

## DIETARY HABITS AND ESTIMATION OF SALT INTAKE IN CROATIAN SCHOOLCHILDREN

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### Summary

High salt intake is the major cause of hypertension and accordingly leads to cardiovascular diseases. The intake of the so-called "hidden salt" through some food stuffs is an important public health issue. This cross-sectional population based study examined dietary habits and evaluated the salt intake through daily snacking among Croatian schoolchildren. The study included 1077 schoolchildren, aged 8.6±1.2 years (range 6 to 11 years old), 48.9% boys and 51.1% girls. The self-administered questionnaire was used for data collection on dietary habits and laboratory determination of salt content in snack meals was performed. Study revealed several unhealthy dietary habits in studied population such as skipping breakfast (32.0% of children), unhealthy snacking (51.6% of children) and consumption of away-from-home meals (46.7% of children) whereas excessive salt intake through unhealthy snacking could pose a serious public health issue in a studied population. In order to improve dietary habits of this population, targeted dietary public health interventions are needed.

*Keywords:* children; diet; nutrition; salt; unhealthy snacking; Croatia

### Introduction

Hypertension is the most significant risk factor for the global burden of disease (Correia-Costa et al., 2016). High salt intake is the major cause of hypertension and accordingly leads to cardiovascular diseases (Cotter et al., 2013; Ma et al., 2015; Ohta et al., 2016). Diets high in salt are now recognized as one of the leading risks to cardiovascular health in the world as they increase blood pressure in both, children and adults (Campbell et al., 2012). Salt restriction is important for the prevention and treatment of hypertension (Ohta et al., 2016).

Reducing salt content of processed foods has been recognized as a feasible and more effective strategy for reducing daily salt intake than simply reducing the amount of salt added during cooking or on the table (Neal, 2007; Nwanguma and Okorie, 2013). This is based on the realization that processed foods are major contributors to the daily salt intake of populations. The top five saltiest processed foods were processed meat, bread and bakery products, dairy and cereal products (Nwanguma and Okorie, 2013; Ni Murchu et al., 2011; Woodward et al., 2012; Gillespie et al., 2009). Unfortunately, consumers are often unaware of the salt content of some of these processed foods that they consume regularly. This so-called 'hidden salt' has been reported to contribute up to 95% of the salt intake of some people, especially in countries where processed foods are widely

consumed (Nwanguma and Okorie, 2013; Anderson et al., 2010). The study of the sodium content of processed foods in the United Kingdom reported sodium concentrations of up to 1200 mg per 100 g (equivalent to 3.0 g of salt per 100 g of bread) in some brands of bread (Ni Murchu et al., 2011). Thus, because of their popularity with both children and adults, bread and other bakery products have been reported to contribute up to 30.5% of the dietary salt intake in some countries (Nwanguma and Okorie, 2013; Ni Murchu et al., 2011; Woodward et al., 2012; Grimes et al., 2011; Villani et al., 2012; Gaitán et al., 2015).

Data from around the world suggest that the population average sodium consumption is well above the minimal physiological needs, and it is above the recommended value of 2 g sodium/day (equivalent to 5 g salt/day) in many countries (World Health Organization, 2012). In children, excessive salt intake by overeating or consuming fast food has also been reported (Ohta et al., 2016; Kar and Khandelwal, 2015). Establishing healthy eating habits early during the childhood can reduce the risk of diet related chronic diseases across the lifespan (Johnsom et al., 2017). If interventions to lower blood pressure levels through healthy dietary choices are initiated in children, then the development of high blood pressure may be suppressed. Therefore, improvements in dietary habits, including salt reduction in childhood, are considered important for

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the prevention of hypertension (Ohta et al., 2016). Understanding the contribution of daily snacking to the intake of salt will enable the design of specific preventative interventions in children directed toward the improvement of diet quality and consequently toward the improvement of children's health in general (Johnson et al., 2017). Thus, the aim of this study was to examine dietary habits and to evaluate the salt intake through daily snacking in a population of schoolchildren from the Osijek area in Eastern Croatia.

