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Association between Salty Taste Threshold and Hypertension among Adolescents in Surabaya

Hubungan Ambang Rasa Asin dengan Kejadian Hipertensi pada Remaja di Surabaya

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ABSTRACT

Background: Hypertension is a condition where arterial blood pressure is constantly high and influenced by various factors. High blood pressure in adolescent years increases the risk of hypertension in adulthood. The taste sensitivity which affects the food intake can be observed by conducting the salty taste threshold test.
Objectives: This study was conducted to observed the association between the salty taste threshold and the incidence of hypertension in adolescents in Surabaya.
Methods: This study used a cross-sectional design and simple random sampling technique for subjects. Primary data were collected through a questionnaire for subject characteristics and salty taste threshold using 3-AFC method with 5 different sodium concentration. The association between the salt taste threshold and hypertension was tested using correlation spearmann.
Results: The results of this study were 4.2% of male respondents had both high salty taste threshold and were classified as hypertension. The results of the association test between high salty taste threshold and hypertension in adolescent boys showed a p-value of 0.027 (r=0.320) for systolic blood pressure and a p-value of 0.003 (r=0.422) for diastolic blood pressure.
Conclusions: There is significant association between the salty taste threshold and hypertension.

INTRODUCTION

Adolescents are categorized as individuals aged 10 - 18 years by the Republic of Indonesia Minister of Health Regulation (Regulation of the Minister of Health) in 2005 and are in a transition phase from childhood to adulthood[1]. In the 2022 Indonesian Statistics book, it is stated that there will be 44.3 million Indonesians in 2021 who fall into the age category of 10 - 19 years, and this number reaches 16% of the total population of Indonesia, namely 272.7 million[2]. In Surabaya, the total number of teenagers aged 10 - 19 is 419,316 teenagers[3].

Adolescence is an important period for growth and development, and the principal nutritional problem in adolescents is malnutrition, especially excess nutrition. The prevalence of overnutrition among teenagers in Indonesia reaches 16%[4]. Overnutrition, which is related to central obesity, is a risk factor for hypertension. These nutritional problems are related to the lifestyle adopted, one of which is diet. Based on 2015 Riskesdas data, 55.4% of teenagers consume fast food at least once or more a week and rarely consume vegetables and fruit[5].

Hypertension is a condition where arterial blood pressure is continuously high and is seen from the force exerted per unit area on the artery walls[6]. The prevalence of hypertension in teenagers at one of Jakarta's high schools was 15.5%, and 21.4% of them were male teenagers. Meanwhile, as many as 9.3% of female teenagers experience hypertension, which is lower compared to men[7]. Blood pressure can be considered high when it exceeds the standard figure above 120/80 mmHg for teenagers over 13 years old by following the 2017 American Academy of Pediatrics guidelines[8]. The 2021 Decree of the Minister of Health of the Republic of Indonesia uses AAP guidelines for managing hypertension in children[9]. One longitudinal study proved that high blood pressure status in youth is associated with the occurrence of hypertension in adulthood[10]. High blood pressure can be influenced by several factors, such as genetics, gender, BMI (Body Mass Index), especially obesity, physical activity, and salt intake. In one of the articles by Hartman-Petrycka, it is stated that taste sensitivity significantly influences the control of food intake[11]. There are 5 basic taste types: sour, sweet, salty, bitter, and umami[11]. These five tastes can be measured and analyzed using sensory evaluation, such as absolute threshold. The absolute threshold test applies the

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principle of testing stimuli starting from a minor concentration that can cause an impression[12]. Individuals with a low taste threshold have high sensitivity to a taste[13]. So, if an individual has low sensitivity, they tend to increase salt consumption to get the appropriate salty taste. Increased salt consumption can occur in someone who has an increased salt taste threshold, and this is associated with an increased risk of hypertension[14].

Research on salt taste thresholds and hypertension in adolescents has not yet been widely conducted or published in Indonesia. However, the increasing prevalence of hypertension is a reason to investigate the salt taste threshold, which could be the first step in preventing hypertension. Therefore, it is necessary to analyze the relationship between saltiness threshold and hypertension in adolescents in Surabaya through this research.

