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EATING HABITS OF CHILDREN AND ADOLESCENTS WITH EPILEPSY IN LATVIA

Zane Vīksna* and Renāte Ligere**

* Faculty of Medicine, University of Latvia, Šarlotes iela 1a, Rīga, LV-1001, LATVIA;
z.viksna@inbox.lv

** Pauls Stradiņš Clinical University Hospital, Pilsoņu iela 13, Rīga, LV-1002, LATVIA;
renlig@latnet.lv

Contributed by Renāte Ligere

The aim of the study was to evaluate the eating habits of epileptic children and adolescents. Forty one patients (12 girls and 14 boys aged 0–10 years, and 10 girls and 5 boys aged 11–18 years) were enrolled in the study. A survey on consumption rate of different dietary products was conducted. The diet groups considered were carbohydrates, fat, protein, fibre and liquid. We found that 35–58% of patients aged 0–10 years used soda drinks, juices and popcorn regularly. The proportion was more than two times in adolescents. Consumption of sweets in both age groups was 83–100%. Half of children aged 0–10 years said that they ate chips and fried potatoes regularly and 80–100% of adolescents consumed these products at least once a week. Half of the boys and almost all younger girls consumed various milk products daily; adolescent epileptic boys consumed milk products two times more than girls. Among older girls, 40% did not drink milk. The youngest girls consumed meat and fish 1.5 to 3.5 times more than boys, while the number of boys consuming these products increased with age. It was estimated that 75–100% of patients ate fruits and vegetables daily. Only two children and two adolescents were found to drink lots of water. In conclusion, children and adolescents with epilepsy preferred meals rich in carbohydrates and fat, rather than protein; a high number of the evaluated patients drank soda drinks and juices several times a week; only a few had intake of water daily; and all patients ate fruits and vegetables daily, thus compensating unhealthy eating habits.

Key words: *children and adolescents, epilepsy, growth and maturation, hormonal changes, antiepileptic drugs, bone metabolism.*

INTRODUCTION

Epilepsy is a fairly prevalent neurological disorder in children and adolescents and is defined as a proneness to recurrent epileptic seizures. An epileptic seizure arises as a result of changed electrical activity in the brain, and is manifested as alterations in sensation (vision, hearing, touch, smell, taste), behaviour or consciousness (Neal and Cross, 2010). The incidence of epilepsy is 5–7 children in 100 000 (about 3–4%) aged 0–15 years (Nettekoven *et al*., 2008). There are still no available precise data regarding the frequency of epilepsy among children and adolescents in Latvia.

Although epilepsy is defined as a condition of recurrent spontaneous seizures not directly related to a specific event, many patients also report that seizures are occasionally provoked by external or internal stimuli (Asadi-Pooya and Sperling, 2007). The most common precipitating factors in adults and children and adolescents include sleep deprivation, consumption of alcohol among adolescents, premature awakening, menstruation, psychological stress, and visual stimulation. Other factors such as reading, thinking, writing, calculating, and playing musical instruments have been reported as well (Frucht *et al*., 2000; Spector *et al*., 2000; Sousa *et al*., 2005). Knowledge of factors promoting seizure precipitants is helpful, as it can modify patient's behaviour and, perhaps, lead to a reduction in seizure frequency.

Nutrition is fundamental in regulating the activity of electrical discharge in the brain. Unfortunately, there has been quite little research regarding nutrition and related eating habits in children and adolescents with epilepsy.

Already 1000 years ago, the great Iranian scientist Avicenna recommended that patients with epilepsy should avoid excessive eating and some foods such as cow and sheep meat, fish, onion, garlic, celery, cauliflower, and carrot (Avicenna, 1991). The ketogenic diet, which is compatible with avoiding excessive eating, is a high-fat, low-carbohydrate and low-protein regimen that has been used successfully for more than 70 years in thousands of patients (Asadi-Pooya *et al*., 2004). It has been calculated that this diet provides 75–100 kcal/kg body weight and 1–2 g of dietary protein/kg body weight per day. Such strict caloric re-

quirements can be adjusted to minimise weight gain and to maximise ketonemia (excessive amount of keton bodies in the blood) (Nordli and De Vivo, 2001). A recent study suggested that caloric restriction reduces neuronal excitability in rats and that it has anticonvulsant effect, perhaps by an increase of fast inhibition (Bough *et al*., 2003).

