

**ADOLESCENTS TASTE SENSITIVITIES IN CLINICAL PRACTICE***Y.M. Nechytailo, O.Y. Pidmurniak, N.I. Kovtiuk*

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**Abstract.** Taste is the type of sensitivities that helps human organism to identify and consume nutrients and to avoid indigestible and dangerous materials. The lower taste sensitivity usually is following by food gradients overconsumption, influenced food choice and food preferences, which contributes, in a cumulative manner, to health status.

**The objective of the study** was examination of children taste oral sensation in association with anthropometric data, resting blood pressure and other factors. **Material and methods.** In study 169 participants in age 10-17 years were included for assessment of salt and sweet taste sensitivities, structure and quality of nutrition, food preferences, anthropometric data, chronotype, blood pressure.

**Results.** The low taste sensitivity to salt minimal concentrations was registered in 50 persons (29.6%) and to sweets - 60 persons (35.5%). Difference between males and females in taste sensitivities level was not established. The association between systolic blood pressure and the salt taste sensitivities was shown in regression model with inclusion of some anthropometric data. Elevated systolic blood pressure significantly correlates with excessive body mass, with heart beat rate and low salt sensitivity. Regarding patients chronotype we found out higher frequency of arterial hypertension in cases with evening type.

**Conclusions.** The taste sensitivity examination is simple in execution but gives additional data for risk factor assessment. Compared with the group of children with normal sensitivity persons with low sensitivity have higher risk of overweight, salt and sweet overconsumption and arterial hypertension.

**Ключові слова:** діти, смакова чутливість, артеріальний тиск, надмірна вага.

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**СМАКОВА ЧУТЛИВІСТЬ У ПІДЛІТКІВ У КЛІНІЧНІЙ ПРАКТИЦІ***Ю.М. Нечитайло, О.Я. Підмурняк, Н.І. Ковтюк*

Смак — це тип чутливості, який допомагає людському організму виявляти та споживати харчові речовини та уникати нестравних і небезпечних матеріалів. Нижча смакова чутливість зазвичай призводить до надмірного споживання окремих харчових інгредієнтів, до формування вибору їжі та харчових звичок, які сукупно впливають на стан здоров'я.

**Мета дослідження** — вивчення смакової чутливості у дітей та її асоціації з антропометричними даними, артеріальним тиском та іншими факторами.

**Матеріал і методи.** У дослідження включено 169 учасників віком 10–17 років для оцінки смакової чутливості до солоного та солодкого, структури та якості харчування, харчових уподобань, антропометричних даних, хронотипу, артеріального тиску.

**Результати.** Знижена смакова чутливість до мінімальних концентрацій харчової солі зареєстрована у 50 осіб (29,6%), а до солодкого — у 60 осіб (35,5%). Різниця між хлопчиками та дівчатками за рівнем смакової чутливості не встановлено. Зв'язок між систолічним артеріальним тиском і смаковою чутливістю до солоного показано в регресійній моделі з включенням деяких антропометричних даних. Підвищений систолічний артеріальний тиск істотно корелював з надмірною масою тіла, з частотою серцевих скорочень і низькою чутливістю до солі. Залежно від хронотипу була виявлена більша висока частота артеріальної гіпертензії в осіб із вечірнім хронотипом.

## Оригінальні дослідження

**Висновки.** Оцінка смакової чутливості проста у виконанні, але надає додаткові дані для встановлення факторів ризику. У порівнянні з групою дітей із нормальною чутливістю особи з низькою чутливістю мають більш високий ризик надмірної ваги, надлишкового вживання солоного або солодкого, артеріальної гіпертензії.

**Ключевые слова:**

дети, вкусовая чувствительность, артериальное давление, избыточный вес.

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**ВКУСОВАЯ ЧУВСТВИТЕЛЬНОСТЬ ПОДРОСТКОВ В КЛИНИЧЕСКОЙ ПРАКТИКЕ**

**Ю.Н. Нечитайло, О.Я. Пидмурняк, Н.И. Ковтюк**

*Вкус — это тип чувствительности, который помогает человеческому организму идентифицировать и потреблять питательные вещества и избегать неперевариваемых и опасных веществ. Более низкая вкусовая чувствительность обычно сопровождается чрезмерным потреблением отдельных пищевых продуктов, влияет на выбор пищи и ее предпочтения, которые в совокупности отражаются на состоянии здоровья.*

**Цель исследования** — изучение вкусовой чувствительности у детей и ее ассоциации с антропометрическими данными, артериальным давлением и другими факторами.

**Материал и методы.** В исследование включены 169 участников в возрасте 10–17 лет для оценки вкусовой чувствительности к соленому и сладкому, структуры и качества питания, пищевых предпочтений, антропометрических данных, хронотипа, артериального давления.

