Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity (2020) 25:51–58
https://doi.org/10.1007/s40519-018-0497-y

ORIGINAL ARTICLE

Investigating the nutritional value of foods targeting children

Sümeyye Güzel[1] · Alev Keser[1] · Şükrü Hatun[2]

Received: 11 January 2018 / Accepted: 28 February 2018 / Published online: 10 March 2018

Abstract

Purpose This study aimed to investigate the nutritional values of some low-nutrition packaged foods widely sold in supermarkets and encouraged for consumption.

Methods The study used 435 packaged foods from six hypermarkets with high sale capacities in Ankara to analyze their contents of energy/total fat/saturated fat/carbohydrate/sugar/salt based on label information.

Results Among the products in the scope of the study, the highest values were found in chocolates for fat (33.0 ± 4.28/100 g) and sugar (45.6 ± 5.95/100 g), wafers for saturated fat (19.2 ± 3.89/100 g), and crackers for sodium (0.9 ± 0.23/100 g). Among the 435 packaged foods investigated in the study, the products exceeded the limits designated in the health codes declared by the Turkish Food Codex Labeling Directive in 83.4% of the instances in terms of sugar, 93.7% of the instances in terms of total fat, 92.4% of the instances in terms of saturated fat, and 70.3% of the instances in terms of sodium.

Conclusion Energy/fat/sugar/salt contents were high in the packaged products that are especially targeted for children for higher consumption. Children's frequent and excessive consumption of these products contribute to the prevalence of childhood obesity and increase in related health risks.

Level of Evidence Level V, descriptive study.

Keywords Childhood obesity · Obesogenic environment · Food addiction · Sugar · Fat

Introduction

Considering that 41 million children worldwide are overweight and obese [1], the epidemic nature of obesity in childhood is a dramatic reality [2]. Obesity is a multifactor disease that may develop in combination of different factors like obesogenic environment [2], social, economic, behavioral, and biological factors [3]. Obesogenic environment leads to obesity through the positive energy balance that develops by decreased physical activity, increased consumption of high-energy foods, and longer times spent in front of the screen [2].

On the other hand, it is increasingly important to understand the neurobiological mechanism of obesity [4]. While homeostatic balance is not sufficient by itself to explain dietary behavior [5], food consumption is controlled by various mechanisms such as peripheral, endocrine, central factors, and reward systems [6]. As a result of the sensitivity of the reward system and disruption of energy homeostasis via neurobiological pathways that regulate the control of inhibitors in this system, the affected reward cycle may lead to compulsive food intake which is considered as addiction in some people. Excessive eating tendency that leads to various complications such as obesity had similar neurobiological characteristics of those in substance addiction [7]. It is argued that, especially salty, fatty, sugary foods, and foods with additive agents have a higher potential of addiction, rather than foods like vegetables, fruits, or lean meat [8, 9]. It is suggested that higher hedonic desire towards fatty and sugary foods may be related to increased neuropeptides and neuromodulators that contain anandamide and

✉ Sümeyye Güzel
sumeyyeguzel91@hotmail.com

Alev Keser
alevkeser@gmail.com

Şükrü Hatun
sukruhatun@gmail.com

[1] Department of Nutrition and Dietetics, Faculty of Health Sciences, Ankara University, Şükriye Mahallesi Plevne Caddesi Aktaş Kavşağı, No: 5, Ankara, Turkey

[2] Department of Pediatric Endocrinology and Diabetes, Faculty of Medicine, Koc University, Davutpaşa Caddesi, No: 4, Topkapı, 34010 İstanbul, Turkey

endocannabinoids [10]. Nevertheless, a study reported that consumption of tasty high-sugar and high-fat foods, in the same way as in substance addiction, changes the brain functions that include the mesolimbic dopamin reward function [11]. According to all these, the presence of food dependency on obese individuals may indicate that food dependency is effective in the development of obesity [12]. In a study where the relationship between childhood obesity and food dependency was investigated, it was reported that the food dependence ratio in children and adolescents in the 99th BMI percentile was 71% and 83.1% [13].

Unfortunately, starting with the early stages of their lives, children are highly exposed to packaged products with high-energy content that provide pleasure in consumption and turn into a habit of life-long consumption. Therefore, this study aimed to investigate some energy and nutrient contents of easy to reach 'junk food' children are encouraged to consume, and emphasize the magnitude of the danger.

