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NUTRITION AND EXERCISE IN THE LIFESTYLE OF LONG-TERM SURVIVORS OF CHILDHOOD CANCER

HRSTKOVÁ H.[1], BRÁZDOVÁ Z.[2], NOVOTNÝ J.[3], BAJER M.[1]

[1] First Department of Paediatrics, Paediatric Teaching Hospital and [2]Department of Preventive Medicine, Faculty of Medicine, Masaryk University, Brno
[3] Department of Physical Education, Pedagogical Faculty, Masaryk University, Brno

A b s t r a c t

At present the prognosis for children with malignant diseases is generally good. Although their survival time has increased considerably, they remain a group at risk because of the possibility of developing cardiovascular disease later in life. This risk can be reduced by healthy lifestyle in which diet and exercise play important roles. We investigated eating habits and engagement in sports and games in a group of 100 survivors of childhood cancer, in the age range of 5 to 23 years, who had been treated at our department. Our results showed that a great part of their energy intake did not come from the food recommended to meet healthy nutrition criteria and the daily composition of food consumed did not fulfil the requirements of a healthy diet. Free time sport and game activities varied according to sex but the group as a whole had energy expenditure lower by half when compared with the healthy children. It is concluded that great emphasis should be placed on the healthy lifestyle of childhood cancer survivors in order to reduce the risk of cardiovascular disease in their adulthood.

K e y w o r d s

Children, Cancer, Diet, Exercise

INTRODUCTION

At present, the prognosis of malignant diseases in childhood is generally good. Children treated for cancer survive up to adolescence or adulthood. However, they constitute a specific group of the population subject to an increased number of hazards, including the risk of cardiovascular disease in adulthood (*1*). There is ample evidence to suggest that this risk can be reduced by healthy lifestyle. The role of eating habits and exercise, as factors lowering the risk of adult cardiovascular disease (*2*), was investigated in children who had been treated for malignant disease.

MATERIALS AND METHODS

We studied a group of 100 children and adolescents with a mean age of 13.9 ± 5.2 years (range, 5.0–22.9 years). The group included 44 girls (average age, 13.7 ± 5.7 years; range, 4.5–22.6 years)

and 56 boys (average age, 14.0 ± 4.8 years; range, 5.0 to 22.9 years). Most of the patients were treated for acute lymphoblastic leukaemia, a minority for malignant lymphoma. All children were free from any anti-cancer treatment for a minimum of 4 years.

We used the 24-hour recall method to assess eating habits. The consumption of foods from the five food groups was estimated by means of unit portions, and the daily intake of energy and nutrients was calculated for each of three age categories (5 to 11, 11 to 15 and 16 to 23 years). Dietary assessments were separate for working and weekend days.

The unit portions were defined for each of the five groups of the food pyramid. In the starch/bread group, which includes bread, cereals, rice and pasta, a unit portion was equivalent to a slice of bread (60 g), a roll or a scoop of cooked rice or pasta (125 g) or a small bowl of müsli. In the vegetable group, it was a large green pepper or carrot or two tomatoes (about 100 g), a small bowl of Chinese cabbage or lettuce, half a plate of potatoes or a glass of undiluted vegetable juice. In the fruit group, one unit portion was equvalent to an apple, orange or banana (about 100 g), a small bowl of strawberries, currant or blueberries or a glass of undiluted juice. In the milk group, which also includes dairy products, it was the amount of food or drink that provides about 300 mg of calcium, i.e., a glass of low fat milk, a yoghurt or about 55 g of cheese. In the meat group, which also covers meat alternatives, a unit portion was equivalent to 100g of fish, chicken, beef or pork meat, or legumes or eggs. In the last category, which is not a food group in terms of the food pyramid, a unit portion was equivalent to 10 g of fat or saccharose.

The assessment of exercise was based on the KIDH Seven-Day Physical Activity Recall (American College of Sports Medicine; *3*). Completed questionnaires provided information on physical activity during leisure time in a typical week. The number of children who participated in sports and games was obtained and the basic statistical characteristics for the time the children spent by exercise were calculated. Energy expenditure was calculated for each child on the basis of the duration and intensity of physical activity. The average values were compared with those found in healthy school children aged 12 years (33 girls and 31 boys from the sixth form).