METHODS

This research is a quantitative and analytical observational study that uses a cross-sectional research design. This research was conducted at the Subulussalam Islamic Boarding School for Students and Students (PPPM) Surabaya from May to July 2022 and was approved by the Ethics Commission of the Faculty of Public Health, Airlangga University (KEPK FKM UNAIR) on 11th July 2022 with number 143/EA/KEPK/2022. The research was conducted at PPPM Subulussalam Surabaya to minimize confounding factors influencing the taste threshold, namely from daily sodium intake because the Islamic boarding school provides food 3 times a day with identical portions. The dependent variable in this study is the incidence of hypertension in adolescents. Then, the independent variable in this research is the saltiness threshold. The sampling technique used was simple random sampling from all PPPM Subulussalam Surabaya students who were teenagers, and a total of 97 samples were obtained. The sample size uses the minimum sample size formula with a minimum sample size of 86 students. Random sampling was carried out by randomly examining respondents directly without paying attention to the strata that exist in the population by adjusting inclusion and exclusion factors. The inclusion factor is that the sample is a PPPM Subulussalam Surabaya student, including teenagers who are in good health or have a taste disorder. Meanwhile, the exclusion factor is students who have a smoking habit.

This research uses primary data from respondents through questionnaires, blood pressure measurements, and taste threshold tests. The questionnaire contained questions regarding the characteristics of the respondents, namely name, age, gender, and history of hypertension in the immediate family, including grandfather, grandmother, father, or mother. The family history of hypertension was asked directly whether any of the family members had a history of hypertension or were taking hypertension medication. Respondents' ages will be classified into three, namely early teens (12 - 14 years), middle teens (15 - 17 years), and late teens (18 - 21 years)[15]. Body weight was measured using a mother and baby scale, and height was measured using a stadiometer. This measurement shows the BMI/U category following the 2020 Minister of Health Regulation guidelines[16]. BMI/U classification will be categorized based on a z-score consisting of thinness (-3SD to < -2SD), normal (-2SD to +1SD), overweight (+1SD to +2SD), and obese (> +2SD). Then, blood pressure was measured using an Omron HEM-7130 Digital Tensimeter. Blood pressure measurements are carried out by trained health workers using calibrated instruments, and measurements are carried out in the morning with the individual in a sitting position 3 times to see which value is closest to the actual value. Blood pressure classification follows the latest AAP (American Academics of Pediatrics) guidelines for adolescents[8]. Teenagers' blood pressure can be said to be normal when it is below 120/80 mmHg. Blood pressure above normal includes high blood pressure at 120/80 mmHg to 129/<80 mmHg, grade 1 hypertension at 130/80 mmHg to 139/89 mmHg, and grade 2 hypertension at number ≥140/90 mmHg. All three blood pressure categories are above normal and categorized as hypertensive.

The taste threshold test was carried out using the method used by Yolanda (2015) and Fayasari (2022)[12,17]. The salt taste threshold test uses the 3-AFC (Alternative Forced Choice) method, and 5 sets of samples with different salt solution concentrations will be tested starting from the lowest concentration to the highest concentration (ascending concentration). The five salt concentrations are 0.58 g/L, 1.87 g/L, 5.84 g/L, 18.7 g/L, and 58.44 g/L. The solution uses NaCl and will be tested one by one using a cotton swab tested on the side papilla, and the respondent must re-neutralize the sense of taste by gargling with distilled water. From each sample, the panelists will determine which solution has a more pronounced salty taste. If the panelists can taste the salty at concentrations 1 and 2, they are said to have a normal salty taste threshold. If you can only taste it at a concentration of 3 - 5, then you are said to have a high saltiness threshold. The assessment will be calculated from the panelist's correct answer or on the solution where the panelist can feel the difference, and the swab can be tested twice if the panelist feels unsure about the answer. The data analysis began with the Kolmogorov-Smirnov normality test to ensure the data obtained was valid, and bivariate analysis was carried out with the Spearman correlation test to see whether there was a relationship between the two variables using the SPSS 25.0 (Statistical Package for the Social Science) application.

