ORIGINAL ARTICLE

Annals of Agricultural and Environmental Medicine 2022, Vol 29, No 2, 287–293
www.aaem.pl

Taste preferences of preschoolers and parents' contribution to shaping their children's eating habits in the context of obesity development

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Strzelecka I, Łyszczarz A, Szpak A, Kolarzyk E. Taste preferences of preschoolers and parents' contribution to shaping their children's eating habits in the context of obesity development. Ann Agric Environ Med. 2022; 29(2): 287–293. doi: 10.26444/aaem/147850

Abstract

Introduction and Objective. Improper diet of children and their preference for sweet taste may be risk factors for the development of obesity and childhood caries. The aim of the study was to evaluate the taste preferences of preschoolers and to estimate the methods used by parents to shape the nutritional behaviour of their children.

Materials and method. The research covered 108 preschool children and 86 parents. All children completed a pictorial questionnaire containing images of 32 food products. The children expressed their preferences (I really like, I like, I don't like) by choosing the appropriate emoji. The questionnaire for parents concerned the diet of children on days off from kindergarten. The nutritional status of children was evaluated on the basis of the BMI. Children with normal weight / underweight and those overweight / obese were compared using χ^2 or the exact Fisher test.

Results. Most preschoolers indicated that they liked the most crisps, jam, sweets, chocolate and sweet drinks. They also enjoyed fruits which are naturally sweet: apples (97%) and bananas (94%). The favourite vegetables were cucumbers (84%), potatoes (83%), and carrots (77%). Children had a tendency to make incorrect food choices. Fast food was very popular, while fish was disliked. Parents reported that children like meatless sweet dishes (crêpes, pancakes, dumplings). Such factors as unlimited access to sweets at home (p=0.05) and rewarding/motivation with sweets (p=0.013) were significantly associated with a child's overweight/obesity status. Excess body weight was found in 22.1% of children (overweight – 3.5 %; obesity –18.6%).

Conclusions. Children had a clear preference for sweet taste. Reducing the consumption of sweets and increasing the nutritional awareness of parents and children may prevent the development of childhood obesity.

Key words

preschool children, eating habits, taste preferences, nutritional status, childhood caries

INTRODUCTION

In recent years, more and more children have excess body weight, and childhood obesity is treated as worldwide epidemic [1]. The most recent estimate of the prevalence of overweight and obesity in children under the age of 5 years has been provided by UNICEF, the WHO and the World Bank [2]. In 2020, according to the WHO classification, it was estimated that 39 million children of this age were overweight or obese () [3]. Analysis of the prevalence of overweight and obesity in children and adolescents aged 5–19 years shows that in 2016 this problem affected over 340 million children, and that the frequency of excess body weight increased from 4% in 1975 to over 18% in 2016. In preschool children, girls are more overweight or obese than boys [4], and the probability of overweight/obesity in the offspring of overweight women is more than 3 times higher than in children of mothers of normal body weight [5].

Clinical findings and literature data show that apart from childhood obesity, the second major problem for public health worldwide is the high incidence of dental caries in children [6]. Early childhood caries remains a global problem which is highly prevalent in preschool children [7, 8, 9, 10]. In England (United Kingdom, or England specifically), in the 2017–2018 school year, about 25% of children aged 4–5 years were overweight or obese [11], and about the same percentage of children at this age had dental caries [12]. In Poland, the results of epidemiological studies conducted in 2013–2015 as part of the National Oral Health Monitoring Programme showed that in the group of 3-year-olds, on average, 3 teeth were affected by caries, and in the group of 6-year-old children only 14.4% of them were free from caries [7].

The major risk factor for both dental caries and obesity is excess sugar intake [13, 14, 15]. Excess free sugars, particularly in the form of sugar-sweetened beverages, significantly contribute to adverse oral and general health [14]. The free sugars (corresponding to the term 'added sugars') are sugars found in foods other than grains, vegetables, whole fruit and milk. Free sugars are the main cause of tooth decay, and simultaneously play a significant role in the etiology not only of obesity, but also other diet-related non-communicable diseases [16, 17]. Therefore, many initiatives are needed to limit the consumption of free sugar and make the diet healthy.

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Received: 16.02.2022; accepted: 29.03.2022; *first published: 13.04.2022*

The contemporary diet is often unhealthy, in which fast-food and highly processed foods, energizing snacks, and, above all, sweet drinks and sweet snacks, are often consumed. By eating favourite sweet, high-energy foods, the child's response to internal signals of satiety is reduced, while the child experiences subjective reward and pleasure [18]. Children's taste preferences are formed in the first years of life and largely determine children's food choices. It has been shown that most children prefer high-energy foods, including sweet and dairy products, and foods high in fat [19].

Parents have a great influence on shaping taste preferences and the correct nutritional choices of children. Parents should give their offspring some freedom in their food choices while themselves being positive role models. A properly prospering family model should be part of a process that establishes and promotes a healthy lifestyle by setting a good pattern, providing healthy and appropriate food for the child, and shaping healthy eating behaviour [20]. Unfortunately, the dietary choices and eating behaviour of the parents are not always pro-health, for example, the use of sweet food as a reward for their children [21, 22].