**Результаты.** Сниженная вкусовая чувствительность к минимальной концентрации пищевой соли была зарегистрирована у 50 человек (29,6%), а к сладкому — у 60 человек (35,5%). Разницы между мальчиками и девочками по уровню вкусовой чувствительности не установлено. Связь между систолическим артериальным давлением и вкусовой чувствительностью к соленому показана в регрессионной модели с включением некоторых антропометрических данных. Повышенное систолическое артериальное давление существенно коррелировало с избыточной массой тела, с частотой сердечных сокращений и низкой чувствительностью к соли. В зависимости от хронотипа была обнаружена более высокая частота артериальной гипертензии у лиц с вечерним хронотипом.

**Выводы.** Оценка вкусовой чувствительности проста в исполнении, но предоставляет дополнительные данные для выявления факторов риска. По сравнению с группой детей с нормальной чувствительностью лица с низкой чувствительностью имеют более высокий риск избыточного веса, чрезмерного употребления соленого или сладкого, артериальной гипертензии.

**Introduction.** Taste is the type of sensitivities that help human organism to identify and consume nutrients and to avoid indigestible and dangerous materials. It is commonly held that there are five basic tastes — sweet, sour, bitter, umami and salty. Taste buds, the end-organs for gustation, detect and respond to a variety of macronutrient and aversive compounds to generate taste perception during first year of life [1, 2]. Each of these tastes is believed to represent different nutritional or physiological requirements or pose potential dietary hazards. The capacity to perceive taste sensations significantly influences food choice and food preferences, which contribute in a cumulative manner to health status and quality of life [3].

The lower taste sensitivity usually is following by gradi-

ent overconsumption and sometimes with health problems. Overconsumption of sodium, primarily in the form of salt (sodium chloride), is associated with higher incidence of hypertension, which increases the risk of cardiovascular disease and stroke [4]. Overconsumption of sweet products is associated with overweight and metabolic syndrome, which indirectly causes blood pressure elevation [5]. This relation has led health agencies worldwide to call for a reduction of some food components, most recently evidenced by the revised US Dietary Guidelines [6].

Salty taste governs intake of sodium and other salts, essential for maintaining the body's water balance and blood circulation. Because sodium is the ligand for salty taste, a more comprehensive understanding of the factors

that drive salt consumption is needed to help develop effective and successful strategies to reduce sodium intake [7]. A major factor underlying excess sodium consumption is the human preference for salted foods. Although this preference likely shaped by innate components, dietary experience also contributes significantly to the liking for salt. Most of clinical studies have been conducted in adults, but a few suggest that early experiences, both in utero and during infancy, may shape the preference for salty taste [8, 9]. Epidemiological studies show that hypertension onset is strongly associated with salt consumption: there is a close relationship between average sodium salt intake and the incidence of hypertension, when sodium intake restriction substantially decreases blood pressure [7]. The link between dietary sodium and hypertension is well established and dietary modification is a primary step in hypertension risk reduction. Standard clinical advice for the prevention and treatment of hypertension includes limitation of salt intake [10, 11].

Nevertheless, in pediatric clinical practice taste sensitivity investigation is very rare used, but just during childhood could be shaped the preference for some gustation and food forms because of peculiarity of taste sensitivity.

**Objective.** The goal of prospective study was examination of children taste oral sensation in association with anthropometric data, resting blood pressure and other factors.

**Material and methods.** In total 169 children healthy, hypertensive and diabetic (ages 10–17 years, mean age — 13.7 years) were examined. The study included assessment of salt and sweet taste sensitivities, structure and quality of nutrition, food preferences, anthropometric data, resting blood pressure and children quality of life. The salt taste intensity was measured using tests in five concentrations of sodium chloride solution (0.04%, 0.08%, 0.16%, 0.32% and 0.64% sodium chloride dissolved in deionized water) and simple water. The sweet taste intensity was measured using five concentrations of sucrose solution (0.05%, 0.1%, 0.2%, 0.4% and 0.8%). Children were instructed to expectorate taste solution and rinse with water

after each sample. Subjects were asked to report which type of taste they sense. Frequency of added salt was determined with the questionnaire. For level of liking/disliking, subjects report the overall liking of the types of drinks or food. Circadian rhythm chronotype assessed too with the standard questionnaire for identifying the chronotypes (morningness–eveningness). To obtain the resting blood pressure three measurements were recorded at approximately 3-minute intervals, data from average were used. Hypertension was defined as a systolic blood pressure over 95 gender/age/height dependent percentile. Statistical analysis conducted with program Statistica (version 5.11, StatSoft Inc.). All p-values were two-tailed and  $p < 0.05$  was considered statistically significant.

