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Food habits and dietary intake of schoolchildren in Estonia

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Abstract

The social and economic changes which have taken place in Estonia in the early 1990s may have an impact on the dietary habits and nutrient intake of children. This first report is a comprehensive survey focusing on the diet of pubertal children – the period of most rapid growth after infancy.

A school-based cross-sectional dietary study, using food frequency questionnaires and 48-hour recalls, was performed in five Estonian counties. The sample consisted of 562 randomly-selected 12- and 15-year-old rural and urban children, 341 of whom answered the 48-hour recall interview. The mean daily energy intake was 10.2-11.2 MJ in urban and 8.5-9.2 MJ in rural boys and 7.9-8.6 MJ in urban girls compared with 7.6-8.6 MJ in rural girls. Fat accounted for 36-38%, protein for 12-14% and carbohydrates for 49-52% of the total energy intake. The mean intakes of saturated, monounsaturated and polyunsaturated fatty acids comprised 13-15%, 11-14% and 6-8% of daily energy intake, respectively. The mean intakes of vitamins C and D and the minerals calcium and zinc were below the current Estonian recommendations for both girls and boys. The mean iron intake of girls was 20% lower than national recommendations. Cereal products were the most important food group, providing the main source of energy, protein, carbohydrates and iron. The requirements for most vitamins and minerals meet the national recommendations, except for iron in girls. Obesity is not a significant problem in these age groups.

Introduction

The dramatic social and economic changes which have taken place in Estonia since the early 1990s may have an impact on the dietary habits and nutrient intake of both adults and children. Estonia has a high level of morbidity and mortality from atherogenic cardiovascular diseases, with an incidence rate of 3,015 per 100,000 population (1). Dietary habits are among the lifestyle-related determinants of cardiovascular disease. Atherosclerotic arterial lesions begin in childhood and the process is accelerated by the presence of a prolonged elevation of circulating cholesterol in low-density lipoprotein (2). Eating patterns and genetics are both determinants for blood cholesterol levels (3) but also for other biological risk factors, such as obesity.

There have been no long-term dietary surveys of schoolchildren in Estonia. The last reported dietary study of children (10-15-years-old) is from the 1980s (4). The data from that dietary survey, performed in the capital, showed that 38% of total energy was derived from fat with a polyunsaturated/saturated fatty acid ratio (P/S) of 0.27. On average, carbohydrates accounted for 49% and proteins for 13% of the total energy intake. No information is available concerning the diet of children in other regions in Estonia.

This cross-sectional study is the first to describe the dietary habits and food consumption in schoolchildren after the socio-economic changes in Estonia. Our study, as part of a study of risk factors for cardiovascular disease among school-aged children, intends to present information on the nutrient intake, dietary patterns and food sources of 12- and 15-year-old children.

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Subjects and methods

Subjects

The study was carried out from autumn 1993 to spring 1995 in southern Estonia, a mainly rural region which is divided into five counties, two of which have the highest unemployment rate in Estonia.

The study was school-based and the schools were selected according to the consideration that the schools from each county should be of similar size, resulting in a total of 17 secondary schools – 7 from towns and 10 from the countryside. Within a chosen school, children were randomly selected from the school roll and every third child within the appropriate age and sex group was invited to participate. An overall response rate of 74% resulted in a total of 596 12- and 15-year-old children. The non-participants were not asked about their reasons for non-participation. Thirty-four of the returned questionnaires were incompletely filled out and were not accepted for analysis. The final sample consisted of 562 children representing approximately 8% of the total number of children in these age groups in these counties. The group of 12-year-old children (the age range was from 11 years 5 months to 12 years 5 months) consisted of 305 children and the group of 15-year-old children (from 14 years 5 months to 15 years 5 months) consisted of 257 children.

Food habits

Randomly selected children filled out questionnaires on meal patterns, on frequencies of consumption of various foods and on fatty spreads, cooking fat, type of meat and milk used in family. The families were also asked about the changes in consumption of fat and milk type, spreads on bread and salt in the last three years.

