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Article

Salt Intake of Children and Adolescents: Influence of Socio-Environmental Factors and School Education

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Abstract: (1) Background: The aim of study was to investigate the salt consumption by children and adolescents from the Silesian Province (Poland), taking into account the region's dietary traditions and number of years of school education. (2) Methods : 300 students aged 10–18 from different types of schools, were enrolled in the study and divided into groups in terms of: school, sex, the state of nutrition. The survey questionnaire about dietary habits, including the frequency and serving size with respect to 12 salty products was used. On the basis of the frequency and the amount of consumed products, as well as the data on salt content, the amount of total daily intake of salt was estimated.; (3) Results: The mean daily intake of salt by children and adolescents was 1.083 g (0.433 g of sodium); children aged 10–12 consumed the highest amount of salt (1.296 g/day) compared to pupils aged 13–15 (1.131 g of sodium) and adolescents aged 16–18 (0.863 g/day); (4) Conclusions: With age, as a result of various factors, the consumption of salt declines. The parents impact and the familial socio-environmental factors begin to wane, and other factors start to have influence, e.g. school education of healthy lifestyle, health behavior of peers.

Keywords: socio-cultural factors; school; salt intake; children; adolescents

1. Introduction

Eating behaviours, also referred to as “food preferences,” are defined as “general predispositions to certain types of foods regardless of the situation in which they are eaten” and are conditioned by a range of various factors [1]. Food preferences comprise an integrated system, within which there are many interactions. Factors include stimuli, inhibitors, or specific conditions and affect food consumption [2–4]. Particularly significant are social factors (education level, type of occupation, job position, type of school, family status), cultural factors (concerning the closest surroundings and being closely tied to the culture of the given country or region), and psychological factors [5,6].

The quick pace of social transformations, globalization, the imbalance in health (of societies and nations), migrations, and the formation of international cultures within social groups that have been hitherto homogeneous, all of which have been occurring in recent years, has led to changes in eating behavior patterns [2,4]. In Poland, eating habits that have existed in families for generations have started to undergo gradual modifications from the 1980s [7].

Silesia Province is a voivodeship in southern Poland, centered on the historic region known as Upper Silesia. In this region, the cuisine and the dialect have been two of the most important characteristics defining the identity of the Silesian ethnocultural group for generations. The ethnic identity is expressed for instance in the everyday and occasional (holidays, anniversaries, and family events) preparation of dishes and their consumption, and these are long-existing customs. Traditional customs are cultural characteristics and, despite the support of previous (older) generations, are now undergoing modifications [8]. The analysis of the data available so far, particularly in the scope of a

uniform area of studies concerning the Silesia Province, encourages to discuss the possible impact of the local cultural heritage, developed over hundreds of years, and the power of tradition on eating behaviors of the young generation [9,10]. In particular, this can be seen at individual developmental stages of young people and the range of possible influence of other parts of social life, changing over time, including upbringing, education, work, fashionable lifestyle etc. The World Health Organization (WHO) suggests that health literacy should be incorporated in the core curriculum as children enter school, supported by a health-promoting school environment. A comprehensive school commitment towards students' global wellbeing is expected to positively impact both children's behaviours and their families [11,12].

Epidemiological studies show that, the mean salt intake in the world is estimated at 8–15 g/day. In Poland, it is estimated at 10–15 g/day; the daily intake recommended by WHO is 5 g/day, (i.e., 2 g/day of sodium) [13,14]. There is evidence that high salt intake by children and young people also contributes to elevated blood pressure [15,16] and can predispose an individual to the development of many diseases, e.g., cardiovascular diseases, mostly ischemic heart disease, brain stroke, haemorrhagic stroke and heart infarction [17,18], kidney disease (through urea concentration increase), osteoporosis, respiratory diseases, and gastric cancer [19,20]. Whereas, Hu et al. analyze the effects of high salt diet on gut microbiome, demonstrated a considerable decrease in *Bacteroidetes* and *Proteobacteria* by 50.53 % and 2.96 % respectively, and increase in *Firmicutes* by 42.77 % versus healthy composition of gut microbiota [21].

