنة الاضافية
- ✓ البيروني



خيارات جيدة بديلة عن الملح

اطبخ اللحم مع:



اطبخ الدجاج مع:



خيارات جيدة بديلة عن الملح



Appendix 18: HAAD medical waste management in health care facilities policy and procedure

Available at <https://www.khadamat.ae/wp-content/uploads/2017/04/HAAD-policy-on-medical-waste.pdf>

Health Authority – Abu Dhabi		هيئة الصحة - أبوظبي
Division/Department/Section: PPR/HCP	Reference Number: PPR/HCP/P0002/07	
Subject: Medical Waste Management in Health Care Facilities	Issue Date: May 2007	
	Revision Date: May 2009	
	Version: 1	

- 2.4. Every HCF shall provide the required resources for proper waste management at its premises. The HCFs should recruit or designate staff that will be overall responsible for the waste management of the facility. The designated staff must have written responsibilities for proper waste management for the facility. (Please see appendix, for the assigned staff responsibilities).
- 2.5. Health care facilities management should provide adequate support to the designated person, providing him with the necessary equipment, material, and work space.
- 2.6. There must be demonstrated and continuous training provided to all HCF staff who are involved in this process especially to the house keeping staff and cleaners whether directly employed by the HCF or out sourced by the HCF. The record of their training must be maintained. This training must include the demonstration of the colour coded bags by the company for the purposes of familiarisation which will be helpful for the staff in the process of implementation. The management of clinical waste must be included in the mandatory annual training plan by each of the HCF.
- 2.7. Health care facilities should have a log book which has to be filled properly by the HCF for the purpose of tracking and maintaining a record of all disposed medical waste. The log book must include the following information such as the date and time the waste was collected, name of the waste, type of waste, the weight of the waste and the name and signature from both parties (the facility designated person and waste collection company designated person).
- 2.8. Specific clinical wastes must be disposed under the supervision of the HCF designated staff and a record has to be maintained. These clinical wastes include anatomic, pathological, pharmaceutical, genotoxic and radioactive waste.
- 2.9. Health care facilities should choose waste handling, collecting, transporting and disposal companies carefully, since the waste generator is directly held accountable for ensuring that all stages of transportation and disposal are carried out in a safe and legal manner.

Appendix 19: Participant consent form Study 4 (Interview)



CONSENT FORM

UREC Registration No: 191337

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

Mr. Amjad Jarrar (Student MPhil/PhD), Department of Sport, Health Sciences & Social Work, Oxford Brookes University
Tel: 00971 553710322
Email: amjadj@uaeu.ac.ae / 16111505@brookes.ac.uk

Dr P. Sangeetha Thondre (Director of Study); Research/ Lead, Oxford Brookes Centre for Nutrition and Health (OxBCNH), Department of Sport, Health Sciences and Social Work, Oxford Brookes University
Tel: +44 (0)1865 483988
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Dr Ayesha Al Dhaheri (Project Co-Supervisor), Department of Nutrition and Health, College of Food and Agriculture, UAE University.
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Email: ayesha_aldhaheri@uaeu.ac.ae

Dr Leila Cheik Ismail (Project Co-Supervisor), Clinical Nutrition and Dietetics Department, College of Health Sciences, University of Sharjah, UAE.
Tel. 00971561914363
Email: lcheikhismail@sharjah.ac.ae

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.
3. I agree to take part in the above study.
4. I agree to do individual interview by interviewer and to audio-record this interview for the purpose of the study above.

☐☐☐☐

Name of Participant

Date

Signature

Name of Researcher

Date

Signature

Appendix 20: Participant information sheet Study 3 & 4



UREC Registration No: 191337

Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

Chronic diseases, such as cardiovascular diseases (CVD), cancer, chronic respiratory diseases (CRD), and diabetes are increasing worldwide and are considered the leading causes of death. In the United Arab Emirates (UAE), CVD accounts for more than 25% of all deaths countrywide and 29% of all deaths in the emirate of Abu Dhabi. There is a strong relationship between high salt intake and CVD, therefore, best method to measure salt by assessing 24-hr urinary sodium excretion. The aim of the study is to investigate the effectiveness of different intervention plans using WhatsApp's and electronic brochure messages to reduce sodium intake in sample of UAE population. This study will measure efficacy and percentage of reduction in salt intake. Moreover, will identify main obstacles in reducing salt intake in a sample of UAE population.

Why have I been invited to participate?

A random sample of 120 UAE adult residents of both genders, aged 20 to 40 years, will be recruited to participate in the study. Participants will be recruited from UAE University and from different Emirates,

The exclusion criteria for participating in the study are:

- diagnosis with renal failure
- on anti-hypertensive medication
- pregnant, lactating
- menstruating female during the period of urine collection
- use of diuretic medication
- unable to collect adequate urine (less than 500 ml)

Do I have to take part?

It is up to you to decide whether to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time, without giving a reason, and to withdraw any unprocessed data previously supplied. If you are involved in a dependent, relationship (i.e. Teacher\student) with the projects, principal investigator (PI), and your involvement in the study will not affect your grades, assessments, or future studies.

What will happen to me if I take part?

You will answer questionnaires, which includes questions related to demographical data, attitudes to salt intake, preference towards purchasing foods with high or low salt, and knowledge of identifying salty foods. Moreover, to answer food frequency questionnaire in the beginning of the study and after 6-weeks of the study, this will take 30-45 minutes of your time.

This study will last for 6-weeks and will include three groups; you will be randomly assigned to any group.

You will be asked to provide a single timed 24-hour urine in any day you wish at the beginning of the study and at the end of the study after 6-weeks. Instruction sheet on how to collect single timed 24-hour will be provided to you, instruction include when to start to collect urine and how to record start time, end time of 24-hour and missed urination time on the container, and to record start date and end date.

At the end of the 6-weeks, you can give your feedback, about obstacles of reducing salt intake, and what you want to see as a next step, through answering some of researcher questions; this part is **OPTIONAL**. (The interview time for each participants will take from 30 to 60 min).

This part of this study will take place a week after end of intervention part, voice will be recorded for the study purpose.

What are the possible disadvantages and risks of taking part? (where appropriate)

The age group of participants will range from 20 to 40 years old and above and all the participants will be able to urinate without any help. In this study, there will be minimal potential risk in contamination. A 5-L coded plastic container that contains 1g of boric acid to preserve the collected urine sample will be provided to participants. Participants will be provided with instructions sheet on how to collect 24-hour urine and how to fill the 24-hr urinary collection sheet.

It is up to you to choose day to collect 24 hr urine sample within a week of your approval to be part of this study. In addition, you give another sample after 6-weeks later. Answering questionnaire will require a time, but you have one week to answer the questionnaire, even at the end of the study after 6-weeks you have one week more to answer the questionnaires.

With respect to the second part of the study - In-depth interview (Optional), if you decided to be part of it, you will have the choice to do the interview face to face or by telephone. If you wanted, by telephone, Amjad Jarrar- the Researcher will arrange a telephone call using UAEU landline and time will be arranged according to your free time, anytime within two weeks after the end of intervention study, which will last for 6-weeks.

In this, study you will not have to spend anything, all the documents and consumable material like plastic bag and urine bottle will be provided to you.

What are the possible benefits of taking part?

You can find out how much salt you consumed and main sources of salt in your diet. In addition, this study can assess your knowledge to sources of salt in your diet and assess if you can control or reduce your salt intake.

At the population level, your contribution in this study will give a better understanding about quantity and sources of salt consumed in UAE, in addition to efficiency and effectiveness of salt reduction plan. Decision maker in UAE can use result of this study to plan intervention approaches.

Will what I say in this study be kept confidential?

Many steps will be taken into account to maintain and enhance participants confidently such as, participant names will be replaced with codes, and codes will be used in all papers, lab work, food analysis software and statistical work among research team.

All the data stored in laptops and other devices will be protected by password and access will be given to PIs of the study. In addition, all the data generated in the course of the research must be kept securely in paper or electronic form for a period of ten years after the completion of a research project.

What should I do if I want to take part?

If you wish to be part of this study, or for more information you can communicate with research team through any phone number listed in the flayer or even by sending WhatsApp message. Feel free to communicate with any member of the research team to participate or for more information. After reading information sheet you will be asked to sign the consent form. After that, you will be part of this study.

