ORIGINAL ARTICLE

Efforts on Reducing Dietary Salt Intake and its Associated Factors Among Medical Students in Universiti Putra Malaysia

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ABSTRACT

Introduction: Increased dietary salt intake can cause retention of fluid and subsequently an increase in blood pressure. Excessive salt consumption is one of the main causes of hypertension. This study aims to determine efforts done by medical students to reduce dietary salt intake and its associated factors in Universiti Putra Malaysia (UPM). **Methods:** This is a cross-sectional study. A self-administered questionnaire looking into efforts to reduce dietary salt intake adapted from the WHO STEPS questionnaire was used. There were six efforts altogether which were; limiting consumption of processed food; looking into sodium contents on food labels; purchasing low salt or sodium alternatives; avoid eating out; using spices when cooking; and doing things specifically to control salt consumption. Other factors in this questionnaire are on socio-demographic, practice of salt consumption, awareness, perception, attitude of dietary salt intake. **Results:** A total of 362 respondents participated. The majority had good awareness on salt intake (98.1%). A larger proportion of females significantly made the effort to buy low salt alternatives (p=0.003) and avoided eating out (p=0.048). On salt consumption practice, there were a bigger proportion of those that rarely ate processed food, that avoided eating out (p=0.08), bought low salt/sodium alternatives (p<0.001), looked at the sodium contents on labels (p=0.027) and limited the consumption of processed food (p<0.001). **Conclusion:** There are significant associations between the female gender and practice of eating processed food with efforts to decrease salt intake. More studies are recommended to look into assisting efforts to reduce salt consumption.

Keywords: Hypertension, Dietary salt, Awareness, Practice, Effort

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INTRODUCTION

Hypertension is a disease that has become a known worldwide public health problem. Its complication includes cardiovascular diseases including, heart disease, stroke and kidney failure. Apart from that it leads to premature mortality and morbidity (1,2). The Word Health Organization (WHO) reports that in 2008 around 40% of those aged 25 and above had hypertension. Furthermore, the number of people with high blood pressure (BP) worldwide, increased from 600 million in 1980 to 1 billion in 2008 (3). Surveys done in the last decade puts the prevalence of hypertension in the western countries to be 19-30% while eastern countries bore higher numbers of 25-48% (4). Looking into the Asian perspective, China reports 180 million people to have hypertension in the year 2000 and was estimated to increase to 100 million by the year 2025 (5). In Southeast-Asia (SEA), it is estimated that around a third of the adult population have hypertension, with 9.4% of total deaths caused by high BP annually in 2016 (6). The prevalence of hypertension in Malaysian adults bore similar numbers; reported to be around 30.3% in 2019 (7). Many epidemiological studies show an increasing trend of prehypertension or hypertension in students studying in university. For example a study among undergraduate students in India reported, 19.18% as prehypertensive while 13.88% were hypertensive (8). In another study among 237 undergraduate students in Malaysia, the prevalence of prehypertension and hypertension were reported as 42.9% and 12.8% respectively (9).

Awareness on hypertension is said to be high in western countries like England (66%), Canada and the United States (US), which is more than 80% (4). Awareness on hypertension in Asia is said to be variable between 37-64%. The highest (64%) is the level of awareness in Korea, while the lowest reported is in Indonesia (37%). Poor awareness has been associated with suboptimal hypertension control especially in the lower income

countries, making it top priority to identify and educate the public on the prevention, complications and impact of hypertension (4).

The World Health Organization (WHO) reports, dietary salt intake is one of the leading causes for hypertension (1). Furthermore, it is associated with increased risk of stroke, and cardiovascular mortality (10). However, even with the risks associated with high salt consumption, the general population consumes a high amount of salt (3). Because of these alarming statistics, the WHO advocates reducing salt consumption to under 5 grams per day (3,11). In Malaysia, it is estimated the intake is 8.7- 9.5 g of salt consumption per day, which is more than the recommended amount (12). The high salt intake is the same for younger adults (13), and even among the Ministry of Health (MoH) staff (14). Consumption of excessive salt has also been reported among Malaysian university students (13).