Methods

The location, time, and sampling of the study

This study included packaged foods that are thought to have high-sugar, -fat, or -salt contents sold in 6 hypermarkets with high sale capacities located in Ankara between June 2016 and September 2016. All products in the snack sections of the markets were included.

The general setting of the study

The study included a total of 435 packaged foods from 24 different brands. The numbers of the types of products taken from the brands are given in Table 1.

The contents of energy (kcal), total fat (g), saturated fat (g), carbohydrate (g), sugar (g), and sodium (g) per 100 g of the products as captured on their labels were recorded for analysis. In addition, the number of products where these nutritional elements are provided in label information is determined, and this number is shown in the tables as '*n*'. As the sodium content was not included in labels of all products, the sodium value was calculated by multiplying the salt value on the labels by 0.4. The data were collected by the researchers by taking the photos of the products on hypermarket shelves and storing them.

Statistical analysis

The data obtained in the study were analyzed using the SPSS 15 package software. Number (*N*) and percentage (%) tables were formed for qualitative data. Arithmetic mean ($\bar{x}$), standard deviation (SD) and range values were given as descriptive statistics.

Table 1 Number of brands and products included in the study

Type of food	Number of brand	Number of product
Biscuit	6	58
Wafer	6	39
Cracker	3	16
Cake	5	54
Chocolate	9	57
Bar	4	13
Fruit yogurt	3	18
Pudding	4	9
Breakfast cereal	2	15
Chips	11	54
Ice cream	3	102

Results

Table 2 shows the mean, standard deviation, range values of the energy, and some nutrient contents of the types of biscuits, cakes, crackers, and chips included in the study. Accordingly, chips had the highest energy content by 514.0 ± 27.80 kcal and highest fat content by 27.9 ± 5.23 g. Among the group, the highest saturated fat and carbohydrate contents were found in biscuits (respectively 10.7 ± 3.84 and 67.3 ± 7.03 g). The highest sugar content was in cakes (33.4 ± 6.94 g). Chips (0.6 ± 0.16 g) and crackers (0.9 ± 0.23 g) had the highest sodium content. Although they contained sugar, no information was included on the labels regarding sugar content in 16 biscuit products, 12 cake products, and 2 cracker products (Table 2).

The mean, standard deviation, and range values of the energy and some nutrient contents in types of chocolates, bars, and wafers are given in Table 2. Accordingly, chocolates had the highest values for energy by 546.2 ± 22.39 kcal, for fat by 33.0 ± 4.28 g, and for sugar by 45.6 ± 5.95 g. While the highest values for saturated fat (19.2 ± 3.89 g) and Carbohydrates (58.8 ± 5.40 g) were found in wafers, the highest sodium content was found in bars (0.2 ± 0.09 g). No information was provided about sugar content in 6 chocolate types, 5 bars, and 12 wafer products (Table 2).

The mean, standard deviation, and range values of the energy and some nutrient contents in types of ice cream, fruit yogurt, pudding, and breakfast cereals are given in Table 2. According to this table, breakfast cereals had the highest contents of energy (386.0 ± 14.87 kcal), Carbohydrate (76.2 ± 3.80 g), sugar (23.8 ± 5.46 g), and sodium (0.3 ± 0.23 g). Ice creams had the highest contents of total

Table 2 Mean ($\bar{x}$), standard deviation (SD), and range values for energy and some nutrient contents in types of biscuits, cakes, crackers, chips, chocolates, bars, wafers, ice cream, fruit yogurt, pudding, and breakfast cereals (100 g)

