



Health Literacy Regarding Sodium Consumption of Undergraduate Students in the Lower Northern Region, Thailand

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Abstract

At present, the sodium intake of Thai youth is about twice as high as recommended. Health literacy has been confirmed to be an important factor in disease prevention, health promotion, and quality of life improvement. However, few studies have concentrated on the sodium health literacy among university students. This cross-sectional survey study aimed to describe health literacy regarding sodium consumption of undergraduate students in the lower northern region of Thailand and to identify factors affecting the students' sodium consumption behaviors. An online self-administered questionnaire was used to collect data from 395 first-year students of a selected university. Binary Logistic Regression (BLR) was performed to analyze factors affected high sodium consumption behaviors. Results of the study revealed that, most of the students were female (68.6%), age over 18 years old (61.6%), studied in non-health science areas (74.0%). The number of students who had underweight and obese were similar (28.6% and 26.3%, respectively). Approximately half of participants were self-cooking (52.9%), and eating late at night (55.2%). Most of them love spicy taste food (74.4%) and using social media about food (81.0%). Regarding health literacy about sodium consumption, majority of the students (79.5%) had low cognitive skills; they had moderate skills on accessibility to information (44.6%), communication (55.9%), self-management (49.1%), and media literacy (44.1%); and had high decision-making skills (44.6%). Results of the BLR analysis using enter method showed the characteristic factors of the students that affected their high sodium consumption behaviors ($OR > 1.0$) were love to eat spicy taste food ($OR = 2.20$; 95%CI: 1.18–4.09) followed by had underweight BMI ($OR = 2.12$; 95%CI: 1.17–3.85), and male students ($OR = 1.95$; 95%CI: 1.16–3.28). When health literacy regarding sodium consumption were considered, low communication skills had the highest affected on high sodium consumption behaviors ($OR = 3.08$; 95%CI: 1.33–7.10) followed by low cognitive skills ($OR = 2.35$; 95%CI: 1.18–4.80). In order to reducing high sodium consumption behaviors of the youth, health literacy about sodium consumptions should be enhanced through behavioral modification program specifically communication skills and cognitive skills. Additionally, students who love to eat spicy taste food should be emphasized. This result provides factors affected to high sodium consumption behaviors should be considered for interventions to reduce high sodium consumption among university students.

Keywords: Health literacy, sodium consumption, undergraduate students, Thailand

Introduction

High sodium consumption is linked to the risk of increased blood pressure and kidney disease, which indicates the potential for serious health problems (Malta et al., 2018). However, meta-analyses of epidemiological studies focusing on relative risk found that 30% of reducing sodium intake can save premature deaths worldwide almost 100 million lives within 25 years (Kontis et al., 2019).

The average dietary sodium consumption among Thai population in 2019–2020 was approximately 3,636 mg/day. Focusing on North region found that the mean dietary sodium intake was 3,562 mg/day (Chailimpamontree et al., 2021) which was higher than those WHO's recommended 2,000 mg/day (World Health Organization, 2012). Interestingly younger aged was associated with higher sodium intake (Chailimpamontree et al., 2021). Therefore, the Thai government has instituted policies and strategic plans for



reducing sodium consumption by 30% during 2016–2025 period (Department of Diseases Control, Ministry of Public Health, & Thailand, 2016).

Health literacy is defined as social determinant of health that affects quality of life among populations (Nutbeam & Lloyd, 2020). This highlights the competency and skill of individuals to access information and understand health information. People need to communicate with health, through reading labels, self-management and being able to critique information and make appropriate health decisions and to apply good health practices (Health Education Division, Department of Health Service Support, & Ministry of Public Health, 2018.). There is a significant positive relationship between health literacy and health behaviors in adolescents (Fleary, Joseph, & Pappagianopoulos, 2018; Kaboudi, Kianipour, Ziapour, & Dehghan, 2017). However, previous research applying the structure of health literacy regarding salt consumption for development the questionnaire for older adults (Chau et al., 2015). In addition, some studies applied the health literacy on sodium restriction in hypertension patients (Suon & Ruaisungnoen, 2019). Likewise, little work has been studied among university students.