The behaviour of food consumption is closely linked to age, socio-cultural factors, education, and income (15–17). For example, some cultures believe food to have medicinal properties, such as food with extra chilies can cure sore throat. Foods like tamarind, banana leaves and tea have medicinal properties (15). In terms of age, the older generation are more prone to eating traditional food, whereby the younger generation have been reported to prefer food such as processed food, sweet beverages, larger portion food, skipping breakfast and eating out (15,16). Furthermore, a study in Lebanon looking into salt related behaviour found that the age group more than 40 years old scored higher in terms of favourable attitude towards salt reduction (17). Income also plays an important role in dietary behaviours. A paper that looks into migrant food behaviour report that the lower income group tend to purchase poorer quality food (15). The relationships are explained further in a cross-sectional online study done in Australia, where the researchers report that misconceptions, knowledge, and beliefs mediate the relationships between education, gender, and age with salt use (18).

There has been worldwide efforts made towards reducing salt intake, mainly collaboration with the industry to minimise the usage of salt. This is categorised as one of the most successful ways to decrease salt consumption in the community (19–21). However, these types of effort are often slow and involves public health policies in a country. Health education is reported to be a faster method. It can include many sectors including educators in schools, institutions of higher learning, healthcare centres and the community (21).

The obstacle to reduction of dietary salt intake among the population may be a lack of awareness of the problem and its complications. Without determining the level of awareness, attitude and practice of salt control, it is hard to develop and implement effective public education initiatives and policies. Any strategy to reduce dietary salt intake is related to change in food behaviour. Medical students are a group of people who have certain amount of knowledge concerning proper eating behaviours. However, the application of this knowledge especially on recommended daily salt intake may not be well-practised. Having the understanding on salt intake control is beneficial but does not automatically mean that this behaviour will be followed. This phenomenon is a concern because as medical students who are also future doctors, they are an advocate to the public to promote healthy dietary salt intake. If they themselves do not have enough knowledge and have poor practice on salt control, it will be difficult to create awareness on a larger scale. Therefore, it is beneficial to have an overview on behaviours such as efforts to limit salt intake among medical students because they are individuals who will work in a healthcare setting in the near future. Hence this study's objective is to determine the efforts being done by medical students on reducing their consumption of salt, and its associated factors, in Univeristi Putra Malaysia (UPM).

MATERIALS AND METHODS

This is a cross-sectional questionnaire study done among the medical students of Universiti Putra Malaysia (UPM) between April to August 2019. The sample size was calculated using the formula for two proportions by Lawanga and Lemeshaw (22), using the proportion of good and poor attitude towards salt intake which was 19% and 32% respectively (23). The sample size calculated is 385 considering the expected non-response rate of 10%.

The inclusion criteria were all registered medical students for academic year 2018/2019. The exclusion criteria were those who were acutely unwell (having a medical certificate or admission in a healthcare facility), those that have dropped out of the course and those who were on long leave. We used stratified random sampling to select the participants according to their year of study. All the 502 medical students of UPM were listed. The students were divided into strata according to their year of study. Numbers between 1 to N were assigned to each student within each year of study. Random sample was selected from each stratum. According to the sample size estimated, about 77% of students from each year of study (89 students from Year 1, 73 students from Year 2, 77 students from Year 3, 68 students from Year 4 and 78 students from year 5) were selected. The number of students selected were proportionate since sample size estimated was of the population size.

Tools

The questionnaire used in this study consists of two sections. The first section was socio-demographic and physical measurements, which consists of measurement of blood pressure (BP) and body mass index (BMI).

Quality control for blood pressure monitor was done by ensuring that the researchers use the same digital automatic blood pressure monitor for all respondents. The instrument was calibrated each time before using. Blood pressure readings were taken 3 times and the average reading was used for analysis. The researchers also calibrated the weighing machine each time before using . BMI was calculated by using the respondents' height (m) and weight (kg) using the formula. The unit for BMI is kg/m2. BMI for obesity is >25 kg/m2. Abnormal BP is "at risk for hypertension" and hypertension which is BP > 130/85 (2).