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RESULTS AND DISCUSSION

There were 97 respondents in the research conducted at the Subulussalam Student and Student Islamic Boarding School in Surabaya, and the characteristics of the respondents obtained from the research results are presented in Table 1. The average age of the respondents was 14 years, with an age range from 12 years to 18 years. The comparison between the number of male and female respondents is not much different, namely 48 male respondents (49.5%) and 49 female respondents (50.5%). Based on a family history of hypertension, there were 15 respondents (15.5%) who had a history of hypertension in one of their family members, while 82 respondents (84.5) had no family history of hypertension. For nutritional status based on BMI/U, use the Ministry of Health's guidelines for children aged 5 - 18. As many as 23.7% were classified as above normal, namely overweight and obese. Research conducted by Adam et al. shows a relationship between a family history of hypertension, especially in parents, and the incidence of hypertension[18]. This is also in line with research by Widyartha et al. namely that in the hypertension case group, 66.23% had a family history of hypertension[19].

Table 1. Frequency Distribution of Respondent Characteristics

Variable	n = 97 (%)	Mean±SD
Age		
Early Adolescence	20 (20.6)	14.79±1.45
Middle Teenager	62 (63.9)	
Late Teenagers	15 (15.5)	
Gender		
Man	48 (49.5)	
Woman	49 (50.5)	
Family History of Hypertension		
There is	15 (15.5)	
There is not any	82 (84.5)	
BMI/U		
Thinness	2 (2.1)	
Normal	72 (74.2)	21.83±4.41
Overweight	11 (11.3)	
Obese	12 (12.4)	

The research results regarding the saltiness threshold in adolescents are presented in Table 2. There were 15 respondents (15.5%) were classified as having a high saltiness threshold. Respondents are said to have a high salt taste threshold when they can only taste a salty solution at the third concentration, namely 5.84 g/L (0.1 mol/L) or higher. A study conducted by Dora et al. regarding differences in salt taste thresholds in children of various ethnicities[20]. The results showed that children of Chinese ethnicity had a salty taste threshold of 1.21±0.53 mmol/L, which is a higher value when compared to ethnic Malaysian children, namely 1.13±1.13 mmol/L and ethnic Indian children, namely 0.67±0.72 mmol/L. This is influenced by the different ingredients, food, and thresholds between the two ethnicities. Preserving and processing vegetables, tofu derivative products, seafood, poultry, and eggs using the salting method is common in Chinese culture among ethnic Chinese[20]. Several factors related to the sense of taste can influence a person's taste threshold. There are four types of papillae on the human tongue: filiform papillae, fungiform papillae, circumvallate papillae, and foliate papillae. Inside the papilla are taste buds (taste buds) to taste food. Several factors can influence the sense of taste, including age, gender, food temperature, abnormalities in the sense of taste, and smoking habits. The sensitivity of the sense of taste can be influenced by age because taste buds begin to degenerate at 45. Older individuals have higher sweet, salty, and bitter taste thresholds[21]. There are fungiform papillae on the tongue, which contain taste receptor cells, and the number of papillae in a unit area is called the density of fungiform papillae. The density value of the fungiform papilla is directly proportional to the density value of taste buds per fungiform papilla so that individuals with a higher density of fungiform papilla have taste buds with higher sensitivity. Fungiform papilla density in women (66.6±2.2 FPs/cm^2) higher than men (55.6±2.1 FPs/cm^2)[22].

