ORIGINAL ARTICLE

Practices related to dietary salt intake and associated factors among adults in Kuala Terengganu

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ABSTRACT

Introduction: Sodium plays a crucial role in regulating blood volume and osmotic balance; however, excessive intake can lead to fluid retention and increased blood pressure. Assessing knowledge, attitudes, and practices (KAP) related to salt consumption is a fundamental step in developing effective public health strategies to reduce excessive salt intake.

Materials and Methods: This cross-sectional study was conducted among 1,001 adults in Kuala Terengganu using a snowball sampling method to assess salt-related KAP and the factors associated with good dietary salt intake practices. Eligible participants were aged 18 years and above, proficient in Bahasa Malaysia, and had access to a smartphone with internet connectivity. Data were collected through a structured, pre-tested questionnaire administered via Google Forms and analysed using multiple logistic regression to identify factors associated with good dietary salt intake practices.

Results: Among the total respondents, 28.8% (95% CI: 26.0% - 31.6%) demonstrated good dietary salt intake practices. The study revealed a disconnect between knowledge and practice, indicating that awareness alone did not translate into healthier dietary behaviours. Multiple logistic regression analysis identified employment status (adjusted OR: 1.541, 95% CI: 1.166 - 2.038; p<0.001) and higher attitude scores (adjusted OR: 1.138, 95% CI: 1.065 - 1.215; p<0.001) as significant positive predictors of good dietary salt intake practices.

Conclusion: The findings provide valuable insights into salt consumption behaviours and associated factors among the self-selected adults in Kuala Terengganu. The results underscore the importance of targeted public health interventions, particularly those promoting positive attitudes and addressing employed populations, to encourage healthier dietary salt intake practices.

KEYWORDS:
Dietary salt intake, knowledge, attitude, practice, Kuala Terengganu

INTRODUCTION

Noncommunicable diseases (NCDs) are the leading cause of death globally,[1] necessitating cost-effective strategy to mitigate their impact. High sodium intake is a significant contributor to NCDs, particularly hypertension and its cardiovascular complications.[2] Sodium is essential for regulating blood volume and osmotic balance; however, excessive consumption can lead to fluid retention and increased blood pressure. According to the National Health and Morbidity Survey (NHMS) 2019, approximately 6.4 million Malaysians were living with hypertension.[3] However, compared to other countries, awareness and control of hypertension among Malaysians remain relatively low.[4]

Salt consumption behaviours are influenced by various sociodemographic factors, such as cultural practices, age, educational level, and income.[5] Individual knowledge, attitudes, and behaviours also play a role in salt intake.[6] Additionally, the increasing availability and affordability of highly processed, energy-dense foods rich in saturated fats, trans fats, sugars, and salt have contributed to changing dietary patterns.[7]

Recent studies have established a strong link between high sodium intake and adverse health outcomes, including cardiovascular diseases, gastric cancer, osteoporosis, cataracts, kidney stones, and diabetes.[8] Research indicates that reducing salt intake by less than 2g per day can lower systolic and diastolic blood pressure by approximately 3.47 mmHg and 1.81 mmHg, respectively.[9] The World Health Organization (WHO) recommends a daily salt intake of less than 5 grams (approximately 2g sodium) per person to prevent cardiovascular diseases.[10]

In Malaysia, the Malaysian Community Salt Survey (MyCoSS)[11] reported an average daily salt intake of 7.9 grams (3,167 mg sodium), surpassing WHO guidelines. While a majority of Malaysians are aware of the negative health impacts of excessive salt consumption and acknowledge the importance of reducing intake, their dietary practices are often not reflective of this awareness. For instance, 72.9% of MyCoSS participants reported adding salt during cooking, and 47.7% reported using additional salt, sauces, or condiments at the table.[11]

Recognizing the urgency of addressing high salt intake, the Ministry of Health Malaysia has implemented the Salt Reduction Strategy 2021-2025, aiming to reduce salt consumption by 30% by 2025 and alleviate the burden of NCDs. This initiative emphasizes creating environments that support healthy eating practices.[12] Understanding

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sociodemographic factors, along with community knowledge and attitudes toward dietary salt intake practice, is critical for cultivating such lifestyle changes. Insights from this research can guide stakeholders and drive actions to enhance public health outcomes.