## Subjects and methods

### *Participants*

This cross-sectional population based study was conducted during 2009/2010 school year among elementary schoolchildren aged between 6 and 11 from the Osijek area in Eastern Croatia. Six out of 20 elementary schools founded by the city of Osijek (30.0% of elementary school situated in the Osijek area) were randomly selected for the conduction of this study. The study was conducted in accordance with the Declaration of Helsinki. The Ethics Committee of the Institute of Public Health for the Osijek-Baranja County approved the study (ethical approval code: 6002/09) and informed consents were obtained from parents of schoolchildren who participated in the study.

### *Questionnaire*

Through self-administered questionnaire the data of the age and gender of children and their dietary habits, such as eating breakfast every day, number of meals per day, type of daily snack meals and frequency of eating at least one cooked meal at home daily, were collected. Response rate was 90% (1077/1200).

### *Determination of salt content in bakery products*

The value of salt content in 42 bakery products available at the bakery shops around six schools included in this study, was established in the Institute of Public Health for the Osijek-Baranja County. Among these 42 bakery products, there were 22 most frequently sold pastries and 20 most frequently sold stuffed bakery products.

Determination of salt content in bakery products was based on titrimetric determination of chloride ions with silver nitrate, and calculation of corresponding sodium chloride content. Titration was performed using the visual method for determining the end

point, enabled by the presence of potassium chromate as an indicator. The procedure for determining sodium chloride content in bakery products was as follows: test sample was finely comminuted and thoroughly mixed. Visual determination: 10.0 g of test sample was weighed into a 100 ml volumetric flask and diluted to volume with distilled water. After mixing and filtration, 20 ml aliquot was transferred to titration flask and potassium chromate indicator was added. The solution was titrated with silver nitrate standard volumetric solution (0.1 M) to the characteristic yellow-orange end point. Salt content was calculated according to the following equation:  $\text{NaCl (\%)} = \text{mL AgNO}_3 \times 0.05844 \times 5 \times 100 / \text{g of test sample}$ . All the results were expressed as percentage of sodium chloride as described as an appropriate methodology within the research of Paplović et al., (2015).

### *Statistical analysis*

Statistical analysis included data obtained by the laboratory analysis (determination of salt levels in the selected bakery products available at bakery shops in the Osijek area) and data on dietary habits of the schoolchildren from the same area collected through the self-administered questionnaire.

Upon confirming normality of data distribution by Kolmogorov-Smirnov test, all data were processed by the methods of descriptive statistics. The categorical variables were described in absolute and relative frequencies. The  $\chi^2$ -test and the Fisher's exact test were used for the comparison of categorical variables between the groups. The level of statistical significance was set at  $p < 0.05$ . Statistical analysis was done using SPSS Statistical Package for Windows, version 13.0 (SPSS Inc., Chicago, IL, USA).

## Results

The study included 1077 children aged  $8.6 \pm 1.2$  years (range 6 to 11 years old) from the Osijek area in Eastern Croatia. Among the study subjects there were 48.9% boys and 51.1% girls. The study revealed that there were 68.0% children who eat breakfast every day, 27.5% children who eat breakfast sometimes and 4.5% children who never eat breakfast. Considering the number of meals consumed daily, the study revealed that 32.7% children consume five meals per day, 51.9% children consume three to four meals per day and 15.4% consume one or two meals per day. Regarding the type of snack meal consumed each day the study established that 48.4% children consume fruit as a snack meal each day, 32.0 % children consume some

kind of bakery product as a snack meal each day while 19.6% children consume some kind of sweets as a snack meal each day. Finally, the study revealed that there were 53.3% children who eat at least one cooked meal at home daily, 29.6% children who eat at least one cooked meal three to four times a week and 17.1%

children who eat at least one cooked meal one or two times a week, during weekends only. Regarding the habit of eating breakfast, the study determined some differences between boys and girls but these were not statistically significant ( $\chi^2$ -test;  $p=0.280$ ) (Fig. 1).