Dietary intake method

The dietary assessment was carried out in the school setting. The interviewers were two paediatricians trained in dietary survey-taking in Finland. Due to the time-consuming interview and the small study team, every third child was excluded from the dietary interview. About 30 recalls were failed because of difficulties either in remembering preceding days or because of an extraordinary preceding day, e.g. ill, birthday. In total, 341 children (176 girls, 165 boys) took part in the 48-hour recall interview about detailed food consumption, by which information was obtained on the amount of food consumed by the subject during the two days preceding the

Table 1a. Frequency of consumption of different food groups in urban children.

	Boys n=83								Girls n=95							
	Never		Once/month		Once/week		Daily		Never		Once/month		Once/week		Daily	
	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y
Bread, cereals	0	0	0	0	0	0	100	100	0	0	0	0	0	2	100	98
Vegetables	3	1	10	14	56	57	31	28	0	1	4	4	63	67	33	28
Potatoes	0	0	0	0	38	31	62	69	0	0	1	1	45	47	54	52
Fruit, berries, juice	0	1	4	5	44	44	52	50	0	0	5	5	45	44	50	51
Milk	0	5	0	5	38	20	62	70	7	5	4	3	21	31	68	61
Cheese	0	0	2	2	66	58	32	40	12	11	14	11	59	56	15	22
Yoghurt	28	20	14	20	44	50	14	10	24	15	2	25	63	51	11	9
Meat, meat products	0	0	0	0	36	15	64	85	0	0	0	2	47	47	53	51
Fish	16	22	38	27	43	50	3	1	20	18	34	36	46	44	0	2
Sweets	0	0	0	0	43	28	57	72	0	0	0	0	41	39	59	61

Table 1b. Frequency of consumption of different food groups in rural children.

	Boys n=82								Girls n=81							
	Never		Once/month		Once/week		Daily		Never		Once/month		Once/week		Daily	
	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y	12y	15y
Bread, cereals	0	0	0	0	1	0	99	100	0	0	0	0	0	0	100	100
Vegetables	0	0	14	2	49	60	37	38	1	5	4	4	54	50	41	41
Potatoes	0	0	0	0	13	25	87	75	0	0	0	0	29	30	71	70
Fruit, berries, juice	0	0	7	1	37	50	56	49	0	0	0	0	49	53	51	47
Milk	6	4	6	2	7	17	81	77	6	0	12	2	14	19	68	79
Cheese	0	0	7	1	71	65	22	34	0	6	16	12	54	78	30	4
Yoghurt	32	52	27	3	35	43	6	2	41	39	35	25	23	31	1	5
Meat, meat products	0	0	0	0	32	36	68	64	0	0	0	0	64	31	36	69
Fish	6	10	22	24	66	64	6	2	9	33	47	29	44	32	0	6
Sweets	0	0	0	0	36	34	64	66	0	0	0	0	45	35	55	65

day of the interview. A selection of household measures and photocopy models of various foods were used to quantify the intake.

Intakes were classified as breakfast, school-lunch, lunch, dinner and snacks. Breakfast was the first meal of the day and it occurred within one hour of waking up. Lunch was classified as a meal of prepared food in the middle of the day and before 3 p.m. Dinner was classified as a meal of prepared food in the afternoon or evening after 3 p.m. All other meals between main meals were classified as small meals (sandwiches, fruits, biscuits, sweets).

Anthropometry

The subjects' heights and weights were measured with the subjects in their underwear, and without shoes. Beam platform scales were used and weight was recorded to the nearest 0.1 kg. The scales were adjusted regularly in every school each year. Height was measured twice to the nearest 0.5 cm using wooden length boards. An average of two measurements was used in the data analyses. Measurements were obtained by paediatricians, although other staff assisted in some schools.

Obesity is defined as a ratio of actual weight to mean weight for actual height (5) by Estonian growth curves from 1993, which exceeds 120%.

Statistical analysis

Nutrient intake was determined using the Finnish program Micro-Nutrica (6) and a food composition database. Estonian food data have been added to the files. The analysis program generated the daily intake of energy, micronutrients, and the macronutrients for each subject, as well as the mean intake of nutrients and the percentage distribution of food sources for energy and nutrients for the study group. The energy and nutrient intakes were also calculated separately for each meal.