Data from the literature shows that the nutritional mistakes of parents and children may play a key role in the development not only of overweight and / or obesity, but also early childhood caries.

OBJECTIVE

The aim of the study was to evaluate the taste preferences of preschool children, especially their preference for sweet / sweetened products with a high free sugar content, and to estimate the methods used by parents to shape the nutritional behaviour and eating habits of their children. The association between children's demographics characteristics, nutritional behaviour of parents, and the presence of overweight / obesity was also verified.

An additional, non-research goal was to assess the relationship between improper eating habits and childhood caries, as well as between obesity and caries, based on literature data.

MATERIALS AND METHOD

The study consisted of 2 parts. In the first part, the research covered 108 children attending a kindergarten in Oleśnica, Świętokrzyskie (Holy Cross) Province, in the central part of Poland. The children were aged 3–6 years and belonged to 5 different preschool groups. The parents were fully informed about the scope and purpose of the study and gave their written consent for the participation of their children. All children were asked to complete a pictorial questionnaire designed to identify their taste preferences in relation to 32 food products (their images) from various food groups. Three symbols were placed next to each food product:

Each child coloured the symbol of each product that best reflected his/her own dietary preferences. Tested food groups included:

- drinks: *coca-cola, juice, mineral water;*
- dairy products: *natural yoghurt, cream cheese, 'Monte' cheese, white cheese, yellow cheese, milk;* – eggs;

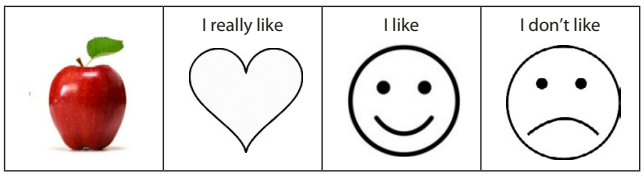

Figure 1. Screenshot of a food item.

- fruits: *apples, pears, bananas, oranges, kiwi;*
- vegetables: *tomatoes, cucumbers, carrots, potatoes, broccoli, peppers*;
- fast food: *chips, pizza, fries, hamburger;*
- snacks: *chocolate, sweets, doughnuts, jelly beans, 'Nesquik' flakes;*
- meat products: *chicken, sausages;*
- fish.

Children completed the questionnaire in the kindergarten under the supervision of kindergarten teachers.

In the second part of the study, the parents of all 108 surveyed children were asked to complete a questionnaire concerning information about the eating behaviour and food preferences of their children on days off from kindergarten. The questionnaire consisted of 28 questions. Only 86 parents returned a completely and correctly completed questionnaire. Thus, only 86 children and 86 parents could be enrolled in this part of the study. When completing the questionnaire, the parents provided information about whether the child had unlimited access to fruit and vegetables, as well as to sweets at home; what fruit and vegetables are the most liked and the most disliked, and which dishes are eaten most willingly by the child. Parents were asked to provide information about what guided them when preparing meals: the child's taste preferences, the ease and short time of preparing a given dish; using products currently available at home, and the nutritional value of prepared meals. In addition, they were to answer whether they use sweets as a form of reward / motivation for the child. An important issue was to obtain information on whether the 2 recommendations contained in Healthy Eating and Lifestyle Pyramid for Children and Adolescents [23] were fulfilled: 'Drink at least 3–4 glasses of milk daily; this can be substituted by natural yoghurt, kefir, and partially by cheese,' and 'Eat veggies and fruit very often and in big amounts – at least 400 g of vegetables and fruit, in 5 portions (a serving is 80–100 g of vegetables or fruit) or 170 ml of 100% fruit juice.'

Anthropometric measurements. The height and weight of the 86 children whose parents consented to anthropometric examination were measured in the kindergarten by an experienced kindergarten teacher. The children were in fasting status. A correctly-calibrated medical balance was used. Based on the measurements of body weight and height, the BMI was calculated, according to the following formula: body weight (kg) / height (m)^2. The BMI percentile of each child was calculated using the BMI percentile charts obtained from the results of the OLAF Project [24]. Based on the BMI percentile, the following ranges of nutritional status have been determined: underweight (<3th percentile); normal weight (between 3th-89th percentile); overweight (BMI ≥90th percentile and <97th percentile); obesity (≥97th percentile).

Statistical analysis. Data from the questionnaire for parents and the child's overweight / obesity status were described using number and percentages. Due to the small population size, children were categorized into 2 groups: underweight / normal weight vs. overweight / obese, in further analyses. Children with normal weight or underweight and those overweight or obese were compared using chi square test or exact Fisher test. Analyses were performed using Stata/IC 13.1 (StataCorp LP., College Station, TX, USA) and significance was set at $p = 0.05$.

RESULTS

PART I

The first part of the study covered 108 preschool children. The results from the questionnaire addressed to children are presented in Table 1 and Table 2.