There are several possible reasons why specific foods may lead to seizures. Firstly, some foods may lower the seizure threshold (food-disease interaction) (Gallagher *et al*., 1968; Bhagavan *et al*., 1971; Miwa *et al*., 2001). Such a food-disease interaction has been observed in adult patients with migraine headache, in some of whom certain foods induced attacks, such as chocolate, hot dogs, smoked meats, aged cheese, orange, and monosodium glutamate (MSG). Some theories suggest that migraine may be triggered via an allergic or chemical reaction that affects the vascular system (Burns and Carr-Davis, 1996; Victor and Ropper, 2001).

Secondly, a food-drug interaction has been observed with carbamazepine: the bioavailability and plasma concentration of carbamazepine was increased in patients who consumed grapefruit juice and dairy products (Garg *et al*., 1998). Moreover, among patients who used carbamazepine, the belief and experience with a food-seizure relationship were reported more often than using phenobarbital or valproic acid.

There are several reports suggesting hazardous effect of certain foods on the brain by triggering seizures, including the occurrence of generalised convulsions after consumption of large amounts of Ginko nuts (Miwa *et al*., 2001). There are also reports about decrease of the seizure threshold in rats by intake of excessive amino acids (Gallagher *et al*., 1968), induction of convulsions by MSG in rats (Bhagavan *et al*., 1971), and the induction of *status epilepticus* by star fruit intoxication in patients with chronic renal disease (Tsai *et al*., 2005).

Noteworthy research regarding the preferences for food items in epileptic children and adolescents, compatible and incompatible with the ketogenic diet, has been conducted in the USA (Amari *et al*., 2007). Enrolled patients was asked to choose a food item from a list of high-fat and high-carbohydrate food items. The researchers observed that the most popular item among children with seizures was bacon, and among the control group, noodles. The obtained data supported the prediction that children with seizures would exhibit higher preferences for high-fat than high-carbohydrate foods, compared with controls. This was a novel finding, without precedent in the literature.

It has been hypothesised that humans and animals may prefer to choose certain items to compensate for physiological and metabolic imbalances (Weingarten and Elston, 1990). For instance, significantly increased sodium-seeking behaviour and hedonic preference for salty foods were observed among adolescents with congenital adrenal hyperplasia (Cohli *et al*., 2005). Another study demonstrated that carbohydrates are selectively craved by people who experience a depressed mood (Wurtman and Wurtman, 1986; 1988; Christensen and Pettijohn, 2001).

It has been proved that consumption of fat versus carbohydrates as the primary source of energy is highly effective in controlling seizures in individuals, as well as improving behaviour, alertness, and mood. Compared to carbohydrates, consumption of fat in epileptic patients has positive consequences — reduced abnormal electrical discharge activity in the brain, increased alertness, and improved mood (Amari *et al*., 2007).

Norwegian researchers evaluated nutritional habits in 12–19-year-old youth with epilepsy who consumed unhealthy food (candy, coffee/tea, potato chips, French fries or soda pop) at least once a day. They found that being male and never eating breakfast were the strongest predictors for eating „unhealthy food". The authors also found that the significant increase among youth with epilepsy was associated with greater psychosocial problems within the adolescents (Clench Aas *et al*., 2006).

In other work, Iranian scientists questioned 125 families with children who had epilepsy (the mean age 8.4 ± 4.3 years) in order to identify the beliefs and experiences associated with specific dietary restrictions (Asadi Pooya and Ghafari, 2004). It was observed that most of the families believed in such relationship — one-third had personal experience with seizure occurrence after consumption of specific foods. Dairy products, sour foods (like vinegar and lemon juice), fruits and vegetables, and fish and meat were the most common foods reported as the responsible ones (Asadi-Pooya and Hossein-Zade, 2005).

Conversely, research on adult patients in the USA (n = 193; mean age 40.3 ± 16 years), identified that only 11 patients (5.7%) reported foods as precipitating factors for seizures (Asadi-Pooya and Sperling, 2007). Moreover, there was no relationship between gender, education, seizure control, and certain food items. Thereby, authors suggested that reports of seizure precipitants were subjective impressions, which could easily be influenced by cultural beliefs or patterns of thought or superstitions. However, careful scientific studies are needed to establish the true incidence of food-induced seizures. It is also the responsibility of physicians and health care workers to provide patients and their families with appropriate and correct information regarding future changes in their lifestyle.