In connection with disturbing reports on excessive salt consumption in Poland [13,22,23], this study aims to evaluate the consumption of salt (sodium chloride) by school- aged children and adolescents from one of the Polish region - the Silesian Province [24], taking into account the region's dietary traditions but also the number of years of school education.

2. Materials and Methods

2.1. Ethics

The current study protocol was registered with the Bioethical Committee of the Medical University of Silesia in Katowice. The Committee wrote that "the project does not meet the criteria of a medical experiment in the context of law and does not require assessment by the bioethical committee; However, failure to obtain the consent requirement does not release the applicant from compliance with generally applicable laws and standards" (Letter KNW/0022/KB1/102/15). Still, according to the Declaration of Helsinki 2013 the participation in the study was voluntary and informed. Moreover, participants were informed in detail about the study - the study was preceded by informative meetings with the school heads and letters were sent to the respondents' parents or guardians outlining the purpose, scope and methodology of the project. Written consent was obtained from the directors and parents or guardians of the children/adolescents and from the student if they were aged 16 or over. Thus, patient data has been encoded in accordance with the pseudo-anonymization procedure, which means that personal data is processed in such a way that it cannot be assigned to a specific data subject, without the use of an additional "key."

2.2. Participants

Three hundred pupils aged 10–18 years from different types of schools in small silesian city (elementary, lower secondary, and higher secondary schools) were included in the study. The inclusion criteria were: obtaining written consent to participate in the study.

The study consisted of four phases

Phase one was the development and validation of the authors' questionnaire and this began with an initial draft list of the questionnaire items generated by the authors based on the literature. The questionnaire contained:

a/ questions about sex, age, body weight, body height, type of school and b/ questions regarding eating behavior taking into account frequency and sizes of helpings of the 12 salt products. Children aged 10-15 completed the questionnaire in the presence of their parents.

Based on national surveys [11,12] we analysed the following 12 products: salted crisps, unsalted crisps, salted biscuits, unsalted biscuits, salted sticks/pretzels, unsalted sticks/pretzels, corn curls, salted peanuts, unsalted peanuts, batter-coated peanuts, popcorn, and roasted salted sunflower seeds. The respondents could choose between the following frequency criteria: several times a day (<3 times, 3 times, 2 times, and 1 time), several times a week (1 time, 2 times, 3 times, 4 times, 5 times, and 6 times), several times a month (1 time, 2 times, and 3 times), rarely (up to 5 times a year and over 5 times a year), and no consumption. To determine the size of a helping of the eaten products, the survey included original photos of helpings of the products modeled according to the *Album of Photographs of Food Products and Dishes* [26]. The album of 201 color photos, prepared and published by the Food and Nutrition Institute in Poland is a popular tool used in this type of research. To facilitate the determination of the portion size consumed by respondents, several photos of different sizes of product portions were prepared. The following helping sizes of products were assumed: for crisps, 20, 40, and 70 g; for biscuits, 10, 20, and 30 g; for sticks, pretzels, and corn curls, 10, 20, and 50 g; for peanuts and batter-coated peanuts, 20, 30, and 50 g; for popcorn, 10, 20, and 30 g; for roasted salted sunflower seeds, 10, 20, and 40 g. The salt content in the above products ranged from 0.93 g per 100 g in salted peanuts to 4.27 g per 100 g in salted sticks. The mean was 2.05 g per 100 g of product.

During phase two, the questionnaire devised by the authors was distributed to the pupils with informed consent and they were given a deadline to return them by. Phase three was determining which pupils had returned their properly completed questionnaires which limited participation in the study.

During phase four, on the basis of the frequency and the helping size of the consumed products and on the data on salt content found on product packages, the amount of the total daily intake of salt with a diet was estimated.