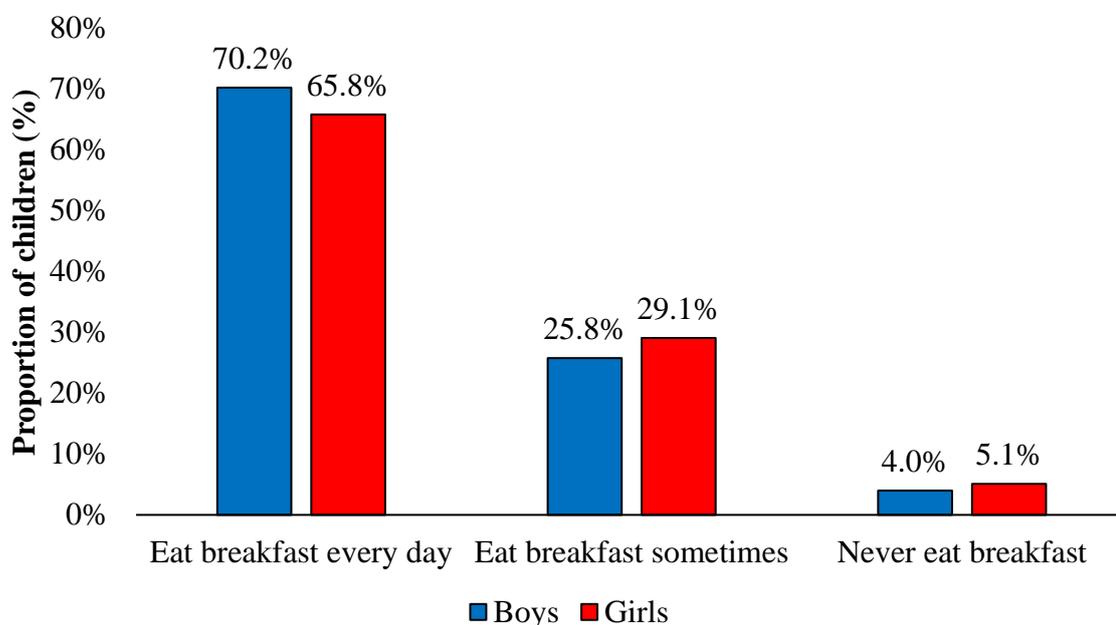


Fig. 1. The habit of eating breakfast among schoolchildren from the Osijek area in Eastern Croatia ( $\chi^2$ -test;  $p=0.280$ )

The study further found some differences between boys and girls in the number of meals consumed

every day but these were not statistically significant ( $\chi^2$ -test;  $p=0.366$ ) (Fig. 2).

