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Estimating Salt Intake by Citizens of Kosovo Using 24-Hour Urine Sodium Excretion

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Abstract

Background: The minimum physiological need for sodium is estimated to be 200-500 mg/day (about 0.5-1.25 g of salt per day) (WHO, 2012). Many studies have shown that salt consumption is the main factor in increasing blood pressure and cardiovascular disease cases.

Methods and Results: This transversal cross-sectional study was performed in Kosovo in 2019. The study included 219 people of both sexes (49.9% men and 50.2% women) aged 20–59 years. Urine was collected within 24 hours in accordance with the written instructions, and an oral explanation was provided to each research participant. Na and K in urine were analyzed using SmartLyte® autoanalyzer (Diamond Diagnostics, Holliston, Massachusetts, USA). Our results showed that the average urinary Na excretion over 24 hours in the Kosovo population was 9.52 g/24h, which corresponds to a daily salt intake of 23.8 g/24h. The average amount of urinary Na excreted in 24 hours was significantly higher in men (11.60 g/24h) than in women (7.46 g/24h) ($P<0.001$). Thus, the average amount of salt consumed by participants was 29.46 g/24h for men and 18.94 g/24h for women. The average urinary K excretion over 24 hours in men was 2.02 g/24h, while that in women was 1.61 g/24h ($P=0.000$). The Na/K ratio was significantly higher in men (6.58) than in women (5.27) ($P<0.05$).

Conclusion: The citizens of Kosovo consume a large amount of salt, greater than 5 g/day. In Kosovo, there has yet to be a comprehensive strategy for reducing salt consumption.(**International Journal of Biomedicine. 2022;12(4):631-635.**).

Keywords: salt • urine • sodium excretion • potassium • Kosovo

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Introduction

The minimum physiological need for sodium is estimated to be 200-500 mg/day (about 0.5-1.25 g of salt per day) (WHO 2012).[1] Many studies have shown that salt consumption is the main factor in increasing blood pressure (BP) and cardiovascular disease cases. Consuming more salt will increase the risk of heart attack, left ventricular hypertrophy, and kidney disease. Increased salt consumption and reduced liquid consumption are also associated with obesity, kidney stones, osteoporosis, and stomach cancer.[2]

WHO data reports show that cardiovascular diseases are the most frequently occurring diseases worldwide.[1] Approximately 7.1 million deaths worldwide are estimated to be caused by high BP. Additionally, one-third of disability-adjusted life years in developed countries, developing countries with high mortality rates, and developing countries with low mortality rates are attributed to high BP.[3]

Many studies have shown that BP can be influenced by the ratio between potassium (K) and sodium (Na). Low K levels in the blood can increase BP, while sufficient K levels obtained from fruit and vegetable consumption help

to stabilize BP.[4] Similarly, research shows the connection between salt intake and increased susceptibility to vascular diseases in patients with diabetes.[5,6]

Research shows that excessive salt intake reduces the effectiveness of hypertension drugs.[5] Because Na+ and chloride (Cl−) ions are extracellular fluid ions, the natural concentration of these two ions in food products is low. In industrially processed foods that are cooked or processed, the concentration of both ions is significantly higher than that in non-processed foods. In processed foods, Na and Cl concentrations are approximately the same or standardized, while in natural (unprocessed) foods, the concentration of Cl− ions is higher than that of Na+ ions. Foods of plant origin naturally contain more Cl− than Na+ ions, while foods of animal origin contain more Na+ than Cl− ions.[4]

