

Food choice and caries experience in Dutch teenagers as a function of the level of education of their parents

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The relation of the level of education attained by the father and mother with caries prevalence and food intake in the child was investigated in 284 fourteen-year-old Dutch schoolchildren. Foods were classified into three categories: 'health food', 'supplementary food' and 'luxury food'. Food intake was assessed by a 24-h recall with special emphasis on the sugar-containing foods. In multiple regression analysis a significant positive correlation was found of the education of the father with the percentage of the child's energy intake provided by 'healthy foods' (r partial = 0.18, n = 284, P = 0.001). Significant negative partial correlations were also found of the education of the father (r = -0.23) and the mother (r = -0.29) with the number of decayed, missing and filled tooth surfaces in the teenagers. These results indicate an increased risk of 'unhealthy' food habits in children of less-educated parents.

Socio-economic status is an important determinant of health. Less-educated people experience more caries (Tijmstra, 1981; Truin *et al.*, 1981) obesity (Rolland-Cachera & Bellisle, 1986; Jeffery *et al.*, 1989), and coronary heart disease (Pocock *et al.*, 1986; Marmot & McDowell, 1986) than highly educated ones. Although several of these diseases are related to food intake and dietary habits, surprisingly little information is available on the relation between food intake and socio-economic status. If prevention of these diseases is to be successful, it is important to define differences in food intake between socio-economic groups and investigate whether they are already present at a young age. It has been found that poor feeding practice in infancy should be considered as an indicator of high risk for dental caries (Silver, 1987).

There are few investigations into the

relation between socio-economic status and food intake of teenagers. British studies show almost no relationship between family socio-economic status and food intake of teenagers (Hackett *et al.*, 1984a,b; Cook *et al.*, 1973). The influence of socio-economic status on caries experience of children (aged 8–16) has been studied more frequently; teenagers from families of high socio-economic status have better dental health than children of lower socio-economic status (Flach, Klingenberg & Linden 1981; Hausen, Heinonen & Paunio 1981; Lachapelle-Harvey & Sévigny, 1985; Colquhoun, 1985; Kalsbeek & van Foreest, 1986; Truin *et al.*, 1988). However the role of the dietary habits as opposed to fluoride use and dental hygiene in causing this social gradient has not been defined. The present study was conducted in order to explore the influence of socio-economic status on food intake and caries experience of 14-year-old Dutch teenagers.

Subjects and methods

Subjects and sampling

The study was performed on children who had taken part in the final examination in 1985 of the School Health Education Programme carried out by Project Team School Health Education Nijmegen (Saris *et al.*, 1982) in and around the cities of Nijmegen, Oss and 's-Hertogenbosch (the Netherlands). The project involved children from 55 secondary schools. At the start of the programme in the year 1977, these children were still in primary school. All 6-year-olds were included at that time. At 11 of these primary schools the children had been subjected to the Health Education Programme by classroom teaching, and at the other 13 schools the children had served as untreated controls. Since no marked effects of the programme were found on health indicators and health related behaviour, children from experimental and control schools were pooled for the present study. A non-participation study and postintervention analysis showed that the experimental sample could be considered a random sample (de Vries, 1989). Since the water fluoridation was stopped in 1973 in the Netherlands and since almost every toothpaste was fluoridated from 1973, no differences are to be expected as far as exposure to fluoride is concerned.

Of the original sample of 381 children 291 teenagers were found to be eligible for inclusion in the present study. The main reason for exclusion was participation in a longitudinal study conducted concurrently. Further eligibility criteria were the availability of both dental and food examination data. Seven out of these 291 teenagers were dropped because of incomplete socio-economic data, leaving a final sample of $291 - 7 = 284$ children for the present analysis.

Caries prevalence

Caries examinations were carried out in May and June 1985 at the schools by an epidemiologically trained dentist. The examinations were co-ordinated so that the dentist had no knowledge whatsoever about the children, ie it was performed blindly. The subject was seated on a portable dental chair with an adjustable head rest. All teeth

were dried with compressed air before being assessed. A projector with a 50 Watt halogen lamp fibre optic (4 mm) for flexibility Intralux®, Volpi 5 Volts was used to provide a uniform source of light. Clinical diagnoses were carried out visually with the aid of a plane mouth mirror. A sickle probe was used only to remove plaque. A partial recording of caries prevalence according to Marthaler's reduced count method was carried out (Marthaler, 1966). In this method 44 out of the total 128 tooth surfaces are excluded because development of caries rarely occurs on these surfaces. For the remaining 84 surfaces a summary score of decayed (D), missing (M) and filled (F) surfaces (S) was calculated. This is notated as the DMF-S-score.