Statistical package SAS, version 6.11 was used to analyse food frequency data and to compare macronutrient and micronutrient consumption between groups. The significance of the differences between boys and girls and rural and urban children were evaluated with Student's t-test. The $p<0.05$ level was selected as the criterion of statistical significance.

The study was approved by the Ethics Committee of the Medical Faculty of Tartu University.

Results

Food habits

The meal pattern of 562 children showed that 67% of them regularly had three meals per day and 40% of children irregularly had small meals, mainly sandwiches, apples and biscuits, in between main meals. Altogether, 13% of children regularly skipped breakfast.

A prepared charged school lunch was served in every school. Sixty-eight per cent of children ate at school but only 50% ate a prepared warm school lunch regularly, and the tendency not to eat a school lunch increased consistently with increasing age. Only minor differences were noted between urban and rural children in spite of financial subsidies for school lunch from local authorities in some rural schools. The main reasons mentioned by the children for ceasing to eat school lunch were the high charge and the non-tasty food. Those who did not eat a prepared school lunch occasionally had buns, biscuits, apples and soft drinks instead. As expected, dinner was considered the amplest meal of a day. Two per cent of children reported the school lunch as a main meal.

The times for breakfast and dinner, but

Table 2. Mean (mean ± SD) daily energy intake and enegy percentages from macronutrients of 341 children.

		Urban				Rural				Estonian Nutrition Recommendations (7)
		Boys		Girls		Boys		Girls		
		12y n=43	15y n=40	12y n=50	15y n=45	12y n=40	15y n=42	12y n=39	15y n=42	
Energy	MJ	10.2±2.7	11.2±4.3	7.9±3.0	8.6±3.9	8.5±2.3	9.2±2.2	8.6±2.5	7.6±3.1	Boys 7.4-14.9 MJ Girls 6.1-11.6 MJ
Protein	E%[1]	12±3	12±6	14±3	13±3	13±3	12±2	14±3	13±4	10-14
Fat	E%	36±5	37±8	37±7	36±9	38±9	38±7	36±8	36±9	30-32
SFA[2]	E%	14±4	15±7	13±3	13±4	15±5	15±5	14±4	15±5	10-12
MUFA[3]	E%	11±2	14±4	13±4	13±3	12±4	12±3	12±3	12±4	10
PUFA[4]	E%	6±3	8±5	7±4	7±3	7±3	6±2	6±4	6±3	10
Carbohydrate	E%	52±6	51±10	49±7	51±10	49±9	50±9	50±8	49±10	52-60
Sucrose	E%	10±5	11±4	10±6	10±5	9±5	9±6	10±5	12±5	10

[1]Energy per cent; [2]SFA=Saturated fatty acids; [3]MUFA=Monounsaturated fatty acids; [4]PUFA=Polyunsaturated fatty acids

not for lunch, were fairly regular on weekdays but varied at weekends. On weekdays breakfast was taken between 7:00 and 7:30 a.m. and dinner was mainly between 6 and 8 p.m. Both on weekdays and at weekends nearly all the families ate their meals at home.

Fifty-two per cent of families have changed their fatty spreads on bread from butter to mixed butter and vegetable oil spreads or to soft margarines. In 60% of the urban families and in 55% of the rural families, mainly oil was used in preparing food. As for meat, poultry and pork were the main types of meat used in urban families, while the rural families ate mainly pork.

High-fat milk (3.2% and more) constituted two-thirds of the consumed milk. Low-fat milk (1.5%) was consumed in only 15% of urban families and in 3% of rural ones. Approximately 5% of children did not drink milk at all.

According to 48-hour recalls of 341 children, a daily energy intake distribution revealed 22% at breakfast, 14% at school-lunch, 26% at lunch, 31% at dinner and 7% from small meals. The main meal of a day was dinner, which gave the main proportion of energy and fat intake.

The data about frequency of consumption of different food groups were obtained from 562 children. There were no significant differences between children who passed 48-hour recall (n=341) and the rest of 221 children. The frequency of consumption of main food groups of 341 children is shown in Table 1a for urban children and in Table 1b for rural ones.

The main food groups consumed nearly every day were bread, milk and potatoes by both rural and urban children. Vegetables were mainly used once a week. Fifty per cent consumed fruit or juice every day. The apples were the main fruit used by rural children, while apples and bananas were mainly used by urban children in both age groups. Diluted red-currant and apple juice were the juices used by rural children, and orange juice was used additionally by urban children.