University students tend to be a risk group for excessive sodium intake and consequently health problems in many countries (Ismail et al., 2019; Jia Jiet & Soma R, 2017) including Thais university students (Chaikate, 2016; Srikan, Thatan, Srichanpan, & Pinsakul, 2018). As for health literacy regarding sodium consumption among undergraduate students in the lower northern region, to the authors' knowledge, few studies have focused on factors affected sodium consumption especially when applied to the aspect of health literacy. The objectives of this study were to describe health literacy regarding sodium consumption and identify factors affected sodium consumption behaviors of undergraduate students in the lower northern region, Thailand.

Methods and Materials

Study design and area

This cross-sectional study was conducted in first-year students of academic year 2020 from the University located in Phitsanulok Province. The researcher using the n4Studies application for calculating the sample size by using the formula of finite population proportion for testing proportion (Ngamjarus C. & Chongsuvivatwong V., 2014). When $Z = 1.96$ ($\alpha = 0.05$), $p = 0.57$ (Chaikate, 2016) $d=0.05$, and $N = 7,991$ students. The calculated sample size was 360, but 10% was added to drop-out rate (Kadam & Bhalerao, 2010). Therefore, the adjust number of sample size was 444 students. The sampling process used the multistage technique, stratified random sampling and criteria were selected one university which met the criteria consisted of 1) located in the area of the highest prevalence of hypertension in lower northern region, Thailand (Ministry of Public Health, 2015). 2) the criteria for the university required that it is a comprehensive university, with more than 10,000 students. The faculty was cluster random sampling one from each three studied areas (the Health Sciences areas, the Science and technology areas, and the Social sciences and humanities areas). The department of the selected faculty member were randomly selected and collected all students to 444 students. The inclusion criteria were first-year students, 18 years old or older both male and female, agreed to participate in the study. Students who did not available access online devices were excluded from the study. Data were collected in August 2020.



Research instruments

The instrument for collecting data was an online self-administered questionnaire, which consisted of 3 parts as follows: **Part 1)** Personal characteristics including sex, age, BMI, studied areas, dietary habits and using social media about food. **Part 2)** Health literacy regarding sodium consumption (HLSC) was modified and based on the literature review (Chau et al., 2015), which divided into 6 components included of cognitive skill, accessibility to information skill, communication skill, self-management skill, media literacy skill, and decision-making skill. **Part 3)** Sodium consumption behaviors were used to ask about frequency of high dietary sodium consumption behaviors during the preceding week. Self-reported weight and height were used to calculate the body mass index (BMI). The classification of nutritional status by using BMI for Asia Pacific Perspective which divided into 4 categories: underweight ($BMI < 18.5 \text{ kg/m}^2$), normal ($BMI = 18.5 - 22.9 \text{ kg/m}^2$), overweight ($BMI = 23 - 24.9 \text{ kg/m}^2$), and obese ($BMI \geq 25 \text{ kg/m}^2$) (Pan & Yeh, 2008).

The six components of health literacy regarding sodium consumption divided into 3 levels consisted of low, moderate, and high by using the 25th, 50th, and 75th Percentile, respectively as follow;

- 1) The total of cognitive skills scores ranged from 0–10. A total score < 6 indicates low cognitive skills. A score from 6 to 7 indicates moderate cognitive skills, and a score ≥ 8 indicates high level of cognitive skills.
- 2) The total of accessibility to information skills scores ranged from 3–15. A total score < 9 indicates low accessibility to information skills. A score from 9 to 11 indicates moderate accessibility to information skills, and a score ≥ 12 indicates high level of accessibility to information skills.
- 3) The communication skills scores ranged from 4–20. A total score < 10 indicates low communication skills. A score from 10 to 13 indicates moderate communication skills, and a score ≥ 14 indicates high level of communication skills.
- 4) The total of self-management skills scores ranged from 5–25. A total score < 12 indicates low self-management skills. A score from 12 to 17 indicates moderate self-management skills, and a score ≥ 18 indicates high level of self-management skills.
- 5) The total of media literacy skills scores ranged from 3–15. A total score < 7 indicates low media literacy skills. A score from 7 to 9 indicates moderate media literacy skills, and a score ≥ 10 indicates high level of media literacy skills.
- 6) The total of decision-making skills scores ranged from 4–16. A total score < 10 indicates low decision-making skills. A score from 10 to 11 indicates moderate decision-making skill, and a score ≥ 12 indicates high level of decision-making skills.