PATIENTS AND METHODS

In total, 41 epileptic patients (26 children and 15 adolescnts) were included in the study, conducted at the Children's Clinical University Hospital in Rīga. Patient groups were made according to gender and age of overall physical maturation: (1) 12 girls and 14 boys aged 0–10 years; and (2) 10 girls and 5 boys aged 11–18 years. The survey consisting of detailed questions about the consumption rate of different dietary products (milk, kefir, yoghurt,

sour cream, curd; pork, beef, poultry, fish; vegetables and fruits; sweets, soda drinks, water, coffee, tea; popcorn, potato chips, fried potatoes/French fries, and cereal products). Five dietary groups were made according to above mentioned dietary products: carbohydrates, fat, protein, fibre and liquid. All of the enrolled children had a written agreement from their parents or responsible persons, and the study was approved by the Ethical Commission.

RESULTS

Of the enrolled children, three girls (25%) aged 0–10 years were on ketogenic diet for more than three months. Of these girls, one was fed via nasogastric tube and one girl could not eat herself. Three boys aged 0–10 years (21.4%) had difficulties in consuming food: one boy (7.1%) had hypersensitivity (urticaria) from consuming potatoes, carrots, and apples, 1 boy (7.1%) had difficulty in chewing meat and complained of nausea after he had eaten an egg, 1 boy (7.1%) could not put a spoon in his mouth, and had difficulties in chewing and swallowing solid food items. One 11-year-old girl 1 (10%) consumed food in small portions, because she was constantly having nausea.

On average, 3–4 meals per day were consumed by 71.4% boys and 83.3% girls in the youngest age group, and 100% boys and 60% girls in the oldest age group. 40% of girls aged 11–18 years had three and more snacks in between meals, which was twice higher than in boys (20%). However, more young boys (28.6%) had four or more snacks than girls (8.3%), a 3.4 times difference. Parents of boys from the youngest patient group mentioned increased appetite 2.6 times more often than the parents of girls (21.4% and 8.3%, respectively); one 14-year-old boy complained of increased appetite (20%), whereas 4 boys (28.6%) and two girls (16.6%) aged 0–10 years, as well as two girls (20%) aged 11–18 years complained of reduced appetite. One 15-year-old and one 11-year-old girl (20%) did not eat breakfast.

Carbohydrates. Of patients aged 0–10 years, 35–58% used soda drinks and juices regularly. With increase of age, the proportion rose more than two times (70–100%). Similar proportions by gender of children in the youngest age group consumed sweets (chocolate cheese, chocolate, candies, cookies, cakes) regularly and ten girls (83.3%) and ten boys (81.7%), and nine (90%) adolescent girls and five (100%) boys consumed sweets every day. Two times more younger girls than boys consumed soda pop 1–3 times per month (58.3% versus 21.4%), and in adolescents with epilepsy — three boys (60%) and seven girls (70%). Every second boy (57.1%) aged 0–10 years did not eat popcorn, and in adolescent patient group 40% of boys and 30% of girls did not eat popcorn. Consumption of high-carbohydrate food items is shown in Figures 1 and 2.

Fat. Up to 66.6% girls and 50% boys aged 0–10 years and more adolescent girls (80%) and 100% boys consumed potato chips at least once a week. 357% boys and 83% girls in the youngest patient group, and 10% girls aged 11–18 girls did not eat potato chips. 66.6% girls and 64.3% boys with epilepsy aged 0–10 years consumed fried potatoes at least once per week, and adolescents with epilepsy — considerably more often (100% girls and 80% boys, respectively). One (10%) girl in the oldest patient group drinks cocoa every day, but in the youngest age group — three epileptic girls (25%) drinks cocoa 1–3 times per week. Consumption of high-fat food items is shown in Figures 1 and 2.

Protein. Every second boy and almost all younger girls (90%) consumed different dairy products (milk, kefir, yoghurt, curd, sour cream) daily, and almost two times more adolescent epileptic boys than girls (60% girls and 100% boys). 40% older girls did not drink milk. 75% girls and 50% boys aged 0–10 years consumed meat 2–4 times per week; these proportions were 70% in adolescent girls and 1.6 times more (80%) in boys. Girls aged 0–10 years consumed fish 3.5 times more than boys (50% versus 14.3%, respectively), and in adolescents with epilepsy: 20% girls versus 40% boys. Consumption of high-protein food items is shown in Figures 3 and 4.