Table 2. Frequency distribution of salty taste thresholds

Variable	n = 97 (%)
Wrong Answer	
Concentration 1 (0.58 g/L)	46 (47.4)
Concentration 2 (1.87 g/L)	13 (13.4)
Concentration 3 (5.84 g/L)	3 (3.1)
Concentration 4 (18.7 g/L)	97 (100)
Concentration 5 (58.44 g/L)	97 (100)

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Variable	n = 97 (%)
Saltiness Threshold	
Normal	82 (84.5)
Tall	15 (15.5)

Food and drink temperatures that are too extreme can damage taste cells. Even though cell regeneration occurs quickly, high temperatures can reduce the response to salty taste[21]. Abnormalities in the sense of taste will affect an individual's perception of taste, especially disorders of the nerves, such as Bell's palsy and vestibular schwannoma, and several infectious diseases that can also affect taste sensitivity[23]. Apart from that, smoking habits can affect the sensitivity of the sense of taste due to the continuous burning of tobacco and irritate the tongue, resulting in the thickening of the mucosal tissue in the mouth. Nicotine accumulates more easily, covering the taste buds and receptor membranes. This ultimately reduces the sensitivity of the taste buds[24].

The results of the respondents' blood pressure measurements are presented in Table 3. The classification of blood pressure in adolescents used the guidelines established by the American Academy of Pediatrics 2017, and the results showed that 15 respondents had blood pressure above normal. As many as 15.5% had blood pressure above normal and were included in the Hypertension category.

Table 3. Frequency distribution of adolescent blood pressure based on gender

Variable	n = 97 (%)	Mean±SD	Minimum	Maximum
Man				
Systolic Blood Pressure		111.19±16.170	88	154
Diastoyl Blood Pressure		66.67±6.83	53	90
Normal	37 (77.1)			
Hypertension	11 (22.9)			
Woman				
Systolic Blood Pressure		100.47±10.25	75	124
Diastoyl Blood Pressure		66.27±7.99	45	78
Normal	45 (91.8)			
Hypertension	4 (8.2)			

Blood pressure is the effort required so that blood can be pumped from the heart to the rest of the body through the blood vessels, and the blood pushes against the walls of the blood vessels, causing blood pressure to rise[25]. Blood pressure consists of systolic blood pressure when the heart is pumping and diastolic blood pressure when the heart is relaxing between two pulses. An increase in blood pressure can occur if there is an obstacle or disturbance. As a result, the heart has to work harder to pump. Hypertension is caused by several risk factors that can be changed or not. Some examples of risk factors that cannot be changed are genetic factors, gender, and age. Several individual habits can also be risk factors for hypertension. Toxic chemicals contained in cigarettes, such as nicotine and carbon monoxide, can damage the endothelial lining of arteries. The absorbed nicotine will also trigger the brain to send signals to the adrenal glands to release the hormone epinephrine, which constricts blood vessels[26]. Also, staying up late affects blood pressure because the hormone cortisol secretion is disrupted[27]. Another habit that is a risk factor for hypertension is the habit of eating foods that contain high sodium[28,29]. High sodium levels in the body obtained from an individual's daily consumption must be excreted through urine to avoid excess in the body and maintain electrolyte balance.

The salt taste threshold is related to the tongue's sensitivity to the salty taste felt on the tongue. Individuals with a low salt taste threshold can taste salty in low concentrations[13]. This means that the individual is sensitive or highly sensitive to the taste of salt. Individuals with low sensitivity to salty taste tend to increase salt consumption to obtain a salty taste that suits their tastes[13]. Oner et al. also stated in their study that high salt consumption will reduce sensitivity to the taste of salt, so individuals will add more salt to their food so that the salty taste can still be felt[13].

On the other hand, reducing salt consumption will lower the taste threshold value and influence preferences and consumption of salty tastes. The saltiness threshold can influence appetite for salty foods and can be used as a benchmark for sodium intake. This was also mentioned in research by Kim et al. Individuals with a high taste threshold for salty taste will consume more salt than those with a low taste threshold[30].