You will be provided with questionnaire including questions related to demographical data, some questions related to salt intake, selection of foods and knowledge of salty foods. In addition to that, you will be asked to answer a food frequency questionnaire and to provide a single time 24-hr urine sample two times at the beginning of the study and after 6-weeks.

What will happen to the results of the research study?

Ultimately, the results of the study will be written up as part of a PhD thesis. In addition, the results will be published in peer-reviewed journals and presented at meeting and conferences. Participants will not be identified in any publications. Participants who wish to obtain a copy of the published research can communicate with the research team to be provided with a link.

Who is organising and funding the research?

This is a research student project (MPhil/PhD) at Oxford Brookes University, Department of Sport, Health Sciences & Social Work, Faculty of Health and Life Sciences at Oxford Brookes University. This project is self-funded; Nutrition and Health Department- College of Food and Agriculture, UAE University will provide all consumable material, in addition all the analysis of samples will be performed at laboratories of UAEU.

Who has reviewed the study?

This research has been approved by the University Research Ethics Committee, Oxford Brookes University.

Contact for Further Information

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Clinical Nutrition and Dietetics Department
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Email: lccheikhismail@sharjah.ac.ae

If you have any questions regarding the Ethical Approval or any issues / problems related to this study, please contact: the Chair of the University Research Ethics Committee on ethics@brookes.ac.uk.

Thank you, For taking time to read the information sheet.

Date: Data collections, will start on 15/11/2019 until 15/11/2020

الفئة فعليّة خطط لتدخل لمخففة لتس ويل خفض لريت هالك لم ح في عينة من مجتمع الامارات لعربيّة لتحدة

تتم دعوتكم للمشاركة في دراستنا قبل أن تقر ما إذا كنت ستشارك أم لا من المهل المناسب لك لتفهم
لماذا يجري البحث وما سوف نطوي عليه. يرجى ترك بصمة إصبعك على بطاقة الاستبيان الخاصة بالدراسة.

ما هو الغرض من الدراسة؟

تزداد أمراض المزمنة (غير المعدية)، وخاصة أمراض القلب والأوعية الدموية، في الإمارات، وأمراض
التهنئة النفس للمزمنة، وداء السكري في جميع أنحاء العالم، وتعتبر الأسباب الرئيسية لوفيات وعجز
المواطن. في الإمارات العربية المتحدة، شملت الأمراض المزمنة 25% من جميع الوفيات
على مستوى البلاد و 29% من مجموع الوفيات في الإمارات العربية المتحدة.

الغرض من الدراسة:

الهدف من هذه الدراسة هو التعرف على فعليّة خطط التدخل لمخففة لتس ويل خفض لريت هالك لم ح
والتأثيرات على جودة الحياة والصحة النفسية في عينة من سكان دولة الإمارات العربية المتحدة. تتوقع هذه الدراسة
فعليّة ونسبة انخفاض في ضيق التنفس واللامبالاة لعينة الإمارات العربية المتحدة.

لماذا يجري هذا البحث؟

سيتم إشراك عينة عشوائية من 120 قديم مصححي من الإمارات العربية المتحدة من كلالينيين، الذين تتراوح
أعمارهم بين 20 و 40 عامًا، الذين شاركوا في الدراسة. سيتم تطبيق طابالمشراكين من خلال طرق مختلفة من
جامعة الإمارات العربية المتحدة ومختلف الإمارات وتلك من خلال: التقييمات وجه لوجه وإلحاقات معقولة
التصالحات البحث من خلال جامعة الإمارات العربية المتحدة. يهدف الباحثون إلى تقييم تأثيرات
لبرنامج واحد من التدخلات التي أجريت في الإمارات العربية المتحدة. سيتم تطبيق طابالمشراكين.
معياري التقييمات التي أجريت في الإمارات العربية المتحدة، والتي تشمل تقييمات لمدى جودة الحياة، والتأثيرات
وإلحاقات، والمرضات أو انخفاض الالتفات إلى العمل، ولتدخل ألدنيّة في العمل. أوالمشراك
الذين قد يكونون على جمع عينات قبول لفعليّة (كل من 500 مل).

لماذا يجب عليّ المشاركة؟

قرار المشاركة من عدمه متروك لك. إذا قررت المشاركة، ستعطى لك ورقة المعلومات وذلك تعرف
بصور مفصلة ونوع تدبير طبي في تلك التوقعات على نموذج الفعليّة. إذا قررت المشاركة، فإنك ستعطى
التصالحات في أي وقت، دون إبداء الأسباب، وسحب أي بيانات غير مكتملة ستبقى في راحة. إذا كانت لك علاقة
العمل / الطالب / مع الباحث في هذا البحث فاعلم أن مشاركتك من عدمه في هذا البحث لن تؤثر على
درجتك أو تقييمك أو دراستك.

ماذا سيحدث لي إذا شاركت؟

إذا شاركت، سيتم إجراء التقييمات في أي وقت يطلب منك إلى جلسة مع إحدى الطبيات المتخصصات
بللدراسة: لتقييم فعليّة والتصرف وممارستين أو للملاح ومعرفة لطيف الفهم للفعليّة أو الرضا عن فعليّة
لبنه اللفظ لم ح الفعليّة. بعض التقييمات التي سوف نقوم بها الفعليّة إلى جلسة لتقييم الفهم، وذلك
يتم غرق 30-45 دقيقة فقط من وقتك. سوف يطلب منك توقيع على نموذج موافقة على المشاركة و 24 ساعة و هذا
في البداية للدراسة بعد 6 أسابيع من الدراسة. سيتم توفير الفعليّة من قبل الأطباء الذين يتركون في العمل يوم
توقعي ترك في العمل. هذا التهاء من الدراسة في الفعليّة المشاركة إعطاء رأيك وإلحاقات على بعض التقييمات الفعليّة
بللدراسة. عقب التهاء واجهه التهاء للدراسة في سبيل لتقييم الفعليّة في العمل. هذا الجزء من الدراسة
لغريّ وسوف يتم من قبل الفعليّة قصوي. مدّة الفعليّة (30-60 د).

إذا كنت ترغب في مزيد من المعلومات الخاصة بك، يرجى الاتصال بـ

ما هي فوائد الفعليّة من المشاركة؟

على الرغم من أن الفعليّة هي مخصصة للفهم، فإنها قد توفر معلومات إضافية عن الفعليّة. وهذا هو الحال مع الفعليّة التي هي
الفعليّة الخاصة بك. ومع ذلك، قد تكون الفعليّة أحياناً غير كافية في العمل.

جامع غلشارقة

ملف: 00971561914363

إذا كنت لبيك أي لؤلؤ قب خوص لملققة أل خلقىة أو أي قضيلا أو من كل لملققة هذال دراسة يبرجى الللصل اللب لملققة
أل خلقىات الللحو شاعلى ethics@brookes.ac.uk

شكرا

لللخرى ص جزء من لملققة لملققة ورقة لملققة لملققة.

Appendix 21: Proposed schedule for individual interviews for the intervention groups



Effectiveness and efficacy of different intervention plans to facilitate salt intake reduction in a sample of UAE population

Proposed schedule for Individual interview for the intervention groups

- If you prefer face-to-face interview, for female participants you can come to Building E-3 room 0010-ground floor near (Alain gate) or Building C-6 room 0014- ground floor, near Crescent Building or Faculty gate.
- For Male participants, you can come to Building E-3 room 0010 group floor near (Male gate) on Wednesday or Crescent Building on Thursday.

Meeting times:

- Monday: 10:00 -12:00 pm and 4:00-6:00 pm (Female participants)
- Wednesday: 10:00-12:00 pm and 4:00-6:00 pm (Male participants)
- Thursday: 10:00 -12:00 pm and 4:00-6:00 pm (Female/ Male participants)

If you prefer landline, phone calls will be arranged according to your time as possible, phone calls all Sunday/ Tuesday/ Saturday: 10:00 am up to 12:00 pm and 5- 6 pm

- Sunday: 10:00- 12:00pm, and 5:00- 6:00 pm.
- Tuesday: 10:00- 12:00pm, and 5:00- 6:00 pm.
- Saturday: 10:00- 12:00pm, and 5:00- 6:00 pm.