RESULTS

Energy intake assessment

Our results show that the children had insufficient energy intake from the recommended food sources and that part of their energy intake came from food which had no nutrition value (*Tables 1,2,3,4*). The insufficient intake of unit portions was found in the vegetable group in all age categories and on all days (working and weekend days); in the fruit category, it was found in children older than 11 years and in adolescents on all days and, in the milk group, it was recorded in all age categories on all days. The results are presented in *Figs. 1 to 6.*

The assessment of nutrient intake revealed that the food items consumed by the children in our study were not in agreement with the principles of healthy diet

Physical activity assessment

Of the 44 girls, 21 (48%) preferred general outdoor activities, 16 (36%) rode bycicles, five (11%) went swimming, five (11%) attended aerobic classes and four (9%) played volleyball. None of them pursued typical male activities such as football, body building, etc.

Of the 56 boys, 30 (54%) rode bicycles, 21 (41%) played ball games such as football, basketball and volleyball, 17 (30%) were interested in other outdoor

Table 1.

Assesment of daily energy and nutrition intake in three age categories

Nutrients	Age (years) 5-10	11-15	16-23
Energy [kJ]	6844.09	7815.16	6451.84
Energy [kcal]	1641.68	1874.50	1547.59
Proteins [g]	59.99	69.67	54.48
Fat [g]	47.80	54.83	53.90
Carbohydrates [g]	235.49	263.53	196.47
Calcium [mg]	702.51	803.54	585.43
Iron [mg]	16.19	17.85	16.79
Potassium [mg]	2243.52	2355.57	2189.62
Fiber [g]	19.96	20.70	17.48
Vitamin A [ug]	616.31	579.33	542.31
Vitamin B_1 [mg]	1.31	1.51	1.36
Vitamin B_2 [mg]	1.03	1.18	0.91
Vitamin B_6 [mg]	1.40	1.53	1.34
Vitamin B_{12} [ug]	2.65	3.24	3.94
Vitamin C [mg]	51.79	40.24	45.45
Vitamin E [mg]	6.81	7.76	6.39

games, 17 (30%) went swimming and 7 (13%) pursued in-line skating. They were not interested in aerobics, dancing or horse riding.

Some of the children, both girls and boys, were engaged in more than one sport or game. The kind of exercise was different according to age; in the 5- to 10-year group, the children usually played outdoors and showed spontaneous physical activities.

In the boys and girls studied, the values (450 $kj.kg^{-1}$and 310 $kj.kg^{-1}$) for energy expenditure in sports and free-time activities was much lower, by about half, than the values (875 $kj.kg^{-1}$ and 526 $kj.kg^{-1}$) found in healthy boys (n=31) and girls (n=33). This difference was statistically significant ($P<0.05$).

Table 2
Assessment of daily energy and nutrient intake in children aged 5 to 10 years

Nutrients	Starch/ bread group	Vegetable group	Fruit group	Milk group	Meat group	Fat & saccharose	Total daily intake
Energy [kJ]	3297.56	480.35	476.24	876.22	1163.50	550.12	6844.08
Energy [kcal]	790.70	115.21	114.17	210.10	279.04	132.44	1641.67
Proteins [g]	23.25	7.80	1.67	18.02	9.24		59.99
Fat [g]	8.55	1.21	0.55	8.66	18.61	10.19	47.79
Carbohydrates [g]	155.95	20.15	29.98	12.09	7.12	10.19	235.49
Calcium [mg]	89.60	75.72	40.60	432.29	64.28		702.51
Iron [mg]	6.49	3.4125	1.49	0.43	4.35		16.18
Potassium [mg]	561.90	592.80	325.75	324.16	438.90		2243.52
Fiber [g]	10.26	4.225	4.285	0.00	1.18		19.95
Vitamin A [ug]	2.05	227.9875	163.90	179.07	43.29		616.31
Vitamin B_1 [mg]	0.61	0.1625	0.0745	0.09	0.36		1.31
Vitamin B_2 [mg]	0.27	0.0975	0.0745	0.45	0.13		1.03
Vitamin B_6 [mg]	0.68	0.325	0.13	0.022	0.23		1.39
Vitamin B_{12} [ug]	0.00	0.00	0.00	0.41	2.24		2.65
Vitamin C [mg]	0.00	20.15	29.05	2.05	0.52		51.78
Vitamin E [mg]	4.10	1.4625	0.18	0.00	1.05		6.80

DISCUSSION

Chemotherapy and radiotherapy administered in childhood may have negative impacts on growth (*1*). Local irradiation can cause growth retardation in the areas treated (*4*). Children who have undergone radiotherapy may later have problems with choosing appropriate physical exercise. Therefore, children treated by irradiation of the abdomen, spine or limbs were not included in the study. Patients treated for cancer in childhood may develop late sequelae of this treatment and particularly those treated at a very young age can be severely affected (*5*). The childhood cancer survivors are considered to be a high-risk group that may suffer from cardiovascular diseases, obesity, hypertension or hyperlipidaemia in adulthood (*1*).