One-third of the children did not consume milk every day. Rural children drank milk more often but consumed less dairy products than to the urban ones. Yoghurt was not consumed by half of the rural 15-year-old boys and by one-third of the rest of the rural children.

Energy and nutrient intake.

The mean daily intake of energy and proportion of energy percentages from macronutrients are shown in Table 2. The mean intake of energy was higher in urban boys than in the rural ones ($p< 0.05$). The intake of macronutrients, expressed as a percentage of energy intake, was similar in boys and girls in both age groups. Protein contributed 12-14%, fat 36-38% and carbohydrates 49-52% to the energy intake. Compared with the urban children, the rural children showed a higher proportion of energy from fats, especially from saturated fats. Saturated, mono-unsaturated and polyunsaturated fatty acids constituted 13-15%, 11-14% and 6-8% of the total energy intake, respectively. It is noteworthy that 76% of the children exceeded the national recommendation (7) of a maximum of 32% energy intake from fat. Almost 36% of subjects consumed diets in which more than 40% of energy was derived from fat. Thirty-three per cent of the children ate diets in which more than 15% of energy was derived from saturated fatty acids. Such a high saturated fat consumption was found in nearly half of the rural boys and girls.

Table 3. Percentage distribution of food source of energy and nutrients of 341 12 and 15 year-old children.

	Energy				Protein				Fat				Carbohydrate			
	Urban		Rural		Urban		Rural		Urban		Rural		Urban		Rural	
Food sources	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Cereals	28	29	33	23	33	28	36	32	5	5	7	4	45	44	51	43
Vegetables	1	1	1	1	2	2	1	1	1	2	1	1	1	2	1	1
Potatoes	10	9	9	10	9	7	7	8	1	1	1	1	18	18	16	18
Fruit, berries, juice	6	5	2	5	2	2	1	1	0	0	0	0	10	8	4	7
Fats, oils	18	17	15	15	1	1	1	1	43	44	42	40	0	0	0	0
Milk, milk products	10	13	15	14	19	21	23	21	21	17	24	20	5	7	8	9
Meat, meat products	11	10	10	13	28	30	25	27	22	25	19	25	1	1	1	1
Sweets	10	11	11	14	2	1	1	3	4	3	3	6	17	18	18	19
Others	6	5	4	5	4	8	5	6	3	3	3	3	3	2	1	2

Table 4. Mean (mean ± SD) daily intake of nutrients, nutrient density as amount per 10 MJ, body weight and body mass index (BMI).

		Urban				Rural			
		Boys		Girls		Boys		Girls	
		12y n=43	15y n=40	12y n=50	15y n=45	12y n=40	15y n=42	12y n=39	15y n=42
Protein	g	70±30	80±43	62±21	61±31	64±20	79±19	65±18	57±21
Protein	g/10MJ	69±18	63±34	79±15	72±18	73±36	86±14	77±18	78±21
Fat	g	90±30	113±70	78±36	82±42	85±31	87±32	80±40	80±40
Fat	g/10MJ	89±14	101±54	97±15	94±25	97±26	115±21	92±20	100±26
Carbohydrate	g	317±147	337±798	227±87	255±122	243±77	282±56	253±70	219±93
Carbohydrate	g/10MJ	310±125	301±84	289±59	300±62	285±55	297±84	300±49	292±62
Sucrose	g	52±33	69±39	46±48	48±36	44±30	57±37	62±47	47±41
Sucrose	g/10MJ	51±19	62±30	52±38	57±28	51±31	70±55	73±45	59±37
Cholesterol	mg	259±119	294±139	284±122	253±116	284±104	288±106	258±147	286±153
Cholesterol	mg/10MJ	254±105	233±132	320±150	296±114	341±130	303±196	310±124	346±139
Fibre	g	37±17	43±16	20±11	23±13	28±10	25±10	25±11	21±10
Fibre	g/10MJ	36±11	34±23	25±10	28±10	32±11	26±12	29±11	28±8
Weight	kg	40.5±8.6	57.1±10.0	40.6±7.8	53.8±7.5	40.3±6.7	57.9±12.4	41.1±9.5	53.8±8.7
BMI	kg/m^2	17.5±2.5	19.7±2.8	17.4±2.6	19.6±2.4	17.5±2.5	19.8±3.0	17.9±3.0	19.3±2.6

Table 3 shows the food sources of energy and nutrients. There were no significant differences between age groups of 12 and 15, and the data of both age groups are summarized. The most important sources of energy, protein, carbohydrates and iron were cereals and rye bread. Nearly one-third of the energy was derived from cereals. Meat and meat products and milk with dairy products were the second and the third most important food groups.