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Table 4. The relationship between saltiness threshold and hypertension in adolescents based on gender

Saltiness Threshold	Hypertension			Systolic Blood Pressure		Diastolic Blood Pressure	
	Normal	Hypertension	Total				
	n (%)	n (%)	n (%)	r	p-value	r	p-value
Man							
Normal	30 (62.5)	9 (18.8)	39 (81.3)	0.320	0.027	0.422	0.003
Tall	7 (14.5)	2 (4.2)	9 (18.7)				
Woman							
Normal	40 (81.6)	3 (6,2)	43 (87.8)	0.133	0.362	0.148	0.310
Tall	5 (10.2)	1 (2.0)	6 (12.2)				

There is a significant relationship between the salty taste threshold and the incidence of hypertension in male respondents, as shown in Table 4. A total of 39 male teenagers with normal taste thresholds, 9 of them were classified as hypertensive, and 2 of the 9 male teenagers with a high taste threshold are classified as hypertension. In contrast to the test results on adolescent girls, there was no significant relationship with systolic or diastolic blood pressure. Several studies show that men have a higher prevalence and risk of developing hypertension than women[31-33]. The differences in risk factors are associated with age, BMI, smoking habits, awareness of healthy lifestyles, and hypertension, as well as biological differences such as different sex hormones. Men have a higher chance of experiencing hypertension than women. The results of statistical tests in this study are different from the results of research by Fayasari and Cahyani, and there was no difference in the salty taste threshold between the control group and the hypertension group[17]. Another study by Kim showed no correlation between the detection or recognition of taste thresholds and systolic blood pressure[30]. This study's results align with the literature study conducted by Sari et al. who found a correlation between the salt taste threshold and hypertension as measured by questionnaires and 24-hour urinary sodium excretion[34]. However, a study by Sawai et al. shows a relationship between the saltiness threshold and consuming foods containing high salt[35]. A salty taste that is more difficult to detect will increase the consumption of foods high in salt, such as soupy foods that are rich in flavor or fast food that is high in sodium. Another study examining the salt taste threshold found an association with metabolic syndrome and salt consumption habits[36]. Metabolic syndrome is measured by measuring waist circumference, fasting glucose, blood pressure, and triglycerides. Respondents with a high salt taste threshold also tend to add salt to food because of their low sensitivity to the taste of salt.

This research shows the results of a significant relationship between the saltiness threshold and the incidence of hypertension in male adolescents in Surabaya. This proves that the salt taste threshold, influenced by salt consumption patterns, can be a risk factor for increased blood pressure. Increased blood pressure in youth can increase the risk of hypertension in adulthood. If hypertension is not treated early, complications will occur, such as stroke, kidney disease, heart disease, and others. As an early preventive measure, further research should be carried out regarding the risk factors that cause hypertension in respondents and the taste threshold as an early detection step in high salt consumption. Both the saltiness threshold and hypertension are influenced by various factors not examined in this study. In this taste threshold test, there can be some bias in data collection, such as respondents who have just consumed food with a salty taste or did not neutralize their mouths first before changing samples, which will then influence the results of the salty taste threshold.

CONCLUSIONS

As many as 4.2% of male respondents had a high salt taste threshold and were classified as hypertensive. Based on the results of statistical tests, there is a significant relationship between systolic and diastolic blood pressure. However, there was no relationship between a high salt taste threshold and the incidence of hypertension in female respondents. Further research needs to be done regarding gender, which influences the salt taste threshold and blood pressure, as well as other variables that can influence the relationship between these variables.

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Conflict of Interest and Funding Disclosure

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REFERENCES

1. Kemenkes Rl. *Upaya Kesehatan Anak*. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 25 Tahun 2014* (2014).
2. Badan Pusat Statitsik. *Statistik Indonesia 2021*. (2021).
3. Badan Pusat Statitsik. *Proyeksi Penduduk Kota Surabaya (Jiwa), 2018-2020.* https://surabayakota.bps.go.id/indicator/12/197/1/proyeksi-penduduk-kota-surabaya.html (2021).
4. Kemenkes Rl. *Laporan Nasional Hasil Riset Kesehatan Dasar (Riskesdas) Indonesia Tahun 2018*. https://kesmas.kemkes.go.id/assets/upload/dir_

How to cite: *Syifadhiya, Q., & Farapti, F. (2023) Association between Salty Taste Threshold and Hypertension among Adolescents in Surabaya: Hubungan Ambang Rasa Asin dengan Kejadian Hipertensi pada Remaja di Surabaya. Amerta Nutrition, 7(4), 487–493.*