Food intake

The food intake data were collected between March and June 1985 by 5 trained dieticians. In an interview with the parent(s) at their home, food intake of the teenager was recorded by 24-h recall. This was checked and, if necessary, corrected and completed with information given by the teenage subject him-/herself. In addition, detailed information was obtained about the intake of sugar-containing products between the meals. Sundays and days after national holidays were not covered by the recalls.

Foods were classified into three predetermined groups according to Cramwinckel (1977) and Cramwinckel *et al.* (1985) (Table 1):

1. 'Healthy' food with mostly positive effects on health.
2. 'Supplementary' foods with both positive and negative effects on health.
3. 'Luxury' foods, with mainly negative effects on health.

Table 1 presents the major foods in each group. The percentage of energy provided by foods from each of the three groups was calculated using the 1986 edition of the national Dutch Nutrient Data base (Commissie UCV, 1980). Timing and frequency of the consumption of sweets were carefully recorded. Duration of consumption of sweets between meals was calculated by assigning a period of 20 min to each occur-

Table 1. Sample of foods classified into three groups by their effects on health (see Cramwinckel, 1977; Cramwinckel *et al.*, 1985).

'Healthy' foods	'Supplementary' foods	'Luxury' foods
Wholemeal bread	French bread	Cornflakes
Rye bread	Rusk	Pizza
Breakfast cereals	Macaroni, rice	Pancakes prepared with margarine
Wholemeal macaroni	Pancakes prepared with oil	Pastry, biscuits
Legumes	Eggs	Chips
Vegetables	Poultry	Butter, margarine
Fruit	Low-fat meat	Medium-fat and high-fat meat (sausages, bacon)
Skim milk	Fish	Minced meat
Skim yoghu	Cheese	Hamburger
Linoleic acid	Regular milk and yogurt	Honey, marmalade
Enriched coffee-milk	Nuts	Ice cream, cream
	Soup	Sweets, candybars
	Mayonnaise	Soft drinks
	Coffee, tea	Alcoholic beverages

rence of the consumption of a cariogenic sugar-containing product. When overlap occurred the sweet eating time was recorded as one continuous period. For instance if two cariogenic products were eaten at a 10-min interval, 20 + 10 min were recorded instead of 40.

Socio-economic status

Details concerning social class had already been obtained when the child was aged 6 and 12. In the present survey, at the age of 14, an additional questionnaire about background and knowledge concerning nutrition and dental health was presented to the teenager at school.

The attained level of education of the parent(s) was scored in three categories as follows: Low, primary school or a lower grade training in manual skills; Middle, secondary school training; and High, higher professional training (college or university). The average number of days per week on which the father or mother had a paying job outside of the home, was also recorded.

The education of the children after age 12 was recorded as: Low, LBO, LHNO (lower educational training); Middle, MAVO (secondary educational training); and High, HAVO and VWO (secondary education that gives access to college and university). The amount of pocket money that the children received every week, was recorded by questionnaire.

Statistical analysis

Pearson product-moment correlations were calculated between the dependent variables (food intake and caries experience) and the independent variables (socio-economic variables). This was followed by a stepwise multiple regression analysis. Variables that were not distributed normally (caries prevalence, snack eating time and frequency, and percentage of energy from 'healthy' foods) were transformed by a Box-Cox transformation (1964). Bonferroni's correction was applied in calculating significance levels so as to avoid spurious significances caused by multiple testing (Snedecor & Cochran, 1980).

Results

The mean age of the teenagers was 14 years \pm 4 months. Thirty-five per cent lived in the towns of Nijmegen, Oss and 's-Hertogenbosch, while the others lived in the urbanized countryside around these towns. Seventy-four per cent of the fathers and 10 per cent of the mothers had a full-time job outside the home. Ten per cent of the fathers had a part-time job, and 16 per cent were unemployed; 57 per cent of the fathers had attained a 'low', 26 per cent a 'middle' and 17 per cent a 'high' educational level. For the mothers these figures were: 65 per cent low, 29 per cent middle and 6 per cent

higher education. Forty-seven per cent of the teenagers were enrolled in a form of secondary education that gave access to college and university. All these figures are fairly typical for the population of the Netherlands as a whole.