This study aims to assess practices related to dietary salt intake and determine its associated factors among adults in Kuala Terengganu, Malaysia. By assessing their knowledge, and attitudes, the influencing factors of salt intake practice, this research seeks to fill existing gaps in understanding and contribute to the ongoing efforts to reduce NCD prevalence in Malaysia.

MATERIALS AND METHODS

A cross-sectional study was conducted from 27th November 2022 to 12th January 2023 to assess prevalence of dietary salt intake and its associated factors among adults in Kuala Terengganu. The study included individuals aged 18 years and above who could read and understand Bahasa Malaysia and had access to a smartphone with internet connectivity. The required sample size was calculated using the two-proportions formula, with a power of 80% and a significance level (α) set at $p<0.05$. This calculation considered several independent variables identified from previous literature, and after accounting for a 10% non-response rate, the final sample size was determined to be 1,001 participants. The study protocol and ethical aspects were approved by Universiti Sultan Zainal Abidin Human Research Ethics Committee (UHREC) (Study protocol code: UniSZA/UHREC/2022/444).

A snowball sampling method was applied to recruit eligible respondents in Kuala Terengganu. The recruitment process began with an initial distribution of the survey link through professional and social networks, including healthcare professionals, community groups, and public forums. Participants were then encouraged to share the survey link with their eligible contacts. The researchers did not have direct contact with all respondents, as the survey was disseminated primarily through peer sharing via digital platforms such as WhatsApp, Facebook, and email. A structured, pre-tested, and validated questionnaire developed in Google Forms was used as the data collection tool from all the eligible respondents for this cross-sectional study. The questionnaire items were gathered from prior studies,[11,13] and refined following discussions with experts and approval from UHREC. As for face validity, the first draft of the questionnaire was reviewed by two medical lecturers and three staff from the UniSZA Medical Faculty. Feedback was used to improve the questions, and a validation study was subsequently conducted in Kg. Teluk Pasu, Kuala Terengganu, involving 100 participants with characteristics similar to the actual study population. Amendments to the questionnaire were made based on their responses and reliability analysis.

The final questionnaire consisted of 42 items divided into four sections (I, II, III, IV). The first section comprised nine items on socio-demographic variables. The second section assessed knowledge about dietary salt intake, including the recommended daily amount, the relationship between salt and sodium, health risks of high salt consumption, and sources of information. Of the 23 items in this section, 17 assessed knowledge, while the remaining six explored sources of information. Correct answers were awarded two points, "Not sure" responses received one point, and incorrect answers received zero points, with a total possible score of 0 to 34. The third section evaluated attitudes towards dietary salt intake through four items using a five-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." Scores ranged from 4 to 20. The final section measured salt intake practices through six items on a Likert scale from "Never" (zero points) to "Always" (ten points), with total scores ranging from 0 to 60. Then, practices were categorized as "good practice" (0–30) or "poor practice" (31–60).

Participants were informed about the study objectives, the measures taken by the investigators to ensure strict confidentiality, and the voluntary nature of their participation. Consent was obtained prior to participation, and those who failed to complete all questions or did not respond within the data collection period were excluded.

Statistical analysis

Data were analysed using SPSS version 25. Descriptive statistics were used to summarize categorical variables as frequencies and percentages, and numerical variables as means with standard deviations or medians with interquartile ranges, depending on their distribution. Simple logistic regression was conducted to identify potential factors associated with dietary salt intake. Variables with a p-value <0.250 in univariable analysis and clinically significant variables were further analysed using multiple logistic regression. Forward and backward selection methods were employed, with variables entering the model at $p<0.05$ and removed at $p>0.10$. Ultimately, the forward selection method provided a parsimonious model which was used for further data analysis. Then, the model was subsequently evaluated using the Hosmer-Lemeshow goodness-of-fit test, overall classification accuracy, and the area under the receiver operating characteristic (ROC) curve. Results were reported as crude and adjusted odds ratios with 95% confidence intervals (95% CI), and p-values. Statistical significance for multivariable analysis was set at $\alpha<0.05$.