The second part of the questionnaire is adapted from WHO STEPwise approach to non-communicable disease (NCD) risk factor surveillance called the STEPS Instrument, version 3.1.(24). This tool is used to measure NCD risk factors and consists of several 'steps.' The first part of the STEPS instrument is a questionnaire, the second step gathers physical measurements including BP, height and weight, and the third step ascertain biochemical measurements including fasting blood sugar, total cholesterol, and urinary sodium and creatinine. This current study uses this part of the questionnaire that assess salt intake behaviour as done in previous studies (14,23,25)

There were three questions that assessed the practice on salt consumption. 1) "How often do you add salt or a salty sauce to your food before eating or while eating?" 2) "How often is salt, salty seasoning or a salty sauce added in cooking or preparing food in your household?" 3) "How often do you eat processed food high in salt?" The answer choices are a 6-point Likert Scale which are "always", "often", "sometimes", "rarely", "never", and "don't know". This is later grouped into "rarely" (rarely, never, don't know) & and "often" (always, often, sometimes).

One question assessed the perception of salt intake; "How much salt do you think you consume?" The answer choices are in the form of a 6-point Likert Scale which are "far too much", "too much", "just the right amount", "too little", "far too little", and "don't know". This is later grouped into "too little" (too little, far too little and don't know) and "right amount & too much" ("far too much, "too much" and "just the right amount").

Another one question that assessed the attitude on salt intake; "How important to you is lowering the salt in your diet?" The answer choices are in the form of a 4-point Likert Scale which are "very important", "somewhat important", "not important at all", and "don't know". This is later grouped into "unimportant" ("not important" at all and "don't know") and "important" ("very important" and "somewhat important")

One question assessed the awareness in the questionnaire. "Do you think that too much salt in your diet could cause a health problem?" 'Yes' means good awareness. 'No' and 'Don't Know' means poor awareness.

Lastly, there were 6 questions on efforts on reducing salt intake. This question asks, "Do you do any of the following to control your salt intake?" The details of the questions are in Appendix A. There are 6 questions altogether that asks of the efforts done such as limiting processed food consumption, looking at food labels for content, buying sodium alternatives or low salt content foods, use of spices as opposed to salt for food flavor when cooking, not eating out, and if they do anything to limit salt intake. For every question, answer 'Yes' means that the respondent has good effort of what is stated in the question, and 'No' means that the respondent has poor effort.

A pre-test was conducted on 40 non-medical students in UPM using the questionnaire before the data collection period. Feedbacks on the pre-test were obtained and amendments had been carried out accordingly. Consultation from 4 experts for content validity which were 2 family medicine specialists and 2 public health specialists was done to ensure that the contents met the requirements of the study.

Data Collection Technique

Data was collected by distributing self-administered questionnaire. The respondents were required to complete the questionnaire and return the questionnaire back to the researcher. The physical measurements (blood pressure, height and weight) of the medical students were also recorded during the data collection period. The respondents were seated for their blood pressure to be taken three times, and the average measurement was taken in mmHg. They were required to stand on our calibrated weighing scale to get their weight (in kg), and later their height (in cm) was measured by using a measuring tape against a wall.

Data Analysis

Data analysis was done using the Statistical Package for the Social Science (SPSS) version 25.0. Testing of normality was done on all data which were numerical and abnormally distributed continuous data was presented by median and interquartile range. A descriptive test was done on sociodemographic factors, BMI, blood pressure, awareness, practice of salt consumption, perception, and attitude with efforts on reducing salt intake using frequency, percentage, median and interquartile range. The analysis of associations between sociodemographic factors, BMI, blood pressure, awareness, practice of salt consumption, perception, and attitude, with efforts on reducing salt intake was done using the Chi-square test. $P<0.05$ was set as the significance level.

Study Ethics

Ethical clearance from Ethics Committee for Study

involving Human subjects of Universiti Putra Malaysia (JKEUPM) was obtained (JKEUPM-2019-206). Written consent from the respondents were obtained. Information obtained through the questionnaire was kept confidential.

RESULTS

Among 385 targeted respondents, 23 respondents (5.97%) were unable or did not agree to partake in this study. The respondents in this study is 362, therefore the response rate is 94.03%.

Sociodemographic factors and physical measurements

Table I shows the distribution of our respondents according to their socio-demographic factors. The median age of the respondents is 22 with an interquartile range of 2. The respondents were mostly female (67.4%), Malay (57.2%), and 55.2% were in their clinical year posting. For BMI, 51.4% of the respondents had normal BMI. The median of systolic blood pressure of the participants was 113mmHg, while the median diastolic blood pressure was 71mmHg. Median was used for blood pressure because it was not normally distributed.