In most developed countries, salt reduction can be achieved by gradually reducing the amount of salt in processed foods. Modest reductions in salt worldwide are seen as major advances in public health.[2] Guidelines for salt consumption have changed over the past decades. The Conference on Food, Nutrition and Health, organized by the US government in 1969, published the first recommendations highlighting Na's role in hypertension.[7] In 1994, the British Committee on Health and Food Policy (COMA) advised a gradual reduction in salt intake from 9 g/day to 6 g/day.[8] At the same time, the National Heart, Lung, and Blood Institute of the USA proposed a salt intake of 6 g (2440 mgNa) per day.[9] The WHO and the Food and Agriculture Organization of the United Nations, in their 2003 technical report "Diet, Nutrition and Prevention of Chronic Diseases," advise limiting salt intake to 5g/day on the basis of results from a technical report on primary prevention of essential hypertension in 1983.[10] WHO's recommendation (2012) is less than 5 grams of salt or 2 grams of sodium per person per day to prevent cardiovascular diseases.[1]

To date, no research has been conducted in this direction in Kosovo, and there is no data on salt consumption among the Kosovo population. This research highlights the amount of salt used by the citizens of Kosovo and the problems related to it. Additionally, the results of this study will inform the national strategy for reducing salt consumption.

Material and methods

Ethical approval for this study was obtained from the Ethical Committee of the Medical Faculty of the University of Prishtina, Kosovo.

Study design

This transversal cross-sectional study was performed at the country level in Kosovo in 2019. There were 219 people of both sexes (49.9% men and 50.2% women) aged 20–59 years included in the study. All participants were divided into four age groups (20–29, 30–39, 40–49, and 50–59 years). Participants' involvement in this research was voluntary. Information was distributed to each participant in written form to inform them about the purpose of the research. Each participant then provided informed consent to participate in the study.

Participants were recruited on the basis of the seven regions in Kosovo, with 31 people included from each region. The people included in the research were healthy and active, and they were randomly selected. First, in each region, the city and village were selected, then a street or a neighborhood was selected, followed by a selection of the family or adult members of that family according to the Kish method.[11]

Sample collection and analysis

Urine was collected within 24 hours in accordance with the written instructions, and an oral explanation was provided to each research participant. The first urine of the morning was discarded, and the entire amount of urine was collected for the next 24 hours using a standard bottle. The total volume of collected urine was measured.

Na and K in urine were analyzed using SmartLyte® autoanalyzer (Diamond Diagnostics, Holliston, Massachusetts, USA). The electrolyte analyzer methodology is based on measurements using ion-selective electrodes to determine the measurement values. There are six different electrodes: Na, K, chlorite, ionizing calcium, lithium, and the reference electrode. Each electrode has an ion-selective membrane that undergoes a special reaction with the corresponding ions contained in the sample being analyzed. The membrane is an ion exchanger that reacts to electrical charges by causing a potential change.

Urine Na concentrations are calculated in mmol/L and converted to grams using a conversion factor of 0.023 for Na, and 0.039 for K. Daily Na excretion was calculated by multiplying the corresponding urinary concentrations by the total urine volume. The estimated daily salt intake in grams was then calculated by multiplying the daily Na excretion by 2.54. Na/K ratio, using the 24-h urine samples, was calculated by dividing the Na concentration by the K concentration, both in mmol/L.

Statistical analysis was performed using statistical software package SPSS version 26.0 (SPSS Inc, Armonk, NY: IBM Corp).For descriptive analysis, results are presented as mean±standard deviation (SD). For data with normal distribution, inter-group comparisons were performed using Student's t-test. Multiple comparisons were performed with a one-way ANOVA. A probability value of $P<0.05$ was considered statistically significant.

Results

Out of 219 participants included in this research, the proportions of participants of each sex between age groups did not differ significantly (Table 1).

The mean 24-hour urine volume was 1.42 L in women and 1.50 L in men. The 24-hour urinary Na and K excretion was significantly higher in men than in women ($P<0.001$). The Na/K ratio was significantly higher in men (6.58) than in women (5.27) ($P<0.05$). The average amount of urinary Na excreted in 24 hours in men was 504.32 mmol/24h or 11.60 g/24h, while that in women was 324.23 mmol/24h or 7.46 g/24h. This corresponds to a daily salt intake of 29.46 g/24h for men and 18.94 g/24h for women. This difference was also significant ($P=0.000$). The average urinary K excretion over 24 hours in men was 51.68 mmol/24h or 2.02 g/24h, while

that in women was 41.40 mmol/24h or 1.61g/24h, and this difference was also significant (*P*=0.000) (Table 2).