The estimated daily intake (EDI) of salt was calculated according to the following formula, depending on the helping size:

$$EDI = F / 100 * M * R \text{ [g/day]}$$

where EDI is the estimated daily intake of salt; F is the data on the helping size of product [g]; M is the salt content in products [g/100 g of product]; R is the data on the frequency of intake converted into days (multiple daily intake, several times a week (R/7), several times a month (R/30), and rarely (R/365)).

For the purposes of the analysis, the respondents were divided into groups in terms of the type of school, sex, and the state of nutrition. The state of nutrition was assessed with percentile charts. The BMI centile charts developed in 2010 by the Children's Health Centre in Warsaw were used to interpret the results and these provided the following BMI definitions: underweight <5th percentile, normal weight ≥5th percentile to <85th percentile, overweight ≥85th percentile to <95th percentile and obesity ≥95th percentile [27].

On the basis of the estimated intake of salt from the salty snacks, the amount of sodium intake was calculated, given that 5 g of salt (NaCl) provides 2 g of sodium (Na). In addition, the percentage of the daily sodium requirement coverage was calculated given that the mean norm for the studied group was 1400 mg and that, for individual age groups, it was 1300 mg (10–12 year olds) and 1500 mg (13–18 year olds) [13,14].

2.3. Statistical Analysis

The statistical analysis was conducted with Statistica v.13.0. A hypothesis about the normal distribution of analyzed variables was verified with the Shapiro–Wilk test. To demonstrate the difference in the amount of salt consumed with diet, taking into account the type of school (age), the sex, and the state of nutrition (according to BMI), the Mann–Whitney U test, the Kruskal–Wallis test (distribution other than normal distribution), a one-way analysis of variance (one-way ANOVA), or the Tukey procedure (normal distribution) were conducted. A P-value of $p < 0.05$ was statistically significant.

3. Results

The total sample group consisted of 300 students, including 165 girls and 135 boys. The students were divided into three age groups: 10–12, 13–15 and 16–18 years. The largest group was from the lower secondary school (38%), followed by the higher secondary (35%) and elementary (27%) schools. Normal body weight was 251 (84%) pupils, underweight 31 (10%), overweight 15 (5%) and obesity only 3 (1%) respondents – Table 1.

Table 1. Characteristics of the studied group.

		N	%
Total		300	100
Sex	Girls	165	55
	Boys	135	45
Age/school	10–12 /elementary	81	27
	13–15 /lower secondary	114	38
	16–18 /higher secondary	105	35
BMI	Underweight	31	10
	Normal body weight	251	84
	Overweight	15	5
	Obesity	3	1

BMI calculated according centile charts by Kułaga et al. [27].

3.1. Salt/Sodium Intake Estimation

The mean daily intake of salt by children and adolescents was 1.083 g (0.433 g of sodium). The consumption of salty snacks covered nearly 31% of the daily requirement for that mineral (given that the norm for the non-homogeneous study group was 1.4 g/day). The statistical analysis showed the salt intake differed depending on the sex of the respondents ($p < 0.05$). The boys consumed 1.423 g of salt (i.e., 0.569 g of sodium) daily, and girls consumed 0.809 g (i.e., 0.324 g of sodium). The maximum salt intake by the boys was 10.247 g/day (i.e., 4.1 g of sodium per day) and that by the girls was 8.513 g/day (i.e., 3.4 g of sodium per day) – Table 2. The salty snacks consumed by the boys covered over 40% of the daily requirement for sodium.

Table 2. The mean amount of the intake of salt (sodium) (g/day) by the pupils, taking into account the sex, age, and the state of nutrition; % of daily requirement for sodium according to age and sex norms.