Type of food	Energy and some nutrient contents	Number (n)	$\bar{x} \pm$ SD	Range
Biscuit				
	Energy (kcal)	58	468.3 ± 34.70	379.0–522.0
	Total fat (g)	58	19.7 ± 6.18	7.2–31.7
	Total fat (% energy)	58	37.2 ± 9.76	17.1–55.2
	Saturated fat (g)	50	10.7 ± 3.84	3.7–22.5
	Saturated fat (% energy)	50	20.3 ± 6.32	8.7–41.0
	Carbohydrate (g)	58	67.3 ± 7.03	47.5–81.3
	Carbohydrate (% energy)	58	8.1 ± 9.75	39.6–78.8
	Sugar (g)	42	31.4 ± 8.33	18.5–52.7
	Sugar (% energy)	42	27.6 ± 8.91	16.0–51.9
	Sodium (g)	44	0.2 ± 0.10	0.0–0.4
Cake				
	Energy (kcal)	54	422.8 ± 39.00	322.0–488.0
	Total fat (g)	54	19.9 ± 4.41	9.8–27.4
	Total fat (% energy)	54	42.0 ± 7.04	22.8–55.5
	Saturated fat (g)	48	10.6 ± 2.66	5.2–16.7
	Saturated fat (% energy)	48	22.3 ± 4.34	14.2–34.6
	Carbohydrate (g)	54	56.7 ± 6.55	34.6–68.3
	Carbohydrate (% energy)	54	4.0 ± 7.05	36.4–67.2
	Sugar (g)	42	33.4 ± 6.94	1.0–44.7
	Sugar (% energy)	42	31.3 ± 6.66	1.0–43.0
	Sodium (g)	42	0.3 ± 0.18	0.0–0.7
Cracker				
	Energy (kcal)	16	443.6 ± 36.62	383.0–496.0
	Total fat (g)	16	16.7 ± 5.30	5.6–24.6
	Total fat (% energy)	16	33.4 ± 8.66	13.0–44.6
	Saturated fat (g)	16	8.0 ± 2.58	3.1–11.2
	Saturated fat (% energy)	16	16.0 ± 4.24	7.2–22.0
	Carbohydrate (g)	16	66.6 ± 5.40	57.1–78.5
	Carbohydrate (% energy)	16	60.6 ± 8.74	49.8–81.5
	Sugar (g)	14	8.3 ± 2.32	4.6–12.5
	Sugar (% energy)	14	7.3 ± 1.75	4.7–10.7
	Sodium (g)	14	0.9 ± 0.23	0.4–1.3
Chips				
	Energy (kcal)	54	514.0 ± 27.80	450.0–572.0
	Total fat (g)	54	27.9 ± 5.23	15.7–36.1
	Total fat (% energy)	54	48.6 ± 7.31	31.3–58.8
	Saturated fat (g)	54	8.5 ± 5.34	1.6–16.2
	Saturated fat (% energy)	54	14.7 ± 9.01	2.9–26.3
	Carbohydrate (g)	53	58.0 ± 5.47	51.0–71.4
	Carbohydrate (% energy)	53	45.3 ± 6.00	37.4–61.0
	Sugar (g)	54	3.7 ± 2.98	0.5–13.8
	Sugar (% energy)	54	2.9 ± 2.34	0.6–11.1
	Sodium (g)	54	0.6 ± 0.16	0.2–1.0
Chocolate				
	Energy (kcal)	57	546.2 ± 22.39	487.0–582.0
	Total fat (g)	57	33.0 ± 4.28	22.0–41.3
	Total fat (% energy)	57	54.3 ± 6.43	37.0–65.1
	Saturated fat (g)	51	17.0 ± 6.68	0.0–25.5
	Saturated fat (% energy)	51	28.1 ± 11.08	0.0–41.2
	Carbohydrate (g)	57	51.6 ± 5.72	36.1–67.0

Table 2 (continued)

