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Estimation of Salt Intake and its Relation to Knowledge and Attitude Regarding the Dangers of High Salt Intake Among an Urban Omani Population

A pilot study

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Abstract

Objectives: High salt consumption is a major risk factor for hypertension. Studies have shown dietary salt intake to be high in many parts of the world. The aim of this study was to assess the daily salt consumption by the urban population in Oman and to assess their knowledge and attitudes towards dietary salt. ***Methods***: This was a cross-sectional questionnaire-based study conducted between September to December 2017 in Muscat. We used previously validated questionnaires to assess salt intake and the knowledge and attitudes to salt intake. ***Results***: 345 responses were received out of 500 distributed questionnaires (response rate 69%) of which 300 responses (27.88 ± 7.9 years, 53.3% male) were included for analysis. 94% of the participants agreed that lowering salt in diet is important and nearly half the participants said that they were taking measures to reduce salt intake. However, the median salt intake was high at 10.5(7.3-15.1) gm salt/day. 90% of those questioned consume more than the maximum recommended amount of salt per

day. Salt intake was significantly higher in females and older age group (>40 years of age), There did not appear to be any correlation between awareness of the dangers of salt intake and the amount consumed. ***Conclusion***: The salt intake in our sampled population in Oman is high and does not depend on knowledge. Strategies should be designed to reduce salt intake by health education and increasing knowledge about complications of high salt intake among the urban population.
Keywords: dietaray sodium chloride; knowledge attitudes and practices.

Advances in knowledge

- This study demonstrates that the average salt intake in the Omani population is high (more than double the recommended levels)
- The knowledge regarding the dangers of high salt intake is high, but it does not translate into action

Application to patient care

- Patients should be advised to reduce their salt intake
- Patients should be educated about the different methods to reduce salt intake and the dangers of high salt in their diet

Introduction

Cardiovascular diseases (CVDs) are a leading cause of death and disability worldwide affecting more than 17.5 million people annually.[1] This is especially relevant in the Middle East region, which has seen dramatic transformations in its socio-economic situation over the last few decades fueled by rapid urbanization, migration and modernization and accompanied by significant changes to diet and lifestyle. This has led to an increase in the prevalence of cardiovascular risk factors such as diabetes, hypertension and obesity and a high incidence of CVD.[2-4] It is estimated that CVD account for more than 34 % of the deaths in the Middle east region.[5]

Hypertension is a major risk factor of CVD and it is estimated that 1 in 5 deaths and 7% of all disability can be attributed to suboptimal blood pressure control.[6] High salt intake is

considered to be a major risk factor for hypertension and is considered to be responsible for about one third of hypertension or around 300 million people worldwide.[7] In addition to hypertension, high salt intake is also found to be associated with Meniers disease, osteoporosis, and gastric and renal cell cancers. Modern western diets which are high in processed foods tend to have a high salt content and is considered a major global health issue. In fact the world health organization (WHO) has listed the reduction of dietary salt intake by 30% as one of its nine global targets to be achieved by the year 2025.[8]

As mentioned in the WHO recommendations, the ideal daily adult salt consumption should be $\leq$ 5g salt/day. However data from many countries have consistently shown that the dietary intake of salt far exceeds this.[9] Many countries have implemented community education schemes to educate their population about the harms of high salt intake and the need to reduce it.[10-12]

The dietary sources of sodium are different from one country and culture to another. For example, the top 10 sources in the United States are breads, pizza, sandwiches, cured meats, soups, burritos and tacos, savory snacks, chicken, cheese and eggs and omelets,[13] whilst in some Asian countries, soup, rice and yeast bread accounts for almost a third of the dietary salt source.[14-15]

In Oman, CVD accounts for around 39 % of all deaths and is a leading cause of morbidity and represents a major public health concern.[16] Hypertension is also fairly common with a prevalence of around 30% of the adult population.[17] According to the according to the national nutrition survey published in 2004, the average salt intake in the Omani population was about 11-12 g salt/day.[18] Many steps have been taken to try to reduce this intake to recommended levels.[19] These include reduction in the salt content in bottled water and bread and public education. However, the effect of these steps are not known.