It has been reported that diet in these cancer survivors is imbalanced; it often lacks several of the basic nutrients, as defined by the food pyramid, but provides

Table 3
Assessment of daily energy and nutrient intake in children aged 11 to 15 years

Nutrients	Starch/ bread group	Vegetable group	Fruit group	Milk group	Meat group	Fat & saccharose	Total daily intake
Energy [kJ]	4078.57	413.84	323.89	1056.28	1425.09	517.50	7815.16
Energy [kcal]	977.98	99.26	77.65	253.28	341.76	124.58	1874.50
Proteins [g]	28.76	6.72	1.14	21.73	11.32		69.67
Fat [g]	10.58	1.05	0.38	10.45	22.80	9.58	54.83
Carbohydrates [g]	192.89	17.36	20.39	14.58	8.73	9.58	263.53
Calcium [mg]	110.83	65.24	27.61	521.13	78.73		803.54
Iron [mg]	8.04	2.94	1.01	0.52	5.34		17.85
Potassium [mg]	694.99	510.72	221.54	390.78	537.54		2355.57
Fiber [g]	12.69	3.64	2.91	0.00	1.46		20.70
Vitamin A [ug]	2.54	196.42	111.47	215.88	53.03		579.33
Vitamin B_1 [mg]	0.76	0.14	0.05	0.11	0.45		1.51
Vitamin B_2 [mg]	0.34	0.084	0.05	0.55	0.16		1.18
Vitamin B_6 [mg]	0.85	0.28	0.09	0.03	0.29		1.53
Vitamin B_{12} [ug]	0.00	0.00	0.00	0.50	2.75		3.24
Vitamin C [mg]	0.00	17.36	19.76	2.48	0.65		40.24
Vitamin E [mg]	5.08	1.26	0.13	0.00	1.29		7.76

high-energy intake, which is a frequent finding in children in general (*6,7*). Obesity in children is considered to be one of the most challenging issues in paediatrics (8). A correlation is known between the incidence of chronic diseases and cancer and the lifestyle and eating habits in a defined geographic areas (*9*). These are studies showing that 30% of obese adults were overweight as children (*10*). The obese adult population has a higher risk of hypertension, myocardial infarction, angina pectoris, stroke, venous thrombosis, non-insulin-dependent diabetes mellitus, gout, hyperlipoproteinaemia, cholecystopathy, colorectal, breast and uterine carcinoma, arthritis and hip fracture (*11,12*).

A decrease in both energy expenditure and exercise may result in an increase in body mass and fat in children treated for cancer (*13*). Generally, physical activity is very important for optimal energy expenditure and has a great effect on the health status in childhood and later in adulthood (*14*). Regular physical

Table 4
Assessment of daily energy and nutrient intake in survivors aged 16 to 23 years

Nutrients	Starch/ bread group	Vegetable group	Fruit group	Milk group	Meat group	Fat & saccharose	Total daily intake
Energy [kJ]	2603.34	417.01	420.08	625.88	1888.90	496.61	6451.84
Energy [kcal]	624.24	100.02	100.71	150.07	453.00	119.55	1547.59
Proteins [g]	18.36	6.77	1.48	12.87	15.00		54.48
Fat [g]	6.75	1.06	0.49	6.19	30.21	9.20	53.90
Carbohydrates [g]	123.12	17.49	26.45	8.64	11.57	9.20	196.47
Calcium [mg]	70.74	65.74	35.81	308.78	104.36		585.43
Iron [mg]	5.13	2.96	1.31	0.31	7.07		16.79
Potassium [mg]	443.61	514.63	287.34	231.55	712.50		2189.62
Fiber [g]	8.10	3.67	3.78	0.00	1.93		17.48
Vitamin A [ug]	1.62	197.92	144.57	127.91	70.29		542.31
Vitamin B_1 [mg]	0.486	0.14	0.07	0.07	0.60		1.36
Vitamin B_2 [mg]	0.216	0.08	0.07	0.33	0.21		0.91
Vitamin B_6 [mg]	0.54	0.28	0.12	0.02	0.39		1.34
Vitamin B_{12} [ug]	0.00	0.00	0.00	0.29	3.64		3.94
Vitamin C [mg]	0.00	17.49	25.63	1.47	0.86		45.45
Vitamin E [mg]	3.24	1.27	0.16	0.00	1.71		6.39