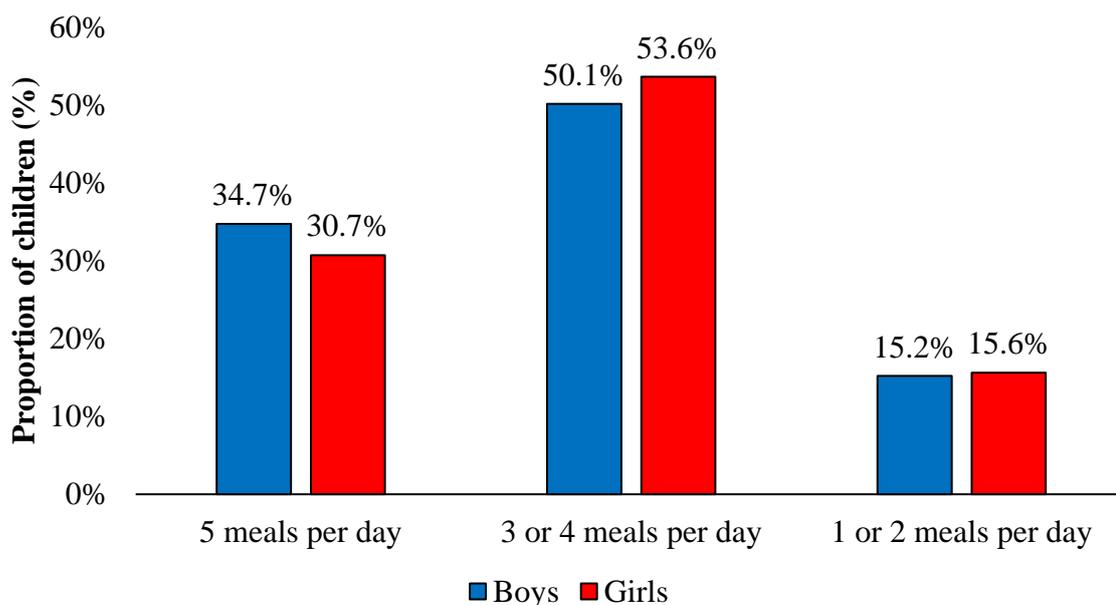
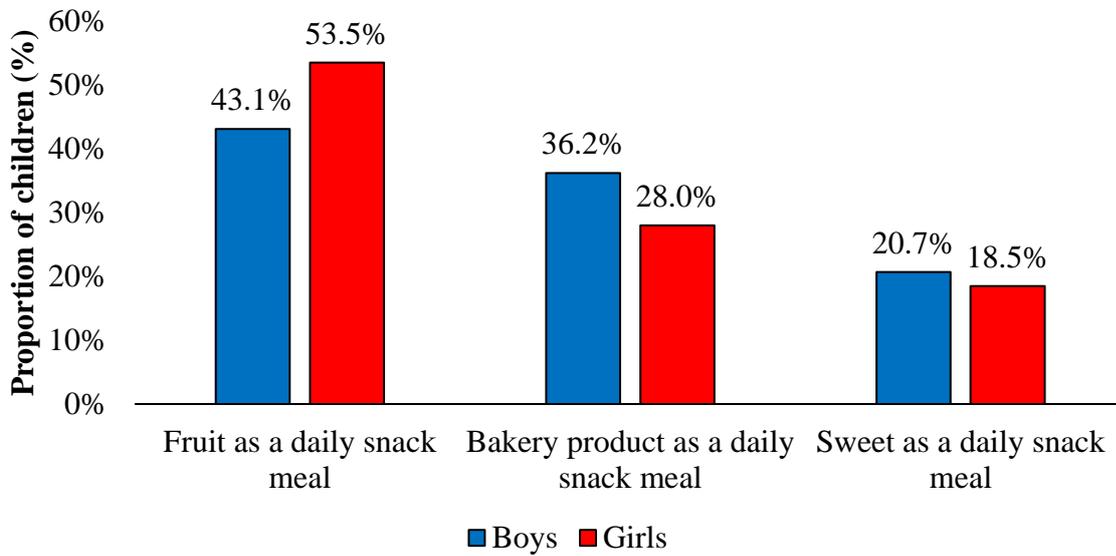


Fig. 2. Number of meals consumed every day among schoolchildren from the Osijek area in Eastern Croatia ( $\chi^2$ -test;  $p=0.366$ )

Considering the type of snack meal consumed each day the study revealed statistically significant