RESULTS

The survey included 1,001 participants who met the inclusion criteria, with ages ranging from 18 to 70 years. Table I presents the socio-demographic profile of the respondents. The majority of respondents were Malay (74.3%), single (63.0%), and female (61.0%). Regarding education, 1.6% had attained primary school, 11.4% secondary school, and 87.0% higher education. Most participants (59.7%) were unemployed, comprising students, housewives, retirees, and others, while 40.3% were employed. In terms of each respondent's total household income level, based on the 2019 Household Income and Basic Amenities (HIS/BA) Survey Report classification,14 57.4% of respondents fell into the B40 income category, 30.5% into M40, and 12.1% into T20. Additionally, 652 respondents (65.1%) reported a positive family history of hypertension, while 34.9% had no such history.

Table I: Socio-demographic characteristics of the adults in Kuala Terengganu (n =1001)

Variables	Frequency (%)	Mean (SD)
Age (in years)		29.66 (11.59)
Gender		
Female	611 (61.0)	
Male	390 (39.0)	
Ethnicity		
Malay	744 (74.3)	
Non-Malay	257 (25.7)	
Marital status		
Single	631 (63.0)	
Married	370 (37.0)	
Highest completed education		
Primary	16 (1.6)	
Secondary	114 (11.4)	
Tertiary	871 (87.0)	
Occupation		
Unemployed	598 (59.7)	
Employed	403 (40.3)	
Total household income levels of the respondents		
B40 (< RM4850)	575 (57.4)	
M40 (RM4850-RM10959)	305 (30.5)	
T20 (> RM10959)	121 (12.1)	
Family history of hypertension		
No	349 (34.9)	
Yes	652 (65.1)	

Table II: Construct validity and reliability analyses of questionnaire on knowledge, and attitude and practices related to dietary salt intake among respondents in Kampung Teluk Pasu (n =100)

Items	Factor loading		
	Factor 1 (Knowledge)	Factor 2 (Attitude)	Factor 3 (Practice)
Knowledge			
Q1: The recommended amount of salt is 5g/day (about 1 teaspoon).	0.464		
Q2: The relationship between salt and sodium is salt contains sodium.	0.331		
Q3: Food that contains highest salt consumed by Malaysian adults are:			
a: Fried rice	0.684		
b: Omelette	0.571		
c: Curry noodle	0.606		
d: Light soy sauce	0.667		
e: Fried vegetables	0.799		
f: Fried instant noodle	0.861		
g: Vegetable with soy sauce	0.399		
h: White/ wholemeal bread	0.528		
i: Fried chicken with spices	0.476		
Q4: Diet that contains high amount of salt could cause health problem/s such as:			
a: Stroke	0.303		
b: Kidney stones	0.515		
c: Stomach cancer	0.354		
d: Heart disease	0.532		
e: Osteoporosis	0.420		
f: High blood pressure	0.421		
Attitude			
Q5: In my opinion, identifying food that has high amount of salt is very important.		0.592	
Q6: In my opinion, reducing the amount of salt in diet is very important.		0.852	
Q7: In my opinion, my health will improve if I reduce the intake of salt in my diet.		0.508	
Q8: In my opinion, checking for salt content on food labels is very important.		0.583	
Practice			
Q9: I do not add salt when cooking at home.			0.629
Q10: I ask for less salt in the food that I ordered when eating out.			0.559
Q11: I do the followings as routine to control my salt intake:			
a: Not adding salt when cooking.			0.383
b: Buy alternative food with low salt.			0.549
c: Read the salt content on the food labels.			0.675
d: Avoid/minimize the consumption of processed food.			0.318

Table III: Factors influencing dietary salt intake practice among adults in Kuala Terengganu (n = 1001)