The total of sodium consumption behavior (SCB) scores ranged from 25–125. A high SCB score indicates high sodium consumption. The 75th percentile was used to divide SCB into 2 levels as follows: a total score of < 71 indicates low SCB, and a score ≥ 71 indicates a high level of SCB.

The questionnaire was submitted to five experts for verified validation. The IOC index value was 1.00. Questionnaire was test for reliability in 50 undergraduate students with resemble characteristics with the subjects. The Cronbach's alpha was 0.809 for the HLSC. The Kuder-Richardson 20 (KR-20) was 0.793 for cognitive skills on sodium and health. The Cronbach's alpha was 0.76 for sodium consumption behaviors.



Data analysis

The data were analyzed through the statistical software SPSS Statistics version 17 for Windows. Descriptive statistic was used to describe all information related to the participants such as mean, standard deviation, frequency and percentage. Binary Logistic Regression with Enter method was used to identify factors affecting the students' high sodium consumption behaviors. The independent variables that had p -value < 0.25 were processed to a multivariable analysis. The dependent variable was divided into 2 groups by using 75th percentile as high sodium consumption behaviors (≥ 71 scores) and low sodium consumption behaviors (< 71 scores). A 95% confidence interval (CI) and p -value < 0.05 was a statistically significant level.

Ethical considerations

This research protocol was reviewed and approved by the human ethics research committee, Burapha University (No. IRB G-HS 031/2563). Participants were voluntary. An online self-administered questionnaire was conducted after the participant had read and signed informed consent.

Results

The final number of completed questionnaire and conducted to analyze were 395 students. The majority subjects' students were female (68.6%), age over 18 years old (61.8%), studied in non-health science areas (74.0%). The number of students who had underweight and obese were similar (28.6% and 26.3%, respectively). Approximately half of participants were self-cooking (52.9%), and eating late at night (55.2%). Most of them love spicy taste food (74.4%) and using social media about food (81.0%). (Table 1)

Table 1 Personal characteristics of subjects' students (n=395)

Personal characteristics	Number	Percentage
Sex		
female	271	68.6
male	124	31.4
Age		
18 years old	151	38.2
Age over 18 years old	244	61.8
Mean = 18.64 SD = 0.535 Min = 18 Max = 21		
Body Mass Index (BMI)		
Underweight ($<18.5 \text{ kg/m}^2$)	113	28.6
Normal ($18.5\text{--}22.9 \text{ kg/m}^2$)	148	37.5
Overweight ($23\text{--}24.9 \text{ kg/m}^2$)	30	7.6
Obese ($\geq 25 \text{ kg/m}^2$)	104	26.3
Mean = 22.06 SD = 5.14 Min = 14.88 Max = 44.46		
Studied areas		
Non-health science areas	292	74.0
Health science areas	103	26.0
Self-cooking		
Yes	209	52.9
No	186	47.1

**Table 1 (Cont.)**

Personal characteristics	Number	Percentage
Eating late at night		
Yes	218	55.2
No	177	44.8
Love spicy taste food		
Yes	294	74.4
No	101	25.6
Using social media about food		
Yes	320	81.0
No	75	19.0

Health literacy regarding sodium consumption of the students found that most of them (79.5%) had low level of cognitive skills; they had moderate level skills on accessibility to information (44.6%), communication (55.9%), self- management (49.1%), and media literacy (44.1%); and had high decision- making skills (44.6%). (Table 2)

Table 2 Levels of health literacy on sodium consumption of subjects' students (n=395)

Health literacy regarding sodium consumption	Number (Percentage)		
	Low	Moderate	High
Cognitive skills	314 (79.5)	70 (17.7)	11 (2.8)
Accessibility to information skill	63 (15.9)	176 (44.6)	156 (39.5)
Communication skill	60 (15.2)	221 (55.9)	114 (28.9)
Self-management skill	81 (20.5)	194 (49.1)	120 (30.4)
Media literacy skill	85 (21.5)	174 (44.1)	136 (34.4)
Decision making skill	72 (18.2)	147 (37.2)	176 (44.6)