The aim of this study was to assess the amount of salt intake by the urban population in Oman and compare with the reported levels from 2004. In addition, we also sought to

study the knowledge and attitudes of the urban population towards salt and whether this had any impact on their salt consumption.

Methods

This was a cross-sectional questionnaire- based study conducted among the urban population in Muscat, Oman, between September and December 2017. We used a convenience sampling method. The subjects were recruited from malls (during health promotional activities), university students, and staff, hospital staff and their relatives and patient relatives. The inclusion criteria were Omani nationals aged above 18 years, normotensive and non-diabetic, no evidence of CVD and not taking any medications for either hypertension nor diabetes or CVD. We excluded those below 18 years of age as well as those who have hypertension or diabetes or evidence of CVD and those who were taking medications for any of these conditions. The members of the public were approached and prior to filling in the questionnaire, the rationale and reason for conducting the study was explained to the participants and they signed a consent statement on the questionnaire.

The questionnaire itself was in three parts. The first part comprised of the demographic data of the participants including age, educational and employment status and eating habits. The second part of the questionnaire collected data on their knowledge attitudes and practices with regards to salt intake. This was based on a questionnaire devised by the WHO.[20] This was translated into Arabic by native professional Arabic speaker. It was then translated back into English to assess consistency. It was then piloted on non medical university students to see if there were any questions that could cause confusion.

The third part of the questionnaire was derived from a previous cross-sectional study from South Africa.[21] We chose this questionnaire as the dietary habits of south Africans are fairly similar to that in Oman. In addition, this questionnaire has been validated, the details of which have been published before. [21] However we made a few changes to the questionnaire by deleting some of the foods that are not consumed in Oman and substituting them with similar food types. This questionnaire was also translated into

Arabic and then back into English to assess consistency. This questionnaire is free to use and does not require any license. However permission was obtained from the authors of the questionnaire prior to the study (private communication).

Calculation of the daily salt intake of every participant from the questionnaire was done according to the formula devised by Charlton et al. [21] This was calculated by multiplying the average of chosen frequency with the Sodium (Na) content per serving. The sum of the 36 categories would then give the total amount of Na intake (mg/day) of a participant. Conversion of Na (mg/day) to salt (g/day) is obtained by dividing by 1000 and multiplying by 2.5. The equation applied was $S(g/d)=[(f_{n1}xNa_{n1})+(f_{n2}xNa_{n2})+ +f_{n36}+Na_{n36})\}$ x 2.5/1000 where S(g/d) is the daily salt in grams per day, f_n is the chosen frequency of the food category "n" and Na_n is the sodium in one serving of the food category "n".

The sample size was calculated based on the formula for calculating the number required for a cross sectional prevalence study. The sample size $n= (Z_{1-\alpha/2})^2 (\sigma)^2 /d^2$; where $(Z_{1-\alpha/2})$ is the Standardized value for the corresponding level of confidence. (99% confidence interval or 1% type I error it is 2.58), σ is the standard deviation based on previous studies (value of 5gm was used for our calculations),[9] and d is the margin of error (set at 1gm). Using these values we derived a sample size of 166. However, we recruited a higher number of individuals.

Ethical approval was granted by the medical research ethics committee, college of medicine and health sciences at sultan Qaboos University, Muscat, Oman. The data were analyzed using SPSS version 21 software. All data are described as either percentages or mean $\pm$ standard deviation or median (interquartile range). Chi-square test, students t-test or non parametric (Mann Whitney-U test or Kruskall Wallis test) tests were used as appropriate. Spearmans coefficient of correlation was used to assess correlation between the salt intake (non normally distributed data) and age. A p value of <0.05 was considered to be significant.

Results

Five hundred questionnaires were distributed of which three hundred and forty five responses were received (response rate of 69%). Forty-five responses were excluded from the study as they were incompletely filled. Therefore, responses obtained from 300 participants, (mean age 27.88 $\pm$ 7.9 years, range from 18 to 56; 53.3% male) were included in the final analysis. All the participants live in Muscat. Forty four percent of the participants had a secondary school degree or less and more than half (54.7%) of the participants were not in active employment (either homemaker, unemployed or retired) [Table 1].