Type of food	Energy and some nutrient contents	Number (n)	$\bar{x} \pm$ SD	Range
	Carbohydrate (% energy)	57	37.9 ± 5.28	25.0–54.3
	Sugar (g)	51	45.6 ± 5.95	31.1–57.5
	Sugar (% energy)	51	33.4 ± 4.39	23.9–43.0
	Sodium (g)	45	0.1 ± 0.07	0.0–0.3
Bar				
	Energy (kcal)	13	467.8 ± 72.56	318.0–561.0
	Total fat (g)	13	23.9 ± 6.08	16.3–33.5
	Total fat (% energy)	13	45.8 ± 6.66	33.2–56.6
	Saturated fat (g)	10	12.4 ± 3.42	8.8–18.9
	Saturated fat (% energy)	10	24.0 ± 4.90	17.5–34.0
	Carbohydrate (g)	13	55.5 ± 10.47	37.4–70.2
	Carbohydrate (% energy)	13	47.8 ± 7.85	31.6–62.5
	Sugar (g)	8	37.5 ± 5.66	29.2–44.1
	Sugar (% energy)	8	32.9 ± 5.27	24.7–40.8
	Sodium (g)	7	0.2 ± 0.09	0.0–0.3
Wafer				
	Energy (kcal)	39	519.2 ± 26.93	461.0–585.3
	Total fat (g)	39	28.4 ± 4.93	22.0–43.7
	Total fat (% energy)	39	49.0 ± 6.11	40.0–67.2
	Saturated fat (g)	35	19.2 ± 3.89	12.9–28.2
	Saturated fat (% energy)	35	33.4 ± 6.69	22.4–45.2
	Carbohydrate (g)	37	58.8 ± 5.40	46.8–67.1
	Carbohydrate (% energy)	37	45.5 ± 5.94	34.4–54.1
	Sugar (g)	27	36.9 ± 5.43	28.1–49.5
	Sugar (% energy)	27	28.3 ± 4.05	22.7–38.3
	Sodium (g)	24	0.1 ± 0.06	0.0–0.3
Ice cream[a]				
	Energy (kcal)	102	236.7 ± 82.94	70.0–420.0
	Total fat (g)	100	10.8 ± 6.79	0.1–26.0
	Total fat (% energy)	100	37.3 ± 15.16	0.4–62.2
	Saturated fat (g)	85	8.1 ± 4.67	0.1–18.0
	Saturated fat (% energy)	85	27.5 ± 10.85	0.4–51.9
	Carbohydrate (g)	41	29.6 ± 4.26	17.0–37.0
	Carbohydrate (% energy)	41	53.8 ± 16.91	32.9–98.7
	Sugar (g)	87	23.1 ± 3.94	6.0–33.3
	Sugar (% energy)	87	41.4 ± 13.87	22.8–84.7
Fruit yogurt[b]				
	Energy (kcal)	18	93.6 ± 8.22	74.0–99.0
	Total fat (g)	18	2.8 ± 0.53	1.7–3.3
	Total fat (% energy)	18	27.2 ± 3.19	20.6–30.0
	Carbohydrate (g)	18	13.4 ± 0.93	11.6–14.7
	Carbohydrate (% energy)	18	57.6 ± 4.52	50.5–64.2
Pudding[a]				
	Energy (kcal)	9	113.7 ± 15.91	86.3–134.4
	Total fat (g)	9	2.9 ± 0.90	1.5–4.0
	Total fat (% energy)	9	22.7 ± 5.02	14.3–29.0
	Saturated fat (g)	5	2.2 ± 0.43	1.8–2.9
	Saturated fat (% energy)	5	16.8 ± 1.84	14.3–19.4
	Carbohydrate (g)	6	18.8 ± 3.50	14.5–23.5
	Carbohydrate (% energy)	6	65.9 ± 10.04	46.7–74.2
	Sugar (g)	3	15.3 ± 1.58	14.0–17.1

Table 2 (continued)

Type of food	Energy and some nutrient contents	Number (n)	$\bar{x} \pm$ SD	Range
	Sugar (% energy)	3	55.4 ± 4.64	51.3–60.5
Breakfast cereal				
	Energy (kcal)	15	386.0 ± 14.87	365.0–421.0
	Total fat (g)	15	4.3 ± 2.69	0.9–10.0
	Total fat (% energy)	15	9.8 ± 5.83	2.1–21.3
	Saturated fat (g)	15	1.9 ± 1.67	0.2–5.9
	Saturated fat (% energy)	15	4.3 ± 3.62	0.4–12.6
	Carbohydrate (g)	15	76.2 ± 3.80	68.7–83.0
	Carbohydrate (% energy)	15	9.1 ± 5.51	68.1–88.2
	Sugar (g)	15	23.8 ± 5.46	10.0–30.0
	Sugar (% energy)	15	4.6 ± 5.15	10.7–30.2
	Sodium (g)	15	0.3 ± 0.23	0.0–0.7

[a]As the sodium contents in ice creams and puddings were in trace amounts, they were not included in the table

[b]As the saturated fat, sugar, and sodium contents of fruit yogurts were not found in the labels, they were not included in the table

fat (10.8 ± 6.79 g) and saturated fat (8.1 ± 4.67 g). No information was provided about sugar content in 25 ice cream types and 5 pudding products (Table 2).

Table 4 shows the distribution of the foods in the scope of the study according to the health code criteria in the Turkish Food Codex Labeling Directive published by the Ministry of Food, Agriculture and Livestock [14]. Accordingly, unhealthy amounts were found in terms of sugar in 363 (83.4%) products, in terms of fat in in 93.7% of the products, in terms of saturated fat in 92.4% of the products, and in terms of sodium on 70.3% of the products among all 435. According to the results, most products in the shelves are 'unhealthy products' as they do not comply with health code criteria.