Table 4 presents the average daily consumption of nutrients and the nutrient densities. The mean daily intake of most nutrients was higher in boys. There were no significant differences in nutrient intakes between urban and rural children. Approximately the same nutrient densities were found in both sexes and in urban and rural children. However, the nutrient density of protein was lower in urban 15-year-old boys compared with other age and sex groups.

The mean daily consumption of vitamins and minerals is presented in Table 5. The mean daily dietary supply of vitamins D and C was below the national recommendations, while the intakes of vitamin A, riboflavin, thiamin and pyridoxin were well above the national recommendations. Of mineral elements, calcium and zinc were low for both sexes and the intake of iron was low only for girls. None of the children reported taking any supplements.

The mean dietary intake of salt, where only salt used for food preparation is included, was 8 g per day in boys and 6.5 g per day in girls.

In our study the occurrence of obesity was 5.7% and 2.2% for 12- and 15-year-old girls respectively compared to 2.6% and 3.6% for boys from the same age groups. Two children, a 15-year-old urban girl and a 12-year-old rural boy, were underweight, with a weight lower than mean -2SD for height. Their energy intakes and nutrient densities were in age and sex set values.

Discussion

In this study the mean energy intakes in girls were relatively low. As compared with the values found in a 48-hour recall study of Finnish 12- and 15-year-old

Table 5. Mean (mean ± SD) daily intake of vitamins and minerals of 341 12- and 15-year-old children.

		Urban				Rural				ENR[1]	
		Boys		Girls		Boys		Girls		Boys	Girls
		12y n=43	15y n=40	12y n=50	15y n=45	12y n=40	15y n=42	12y n=39	15y n=42		
Vitamin A[2]	mg	1.1±0.65	1.2 ±0.65	1.1 ±0.70	0.95 ±0.70	0.98 ±593	1.3 ±0.86	1.0 ±0.63	1.5 ±0.80	1.0	0.80
Vitamin D	µg	2.7±1.2	3.7±2.3	3.0±2.6	3.5±1.2	3.2±2.3	3.7±3.0	3.2±3.0	2.6±2.0	5	5
Thiamin	mg	2.3±1.1	3.1±2.3	1.7±0.8	1.9±1.1	2.0±0.8	1.4±0.5	1.8±0.9	1.8±0.8	1.2-1.4	1.0-1.1
Riboflavin	mg	1.7±0.6	1.9±1.0	1.9±1.3	1.3±0.8	1.7±1.0	1.5±0.7	1.5±0.5	1.7±1.1	1.4-1.7	1.2-1.3
Pyridoxin	mg	1.9±1.3	2.1±1.4	2.1±1.0	2.2±1.1	2.0±1.2	2.0±0.7	1.6±1.0	2.0±1.0	1.7-2.0	1.5-1.6
Vitamin C	mg	68±45	53±42	46±24	51±32	60±47	49±28	55±47	43±32	50-60	50-60
Calcium	mg	855±295	825±440	648±300	592±391	719±498	755±453	618±359	658±365	1000	1000
Magnesium	mg	442±157	488±350	268±113	289±125	301±114	292±125	310±103	269±115	350-400	350-400
Iron	mg	21.0±9.9	21.1±10.4	14.0±7.7	14.2±7.2	15.0±4.6	15.6±4.6	14.3±4.1	13.2±6.5	12	18
Zinc	mg	12.9±3.5	15.3±4.8	10.2±4.4	10.0±4.9	11.1±3.8	12.1±4.1	10.9±3.2	9.4±3.9	15	15
Selenium	µg	67±28	72±33	67±29	68±38	70±24	59±30	68±24	54±29	30-60	30-60

[1]ENR= Estonian Nutrition Recommendations (7). [2] Retinol equivalents

children (8) the mean energy intake is nearly the same in 12-year-old children and lower in Estonian 15-year-olds. There may be several reasons for this low energy intake. Dieting in girls connected with the emphasis on body weight inspired by the recently launched miss and model competitions may be a contributing factor. Underreporting or selective food consumption could serve as alternative explanations. There are also indications that children have become physically less active in Estonia (9).