Variables	Simple Logistic Regression		Multiple Logistic Regression[a]	
	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (in years)	1.148 (0.869, 1.518)	0.331		
Sex				
Male	1.00			
Female	1.007 (0.995, 1.018)	0.258		
Ethnicity				
Non-Malay	1.00			
Malay	1.224 (0.900, 1.664)	0.198		
Marital status				
Single	1.00			
Married	1.296 (0.979, 1.716)	0.070		
Highest completed education				
Primary	1.00			
Secondary	1.024 (0.306, 3.424)	0.970		
Tertiary	1.242 (0.397, 3.887)	0.710		
Occupation				
Unemployed	1.00		1.00	
Employed	1.495 (1.133, 1.971)	0.004	1.541 (1.166, 2.038)	<0.001
Household Monthly income				
B40 (< RM4850)	1.00			
M40 (RM4850-RM10959)	1.445 (1.069, 1.953)	0.017		
T20 (> RM10959)	1.153 (0.746, 1.781)	0.521		
Having family history of hypertension				
No	1.00			
Yes	0.869 (0.654, 1.156)	0.335		
Total knowledge scores	1.032 (1.007, 1.058)	0.013		
Total attitude scores	1.132 (1.060, 1.208)	<0.001	1.138 (1.065, 1.215)	<0.001

[a]Forward likelihood ratio approach was used, confirming no collinearity or interactions among variables. The model demonstrated a reasonable fit, as assessed by the Hosmer-Lemeshow test (p=0.050). The model's performance was further supported by an overall correctly classified percentage of 71.2% and an area under the ROC curve of 59.2% (95% CI: 55.4, 63.0; p<0.001).

Exploratory factor analysis and internal consistency

Table II presents the analysis results of construct validity and reliability of the questionnaire evaluating knowledge, attitude and practice related to dietary salt intake among respondents. The Cronbach's alpha values for the knowledge, attitude, and practice sections were 0.673, 0.731, and 0.513, respectively, with an overall reliability score of 0.50 for all 27 items.

Knowledge and attitude towards dietary salt intake among adults in Kuala Terengganu

Of the total respondents, 486 (48.6%) correctly identified the recommended daily salt intake as 5g. Regarding the relationship between salt and sodium, 402 respondents (40.2%) understood that salt contains sodium, yet more than one-third (36.5%) selected the wrong answer. A majority of respondents recognized foods with high salt content commonly consumed by Malaysian adults, including fried rice (69.4%), omelette (76.6%), light soy sauce (67.5%), fried vegetables (47.9%), fried instant noodles (72.1%), vegetables with soy sauce (86.3%), and white or wholemeal bread (75.1%). However, only 43.4% identified curry noodles, and just 15.7% acknowledged fried chicken with spices as high-salt foods. When asked about health problems associated with high salt consumption, most respondents recognized conditions such as stroke (75.8%), kidney stones (53.5%), heart disease (70.2%), and high blood pressure (94.3%). In contrast, fewer respondents identified stomach cancer (29.0%) and osteoporosis (24.5%) as potential health risks related to excessive salt intake.

Sources of information regarding the dietary salt intake

Most of the respondents (93.0%) acquired information regarding dietary salt intake from the Internet followed by social media such as Facebook, twitter and Instagram (87.8%), television (67.3%), healthcare personnel (67.2%), newspaper (46.0%) and magazine (40.2%).

Attitude towards dietary salt intake among adults in Kuala Terengganu

Regarding the attitudes toward salt intake, the majority of participants agreed on the importance of identifying foods high in salt (91.7%) and reducing salt intake in their diet (92.9%). Additionally, most respondents believed that reducing salt consumption would improve their health (90.6%). Regarding the practice of checking salt content on food labels, 89.5% of participants agreed that it is very important.

Total knowledge and attitude scores towards dietary salt intake among adults in Kuala Terengganu

According to the scoring system outlined in the methodology, respondents' knowledge scores ranged from 0 to 34, with a mean score of 22.61 (SD=5.68). Attitude scores ranged from 8 to 20, with a mean score of 18.15 (SD=2.32).

Dietary salt intake practice among residents in Kuala Terengganu

Among the participants, 102 (10.2%) reported never adding salt when cooking at home, while 54 (5.4%) consistently avoided this practice. The majority, 239 (23.9%), exhibited occasional adherence to this behaviour, falling into the mid-

range of the scale. Regarding the practice of requesting less salt in food when dining out, 408 (40.8%) participants reported never doing so, whereas only 38 (3.8%) consistently followed this habit. This suggests that a significant portion of participants rarely prioritized salt reduction when eating out.