All the interviews will be audio recorded for the purpose of the study, as mentioned in information sheet and consent form.

You choose the time that fit you, as long as this time will be within two weeks of ending the intervention study. This study may extend for one week extra to complete interview of participants.

For more information, please feel free to contact research member: Amjad Jarrar team, you can book your appointment through email, WhatsApp, text message, phone call.

Mr. Amjad Jarrar (Mobile/WhatsApp: 00971553210322)

Email: amjadj@uaeu.ac.ae

Proposed schedule for Individual interview

No	Participants Code	Building E- 3, Room 010	Building C- 6 Room 0014	College of Food Agriculture- Office 211	Telephone Interview
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Appendix 22: Thesis Tables

Appendix 22_Table 2.5

Internal reliability and external reliability of KAP questionnaire content validity for the KAP questionnaire items

KAP questionnaire- Parts	KAP questionnaire- Items	Total Essential	CVR²	Interpretatio n
Attitude- Items	1	9	1.00	Accepted
	2	9	1.00	Accepted
	3	9	1.00	Accepted
	4	9	1.00	Accepted
	5	8	0.777	Accepted
CVI			0.955	Accepted
Practice-Items	1	9	1.00	Accepted
	2	9	1.00	Accepted
	3	9	1.00	Accepted
	4	9	1.00	Accepted
	5	9	1.00	Accepted
	6	8	0.777	Accepted
	7	9	1.00	Accepted
	8	9	1.00	Accepted
	9	9	1.00	Accepted
	10	9	1.00	Accepted
	11	9	1.00	Accepted
	12	9	1.00	Accepted
CVI			0.981	Accepted
Knowledge- Food	1	9	1.00	Accepted
	2	9	1.00	Accepted
	3	9	1.00	Accepted
	4	9	1.00	Accepted
	5	9	1.00	Accepted
	6	9	1.00	Accepted
	7	9	1.00	Accepted
	8	9	1.00	Accepted
	9	9	1.00	Accepted
	10	9	1.00	Accepted
	11	9	1.00	Accepted
	12	9	1.00	Accepted
	13	9	1.00	Accepted
	14	9	1.00	Accepted
	15	9	1.00	Accepted
	16	9	1.00	Accepted
	17	9	1.00	Accepted
	18	9	1.00	Accepted
	19	9	1.00	Accepted
	20	9	1.00	Accepted

	21	9	1.00	Accepted
	22	9	1.00	Accepted
CVI			1.00	Accepted
Knowledge-Medical	1	9	1.00	Accepted
	2	9	1.00	Accepted
	3	9	1.00	Accepted
	4	9	1.00	Accepted
	5	9	1.00	Accepted
	6	9	1.00	Accepted
CVI			1.00	Accepted

¹ Number giving Essential ² Content validity Ratio

Appendix 22_Table 3.4

Urinary (24-hour). sodium, potassium, and creatinine excretions according to gender and age groups (n=190)

Variables	df	Mean ± SD ¹ (20-29.9 Years)					
		Total (48) ²	Females (24)	Males (24)	f-value	t-value	P-value ³
Urinary Sodium (mg)	46	3197.4±748.1 ^a	2827.5± 365.6	3567.3± 851	14.596	-3.912	0.001
Salt (mg)	46	7993.5± 1870.1 ^a	7068.9± 914	8918.2± 2127.7	14.596	-3.912	0.001
Urinary Potassium (mg)	46	2181.3± 949.4 ^a	2080.6 ±481	2276.5± 1564.4	0.091	-1.347	0.185
		Mean ± SD ¹ (30-39.9 Years)					
		Total (49)	Females (26)	Males (23)	f-value	t-value	P-value ³
Urinary Sodium (mg)	47	2922.5±613.5 ^{ac}	2836.5± 685.3	3024.2±601.4	0.00	-1.013	0.316
Salt (mg)	47	7306.3±1533.8 ^{ac}	7091.5± 1713.2	7560.4± 1503.5	0.00	-1.013	0.316
Urinary Potassium (mg)	47	1964.5± 455.0 ^{ab}	1877.1± 443.0	2063.3±457.8	0.01	-1.445	0.155
		Mean ± SD ¹ (40-49.9 Years)					
		Total (47)	Females (25)	Male (22)	f-value	t-value	P-value ³
Urinary Sodium (mg)	45	2677.5±601.4 ^{bc}	2620.6± 595.5	2742.0± 615.3	0.014	-0.687	0.515
Salt (mg)	45	6693.6± 1503.8 ^{bc}	6551.6± 1488.8	6855.1 ±1538.3	0.014	-0.687	0.515
Urinary Potassium (mg)	45	1802.4± 437.0 ^b	1712.3± 396.0	1904.8± 467.4	1.304	-1.529	0.133
		Mean ± SD ¹ (≥ 50 Years)					
		Total (46)	Females (21)	Male (25)	f-value	t-value	P-value ³
Urinary Sodium (mg)	44	2444.6±432.6 ^{bd}	23505± 364.6	2523.7± 527.6	4.518	-1.366	0.161
Salt (mg)	44	6111.6±1081.6 ^{bd}	5876.2± 661.6	6309.3± 1318.9	4.518	-1.366	0.161
Urinary Potassium (mg)	44	1838.6 ±419.3 ^b	1744.8±346.4	1917.3± 464.3	2.734	-2.435	0.167

1

presented as Mean ± standard deviation. ² Means with different letters in the same column for the same variable for different age group are significantly different with p<0.05, One-way ANOVA, followed by the Bonferroni test. ³ Independent-Samples T-test used to assessed Significance at p<0.05 for variable according to gender.

Data

Appendix 22_Table 3.5

Food and health related knowledge scores and classifications for study population

Variables		Mean ± SD ^a		Mean ± SD ^a		Mean ± SD ^a				
	Df	Total (n=190)	Classification ¹	Female (n=96)	Classification ¹	Male (n=94)	Classification ¹	f-value	t-value	P-value ^d
Foods related knowledge ^b	188	5.1 ±2.3	Poor	5.5 ±2.0	Poor	4.6 ±2.5	Poor	7.289	2.781	0.008
Health related knowledge ^b	188	6.2± 2.9	Fair	6.4 ±2.9	Fair	6.1 ± 2.9	Fair	0.337	0.687	0.562
P-value ^c		0.001		0.009		0.001				
Age group (years)		20-29.9				30-39.9				
		Total (n=48)	Females (n=24)	Males (n=24)	P-value	Total (n=49)	Females (n=26)	Males (n=23)	P-value	
Foods related knowledge ^b		5.1±2.0 ^{c 2}	5.9±1.5 ²	4.3±2.0 ²	0.04	5.1 ±2.1 ^{c 2}	5.4±1.7 ²	4.8±2.5 ²		0.366
Health related knowledge ^b		6.5±2.2 ^{p 3}	6.9±2.1 ³	6.0±2.3 ³	0.164	5.8±3.1 ^{p 2}	5.7±2.7 ²	5.9±2.3 ²		0.164
Age group (years)		40-49.9				≥ 50				
		Total (n=47)	Females (n=25)	Males (n=22)	P-value	Total	Females (n=21)	Males (n=25)	P-value	
Foods related knowledge ^b		4.4±2.6 ^{c 2}	4.7±2.2 ²	4.1±3.1 ²	0.425	5.7±2.3 ^{c 2}	6.2±2.2 ³	5.2±2.3 ²		0.124
Health related knowledge ^b		5.9 ±3.4 ^{p 2}	5.7±3.5 ²	6.2±3.5 ³	0.591	6.6±2.7 ^{p 3}	7.3±2.8 ⁴	6.1±2.5 ³		0.118

^a Mean ± standard deviation. ^b Knowledge score out of 10. ^c Paired sample t-test used to compare means for health and food related knowledge, (p< 0.05)

^d Independent-Samples T-test used to assessed significance at p<0.05 for variable according to gender. ^e Means with different letters in the same variable for different age group are significantly different with p<0.05, One-way ANOVA, followed by Bonferroni test. ^p Means with different letters in the same the same variable for different age group are significantly different with p<0.05, One-way ANOVA, followed by the Bonferroni test.