Table 1.

Participant demographic data

Variable		20–29 years	30–39 years	40–49 years	50–59 years	Total
Women	n	29	26	28	27	110
	%	26.4	23.6	25.5	24.5	100.0
Men	n	27	27	29	26	109
	%	24.8	24.8	26.6	23.9	100.0
Total	n	56	53	57	53	219
	%	25.6	24.2	26	24.2	100.0

Table 2.

The 24-hour urinary Na and K excretion by sex

Parameters	Women (n=110)	Men (n=109)	P-value
Age (years)	38.44±12.32	38.98±12.01	0.741
Urine volume (L/24 h)	1.42±0.41	1.50±0.36	0.155
Na (mmol/24 h)	324.23±170.01	504.32±226.36	0.000
K (mmol/24 h)	41.40±16.33	51.68±22.35	0.000
Na (g/24 h)	7.46±3.91	11.60±5.21	0.000
K (g/24 h)	1.6±10.64	2.02±0.87	0.000
Na/K ratio	5.27±3.26	6.58±3.51	0.005
Calculated NaCl intake (g/24 h)	18.94±9.93	29.46±13.22	0.000

The average Na and K levels in 24-h urine were analyzed based on the area of residence. The results showed that the average urinary Na and K excreted over 24 hours, which was expressed in mmol/24h or g/24 h, was significantly higher in the rural population than in the urban population (*P*<0.001). The Na/K ratio was not significantly different between rural and urban participants. The average urinary Na excretion over 24 hours in the rural population was 454.07 mmol/24h or 10.44 g/24 h, while that in the urban population was 377.50 mmol/24h or 8.68 g/24 h. This corresponds to 26.52 g/24h of salt intake for the rural participants and 22.05 g/24 h for the urban participants (*P*<0.009; Table 3).

Urinary Na and K excretion over 24 hours by age group in women did not differ significantly. This also reflects the amount of salt intake. For women, the Na/K ratio showed a significant difference from that in men (*P*=0.011). Additionally, for men, Na and NaCl (g/24 h) values showed a significant increase with increasing age (*P*=0.011, Table 4).

Table 3.

The 24-hour urinary Na and K excretion by the area of residence

Parameters	Rural (n=104)	Urban (n=115)	P-value
Age (years)	39.88±11.57	37.65±12.60	0.009
Urine volume (L/24h)	1.53±0.39	1.40±0.37	0.423
Na (mmol/24 h)	454.07±216.87	377.50±215.52	0.009
K (mmol/24 h)	49.11±21.37	44.18±18.84	0.008
Na (g/24 h)	10.44±4.99	8.68±4.96	0.009
K (g/24 h)	1.92±0.83	1.72±0.73	0.010
Na/K ratio	6.11±3.20	5.74±3.64	0.071
Calculated NaCl intake (g/24 h)	26.52±12.67	22.05±12.59	0.009

Table 4.

The 24-hour urinary Na and K excretion by age group and sex

Women (years)	n	Na (mmol/24 h)	K (mmol/24 h)	Na/K ratio	Calculated NaCl intake (g/24 h)
20–29	29	284.3±101.9	37.7±14.1	4.9±2.3	16.6±5.9
30–39	26	322.3±158.3	42.5±18.9	5.5±3.8	18.8±9.2
40–49	28	302.2±134.2	46.2±14.3	4.0±1.5	17.7±7.8
50–59	27	391.8±245.2	39.3±17.4	6.8±4.3	22.9±14.3
	P	0.095	0.213	0.011	0.095
Men (years)	n	Na (mmol/24 h)	K (mmol/24 h)	Na/K ratio	Calculated NaCl intake (g/24 h)
20–29	27	402.0±201.6	42.4±18.7	6.8±4.2	23.5±11.8
30–39	27	499.9±255.9	55.0±24.7	5.9±3.2	29.2±14.9
40–49	29	511.8±184.3	52.8±20.0	6.5±3.3	29.9±10.8
50–59	26	606.8±224.9	56.7±24.1	7.1±3.3	35.4±13.1
	P	0.011	0.082	0.644	0.011

