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Nutrition and nutritional status of 8-year old Surinam immigrant and Dutch (Caucasian controls) schoolchildren in Amsterdam

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In order to gain better insight into the nutritional problems of the Surinam immigrants in The Netherlands, a survey of the nutritional status and dietary habits among 8-9 year old Surinam immigrant and Dutch (Caucasian controls) schoolchildren was carried out in Amsterdam in the period of January to June 1978. 156 Surinam immigrants and 182 Dutch schoolchildren as well as their parent(s) volunteered for the study, representing 84.7% of the selected population. Demographic and socioeconomic data were obtained from the parents by oral inquiries.

Food consumption data were collected from mothers and children using the 24 hour recall method. The nutritional status was assessed by means of oral inquiries, medical examination (including blood pressure readings), anthropometric measurements, and biochemical tests. Food consumption data were in close agreement with biochemical findings. Both sets of data indicate that the Surinam immigrants are much more at risk for developing iron deficiency anaemia and pathology related to deficient cellular thiamin and riboflavin saturation than the Dutch controls. Low 25-OH-vitamin D values with accompanying high serum alkaline phosphatase activities were frequently found among the immigrants, indicating that subclinical vitamin D deficiency might occur among these children.

Total serum cholesterol values in Surinam-Hindustani were significantly lower than in Surinam-Creoles and controls. Serum immunoglobulin levels in Surinam children were significantly higher than in controls. No clear signs of nutrient deficiencies were found. In all ethnic groups the prevalence

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of dental caries was high. Obesity was rare in immigrants and controls. It is advised to stimulate in nutrition information and education among immigrants the use of products like brown bread, nuts, pulses, liver, vegetables, and milk (products); the use of sweets and soft drinks should be restricted. A general prescription of AD-prophylaxis by general practitioners and youth physicians is recommended. Attention should be given by youth physicians and dentists to the use of fluoride supplements or toothpaste containing fluorine.

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1 Introduction

Epidemiological nutritional studies during the past decade have revealed that nutrient deficiencies are common among immigrants in the USA and the UK. Two studies carried out in The Netherlands among adults (Verweij-Burke 1971) and infants and toddlers (Van Steenbergen 1978a & 1978b), indicated that immigrants from Surinam (South America) also showed problems in adjusting themselves to the Dutch dietary habits. To get a deeper insight in the nutritional problems of the Surinam immigrants, a survey of the nutritional status and dietary habits among 8- to 9-year old Surinam immigrant and Dutch (controls) schoolchildren was carried out in Amsterdam in the period of January to June 1978.

2 Subjects and methods

2.1 Study population

The study sample consisted of all registered 8- to 9-year old Surinam and Dutch schoolchildren in a suburb (Bijlmermeer) of Amsterdam. The Surinam children were of African origin (referred to as Creoles), East-Indian origin (referred to as Hindustani) and mixed descent. The Dutch controls were of Caucasian origin.
The participation rate was high: 156 Surinam immigrants and 182 Dutch schoolchildren as well as their parent(s) volunteered for the study, representing 84.7% of the selected population. The participaton rate among the Surinam children (Creoles: 89%, Hindustani: 96.5%, and mixed group: 92.3%) was higher than among the Dutch controls (79.3%). The mean age of the total population was 8 years and 6 months.

2.2 Data collection

Demographic and socioeconomic data were obtained from the parents by oral inquiries. Food consumption data were collected from mothers and children using the 24 hour recall method. The nutritional status was assessed by means of oral inquiries (use of vitamin/mineral supplements, clinical history, etc.), medical examination (macroscopic dental examination, signs of nutrient deficiencies, blood pressure readings, anthropometric measurements), and biochemical tests. The main anthropometric measurements included weight, standing height, left mid-upper-arm circumference, left and right bicondylar femur widths, and 4 skinfold thicknesses (biceps, triceps, subscapula, and supra-iliac). All the anthropometric measurements were carried out by one observer. The children only wore underwear. With the exception of the triceps skinfold, the anthropometric measurement were performed according to Tanner (1962). The triceps skinfold thickness was measured according to published recommendations of Durning and Womersley (1974). The skinfold thickness measurements were performed on the left side of the body with the aid of a Holtain skinfold caliper (reading accuracy: 0.2 mm). The mid-upper-armmuscle circumference (as an indicator of muscle mass) was calculated from the left mid-upper-arm circumference and the triceps skinfold according to Jelliffe (1966). Non-fasting venous blood samples were collected. Tests performed on serum specimens included: total cholesterol (Huang et al 1961), iron and total iron binding capacity (Führ 1965), ferritine via a radioimmuno assay with Ramco kits, folic acid via a modified competitive proteinbinding assay with Bio-Rad kits, vitamin B_{12} via a competitive proteinbinding assay with Phadebas kits, 25-hydroxyvitamin D via a modification of the method of Preece et al (1974), calcium via a Marius-Calcium Titrator, phosphate (Gomori 1942), alkaline phosphatase activity (37°C) (Bessey et al 1946), IgA, IgG, and IgM (Mancini et al., 1964). Serum iron saturation was calculated from the ratio serum iron/total iron binding capacity. Tests performed on whole blood samples included: hemoglobin and hematocrit (NEN 1961), erythrocyte transketolase (ETK) activity and stimulation with thiamin pyrophosphate (TPP-effect) according to Smeets et al. (1971), and erythrocyte glutathione reductase (EGR) activity and stimulation with flavin adenine dinucleotide (FAD-effect) according to Tillotson and Baker (1972).
In view of their ethnic background, blood samples of 52 Surinam children chosen at random were examined for hereditary hemoglobin anomalies (thalassaemia and sickle cell disease) and hereditary enzyme deficiencies (glucose-6-phosphate dehydrogenase activity).