activity has been reported to have a favourable effect on the function of the cardiovascular system. It promotes the heart's pumping capacity, the structural development of both the heart and blood vessels and the function of autonomous regulations (*2*) Regular exercise has an important role in cancer prevention (*15*).

In children treated for cancer, poor diet combined with hypokinesis can make their condition considerably worse. Because anti-cancer treatment often results in reduced physical activity, it is necessary to start rehabilitation therapy as soon as possible and also to pay attention to proper diet. The treatment should be carried out under the supervision of experienced therapists (*16*). Even though the methods for physical activity assessment based on questionnaires do not give very accurate results, the degree of exercise found in our patients corresponds to their actual physical condition (*17,18*).

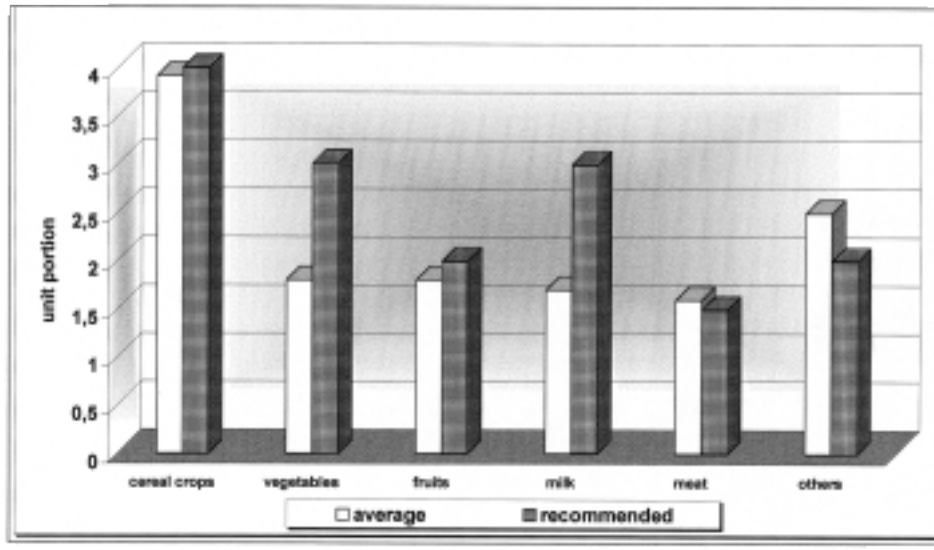

Fig. 1
Food consumption on working days in children aged 5 to 10 years.

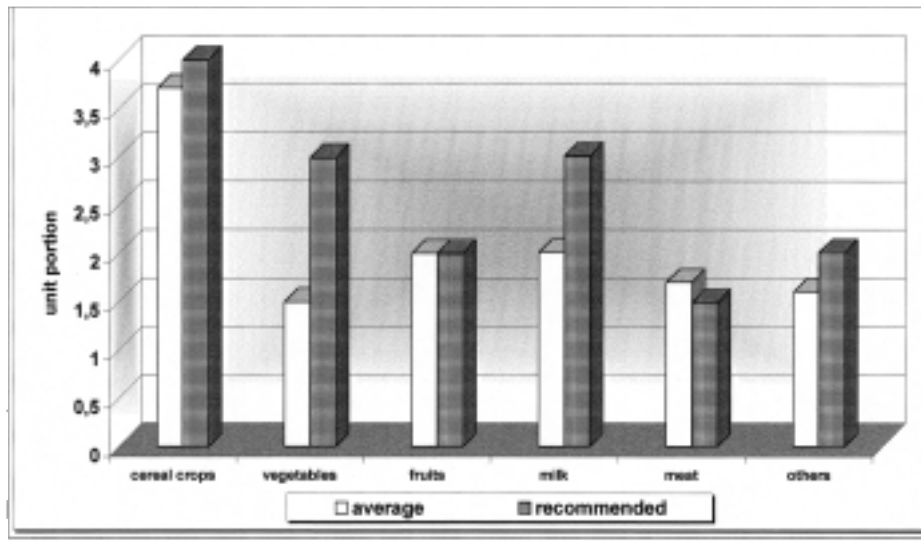

Fig. 2
Food consumption on weekend days in children aged 5 to 10 years.