Food intake

As shown in Table 2 and Fig. 1, a positive correlation was found between the education of the father and the percentage of energy from 'healthy' foods. The educational level of the child's present school was

Table 2. Product-moment correlations between the variables measured in the study of food choice, caries and their determinants in 284 Dutch children aged 14 years in 1985.

	Sex of child	Urban/rural	Education			Job status		
			Father	Mother	Child	Father	Mother	Pocket money
<i>Independent variables</i>								
Sex ^a	1							
Urban rural ^b	-0.09	1						
Education father ^c	-0.12	-0.02	1					
Education mother ^c	-0.02	-0.04	0.46***	1				
Education child ^c	0.05	0.03	0.41***	0.42***	1			
Paid job, father ^d	-0.11	0.06	0.23***	0.13*	0.04	1		
Paid job, mother ^d	-0.03	-0.05	0.02	0.12*	-0.03	0.16*	1	
Pocket money ^e	-0.11*	0.15	-0.03	-0.08	-0.14*	-0.03	0.10	1
<i>Dependent variables</i>								
En % healthy foods ^f	-0.00	0.11	0.18***	0.13*	0.17**	0.09	0.07	-0.09
En % suppl. foods ^g	-0.02	0.05	0.02	0.00	0.01	0.06	-0.11	-0.04
En % luxury foods ^h	0.06	-0.12*	-0.17**	-0.11	-0.13*	-0.10	0.04	0.10
Snack eating ⁱ	0.02	-0.03	0.01	-0.01	0.02	-0.04	0.00	0.15**
Number of sweets ^j	-0.00	-0.05	0.02	0.03	0.03	-0.03	0.03	0.15**
Caries ^k	0.03	-0.05	-0.23***	-0.29***	-0.27***	-0.09	0.06	0.13*

* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$.

^a Boy = 0, girl = 1; ^b Town = 0, urbanized countryside = 1; ^c Low = 0, middle = 1, high = 2; ^d Number of days of paid work per week; ^e Amount of pocket money; ^f Percentage of energy from 'healthy' foods; ^g Percentage of energy from 'supplementary' foods; ^h Percentage of energy from 'luxury' foods; ⁱ Snack eating time in minutes/day; ^j Number of sweets per day; ^k Total decayed, missing and filled surfaces.

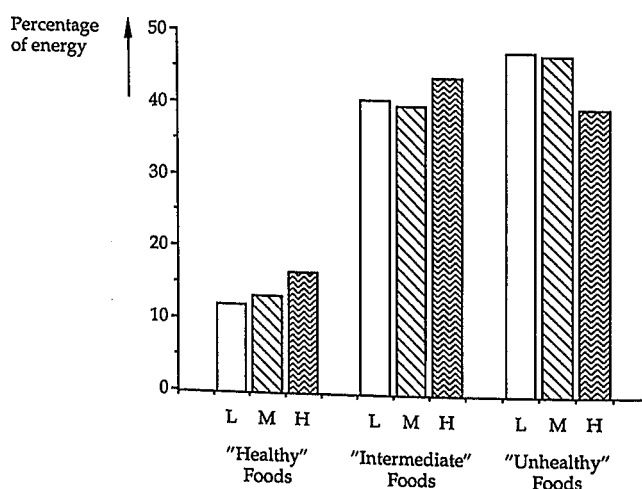


Fig. 1. Percentage of energy obtained from three food groups (healthy, intermediate and unhealthy foods) by education of the father (L = Low, M = Middle, H = High) in 284 Dutch children aged 14 years in 1985.

also correlated positively with a high consumption of 'healthy' foods.

A negative correlation emerged between the education of the father and the percentage of energy from 'luxury' or 'less healthy' foods. The higher the education of the father, the more the children tended to eat 'healthy' foods and the less they obtained their calories from foods of 'undesirable' nutrient composition. Teenagers of more highly educated fathers obtained 39.7 per cent of their daily energy from 'undesirable' foods, as against 47.3 per cent for the teenagers with less educated fathers. The difference amounts to 745 kJ/d, which is equivalent to three-quarters of a chocolate bar or three and a half biscuits. Multiple regression analysis was performed with intake from the three food groups as dependent variables, whereas sex, residency, education of the father, the mother and the child itself, paid job status of the father and mother, and amount of pocket money were considered independent variables. The results showed that the education of the

father was an important independent determinant of the percentage of energy obtained by the child from 'desirable' or 'undesirable' foods (see Table 4). The percentage of explained variance was 3.4 per cent for foods from group I ('healthy') and 3.0 per cent from group III ('unhealthy'). A positive univariate correlation ($P = 0.05$) was found between the amount of pocket money received by the child and the frequency of the consumption of sweets between meals. However, upon stepwise multiple regression no single independent variable had a significant correlation with the sweet eating time or frequency.