Table I: Sociodemographic Factors and Physical Measurements of Medical Students in UPM

Characteristics N=362	Median (IQR)	n	%
Year of study			
Pre-Clinical		162	44.8
Clinical		200	55.2
Ethnicity			
Malay		207	57.2
Chinese		94	26.0
Indian		52	14.4
Others		9	2.5
Gender			
Male		118	32.6
Female		244	67.4
Body Mass Index (kg/m²)			
underweight		25	14.9
normal		186	51.4
Overweight		54	14.9
Obese		68	18.8
Blood Pressure (mmHg)			
SBP	113 (104-121)		
DBP	71 (65-78)		

Practice of salt consumption

For practice of salt consumption, 8.8% of medical students always add salty sauce or salt to their meals before consumption, and 24.9% always add salt to their food while cooking. About half of the respondents (51.9%) said they only sometimes eat processed food high in salt. This is portrayed in Table II.

Awareness, perception, and attitude on dietary salt intake

Out of all the medical students, 98.1% of them answered "Yes" to the question in the questionnaire of "Do you think that too much salt in your diet could cause a health problem?", indicating good awareness on salt consumption. More than half of the respondents (63.5%) perceive they consume just the right amount of salt. Based on the attitude on dietary salt intake, only 59.4% of the participants think that reducing dietary salt is "very important", while 38.7% of them think it's only somewhat important, while 1.4% thinks that it is not important at all (Table III).

Table II: Frequency and Percentage distribution of Practice of Salt Consumption

Questions on practice N=362	n	%
How often do you add salt or a salty sauce to your food before eating or while eating?		
Always	32	8.8
Often	62	17.1
Sometimes	120	33.1
Rarely	102	28.2
Never	45	12.4
Don't know	1	0.3
How often is salt, salty seasoning or a salty sauce added in cooking or preparing foods in your household		
Always	88	24.9
Often	145	40.1
Sometimes	91	25.1
Rarely	32	8.8
Never	3	0.8
Don't know	3	0.8
How often do you eat processed food high in salt?		
Always	9	2.5
Often	98	27.1
Sometimes	188	51.9
Rarely	65	18.0
Never	2	0.6
Don't know	0	0

Efforts done to reduce salt consumption

Table IV shows efforts to reduce dietary salt consumption. About 79.6% of the respondents limit consumption of processed foods. Using spices for better taste when cooking is reported in 61.0% of the respondents and 51.4% admits to "doing specific things to control their salt consumption". However, more than half of the respondents said 'no', thus have poor efforts on the steps taken to reduce dietary salt intake. These efforts are : looking at the food label for salt and sodium content (58.3%), buy sodium alternatives or low salt food (54.7%), and avoid eating out (60.5%).

Association of socio-demographic factors, physical measurements, practice of salt consumption, awareness,

Table III: Awareness, Perception, and Attitude on Dietary Salt Intake

Awareness, Perception, Attitude (N=362)	n	%
Awareness		
Do you think that too much salt in your diet could cause a health problem?		
Yes (Good Awareness)	355	98.1
No (Poor Awareness)	7	1.9
Perception		
How much salt do you think you consume?		
Far too much	7	1.9
Too much	96	26.5
Just the right amount	230	63.5
Too little	12	3.3
Far too little	2	0.6
Don't know	15	4.1
Attitude		
How important to you is lowering the salt in your diet?		
Very important	215	59.4
Somewhat important	140	38.7
Not at all important	5	1.4
Don't know	2	0

Table IV: Frequency and Percentage Distribution of Respondents by Efforts on Reducing Salt Intake

Effort Statements	Yes		No	
N=362	n	%	n	%
I. Limit consumption of processed food	288	79.6	74	20.4
II. Look at the salt or sodium content in food labels	151	41.7	211	58.3
III. Buy low salt/sodium alternatives	164	45.3	198	54.7
IV. Use spices other than salt when cooking	221	61.0	141	39.0
V. Avoid eating out	143	39.5	219	60.5
VI. Do things specifically to control your salt intake	186	51.4	176	48.6

perception, and attitude on dietary salt intake and efforts to reduce salt consumption.