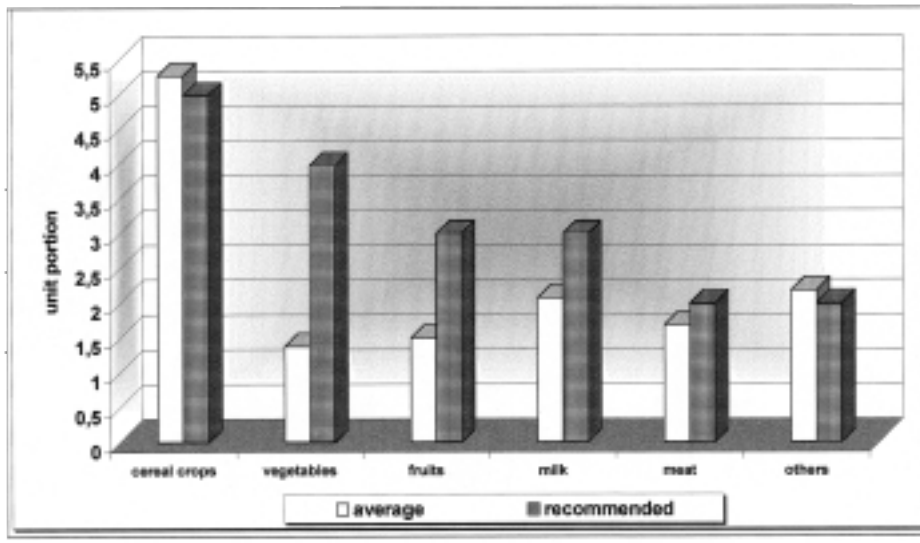

Fig. 3
Food consumption on working days in children aged 11 to 15 years.

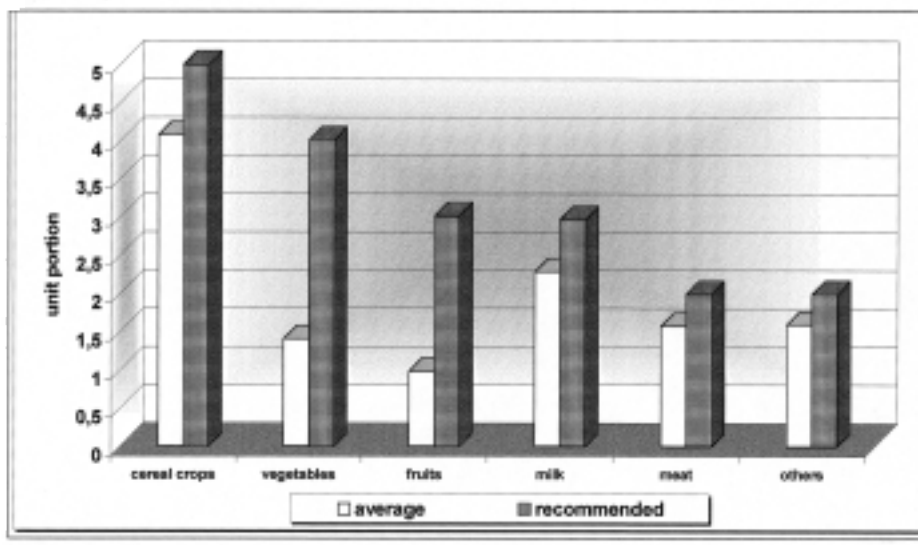

Fig. 4
Food consumption on weekend days in children aged 5 to 10 years.