Binary Logistic Regression analysis using enter method found the characteristic factors of the students that affected their high sodium consumption behaviors (OR>1.0) were love to eat spicy taste food (OR=2.20; 95%CI: 1.18–4.09) followed by had underweight BMI (OR=2.12; 95%CI: 1.17–3.85), and male students (OR=1.95; 95%CI: 1.16–3.28). When health literacy regarding sodium consumption were considered, low communication skills had the highest affected on high sodium consumption behaviors (OR=3.08; 95%CI: 1.33–7.10) followed by low cognitive skills (OR=2.35; 95%CI: 1.18–4.80). (Table 3)

**Table 3** Binary Logistic Regression analysis using enter method for identify factors affected high sodium consumption behaviors of undergraduate students in lower northern region, Thailand (n=395)

Variables	n	Level of sodium (%) consumption behavior		Odds ratios (OR)	95% CI	p-value
		Low	High			
Personal characteristics						
Sex						
Male	124	67.7	32.3	1.95	1.16–3.28	0.012
Female*	271	76.8	23.2			
Age						
18 years old	151	80.1	19.9	0.53	0.32–0.90	0.018
Over 18 years old*	244	70.1	29.9			
BMI						
Underweight	113	62.8	37.2	2.12	1.17–3.85	0.014
Normal	148	81.8	18.2	0.63	0.34–1.14	0.128
Overweight and obesity*	134	74.6	25.4			
Self-cooking						
No	186	78.5	21.5	0.60	0.36–0.97	0.036
Yes*	209	69.9	30.1			
Eating late at night						
Yes	218	69.7	30.3	1.41	0.85–2.34	0.182
No*	177	79.1	20.9			
Love spicy taste food						
Yes	294	70.7	29.3	2.20	1.18–4.09	0.013
No*	101	83.2	16.8			
Health literacy on sodium consumption						
Cognitive skills						
Low	314	71.3	28.7	2.35	1.18–4.80	0.016
Moderate to high*	81	84.0	16.0			
Communication skills						
Low	60	69.5	30.5	3.08	1.33–7.10	0.008
Moderate to high*	335	86.7	13.3			

* Reference group, $p < 0.05$

Discussion

This study found that factors affected high sodium consumption behaviors of students ($OR > 1.0$) were students who love to eat spicy taste food are more likely to have an increased sodium intake than those who did not love spicy taste food. This finding suggests that most 'spicy taste' foods have large amounts of salt, sodium, and seasoning because the saltiness gives a better taste (Institute of Medicine (US), 2010). It was similar with the result from others studies found that 90% of dietary sodium intake in Thai populations comes from condiments, seasoning cube and monosodium glutamate or MSG which is popular used in Thai recipes (Chailimpamontree et al., 2021) for its Umami flavor or delicious taste help to increase food intake and affect



to excessive sodium consumption (Mouritsen, 2012). This result is in line with the finding from previous studies which reported that salt preference in soup was related with the salt habit and subject with high salt preference had a higher salt consumption compared to those who preferred low salt (Pilic et al., 2020). In addition, some studies showed that 72% of students preferred salted food because it was easier to access, affordable, and had a better taste than unsalted food (Zamora, 2019). Therefore, supporting knowledge about the sodium and taste test is a crucial for younger students to prevent a poor-quality diet. Students who had BMI at the underweight level were more likely to have a higher sodium intake than those who are overweight or obese. This reflects the notion that students who are perceived to have a normal nutritional status lead to having a higher nutrition literacy level and a healthy dietary consumption than those who are thin or overweight (Siripitchtrakul, Vatanasomboon, Satheannoppakao, & Sujirarat, 2020). Male students tend to have a higher consumption of sodium than female students. These findings were in line the results of other studies on sodium consumption which reported that sodium intake among male students was about 1.3 times higher than female students (Leite & Kunkulberga, 2018; Othman et al., 2019). The possible reasons that could explain this finding were that male students preferred to buy convenience foods such as ready to eat, processed food and snacks more than female students a pattern that is pervasive across all university students because of other factors including time pressures, taste, and perceived health awareness (Sprake et al., 2018; Wadhera & Wilkie, 2018). A further explanation could be that gender differences might suggest that females in general are more concerned about their self-evaluated nutritional status than males (Siripitchtrakul et al., 2020).