2.3 Data analysis

The energy and nutrient content of the foods were calculated by a computer, utilizing the food values from the Dutch Food Composition Tables (Hautvast 1975). With the exception of the food consumption data of the vitamins A and C, the statistical analysis for all the continuous variables was performed via the Student t-test ($\alpha < 0.05$). Because of the skewed distributions of the vitamins A and C, these variables were analysed with the Wilcoxon-test. Logarithmic transformation of the skinfold thickness data (Edwards et al 1955) was performed before data analysis was carried out.

3 Results

3.1 Demographic and socioeconomic data

Migration data: Approximately 50% of the examined Creoles and about 14% of the Hindustani migrated to The Netherlands before 1973. In the period of 1973-1975 only 37% of the Creoles but circa 51% of the Hindustani established themselves in The Netherlands.
Family size and composition: The mean actual family size

of the Surinam and Dutch families varied substantially (Creoles: 5.2, Hindustani: 6.1, and (Dutch) Caucasians: 4.1). Unlike the Dutch families the Surinam families frequently had grandparents or other relatives living with them. The majority of the Creole (50.7%), Hindustani (72.5%), and Dutch children (74%) were brought up by their natural father and mother. However, 40.3% Creoles and 23.5% Hindustani were reared by their natural mother alone, which was the case with only 14.4% of the Dutch controls.

Parental education: In comparison with the parents of the Dutch children, the parents of the immigrant children (with the exception of the Creole mothers) had a lower level of education (Table 1).

Table 1. Percentage distribution according tot educational level of the mothers and fathers of examined schoolchildren by ethnic group

Educational level	Creoles Mo[2]	Creoles Fa[3]	Hindustani Mo	Hindustani Fa	Caucasians[1] Mo	Caucasians[1] Fa
None	0	0	4	6	0	0
Elementary	28	22	69	49	23	14
Low vocational	13	8	6	8	34	24
Advanced elementary	30	13	16	10	23	16
Medium vocational	12	6	2	0	6	11
Grammar school	0	2	0	2	7	9
High vocational	12	6	2	0	6	7
University	0	0	0	0	0	4
Unknown	5	45	2	24	1	16

[1] Dutch controls
[2] mother
[3] father

Socioeconomic status (SES) of the family: The assessment of the SES of the family was based on information about education, occupation, and position of the father and the mother. Most of the Creole (72%) and Hindustani (83%) children came from families with a low SES (Table 2, categories IV+V). On the other hand, 52% of the Dutch children came from upper and middle class families (categories I+II+III).

Table 2. Percentage distribution according to socioeconomic status (SES) of the family of examined schoolchildren by ethnic group

SES[1] of the family (category)	Creoles	Hindustani	Caucasians[2]
I (high)	3	4	13
II	13	2	13
III	8	10	26
IV	60	26	37
V (low)	12	57	11
Unknown	5	2	1

[1] According to Attwood statistics
[2] Dutch controls

3.2 Medical data

Vitamin/mineral supplements: Circa 48% of the Surinam children and 63% of the Dutch controls used vitamin and/or mineral supplements on the day of the examination. More than 60% of the Creoles, circa 30% of the Hindustani and 61% of the Dutch children regularly used these supplements. Less than one out of ten of the Creoles and Hindustani versus one out of three of the Dutch children used fluoride supplements.

Clinical signs: No clear physical signs of nutrient deficiencies were found. However, the prevalence of bow-legs was high among al ethnic groups (Creoles: 40%, Hindustani: 26%, and controls: 28%). Knock-knees occurred in circa 3% of the Hindustani and Caucasians, but not in Creoles. Dental examination showed the highest prevalence of decayed elements among Hindustani children (almost 41%). Among Creoles and Dutch children a prevalence of 21% and 17% respectively was found. Totally sound elements were observed in 47% Creoles, 30% Hindustani, and only in 27% Dutch controls. Goitre (category O^b according to Stanbury et al. 1974) was encountered in 1.1% of the Dutch controls, but absent in the Surinam schoolchildren.

Blood pressure: Systolic and diastolic (phase V, disappearance of sounds) pressures were recorded by one observer using a London School of Hygiene sphygmomanometer. Neither in boys nor in girls significant differences in mean systolic or diastolic blood pressure were found between the ethnic groups. In boys mean blood pressure values were 98/53 mm Hg (Creoles), 97/53 mm Hg (Hindustani), and 99/53 mm Hg (Dutch controls); in girls respect ively 100/54, 98/53 and 101/54 mm Hg. Blood pressure values > 130 mm Hg (systolic) and/or > 80 mm Hg (diastolic) were absent in boys and girls of all ethnic groups.