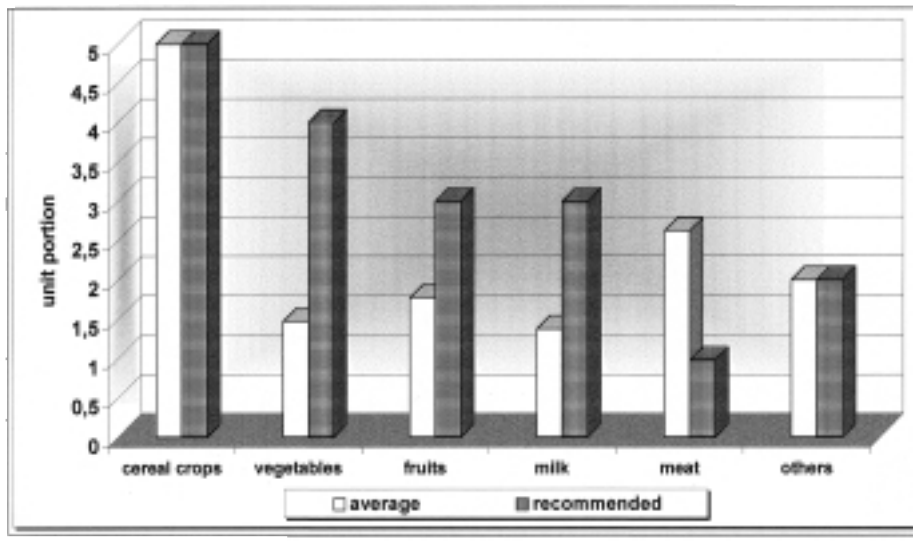

Fig. 5
Food consumption on working days in adolescents aged 16 to 23 years.

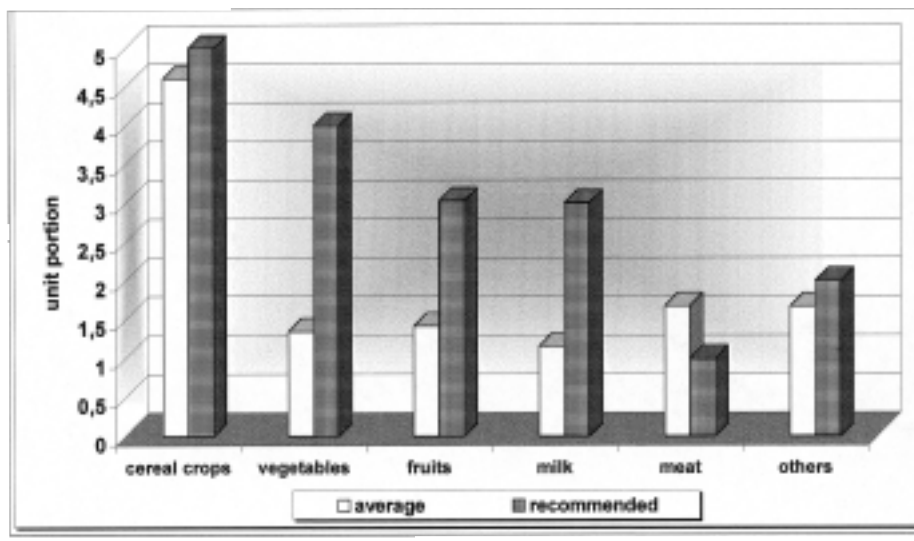

Fig. 6
Food consumption on weekend days in adolescents aged 16 to 23 years

We conclude that proper diet and physical exercise can play important roles in improving the quality of life in children treated for cancer.

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VÝŽIVA A POHYBOVÁ AKTIVITA JAKO SOUČÁST ŽIVOTNÍHO STYLU DĚTÍ PO LÉČBĚ ZHOUBNÉHO NÁDORU

S o u h r n

V současné době je velmi dobrá prognóza dětí se zhoubnými nádory a děti přežívají dlouhodobě. Jedná se o skupinu vysoce ohroženou rizikem kardiovaskulárních chorob v dospělosti. Toto riziko by mohl snižovat zdravý životní styl v dětství. Sledovali jsme výživové zvyklosti a pohybovou aktivitu u souboru 100 dětí a adolescentů ve věku od 5-23 let, kteří byli v dětství léčeni pro zhoubný nádor. Výsledky příjmu energie prokázaly nedostatečný příjem z doporučených potravinových zdrojů. Denní složení stravy neodpovídá zásadám správné výživy. Při hodnocení pohybové aktivity jsme zjistili, že druhy činností se liší podle pohlaví. Děvčata i chlapci mají poloviční výdej energie ve srovnání se zdravými vrstevníky. Ke zlepšení kvality života těchto dětí v dospělosti mohou přispět správné výživové návyky a vhodná pohybová aktivita.

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