		NaCl	Na	% of recommended daily intake of Na covered
Sex *	Total, M (SE)	1.083 (0.09)	0.433 (0.04)	30.9
	Girls, M (SE)	0.809 (0.09)	0.324 (0.04)	23.1
	Boys, M (SE)	1.423 (0.17)	0.569 (0.07)	40.7
Age [years]	10–12 , M (SE)	1.296 (0.17)	0.518 (0.07)	39.9
	13–15 , M (SE)	1.131 (0.18)	0.452 (0.07)	30.2
	16–18 , M (SE)	0.863 (0.12)	0.345 (0.05)	23.0
State of nutrition *	Underweight, M (SE)	1.232 (0.24)	0.493 (0.09)	35.2
	Normal body weight, M (SE)	1.059 (0.10)	0.424 (0.04)	30.3
	Overweight, M (SE)	0.790 (0.24)	0.316 (0.10)	22.6
	Obesity, M (SE)	2.896 (2.86)	1.158 (1.14)	82.7

* - statistically significant differences at $p < 0.05$; M: mean; SE: standard error.

The age of the respondents did not determine the amount of the salt consumed in diet. However, a certain tendency was observed. Pupils aged 10–12 consumed the highest amounts of salty snacks, which was reflected in the intake of the highest amount of salt (1.296 g/day, i.e., 0.518 of sodium per day) compared to pupils aged 13–15 (1.131 g/day, i.e., 0.452 g of sodium per day) and pupils aged 16–18 (0.863 g/day, i.e., 0.345 g of sodium per day).

Among the youngest respondents, as well as among people with underweight, 65 % reported the highest frequency of consumption of salty snacks (at least once a week). The products of choice with such frequency were the salted sticks or salted pretzels. Students with obesity frequently consumed several types of salty snacks, such as salted sunflower seeds, salted sticks or salted pretzels, corn curls and popcorn (several times a week to several times a month).

Similarly, the shares of sodium from salty snacks for elementary, lower secondary, and higher secondary school students are 39.9, 30.2, and 23.0% of the daily requirement for that mineral, respectively.

The state of nutrition of all pupils determined according to BMI was the factor differentiating the mean amount of salt intake. The highest salt intake was observed in the obese pupils—2.896 g/day (i.e., 1.158 g of sodium/day)—and the lowest in overweight pupils—0.790 g/day (0.316 g of sodium/day). The pupils who were normal and underweight consumed similar amounts of salty snacks and in turn consumed similar amounts of sodium chloride intake (1.059 and 1.232 g, respectively) and sodium intake (0.424 and 0.493 g, respectively).

3.1.1. Analysis of elementary school pupils

Sex differentiated the amount of salt intake of elementary school pupils. The girls' intake was 0.985 g of salt/day (i.e., 0.394 g of sodium/day) and the boys' intake was 1.614 g (i.e., 0.646 g of sodium/day)- Table 3.

Consuming salty snacks, the boys covered almost half of their daily requirement of sodium (49.7%). Age did not differentiate the intake of salt (sodium). The mean daily intake of sodium in salty snacks among 10–12-year-olds was similar and ranged from 1.097 to 1.388 g, and teenagers' daily intake of sodium ranged from 0.439 to 0.555 g. However, it should be noted that, with age, the share of salt (sodium) from consumed salty snacks increased (33.8, 39.3, and 42.7%).

Table 3. The mean amount of salt intake (g/day) by elementary school pupils, taking into account sex, age, and the state of nutrition (norm for 10–12-year-olds: 1.300 g).

		N	NaCl	Na	% of recommended daily intake of Na covered
Sex *	Total, M (SE)	81	1.296 (0.17)	0.518 (0.07)	39.9
	Girls, M (SE)	41	0.985 (0.16)	0.394 (0.06)	30.3
	Boys, M (SE)	40	1.614 (0.30)	0.646 (0.12)	49.7
Age [years]	10, M (SE)	17	1.097 (0.27)	0.439 (0.11)	33.8
	11, M (SE)	23	1.278 (0.30)	0.511 (0.12)	39.3
	12, M (SE)	41	1.388 (0.28)	0.555 (0.11)	42.7
State of nutrition	Underweight, M (SE)	7	1.181 (0.30)	0.472 (0.12)	36.3
	Normal body weight, M (SE)	71	1.311 (0.19)	0.524 (0.07)	40.3
	Overweight, N, (SE)	3	1.212 (0.70)	0.485 (0.27)	37.3

* - statistically significant differences at $p < 0.05$; M: mean; SE: standard error.