More than half of participants (55.5%) agreed that lowering the salt/sodium in their diet is somewhat important. Almost half of participants (42.4%) were never or rarely adding salt at the table. Half of participants said they tried to control their salt consumption on a regular basis (50%). 79% of the respondents felt that they were consuming either just the right amount (65.2%) or lower than recommended (14%). Most of participants believed that a high salt diet causes serious health diseases (89.3%). Most of the participants (92.5%) did not know what the recommended daily salt intake per person per day is. Whilst many (71.3%) believed that excessive salt consumption can cause hypertension, not many were aware of the other conditions that can be caused by excess salt (16% kidney stone, osteoporosis (1.6%) and 11% thought it causes all conditions listed). Table 2 lists the responses to the various questions.

When investigating factors that contributed to the knowledge regarding salt, we found that 67% of those with Master/Ph.D. degree and 44% bachelor's degree's participants thought that lowering salt consumption was very important while only 27.5% of high school diploma holders or less thought it was very important to lower salt intake ($p=0.02$). Similarly, 71.3% of those who are older than 40 years said they take actions to control salt consumption as compared to 43.5% of participants whose age was below 40 take some steps to reduce their salt consumption ($p=0.005$)

The median salt intake in our cohort was 10.5(7.3-15.1) gm/day. Out of 300 participants 270 (90%) participants had salt intake more than the WHO recommended amount of 5 g/day while only 30 (10%) had intake ≤ 5 g/day. Table 3 describes the characteristics of those subjects with normal and high salt intake. There was a higher proportion of males (73.3%), those who had attended up to secondary school (70%) and those who were unemployed (73.3%) who had normal salt intake as compared to women(26.6%), those who had a diploma degree or higher (30%) or those in active employment (26.7%) respectively.

Table 4 shows the calculated salt intake by the different groups. The median salt intake by males was 9.9 (6.1-14.4) g/day compared to 11.1 (7.9-15.6) g/day by females (p=0.034). 86.3% of male participants had salt intake more than the WHO recommended amount (≥5 g/day) compared to 94.3% of female participants who consumed more than the recommended levels.

When analyzed based on age groups (18-29 years), (30-39 years) and (≥40 years), we found that the salt intake was the highest in the older age group (≥40 years) at 11.82(9.5-13.4) gm/day and the lowest intake was by the youngest group (18-29 years) at 10.3(7.12-15.2)gm/day (p-value=0.011). However, there was no overall correlation between age and the amount of salt consumed (spearmans coefficient of correlation =0.06, p=0.27)

There was no difference between the employment groups (10.7 (7.8-14.9) gms/day for unemployed vs 10.4 (7.1-14.8)gm/day for the employed, p=0.8) or education level (10.02 (6.1 – 15) for secondary school and lower vs 10.6 (7.6-15.1) for diploma holder and higher, p =0.4) with regards to salt intake.

The three highest foods contributing to salt intake in the sample in order are fish biltong which is dried salty fish, white bread and soup. The averages of sodium intake in fish biltong (dried salty fish), white bread and soup are 469.1 mg Na/day, 386.8 mg Na/day and 370.4 mg Na/day respectively.

Discussion

This study assessed the amount of dietary salt intake in Oman among a healthy population and corelated it with their awareness of the dangers of high salt intake. Due to widespread use of sodium in food processing and extensive distribution of sodium in food, presence of sodium in drinking water and extensive use of salt as table salt, the accurate measurement of salt intake is difficult.