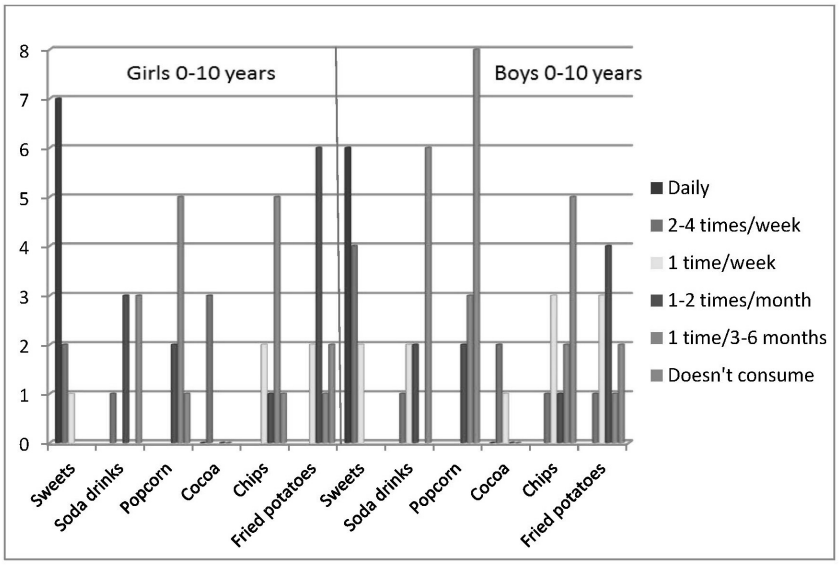

Fig. 1. Mean values of carbohydrate- and fat-rich dietary product consumption in 0–10-year-old patients with epilepsy.

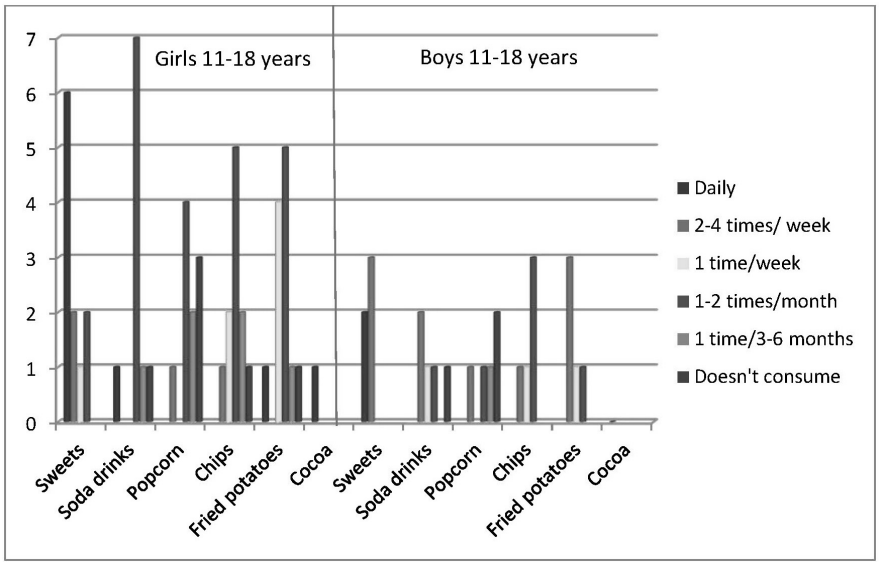

Fig. 2. Mean values of carbohydrate- and fat-rich dietary product consumption in 11–18-year-old patients with epilepsy.