The results from the pictorial questionnaire indicate that children prefer sweet / sweetened products with a high free sugar content. More than 80% of children indicated that they liked very much snacks such as crisps and jelly sweets. The same percentage of children indicated apples and bananas from the fruit group as being well liked. Among vegetables, children like potatoes, cucumbers and carrots the most. Other sweet-tasting products were also very popular. More than half of the children liked very much or liked other sweet products, such as: chocolate, doughnuts, Nesquik flakes, and fruits and vegetables such as pears, oranges and tomatoes.

Table 1. Products from 4 food groups indicated by children as the most liked and disliked

Group of products	Products	I really like		I like		I don't like	
		n	%	n	%	n	%
Fruits	apples	89	*82*	16	*15*	3	*3*
	bananas	87	*81*	14	*13*	7	*6*
	pears	59	*55*	23	*21*	26	*24*
	kiwi	29	*27*	22	*20*	57	*53*
	oranges	47	*44*	25	*23*	36	*33*
Vegetables	potatoes	72	*66*	18	*17*	18	*17*
	cucumbers	71	*66*	20	*18*	17	*16*
	carrots	58	*54*	25	*23*	25	*23*
	tomatoes	56	*52*	22	*20*	30	*28*
	peppers	25	*23*	20	*19*	63	*58*
	broccoli	26	*24*	15	*14*	67	*62*
Snacks sweetened beverages	crisps	89	*83*	11	*10*	8	*7*
	jelly sweets	87	*81*	14	*13*	7	*6*
	sweets	83	*77*	18	*17*	7	*6*
	chocolate	76	*70*	18	*17*	14	*13*
	Nesquik flakes	74	*69*	29	*27*	5	*4*
	doughnuts	62	*57*	31	*29*	15	*14*
Drinks	*Coca-cola*	68	*63*	12	*11*	28	*26*
	ready-made juices in bottles /cartons	82	*76*	20	*19*	6	*5*
	mineral water	67	*62*	22	*20*	19	*18*

Table 2. Products from the next 5 food groups indicated by children as the most liked and disliked

Group of products	Products	I really like		I like		I don't like	
		n	%	n	%	n	%
Dairy products	'Monte' cheese	85	*79*	16	*15*	7	*6*
	milk	59	*55*	27	*25*	22	*20*
	yellow cheese	36	*33*	31	*29*	41	*38*
	white cheese	34	*31*	18	*17*	56	*52*
	natural yogurt	22	*20*	18	*17*	68	*63*
Eggs	eggs	42	*39*	19	*18*	47	*43*
Fast-food	French fries	95	*88*	10	*9*	3	*3*
	pizza	82	*76*	13	*12*	13	*12*
	hamburger	49	*45*	16	*15*	43	*40*
Meat products	sausages	87	*81*	13	*12*	8	*7*
	chicken	49	*45*	25	*23*	34	*32*
Fish	fish	20	*18*	18	*17*	70	*65*

The group of drinks deserves special attention. Almost all children love or like sweet ready-made juices in bottles / cartons; ¾ of them indicated Coca-Cola. At the same time, it should be noted that mineral water was accepted by almost all children – mineral water is recommended by specialists as the most suitable drink for children. Food products with a pronounced sour-bitter taste were the most disliked. More than half of the children indicated kiwi, peppers and broccoli as the most disliked by them.

From the group of dairy products, mild cheese (e.g. 'Monte') was the most preferred by children. White cheese and natural yogurt were the most disliked. Fortunately, milk was much liked or liked by over 3/4 of the children. The group of popular products also included: French fries, pizza, sausages. Fish and eggs were among the disliked products, disliked by about half of the children.

PART II

Characteristics of the populations. In the second part of study, 86 children and 86 of their parents were included. The group of parents consisted of 82 mothers and 4 fathers; most of them (77%) were aged 30–39. Most of the parents (64%) had secondary/vocational education while 34% had higher education. Professional work in the family was as follows: 44% – both parents worked; 55% – only the father worked; in the case of only one child – only the mother worked.

The group of children included 39 girls (45.3%) and 47 boys (54.7%); 26.7% of them were an only child, the rest had siblings. At the age of 3–4 years, there were 33 children (38.4%), and at the age of 5–6 there were 53 children (61.6%).

Assessment of the nutritional status based on the distribution of BMI was as follows:

- underweight (<3th percentile) – 14 children (16.3%);
- normal weight (between 3th-89th percentile) – 53 children (61.6%);
- overweight (BMI ≥90th percentile and < 97th percentile) – 3 children (3.5%)
- obesity (≥97th percentile) – 16 children (18.6%).