Discussion

Excessive weight and obesity have recently become a significant public health issue among children and adolescents in the world. One of the reasons for increased obesity prevalence is the obesogenic environment in industrialized countries that promotes excessive consumption of foods with high energy, sugar, saturated fat, and sodium contents, while inclusion of these products in shops increased and access to these became easier [15].

According to the Turkish Food Codex Labeling Directive, based on 100 g measurements, a food is low-sugar if it contains < 5 g sugar, it is low-fat if it contains < 3 g fat, and it is low-sodium if it contains < 0.12 g sodium. In addition, to consider a food as low-saturated-fat, the energy provided by saturated and trans fatty acids must be lower than 10% of the total energy [14]. The vast majority of the foods included in the study were found to be 'unhealthy' as they did not comply with the health code criteria determined by the Turkish Food Codex Labeling Directive (Table 4). In a study where products targeting children and those targeting adults were compared, the salt, sugar, and fat contents of 147 yogurts, 145 grain bars, and 144 ready meals were compared, and it was found that the sugar, total fat, and saturated fat contents of yogurts and grain bars targeting children were higher than those of the same products targeting adults. It was also found that the sodium contents of ready meals and yogurts were lower [16]. In a study investigating 186 foods produced for babies and children, more than 53% of the products had higher than 20% of their energy supplied by sugar, and more than 12% of these had medium (130–260 mg) or high (> 260 mg) sodium levels [17]. These data show that children are subjected to the effects of the consumer society which lead to obesity. Therefore, it is an important necessity that children are protected from the environmental factors that lead them to obesity.

Especially, the consumption of high-sugar foods, just as in substance addiction, promotes higher consumption of these foods by affecting the reward system of the brain [18]. A study found that it is easier to reduce the amount of fat in biscuits than to reduce the amount of sugar, and it is more difficult for a consumer to notice the difference [19]. In another study with breakfast biscuits, liking of the biscuit with 33% reduced fat increased significantly in 4 weeks, while biscuits with 9% and 16% reduced sugar were liked more than the biscuit with 28% reduced sugar [20]. In a study on puddings, women were given four different puddings containing lower/higher amounts of sugar and fat, and it was observed that the women were able to distinguish low- and high-sugar puddings, while they were not able to

distinguish low- and high-fat puddings clearly. Accordingly, it was concluded that sugar is more effective on the hedonic system [21].

The maximum daily intake of sugar in terms of healthy living principles was determined for the first time in 1989 by WHO as 10% of total energy, and this amount was confirmed by WHO and the Food and Agriculture Organization (FAO) again in 2002 [22]. In this study, it was found that 63.2% of the foods included more than 10% of the total energy in sugar. Sugar consumption amounts of children and adolescents in Turkey were found as 8.98 g in males and 10.42 g in females of age 2–5; 10.59 g in males and 13.21 g in females of 6–8; 11.94 g in males and 12.89 g in females of age 9–11; 16.46 g in males and 13.63 g in females of age 12–14; 19.01 g in males and 14.78 g in females of age 15–18 (Table 3) [23]. In a study with 262 children of age 7–12 that emphasized that sugar consumption had a big contribution on development of obesity recently, a positive relationship was found between BMIs of the children and their sugar consumption [24]. It was reported that sugar consumption in childhood paves the way for cardiovascular diseases by increasing adiposity and dyslipidemia [25].

As a result of the study, it was found that chocolates had the highest total fat (33/100 g) and wafers had the highest saturated fat (19.2/100 g) contents among the others (Table 2). According to the analysis of the foods in the scope of the study based on the health code criteria in the Turkish Food Codex, 408 (93.7%) of the 435 foods exceeded the recommended fat amount, 402 [92.4% exceeded the saturated fat amount (Table 4)]. In scope of healthy living principles, WHO/FAO recommended that the daily energy consumption needs should be met by 25–30% with total fats, and the energy coming from saturated fatty acids should not exceed 10% [26]. This is because high-fat dietary patterns are strongly related to high BMI-Z scores [27]. In another study, 1696 children of 6 to 9 years of age were asked to consume low- and high-fat crackers with low- and high-sugar apple juice, and children's preference of high-fat cracker and high-sugar juice was found to be positively related to their status of weight [28]. It was an interesting finding in this study that chocolates had higher fat contents (33.0 ± 4.28/100 g) than even chips (27.9 ± 5.23/100 g) (Table 2).