Table V shows association of sociodemographic factors and physical measurements on all 6 efforts to reduce salt consumption. A significantly higher proportion of females make the effort to buy low salt products or salt alternatives (p=0.033) compared to males. This significant association is also the same with the effort of avoiding eating out (p=0.008). There was a significantly higher proportion of those that were obese (76.5%) reported to use spices other than salt when cooking compared to those that were not obese (57.5%), p=0.004.

Table VI shows how the practice of salt consumption is associated with all the 6 efforts of reducing dietary salt intake. There is significant association with practice 3 which asks "How often do you eat processed food high in salt?" with 4 out of the 6 efforts. These efforts are: limiting consumption of processed food (p<0.001), looking at the salt or sodium content in food labels (p=0.027), buying low salt/sodium alternatives (p<0.001), and avoiding eating out (p=0.008).

There were no other signification associations between year of study, ethnicity, BP, awareness, perception, and attitude with efforts to reduce dietary salt intake.

DISCUSSION

We report that nearly all the students had good awareness, noting that too much salt can cause health problems. Looking into efforts to reduce salt consumption, we report a majority of the UPM medical students try to limit their consumption of processed food. We found a larger proportion of female students significantly made the effort to buy low salt or salt alternatives and avoided eating out. In terms of practice, there was a significantly bigger proportion of those that practice rarely eating processed food that made efforts to reduce dietary salt intake.

There is good awareness on salt intake in this current study. This is comparable to another local study done among health staff in the Ministry of Health (MoH) of Malaysia which reported 94.7% level of good awareness (14). Another study in Indonesia done among urban costal community who mainly work as fishermen found the level of awareness to be 68.3%, however this is after some public health intervention (26). All report a relatively higher awareness than a study done in North India among urban slum population, which only reported a 39.5% level of good awareness (23). It is not surprising that level of awareness should be better in those working in the healthcare line or students studying where they are more likely to be given information of health and diet. Levels of awareness would increase if there was intervention done such as public health education programs. Hence, health education is of paramount as it has been reported that awareness and participation in health education programs were associated significantly with lower salt intake (26,27).

Intake of processed food are influenced by many factors, among them are the convenience to the consumer including the fact that they have a long shelf life, packaged well, and its easiness of preparation that can save time, cost and energy (28). A large proportion of students in this study (79.6%) report that they made the effort to "limit consumption of processed food", this is much higher than reported in a nationwide Malaysian study done among staff in the MoH (42.4%) and the North Indian urban slum population (14.2%). We postulate, the high percentage that made an effort to limit consumption of processed food among the medical students may be due to their background in health education where they are actively learning on health subjects. Environmental factors, policies and awareness level may be among the factors that motivates this strategy of limiting consumption processed food (28).

For efforts of "avoiding eating out", we found that it was higher among the North India population (53%), as

Table V: Association Between Socio-Demographic factors, Physical Measurements and Efforts to Reduce Dietary Salt Intake