In terms of controlling salt intake, 205 (20.5%) participants moderately refrained from adding salt when cooking, and 41 (4.1%) consistently adhered to this practice. Similarly, 207 (20.7%) participants reported moderate adherence to buying low-salt alternatives, while only 40 (4.0%) consistently purchased such products. Reading food labels for salt content was another behaviour assessed; 169 (16.9%) participants never engaged in this practice, whereas 57 (5.7%) consistently checked food labels for salt content. The avoidance or minimization of processed food consumption was consistently practiced by 75 (7.5%) participants, with 232 (23.2%) moderately adhering to this behaviour. These findings indicate varying levels of adherence to practices aimed at reducing dietary salt intake, with only a minority of participants consistently following recommended habits. Based on the study results, out of 1001 respondents, 28.8 % of them (95% CI: 26.0%, 31.6%) had good dietary salt intake practice.

Associated factors of having good dietary salt intake practice among residents in Kuala Terengganu

Based on the univariable analysis results, several factors were identified as potential predictors of having good dietary salt intake practices when no confounding variables were identified. These included ethnicity (Malays, p=0.198), marital status (being married, p=0.070), employment status (employed, p=0.004), socioeconomic status (M40 family, p=0.017), total knowledge scores (p=0.013), and total attitude scores (p<0.001).

After performing multiple logistic regression analysis, only employment status (being employed, p<0.001) and total attitude scores (p<0.001) remained significantly associated with having good dietary salt intake practices. The results of the final model implied that employed respondents and those with higher total attitude scores were more likely to exhibit good dietary salt intake practices compared to their counterparts. (Table III).

DISCUSSION

Excessive salt consumption is a significant public health concern, contributing to hypertension and an increased risk of cardiovascular diseases.[7] Recognizing the urgency of addressing high salt intake, it is crucial to implement interventions that promote environments supportive of healthy eating practices. Understanding individuals' dietary salt-related practices, along with their knowledge and attitude towards salt intake, is essential in formulating effective strategies to reduce overall salt consumption.[15] Therefore, this study was conducted to assess salt-related knowledge, attitude, and practices among the adult population in Kuala Terengganu. Our findings contribute to the growing body of evidence on salt intake practices, offering insights into potential areas for intervention within this population.

While nearly half of the respondents correctly identified the recommended daily salt intake of 5g (48.6%) and understood the relationship between salt and sodium (40.2%), their knowledge did not always extend to recognizing hidden sources of salt in everyday foods. Although many participants were aware of high-salt food sources such as vegetables with soy sauce, fried instant noodles, and light soy sauce, they were less aware of the salt content in local dishes like curry noodles and fried chicken with spices. This suggests that while general knowledge about salt is present, people may underestimate their actual sodium intake from commonly eaten foods.

Moreover, although nearly all participants acknowledged the link between excessive salt intake and its negative health consequences, particularly hypertension and cardiovascular diseases, fewer recognized other potential risks such as stomach cancer and osteoporosis. Similar patterns have been observed in previous studies conducted in Malaysia among public university staff in Selangor,16 fast food consumers in Klang Valley[13] and Chinese adults in Johor.[17] This indicates that while hypertension is widely recognized, awareness of other salt-related health risks remains limited, emphasizing the need for broader public health campaigns. This necessity has also been highlighted in the National Strategic Plan for Non-Communicable Disease 2016–2025 by the Ministry of Health Malaysia.[18]

Despite this level of awareness, no significant association was found between knowledge and actual dietary salt intake practices. This finding aligns with previous studies,[19,20] which have shown that knowledge alone may not be sufficient to drive behavioural change. The gap between awareness and practice highlights the influence of external factors such as cultural dietary habits, taste preferences, and food availability.[21] Even individuals who understand the risks of excessive salt intake may continue consuming high-salt foods due to social influences or the convenience of salty, processed foods. These findings underscore the need for targeted interventions that go beyond education alone, incorporating policy measures, food environment modifications, and community-based initiatives to effectively reduce salt intake among the population.