3.3 Anthropometric data

Major results of the anthropometric evaluation of body build are summarized in Table 3. Dutch control boys were on the average 2.4 cm taller than Creole boys and 4.5 cm taller than Hindustani boys ($P<0.05$). Hindustani girls were on the average 4.6 cm shorter than Dutch control girls and 3.9 cm shorter than Creole girls ($P < 0.05$). The differences in mean body height between children from the 3 ethnic groups were partially parallelled by differences in mean body weight. Hindustani boys weighed on the average 3 kg less than Dutch boys and 3.3 kg less than Creole boys ($P < 0.05$). Hindustani girls were found to weigh 2.5 kg less on average than Dutch girls and 3 kg less than Creole girls ($P < 0.05$).

In comparing results of skeletal width, measured by the sum of left and right bicondylar femur widths, it was found that Hindustani showed significantly lower mean values than Creoles and Dutch controls. The significant differences in mean skeletal width between Hindustani and both other ethnic groups were parallelled by differences in mean mid-arm muscle circumference (= indicator of muscle mass). Mean mid-arm muscle circumference values in Hindustani were significantly lower than those in Creole and Dutch children.

Although the Hisdustani showed the lowest mean values for height, weight, sum of knee widths, and muscle mass, no significant differences in mean sum of 4 skinfold thicknesses were observed between them and both other ethnic groups. However, significantly higher mean biceps and triceps skinfold thicknesses were measured in Hindustani girls than in Creole and Dutch girls respectively. In addition, their mean suprailiac skinfold thickness significantly exceeded that of both other ethnic groups.

3.4 Blood/serum data (Tables 4A, 4B, 5 and 6)

Total serum cholesterol: Neither in boys nor in girls significant differences in mean cholesterol values were observed

Table 3. Major results of anthropometric measurements by gender and ethnic group

Measurements	Creoles mean	Creoles s.d.	■	Hindustani mean	Hindustani s.d	■	Dutch controls mean	Dutch controls s.d	■
Boys:									
Body weight (kg)	27.7	5.2	H	24.4	4.9	C,D	27.4	3.9	H
Standing height (cm)	130.4	4.7	D	128.0	6.0	D	132.5	6.2	C,H
Sum of knee widths (cm)	16.1	1.0	H	15.4	0.9	C,D	16.1	0.8	H
Mid-arm muscle circumference (cm)	15.7	1.3	H	14.4	1.3	C,D	15.3	1.5	H
Sum of 4 skinfolds (mm)	23.5	11.1		26.9	12.9		24.5	6.4	
Girls:									
Body weight (kg)	27.1	5.4	H	24.1	4.3	C,D	26.6	3.9	H
Standing height (cm)	130.8	5.9	H	126.9	6.5	C,D	131.5	6.0	H
Sum of knee widths (cm)	15.4	1.0	H	14.9	0.9	C,D	15.2	0.8	H
Mid-arm muscle circumference (cm)	15.0	1.1	H	13.9	0.9	C,D	14.7	1.0	H
Sum of 4 skinfolds (mm)	29.1	13.8		32.6	10.6		29.6	9.0	

■ Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H), and Dutch Caucasian controls (D)
Number of examined children: Male: 24 Creole, 26 Hindustani and 83 Dutch control
Female: 43 Creole, 28 Hindustani and 94 Dutch control

Table 4A. Boys: major results of the biochemical analyses in blood/serum by ethnic group

Parameter	Creoles n	Creoles mean	Creoles s.d.	■	Hindustani n	Hindustani mean	Hindustani s.d.	■	Dutch controls n	Dutch controls mean	Dutch controls s.d.	■
Total cholesterol[1] (mmol/l)	23	4.7	0.8		23	4.4	0.8	D	50	5.1	0.9	H
Haemoglobin (mmol/l)	23	8.1	0.7	D	25	8.5	0.7		53	8.5	0.5	C
Haematocrit (%)	23	38.8	2.8	D	25	40.0	2.7		53	40.1	2.1	C
Iron saturation (%)	16	25.3	12.9		14	19.5	7.1	D	43	28.1	9.5	H
ETK-activation (ratio)[2]	24	1.18	0.14	D	25	1.12	0.09		51	1.10	0.08	C
EGR-activation (ratio)[3]	24	1.23	0.25	D	25	1.35	0.47	D	50	1.11	0.12	C,H
Serum folate (nmol/l)	23	7.4	2.2		22	8.0	4.5		27	8.1	2.5	
Vitamin B_{12} (pmol/l)	22	562	148		23	643	175		31	553	216	
25-OH-vitamin D (nmol/l)	14	28.3	14.3	D	24	33.9	17.9	D	38	56.6	25.8	C,H
S.calcium (mmol/l)	23	2.43	0.12		22	2.40	0.09		49	2.46	0.17	
S.phosphorus (mmol/l)	22	1.54	0.21		22	1.47	0.16		48	1.53	0.12	
S.alkaline phosphatase activity (U/l)	23	40.4	10.4		24	40.9	9.0		48	38.7	10.2	

■ Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H) and Dutch Caucasian controls (D)
[1] Huang-method (1961); 2) Erythrocyte transketolase activation ratio; 3) Erythrocyte glutathione reductase activation ratio

Table 4B. Girls: major results of the biochemical analyses in blood/serum by ethnic group

Parameter	Creoles n	Creoles mean	Creoles s.d.	■	Hindustani n	Hindustani mean	Hindustani s.d.	■	Dutch controls n	Dutch controls mean	Dutch controls s.d	■
Total cholesterol[1] (mmol/l)	29	5.0	0.9	H	24	4.4	0.6	C,D 0	51	4.9	0.8	H
Haemoglobin (mmol/l)	32	8.0	0.8	H,D	26	8.4	0.4	C,D	55	8.7	0.5	C,H
Haematocrit (%)	32	39.0	3.1	D	26	40.1	2.0		55	40.9	2.2	C
Iron saturation (%)	25	22.7	10.8	D	22	21.5	7.3	D	46	30.3	10.9	C,H
ETK-activation (ratio)[2]	30	1.14	0.08	D	26	1.13	0.09		52	1.10	0.06	C
EGR-activation (ratio)[3]	30	1.28	0.21	D	26	1.30	0.15	D	52	1.12	0.09	C,H
Serum folate (nmol/l)	25	7.1	2.2		25	8.4	3.6		44	8.1	2.6	
Vitamin B_{12} (pmol/l)	23	605	173		21	564	219		45	562	163	
25-OH-vitamin D (nmol/l)	23	36.0	17.6	D	21	30.1	15.8	D	48	61.5	30.0	C,H
S.calcium (mmol/l)	29	2.46	0.09		26	2.45	0.07		50	2.44	0.09	
S.phosphorus (mmol/l)	29	1.63	0.16	D	24	1.55	0.17		50	1.48	0.15	C
S.alkaline phosphatase activity (U/l)	29	49.7	14.1	H,D	25	39.9	10.7	C	52	40.3	8.5	C

■ Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H) and Dutch Caucasian controls (D)
[1] Huang-method (1961); 2) Erythrocyte transketolase activation ratio; 3) Erythrocyte glutatione reductase activation ratio

between Creoles and Dutch controls (Tables 4A and 4B). However, Hindustani boys showed a significantly ($P < 0.005$) lower mean cholesterol value than Dutch boys, and in Hindustani girls a significantly lower mean cholesterol concentration was found than in Creole girls ($P < 0.01$) and Dutch girls ($P < 0.03$). The prevalence of hypercholesterolaemia was evaluated using 2 different cut-off points. The first cut-off point, 5.9 mmol/l Huang-method (= 5.2 mmol/l Abell-Kendall-method 1952), defined borderline plus frank hypercholesterolaemia, while the second, 6.5 mmol/l Huang-method (= 5.7 mmol/l Abell-Kendall-method), defined the level above which frank hypercholesterolaemia was considered to be present (see Table 5). Frank hypercholesterolaemia was found in 10% Creole girls, 6% Dutch boys, and 4% Dutch girls, but not in Creole boys and Hindustani boys and girls.

Iron status: Mean haemoglobin (Hb) and haematocrit values in Creole boys were significantly lower than in Dutch controls ($P < 0.005$ and $P < 0.03$ respectively). Hindustani boys showed a lower mean iron saturation value than Dutch control boys ($P < 0.005$). In Creole girls a significantly lower mean haemoglobin value was found than in Hindustani ($P < 0.005$) and Dutch girls ($P < 0.0005$). Hindustani girls showed also a lower haemoglobin concentration than Dutch control girls ($P < 0.003$). Creole girls as well as Hindustani girls showed a significantly lower mean iron saturation value than Dutch controls ($P < 0.005$ and $P < 0.001$ respectively). Subclinical anaemia (7.5 > Hb < 6.8 mmol/l) was present in 26% Creole boys and 10% Creole girls; clinical aneamia (Hb < 6.8 mmol/l) was found in 6% of the Creole girls and not among the rest of the population. Depleted iron stores (iron saturation values < 15%) were frequently found in the Surinam schoolchildren, however, only one third of the Creoles had also a concomitant low haemoglobin concentration (<7.5 mmol/l). Hereditary haemoglobin anomalies (thalassaemia and sickle cell disease) were absent. Hereditary enzyme deficiencies (glucose-6-phosphate dehydrogenase activity) were observed in 8 immigrant children, however, non of these children had abnormal values for iron or B-vitamins.