Caries experience

In Table 2 are presented the correlations of the number of decayed, missing and filled tooth surfaces with various independent variables. Both the education of the parents and the educational level of the school in which the child was enrolled were negatively correlated with the caries prevalence. In Table 3 the mean percentages of energy

Table 3. Mean percentages of energy obtained from three food groups ('healthy', 'supplementary' and 'luxury' foods; Table 1) and mean caries prevalence (DMF-S) by education of the father (Low, Middle and High) in 284 Dutch 14-year-old children in 1985.

Education of father	'Healthy' foods	'Supplementary' foods (% of energy in child's diet)	'Luxury' foods	Total	DMF-S score*
Low n = 162	12.12	40.59	47.30	100	5.72
Middle n = 74	13.40	39.78	46.81	100	4.18
High n = 48	16.73	43.74	39.54	100	2.85

* DMF-S: Decayed, missing and/or filled tooth surfaces.

Table 4. Stepwise multiple regression analysis with dietary pattern and caries experience as dependent variables in a study of food choice, caries and their determinants in 284 Dutch children aged 14 years in 1985.

Dependent variable	Independent variable	^a Partial r ²	P
Intake of healthy foods	Education father	0.034	0.002 ^b
Intake of luxury foods	Education father	0.030	0.0004 ^b
Caries experience	Education mother	0.086	0.0001 ^b
	Education father	0.027	0.004 ^b

^a Partial correlation according to 8 background variables.

^b Significant at $P = 0.05/8 = 0.006$ (Miller, 1981; correction for multiple testing).

obtained from the three food groups ('healthy', 'supplementary' and 'luxury' foods) and mean caries prevalence are given by education of the father (Low, Middle or High). The data shows that the higher the educational level of the father, the higher the proportion of energy from 'healthy' and the lower the proportion from 'luxury' foods. The caries score decreased with higher educational level. In the multiple regression analysis the education of the mother was the most significant determinant of caries experience (Table 4).

The explained variance was 8.6 per cent for the DMF-S caries score. When the education of the child was taken into account 2.7 per cent was added to the explained proportion of variance. When the education of the mother was added the percentage of variance explained was 11.3.

Discussion

Food intake

The major new finding in this study was a positive correlation between the education of the father and the intake of 'healthy' foods and a negative correlation between the education of the father and the intake of 'luxury' foods. Some similar correlations were reported in other studies among teenagers (Samuelson, Grahnén & Arvidsson, 1971; Van Poppel *et al.*, 1989) and adults (Windham *et al.*, 1983; Knapp *et al.*, 1985). Other studies show almost no relationship between the socio-economic status and food intake of teenagers (Hackett *et al.*, 1984 *a, b*; Cook *et al.*, 1973; Woodward 1984, 1986).

A possible explanation for the correlation between education of the father and food intake of the teenager is that children of more highly educated fathers had more knowledge about nutrition and a different attitude towards nutrition. In another part of this study a connection was found between the education of the father and the extent of knowledge about nutrition in the child (de Vries, 1989). The educational level of the father and of the mother, and the type of school in which the child was enrolled were related to one another. Therefore it

would be safer to state that the educational level of the family was associated with food consumption and food choice in the child.

None of the educational variables explained the variance in the duration or frequency of eating sweets. The influence of the amount of pocket money was of borderline significance. It is remarkable that there was an association of the education of the father with the percentage of energy from 'undesirable' foods but not with the consumption of sweets between meals. The 'undesirable' products were those with a high fat content or with an unfavourable amount of saturated fatty acids or sugars. Thus the relation between education of the father and consumption of 'undesirable' foods appears to be limited to foods high in saturated and total fat.

On the other hand, the frequency of consumption of sweets was much lower than expected. Although it was not mentioned by the investigators, the children may have guessed that sugar intake and caries were a major focus of the study and a point of intense interest to the investigators. Therefore, underreporting of sweets consumption may have occurred.