Table 3. Child's demographics and nutritional characteristics by overweight / obesity status

		Total (n=86)	Overweight / obese children (n=19)	Children with normal weight / underweight (n=67)	p-value
Gender	boy	47 (54.7%)	9 (47.4%)	38 (56.7%)	0.470
	girl	39 (45.3%)	10 (52.6%)	29 (43.3%)	
Age (years)	3	13 (15.1%)	3 (15.8%)	10 (14.9%)	0.922
	4	20 (23.3%)	5 (26.3%)	15 (22.4%)	
	5	28 (32.5%)	5 (26.3%)	23 (34.3%)	
	6	25 (29.1%)	6 (31.6%)	19 (28.4%)	
Having siblings		63 (73.3%)	14 (73.7%)	49 (73.1%)	0.962
Siblings	only child	23 (26.7%)	5 (26.3%)	18 (26.9%)	0.296
	only younger	18 (20.9%)	4 (21.1%)	14 (20.9%)	
	both younger and older	10 (11.6%)	0 (0%)	10 (14.9%)	
	only older	35 (40.7%)	10 (52.6%)	25 (37.3%)	
BMI category	underweight	14 (16.3%)	-	14 (20.9%)	
	normal	53 (61.6%)	-	53 (79.1%)	
	overweight	3 (3.5%)	3 (15.8%)	-	
	obese	16 (18.6%)	16 (84.2%)	-	
Unlimited access to fruit at home		76 (88.4%)	19 (100%)	57 (85.1%)	0.108
Unlimited access to vegetables at home		74 (86%)	18 (94.7%)	56 (83.6%)	0.286
Unlimited access to sweets at home		30 (34.9%)	11 (57,9%)	19 (28,4%)	**0.050**
Rewarding / motivation with sweets	no	23 (26.7%)	1 (5.3%)	22 (32.8%)	**0.013**
	sometimes	50 (58.1%)	12 (63.2%)	38 (56.7%)	
	yes	13 (15.1%)	6 (31.6%)	7 (10.4%)	
What guides parents in preparing dishes	ease and short time of preparing a given meal	4 (4.7%)	1 (5.3%)	3 (4.5%)	0.967
	child's taste preferences	54 (62.8%)	13 (68.4%)	41 (61.2%)	
	nutritional value of prepared meals	15 (17.4%)	3 (15.8%)	12 (17.9%)	
	use of products currently available at home	13 (15.1%)	2 (10.5%)	11 (16.4%)	
Child compliant with the milk / diary products recommendations*		55 (64.7%)	10 (52.6%)	45 (68.2%)	0.211
Child compliant with fruit and vegetables recommendations*		71 (82.6%)	15 (78.9%)	56 (83.6%)	0.733

N – %; *recommendations contained in *Healthy Eating and Lifestyle Pyramid for Children and Adolescents.*

Results from the questionnaire addressed to parents. Association between child's demographic characteristics, parental nutritional behaviours and overweight/obesity status is presented in Table 3.

Such factors as unlimited access to sweets at home and rewarding or motivation with sweets were significantly associated with child's overweight / obesity status. Among overweigh / obese children, the parents used sweets to reward / motivate them much more frequently than those of children with normal weight / underweight (31.6% vs. 10.4%; p=0.013). Also, statistically significantly more overweigh / obese children than normal weight / underweight children had unlimited access to sweets at home (57.9% vs. 28.4%; p=0.050). In the case of association between unlimited access to fruit and vegetables and overweight / obesity status, no statistical significance was found. Also, no significant association was observed between a child's demographic characteristics and overweight / obesity.

Parents replied that the implementation of the recommendation contained in the *Healthy Eating and Lifestyle Pyramid* for *Children* and *Adolescents* regarding vegetables and fruit was met in 82.6% of children, and the recommendations on milk / dairy consumption were met by 64.7%; the differences between overweight / obese children and those with normal weight / underweight were statistically not significant. When preparing meals, parents were most often guided by the taste preferences of their children.

Parents were also asked to name the fruits and vegetables most liked and least liked by children and to name 3 dishes most willingly and least readily eaten by children (Tab. 4).

Table 4. Foods most liked and least liked by children, in the opinion of parents

Products / dishes	Most liked / most willingly eaten by children	Least liked / least readily eaten by children
Fruits	apples, bananas, tangerines	pomegranate, persimmon plums, pomelo
Vegetables	carrots, cucumbers, potatoes	asparagus beans, cabbage, zucchini
Soup	chicken noodle soup, tomato soup	cabbage soup, pea soup, cucumber soup
Dishes	crêpes, pancakes, dumplings, spaghetti	fish, stewed liver
Fast food	French fries, pizzas	lack of junk food in the child's diet (43%)

Parents' responses confirmed the sweet taste preferences declared by children in terms of fruit and vegetables. An analysis of the dishes served for lunch / dinner revealed that children had a greater preference for meatless, sweet dishes, such crêpes, pancakes and dumplings, than for salty / sour dishes. Among soups, cabbage soup, pea soup and cucumber soup were the least eaten. The parents' opinion about fish was consistent with the opinions of the children. Parents reported that fish, like liver, were reluctantly eaten by their children. Parents also declared that the children liked French fries and pizza, but at the same time, the menu of almost half of the children lacked junk food.