Among elementary school pupils, the state of nutrition based on BMI did not differentiate the amount of salt intake. The respondents' salt intake ranged from 1.181 to 1.311 g per day (i.e., 0.472–0.524 g of sodium).

3.1.2. Analysis of elementary school pupils

Among lower secondary school pupils, sex was the factor differentiating the intake of salt - Table 4. The boys' intake of sodium chloride was higher than the girls' intake (1.540 and 0.762 g/day, respectively) and the difference was statistically significant. The share of salt from salty snacks in covering the daily requirement for sodium was twice as high in the boys (41.1 vs. 20.3%).

Table 4. The mean amount of salt (sodium) intake (g/day) in lower secondary school pupils, taking into account sex, age, and the state of nutrition (norm for 13–15-year-olds: 1.500 g).

		N	NaCl	Na	% of recommended daily intake of Na covered
	Total, M (SE)	114	1.131 (0.18)	0.452 (0.07)	30.2
Sex *	Girls, M (SE)	60	0.762 (0.16)	0.305 (0.06)	20.3
	Boys, M (SE)	54	1.540 (0.33)	0.616 (0.13)	41.1
Age [years]	13, M (SE)	17	0.820 (0.48)	0.328 (0.19)	21.9
	14, M (SE)	62	1.024 (0.22)	0.410 (0.08)	27.3
	15, M (SE)	35	1.471 (0.40)	0.588 (0.16)	39.2
State of nutrition	Underweight, M (SE)	9	1.210 (0.54)	0.484 (0.21)	32.3
	Normal body weight, M (SE)	99	1.178 (0.21)	0.471 (0.08)	31.4
	Overweight, M (SE)	5	0.242 (0.08)	0.097 (0.03)	6.5
	Obesity, M (SE)	1	0.175	0.070	4.7

* - statistically significant differences at $p < 0.05$; M: mean; SE: standard error.

Age did not differentiate the amount of consumed salt. The highest amount of salty snacks was consumed by 15-year-old pupils, which was reflected in the intake of the highest amount of salt (1.471 g/day; 0.855 g of sodium per day). The lowest daily intake of sodium chloride in that group was exhibited by 13-year-olds. The share of salt from salty snacks in covering the daily requirement for that ingredient was distributed in the same way (39.2 vs. 27.3 vs. 21.9%). The mean daily intake of salt was not statistically different given various states of nutrition based on BMI. The highest salt intake was exhibited in underweight respondents (1.210 g/day), and the lowest amount of salty snacks was eaten by overweight and obese respondents. Salt intake among those pupils ranged from 0.175 to 0.242 g/day.

3.1.3. Analysis of higher secondary school pupils

Sex did not determine the intake of salt from salty snacks by higher secondary school pupils. The intake of that ingredient by the girls, i.e., 0.741 g/day, was slightly lower compared to the boys (1.065 g/day) - Table 5. Nevertheless, the share of salt resulting from the consumption of salty snacks in the girls' diet was nearly 9% lower compared to the boys' diet. The salt intake by pupils was differentiated by age ($p < 0.05$). The highest amounts of sodium chloride were consumed by 16-year-olds. The daily intake of salt in that age group was nearly 3 times higher than in the 18-year-old group (1.359 and 0.488 g, respectively). Similarly, the share of salt in the diet of 16-year-olds was 3 times higher than the share of salt in the diet of 18-year-olds and 2 times higher compared to the diet of 17-year-olds.