**Results and discussion.** From study cohort 52 children (30.8%) identified the sweet taste intensity in minimal concentration (0.05% of sucrose), sensitivity to next concentration (0.1% of sucrose) was registered in 57 children (33.7%). We regarded these two children's cohorts as "normal sensitivity" group (109 persons). To the group with low sensitivity we included next three cohorts (in total 60 persons, 35.5%) with identification of sweet taste in concentration 0.2% — 29 persons (17.2%), 0.4% — 21 persons (12.4%) and 0.8% solution of sucrose — 10 persons (5.9%).

As to the salt taste assessment the result was following — "normal sensitivity" group included 84 persons (49.7%) with identification 0.04% solution of NaCl and 35 children (20.7%) with identification of next concentration (0.08% NaCl). To the group with low sensitivity we put three cohorts (in total 50 persons) with minimal concentration of salt taste range between 0.16%, 0.32% and 0.64% solution of NaCl corresponding — 25 (14.8%), 16 (9.5%) and 9 (5.3%) persons. In some children we registered deviation in taste (disgeusia) — they accept minimal concentration of salty solution as sour (11–6.5%) or bitter (12–7.1%). We did not find any difference between males and females in sweet and salt sensitivities level. The sweet taste sensitivity negatively correlated with BMI and was lower in diabetic patients. We did not find any significant

Regression summary for dependent variable systolic blood pressure

Table

|   |                  | Regression index |       |         |
|---|------------------|------------------|-------|---------|
|   |                  | BETA             | B     | p-level |
| 1 | Age              | -0,01            | -0,11 | 0,95    |
| 2 | Gender           | -0,05            | -4,26 | 0,48    |
| 3 | Height           | 0,52             | 0,39  | 0,13    |
| 4 | Weight           | 0,02             | 0,05  | 0,69    |
| 5 | BMI              | 0,43             | 0,17  | 0,03    |
| 6 | Pulse            | 0,43             | 0,62  | 0,02    |
| 7 | Salt sensitivity | -0,10            | 43,0  | 0,01    |

## Оригінальні дослідження

correlation between sweet and salt taste sensitivity.

To further examine the relation between low taste acceptances we hypothesized that dietary exposure to sodium and sweets was important in the formation of taste preference [12, 13]. The children's "liking for salty foods" was assessed using a 5-point category scale to indicate child's liking of common table foods that varied in degree of perceived saltiness. The salt taste sensitivity in our investigation not differs with age or gender of children but has strong negative correlation with salty foods preferences and overall sodium consumption. The frequency of adding salt to food varied significantly by salt taste intensity group. The percentage of subjects who reported never adding salt was higher in the normal group (78.9%) compared to the group with low sensitivity (30.0%).

The association between systolic blood pressure and the salt taste sensitivities was studied in model with inclusion of some anthropometric data. Regression summary was shown below (table). In this model elevated systolic blood pressure significantly correlate with excessive body mass, with heart beat rate and low salt sensitivity. Regarding patients chronotype we found out higher frequency of arterial hypertension in cases with evening type.

In addition, the frequency of adding salt to food was significantly ( $p < 0.01$ ) related to hypertension status, that correlate with data established by H. Lee et al. [14]. Among the hypertensive, 30% never added salt while among the non-hypertensive 54% never added salt to food. However, when the analysis was restricted only to non-hypertensive the relationship between blood pressure level status and discretionary salt use was no longer significant. For hypertensive children significant association between blood pressure and the intensity of salt taste was observed: systolic BP ( $r = 0.79$ ,  $p < 0.05$ ), diastolic BP ( $r = 0.61$ ,  $p < 0.05$ ).

Overall, we did not find any apparent difference between males and females salt sensitivities or blood pressure level inside every group. Some researchers have suggested that a family history of hypertension is associated with salt consumption and level of blood pressure, implying that this phenomenon may be genetically mediated. J.E. Hayesa et al [7] did explaining variability in sodium intake through oral sensory phenotype, salt sensation and liking or disliking some type of food.

The disorders of taste sensitivity are relatively common problems that may have a real impact on a person's quality of life. In our investigation, we found nonsignificant decrease of mental health component of quality of life in patients with low salt sensitivity but for this result verification additional analyses and enlargement of sample size must be done. While the sensory system of taste is regarded together with clinical features, its deviations could be potential clinical problems depending on the degree of dysfunction.

## Conclusions

The taste sensitivity examination is simple in execution but gives additional data for risk factor assessment. The taste deviation poses a significant challenge for the health care of children population. The persons with low sensitivity have higher risk of overweight, salt and sweet overconsumption and hypertension compared with the group of normal sensitivity children, they also reported greater liking of food with higher levels of corresponding product components.

**Conflicts of interests.** The authors declared no conflict of interest.

**Ethics statement.** To ensure the participants' human rights ethical principles and standards of rights protection were adhered to during the entire research process.

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