Caries experience

Other studies also showed that teenagers of more highly educated parents have better dental health than those of poorly educated parents (Flach *et al.*, 1981; Ruiken, 1983; Lachapelle-Harvey & Sévigny, 1985). In general, teenagers of high socio-economic status have a lower caries experience than teenagers of low socio-economic status (Hitchcock & Gracey, 1980; Hausen *et al.*, 1981; Colquhoun, 1985; Kalsbeek & van Foreest, 1986).

Probably, more highly educated people show a more dental health-minded behaviour: they brush their teeth better and longer, use fluorides more often and visit the dentist regularly (de Vries & Ruiken, 1987). Use of fluoride preparations is especially important because tap water in the Netherlands is not fluoridated. That more highly trained parents administered fluoride more conscientiously has been shown previously (Tan, ter Horst & Dekking, 1981) although this was not confirmed in

another study (Kalsbeek & van Foreest, 1986). In another part of the present study no relation was found between the socio-economic status of the children studied here and the frequency of their visits to a dentist (de Vries, 1989).

Recent research among Dutch 15-year-olds showed that better knowledge is associated with a more positive attitude concerning dental health, and with better oral hygiene (Visser, Wiegman & Eijkman, 1985). However, this is not a general finding (Kok, Vandenbroncke & Matroos, 1980; Loon, van de Boer & Dooghe, 1984).

Conclusions

We found intake of less healthy food and an increased prevalence of caries in teenagers from less educated families. Such families should therefore be a prime target in the fields of nutrition and dental health education.

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References

- Box GEP, Cox DR (1964): An analysis of transformations. *IRSS-B*, 26.
- Colquhoun J (1985): Influence of social class and fluoridation on child dental health. *Community Dental Oral Epidemiol.* **13**, 37-41.
- Commissie Uniforme Codering Voedingsenquetes (UCV) (1980): Uitgebreide voedings-middelentabel 1980. Voorlichtingsbureau voor de Voeding Den Haag.
- Cook J, Altman DG, Moore DMC, Topp SG, Holland WW & Elliott A (1973): A survey of the nutritional status of schoolchildren. Relation between nutrient intake and socio-economic factors. *Br. J. Prev. Soc. Med.* **27**, 91-99.
- Cramwinckel AB (1977): Gezonde voeding. Van Gorcum, Assen, The Netherlands.
- Cramwinckel AB, Boeijen WGM, Cluitmans R, Elvers JWH & Winkelman M (1985): De groepsindeling getoetst en herzien. *Voeding, Netherlands J. Nutr.* **46**, 136-140.
- Flach M, Klingenberg I & Linden H (1981): De gebitstoestand van 7- en 11-jarige Nederlandse kinderen in Rotterdam. Report no. 99, Department of health education, Agricultural University, Wageningen.
- Hackett AF, Rugg-Gunn AJ, Appleton DR, Allison M & Eastoe JE (1984a): Sugars-eating habits of 405 14-year-old English children. *Br. J. Nutr.* **51**, 347-356.
- Hackett AF, Rugg-Gunn AJ, Appleton DR, Eastoe JE & Jenkins GN (1984b): A 2-year longitudinal nutritional survey of 405 Northumberland children initially aged 11.5 years. *Br. J. Nutr.* **51**, 67-75.
- Hausen H, Heinonen OP & Paunio I (1981): Caries in permanent dentition and social class of children participating in public dental care in fluoridated and non-fluoridated areas. *Community Dental Oral Epidemiol.* **9**, 289-291.
- Hitchcock NE & Gracey M (1980): Diet and nutrient intakes related to socio-economic status. *Food Nutr. Notes Rev.* **37**, 115-121.
- Jeffery RW, Forster JL, Folsom AR, Luepker RV, Jacobs DR & Blackburn H (1989): The relationship between social status and body mass index in the Minnesota heart health program. *Int. J. Obesity* **13**, 59-67.
- Kalsbeek H & van Foreest JD (1986): Het mondhygiënisch gedrag en de gebitsgezondheid van 13-jarigen in Amersfoort. *Ned Tijdschr Tandheelkd* **93**, 105-12.
- Knapp JA, Haffner SM, Young EA, Hazuda HP, Gardner L & Stern MP (1985): Dietary intakes of essential nutrients among Mexican-Americans heart study. *Am. J. Clin. Nutr.* **42**, 307-316.
- Kok FJ, Vandenbroncke JP & Matroos AW (1980): Voedingsgedrag . . . hoeveel invloed heeft kennis? *T. Soc. Geneesk.* **58**, 802-806.
- Loon F, Boer L van den & Dooghe G (1984): Voedingskennis en -gedrag in Vlaanderen. *Voeding, Netherlands J. Nutr.* **45**, 393-396.
- Lachapelle-Harvey D & Sévigny J (1985): Multiple regression analysis of dental status and related food behaviour of French Canadian adolescents. *Community Dental Oral Epidemiol.* **13**, 226-229.
- Marmot MG & McDowell ME (1986): Mortality decline and widening social inequalities. *Lancet* **2**, 274-276.
- Marthaler TM (1966): Partial recording of dental caries in incidence studies. *Adv. Fluoride Res. Dental Caries Prev.* **4**, 41.
- Miller RG Jr (1981): *Simultaneous statistical inference*. New York: Springer-Verlag.
- Pocock SJ, Shaper AG, Cook DG, Phillips AN & Walker M (1986): Social class differences in ischaemic heart disease in British men. *Lancet* **2**, 197-201.
- Poppel G van, Schneijder P, Mass IAM, Schrijver J, Sluiter-van Nies & Kok FJ (1989): Sociaal-economische verschillen in voeding en voedings-toestand bij 10-11-jarige jongens. *Ned Tijdschr Geneesk* **133**, 1223-1227.
- Rolland-Cachera MF & Bellisle F (1986): No correla-