Table 5. The mean amount of salt (sodium) intake (g/day) by higher secondary school pupils, taking into account sex, age, and the state of nutrition (norm for 16–18-year-olds: 1.500 g).

		N	NaCl	Na	% of recommended daily intake of Na covered
Sex *	Total, M (SE)	105	0.863 (0.12)	0.345 (0.05)	23.0
	Girls, M (SE)	64	0.741 (0.16)	0.296 (0.06)	19.8
	Boys, M (SE)	41	1.065 (0.17)	0.426 (0.07)	28.4
Age [years] *	16, M (SE)	33	1.359 (0.32)	0.544 (0.13)	36.2
	17, M (SE)	46	0.704 (0.12)	0.282 (0.05)	18.8
	18, M (SE)	26	0.488 (0.12)	0.195 (0.05)	13.0
State of nutrition *	Underweight, M (SE)	15	1.268 (0.37)	0.507 (0.15)	33.8
	Normal body weight, M (SE)	81	0.690 (0.10)	0.276 (0.04)	18.4
	Overweight, M (SE)	7	1.036 (0.41)	0.414 (0.16)	27.6
	Obesity, M (SE)	2	4.257 (4.06)	1.703 (1.62)	113.5

* - statistically significant differences at $p < 0.05$; M: mean; SE: standard error.

The higher secondary school pupils' salt intake was determined by the state of nutrition based on BMI. The mean daily intake of sodium chloride by obese pupils was as much as 4.257 g, thus exceeding the daily requirement for that compound by 13.5%. Salt intake of those respondents was nearly 6 times higher compared to the intake of the young people with a normal body weight.

4. Discussion

Many studies have indicated that food preferences are a complex of psychological, social, and cultural factors [2,3]. The impact of these factors is different at different life stages. In childhood, the family and close relations formed are the most significant and at school age and during puberty, the peer group is key for the development of young people. In the case of adults, mass media, reference groups, fashion, or prestige are the relevant factors [28].

4.1. Salty Snack Consumption Frequency

Our study indicates that 65% surveyed children and young people ate salty snacks at least once a week, most often when meeting with friends, watching TV, studying, or going to the cinema. Inhabitants of other European countries ate salty snacks at a similar frequency [29]. The highest level of salty snack consumption was exhibited by Spaniards (78%) and then by the population of Great Britain (76%). In the cited studies, the percentage of Poles (regardless of age and sex) eating salty snacks at least once a week was 66%. Similar results were obtained in the studies of adolescents living in the Silesian Region, where 70% of adolescents snacked at least once a week, between meals [30]. While, Jensen et al [31] concluded that 95.2% of the Chilean children and 89.9% of the adolescents consumed at least one snack per day, with a mean per capita of 2.30 ± 0.03 snacks consumed per day.

These analyses highlight that pupils groups regularly eat salty snacks between meals. Several studies showed that salt preference might be associated with the frequency or the amount of salty food consumption [32,33].

4.2. Salt/Sodium Intake

In Poland, no social group consumes 5 g of salt daily. The most salt, as much as 16 g per day, is consumed by pensioners. The lowest amount of salt is consumed by the self-employed (8.8 g of salt per day) [13,27,34].

Present studies show that the pupils attending the schools of Silesian city consume 1.083 g of salt/day, i.e., 0.433 g of sodium per day, through salty snacks alone. According to Ponzo et al. [35], 11–13-year-olds obtain much more sodium from snacks. The mean consumption of sodium from snacks was 1.4 g/day. On the basis of analysis of our own results, it was determined that boys consumed significantly more sodium compared to girls (0.569 g of sodium/day vs. 0.324 g of sodium/day, respectively). A similar correlation was indicated in a Polish salt consumption report. The salt consumption of boys over 13 and men from 19 to 25 years, who preferred salty products, reached 15 g per day. Girls aged 13–15 years consumed 10 g of salt on average [13]. Caine-Bish and Scheule [36] reported that food preferences of American children differed across gender. Furthermore, the gender difference varied among elementary, middle, and high school students. According to the American Heart Association [18], boys aged 12–19 eat the most sodium—an average of 4,220 mg/day; girls at the same age eat about 2,950 mg/day.