¹Score for Knowledge < 6 classified as “Poor”, 6–7 classified as “Fair”, >7 classified as “Good” (Haron *et al.*, 2021; Jarrar *et al.*, 2022)

Appendix 22_Table 3.6

Salt-related attitudes among study population by gender (n=190)

Variable ^a	Total n (%) ^b	Female n (%)	Male n (%)	Chi-Square (p-Value) ^c
How much salt do you think you consume (Just the right amount)	134 (70.5)	69 (71.9)	65 (69.1)	0.742 (p=0.690)
Are you concerned about the amount of salt/sodium in the diet (Yes)	21 (11.1)	9 (9.4)	12 (12.8)	1.534 (p=0.464)
Reducing added salt to foods is important to you (Agree)	49 (25.8)	26 (27.1)	23 (24.5)	4.114 (p=0.128)
Reducing consumption of processed foods is important to you (Agree)	80 (42.1)	35 (36.5)	45 (47.9)	3.483 (P=0.175)
Reducing your sodium intake is important to you (Agree)	39 (20.5)	14 (14.6)	25 (26.6)	6.115 (p=0.047)

^a Attitude was assessed based on a three-point Likert scale but only answers of “Agree or Yes” are presented. ^b Data presented as number and frequencies of agree or yes answer. ^c Chi-square test used to compare variable association with gender, (p<0.05).

Appendix 22_Table 3.7

Salt-related practices among study population by gender (n=190)

Variable ^a	Total n (%) ^b	Female n (%)	Male n (%)	Chi-square (P-value) ^c
Check food labels (Often)	30 (15.8)	23 (24.0)	7 (7.5)	9.742 (<i>p</i> =0.008)
Information on food labels affects purchasing decisions (Often)	17 (9.0)	10 (10.4)	7 (7.4)	0.660 (<i>p</i> =0.719)
Check labels specifically for salt/sodium content (Often)	15 (8.0)	7 (7.3)	8 (8.5)	1.723 (<i>p</i> =0.423)
Salt/sodium content on label affects purchasing decisions (Often)	13 (6.8)	7 (7.3)	6 (6.4)	2.552 (<i>p</i> =0.279)
Try to buy “low salt” foods (Often)	25 (13.2)	11 (11.5)	14 (14.9)	0.495 (<i>p</i> =0.781)
Add salt to food during cooking (Often)	120 (63.2)	62 (64.6)	58 (61.7)	0.661 (<i>p</i> =0.719)
Use Stock Cubes during cooking (Often)	33 (17.4)	19 (19.8)	14 (14.9)	0.795 (<i>p</i> =0.672)
Add salt to food at the table (Often)	24 (12.6)	11 (11.5)	13 (13.8)	1440.0 (<i>p</i> =0.487)
Add salt before tasting the food (Often)	23 (12.1)	5 (5.2)	18 (19.2)	13.681 (<i>p</i> =0.001)
Did you try to reduce salt intake before (Yes)	89 (46.8)	46 (47.9)	43 (45.7)	0.657 (<i>p</i> =0.720)
Did you try to use spices (lemons and herbs) to reduce salt (Yes)	65 (34.2)	37 (38.5)	28 (29.8)	4.266 (<i>p</i> =0.118)

^a Practice was assessed based on a three-point Likert scale but only answers of “Often or Yes” are presented. ^b Data presented as number and frequencies of agree or yes answer. Each yes or agree answer earn 1 score. ^c Chi-square test used to compare variable association with gender, (*p*<0.05).

Appendix 22_ Table 4. 3:

24-hour urinary excretion for sodium, potassium, creatinine, and salt

	Mean $\pm$ SD ¹							
Variables	Control (n=39)		WhatsApp (n=41)		Brochures (n=41)		Total (n=121)	
	Baseline	End	Baseline	End	Baseline	End	Baseline	End
Urinary sodium excretion (mg)	3008.7 $\pm$ 664.0 ^a	3112.5 $\pm$ 609.0 ^a	3019.5 $\pm$ 593.0 ^a	2741.5 $\pm$ 636.0 ^a	3094.0 $\pm$ 605.0 ^a	2925.2 $\pm$ 571.7 ^a	3040.8 $\pm$ 654.3 ^a	2926.4 $\pm$ 664.3 ^a
P-value ^c	0.055		0.001		0.018		0.189	
Salt (mg/day)	7521.8 $\pm$ 1510.0	7781 $\pm$ 1622.5	7548.7 $\pm$ 1482.5	6853.6 $\pm$ 1591.0	7735.0 $\pm$ 1513.6	7313.1 $\pm$ 1429.2	7601.9 $\pm$ 1635.7	7316.1 $\pm$ 1626.3
P-value ^c	0.046		0.001		0.018		0.189	
Urinary potassium excretion (mg)	2037.0 $\pm$ 707 ^b	2014.4 $\pm$ 663.0 ^b	1868.7 $\pm$ 591.2 ^b	2095 $\pm$ 630.0 ^b	2047.0 $\pm$ 672.0 ^b	2063.2 $\pm$ 522.4 ^b	1984.8 $\pm$ 658.5 ^b	2051.5 $\pm$ 602.0 ^b
P-value ^c	0.867		0.033		0.987		0.409	
Urinary creatinine excretion (mg)	1340.6 $\pm$ 327.0	1324.0 $\pm$ 356.0	1424.9 $\pm$ 371.4	1437.7 $\pm$ 365.3	1369.6 $\pm$ 319.0	1387.6 $\pm$ 304.8	1378.4 $\pm$ 339	1383.1 $\pm$ 344
P-value ^c	0.369		0.768		0.711		0.902	
Creatinine excretion (mg/kg body weight)	19.5 $\pm$ 3.8	19.0 $\pm$ 3.6	20.1 $\pm$ 4.4	20.7 $\pm$ 4.2	19.7 $\pm$ 3.14	20.0 $\pm$ 3.4	19.8 $\pm$ 4.0	19.9 $\pm$ 4.2
P-value ^c	0.651		0.780		0.635		0.908	

¹ Data presented as Mean $\pm$ standard deviation. ^a Significantly higher than, the WHO recommendations for sodium, (One- Sample t-test used to compare mean with RDA=2300 mg/day, Significance at α =5%). ^b Significantly lower than, the WHO recommendations for potassium, (One- Sample t-test used to compare mean with RDA=3510 mg/day, Significance at α =5%). ^c paired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_ Table 4. 5:

Percentage of participants exceeding WHO recommendation of Sodium intake before and after 6- weeks of intervention

Exceeding WHO recommendation of Sodium intake (Yes)		Total (n=121)		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		n (%) ^a	Mean ± SD ^b	n (%) ^a	Mean ± SD ^b	n (%) ^a	Mean ± SD ^b	n (%) ^a	Mean ± SD ^b
	Baseline	94 (77.7)	0.78±0.41	31 (79.5)	0.80±0.42	32 (78.0)	0.78±0.40	31 (75.6)	0.76±0.42
	End	86 (71.1)	0.71±0.45	30 (76.9)	0.77±0.44	27 (65.8)	0.66±0.47	29 (70.7)	0.71±0.45
	P-value ^c	0.004		0.323		0.023		0.160	

^aData presented as number and frequency.