Although no association was found between knowledge and practice, the study findings revealed that attitude was significantly associated with dietary salt practices. This is consistent with a study conducted among Turkish adults, which also found that higher attitude scores were predictive of better salt reduction behaviours.[22] This suggests that individuals with a more positive attitude toward salt reduction are more likely to adopt healthier dietary habits.

In this study, the majority of respondents exhibited a positive attitude toward reducing salt intake. A high percentage of participants agreed on the importance of identifying foods high in salt (91.7%), reducing salt intake in their diet (92.9%), and recognizing the potential health benefits of doing so (90.6%). Additionally, 89.9% expressed a positive opinion about checking salt content on food labels. These findings align with previous studies conducted in Malaysia[13] and North India.[23] The positive perceptions may encourage

individuals to make healthier dietary choices, reinforcing the role of attitude in shaping better salt-related behaviour.16 Therefore, fostering positive attitudes through targeted interventions and behavioural change strategies may be a key approach to improving salt reduction practices.

Employment status was another significant factor associated with good dietary salt intake practices, as identified through multiple logistic regression analysis. This finding is consistent with previous research indicating that socio-economic factors, such as employment and income, play a role in shaping dietary behaviours. Employed individuals may have better access to resources, information, or healthier food choices, which could contribute to have good practice compared to the unemployed individuals.[24,25]

Despite high levels of awareness and positive attitudes toward dietary salt reduction, the findings indicate a gap between knowledge, attitude, and actual practice behaviour. The study revealed that only 10.2% of participants reported never adding salt when cooking at home, and merely 3.8% requested less salt when dining out. Furthermore, only a small proportion consistently adhered to recommended salt reduction behaviours, including refraining from adding salt while cooking (4.1%), purchasing low-salt alternatives (4.0%), reading food labels for salt content (5.7%), and minimizing processed food consumption (7.5%). These findings suggest that while participants recognize the importance of reducing salt intake, they often fail to implement these practices in daily life.

This discrepancy between knowledge, attitude, and practice is consistent with findings from previous studies in Malaysia and other countries, where salt reduction behaviours remain challenging despite positive attitudes toward dietary changes.[13,23] One possible explanation is the deep-rooted dietary habits and taste preferences within Malaysian food culture, where salty and savoury flavours are commonly preferred. Additionally, the availability and affordability of high-sodium processed foods may encourage habitual salt intake rather than active dietary modifications. Furthermore, the low adherence to reading food labels for salt content (5.7%) suggests that many consumers may either lack awareness of food labelling information or find it difficult to interpret. This aligns with findings from previous studies indicating that food labelling alone is often insufficient to drive behavioural change unless accompanied by public education and policy interventions.[26]

LIMITATIONS

This study has several limitations. Firstly, the reliance on self-reported data may introduce reporting biases, as participants could underreport or overreport their dietary practices.[27] Secondly, the use of snowball sampling limits the generalizability of the findings, as this method does not approximate probability sampling and may not fully represent the broader adult population. Thirdly, the study was restricted to adults in Kuala Terengganu who had access to a smartphone with internet connectivity. As a result, the findings should be interpreted cautiously, as they reflect a self-selected sample and may not be generalizable to all adults in Kuala Terengganu.

CONCLUSION

This study highlights the dietary salt intake knowledge, attitudes, and practices among self-selected adults in Kuala Terengganu, revealing key gaps in salt reduction behaviours. While a majority of respondents demonstrated awareness of the recommended salt intake and its health implications, actual adherence to salt reduction practices remained low, with only 28.8% exhibiting good dietary salt intake behaviours. Multiple logistic regression analysis identified employment status and attitude scores as significant predictors of good dietary salt intake practices, suggesting that those who are employed and have positive attitudes toward salt reduction are more likely to adopt healthier habits.

Given these findings, multi-level interventions are necessary to improve salt intake practices of the studied population in Kuala Terengganu. Public health strategies should not only focus on raising awareness but also on creating an environment that facilitates healthier choices. This could involve policy-driven approaches such as mandatory salt reduction in processed foods and clearer front-of-package labelling. Moreover, educational campaigns emphasizing the importance of reading food labels, reducing salt usage when cooking and dining out, and choosing low-sodium alternatives should be intensified, particularly among unemployed individuals and those with lower attitude scores.

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