Vitamin B status: Erythrocyte transketolase (ETK) activity and erythrocyte glutatione reductase (EGR) activity measurements were performed as functional tests of nutritional adequacy of thiamin (vitamin B_1) and riboflavin (vitamin B_2) respectively. A high activation coefficient (in Table 4A and 4B: 'ETK-ratio' and 'EGR-ratio' respectively) is indicative of a low saturation level in the erythrocytes of thiamin and riboflavin respectively. Mean ETK-activation ratios in Creoles were significantly higher than in Dutch controls ($P < 0.01$). Circa 20% of the Creoles and 8–20% of the Hindustani showed ETK-activation ratios beyond 1.20 (95th percentile Dutch controls = ICNND-classification, 1963). Mean EGR-activation ratios in both Creoles and Hindustani were significantly higher than in Dutch controls ($P < 0.005$). EGR-activation ratios beyond 1.29 (= 95th percentile Dutch controls; ICNND-classification = 1.28)

Table 5. Percentage distribution of blood/serum values below or beyond cut-off points by gender and ethnic group

	boys			girls		
Cut-off points	Creoles	Hindustani	Dutch controls	Creoles	Hindustani	Dutch controls
Tc > 5.9 mmol/1/l[1]	9	0	20	21	4	6
TC > 6.5 mmol/l[2]	0	0	6	10	0	4
HB < 7.5 mmol/l[3]	26	4	2	16	4	0
Hb < 6.8 mmol/l	0	0	0	6	0	0
Ht > 36%[4]	9	4	2	9	4	0
I.S. < 15%[5]	19	43	7	24	9	7
ETK ratio > 1.20[6]	21	20	–	20	8	–
EGR ratio > 1.29[7]	29	40	–	50	42	–
S. folate < 3.9 nmol/l[8]	4	5	–	8	4	–
25-OH-vit. D < 20.5 nmol/l[8]	21	25	–	22	38	–

[1] Total serum cholesterol Huang-method (= 5.2 mmol/l Abell-Kendall-method)
[2] Ibid (= 5.7 mmol/l Abell-Kendall-method)
[3] Haemoglobin
[4] Haematocrit
[5] Serum iron saturation
[6] Erythrocyte transketolase activation ratio beyond the 95th percentile Dutch Caucasian controls
[7] Ibid Erythrocyte glutathione reductase activation ratio
[8] Values below the 5th percentile Dutch Caucasian controls

Table 6. Mean serum immunoglobulin values (± SD) by gender and ethnic group

		boys				girls			
Parameter	Ethnic group	n	mean	s.d.	▪	n	mean	s.d.	▪
IgA[1] (I.U./ml)	Creoles	23	86.9	28.7	D	29	95.5	33.2	
	Hindustani	23	96.1	37.8	D	25	89.0	30.7	
	Dutch controls	50	72.5	28.0	C, H	52	82.8	30.5	
IgG (I.U./ml)	Creoles	23	157.0	29.0	D	28	162.1	27.5	D
	Hindustani	23	149.2	24.0	D	25	169.4	29.0	D
	Dutch controls	50	120.0	27.0	C, H	52	125.7	29.1	C, H
IgM (I.U./ml)	Creoles	23	137.6	45.6		29	157.2	66.9	
	Hindustani	23	139.3	47.6		25	174.7	74.1	D
	Dutch controls	50	123.6	47.1		52	141.2	56.3	H

▪ Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H), and Dutch Caucasian controls (D)
[1] 1 mg IgA 100 ml serum is equivalent with 59.5 IU. IgA/ml serum (Standard human batch no. 174, Behringwerke A.G.), ibid 1 mg IgG/100 ml = 11.5 I.U. IgG/ml, ibid 1 mg IgM/100 ml = 115 I.U. IgM/ml.

were present in 29 - 50% of the immigrant schoolchildren. Immigrants as well as Dutch controls showed high serum folate and vitamin B_{12} levels.

Association between iron and riboflavin status: According to Alfrey & Lane (1970) riboflavin deficiency would result in a normocytic normochromic anaemia. Statistical analysis showed in both Creole boys and girls a significant, inverse correlation between haemoglobin concentration and EGR-activation ratio (boys: $r = -0.42$, girls: $r = -0.41$, $P < 0.05$) and between packed cell volume and EGR-activation ratio (boys: $r = -0.41$, girls: $r = -0.40$, $P < 0.05$).

Vitamin D status: Mean 25-OH-vitamin D levels in Creoles as well as in Hindustani were significantly lower (circa 50%) than in Dutch controls ($P < 0.0005$). 25-OH-vitamin D values below 20.5 nmol/l (= 95th percentile Dutch controls) were present in 21 - 38% of the Surinam immigrant children. Neither is mean serum calcium nor in mean serum phosphate level significant differences were observed between immigrants and Dutch controls. Mean serum alkaline phosphatase activity in Creole girls was significantly higher than in Hindustani and Dutch control girls ($P < 0.005$ and $P < 0.0005$). Low 25-OH-vitamin D values with accompanying high serum alkaline phosphatase activities were frequently found among the Surinam immigrants.

Serum immunoglobulins: Mean serum IgA and IgG levels in both Creole and Hindustani boys were significantly ($P < 0.005$) higher than in Dutch controls (Table 6). Mean serum IgG levels in Surinam girls were also higher than in controls (Creoles: $P < 0.01$; Hindustani: $P < 0.0005$). Hindustani girls showed at the same time a significantly higher mean IgM concentration than the controls ($P < 0.03$).