Our study found that the median daily salt intake was 10.5(7.3-15.1) gm/day which was similar to the previous reports and is similar to that from other countries in the Arabian gulf region.[19,22] The median salt intake of women in our study is higher than that of the men. This is contrary to many other studies which found the salt intake in males to be more than females.[23,24] However, few studies have shown women consume more salt than men such as in Japan [25] while some studies found no difference between the two genders.[26] These different results could be because of cultural differences among the different populations or indeed the method used to assess salt intake. Eating habits between the genders can vary considerably according to the culture. In some cultures, the men tend to eat out more whilst the women stay at home and tend to eat more home cooked meals.[26]

Awareness regarding the dangers of salt intake in our study was high, as reflected in other recent studies from the region.[22,27] However this did not translate into actual reductions in the amount of salt consumed. We found that the youngest age group (18-28 years) had the lowest salt intake compared to other two groups, although on the practices questionnaire, they were less likely than the older group to take actions to reduce salt. Similarly, we found that participants who achieved a diploma degree or higher claimed to take actions to reduce salt intake, but there was no difference in the amount of salt consumed. Though some studies have shown that salt consumption decreases with increasing educational status, [28] most studies show that education alone or awareness in itself is inadequate in reducing salt intake.[29] Similarly employed participants tended to have a slightly higher salt intake compared to the unemployed participants. This also

could be a reflection of the busy lifestyle where the employed participants would have had to eat outside whilst those at home probably had more home cooked meals.

In our study the major food types which contribute to high salt intake are fish biltong, which is a salty dried fish, bread and soup respectively. The major processed foods contributing for salt intake are different among populations. For example, in Kuwait the major foods contributing for salt intake are Kuwaiti composite dishes, bread and sandwiches and pastries [19] whilst in the Netherlands the major sources are breads and cereal products, cheese and meat.[30]

One of the main issues that hinder the reduction of salt intake by the public is their perception of what is recommended and what is high salt intake. In our survey, although almost none of the respondents knew what the recommended level of dietary salt intake is, majority of them still felt that they felt they were consuming just the right amount or indeed even less, while in reality were consuming a high amount of salt. Even those who were claiming to take steps to reduce their salt intake were also consuming a high amount. It is imperative to increase awareness of the presence of high levels of salt in processed foods and in other routinely consumed foods. Increasing awareness of what is normal or high dietary salt intake and the importance of avoiding high salt containing foods is key to tackling the problem of high dietary salt intake.[9,11,12]

The major limitation of our study was the lack of urinary sodium estimation to validate the responses of the individuals making the findings unreliable. However, the questionnaire that was used was validated previously.[21] This being a questionnaire-based study, there are the inherent limitations of such a study whereby patients tend to answer what they feel they should be doing rather than what they are actually doing[31] and hence the amount of salt consumed might be even higher than what we have obtained by the questionnaire. However, this was a pilot study and our intention was to get a general feel for the amount of salt consumption in the country.

The sample size was small and this would affect the generalizability of the study findings. In addition, our survey was limited to the Muscat region, which is urban, and did not take into consideration the vast geographical extent of Oman. It is highly likely that in rural parts of the country, the diet is mainly freshly cooked food and therefore the salt content would vary significantly. Another limitation is that the questionnaire contains only 36 food categories which contain 50 mg Na/serving or more. Many food items which have less than 50 mg Na/serving were not included in the questionnaire. Therefore, it is likely that the actual salt intake might be higher than what was calculated.

Another possible limitation is that the questionnaire was established with referenced sodium amount for each serving according to south African food. The Omani food and serving size may contain different amount of sodium, but we do not have the reference for the sodium content in Omani foods. We cannot categorically state that the salt intake is what we have found, though it gives us an idea of the salt intake in the urban population of Oman. This, along with other similar studies from the region will help shape future public health initiatives to tackle the problem of high dietary salt.

Conclusion

Despite many health education campaigns and public awareness programs, the level of salt consumption in our small sample was high. There was a high level of awareness, but this did not translate into action. More needs to be done to help people reduce the amount of salt in their diet by means of more education and also perhaps on food manufacturers to reduce the amount of salt in commercially available food.

Authors' Contribution

MMS was involved in data collection and manuscript writing. AHZA and QAKA was involved in data collection. KA was contributed to manuscript writing. SKN was involved in data analysis and manuscript writing.

Conflict of Interest

The authors declare no conflicts of interest.