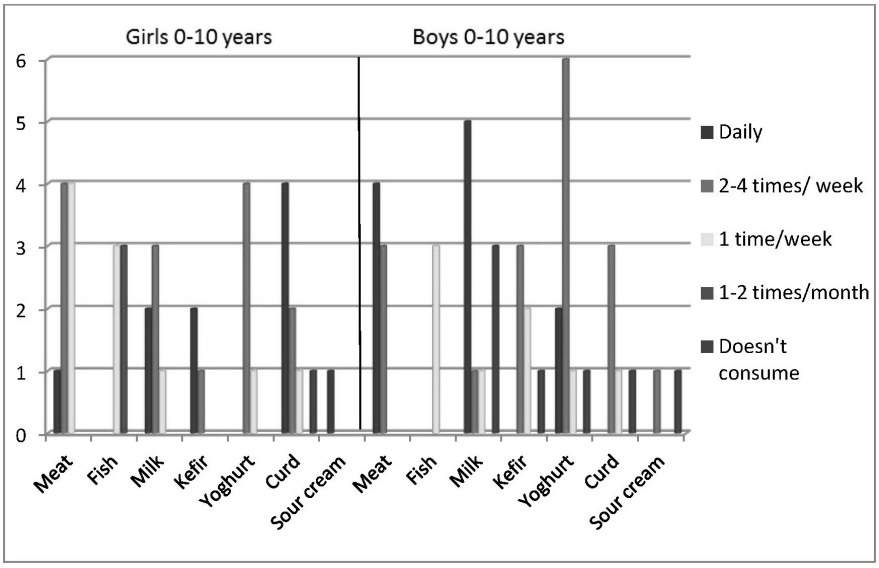

Fig. 3. Mean values of protein-rich dietary product consumption in 0–10-year-old patients with epilepsy.

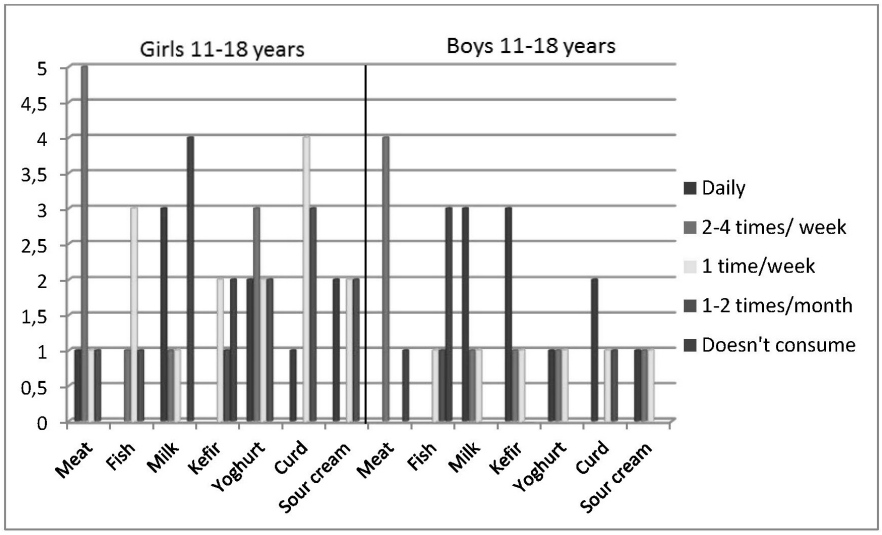

Fig. 4. Mean values of protein-rich dietary product consumption in 11–18-year-old patients with epilepsy.

Fibre. Fruits were used daily among girls in both age groups, whereas boys — slightly less at the age of 0–10 years (85.7%) and all of boys aged 11–18 years. Younger boys with epilepsy more often than girls consumed both fresh and heat-treated vegetables (100% boys and 75% girls, respectively), and up to 100% patients of both genders aged 11–18 years consumed vegetables (fresh and heat-treated) equally. Only one 5-year-old boy (7.1%) consumed