Studies of Spanish children between 7 and 11 years old have shown that boys consume more dietary sodium and sodium from ultra-processed food (UPF) than girls. The main sources of dietary sodium were meat and meat products (25.1%), ready-to-eat and pre-cooked dishes (7.4%), and sugars and sweets (6.3%) [37].

Whether or not the eating habits will be healthy depends to a high extent on the sociocultural environment where children grow up. Their first educators are their parents, then their siblings and family, and subsequently their teachers. The fashion or promoted lifestyle also has a considerable impact in this area. The prices of healthy vs. unhealthy foods are also significant.

We have observed that children aged 10–16 consume the highest amounts of sodium: from 0.328 to 0.588 g per day. On the other hand, 17- and 18-year-olds obtain salty snacks much less often, which implies a lower salt intake compared to other pupils (0.195–0.282 g/day).

It might be ventured that higher salt intake from salty snacks among younger children results from their parents' lack of eating awareness. Parents are the most influential in their children's eating choices: they decide what products and what dishes their children will eat [3,38]. This has been confirmed by the Institute of Mother and Child in Warsaw, which has shown that salt consumption is already excessive in 90% of children up to the age of 3. It was found that this does not result from stronger desires to eat salty products (e.g., crisps), but is the fault of adults who think that the dishes served to their children have to be properly salted [39].

This belief of the parents is "carried on" to the young generation. Most adults allow their children to eat unhealthy snacks. Food choices can be used by adolescents as a way to express their independence from families and parents. At this age, young people may prefer to eat fast-food meals in a peer group instead of meals at home with their families.

This relation can also be seen in our studies, where most inhabitants of Silesia Province had elementary, vocational, or secondary education and where younger people had certain eating behaviors that entailed a higher salt intake. A lack of eating awareness in young people is conducive to copying the unhealthy eating choices of their parents.

With age, the consumption of salty snacks declines as a result of various factors (higher eating awareness and school education), The parents' impact starts to wane, and factors outside the family start to play a role, e.g., above all, the school that promotes healthy habits and healthy lifestyle trends, peers, media.

In many countries, 80% of consumed salt comes from processed products such as bread, breakfast cereals, ready-made dishes and snacks, and dishes served in restaurants, canteens, cafes, or other food premises. It was determined that children cover 15% of their daily requirement for sodium at breakfast, 30% at lunch, and 39% at dinner, and 16% of their sodium intake comes from salty snacks [40,41].

In our studies, the sodium intake from salty snacks by the pupils covered nearly 31% of the daily requirement of sodium. This coverage differed at different stages of ontogenetic development. Ponzo et al. [35] has concluded that the consumption of sodium from salty snacks among teenagers comprised nearly half of the mean daily intake of sodium. Based on present study, the amount of consumed salt, and in turn sodium, is very high, as the daily sodium intake includes other foods that

are eaten and that contain that element, such as bread, highly processed breakfast cereals, meat products, yellow cheeses, cheese spread, margarine, and even sweets.

Strengths and Limitations

The questions have been developed on the basis of large, international studies on the nutritional behaviors of school-aged children [42]. All questionnaires were completed under the supervision of a trained dietician who could explain the respondents' doubts on an ongoing basis.

Respondents for our study were recruited from schools of one silesian city, which can be a certain limitation. The limitations of the study is also the sample size – 300 students.

5. Conclusions

In present study, salt intake was found to be differentiated by the age (type of school) and sex of respondents, and these relations are not symmetrical. With age, as a result of various factors, the consumption of salt declines. The parents' impact and other familial socio-cultural factors begin to wane, and factors such as school education of healthy lifestyle, being among peers, other health behavior patterns start to have influence.

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