^bData presented as Mean ± standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_Table. 4. 7

The number and percentage of participants who correctly answered the questions on food related knowledge

Variables	(n, %) ^a					
	Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
Sodium content in the following foods is [†]	Baseline	End	Baseline	End	Baseline	End
Arabic bread (High)	10 (25.6)	11 (28.2)	10 (24.3)	34 (82.9)	8 (19.5)	38 (95.0)
Mean $\pm$ SD ^b	0.26 $\pm$ 0.43	0.28 $\pm$ 0.45	0.24 $\pm$ 0.43	0.83 $\pm$ 0.46	0.20 $\pm$ 0.40	0.95 $\pm$ 0.22
P-value ^c	0.323		0.001		0.001	
Iranian bread (High)	12 (30.8)	13 (33.3)	13 (31.7)	37 (92.5)	14 (34.1)	36 (90.0)
Mean $\pm$ SD ^b	0.31 $\pm$ 0.36	0.33 $\pm$ 0.47	0.32 $\pm$ 0.47	0.93 $\pm$ 0.27	0.34 $\pm$ 0.48	0.90 $\pm$ 0.26
P-value ^c	0.323		0.001		0.001	
Rice- Egyptian (Low)	21 (53.8)	23 (0.59)	20 (48.8)	24 (58.5)	22 (53.7)	35 (85.4)
Mean $\pm$ SD ^b	0.54 $\pm$ 0.49	0.59 $\pm$ 0.50	0.49 $\pm$ 0.50	0.59 $\pm$ 0.49	0.54 $\pm$ 0.50	0.85 $\pm$ 0.33
P-value ^c	0.160		0.044		0.001	
Rice-Basmati (Low)	19 (48.7)	21 (53.8)	22 (53.7)	31 (75.6)	20 (48.8)	21 (51.2)
Mean $\pm$ SD ^b	0.49 $\pm$ 0.50	0.54 $\pm$ 0.50	0.54 $\pm$ 0.50	0.76 $\pm$ 0.42	0.49 $\pm$ 0.50	0.51 $\pm$ 0.40
P-value ^c	0.160		0.002		0.323	
Milk/yoghurt (Low)	19 (48.7)	18 (43.9)	18 (43.9)	30 (73.1)	17 (41.4)	35 (85.4)
Mean $\pm$ SD ^b	0.49 $\pm$ 0.50	0.44 $\pm$ 0.50	0.44 $\pm$ 0.50	0.73 $\pm$ 0.43	0.41 $\pm$ 0.50	0.85 $\pm$ 0.33
P-value ^c	0.323		0.001		0.001	
Fresh red meat (Low)	13 (33.3)	15 (38.5)	11 (26.8)	21 (51.2)	13 (31.7)	33 (80.5)
Mean $\pm$ SD ^b	0.33 $\pm$ 0.47	0.39 $\pm$ 0.49	0.27 $\pm$ 0.45	0.51 $\pm$ 0.50	0.32 $\pm$ 0.47	0.85 $\pm$ 0.38
P-value ^c	0.160		0.001		0.001	
Fresh poultry (Low)	15 (38.5)	14 (35.8)	11 (26.8)	21 (51.2)	12 (29.3)	20 (48.8)
Mean $\pm$ SD ^b	0.39 $\pm$ 0.49	0.36 $\pm$ 0.38	0.27 $\pm$ 0.45	0.51 $\pm$ 0.50	0.29 $\pm$ 0.46	0.49 $\pm$ 0.50
P-value ^c	0.3232		0.001		0.003	
Fruits (Low)	25 (64.1)	22 (53.7)	23 (57.5)	37 (92.5)	24 (58.5)	38 (95.0)
Mean $\pm$ SD ^b	0.64 $\pm$ 0.49	0.54 $\pm$ 0.50	0.58 $\pm$ 0.50	0.93 $\pm$ 0.27	0.59 $\pm$ 0.49	0.95 $\pm$ 0.22
P-value ^c	0.083		0.001		0.001	
Fresh vegetables (Low)	26 (66.6)	24 (61.5)	28 (68.3)	41 (100)	26 (63.4)	39 (95.1)
Mean $\pm$ SD ^b	0.67 $\pm$ 0.49	0.62 $\pm$ 0.48	0.68 $\pm$ 0.46	100 $\pm$ 0.00	0.63 $\pm$ 0.48	0.95 $\pm$ 0.16
P-value ^c	0.160		0.001		0.001	

Cheddar cheese (High)	29 (74.4)	28 (71.8)	27 (65.9)	39 (95.1)	28 (68.3)	39 (95.1)
Mean $\pm$SD ^b	0.74 $\pm$ 0.45	0.72 $\pm$ 0.46	0.66 $\pm$ 0.47	0.95 $\pm$ 0.16	0.68 $\pm$ 0.46	0.95 $\pm$ 0.16
P-value ^c	0.323		0.001		0.001	
Pickles (High)	28 (71.8)	33 (84.6)	30 (73.1)	39 (95.1)	28 (68.3)	38 (95.0)
Mean $\pm$SD ^b	0.72 $\pm$ 0.46	0.85 $\pm$ 0.38	0.73 $\pm$ 0.43	0.95 $\pm$ 0.16	0.68 $\pm$ 0.46	0.95 $\pm$ 0.22
P-value ^c	0.023		0.002		0.001	
Olive oil (Low)	18 (43.9)	22 (53.7)	20 (48.8)	35 (85.4)	16 (39.0)	24 (58.5)
Mean $\pm$SD ^b	0.44 $\pm$ 0.50	0.54 $\pm$ 0.50	0.49 $\pm$ 0.50	0.85 $\pm$ 0.33	0.39 $\pm$ 0.49	0.59 $\pm$ 0.49
P-value ^c	0.044		0.001		0.003	
Salad dressing oil (High)	25 (64.1)	26 (66.6)	24 (58.5)	38 (95.0)	22 (53.7)	37 (92.5)
Mean $\pm$SD ^b	0.64 $\pm$ 0.49	0.67 $\pm$ 0.49	0.59 $\pm$ 0.49	0.95 $\pm$ 0.22	0.54 $\pm$ 0.50	0.93 $\pm$ 0.27
P-value ^c	0.323		0.001		0.001	
Ketchup (High)	21 (53.8)	23 (50.9)	20 (48.8)	39 (95.1)	22 (53.7)	39 (95.1)
Mean $\pm$SD ^b	0.54 $\pm$ 0.49	0.59 $\pm$ 0.50	0.49 $\pm$ 0.50	0.95 $\pm$ 0.16	0.54 $\pm$ 0.50	0.95 $\pm$ 0.16
P-value ^c	0.160		0.001		0.001	
Tomato paste (High)	21 (53.8)	22 (53.7)	22 (53.7)	39 (95.1)	21 (51.2)	38 (95.0)
Mean $\pm$SD ^b	0.54 $\pm$ 0.49	0.54 $\pm$ 0.50	0.54 $\pm$ 0.50	0.95 $\pm$ 0.16	0.51 $\pm$ 0.50	0.95 $\pm$ 0.22
P-value ^c	0.323		0.001		0.001	
Corn flakes (High)	8 (20.5)	7 (17.9)	8 (19.5)	33 (80.5)	10(24.4)	35 (85.4)
Mean $\pm$SD ^b	0.21 $\pm$ 0.40	0.18 $\pm$ 0.38	0.20 $\pm$ 0.40	0.81 $\pm$ 0.38	0.24 $\pm$ 0.43	0.85 $\pm$ 0.33
P-value ^c	0.323		0.001		0.001	
Chicken cubes (High)	29 (74.4)	31 (79.5)	26 (63.4)	39 (95.1)	28 (68.3)	40 (97.6)
Mean $\pm$SD ^b	0.74 $\pm$ 0.45	0.80 $\pm$ 0.42	0.63 $\pm$ 0.48	0.95 $\pm$ 0.16	0.68 $\pm$ 0.46	0.98 $\pm$ 0.14
P-value ^c	0.160		0.001		0.001	
Instant noodle (High)	27 (69.2)	26 (66.6)	29 (70.7)	38 (95.0)	28 (68.3)	39 (95.1)
Mean $\pm$SD ^b	0.69 $\pm$ 0.47	0.67 $\pm$ 0.49	0.71 $\pm$ 0.45	0.95 $\pm$ 0.22	0.68 $\pm$ 0.46	0.95 $\pm$ 0.16
P-value ^c	0.323		0.002		0.001	

¹ The correct answers are provided in brackets next to each variable. Each correct answer earned 1 score. ^aData presented as number and percentage. ^b Data presented as Mean $\pm$ standard deviation. ^c paired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_Table. 4. 9

Salt-related practices among study population by intervention groups (n=121)