519d41d8cd98f00/files/Hasil-riskesdas-2018_1274.pdf (2018).
5. Riskesdas. *Riset Kesehatan Dasar 2013*. (2013).
6. Mahan, K., Escott-Stump, S. & Raymond, J. *Krause's Food and the Nutrition Care Process*. (2012).
7. Nurmayanti. Studi Validasi Ukuran Antropometri dan Komposisi Lemak Tubuh Terhadap Tekanan Darah pada siswa-siswi di SMAK 2 Penabur Jakarta Tahun 2014. (Universitas Indonesia, 2014).
8. Flynn, J. T., Kaelber, D. C. & Baker-Smith, C. M. *Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents*. https://publications.aap.org/pediatrics/article/140/3/e20171904/38358/Clinical-Practice-Guideline-for-Screening-and?autologincheck=redirected (2017).
9. Kemenkes RI. Kepmenkes RI No. HK.01.07/MENKES/4613/2021 Tentang Pedoman Nasional Pelayanan Kedokteran Tata Laksana Hipertensi Pada Anak. 1–55 (2021).
10. Urbina, E. M. *et al.* Relation of Blood Pressure in Childhood to Self-Reported Hypertension in Adulthood: the International Childhood Cardiovascular Cohort (i3C) Consortium. *Hypertension* **73**, 1224–1230 (2019).
11. Hartman-petrycka, M., Klimacka-nawrot, E., Ziora, K. & Suchecka, W. Sweet, Salty, and Umami Taste Sensitivity and the Hedonic Perception of Taste Sensations in Adolescent Females with Anorexia Nervosa. *Nutrients* **14**, (2022).
12. Yolanda, S. Uji Ambang Mutlak Lima Dasar pada Sampel Penduduk Jawa Bagian Barat, Tengah, dan Timur dengan Metode 3-AFC (Alternative Forced Choice). (Universitas Brawijaya, 2017).
13. Öner, C. *et al.* A pilot study on salt taste sensitivity threshold in Turkish young adults. *Anatol. J. Cardiol.* **16**, 731–732 (2016).
14. Tjahajawati, S., Rafisa, A., Murniati, N. & Zubaedah, C. Perbedaan Sekresi Saliva, Ambang Kecap, Tekanan Darah, Kadar Glukosa Darah Pada Wanita Perokok Dan Non-Perokok. *Dharmakarya* **8**, 6 (2019).
15. Hurlock, E. B. *Psikologi Perkembangan: Suatu Pendekatan Sepanjang Rentang Kehidupan*. (Erlangga, 2011).
16. Kemenkes Rl. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2020 Tentang Standar Antropometri Anak*. http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No__2_Th_2020_ttg_Standar_Antropometri_Anak.pdf (2020).
17. Fayasari, A. & Cahyani, S. I. Salt taste threshold and sodium intake on the incidence of hypertension in adults in Depok, West Java. **3**, 14–18 (2022).
18. Adam, A. G. A., Jeini, E. N. & Windy, M. V. W. Kejadian Hipertensi dan Riwayat Keluarga Menderita Hipertensi di Puskesmas Paceda Kota Bitung. *J. KESMAS* **7**, 1–5 (2018).
19. Widyartha, I. J., Putra, I. W. G. A. E. & Ani, L. Public health and preventive medicine. *Public Heal. Prev. Med. Arch.* **4**, 186–194 (2016).
20. Dora, R. *et al.* Salty Taste Threshold Among Children of Different Ethnicities. *J. Sens. Stud.* **36**, e12623 (2020).
21. Walker, S. J., Corrales-Carvajal, V. M. & Ribeiro, C. Postmating circuitry modulates salt taste processing to increase reproductive output in Drosophila. *Curr. Biol.* **3**, 2621–2630 (2015).
22. Puspitaningtyas, E. Perbedaan Kepekaan Pengecapa antara Laki-Laki dengan Perempuan pada Penduduk Lanjut Usia di Provinsi Daerah Istimewa Yogyakarta. (2017).
