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Research Article

Saltiness sensory threshold of hypertensive and normotensive consumers

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Abstract

Excessive sodium intake has been linked to development of hypertension and related pathologies [1]. Blood pressure and saltiness sensory thresholds of 25 normotensive (control) and 25 hypertensive consumers were measured by presenting samples with increasing sodium molarity of 0M, 0.02M, 0.03M, 0.05M and 0.07M. Majority of the normotensive consumers detected the lowest sodium concentration of 0.02M whereas more number of hypertensive consumers detected higher sodium concentrations of 0.03M, 0.05M and 0.07M. This implies that hypertensive consumers have higher saltiness sensory threshold than normotensive consumers. Thus, saltiness sensory threshold can be considered a potential factor that affects sodium intake of consumers. Consumers with higher saltiness sensory threshold are more likely to consume higher amount of salt in their diet, thus they are more prone in developing hypertension.

Keywords: sodium chloride, salt, hypertension, blood pressure, nutrition, Philippines.

Introduction

Sodium is an important macromineral responsible for the maintenance of the extracellular fluid balance and pH value, transport of nutrients, absorption of glucose, nerve transmission and muscle contractions [2]. Sodium is naturally present in food, added during processing or cooking and as a condiment. Sodium from milk, meat or vegetables is considered as naturally present, since these food items contain sodium prior to processing. Sports drinks and processed meat contain added sodium. Those that are from fish sauce used as a condiment can be considered as table salt condiment. Salt is a flavouring added in savory dishes up to certain extent in confectioneries and desserts. It is used in mass production of food, preservation and in seasoning sauces and ketchup.

Food preference among individuals is vast and in more ways, dynamic. Food choice is dictated by the organoleptic capability of the individual. Taste, appearance, odor, mouth feel and sound dictate the degree of preference of a person towards food. Various methods of sensory evaluation are utilized to illustrate and quantify the organoleptic preference of individuals. Sensory stimuli detection involves the identification of attributes at controlled environments. Threshold tests are utilized for taste determination at increasing or decreasing concentrations, detection or absolute threshold is the lowest concentration of a stimuli that can be perceived [3, 4].

The salty taste can be stimulated by sodium chloride [5]. Exposure to likeness for salty food has been shown to be influenced by varying sodium concentration [1]. Increased exposure to high concentrations of sodium is linked to increased liking for salty food [6].

Diets containing nine grams of sodium increased blood pressure [7]. Several studies suggest that excessive sodium intake is linked to the development of hypertension or the elevation of blood pressure. It is perceived that sodium contributes to the development of hypertension by increasing the volume of extracellular fluid, increasing biochemical mediated mechanisms in the body like cardiovascular sensitivity [8].

The degree of liking salty food depends on personal preference. However, poor detection of saltiness concentration contained in food is one possible reason for excessive salt consumption of individuals. Excessive salt intake increases blood pressure leading to the development of hypertension. Thus, the objective of this study was to measure blood pressure and evaluate saltiness sensory threshold of hypertensive and normotensive consumers.

Materials and Methods

Preparation of salt (NaCl) solutions

Four different weights of sodium chloride (NaCl) powder were dissolved in small amount of distilled water and diluted to 1 litre. Control sample (water) was included in the set of samples used for saltiness sensory threshold assessment.

Saltiness threshold of normotensive and hypertensive consumers

Concentrations used for threshold assessment of normotensive and hypertensive are presented in Table 1. Fifty (50) consumers, 21 male and 29 female, ages ranging from 18 to 64 years old, took part in the study upon approval of consent. Blood pressure of consumers was measured using an automatic digital sphygmomanometer (Micro Life™, Switzerland). They were grouped into two according to their blood pressure, 25 of them were classified as normotensive group (control) and 25 of them were classified as hypertensive group. Classification was based from the data in Table 2. Normotensive group pertains to those individuals with normal blood pressure and hypertensive group pertains to those individuals with high blood pressure. Saltiness threshold of the participants were determined by detecting the lowest sodium concentration that they can perceived within the coded samples.

Table 1. Salt concentration used for saltiness sensory threshold assessment.

Salt Concentration (M)	Salt Concentration (%)	Grams of NaCl / Liter of H_2O
0	0	0
0.02	0.1	1
0.03	0.2	2
0.05	0.3	3
0.07	0.4	4

Participants were presented with 5 samples, one of which is the control and the remaining four were with salt solutions. Salt solutions were served in 20 mL portions at room temperature, with a 3-digit blinding code to prevent assumptions to the order of concentration. Writing instruments used in marking the sampling cups are odour-free. Participants were given a questionnaire but they did not know the order of concentration and that there is a control sample. They were requested to taste each sample from left to right (from lowest to highest concentration rinsing palate with distilled water between samples). Participants were instructed to encircle the code of the sample where saltiness is first detected.

Table 2. Classification of Blood Pressure [9].

Systolic pressure (mm Hg)	**Diastolic pressure** (mm Hg)	**Stages of High Blood Pressure**
High Blood Pressure		
210	120	Stage 4
180	110	Stage 3
160	100	Stage 2
140	90	Stage 1
Normal Blood Pressure		
130	85	High Normal
120	80	Normal
110	75	Low Normal

Results and Discussion

High blood pressure, or hypertension, is one of the most widespread yet distressing medical problems that physicians and health care providers face in the industry [10]. The leading risk factors are family history, race, stress, obesity, a high intake of saturate fats or sodium, tobacco use, sedentary lifestyle and aging [11].