Health literacy regarding sodium consumption factors found that low communication skills had the highest affected on high sodium consumption behaviors than those who had moderate to high communication skills. These findings suggest that supporting communication skills such as reading nutrition facts, talk and sharing about sodium with their families and friends are playing a role in reducing high sodium intake, and also fat and sugar in foods (Cha et al., 2014). This is consistent with Visedkaew and Muktabhant (2020) found that the score of communication skill of 'nutrition literacy' was statistically significantly and negatively correlated with the energy intake from SSBs (coef. = -13.59, $p = 0.04$). Those students who have higher score of communication skills of nutrition literacy have lower energy intakes from snacks and sweetened beverages (Visedkaew & Muktabhant, 2020). Follow by low cognitive skills had affected high sodium consumption behaviors than those who had moderate to high cognitive skills. This finding was similar to a study which found that less than 1 in 3 students had knowledge about high sodium foods (Ismail et al., 2019) and had low skills levels on label uses (Boonsiri, Piaseu, Putwatana, & Kantachuvesiri, 2017). Furthermore, some studies showed that knowledge was positively significantly associated to sodium reduction behavior among students and employee of the college of nursing (Srikan et al., 2018). This is consistent with Suon and Ruaisungnoen (2019) found that educational level, literacy skills ($\beta = 0.125$, $p = 0.019$), knowledge about hypertension and sodium restriction ($\beta = 0.266$, $p < 0.001$), and health professional communication ($\beta = 0.359$, $p < 0.001$) were significantly associated with the level of health literacy on sodium restriction among patients with hypertension (Suon & Ruaisungnoen, 2019). However, this finding was unlike the systematic review of Buja A, et al., 2021, revealed no evidence of any association between health literacy and salt (Buja et al., 2021).

There are some limitations. First, an online form made for self-administered on health literacy evaluated cognitive and perception skills. The respondent has to synthesize and understand what the questions are asking. Therefore, descriptions inform the samples before testing and making sure are very important to protect against



errors. Second, the sodium consumption questionnaire was evaluated during the preceding week. It might be affecting the recall and over/under estimation of respondents. Finally, this study was conducted only first year students at a government university located in the lower northern region, Thailand. So, the results did not represent the private university in Thailand. Therefore, generalizing these outcomes to private university or university located in different region should be done with caution. However, the strength of this design is suitable of variables that measured at the same time.

Conclusion and Suggestions

The results showed that low communication skills had the highest affected on high sodium consumption behaviors followed by low cognitive skills. The characteristic factors of the students that affected their high sodium consumption behaviors were love to eat spicy taste food followed by had underweight BMI, and male students. Therefore, sodium health literacy intervention and sodium consumption behavioral modification program should be recommended for future study.

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References

- Boonsiri, C., Piaseu, N., Putwatana, P., & Kantachuesiri, S. (2017). Effects of program promoting food consumption for sodium reduction on knowledge and urinary sodium in nursing students. *Thai Journal of Nursing Council*, 32(3), 104–119.
- Buja, A., Grotto, G., Montecchio, L., De Battisti, E., Sperotto, M., Bertocello, C., . . . Baldo, V. (2021). Association between health literacy and dietary intake of sugar, fat and salt: A systematic review. *Public Health Nutrition*, 24(8), 2085–2097. <http://dx.doi.org/10.1017/S1368980020002311>
- Cha, E., Kim, K. H., Lerner, H. M., Dawkins, C. R., Bello, M. K., Umpierrez, G., & Dunbar, S. B. (2014). Health literacy, self-efficacy, food label use, and diet in young adults. *American Journal of Health Behavior*, 38(3), 331–339. <http://dx.doi.org/10.5993/AJHB.38.3.2>
- Chaikate, S. (2016). Factors associated with sodium from food consumption among students at Srinakharinwirot University, Prasarnmit Campus. *Journal of Research Unit on Science, Technology and Environment for Learning*, 7(1), 103–114.