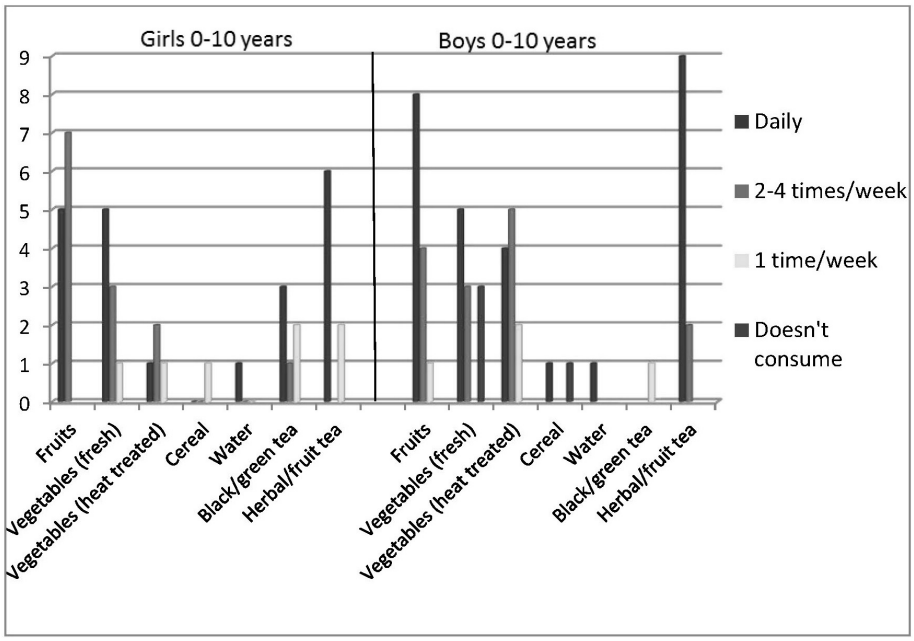

Fig. 5. Mean values of liquid and fiber-rich dietary product consumption in 0–10-year-old patients with epilepsy.

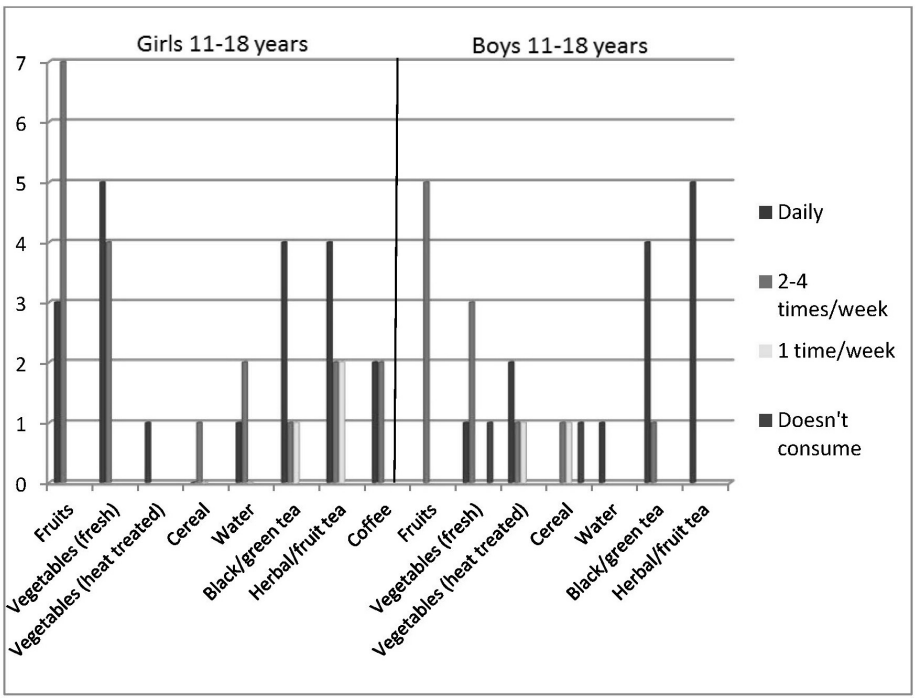

Fig. 6. Mean values of liquid and fiber-rich dietary product consumption in 11–18-year-old patients with epilepsy.

porridge every day, and one 15-year-old girl (10%) and one 13-year-old boy (20%) consumed wholemeal flakes or porridge every other day. Consumption of fibre-rich food items is shown in Figures 5 and 6.

Liquid. On average, every second child with epilepsy (50% girls and 64.3% boys), and 75% girls and 100% boys in the older age group drank herbal (peppermint, camomile, sweet-briar, caraway etc.) and fruit tea daily. 25% of 0–10 year old girls drank green or black tea daily, and adolescents consume this product 2–4 times more (50% girls and 80% boys, respectively). Adolescent boys two times more than girls drank coffee. Only two children aged 0–10 years and two adolescents with epilepsy aged 11–18 years drank lots of water daily. Consumption of liquid is shown in Figures 5 and 6.

DISCUSSION

In the study we observed that in general children with epilepsy consumed healthier food than adolescents with epilepsy. Most often, the choice of food was determined by family nutritional habits, food items that are included in the kindergarten and school menu, as well as the commercials in the mass media whose basic target audience often is children and adolescents. Interestingly, when questioning parents of the enrolled children about their eating habits, it was reported that only a small number of parents drink water, herbal or fruit tea, make fresh salad, buy different fruits and vegetables, dairy products, and cook fish foods regularly themselves. On average, every second child admitted that he or she would consume the above mentioned food item if their parents and other relatives were doing the same.