Discussion

Our study focused on assessing the daily salt intake in the Kosovo population, taking into account traditions and the culture of nutrition. To this end we measured urinary Na and K excretion over 24 hours, which was used to determine the amount of salt (e.g., NaCl) consumed by the citizens of Kosovo.

Our results showed that the average urinary Na excretion over 24 hours in the Kosovo population was high (9.52 g/day): 11.06 g/day for men and 7.46 g/day for women. When these values are converted into NaCl intake, the average amount of salt consumed by participants was 23.8 g/day: 29.46 g/day for men and 18.94 g/day for women.

In 2013, Rysha et al.[12] analyzed food consumed by children in kindergarten and children aged 1–4 years and 4–7 years in Kosovo. They showed that the Na intake values were higher than the recommended daily values for these age groups, with values ranging from 873mg for children 1–4 years old, which was 291% of the recommended daily amounts, to 1253 mg for children 4–7 years old, which was approximately 306% of the recommended daily values. Their results are consistent with those in our study.

Our findings also showed that urinary Na excretion over 24 hours among the citizens of Kosovo was higher than the results of previous research that was performed in Slovenia in 2010.[13] These results applied to both sexes. When analyzed by sex, their results showed that men excreted higher urinary Na values (220.9±86.0 mmolNa/day) than women (169.8±73.8 mmolNa/day). These results are similar to those in our study.

Our results also showed higher urinary Na excretion over 24 hours compared with a 2013 study that enrolled citizens of Novi Sad, where the average urinary Na excretion over 24 hours was 4.58 g/day.[14] This difference was evident even when their results were analyzed by sex, where the average urinary Na excretion in men was 5.58 g/day, and that of women was 3.93 g/day. These results are consistent with our results when analyzed by sex. The average urinary Na excretion over 24 hours in the population of Tromso in 2015–2016 was 3.53 g/day (4.09 g/day in men and 2.98 g/day in women)[15]. These values are lower than those of our results. However, our results were higher than those of a 2013 systematic literature review that included 51 studies from western Europe. The mean 24-hour urinary Na excretion in this review ranged from 3.28 g/day to 4.43 g/day in both sexes.[15]

Our results are also higher than those reported in a 2017 study from Turkey.[16] In this study, the average 24-hour urinary Na excretion was 252.0±92.2 mmol/day, which corresponds to a daily salt intake of 14.5±5.4 g. Published findings show that 24-hour urinary Na excretion is generally lower than the results of our research, which suggests that the citizens of Kosovo consume significantly more salt than the recommended values. This may be because the citizens of Kosovo traditionally consume a large amount of bread and pastries, meat, and meat products (e.g., sausage and dried meat), fast food, pickles, and cheese, all of which contain high amounts of salt.

The mean 24-hour urinary K excretion was lower in both sexes than the result reported for the Tromso population (3.87 g/day for men and 2.97 g/day for women). Additionally, the Na/K ratio was higher for both sexes (6.58 for men and 5.27 for women) compared with that reported for the Tromso population (1.86 for men and 1.79 for women).[15] Low K values and a high Na/K ratio contribute to an increased risk of cardiovascular disease in the population of Kosovo.

In conclusion, our results showed that the citizens of Kosovo consume a large amount of salt, greater than 5 g/day. In Kosovo, there has yet to be a comprehensive strategy for reducing salt consumption. There is an urgent to draft such a strategy as soon as possible.

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Competing Interests

The authors declare that they have no competing interests.

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