- Chailimpamontree, W., Kantachuvesiri, S., Aekplakorn, W., Lappichetpaiboon, R., Sripaiboonkij Thokanit, N., Vathesatogkit, P., . . . Garg, R. (2021). Estimated dietary sodium intake in Thailand: A nationwide population survey with 24-hour urine collections. *The Journal of clinical hypertension (Greenwich, Conn.)*, 23(4), 744–754. <http://dx.doi.org/10.1111/jch.14147>
- Chau, P. H., Leung, A. Y. M., Li, H. L. H., Sea, M., Chan, R., & Woo, J. (2015). Development and validation of Chinese health literacy scale for low salt consumption – Hong Kong population (CHLSalt-HK). *Public Library of Science ONE*, 10(7), e0132303. <http://dx.doi.org/10.1371/journal.pone.0132303>
- Department of Diseases Control, Ministry of Public Health, & Thailand. (2016). *National strategy on salt and sodium reduction 2016–2025*. Nonthaburi: Ministry of Public Health.
- Fleary, S. A., Joseph, P., & Pappagianopoulos, J. E. (2018). Adolescent health literacy and health behaviors: A systematic review. *Journal of Adolescence*, 62, 116–127. <http://dx.doi.org/10.1016/j.adolescence.2017.11.010>
- Health Education Division, Department of Health Service Support, & Ministry of Public Health. (2018.). *Health promotion, health literacy evaluation and health behavior for children and adolescent 7–14 years old and aged over 15 years old*. Bangkok: New Thammada Press.
- Institute of Medicine (US). (2010). In Henney JE, Taylor CL, & Boon CS (Eds.), *Strategies to reduce sodium intake in the United States, 3 Taste and flavor roles of sodium in foods: A unique challenge to reducing sodium intake*. Washington (DC): National Academies Press (US).
- Ismail, L., Hashim, M., Jarrar, A., Mohamad, M., Saleh, S., Jawish, N., . . . Al Dhaheri, A. (2019). Knowledge, attitude, and practice on salt and assessment of dietary salt and fat nntake among University of Sharjah students. *Nutrients*, 11, 941. <http://dx.doi.org/10.3390/nu11050941>
- Jia Jiet, L., & Soma R, M. (2017). High salt diets in young university adults and the correlation with blood pressure, protein intake and fat free mass. *Bioscience Horizons: The International Journal of Student Research*, 10, hzx003–hxx003. <http://dx.doi.org/10.1093/biohorizons/hzx003>
- Kaboudi, M., Kianipour, N., Ziapour, A., & Dehghan, F. (2017). A study of health literacy components and their relationships with health-promoting behaviors in students at Kermanshah University of Medical Sciences. *International Journal of Pediatrics*, 5(12), 6721–6729. <http://dx.doi.org/10.22038/ijp.2017.26823.2313>
- Kadam, P., & Bhalerao, S. (2010). Sample size calculation. *International Journal of Ayurveda Research*, 1(1), 55–57. <http://dx.doi.org/10.4103/0974-7788.59946>
- Kontis, V., Cobb, L. K., Mathers, C. D., Frieden, T. R., Ezzati, M., & Danaei, G. (2019). Three public health interventions could save 94 million lives in 25 years. *Circulation*, 140(9), 715–725. <http://dx.doi.org/10.1161/circulationaha.118.038160>
- Leite, G., & Kunkulberga, D. (2018). Dietary sodium intake and the main sources of salt in the diet of young adults in Latvia. *Proceedings of the Latvian Academy of Sciences. Section B. Natural, Exact, and Applied Sciences.*, 72, 49 – 53.