According to the 48-hour recall data, fats make up a larger proportion of total energy intake in the diet of children studied than recommended by the ESPGAN Committee on Nutrition (10) and national recommendations (7). Compared to fat intake in neighbouring countries in comparable age groups, Estonian children had a lower energy intake from fats than the Finnish children (8) but a higher amount per 10 MJ than the Swedish children (11). The share of saturated fats of the energy exceeds the current Estonian recommendations in both urban and rural children. The diets contained more total fat per 10 MJ in rural children. A shift to low-energy fat spreads on bread and to vegetable oils at the beginning of 1990s, reported in nearly one half of the questionnaires, together with the option of choosing meat, may result for the reduced amount of energy received from saturated fatty acids. The mean daily dietary cholesterol intake was lower than the recommended 300 mg for children.

Though the data of dietary intervention studies to reduce hyperlipidemia are controversial, diet seems to explain less of the variation in plasma lipids and lipoproteins in children than presumed (12). On the other hand, low fat and other restricted diet campaigns should be promoted carefully among Estonian children due to the tendency towards a decrease in body mass index, the lack of correct growth monitoring and the absence of students majoring in nutritional science in Estonia.

Cereal products formed the bulk of the food eaten, and this food-group was the most important source of energy, protein and carbohydrates in both age and sex groups of urban and rural children. Rye bread is traditionally eaten daily in Estonia. Cereals were likewise found to be the main food group for energy and several other nutrients in Swedish dietary studies (11,13). In comparison with the urban children, the rural children consumed milk, vegetables and potatoes more often.

The mean weight of 15-year-old girls studied is 3 kg lower than 10 years ago (14). The unpublished anthropometric data from the *Estonian Anthropological Register* (according to measurements of 17,000 schoolchildren in 1995) show a decrease in body mass index compared to the measurements from 1978 and 1989. This decline is more pronounced in girls and the tendency is particularly strong in girls after the age of 14. Though the prevalence rates for obesity are highly dependent both on the criteria set for obesity and on the reference values chosen, epidemiological studies have indicated that the prevalence of obesity in industrialized countries is on the increase (15). Contrary to the situation prevalent in affluent countries, obesity is not a significant problem in children in Estonia. Though the energy intake was relatively low in investigated children, underweight was not common. The thinness seen in two children is probably due to constitutional causes. Approximately the same nutrient densities and energy intakes were found in underweight children as in children of the same age and sex.

The share of sucrose in total energy intake was on average 10%, which is much lower than the mean 15.2% of energy from all sugars in the European Union (16).

The average intake of protein, most vitamins and mineral elements met the recommended dietary allowances. We found the total daily dietary supply of vitamins D and C to be low according to the current national recommendations. Another important source of vitamin D is sunlight and it is unlikely that schoolchildren constitute a risk group for vitamin D deficiency.

The diet of the study group was low in calcium. The low consumption of milk and dairy products, the main sources of dietary calcium, characterized diets of rural and urban children. It has been stated that adequate calcium intake from milk and milk products in childhood and adolescence is among the determinants for attainment of maximum bone mass (17).

The mean daily intake of iron in girls was lower than 18 mg per day. Poor absorption from cereals, which constitute the main source of iron for Estonian schoolchildren, in combination with low intakes, could lead to iron deficiency in girls.

We found salt consumption in the children studied to be two times higher than the national recommendations of 2-3 g per day. Estonian adults are considered to be abundant dietary salt users, but no previous dietary studies have been carried out in the adult population in Estonia.

The present diet in Estonian schoolchildren and its effect on physiological, biochemical and anthropometric parameters may ultimately, if carried into adulthood, affect the occurrence of diseases for which diet is the principal environmental risk factor.

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