Variables ¹		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	End	Baseline	End	Baseline	End
Check food labels (Often))	(n, %) ^a	7 (17.9)	8 (20.0)	9 (22.0)	20 (48.8)	10 (24.4)	14 (34.1)
	Mean $\pm$ SD ^b	0.18 $\pm$ 0.33	0.20 $\pm$ 0.36	0.22 $\pm$ 0.42	0.49 $\pm$ 0.51	0.24 $\pm$ 0.43	0.34 $\pm$ 0.38
	P-value ^c	0.323		0.003		0.044	
Information on food labels affects purchasing decisions (Often)	(n, %) ^a	5 (12.8)	5 (12.8)	7 (17.5)	17 (41.5)	7 (17.5)	14 (34.1)
	Mean $\pm$ SD ^b	0.13 $\pm$ 0.35	0.13 $\pm$ 0.35	0.18 $\pm$ 0.37	0.42 $\pm$ 0.50	0.18 $\pm$ 0.37	0.38 $\pm$ 0.48
	P-value ^c	1.00		0.001		0.006	
Check labels specifically for salt/sodium content (Often)	(n, %) ^a	2 (5.1)	3 (7.0)	4 (9.8)	18 (45.0)	2 (4.9)	18(45.0)
	Mean $\pm$ SD ^b	0.05 $\pm$ 0.22	0.08 $\pm$ 0.26	0.1 $\pm$ 0.28	0.45 $\pm$ 0.50	0.05 $\pm$ 0.22	0.45 $\pm$ 0.50
	P-value ^c	0.323		0.001		0.001	
Salt/sodium content on label affects purchasing decisions (Often)	(n, %) ^a	3 (7.5)	3 (7.5)	3 (7.3)	13 (31.7)	2 (5.0)	9 (22.5)
	Mean $\pm$ SD ^b	0.08 $\pm$ 0.26	0.08 $\pm$ 0.26	0.07 $\pm$ 0.26	0.32 $\pm$ 0.47	0.05 $\pm$ 0.22	0.23 $\pm$ 0.40
	P-value ^c	1.00		0.001		0.012	
Try to buy “low salt” foods (Often)	(n, %) ^a	1 (2.6)	1 (2.6)	1 (2.4)	10 (24.4)	2 (4.9)	4 (9.8)
	Mean $\pm$ SD ^b	0.03 $\pm$ 0.16	0.03 $\pm$ 0.16	0.02 $\pm$ 0.16	0.24 $\pm$ 0.42	0.05 $\pm$ 0.02	0.10 $\pm$ 0.30
	P-value ^c	1.00		0.002		0.160	
Add salt to food during cooking (Often)	(n, %) ^a	31 (79.5)	32 (82.1)	28 (68.3)	15 (36.6)	30 (73.1)	18 (43.9)
	Mean $\pm$ SD ^b	0.80 $\pm$ 0.40	0.82 $\pm$ 0.43	0.68 $\pm$ 0.46	0.36 $\pm$ 0.49	0.73 $\pm$ 0.44	0. 44 $\pm$ 0.50
	P-value ^c	0.323		0.001		0.001	

Use Stock Cubes during cooking (Often)	(n, %) ^a	16 (41.0)	17 (43.6)	14 (34.1)	5 (12.2)	11 (26.8)	5 (12.2)
	Mean $\pm$SD ^b	0.41 $\pm$ 0.50	0.44 $\pm$ 0.50	0.34 $\pm$ 0.48	0.12 $\pm$ 0.33	0.27 $\pm$ 0.45	0.12 $\pm$ 0.33
	P-value ^c	0.323		0.002		0.012	
Add salt to food at the table (Often)	(n, %) ^a	9 (23.1)	11 (27.5)	7 (17.1)	1 (2.4)	7 (17.5)	1 (2.4)
	Mean $\pm$SD ^b	0.23 $\pm$ 0.42	0.28 $\pm$ 0.45	0.17 $\pm$ 0.38	0.02 $\pm$ 0.15	0.17 $\pm$ 0.38	0.02 $\pm$ 0.15
	P-value ^c	0.160		0.012		0.012	
Add salt before tasting the food (Often)	(n, %) ^a	13 (33.3)	11 (27.5)	8 (19.5)	0 (0.0)	9 (22.0)	1 (2.4)
	Mean $\pm$SD ^b	0.33 $\pm$ 0.47	0.28 $\pm$ 0.45	0.20 $\pm$ 0.40	0.00 $\pm$ 0.00	0.22 $\pm$ 0.42	0.02 $\pm$ 0.15
	P-value ^c	0.160		0.003		0.003	
Did you try to use spices to reduce salt (Yes)	(n, %) ^a	14 (35.9)	13 (33.3)	12 (29.3)	31 (75.6)	16 (39.0)	29 (70.7)
	Mean $\pm$SD ^b	0.36 $\pm$ 0.48	0.33 $\pm$ 0.47	0.29 $\pm$ 0.46	0.76 $\pm$ 0.42	0.39 $\pm$ 0.46	0.71 $\pm$ 0.45
	P-value ^c	0.323		0.001		0.001	

¹ Answer options for practice questions included often, sometimes, and never. Only answers of often are presented, each often answer earn 1 score.

^aData presented as number and frequency. ^bData presented as Mean $\pm$ standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_Table. 4. 10

Food frequency questionnaire for Bread and bread products for study population

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Pita (Arabic bread)	1-3 times/week (n, %)	8 (20.5)	8 (20.5)	12 (29.4)	12 (29.4)	12 (29.4)	14 (34.1)
	4-7 times/week (n, %)	12 (30.8)	11 (28.2)	10 (24.4)	13 (31.7)	10 (24.5)	12 (29.4)
	> 1 time/day (n, %)	18 (45.90)	19 (48.7)	19 (46.3)	15 (36.6)	18 (43.9)	14 (34.1)
	Score -Mean±SD	3.17±0.94	3.2±0.95	3.12±0.98	3.00±0.95	3.07±0.98	2.93±1.14
	P-value	0.324		0.323		0.089	
Iranian bread	1-3 times/week (n, %)	6 (15.4)	7 (17.9)	7 (17.1)	6 (14.6)	8 (19.5)	10 (24.3)
	4-7 times/week (n, %)	6 (15.4)	5 (12.8)	6 (14.6)	3 (7.3)	5 (12.1)	3 (7.3)

	> 1 time/day (n, %)	0	0	0	0	1 (2.4)	1 (2.4)
	Score -Mean±SD	0.77±1.20	0.82±1.21	0.78±1.19	0.51±1.00	0.85±1.26	0.81±1.19
	P-value	0.534		0.070		0.160	
Sponge bread (Sammon)	1-3 times/week (n, %)	14 (35.9)	14 (35.9)	16 (39.0)	18 (43.9)	17 (41.7)	18 (43.9)
	4-7 times/week (n, %)	7 (18.0)	8 (20.4)	8 (19.5)	5 (12.2)	8 (19.5)	6 (14.6)
	> 1 time/day (n, %)	0	0	1 (2.4)	0	1 (2.4)	1 (2.4)
	Score -Mean±SD	1.26±0.67	1.33±1.24	1.46±1.27	1.24±1.16	1.59±1.24	1.42±1.12
	P-value	0.324		0.083		0.181	
Regag bread	1-3 times/week (n, %)	13 (33.3)	13 (33.3)	16 (39.0)	15 (36.6)	14 (34.1)	15 (36.6)
	4-7 times/week (n, %)	5 (12.8)	6 (15.4)	4 (9.8)	3 (7.3)	4 (9.8)	3 (7.3)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean±SD	1.00±1.18	1.07±1.21	1.07±1.15	0.95±1.12	0.98±1.15	0.95±1.11
	P-value	0.323		0.256		0.323	

Toasted bread	1-3 times/week (n, %)	17 (43.6)	16 (41.0)	19 (46.3)	21 (51.2)	18 (43.9)	22 (53.6)
	4-7 times/week (n, %)	11 (28.2)	11 (28.2)	12 (29.3)	9 (22.0)	13 (31.7)	10 (24.3)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean±SD	1.72±1.17	1.67±1.20	1.90±1.07	1.78±1.06	1.83±1.14	1.80±1.09
	P-value	0.534		0.123		0.083	
Manakish Zaatar (Thyme with bread)	1-3 times/week (n, %)	15 (38.5)	17 (43.6)	15 (36.6)	14 (34.1)	14 (34.1)	15 (36.6)
	4-7 times/week (n, %)	3 (7.5)	2 (5.1)	3 (7.3)	2 (4.9)	4 (9.7)	2 (4.9)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean±SD	1.00±1.12	1.03±1.09	0.95±1.12	0.83±1.07	0.98±1.80	0.88±1.08
	P-value	0.661		0.256		0.210	

^a Data presented as number and percentage. ^b Data presented as Mean ± standard deviation. ^c paired t-test according to time of measurements (Baseline vs endpoint) within the same group. ^d Each food frequency match with specific score; 1-3 times/week earn score 2, 4-7 times/week earn score 3, and > 1 time/day earn score 4.