- tion between adiposity and food intake; why are working class children fatter? *Am. J. Clin. Nutr.* **44**, 779-787.
- Ruiken HMHM (1983): Tandcariës en gedrag bij kinderen. PhD thesis, Nijmegen University, The Netherlands.
- Samuelson G, Grahnén H & Arvidsson E (1971): An epidemiological study of child health and nutrition in a northern Swedish country VI. Relationship between general and oral health, food habits and socioeconomic conditions. *Am. J. Clin. Nutr.* **24**, 1361-1373.
- Saris WHM, Binkhorst RA, Cramwinckel AB, Hegger WG & König KG (1982): The development of the health education program for school children. *T. Soc. Geneesk.* **60**, 680-684.
- Silver DH (1987): A longitudinal study of infant feeding practice, diet and caries, related to social class in children aged 3 and 8-10 years. *Br. Dental J.* **163**, 296-300.
- Snedecor GW & Cochran WG (1980): *Statistical methods*. Ames, Iowa: The Iowa State University Press.
- Tan HH, ter Horst G & Dekking YM (1981): Dental knowledge, attitude and behavior in 12-year-old Dutch suburban children. *Community Dental Oral Epidemiol.* **9**, 122-127.
- Tijmstra T (1981): How successful are surveys on the relationship between caries and sociocultural variables? *Community Dental Oral Epidemiol.* **9**, 230-235.
- Truin GJ, Plasschaert AJM, König KG & Vogels ALM (1981): Dental caries in 5-, 7-, 9- and 11-year-old school children during a nine year dental health campaign in The Hague. *Community Dental Oral Epidemiol.* **9**, 55-60.
- Truin GJ, Burgersdijk RCW, Groeneveld A, Helling GWJ, van't Hof MA, Kalsbeek H & Visser RSH (1988): Landelijk Epidemiologisch Onderzoek Tandheelkunde. Deel II. Resultaten Klinisch onderzoek. Nijmegen, Netherlands: Nijmegen University.
- Visser APH, Wiegman HP & Eijkman MAJ (1985): Een onderzoek naar mondgezondheid. Deel VI. Tandheelkundige voorlichtingsbronnen en kennis van 15-jarige kinderen. *Ned Tijdschr Tandheelkd* **92**, 386-389.
- de Vries HCB (1989): Oral health in schoolchildren in relation to (dental) health education. PhD Thesis, Nijmegen University, The Netherlands.
- de Vries HCB & Ruiken HMHM (1987): Gebitsbewust gedrag in de puberteit. *Ned Tijdschr Tandheelkd* **94**, 5-8.
- Windham CT, Wyse BW, Hansen RG & Hurst RL (1983): Nutrient density of diets in the USDA nation-wide food consumption survey, 1977-1978: I Impact of socio-economic status on dietary density. *J. Am. Diet. Assoc.* **82**, 28-34.
- Woodward DR (1984): Major influences on medium energy and nutrient intakes among teenagers. A Tasmanian Survey. *Br. J. Nutr.* **52**, 21-32.
- Woodward DR (1986): What influences adolescent food intakes? *Hum. Nutr. Appl. Nutr.* **40a**, 185-194.