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410 Demographic information of the participants :**Table 1**

Characteristics	**Total sample (n = 300)**	**Percentage (%)**
Age (mean=28.25+7.9) *18-28* *29-39* *≥40*	 146 102 52	 48.7 34.0 17.3
Gender *Male* *Female*	 163 137	 54.3 45.7
Educational level *Primary school or less* *Secondary school* *Diploma's degree* *Bachelor's degree* *Master's degree/Ph.D degree or more*	 23 115 42 114 6	 7.7 38.3 14.0 38.0 2.0
Employment Status *Employed* *Student* *Retired/Unemployed*	 136 126 38	 45.3% 42% 12.7%

411

412 **Table 2**: Responses to the various attitude and knowledge and practice questions

Parameters	**RESPONSES**
Attitude toward salt intake	
How important is lowering the salt/sodium in your diet?	
Not at all important	17(5.7%)
Somewhat important	165(55%)
Very important	118(39.3%)
What is your opinion regarding the amount of salt you consume?	
Too low/low	42 (14%)
Just right	196(65.2%)
High/Too high	40(13.6%)
Don't know	22(7.2%)
Behavior related to salt intake	
Do you add salt to food at the table?	
never/rarely	127(42.3%)
sometime	81(27%)
often/always	92(30.7%)
Do you add salt during cooking	
Never/sometimes	33 (11%)
Mostly/always	267 (88%)
Do you routinely check the salt content on food labels before purchasing them?	
Yes	77(25.7%)
No	223(74.3%)
Do you do anything on a regular basis to control your salt intake?	
Yes	129(43%)
No	151(50.4%)
Don't know	20(6.6%)
Knowledge related to salt intake	
Do you think that a high salt diet can cause serious health problems?	
Yes	268(89.3%)
No	9(3%)
Don't know	23(7.7%)
Can high salt intake cause the following diseases?	
Hypertension	214(71.3%)
Kidney stones	48(16%)
Osteoporosis	5 (1.6%)
All of the above	33(11%)

Do you know what is the recommended maximum salt intake per person per day?	
Yes	23(7.45%)
No	277(92.55%)

413

414 **Table 3**: Differences among the groups with normal and high salt intake

	Normal salt intake (n=30)	High salt intake (n=270)	P value
Age (years)	24.5±6.7	28.2±7.9	0.1*
Gender			
Male(163)	25(15.3%)	138(84.7%)	0.02
Female(137)	6 (4.3%)	131(95.7%)	
Employment Status			
Employed(136)	8 (5.8%)	128(94.2%)	
Student/Retired/Unemployed (164)	22(13.4%)	142(86.6%)	0.03
Educational level			
Secondary school or below(138)	25(18.1%)	113(81.9%)	
Diploma's degree or higher(162)	6(3.7%)	156(96.3%)	0.002
Actively takes steps to reduce salt intake			
Yes (129)	10(7.7%)	121(92.3%)	
No(151)	16(10.5%)	133(89.5%)	0.43.
Don't know (20)	4(20%)	16 (20%)	
Aware of the dangers of high salt intake			
Yes(268)	28(10.4%)	240(89.6%)	
No/don't know(32)	2(6.2%)	30(93.8%)	0.41

415 *Values quoted are number (percentage of the horizontal row)*

416 *Analysis by Chi-square test except * which is by students t-test*

417

418 **Table 4**: Calculated median Salt intake in gm/day (Interquartile range) by the different

419 groups

Group	Salt intake (gm/day)	P value
Age group(years)		
>40(n=183)	11.8(9.5-13.4)	
30-39(n=93)	10.6(7.6-15.8)	
18-29(n=24)	10.3(7.12-15.2)	0.01*
Gender		
Males(n=163)	9.9 (6.1-14.4)	
Females(n=137)	11.1(7.9-15.6)	0.03
Educational status		
Secondary school or lower(n=138)	10.02(6.1-15.2)	0.4
Diploma degree or higher(n=162)	10.6(7.6-15.4)	
Employment status		
Employed(n=136)	10.4(7.1-14.6)	
Unemployed(n=164)	10.7(7.8-14.9)	0.8

420 *Analysis by Mann-Whitney test except for *which is by Kruskal-Wallis*