Appendix 22_Table. 4. 11

Food frequency questionnaire for Cheeses and Buttermilk for the study population

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Cheddar Cheese	1-3 times/week (n, %) ^a	20 (51.2)	19 (48.7)	19 (46.3)	22 (53.7)	19 (46.3)	20 (48.8)
	4-7 times/week (n, %)	4 (10.2)	5 (12.8)	3 (7.3)	2 (4.9)	2 (4.9)	1 (2.43)
	> 1 time/day (n, %)	2 (5.1)	2 (5.1)	2 (4.9)	1 (2.4)	1 (2.4)	1 (2.4)
	Score ^d -Mean± SD ^b	1. 54±1.28	1.56 ±1.25	1.40± 1.27	1.27±1.36	1. 17±1.16	1.15±1.16
	P-value ^c	0.323		0.098		0.323	
Haloumi Cheese	1-3 times/week (n, %)	15 (64.1)	13 (33.3)	16 (39.0)	18 (43.9)	14 (34.1)	16 (39.0)
	4-7 times/week (n, %)	5 (12.8)	4 (10.2)	3 (7.3)	1 (2.4)	5 (12.2)	4 (9.8)
	> 1 time/day (n, %)	1 (2.6)	2 (5.1)	2 (4.9)	1 (2.4)	1 (2.4)	0
	Score -Mean± SD	1.20±1.25	1.12±1.31	1.23±1.27	1.08±1.14	1.25±1.27	1.10±1.15
	P-value	0.584		0.160		0.160	
Cream Cheese	1-3 times/week (n, %)	14 (36)	12 (29.3)	15 (36.6)	15 (36.6)	17 (41.5)	16 (39.0)
	4-7 times/week (n, %)	14 (36)	14 (34.1)	10 (24.4)	6 (14.6)	11 (26.8)	8 (25.2)
	> 1 time/day (n, %)	0	0	0	0	0	0

	Score -Mean± SD	1.74±1.27	1.68±1.24	1.50±1.24	1.20±1.21	1.68±1.19	1.33±1.21
	P-value	0.160		0.044		0.037	
Feta cheese	1-3 times/week (n, %)	8 (20.5)	10 (24.4)	6 (14.6)	7 (17.1)	8 (19.5)	7 (17.1)
	4-7 times/week (n, %)	2 (5.1)	2 (5.1)	2 (5.1)	1 (2.6)	3 (7.3)	2 (5.1)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	0.56±1.00	0.67±1.03	0.45±0.93	0.43±0.87	0.63±1.05	0.50±0.96
	P-value	0.378		0.323		0.256	
Butter milk	1-3 times/week (n, %)	15 (38.5)	12 (30.7)	13 (31.7)	15 (36.6)	12 (29.3)	14 (34.1)
	4-7 times/week (n, %)	6 (15.4)	8 (20.5)	7 (17.1)	7 (17.1)	9 (22.0)	7 (17.1)
	> 1 time/day (n, %)	3 (7.7)	4 (10.3)	4 (9.8)	1 (2.4)	3 (7.3)	2 (4.9)
	Score -Mean± SD	1.53±1.35	1.64±1.44	1.58±1.43	1.38±1.27	1.57±1.40	1.43±1.34
	P-value	0.044		0.073		0.160	

^aData presented as number and percentage

. ^bData presented as Mean ± standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

^d Each food frequency match with specific score; 1-3 times/week earn score 2, 4-7 times/week earn score 3, and > 1 time/day earn score

Appendix 22_Table. 4. 12

Food frequency questionnaire for the intake of processed foods

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Indomie (Instant noodles)	1-3 times/week (n, %) ^a	9 (23.1)	8 (19.5)	13 (31.7)	14 (34.1)	11 (26.8)	12 (29.3)
	4-7 times/week (n, %)	3 (7.7)	4 (9.8)	5 (12.2)	2 (4.9)	2 (4.9)	3 (7.3)
	> 1 time/day (n, %)	2 (5.1)	1 (2.6)	1 (2.4)	0	2 (4.9)	0
	Score ^d -Mean± SD ^b	0.90±1.3	0.82±1.23	1.13±1.26	0.85±1.08	0.90±1.25	0.78±0.17
	P-value ^c	0.474		0.062		0.230	
Canned vegetables	1-3 times/week (n, %)	4 (9.8)	5 (12.8)	5 (12.2)	7 (17.1)	5 (12.2)	6 (14.6)
	4-7 times/week (n, %)	1 (2.6)	2 (5.1)	2 (4.9)	1 (2.4)	3 (7.3)	3 (7.3)
	> 1 time/day (n, %)	0	1 (2.6)	1 (2.4)	0	1 (2.4)	0
	Score -Mean± SD	0.28±0.76	0.51±1.07	0.50±1.06	0.43±0.87	0.58±0.18	1.01±0.16
	P-value	0.130		0.083		0.160	
Dressing oil	1-3 times/week (n, %)	10 (25.6)	8 (20.5)	13 (31.7)	14 (34.1)	8 (19.5)	12 (29.3)
	4-7 times/week (n, %)	2 (5.1)	3 (7.7)	4 (9.8)	1 (2.4)	7 (17.1)	2 (4.9)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	0.67±1.03	0.56±1.00	0.95±1.15	0.78±1.03	0.93±1.24	0.75±1.06
	P-value	0.378		0.109		0.051	
Ketchup	1-3 times/week (n, %)	13 (33.3)	11 (28.2)	12 (29.3)	14 (34.1)	10 (24.4)	13 (31.7)
	4-7 times/week (n, %)	6 (15.4)	7 (18.0)	8 (19.5)	4 (9.8)	7 (17.1)	4 (9.8)
	> 1 time/day (n, %)	2 (5.1)	1 (2.6)	3 (7.3)	1 (2.4)	2 (4.9)	1 (2.4)

	Score -Mean± SD	1.33±1.34	1.21±1.32	1.58±1.41	1.10±1.24	1.23±1.39	1.05±1.24
	P-value	0.201		0.020		0.109	
Tomato paste	1-3 times/week (n, %)	14 (35.9)	15 (38.5)	17 (41.4)	22 (53.7)	18 (43.9)	20 (48.8)
	4-7 times/week (n, %)	9 (23.1)	6 (15.4)	8 (19.5)	4 (9.8)	8 (19.5)	6 (14.6)
	> 1 time/day (n, %)	1 (2.6)	3 (7.7)	2 (4.9)	1 (2.4)	3 (7.3)	1 (2.4)
	Score -Mean± SD	1.51±1.30	1.54±1.35	1.65±1.27	1.50±1.13	1.73±1.28	1.55±1.17
	P-value	0.570		0.286		0.303	
Pickles	1-3 times/week (n, %)	13 (33.3)	11(28.2)	12 (29.3)	7 (17.1)	12 (29.3)	8 (19.5)
	4-7 times/week (n, %)	3 (7.7)	2 (5.1)	3 (7.3)	1 (2.4)	5 (12.2)	2 (4.9)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	0.90±1.12	0.82±1.17	0.83±1.10	0.53±1.04	0.98±1.20	0.70±1.13
	P-value	0.661		0.123		0.182	
Chicken cubes (Low salt)	1-3 times/week (n, %)	7 (18.0)	9 (23.1)	6 (14.6)	10 (24.4)	5 (12.2)	8 (19.5)
	4-7 times/week (n, %)	2 (5.1)	2 (5.1)	2 (4.9)	3 (7.3)	2 (4.9)	3 (7.3)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	0.51±0.97	0.62±1.10	0.45±0.93	0.65±1.03	0.40±0.90	0.63±1.05
	P-value	0.186		0.132		0.118	
Chicken cubes (Regular salt)	1-3 times/week (n, %)	13 (33.3)	16 (41.0)	13 (31.7)	19 (46.3)	11 (26.8)	15 (36.6)
	4-7 times/week (n, %)	10 (25.6)	10 (25.6)	9 (22.0)	0	12 (29.3)	6 (14.6)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	1.44±1.27	1.60±1.21	1.33±1.27	0.95±1.01	1.45±1.31	1.20±1.20
	P-value	0.279		0.007		0.031	