- Malta, D., Petersen, K. S., Johnson, C., Trieu, K., Rae, S., Jefferson, K., . . . Arcand, J. (2018). High sodium intake increases blood pressure and risk of kidney disease. From the science of salt: A regularly updated systematic review of salt and health outcomes (August 2016 to March 2017). *Journal of clinical hypertension (Greenwich, Conn.)*, 20(12), 1654–1665. <http://dx.doi.org/10.1111/jch.13408>
- Ministry of Public Health. (2015). *Annual epidemiological surveillance report 2015: Hypertension*. Retrieved from <http://www.boe.moph.go.th/Annual/AESR2015/aesr2558/Part%201/11/hypertension.pdf>
- Mouritsen, O. G. (2012). Umami flavour as a means of regulating food intake and improving nutrition and health. *Nutrition and Health*, 21(1), 56–75. <http://dx.doi.org/10.1177/0260106012445537>
- Ngamjarus C., & Chongsuvivatwong V. (2014). *n4Studies: Sample size and power calculations for iOS*. Songkla: The Royal Golden Jubilee Ph.D. Program, The Thailand Research Fund & Prince of Songkla University.
- Nutbeam, D., & Lloyd, J. E. (2020). *Understanding and responding to health literacy as a social determinant of health*. Retrieved from <http://dx.doi.org/10.1146/annurev-publhealth-090419-102529>
- Othman, F., Ambak, R., Siew Man, C., Zaki, A., Ahmad, M., Aziz, N., . . . Aris, T. (2019). Factors associated with high sodium intake assessed from 24–hour urinary excretion and the potential effect of energy intake. *Journal of Nutrition and Metabolism*, 2019, 1–8. <http://dx.doi.org/10.1155/2019/6781597>
- Pan, W. H., & Yeh, W. T. (2008). How to define obesity? Evidence-based multiple action points for public awareness, screening, and treatment: an extension of Asian–Pacific recommendations. *Asia Pacific Journal of Clinical Nutrition*, 17(3), 370–374.
- Pilic, L., Lubasinski, N. J., Berk, M., Ward, D., Graham, C. A.–M., Da Silva Anastacio, V., . . . Mavrommatis, Y. (2020). The associations between genetics, salt taste perception and salt intake in young adults. *Food Quality and Preference*, 84, 103954. <http://dx.doi.org/10.1016/j.foodqual.2020.103954>
- Siripitchtrakul, P., Vatanasomboon, P., Satheannoppakao, W., & Sujirarat, D. (2020). Nutrition literacy among grade 9 students of Bangkok metropolitan administration schools. *Thai Journal of Public Health*, 50(1), 61–75.
- Sprake, E. F., Russell, J. M., Cecil, J. E., Cooper, R. J., Grabowski, P., Pourshahidi, L. K., & Barker, M. E. (2018). Dietary patterns of University students in the UK: a cross–sectional study. *Nutrition Journal*, 17(1), 90–90. <http://dx.doi.org/10.1186/s12937-018-0398-y>
- Srikan, P., Thatan, S., Srichanpan, W., & Pinsakul, C. (2018). Relationship between knowledge, self–care agency, sodium reduction behavior and urinary sodium level of students and employees of the Boromarajonani College of Nursing Phayao. *Journal of Boromarajonani College of Nursing*, 34(3), 21–33.
- Suon, M., & Ruaisungnoen, W. (2019). Health literacy on sodium restriction and associated factors among patients with hypertension in Phnom Penh, Cambodia. *Nursing Science Journal of Thailand*, 37(4), 32–41.
- Visedkaew, K., & Muktabhant, B. (2020). Association between nutrition literacy and the consumption of snacks and sweetened beverages among undergraduate students in the Health Sciences Faculties of Khon Kaen University. *Srinagarind Medical Journal*, 35(2), 183–192.



- Wadhera, D., & Wilkie, L. M. (2018). College-aged men view more foods as snacks than women do. *Food Quality and Preference*, 69, 53–56. <http://dx.doi.org/10.1016/j.foodqual.2018.05.008>
- World Health Organization. (2012). *Guideline: Sodium intake for adults and children*. Retrieved from http://www.who.int/nutrition/publications/guidelines/sodium_intake_printversion.pdf
- Zamora, M. C. V. (2019). Applying health and food literacy models to college students' nutrition knowledge and salt consumption. *The Normal Lights*, 13(1), 229 – 255.