Table 3. Saltiness sensory threshold of hypertensive and normotensive consumers.

Salt Concentrations (M)	**Normotensive**	**Hypertensive**	**TOTAL**
0	0	0	**0**
0.02	12	7	**19**
0.03	8	10	**18**
0.05	3	4	**7**
0.07	2	4	**6**

As stated above, high intake of sodium is one of the risk factors of hypertension. In this study, researchers evaluated saltiness sensory threshold and blood pressure of selected consumers. Since their ability to detect saltiness in food may contribute to their increasing intake of sodium which may lead to hypertension. Salt solutions of increasing concentrations were evaluated by 25 normotensive and 25 hypertensive consumers.

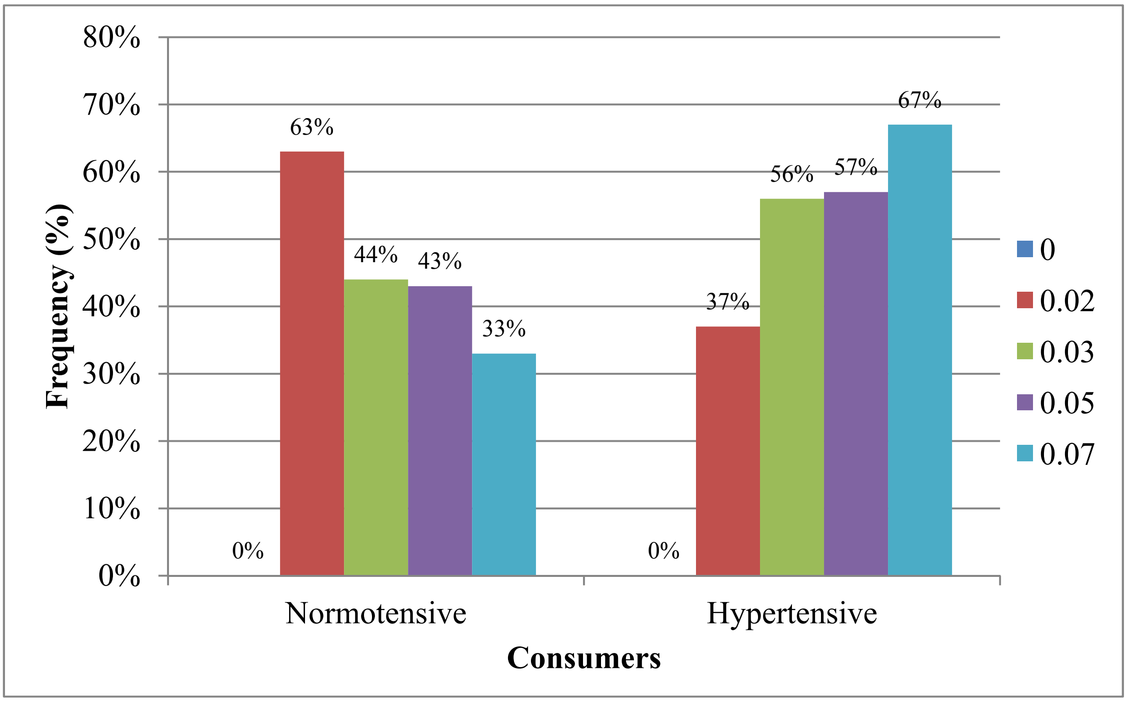

Figure 1. Saltiness sensory threshold of hypertensive and normotensive consumers.

According to Figure 1, 63% of the normotensive subjects and 37% of hypertensive subjects detected 0.02 M sodium concentration. This implies that more people with normal blood pressure detected the lowest sodium concentration than people with high blood pressure. At 0.03 M sodium concentration, 44% normotensives and 56% hypertensives detected saltiness. On the second sodium concentration, saltiness detection of normotensives started to decrease while saltiness detection of hypertensives started to increase. Forty-three percent (43%) of subjects with normal blood pressure and 57% of subjects with high blood pressure detected saltiness from samples with 0.05 M concentration. For samples with 0.07 M sodium concentration, 33% normotensives and 67% hypertensives detected it. Detection of the last two concentrations was observed more by the hypertensive subjects.

Results showed a trend in which most normotensive consumers detected lower sodium concentrations while more hypertensive consumers detected those solutions with higher sodium concentrations. Earlier studies also demonstrated higher salt taste threshold among hypertensives compared to normotensives [12].

Saltiness sensory threshold can be considered a potential factor that affects sodium intake. Subjects with lower saltiness sensory threshold will have a tendency to consume lesser sodium since they can detect saltiness easily while subjects that cannot easily detect saltiness will have a tendency to consume greater amount of sodium. Thus, consumers with higher saltiness sensory threshold are more likely to develop hypertension because poor detection of saltiness may result to excessive sodium intake that will cause an increase their blood pressure.

Conclusion

Majority of the normotensive consumers detected the lowest sodium concentration of 0.02M whereas a greater number of hypertensive consumers detected higher sodium concentrations of 0.03M, 0.05M and 0.07M. Hypertensive consumers have higher saltiness sensory threshold than normotensive consumers. Thus, saltiness sensory threshold can be considered a potential factor which affects sodium intake of consumers. Poor saltiness detection can increase sodium intake and could lead to the development of hypertension. It is suggested that in future studies, population size be increased.

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