^a Data presented as number and percentage. ^b Data presented as Mean ± standard deviation. ^c paired t-test according to time of measurements (Baseline vs endpoint) within the same group. ^d Each food frequency match with specific score; 1-3 times/week earn score 2, 4-7 times/week earn score 3, and > 1 time/day earn score 4

Appendix 22_Table. 4. 13

Food frequency questionnaire for the intake of Fast foods and processed meats

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Pizza (cheese, meat, vegetables)	1-3 times/week (n, %) ^a	8 (20.5)	66 (5.4)	6 (14.6)	7 (17.1)	8 (19.5)	6 (14.6)
	4-7 times/week (n, %)	2 (5.1)	3 (7.7)	3 (7.3)	1 (2.4)	3 (7.3)	1 (2.4)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD ^b	0.56±1.00	0.54±1.02	0.53±1.01	0.43±0.87	0.63±1.05	0.38±0.84
	P-value ^c	0.767		0.210		0.077	
Fast Foods	1-3 times/week (n, %)	23 (59.0)	21 (53.8)	27 (65.9)	29 (70.7)	19 (46.3)	22 (53.7)
	4-7 times/week (n, %)	7 (17.9)	8 (20.5)	5 (12.2)	3 (7.3)	8 (19.5)	5 (12.2)
	> 1 time/day (n, %)	0	0	1 (2.4)	0	0	0
	Score -Mean± SD	1.72±1.02	1.69±1.08	1.83±0.96	1.75±1.03	1.55±1.15	1.48±1.08
	P-value	0.767		0.520		0.083	
Hotdogs	1-3 times/week (n, %)	5 (12.8)	4 (10.3)	4 (9.8)	5 (12.2)	4 (9.8)	4 (9.8)
	4-7 times/week (n, %)	2 (5.1)	2 (5.1)	2 (4.9)	1 (2.4)	2 (4.9)	1 (2.4)
	> 1 time/day (n, %)	0	1 (2.6)	1 (2.4)	0	1 (2.4)	0
	Score -Mean± SD	0.41±0.91	0.46±1.05	0.45±1.04	0.33±0.80	0.38±0.87	0.28±0.75
	P-value	0.160		0.083		0.210	
Luncheon meat	1-3 times/week (n, %)	8 (20.5)	10 (25.6)	8 (19.5)	7 (17.1)	6 (14.6)	8 (19.5)
	4-7 times/week (n, %)	3 (7.7)	2 (5.1)	1 (2.4)	1 (2.4)	3 (7.3)	2 (4.9)

	> 1 time/day (n, %)	1 (2.6)	0	1 (2.4)	0	0	0
	Score -Mean± SD	0.74±1.18	0.67±1.03	0.56±1.00	0.44±0.88	0.54±1.02	0.56±1.00
	P-value	0.083		0.257		0.676	

^aData presented as number and percentage.

^bData presented as Mean ± standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

^d Fast foods served at restaurants these includes (KFC, MAC, Hardees, Pizza)

Appendix 22_Table. 4. 14

Food frequency questionnaire for the intakes of table salt

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Table salt	1-3 times/week (n, %) ^a	13 (33.3)	9 (23.1)	9 (22.0)	18 (43.9)	7 (17.1)	17 (41.5)
	4-7 times/week (n, %)	21 (53.8)	20 (51.3)	23 (56.1)	18 (43.9)	26 (63.4)	18 (43.9)
	> 1 time/day (n, %)	3 (7.7)	5 (12.8)	5 (12.2)	0	3 (7.3)	1 (2.4)
	Score -Mean± SD ^b	2.70±0.77	2.51±1.14	2.68±0.97	2.25±0.90	2.60±1.00	2.30±0.94
	P-value ^c	0.420		0.001		0.001	

^aData presented as number and percentage. ^bData presented as Mean ± standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_Table. 4. 15

Food frequency questionnaire for the intakes of salt substitutes

		Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
		Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Spices and Herbs	1-3 times/week (n, %)	10 (25.6)	14 (35.9)	12 (29.3)	13 (31.7)	14 (34.1)	14 (34.1)
	4-7 times/week (n, %)	20 (51.3)	18 (46.1)	19 (46.3)	23 (56.1)	18 (43.9)	21 (51.2)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	2.05±1.21	1.74±1.25	2.10±1.15	2.43±0.95	2.02±1.14	2.22±0.93
	P-value	0.057		0.0260		0.767	
Lemon	1-3 times/week (n, %)	14 (35.9)	17 (41.5)	13 (31.7)	16 (39.0)	12 (29.3)	14 (34.1)
	4-7 times/week (n, %)	6 (15.4)	5 (12.8)	8 (19.5)	10 (24.4)	7 (17.1)	9 (22.0)
	> 1 time/day (n, %)	0	0	0	0	0	0
	Score -Mean± SD	1.18±1.20	1.26±1.18	1.28±1.25	1.59±1.21	1.15±1.12	1.41±1.25
	P-value	0.520		0.089		0.106	

^aData presented as number and percentage. ^bData presented as Mean ± standard deviation. ^cpaired t-test according to time of measurements (Baseline vs endpoint) within the same group.

Appendix 22_Table. 4. 17

Physical activity for study population using IPAQ questionnaire

	Control (n=39)		WhatsApp (n=41)		Brochures (n=41)	
	Mean ± SE^a		Mean ± SE		Mean ± SE	
	Baseline	Endpoint	Baseline	Endpoint	Baseline	Endpoint
Low Intensity (min/week)	205.8±25.4	195.6±26.6	198.0±20.3	176.5±17.1	181.4±16.4	191.8±20.2
P-value^b	0.692		0.482		0.398	
Low Physical activity level n (%) ^c	29 (74.4)	30 (76.9)	30 (73.2)	29 (70.7)	29 (70.7)	30 (73.2)
Moderate Intensity (min/week)	87.7 ±13.1	79.0±16.0	90.0±16.5	103.7±17.3	86.7±9.5	82.3±9.1
P-value^b	0.679		0.476		0.743	
Moderate Physical activity level n (%) ^c	9 (23.1)	9 (23.1)	10 (24.4)	11 (26.8)	11 (26.8)	10 (24.4)
High Intensity (min/week)	54.1±12.5	41.1±7.3	54.9±7.1	48.8 ±6.4	43.3±6.3	47.1±6.6
P-value^b	0.369		0.414		0.415	
High Physical activity level n (%) ^c	1 (2.6)	0	1 (2.4)	1 (2.4)	1 (2.4)	1 (2.4)

^a Data presented as Mean ± Standard error. ^b Independent-Samples T-test used to assessed Significance at p<0.05 according to gender

^c Forde C. (2005).

Appendix 22_ Table 5. 2

Summary tables for themes and sub-themes of the feedback of intervention group

Themes				
Educational Material	Digital platform/ communication tool	Feasibility	Barriers	Suggestions
Sub-themes				
Reading food label Identify food high/ low in salt Salt alternatives (species and herbs) Health hazard of high salt intake Positive effect of potassium intake on blood pressure/ CVD. Potassium rich food Soak and wash canned vegetables before using	WhatsApp (95%) Electronic brochure (5%)	Easy and simple to implement “If low salt products are available with distinguished colour or section in market” (50%)	Cannot differentiate between high /low salt products easily (17.5%) Low salt food / products not easily available in local market (45%). Not easily to accept taste of low salt food (27.5%) Our traditional way of foods preparation, cooking and presentation doesn't support to provide separated dishes with low salt dishes (32.5%) Outdoor food (restaurant) doesn't provide amount of salt or food labels of dishes (87.5%) Concerns about price of healthy food (15%)	To allocate a special section or with special colour or symbols or label for low salt foods/ products (95%) Provide low salt bread / bakery product with affordable prices (47.5%) Update restaurant menu with low salt food and provide food label or highlight alternative (62.5%) App application to identify food composition (7.5%) Provide nutrition education-awareness campaign focusing on sources and alternative of salt. (52.5%) Use social media as platform for education (30%)
	Sub-Sub-Themes Preference Reason Short WhatsApp messages (easy to be saved, read, resend, searched for it) (75%). Most common application used by different ages (85%).			