DISCUSSION

The eating habits developed in childhood also usually persist into adulthood [25]. During childhood, sweet and salty flavours are widely accepted by children. Children get used to the bitter taste gradually, usually only after trying products with this taste many times, such as certain vegetables. Meanwhile, sweetness is a strong psychobiological stimulus and improves the taste of some dishes and drinks, thus stimulating their increased consumption [26]. The study by Sobek et al. [27] confirmed that the sweet taste was preferred by children. It was also shown that in the group of children who preferred the taste of high sweetness, there were twice as many obese children as in the group of children who preferred the taste of low sweetness. It should be emphasized that in this study, real food products (crackers and apple juice with different sugar content) were used to assess taste preferences. Children's preferences for sweet taste were also found in a study [28] carried out with a method similar to that used in the current study. Children aged 4–6 were included in the research. They defined their taste preferences about 115 different food products and dishes by selecting the appropriate emoticon (happy, sad, or neutral face). It turned out that both boys and girls of all age groups preferred the sweet taste.

The results of the current study are consistent with those of other authors and confirm children's preferences for choosing sweet-tasting food products [29]. Almost all children liked or very much liked sweet snacks, sweet fruit, and sweet drinks. Also in the group of dairy products, the most popular was the mild, sweet 'Monte' cheese. On the other hand, it is positive that about 3/4 of the surveyed children indicated that they really like or like milk. Parents also confirmed that most of their children met the Polish dietary recommendation 'drink at least 3–4 glasses of milk a day', which can be replaced with natural yogurt, kefir and – partially – cheese [23].

Recommendations for the daily consumption of skimmed milk and other dairy products are among the guidelines for a healthy diet for children and adolescents. Unfortunately, both the food industry and parents make the mistake of adding sugar to dairy products. Although sweetened products satisfy the innate craving for sweet foods and are then more eagerly eaten by children, adding sugar lowers their health-promoting properties [16]. The relationship between adding sugars to milk as well as to fruit, and obesity was established in the IDEFICS (Identifying and Preventing Diet-Induced Health Effects and Lifestyle Effects in Children and Infants) study, which included 16,228 children aged 2–10 from 8 European countries (Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain, and Sweden) [30]. This relationship was confirmed in boys and girls aged 6–10 years, while such a relationship was not found in the group of girls and boys aged 2–6 years. Some authors have shown that the taste for sweet preferences is innate and the desire to eat sweet food is stronger in children than in adults [28, 31]. It can therefore be assumed that in childhood, the appetite for sweets may be induced by a higher caloric demand of intensively growing children [32].

The eating habits and taste preferences of children are also shaped by their parents. Parents try to influence the foods that their child likes and dislikes in different ways. Incorrect parental nutritional strategies may contribute to the development of overweight or obesity in children [33]. Parents often use food for non-nutritional purposes. Food is used as a reward for good behaviour and obedience to the mother, for example, at a doctor's visit or in a car. [34] Laboratory experiments have shown that repeated presentation of sweet snacks as a reward increased the preference for choosing these products for consumption [35, 36], which may result in excessive weight gain. Some research has found that the use of food as a reward is associated with a higher Body Mass Index [37] and risk of being overweight [38]. The current study shows that overweight / obese children were statistically significantly more often rewarded with sweets by their parents than proper weight / underweight children. Some authors did not confirm the relationship between rewarding sweetness and the development of excess body weight in children [39, 40]. However, the study performed by Janes et al. [40] showed that a vicious cycle may appear in which children who display food approach behaviour are rewarded with food by their parents, which in turn might lead to emotional eating and fussiness.

If the sweets are not only used as a reward but introduced into daily consumption, then children are at risk of developing both obesity and tooth decay. In the present study, unlimited access to sweets at home was significantly associated with overweight / obesity in a child. Changing eating habits into health-related, and in particular, limiting the supply of sugar, can effectively reduce the risk of developing both health ailments. Unfortunately, assessment of the frequency and intensity of caries in children participating in the current study was impossible in the conditions of the extant Covid-19 epidemic. However, based on the results of research carried out in previous years in children from this kindergarten, and on the basis of literature data [8–10], it may be judged that tooth decay is also a significant problem in the children included in this study.

Diet plays a particularly important role in the etiology of early childhood caries. Olczak-Kowalczyk et al. [41] revealed that an effective way to reduce the risk of caries development at the age of 3 is appropriate nutritional management starting from the age of 12 months. The child should only drink water or unsweetened milk, and sugar-free snacks and fruit may be served between meals. Brushing the child's teeth twice a day plays a very important role in caries prevention, but of primary importance is the reduction of sugar in the child's diet and healthy snacking habits. In England, a strategy paper titled 'Sugar Reduction: Evidence for Action' estimated that a 5% reduction in energy consumption from sugar could prevent the development of tooth decay in nearly a quarter of a million cases [42]. A strong positive correlation was shown between the perception of sweet taste and the

frequency of consuming sweets during the day, and the frequency and intensity of the cariogenic process in preschool children [8]. Also, Malinowski et al. [9] noted the fact that the most common risk factors of early childhood caries include beverages containing sugar, large amounts and high frequency of sugar consumption, along with the lack of proper oral hygiene.