Studies have shown that eating habits of adolescents are greatly influenced by their peers (Bisset *et al*., 2007), food eaten outside the house, and concepts of the youth themselves about their body, weight and beauty standards in the world of today (Cusatis and Shannon, 1996).

We observed that children and adolescents with epilepsy preferred to have high-carbohydrate and high-fat product items. In contrast to what might be expected, that older boys (11–18 years) would consume a rather small amount of dairy products, the results showed that adolescent girls with epilepsy are the ones who choose not to drink milk and kefir in lesser amounts because of personal prejudice.

The research also demonstrated that younger patients eat meat and fish more often than adolescents. Also, older girls generally ate meat and fish less times per week than boys because of different considerations (for example, fear of gaining weight).

Noteworthily, some adolescent girls with epilepsy did not eat breakfast. In most cases, this is associated with concerns of gaining weight. A quite recent study in a number of European countries indicated that skipping breakfast is one of preconditions of obesity (Szajewska and Ruszczynski, 2010).

It has been shown that children and adolescents who eat breakfast have a reduced risk of obesity and reduced body mass index (BMI), compared to those who skip breakfast (Szajewska and Ruszczynski, 2010). In this study, we did not analyze in detail how often children and adolescents skip breakfast, what they consume at all, and why they make such choices. This article only summarizes general hallmarks of eating habits. We have not evaluated changes in individual BMI according to each patient's eating habits.

It is possible that epileptic children and adolescents in Latvia, as has been shown in the USA, prefer high-fat to high-carbohydrate food items (Amari *et al*., 2007). Therefore, future studies are required in this field. Epileptologists and child neurologists should also educate relatives of patients about features of epilepsy and encourage them to make changes in their eating habits.

In summary, the observed 41 children and adolescents with diagnosed epilepsy: 1) chose to have meals rich of carbohydrates and fat, rather than protein; 2) a large number of the evaluated patients drank soda drinks and juices daily; 3) only several of the evaluated patients drank water daily; 4) all patients ate fruits and vegetables daily, thus compensating unhealthy eating habits.

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ĒŠANAS IERADUMI BĒRNIEM UN PUSAUDŽIEM AR EPILEPSIJU

Pētījumā tika iekļauts 41 pacients: 12 meitenes un 14 zēni vecumā no 0 līdz 10 gadiem, 10 meitenes un 5 zēni vecumā no 11 līdz 18 gadiem. Tika veikta anketēšana par dažādu pārtikas produktu lietošanas biežumu uztura grupās: ogļhidrāti, tauki, olbaltumvielas, šķiedrvielas, šķidrums. Darba mērķis bija ēšanas paradumu izvērtēšana un noteikšana bērniem un pusaudžiem ar epilepsiju. No novērotajiem bērniem 33–58% vecumā no 0 līdz 10 gadiem ikdienā dzer gāzētos dzērienus, ēd popkornu, savukārt pusaudžiem šī proporcija palielinās 1,2–2,4 reizes. Saldumus regulāri ēd 83%–100% bērni un pusaudži. Vidēji katrs otrais bērns (0–10 gadi) vismaz vienu reizi nedēļā ēd kartupeļu čipsus, bet pusaudži ar epilepsiju — no 80% līdz 100%. Katrs trešais bērns vecumā no 0 līdz 10 gadiem un 80–100% pusaudžu regulāri ēd ceptus kartupeļus. Katrs otrais zēns un gandrīz visas meitenes no 0 līdz 10 gadiem regulāri ēd dažādus piena produktus, savukārt vecākajā pacientu grupā zēni piena produktus lieto divas reizes biežāk nekā meitenes, 40% meiteņu nedzer pienu. Jaunākās meitenes gaļu un zivis ēd 1,5–3,5 reizes biežāk nekā zēni. Augļus un dārzeņus ikdienā ēd 75–100% bērni un pusaudži ar epilepsiju. Tikai divi bērni un divi pusaudži ikdienā dzer daudz ūdens. Kopumā bērni un pusaudži ar epilepsiju: 1) labprātāk izvēlas ēst ar ogļhidrātiem un taukvielām bagātus pārtikas produktus, nevis olbaltumvielas saturošus; 2) ievērojams skaits epilepsijas slimnieku ikdienā dzer gāzētus dzērienus vai saldinātas sulas; 3) ūdeni dzer tikai daži; 4) visi ēd šķiedrvielām bagātus augļus un dārzeņus, tādējādi kompensējot neveselīgos ēšanas paradumus.