Effort n (%) N=362	Limiting consumption of processed food		Looking at the salt or sodium content in food labels		Buying low salt/sodium alternatives		Using spices other than salt when cooking		Avoiding eating out		Doing things specifically to control your salt intake	
Gender	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Male	94 (79.7)	24 (20.3)	69 (58.5)	69 (58.5)	44 (37.3)	74 (62.7)	74 (62.7)	44 (37.3)	38 (32.2)	80 (67.8)	63 (53.4)	55 (46.6)
Female	194 (79.5)	50 (20.5)	142 (58.2)	142 (58.2)	120 (49.2)	124 (50.8)	147 (60.2)	97 (39.8)	105 (43.0)	139 (57.0)	123 (50.4)	121 (49.6)
p value	0.973		0.960		**0.033***		0.652		**0.048***		0.595	
Year of study	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Pre-clinical	128 (79.0)	34 (21.0)	59 (36.4)	103 (63.6)	77 (47.5)	85 (52.5)	106 (65.4)	56 (34.6)	64 (39.5)	98 (60.5)	77 (47.5)	85 (52.5)
Clinical	160 (80.0)	40 (20.0)	92 (46.0)	108 (54.0)	87 (43.5)	113 (56.5)	115 (57.5)	85 (42.5)	79 (39.5)	121 (60.5)	109 (54.5)	91 (45.5)
p value	0.817		0.066		0.444		0.124		0.999		0.187	
Ethnicity	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Malay	162 (78.3)	45 (21.7)	84 (40.6)	123 (59.4)	92 (44.4)	115 (55.6)	127 (61.4)	80 (38.6)	80 (38.6)	127 (61.4)	113 (54.6)	94 (45.4)
Non-Malay	126 (81.3)	29 (18.7)	67 (43.2)	88 (56.8)	72 (46.5)	83 (53.5)	94 (60.6)	61 (39.4)	63 (40.6)	92 (59.4)	73 (47.1)	82 (52.9)
p value	0.479		0.613		0.704		0.891		0.700		0.158	
Body Mass Index (BMI)#	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Non-obese	230 (78.2)	64 (21.8)	121 (41.2)	173 (58.8)	134 (44.9)	160 (55.1)	169 (57.5)	125 (42.5)	119 (40.5)	175 (59.5)	144 (49.0)	150 (51.0)
Obese	58 (85.3)	10 (14.7)	30 (44.1)	38 (55.9)	30 (44.1)	38 (55.9)	52 (76.5)	16 (23.5)	24 (35.3)	44 (64.7)	42 (61.8)	26 (38.2)
p value	0.193		0.655		0.827		**0.004****		0.431		0.057	
Blood Pressure (BP)[&]	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Normal	265 (80.1)	66 (19.1)	139 (42.0)	192 (58.0)	148 (44.7)	183 (55.3)	202 (61.0)	129 (39.0)	131 (39.6)	200 (60.4)	168 (50.8)	163 (49.2)
Abnormal[&]	23 (74.2)	8 (25.8)	12 (38.7)	19 (61.3)	16 (51.6)	15 (48.4)	19 (61.3)	12 (38.7)	12 (38.7)	19 (61.3)	18 (58.1)	13 (41.9)
p value	0.439		0.723		0.461		0.977		0.925		0.436	

*p<0.05, **p<0.01, # BMI Obese $\geq$ 25kg/m^2, [&] Abnormal BP is at risk for hypertension and hypertension BP $\geq$ 130/85

Table VI: Association of Practice and Efforts to Reduce Dietary Salt Intake

Practice/ Effort n(%) N=362	Limiting consumption of processed food		Looking at the salt or sodium content in food labels		Buying low salt/sodium alternatives		Using spices other than salt when cooking		Avoiding eating out		Doing things specifically to control your salt intake	
Practice 1: How often do you add salt or a salty sauce to your food before eating or while eating?	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Rarely [#]	116 (78.4)	32 (21.6)	60 (40.5)	88 (59.5)	70 (47.3)	78 (52.7)	98 (66.2)	50 (33.8)	62 (41.9)	86 (58.1)	73 (49.3)	75 (50.7)
Often [&]	172 (80.4)	42 (19.6)	91 (42.5)	123 (57.5)	94 (43.9)	120 (56.1)	123 (61.0)	91 (42.5)	81 (37.9)	133 (62.1)	115 (52.8)	101 47.2)
p value	0.643		0.707		0.526		0.094		0.439		0.515	
Practice 2: How often is salt, salty seasoning or a salty sauce added in cooking or preparing foods in your household?	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Rarely [#]	32 (84.2)	6 (15.8)	60 (40.5)	88 (59.5)	20 (52.6)	18 (47.4)	24 (63.2)	14 (36.8)	20 (52.6)	18 (47.4)	19 (50.0)	19 (50.0)
Often [&]	256 (79.0)	68 (21.0)	91 (42.5)	123 (57.5)	144 (44.4)	180 (55.6)	197 (60.8)	127 (39.2)	123 (38.0)	219 (62.0)	167 (51.5)	157 (48.5)
p value	0.452		0.959		0.337		0.778		0.080		0.857	
Practice 3: How often do you eat processed food high in salt?	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Rarely [#]	64 (95.5)	3 (4.5)	36 (53.7)	31 (46.3)	44 (65.7)	23 (34.3)	45 (67.2)	22 (32.8)	36 (53.7)	31 (46.3)	35 (52.2)	32 (47.8)
Often [&]	224 (75.9)	71 (24.1	115 (39.0	180 (61.0)	120 (40.7)	175 (59.3)	176 (59.7)	119 (40.3)	107 (36.3)	188 (63.7)	131 (51.2)	144 (48.8)
p value	**<0.001****		**0.027***		**<0.001****		0.256		**0.008****		0.876	