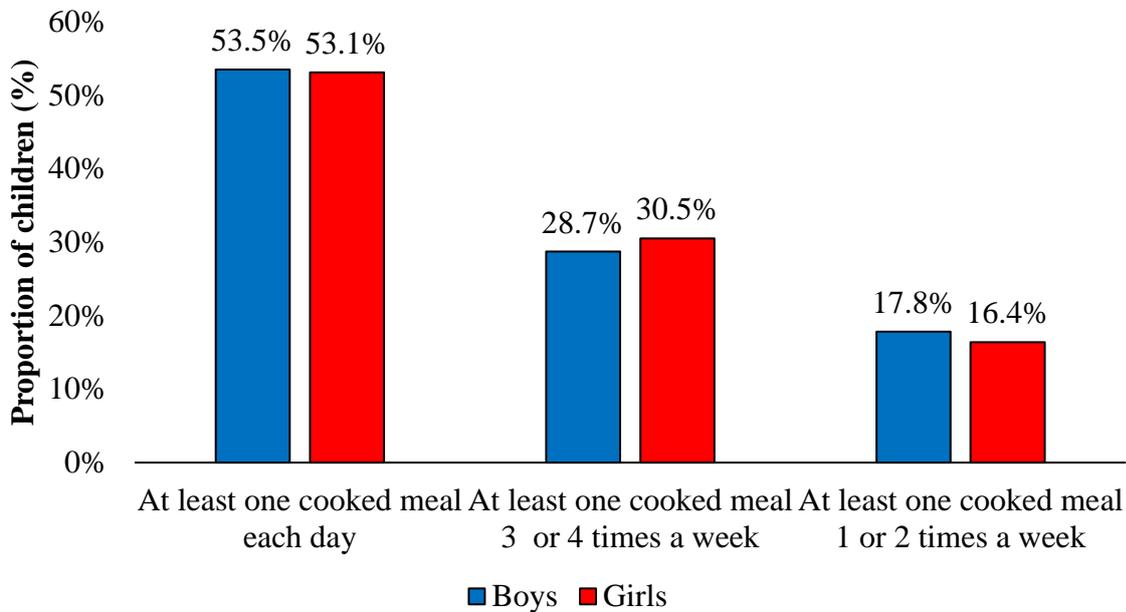
differences between boys and girls ( $\chi^2$ -test;  $p=0.002$ ) (Fig. 3).



**Fig. 3.** The type of daily-consumed snack meal among the schoolchildren from the Osijek area in Eastern Croatia ( $\chi^2$ -test;  $p=0.002$ )

Finally, the study established differences between boys and girls regarding the frequency of eating at least one

cooked meal daily at home but these differences were not statistically significant ( $\chi^2$ -test;  $p=0.716$ ) (Fig. 4).



**Fig. 4.** The schoolchildren from the Osijek area in Eastern Croatia according to the frequency of eating at least one cooked meal daily ( $\chi^2$ -test;  $p=0.716$ )

The mean proportion of salt in all 42 bakery products was  $2.4 \pm 0.9$  %. In pastries, this value was  $2.8 \pm 1.0$  % while in stuffed bakery products it was  $1.9 \pm 0.5$  %. This means that, if a child eats only one salty pretzel per day (~ 70 gram), he or she will intake around 2 grams of salt. So if we know that recommended intake for this age group is 5 grams of salt per day it is clear that children who eat bakery products as a daily snack consume through such product almost 50.0% of recommended salt intake.

## Discussion

Present study showed that schoolchildren from Eastern Croatia exhibit several bad dietary habits. These habits include skipping breakfast (32.0% of children), eating less than five meals per day (67.3% of children), choosing unhealthy snack meal every day such as bakery products or sweets (51.6% of children) and not eating at least one cooked meal at home per day (46.7% of children). The percentage of schoolchildren from Eastern Croatia who eat breakfast every day is similar yet larger than among Lithuanian and Czech schoolchildren (Smetanina et al., 2015, Voráčková et al., 2015). According to experts' recommendations breakfast should supply for 20% of a child's daily energy. Furthermore, there are scientific evidences that proved how not having breakfast has negative effects on alertness, concentration, memory, sight complicated processes, problem solving, and comprehending mathematics (Hosseini et al., 2015). Considering all the above one can say that the results obtained from Eastern Croatia are quite concerning.

This study also revealed that only 32.7% of children consume five meals each day, meaning there are a large proportion of children who skips meals. These data are much lower than among Lithuanian and Norwegian schoolchildren (Smetanina et al., 2015; Stea et al., 2015). Skipping meals, especially skipping breakfast is connected with poor academic performance and obesity in children (Stea et al., 2015; McIsaac et al., 2015) and thus poses a serious threat to health and well-being of children. The consequences of such bad influence can adversely affect the children in adulthood.