3.5 Food consumption data

The assessment and characterization of the dietary intake of the children was performed by means of an interview technique (24 hour recall method) in which the child was allowed to serve as his own respondent (Frank et al., 1977). Additional information was obtained from the parent(s). Since children are apt to forget many snack foods eaten during a day, gentle probing with visual aids was used to remind the interviewee of them. An 'Additional Sweet/Snack Chart System' was developed to aid in distinguishing brands, sizes and colours of snacks foods and sweets.

Food habits: Usually three meals were consumed by all groups. Snacks were mainly eaten between lunch and dinner, but in the evenings as well. For Creoles and Dutch controls breakfast and lunch usually consisted of sandwiches with tea, milk or soft drinks. Hindustani frequently had a hot meal for lunch. For Surinam children dinner consisted of rice, vegetables and some kind of animal product; they drank lemonade or soft drinks with their dinner. Dutch controls had potatoes instead of rice and they drank less lemonade and soft drinks with their dinner than the immigrants.

Dietary intake (Table 7): Surinam children consumed less tubers and roots (mainly potatoes) than Dutch controls; however, as was to be expected the main daily intake of rice was higher among the immigrants. With regard to the intake of bread and cereals Surinam children were not only found to consume less of these products than the controls, but moreover only 24% of the immigrant children used brown bread versus 51% of the controls. More than 75% of the Creoles and controls used animal products in the form of meat and meat products. Dependent on their faith (Muslim/Hindu), the Hindustani are forbidden beef or pork. The animal products used by the Hindustani consisted mainly of poultry and fish. The mean daily intake of dairy products by Surinam children was circa 200 cc lower than that by Dutch controls. Circa 50% of the immigrant children drank less than 200 cc milk per day, while well over 10% of the Dutch controls drank 800 cc or more milk per day! Creoles and Hindustani consumed twice as many nuts and pulses as controls. Pulses were an important protein source for the Hindustani. The immigrants consumed more vegetables than the Dutch controls, but they ate less fruit.

Although immigrants and controls used visible fats in comparable amounts (Table 7), a marked difference between both groups was observed with regard to the total fat intake (Table 8), as a result of a difference in invisible fat intake via snacks, meat and meat products, etc. Immigrants as well as Dutch controls showed a (too) high daily intake of sugar and sugar-rich products (including sugar-rich drinks).

Nutrient intake: The 'translation' of foods in nutrients and energy intake is given in Tables 8 and 9. Although the Hindustani girls showed significantly lower energy intake and protein intake values than Creole and Dutch girls, the energy and protein intake per kilogram body weight did not differ between the ethnic groups. As compared with the Dutch Recommended Daily Allowances (DRDA) all ethnic groups had an adequate supply of energy and protein (per kilogram body weight). However, the percentage contribution of the animal proteins to the energy intake (Table 9) in Creoles and controls was beyond the recently introduced cut-off point of 6 En%. The data with regard to the energy intake/kg body weight showed that overfeeding was a rare

Table 7. Mean dietary intake (g) by ethnic group

Food group	Creoles (n = 68)	Hindustani (n = 52)	Dutch controls (n = 181)
Tubers and roots	52	60	114
Bread and grain products (excluding rice)	125	119	150
Rice (raw)	70	80	4
Meat (products), fish, poultry, cheese and eggs	116	101	110
Diary products	250	186	423
Nuts and pulses (including peanut butter)	20	22	11
Vegetables	116	100	77
Fruits	122	97	154
Margarines, fats and oils	28	31	30
Sugar and sugar-rich products (excl. sugar-rich drinks)	64	50	81
Soft drinks and fruit juices	309	258	265
Snacks	7	4	14

phenomenon in all ethnic groups; this finding was consistent with the results of the skinfold thickness measurements.

The total fat intake by Surinam boys was significantly lower than by Dutch controls ($P < 0.05$), in Hindustani girls circa 16 g lower than in Creole and Dutch girls ($P < 0.02$ and $P < 0.005$ respectively) (Table 8). The percentage contribution of fat to the energy intake (Table 9) in Surinam children was significantly lower than in Dutch controls ($P < 0.005$). Furthermore, the polyunsaturated fatty acids/saturated fatty acids ratio (PUFA/SAFA ratio) in Hindustani (0.73) and Creoles (0.56) was more favourable than in controls (0.38). The favourable fatty acid composition found in Hindustani was in close agreement with their low mean total serum cholesterol values (chapter 3.4) and could partially be explained by the frequent use of oils in food preparation and the consumption of poultry and nuts.