It was also found that, by their respective sodium contents of 0.9 and 0.6 g, crackers and chips had the highest amounts of sodium (Table 2). According to the analysis of the foods in the scope of the study based on the health code criteria in the Turkish Food Codex, 306 (70.3%) of the 435 foods exceeded the recommended amount of sodium (Table 4). According to a study conducted with American children and adolescents, sodium consumption was found 3260 g in the age interval of 8–12, and 3486 mg in the age interval of 13–18. It was noteworthy that these numbers were much higher than the recommended amount of 2300 mg [29]. In another study, it was found that 90% of children between the ages of 6 and 18 years consumed much more sodium than they are required to take [30].

In the Turkey Nutrition Guide 2015, it was stated that in Turkey, the 95th percentile of sodium consumption is 4023 mg, and this amount which may be considered maximal corresponds to about 10 g of salt intake with food per day. It was reported that the excessive sodium intake rate tolerable by foods in children and adolescents is 22.2% [31]. In a study, it was found that the sodium in the 24-h urine of overweight and obese individuals is higher, an excessive amount of salt by 1 g/day increased the risk of obesity in children by 28%, and excessive salt consumption is significantly related to high body mass index [32]. In addition to this, excessively consumed sodium harms organs such as the heart, veins, and kidneys, and leads to diseases such as cardiovascular diseases, cancer, and osteoporosis [33].

Table 4 Distribution of the foods in the study based on health code criteria

	Number (*n*)	Percentage (%)
More than 5 g of sugar in 100 g solid food	363	83.4
More than 3 g of fat in 100 g solid food	408	93.7
Energy provided by saturated fatty acids is higher than 10% of the total energy	402	92.4
More than 0.12 g of sodium in 100 g food	306	70.3

Table 3 Sugar intake of males and females in 2–18 years

Age, range (years)	Males				Females			
	$\bar{x}$	SD	Median	n	$\bar{x}$	SD	Median	n
2–5	8.98	14.81	5.00	1113	10.42	15.99	5.00	1015
6–8	10.59	16.68	6.00	311	13.21	17.87	6.00	282
9–11	11.94	18.97	6.00	325	12.89	17.41	6.10	286
12–14	16.46	21.36	10.00	274	13.63	16.31	8.20	265
15–18	19.01	20.75	12.00	318	14.78	17.81	9.00	350

In a recent study conducted in Turkey, the mean consumption rates of fruit yogurts, breakfast cereals, biscuits–crackers, chocolates–wafer, and candies in children younger than 24 months of age were found respectively as 55.8, 7.7, 80.5, 52.6, and 25.2% [23]. Moreover, according to the research report of the Monitoring Growth in School Children in Turkey (TOCBI) Project, 25.4% of the children of age 6–10 years consumed sweets, candy, bars, wafers, or chocolate, and 19% consumed chips and popcorn every day [34]. Considering these results, it may be seen that a large part of the daily required intake of energy, fat, and Carbohydrate is satisfied by these foods with low nutritional value, and the role of excessive and frequent consumption of these foods in childhood obesity becomes clear.

Consequently, the energy, fat, and sugar contents of foods sold in supermarkets and targeted for children were found excessive. Among the 435 packaged foods investigated in the study, the products exceeded the limits designated in the health codes declared by the Turkish Food Codex Labeling Directive in 83.4% of the instances in terms of sugar, 93.7% of the instances in terms of total fat, 92.4% of the instances in terms of saturated fat, and 70.3% of the instances in terms of sodium. In addition, in children's channels, advertisements are frequently broadcast for these foods also known as 'junk food' that have high-energy, sugar, saturated fat, and salt contents, and low nutritional value. As a result of recording the advertisements broadcast on the four most frequently watched channels in Turkey for 4 days including 2 weekdays and 2 weekend days, it was observed that 32.1% of all advertisements were food advertisements, and 81% of these advertisements were those of unhealthy products that contain high amounts of energy, fat, and sugar. The same study found that 30% of the unhealthy product advertisements were targeted for children using audio-visual techniques [35]. Again, offering gifts for consumption of these foods or including cartoon characters that children like on the packages of these products encourages the purchase of goods and, therefore, increases the consumption of these foods. In this context, in terms of prevention and treatment of childhood obesity, it is of great importance that responsible stakeholders such as relevant offices of government, the food industry, and media cooperate.

Compliance with ethical standards

Conflict of interest The authors declare no potential conflicts of interests.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

Informed consent For this type of study formal consent is not required.