It has been shown that there is a linear relationship between obesity and caries [13], but this may be moderated by some socio-demographic factors, e.g. socio-economic disadvantages, access to sweets at home, etc. Hayden et al. [43] showed a significant relationship between obesity and tooth decay in children from industrialized, but not newly-industrialized countries, and factors such as age and socio-economic class were important moderators. Another study investigating the relationship between obesity and dental caries among adolescents obtained a longitudinal association between central obesity and dental caries experience among adolescents aged 15–18 in Hong Kong [44]. It has also been shown that most children do not outgrow the problem of being overweight or obese. Hernandez et al. [45] found that only about 17% of overweight or obese preschool children returned to normal weight by the time they start lower secondary school.

Overweight, obesity and dental caries are largely preventable. Prevention can be carried out on an individual and societal level. Efforts should be made to implement the principles of a healthy lifestyle and to promote physical activity and a healthy diet. There is a need to improve patterns of physical activity at the individual and population levels. Assessment of the level of physical activity of children and adolescents from the Visegrad countries – Czech Republic, Hungary, Poland, and Slovakia – showed that a large part of them, especially girls, did not comply with the recommendations regarding physical activity [46]. As far as school-age children are concerned, the COSI study [47] conducted in 2016 in 135 Polish schools showed that systemic and social solutions are necessary, both in rural and urban areas, in terms of infrastructure. Solutions supporting the implementation of healthy eating and physical activity are also needed.

Many initiatives are also being taken on a global level and concern the effective fight against obesity in children and adolescents worldwide by promoting healthy eating and increasing physical activity [48,49]. In order to reduce the incidence of diet-related non-communicable diseases, the WHO recommends less than 10% of energy intake from free sugars. The need to lower this limit below 5% as soon as possible was also emphasized. Reducing the supply of free sugars in the diet should be part of a strategy to reduce the incidence of both obesity and caries [50, 51, 52]. Although caries is a multifactorial disease, improper eating habits are the main factor in its development. Promoting healthy eating habits from an early age should be the main goal of preventive actions undertaken by both paediatricians and aediatric dentists.

The child's diet should include high-fibre foods, and water should be preferred over sweetened drinks. Energy supply from foods rich in free sugars and saturated fatty acids should be limited, and the consumption of fruit and vegetables, as well as legumes, whole grains, and nuts, should be increased. The food industry can support healthy diets by reducing the fat, sugar, and salt content in processed foods and by restricting the marketing of this type of food, in particular with regard to children and teenagers. Limiting the supply of sugar in the diet will reduce the incidence of both childhood obesity and childhood caries. The recently-introduced tax on sugar and sugar sweetened beverages is intended to reduce sugar consumption by the Polish population, especially by children and adolescents

CONCLUSIONS

The conducted research confirmed the tendency of children to prefer the sweet taste which can be seen in the types of vegetables, fruits and snacks that were chosen by the children. There has already been a tendency in preschoolers to make incorrect food choices: fast food was invariably very popular, while fish were among the disliked products. Parents were willing to use methods aimed at shaping correct eating habits of their children, and also attempted to follow the recommendations contained in the *Healthy Eating and Lifestyle Pyramid f*or *Children* (¾ of their children had unlimited access to fruits and vegetables). At the same time, parents made many nutritional mistakes, for example – a half of overweight / obese children had unlimited access to sweets. Parents of overweight / obese children used sweets more often than parents of children with normal weight / underweight to reward them or motivate obedience and good behaviour.

When preparing meals, parents also most often suggested the taste preferences of their children. This resulted in the most common meals eaten by children being meatless, sweet dishes, such as crêpes, pancakes and dumplings. Incorrect diet translated into the improper nutritional status of some children. Overweight and obesity were found in 1/5 of the examined children. It is known from the literature and clinical observations that nutritional mistakes are a risk factor not only for the development of obesity, but also for childhood caries. In order to counteract this, parents and kindergarten educators must join in efforts to develop correct eating habits in children. These efforts, in connection with the education of both children and their parents, can contribute to reducing the incidence and occurrence of excess body weight in preschool children.

REFERENCES

1. Di Cesare M, Sorić M, Bovet P, et al. The epidemiological burden of obesity in childhood: a worldwide epidemic requiring urgent action. BMC Med. 2019; 17(1): 212. doi:10.1186/s12916-019-1449-8
2. World Health Organization (WHO). Levels and trends in child malnutrition: UNICEF/WHO/The World Bank Group joint child malnutrition estimates: key findings of the 2020 edition.
3. Obesity and overweigh. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweigh (access: 1.04.2020).
4. Manios Y, Androutsos O, Katsarou C, et al. Prevalence and sociodemographic correlates of overweight and obesity in a large Pan-European kohort of preschool children and their families: The Toy Box-study. Nutrition. 2018; 55–56: 192–198. https://doi.org/10.1016/j.nut.2018.05.007
5. Brown T, Moore TH, Hooper L, et al. Interventions for preventing obesity in children. Cochrane Db Syst Rev. 2019; 7: CD001871. https://doi.org/10.1002/14651858.CD001871.pub4
6. Peres MA, Macpherson LM, Weyant RJ, et al. Oral diseases: a global public health challenge. The Lancet. 2019; 394: 249–260. https://doi.org/10.1016/S0140-6736(19)31146-8
7. Kuśmierz K, Węgrzyniak M, Pawłowska A, et al. Występowanie próchnicy zębów u dzieci w wieku 3, 6 i 12 lat. Med Og Nauk Zdr. 2016; 22(3): 190–193. doi:10.5604/20834543.1220520