With the exception of the Creole girls, no differences in

Table 8A. Energy and nutrient intake by gender and ethnic group

Parameter		boys						girls					
		Creoles [a]		Hindustani [a]		Dutch controls [a]		Creoles [a]		Hindustani [a]		Dutch controls [a]	
Energy (MJ)	x	8.2		8.1		8.7		8.4	H	7.1	C,D	7.8	H
	s.d.	1.8		2.4		2.1		2.3		1.6		1.9	
Energy/kg[1] (MJ/kg)	x	0.31		0.34		0.32		0.32		0.30		0.30	
	s.d.	0.09		0.11		0.08		0.10		0.08		0.08	
	% DRDA[2]	99		107		103		101		96		96	
Protein (g)	x	57.9		56.0		62.0		58.1	H	50.7	C,D	56.3	H
	s.d.	16.8		17.6		20.2		18.5		14.5		15.6	
Protein/kg[1] (g/kg)	x	2.2		2.3		2.3		2.2		2.2		2.2	
	s.d.	0.7		0.6		0.7		0.8		0.7		0.6	
	% DRDA[2]	110		115		115		110		110		110	
Fat (g)	x	77	D	76	D	87	C,H	81	H	65	C,D	80	H
	s.d.	22		25		28		36		19		24	
Cholesterol (mg)	x	180		176		197		187		174		213	
	s.d.	140		147		120		147		152		174	
Carbohydrates (g)	x	264		261		260		263	H,D	230	C	231	C
	s.d.	70		88		64		70		67		63	
Calcium (mg)	x	615	D	565	D	898	C,H	609	D	513	D	806	C,H
	s.d	394		340		470		347		334		392	
	% DRDA[2]	77		71		112		76		64		101	

[a] Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H) and Dutch Caucasian controls (D)
[1] kilogram body weight
[2] Percentage of Dutch Recommended Dietary Allowances (energy 0.3138 MJ/kg/day, protein 2 g/kg/day, calcium 800 mg/day)

Table 8B. Nutrient intake (iron and vitamins) by gender ethnic group

Parameter		boys						girls					
		Creoles [a]		Hindustani [a]		Dutch controls [a]		Creoles [a]		Hindustani [a]		Dutch controls [a]	
Iron (mg)	x	7.4	D	7.1	D	9.6	C,H	8.5	H	7.1	C,D	8.9	H
	s.d.	2.4		3.0		4.1		3.0		2.3		3.7	
	% DRDA[1]	74		71		96		85		71		89	
Retinol equivalents (mg)	x	0.96		0.76		0.70		0.84		1.14		0.82	
	s.d.	1.88		1.32		0.49		0.90		1.94		1.29	
	Median	0.43		0.38		0.59		0.66		0.47		0.56	
	% DRDA[2]	72		63		98		110		78		93	
Thiamin (mg)	x	0.72	D	0.68	D	0.88	C,H	0.81	H	0.61	C,D	0.77	H
	s.d.	0.35		0.46		0.36		0.33		0.18		0.26	
	% DRDA[1]	80		76		98		90		68		86	
Riboflavin (mg)	x	1.08	D	0.91	D	1.41	C,H	1.14		0.94	D	1.29	H
	s.d.	0.63		0.70		0.68		0.61		0.52		0.58	
	% DRDA[1]	83		70		109		95		78		108	
Ascorbic acid (mg)	x	43	D	53		69	C	62		48	D	72	H
	s.d.	35		56		63		55		33		59	
	Median	32		30		47		41		38		58	
	% DRDA[2]	53		50		78		68		63		97	

[a] Statistically significant differences ($P < 0.05$) between Creoles (C), Hindustani (H) and Dutch Caucasian controls (D)
[1] Mean values expressed as a percentage of the Dutch Recommended Dietary Allowances (iron 10 mg/day, thiamin 0.90 mg/day, riboflavin 1.3 mg/day for boys and 1.2 mg/day for girls)
[2] Median values expressed as a percentage of the Dutch Recommended Dietary Allowances (retinol equivalents 0.60 mg/day, ascorbic acid 60 mg/day)

mean carbohydrate intake between the ethnic groups were observed. The percentage contribution of the carbohydrate intake to the energy intake by Surinam children was significantly higher then by Dutch controls ($P < 0.0005$). However, the mean percentage contribution of carbohydrates to the energy intake of none of the ethnic groups did meet the standards of the DRDA (Table 9). The contribution of oligosaccharides to the total carbohydrate intake (37 - 52%) was (too) high in all groups. Mean calcium intake in Surinam children was significantly lower than in controls ($P < 0.0001$). As compared with the DRDA, the calcium intake of the immigrant children was insufficient. The iron intake in Surinam boys was significantly lower than in Dutch controls ($P < 0.01$), whereas the iron intake in Hindustani girls was significantly lower than in Creole and Dutch girls ($P < 0.03$ and $P < 0.01$ respectively). As compared with the DRDA, however, the mean iron intake of none of the ethnic groups did meet the standard. These findings were consistent with the biochemical data with regard to the iron status. Marked differences were encountered in median vitamin A intake values expressed as a percentage of the DRDA. In Hindustani the retinol supply (circa 70% of the DRDA) was the least favourable compared with the two other ethnic groups. In part this may have been caused by a less frequent use of vitamin supplements among Hindustani. In Creoles and controls 10% of the retinol equivalents were derived from vitamin supplements! Mean thiamin intake in Surinam boys was significantly lower than in controls ($P < 0.03$); in girls the thiamin intake of the Hindustani was significantly lower than in Creoles and controls ($P < 0.005$).