23. Barret, K. E., Barman, S. M., Boitano, S. & Brooks, H. L. *Ganong's Review of Medical Physiology, 25th Ed.* (McGraw HILL, 2015).
24. Primasari, A. & Yong, B. C. Pengukuran Sensitivitas Indera Pengecap Rasa Manis Dan Asin Pada Mahasiswa Perokok (Taste Sensitivity Measurement Sweetness and Saltness in Smoking Habit Student). *Dentika Dent. J.* **17**, 30–33 (2012).
25. Sari, Y. N. *Berdamai dengan Hipertensi*. (Bumi Medika, 2017).
26. Umbas, I. M., Tuda, J. & Numansyah, M. Hubungan Antara Merokok Dengan Hipertensi Di Puskesmas Kawangkoan. *J. Keperawatan* **7**, (2019).
27. Shaumi, N. R. F. & Achmad, E. K. Kajian Literatur: Faktor Risiko Hipertensi pada Remaja di Indonesia Literature Review: Hypertension Risk Factors Among Adolescents in Indonesia. *Media Litbangkes* **29**, 115 – 122 (2019).
28. Fatta, L. A. & Sulchan, M. Asupan Tinggi Natrium dan Berat Badan Lahir sebagai Faktor Risiko Kejadian Hipertensi Obesitas pada Remaja Awal. *J. Nutr. Coll.* **1**, 607–613 (2012).
29. Aristi, D. L. A., Rasni, H., Susumaningrum, L. A., Susanto, T. & Siswoyo, S. Hubungan Konsumsi Makanan Tinggi Natrium dengan Kejadian Hipertensi pada Buruh Tani di Wilayah Kerja Puskesmas Panti Kabupaten Jember. *Bul. Penelit. Sist. Kesehat.* **23**, 53–60 (2020).
30. Kim, C. Y., Ye, M. K. & Lee, Y. S. The Salt-Taste Threshold in Untreated Hypertensive Patients. *Clin. Hypertens.* (2017).
31. Pilic, L. & Mavrommatis, Y. Genetic predisposition to salt-sensitive normotension and its effects on salt taste perception and intake. *Br. J. Nutr.* **120**, 721–731 (2018).
32. Singh, S., Shankar, R. & Singh, G. Prevalence and associated risk factors of hypertension: A cross-sectional study in Urban Varanasi. *Int. J. Hypertens.* 10 (2017).
33. Everett, B. & Zajacova, A. Gender Differences in Hypertension and Hypertension Awareness Among Young Adults. *Biodemography Soc. Biol.* **61**, 1–17 (2015).
34. Sari, A. N. & Farapti, F. Salt Taste Threshold as a Detection of Salt Intake in Hypertensive Individuals. *J. Berk. Epidemiol.* 227–236 (2022).
35. Sawai, A., Nagata, Y., Kudo, F., Fujii, H. & Sawai, S. Relationship between Measurement Salt Taste

How to cite: *Syifadhiya, Q., & Farapti, F. (2023) Association between Salty Taste Threshold and Hypertension among Adolescents in Surabaya: Hubungan Ambang Rasa Asin dengan Kejadian Hipertensi pada Remaja di Surabaya. Amerta Nutrition, 7(4), 487–493.*

Threshold and Salt Intake in Japanese Primary School Students, Parents, and High School Students Using Test Papers of Low Concentration Taste Threshold. **24**, (2022).

36. Veček, N. N. *et al.* The association between salt taste perception, Mediterranean diet, and metabolic syndrome: A cross-sectional study. *Nutrients* **12**, 1–22 (2020).

How to cite: *Syifadhiya, Q., & Farapti, F. (2023) Association between Salty Taste Threshold and Hypertension among Adolescents in Surabaya: Hubungan Ambang Rasa Asin dengan Kejadian Hipertensi pada Remaja di Surabaya. Amerta Nutrition, 7(4), 487–493.*