8. Jurczak A, Ciepły J, Gregorczyk-Maga I, et al. Caries prevalence and intensity in 6-year-old children from the Krakow region, Borgis – Nowa Stomatologia. 2013; 4: 160–166.
9. Malinowski K, Majewski M, Kostrzewska P, et al. Early childhood caries – literature review on risk factors, prevalence and prevention. Med Og Nauk Zdr. 2021; 27(3): 244–247. doi:10.26444/monz/140327
10. Adamowicz-Klepalska B. Próchnica zębów mlecznych. Med Prakt. [in Polish] https://www.mp.pl/pacjent/pediatria/choroby/stomatologia/67483,prochnica-zebow-mlecznych (access: 7.02.2021).
11. National Child Measurement Programme, England—2017/18 School Year https://digital.nhs.uk/data-and-information/publications/statistical/national-child-measurement-programme/2017–18-school-year/age (access: 19.06.2020).
12. National Dental Epidemiology Programme for England: oral health survey of five-year-old children 2018. https://www.gov.uk/government/statistics/oral-health-survey-of-5-year-old-children-2017 (access: 19.06.2020)
13. Ravaghi V, Rezaee A, Pallan M, et al. Childhood obesity and dental caries: an ecological investigation of the shape and moderators of the association. BMC Oral Health. 2020; 20(1): 338. doi:10.1186/s12903-020-01329-7
14. Muhanad A. Taxation of sugar-sweetened beverages and its impact on dental caries: A narrative review. Saudi J Med Med Sci. 2021; 9(2): 113–117. doi:10.4103/sjmms.sjmms_54_21
15. Chi DL, Scott JM. Added sugar and dental caries in children: a scientific update and future steps. Dent Clin North Am. 2019; 63(1): 17–33. doi: 10.1016/j.cden.2018.08.003
16. Marshall TA. Nomenclature, characteristics, and dietary intakes of sugars. J Am Dent Assoc. 2015; 146(1): 61–64. doi:10.1016/j.adaj.2014.11.007
17. Swan GE, Powell NA, Knowles BL, et al. A definition of free sugars for the UK. Public Health Nutr. 2018; 21(9):1636–1638. doi:10.1017/S136898001800085X
18. Bellisle F. Intense sweeteners, appetite for the sweet taste, and relationship to weight management. Curr. Obes. Rep. 2015; 4: 106–110. doi:10.1007/s13679-014-0133-8
19. Ventura AK, Worobey J. Early influences on the development of food preferences. Curr Biol. 2013; 23: R401–R408. doi:10.1016/j.cub.2013.02.037
20. Vandeweghe L, Moens E, Braet C, et al. Perceived effective and feasible strategies to promote healthy eating in young children: Focus groups with parents, family child care providers and daycare assistants. BMC Public Health, 2016; 16: 1045. doi:10.1186/s12889-016-3710-9
21. Scaglioni S, De Cosmi V, Ciappolino V, et al. Factors influencing children's eating behaviours. Nutrients. 2018; 10: 706; doi:10.3390/nu10060706
22. Vollmer RL, Bartoshuk LM. Practices and preferences: Exploring the relationships between food-related parenting practices and child food preferences for high fat and/or sugar foods, fruits, and vegetables. Appetite. 2017; 113: 134–140.
23. Healthy Eating and Lifestyle Pyramid for Children and Adolescents. https://ncez.pzh.gov.pl/dzieci-i-mlodziez/piramida-zdrowego-zywienia-i-stylu-zycia-dzieci-i-mlodziezy-2/ ((access: 30.01.2019)
24. Kułaga Z, Różdżyńska-Świątkowska A, Grajda A. Percentile charts for growth and nutritional status assessment in Polish children and adolescents from birth to 18 year of age. Stand Med. 2015; 1: 119–135.
25. Montaño Z, Smith JD, Dishion TJ, et al. Longitudinal relations between observed parenting behaviors and dietary quality of meals from ages 2 to 5. Appetite. 2015; 87: 324–329.
26. Nicklaus S. The role of food experiences during early childhood in food pleasure learning. Appetite. 2016; 104: 3–9.
27. Sobek G, Łuszczki E, Dąbrowski M, et al. Preferences for sweet and fatty taste in children and their mothers in association with weight status. Int J Environ Res Public Health. 2020; 17: 538. doi:10.3390/ijerph17020538.
28. Kostecka M, Kostecka-Jarecka J, Kowal, M, et al. Dietary habits and choices of 4-to-6-year-olds: Do children have a preference for sweet taste? Children. 2021; 8: 774. https:// doi.org/10.3390/children8090774.
29. Gacek M. Dietary patterns in nursery school children from an urban environment [in Polish]. Rocz Panstw Zakl Hig. 2012; 63(4): 477–482.