*p<0.05 **p<0.01, [#] Rarely (rarely, never, don't know), [&] Often (always, often, sometimes)

compared to this study (39.5%). This may be due to the students' lifestyle that rarely cook for themselves and opt the faster and easier option of buying ready-made food. In Brazil, a study done looking into practices of eating out found that the age group of 20-40 years, males, and living in urban areas had a higher proportion of eating out. They postulate this may be due to the different eating habits in the elderly population, availability of establishments selling food in the urban setting, and economic situations (29). Another research done among

university students reported that the eating behaviours are mainly influenced by food service cafeterias at their hostel and around university campus (13). This is likely the pushing factors for the students to eat out in this study as the campus offers an array of food that are available near the hostel.

In terms of gender, a higher proportion of female students made more effort to reduce dietary salt intake compared to their male counterparts. This finding is reflected in other studies which proved that Malaysian males had a higher sodium excretion than females (14,30). Furthermore, another study done in Nepal reported males to have a significantly higher salt intake than females (31). Meanwhile, another study in Poland found that women expressed the importance of having salt content information on food packaging if compared to men (32). Subsequently studies from Italy, Thailand and Saudi find, females not only to have better health behaviour as compared to males, but also knowledge on effects of high dietary salt intake (17,33,34). All this highlights the effect of gender on strategies of salt consumption. The reason behind this may be because men have been reported to have riskier behaviour than women, including health behaviours. For example, men are more prone to smoking and alcohol abuse. This could be due to the way some parts of the society that sees 'risky' behaviour as more masculine (35).

Increased salt intake generally has been associated with obesity and metabolic syndrome. A high dietary salt intake can predict higher consumption of sugar-sweetened beverages and thus increasing the risk of obesity (36). This study also found that those with obese BMI made the effort to use spices other than salt while cooking. While it is a noble effort to use other spices for taste other than salt, it is surprising that this effort is higher among those that are obese. We suggest the reason behind this may be due to the less sensitive nature of taste in higher BMI individuals that may need more spices for better taste. This is illustrated in a study among university students in Australia looking into oral sensitivity towards fatty acids in food. They found those that were hypersensitive were more perceptive of small differences in the fat content in food and had lower BMI (37).

The practice of reducing the consumption of processed food was significantly associated with efforts to reduce dietary salt intake. These efforts were looking into food label contents for salt content, buying low salt food or salt alternatives, and opting to avoid eating out. This is reflected in an earlier mentioned study in Brazil, whereby they report consumption of ultra-processed foods were higher when participants ate out of home compared with when they ate at home (29). There have been reports on increase concerns among the public with regards to processed food, especially in relations to health (38). Furthermore, a Polish study found that respondents that were more health conscious put more emphasis on knowing the salt content in food labels (32). Hence, we hypothesize that those that avoid eating processed food would do so due to health reasons and would make significant efforts to make a healthier choice.

However, it is worth mentioning that the domain of practice and efforts is a complex and not a straightforward one. One study looking into air-traffic controllers with a complex assignment reports their findings of this relationship stating that "effort and performance is increased with practice" (39). Therefore, it is not surprising there are significant associations in this study.

Limitations of this study includes that this study only focused on the medical students of Universiti Putra Malaysia (UPM) and is not representative of the whole country. Other than that, this is a cross-sectional study and is not able to determine the causal relationship. Furthermore, the questionnaires have limitations as it is self-administered and only the perception of the participants. Lastly, the questions on practice and awareness only have a single question which may not be very accurate in assessing the domains.

CONCLUSION

In conclusion, in our study done among medical students in UPM, we found high awareness of the health implications on consuming a diet high in salt. We report a significant association between gender with the effort on buying low salt or sodium alternatives and effort on avoiding eating out. There was also a significant association between the practice of eating processed food high in salt with efforts of reducing dietary salt intake. Information from this study can be used to look into measures that can be taken to assist in efforts to reduce salt consumption.

We suggest research into more objective efforts of salt intake among students such as excretion of urinary sodium. Apart from that, qualitative studies would be recommended to look into why the awareness is high, but not reflected in the practice and efforts to reduce dietary salt intake.

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