Present study further found that 51.6% of children from Eastern Croatia choose some sort of unhealthy snack every day. Besides poor academic performance, unhealthy snacking is also a strong predictor of childhood obesity (Baygi et al., 2013; Correa-Burrows et al., 2015). This study showed that 32.0% of schoolchildren from the Osijek area consume some of the bakery products as a snack meal every day and thus intake additional amount of salt. Such percentage,

although lower than the one determined among children from Bosnia and Herzegovina, still presents a major concern (Hasanbegović et al., 2010). There is also increasing evidence that obesity and high salt intake are not only important risk factors for hypertension but also the two most important modifiable risk factors (Correia-Costa et al., 2016). Based on the previously mentioned one can say that this study reveals an important possibility for specific public health interventions among the studied population in Croatia.

Regarding the frequency of eating at least one cooked meal daily at home this study established that 53.3% of the studied population actually eat at least one cooked meal at home each day. Such finding is rather disturbing because intake of away-from-home meals are associated with greater overall intake of energy, total fat, saturated fat, sugar and salt in children and adolescents putting them at risk of various health disorders in childhood but also in adulthood (Fulkerson et al., 2012; Appelhans et al., 2014). With respect to the above mentioned experts recommend limiting eating out and encourage more frequent home meal preparation (Fulkerson et al., 2012). This is even more important in childhood due to the known fact that dietary habits, which are important for one's long term health status, develop early in life (Kudlová and Schneidrová, 2012). Moreover, some studies indicate that children naturally prefer higher levels of sweet and salty tastes than adults do which makes them especially vulnerable to the modern diet and today's diet differs greatly from the diet of our past, when salt and sugars were once rare and expensive commodities (Mennella et al., 2014). Considering all that it is obvious that excessive intake of salt during childhood directly predisposes a child for such intake later in life.

Present study revealed statistically significant differences between boys and girls considering the type of snack meal consumed each day, where girls made healthier choices more often and consumed less bakery products in comparison to boys. A simple explanation for the latter is that boys have greater energy requirements than girls which leads to a greater total food consumption, therefore, higher salt intake (Marrero et al., 2014). This explanation is confirmed in this study through fact that boys more frequently consumed five meals per day and that they consumed breakfast more regularly in comparison to girls. On the other hand, this study did not find difference between boys and girls regarding the consumption of at least one cooked meal per day at home. This finding confirms the fact that dietary choices and habits of children, especially of younger children such as children in this study, largely depends on diet behaviors and choices of their parents (Kudlová and Schneidrová, 2012).

This study has several limitations and its results must therefore be interpreted with caution. The first limitation is connected with the fact that this study did not include the determination of salt in actual whole daily meals of the study subjects; thus it is not possible to exactly elaborate the amount of salt attributable to some bakery product consumed as a snack meal within the particular child's whole daily meal. Furthermore, the study did not include performance of anthropometrical measurements of children and because of that, it is not possible to exactly elaborate the connection between weight and salt consumption in a studied population that could certainly be important for deeper analysis of the obtained results. Consequently, these issues should certainly be addressed in future studies.

## Conclusions

Present study points to the fact that an excessive salt intake through diet in a population of Croatian schoolchildren could pose a serious public health issue. The study further emphasizes the role of daily consumption of bakery products as a snack meal in the overall intake of salt in the studied population. Understanding children's salt consumption is vitally important given the known associations between salt consumption and life-course progression to hypertension and all of its serious consequences. Because of that, these findings represent valuable information from public health point of view. Namely, bearing in mind that dietary habits, important for one's long-term health status, develop early in life and that parents certainly have an important role in the formation of such habits, it is necessary to strengthen both the parents and the children with additional knowledge dealing with this issue. This can be achieved by designing and implementing targeted preventive activities focused on dietary habits in the study population that need to involve parents, but other interested stakeholders as well. This is important because consequences of poor dietary habits, seen through the morbidity and mortality patterns in the Croatian adult population, negatively affect the whole society and can be changed by focusing on relatively simple issues such as this one that was investigated in this study.

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