References

1. Ares G, Arrua A, Antunez L, Vidal L, Machin L, Martinez J, Curutchet MR, Gimenez A (2016) Influence of label design on children's perception of two snack foods: comparison of rating and choice-based conjoint analysis. Food Qual Prefer 53:1–8. https://doi.org/10.1016/j.foodqual.2016.05.006
2. Avena NM, Gold MS (2011) Food and addiction-sugars, fats and hedonic overeating. Addiction 106:1213–1220. https://doi.org/10.1111/j.1360-0443.2011.03373.x
3. Biguzzi C, Lange C, Schlich P (2015) Effect of sensory exposure on liking for fat-or sugar-reduced biscuits. Appetite 95:317–323. https://doi.org/10.1016/j.appet.2015.07.001
4. Biguzzi C, Schlich P, Lange C (2014) The impact of sugar and fat reduction on perception and liking of biscuits. Food Qual Prefer 35:41–47. https://doi.org/10.1016/j.foodqual.2014.02.001
5. CDC (Centers For Disease Control) (2014) Reducing sodium in children's diets. http://www.cdc.gov/vitalsigns/children-sodium/. Accessed 6 Dec 2016
6. Elliott CD (2010) Sweet and salty: nutritional content and analysis of baby and toddler foods. J Public Health 33:63–70. https://doi.org/10.1093/pubmed/fdq037
7. Garcia-Garcia I, Narberhaus A, Marques-Iturria I, Garolera M, Radoi A, Segura B, Pueyo R, Ariza M, Jurado MA (2013) Neural responses to visual food cues: insights from functional magnetic resonance imaging. Eur Eat Disorders Rev 21:89–98. https://doi.org/10.1002/erv.2216
8. Gearhardt AN, Boswell RG, White MA (2014) The association of "food addiction" with disordered eating and body mass index. Eat Behav 15:427–433. https://doi.org/10.1016/j.eatbeh.2014.05.001
9. Geiselman PJ, Smith CF, Williamson DA, Champagne CM, Bray GA, Ryan DH (1998) Perception of sweetness intensity determines women's hedonic and other perceptual responsiveness to chocolate food. Appetite 31:37–48. https://doi.org/10.1006/appe.1997.0154
10. Guran T, Turan S, Akcay T, Degirmenci F, Avci O, Asan A, Erdil E, Majid A, Bereket A (2010) Content analysis of food advertising in Turkish television. J Paediatr Child Health 46:427–430. https://doi.org/10.1111/j.1440-1754.2010.01753.x
11. HSPH (Harvard T.H. Chan School Of Public Health) (2016) Health risks and disease related to salt and sodium. https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/sodium-health-risks-and-disease/. Accessed 28 Dec 2016
12. Keser A, Yüksel A, Yeşiltepe-Mutlu A, Bayhan A, Özsu E, Hatun Ş (2015) A new insight into food addiction in childhood obesity. Turk J Pediatr 57:51–57
13. Keser A (2016) In the etiology of childhood obesity 'food dependence'. e-SAĞLIK Nutr Diet J 1:32–39
14. Köksal E, Karaçil M (2014) Relationship between sugar consumption and body mass index among school aged children. Firat Med J 19:151–155. https://doi.org/10.3177/jnsv.62.310
15. Lanfer A, Knof K, Barba G, Veidebaum T, Papoutsou S, De Henauw S, Soos T, Moreno L, Ahrens W, Lissner L (2012) Taste preferences in association with dietary habits and weight status in European children: results from the IDEFICS study. Int J Obes 36:27–34. https://doi.org/10.1038/ijo.2011.164
16. Lutter M, Nestler EJ (2009) Homeostatic and hedonic signals interact in the regulation of food intake. J Nutr 139:629–632. https://doi.org/10.3945/jn.108.097618
17. Lythgoe A, Roberts C, Madden AM, Rennie KL (2012) Marketing foods to children: a comparison of nutrient content between children's and non-children's products. Public Health Nutr 16:2221–2230. https://doi.org/10.1017/S1368980013000943