30. Dello Russo M, Ahrens W, De Henauw S, et al. The impact of adding sugars to milk and fruit on adiposity and diet quality in children: A cross-sectional and longitudinal analysis of the Identification and Prevention of Dietary-and Lifestyle-Induced Health Effects in Children and Infants (IDEFICS) Study. Nutrients. 2018; 10: 1350. doi:10.3390/nu10101350
31. Mennella JA, Bobowski NK. The sweetness and bitterness of childhood: Insights from basic research on taste preferences. Physiol Behav. 2015; 152: 502–507.
32. Coldwell SE, Oswald TK, Reed DR. A marker of growth differs between adolescents with high vs. low sugar preference. Physiol Behav. 2009; 96: 574–580.
33. Loth K. Associations between food restriction and pressure-to-eatparenting practises and dietary intake in children: a selective reviewof recent literature. Curr Nutr Rep. 2016; 5: 61–67.
34. Spence A, Campbell K, Hesketh K. Parental correlates of young children's dietary intakes: a review. Aust Epidemiologist. 2010; 17(1): 17–20.
35. Vaughn AE, Tabak RG, Bryant MJ, et al. Measuring parent food practices: a systematic review of existing measures and examination of instruments. Int J Behav Nutr Phys Act. 2013; 10: 61.
36. Russell CG, Worsley A, Campbell KJ. Strategies used by parents to influence their children's food preferences. Appetite. 2015; 90: 123–130.
37. Rodenburg G, Kremers SP, Oenema A, et al. Associations of parental feeding styles with child snacking behaviour and weight inthe context of general parenting. Public Health Nutr. 2014; 17(5): 960–969.
38. Hardy LL, King L, Hector D, et al. Weight status and weight-related behaviour of children commencing school. Prev Med. 2012; 55(5):433–437.
39. Haszard JJ, Russell CG, Byrne RA, et al. Early maternal feeding practices: associations with overweight later in childhood. Appetite. 2019; 132: 91–96.
40. Jansen P W, Derks I P, Mou Y, et al. Associations of parents' use of food as reward with children's eating behaviour and BMI in a population-based cohort. Pediatric Obesity. 2020; 15(11): e12662.
41. Olczak-Kowalczyk D, Gozdowski D, Turska-Szybka A. Protective factors for early childhood caries in 3-year-old children in Poland. Frontiers in Pediatrics. 2021; 9:1–10. doi:10.3389/fped.2021.583660.
42. Public Health England. Sugar reduction: the evidence for action. 2015. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470179/Sugar_reduction_The_evidence_for_action.pdf (access: 19.06.2020).
43. Hayden C, Bowler JO, Chambers S, et al. Obesity and dental caries in children: a systematic review and meta-analysis, Community Dent Oral Epidemiol. 2013; 41(4): 289–308. https://doi.org/10.1111/cdoe.12014.
44. Ling-Wei Li, Hai Ming Wong, Colman P. Longitudinal association between obesity and dental caries in adolescents J Pediatr. 2017; 189: 149–154.e5. doi:10.1016/j.jpeds.2017.06.050.
45. Hernandez RG, Marcell AV, Garcia J, et al. Predictors of favorable growth patterns during the obesity epidemic among US school children. Clin Pediatr (Phila). 2015; 54(5): 458–468. doi:10.1177/0009922815570579
46. Kantanista A, Tarnas J, Borowie J, et al. Physical activity of children and adolescents from the Czech Republic, Hungary, Poland, and Slovakia: A systematic review. Ann Agric Environ Med. 2021; 28(3): 385–390. doi: https://doi.org/10.26444/aaem/125557
47. Korzycka M, Jodkowska M, Oblacińska A, et al. Nutrition and physical activity environments in primary schools in Poland – COSI study. Ann Agric Environ Med. 2020; 27(4): 605–612. doi:10.26444/aaem/114223
48. WHO commission on ending childhood obesity. Report of the commission on ending childhood obesity, 21January 2016 https://www.who.int/publications/i/item/9789241510066 (access: 20.06.2020).
49. World Health Organization (WHO). Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World. Geneva: WHO; 2019.
50. Breda J, Jewell J, Keller A. The Importance of the World Health Organization Sugar Guidelines for Dental Health and Obesity Prevention. Caries Res. 2019; 53(2): 149–152. doi:10.1159/000491556
51. Paglia L. WHO: healthy diet to prevent chronic diseases and caries. Eur J Paediatr Dent. 2018; 19(1): 5. doi:10.23804/ejpd.2018.19.01.01.
52. Brown T, Moore TH, Hooper L, et al. Interventions for preventing obesity in children. Cochrane Db Syst Rev. 2019; 7: CD001871. doi:10.1002/14651858651858.CD001871.pub4