With the exception of the Dutch boys, the mean thiamin intake of all ethnic groups was far below the DRDA standard. The least favourable situation was again encountered in Hindustani. This could be explained by the fact that 60% of the Hindustani did not consume (thaimin-rich) pork. Mean riboflavin intake in Creole boys and Hindustani was significantly lower than in Dutch controls ($P < 0.02$ and $P < 0.005$ respectively). As compared with the DRDA, the riboflavin intake of the Surinam children was insufficient. It was calculated that this was entirely due to their low milk consumption. Both thiamin and riboflavin intake data were in close agreement with the biochemical findings. The vitamin C intake (median value) in Creole boys and Hindustani girls was significantly lower than in Dutch controls ($P < 0.05$ and $P < 0.04$ respectively). Als compared with the DRDA, the vitamin C intake of all ethnic groups was inadequate. It should be kept in mind, however, that the DRDA for vitamin C is one of the highest in the world.

4 Conclusions and recommendations

The total participation rate was much higher than usually encountered in epidemiological surveys. The high response rate among the immigrant groups indicates a positive attitude of immigrants towards health and nutrition surveys.
It is suggested that the differences observed between Surinam children and Dutch controls are partly due to adjustment problems on the part of the immigrants and partly to differences in educational level and socioeconomic status.
Food consumption results were in close agreement with biochemical findings. Both sets of data indicate that the Surinam immigrants are much more at risk (both relative and absolute) for developing iron deficiency anaemia and pathology related to deficient cellular thiamin and riboflavin saturation than the Dutch controls.
In nutrition information and education among Surinam immigrants the use of brown bread, nuts, pulses, liver, vegetables and milk(products) should be stressed. These foods are important sources of iron, thiamin, riboflavin and calcium.
It is suggested that part of the anaemia cases in Creoles is explained by the low riboflavin (EGR) status. However, it should be kept in mind that the same cut-off point for haemoglobin has been used for all ethnic groups, which may be discussable (Dallman et al 1978).
Low 25-OH-vitamin D values with accompanying high serum alkaline phosphatase activities were frequently found among the Surinam immigrants. These data indicate that subclinical vitamin D deficiency might occur among these immigrants.
It is suggested that close attention should be paid to the clinical detection of early vitamin D symptoms in young immigrants. A general prescription of AD-prophylaxis by general practitioners and youth physicians is recommended.
Furthermore, it is advised to carry out a study among younger immigrants in due course to get an insight into possibly existing vitamin D problems.
Total serum cholesterol values in Hindustani were significantly lower than in Creoles and Dutch controls. In close agreement with this finding was the high PUFA/SAFA-

Table 9. Percentage contribution of macro nutrients to energy intake by ethnic group

Parameter (% energy)	Creoles	■	Hindustani	■	Dutch Controls	■	DRDA[1]
Proteins	11.7		11.8		12.1		11
– vegetable proteins (min. 5-6)[2]		5.3		5.9		4.8	
– animal proteins (max. 5-6)[2]		6.2		5.9		7.3	
Fats	35.1	D	34.8	D	37.8	C, H	30-35
– saturated fatty acids (SAFA)		14.2		13.3		17.0	10-12
– mono-unsaturated fatty acids		12.9		11.8		14.4	10-12
– poly-unsaturated fatty acids (PUFA)		8.0		9.7		6.4	10-12
PUFA/SAFA ratio		0.56		0.73		0.38	1.0
Carbohydrates	53.2	D	53.3	D	50.2	C, H	55-59
– oligo-saccharides		23.4		19.7		26.1	
– poly-saccharides		29.8		33.6		24.1	

■ Statistically significant differences ($P < 0.005$) between Creoles (C), Hindustani (H) and Dutch Caucasian controls (D)
[1] Dutch Recommended Dietary Allowances
[2] Recommended Dietary Allowances by the Netherlands Bureau for Food and Nutrition Information (Voedingsinformatie 1980)

ratio in Hindustani (due to relatively high fish, poultry and nuts consumption, low use of meat(products) and the frequent use of oils in food preparation). Whether the low cholesterol values in Hindustani were caused by a shorter stay in The Netherlands compared to the other groups or whether good dietary practice played a major role has to be elucidated by means of a follow-up study.

Low iron saturation values without concimitant anaemia were frequently found in immigrant children. It is not yet clear whether any health risk is involved. It is recommended to carry out in due course a study to elucidate the influence of this phenomenon on mental and physical fitness.

Serum immunoglobulin levels in Surinam children were significantly higher than in Dutch controls. The majority of the Surinam children had been living in The Netherlands for more than one year. It has to be elucidated to what extent these high immunoglobulin levels are caused by a persistent serum immunoglobulin production and to what extent nutritional factors are involved.

In all ethnic groups the prevalence of dental caries was high. In view of the scarce use of fluoride supplements among Surinam children, attention should be given by youth physicians and dentists to the use of fluoride supplements or toothpaste containing fluorine.

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