18. Ma Y, He FJ, Macgregor GA (2015) High salt intake independent risk factor for obesity? Hypertension 66:843–849. https://doi.org/10.1161/HYPERTENSIONAHA
19. Marques-Iturria I, Scholtens LH, Garolera M, Pueyo R, Garcia-Garcia I, Gonzalez-Tartiere P, Segura B, Junque C, Sender-Palacios MJ, Vernet-Vernet M et al (2015) Affected connectivity organization of the reward system structure in obesity. Neuroimage 111:100–106. https://doi.org/10.1016/j.neuroimage.2015.02.012
20. Merlo LJ, Klingman C, Malasanos TH, Silverstein JH (2009) Exploration of food addiction in pediatric patients: a preliminary investigation. J Addict Med 3:26–32. https://doi.org/10.1097/ADM.0b013e31819638b0
21. Millar L, Rowland B, Nichols M, Swinburn B, Bennett C, Skouteris H, Allender S (2014) Relationship between raised BMI and sugar sweetened beverage and high fat food consumption among children. Obesity 22:E96-E103. https://doi.org/10.1002/oby.20665
22. Republic of Turkey Ministry of Food (2011) Agriculture and Livestock. Turkish Food Codex Labeling Regulation. Official newspaper. 29/12/2011, Number: 28157. http://www.resmigazete.gov.tr/eskiler/2011/12/20111229M3-7.htm. Accessed 7 Dec 2016
23. Republic of Turkey Ministry of Health, Hacettepe University Faculty of Health Sciences Department of Nutrition and Dietetics (2014) Turkey nutrition and health survey 2010. http://www.sagem.gov.tr/TBSA_Beslenme_Yayini.pdf. Accessed 2 Jan 2017
24. Republic of Turkey Ministry of Health, Hacettepe University Faculty of Health Sciences Department of Nutrition and Dietetics, Turkey Republic Ministry of Education. Monitoring Growth in School Children in Turkey (TOCBI) Project Research Report. http://beslenme.gov.tr/content/files/yayinlar/kitaplar/diger_kitaplar/tocbi_kitap.pdf. Accessed 12 May 2017
25. Republic of Turkey Ministry of Health (2016) Turkey dietary guide TUBER 2015. https://dosyasb.saglik.gov.tr/Eklenti/10915,tuber-turkiye-beslenme-rehberipdf.pdf. Accessed 5 Mar 2018
26. Richard JM, Castro DC, Difeliceantonio AG, Robinson MJF, Berridge KC (2013) Mapping brain circuits of reward and motivation: In the footsteps of Ann Kelley. Neurosci Biobehav Rev 37:1–26. https://doi.org/10.1016/j.neubiorev.2012.12.008
27. Robertson W, Murphy M, Johnson R (2016) Evidence base for the prevention and management of child obesity. Paediatr Child Health 26:212–218. https://doi.org/10.1016/j.paed.2015.12.009
28. Stewart L (2015) Childhood obesity. Medicine 43:108–111. https://doi.org/10.1016/j.mpmed.2014.11.014
29. Volkow ND, Wang GJ, Fowler JS, Telang F (2008) Overlapping neuronal circuits in addiction and obesity: evidence of systems pathology. Phil Trans R Soc B 363:3191–3200. https://doi.org/10.1098/rstb.2008.0107
30. Volkow ND, Wang GJ, Tomasi D, Baler RD (2013) The addictive dimensionality of obesity. Biol Psychiatry 73:811–818. https://doi.org/10.1016/j.biopsych.2012.12.020
31. Vos MB, Kaar JL, Welsh JA, Van Horn LV, Feig DI, Anderson CAM, Patel MJ, Munos JC, Krebs NF, Xanthakos SA et al (2016) Added sugars and cardiovascular disease risk in children. Circulation 134:1–18. https://doi.org/10.1161/CIR.0000000000000439
32. WHO (World Health Organization) (2003) Diet, nutrition and the prevention of chronic diseases. http://www.who.int/dietphysicalactivity/publications/trs916/en/. Accessed 25 Sep 2016
33. WHO (World Health Organization) (2015) Sugars intake for adults and children. http://www.who.int/nutrition/publications/guidelines/sugars_intake/en/. Accessed 25 Sep 2016
34. WHO (World Health Organization) (2016) Report of the comission on ending childhood obesity. http://apps.who.int/iris/bitstream/10665/204176/1/9789241510066_eng.pdf. Accessed 25 Sep 2016
35. Yang Q, Zhang Z, Kuklina EV, Fang J, Ayala C, Hong Y, Loustalot F, Dai S, Gunn JP, Tian N et al (2012) Sodium intake and blood pressure among US children and adolescents. Pediatrics 130:611–619. https://doi.org/10.1542/peds.2011-3870