Influence of social factors on sugary products behavior in 4-year-old children with regard to dental caries experience and information at child health centers

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The aim was to analyze the steering effects of 15 social factors on sugary products behavior at 4 years of age in 177 children. The parents had in most cases received information on dental health care at child health centers, with due respect to the level of caries among the children, who were classified as 'healthy' (no caries experience) ($n = 83$) or 'diseased' (caries experience) ($n = 84$). The parents filled in a mailed diet history form. Only sugary products unsuitable from a cariologic point of view were considered. The products were given scores reflecting the frequency of intake. The social factors were social background, family, information, and conceptual factors. By means of multiple regression analysis, explanatory values of the social variables for sugary products behavior were estimated. For the total material, 13% of the variance was explained by all variables combined. Among the social background factors, 'parents' age' was statistically significant ($p < 0.05$). Among family factors, 'day-care mainly at home' and 'oldest child' were the most important. All information factors proved to be nonsignificant. Of the conceptual factors, only 'importance of genetic factors' was statistically significant. For the healthy group 26% of the variance was explained by all variables. 'Mother's age', 'importance of genetic factors', and 'oldest child' were statistically significant. For the diseased group all variables were nonsignificant. Explanatory values were negligible. The important conclusions were that very few of traditionally conceived social variables seem to influence 4-year-old children's sugar behavior. Parents of children with caries appear to be a heterogeneous group with an irrational behavior. □ *Behavior; caries; information; social factors; sugary products*

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A classical question is why some people, more or less consciously, behave in a manner that can lead to development of disease or otherwise unfortunate events (1). Typical examples of unsuitable behavior are smoking, overconsumption of foods, and high frequencies of snacks, sweet products in particular. Does this depend on lack of knowledge, wrong attitudes, negligence, social and/or cultural factors? Is it related to quality of life in the sense that people are prepared to pay the price of their health to be satisfied in an easily achievable manner? The lack of clear-cut answers may have to do with different frames of reference for different situations. An individual with insufficient oral hygiene is not necessarily the one crossing the street against the red light. A complex of different categories of variables contribute to a specific behavior, among them attitudes. Consideration of attitudes is important for understanding why people behave the way they do (2). Attitudes consist of cognitive, affective, and intentional components, which all contain a complex of qualities (3).

The cognitive component includes what is believed or known about a certain phenomenon. The knowledge can be correct or incorrect, relevant or irrelevant, scarce or abundant. The affective component describes whether the individual is positive or negative relative to an object or phenomenon. The individual can even be totally neutral and have no feelings at all. The intentional component deals with readiness of action—that is, what one's intentions are and what one intends to change. The intention to change behavior is, however, not the same as realized behavioral change. A change of behavior is dependent on even more social factors than the attitudinal component. The realized behavior is the result of interactions between attitudes, personal valuations, social norms, and valuations in society (4).

Several social variables have been shown to relate to different types of behavior. The following are some examples: high social class is related to quitting smoking in both sexes and to increased intake of vegetables in women (5); parents' socioeconomic group is related to preschool children's food habits and oral hygiene measures (6); adolescents' and adults' interrelated sociocultural demographics are related to dietary behavior (7); schoolchildren's social class, good health, positive life satisfaction, positive school assimilation, and positive health behavior are related to healthy diet (8); British university students' beliefs about the importance of behaviors for health (but not awareness of the role of behaviors in disease) is related to occur-

rence or frequency of the behaviors (9); and schoolchildren's dietary knowledge, health attitudes, and ethnicity are related to dietary behavior (10). It is obvious that dietary behavior attracts a great deal of interest because of its complexity and assumed importance for good health. It is also a matter of current interest in dentistry (11). A more profound approach might, however, be beneficial.

Another issue is therefore how disease, such as dental caries, is related to social factors. In the late sixties preschool children of parents with low educational level had more caries (6). Koch & Martinsson (12) came to the same conclusion in studies of teenagers, but Martinsson (13) found also that the socioeconomic background of the parents was of less importance for the frequency of snacks. It might be that the school-based preventive regimen, including information on dental health care, had reduced the importance of socioeconomic background in this group of children or that other cultural factors, such as the eating habits of the family, were not included in the study. The importance of internal group pressure should not be underestimated. Anyhow, the results illustrate the complex interrelation among social background, behavior, and disease.

Friis-Hasché (14) found, in an extensive study of schoolchildren's health conditions in Denmark, that caries experience was statistically significantly related to the mother's education and socioeconomic group. In addition, the mother's attitudes towards dental care and sweets were of importance, and this applied independently of the social factors. Faresjö et al. (15) found that the effect of prophylactic regimens was greatly influenced by whether the individuals had favorable or unfavorable social prerequisites. Granath Kinnby et al. (16) found also that parents of healthy preschool children had a statistically significantly higher education than parents of children with caries. The level of education, however, did not seem to influence the knowledge as such but rather the ability to put the knowledge into practice. There seems to be a clear distinction between attitudes and actual behavior. The results could be interpreted such that preschool children of mothers with more external locus of control beliefs, lower income, more knowledge of tooth decay and higher stress levels are at greater risk (17). The conclusion is that more research is desirable, not least with regard to how information is given and perceived.

Information on dental health care has long been given at child health centers (CHC) and public dental service clinics (PDS) in Sweden. Köhler & Holst (6) showed that children whose parents had received information in 1967–68 at CHC, starting when the children were 2 years old, had statistically significantly less caries as 4-year-olds than children whose parents had not been counseled. Similar results have been reported for the same period by Forsman (18) and Holm (19). Since then, considerably more health information has been available through different media. Moreover, parents' own oral health conditions have improved over the years, perhaps making them less aware of risks (20). At the same time, however, their level of knowledge is certainly higher than before. This calls for further consideration.

On the above basis, the aim of the present study was to analyze the steering effects of certain social factors on the sugary products behavior of 4-year-old children whose parents in most cases had received information on dental health care at CHC, with due respect to the level of caries among the children.

Materials and methods

Subjects

The study group comprised the same 177 children and their parents as in a previous investigation (16). Information on dental health care at CHC was evaluated with regard to differences in educational level, attitudes, and knowledge among parents of preschool children with different caries experience. The study was performed in 1983, the year the children had their fifth birthday. In conjunction with the telephone interview, the parents were asked to fill in a slightly modified version of a diet history form in accordance with Holm & Samuelsson (21), which was sent to them by mail; 167 answers were returned shortly afterwards, in some cases after a reminder.

The subjects belonged to two groups, called 'healthy' (83 children) and 'diseased' (84 children). As 4-year-olds the healthy children had no cavities or dental restorations; the diseased children had at least three treated approximal and/or occlusal surfaces in primary second molars.

Table 1. Sugary products included in calculation of intake pattern scores of 167 4-year-old children, used as regressand in multiple regression analyses with social factors as regressors

Fruits and berries	Sweetened cereals
Juice	Fruit purée
Buns and rusks	Granulated sugar
Biscuits and cookies	Raisins
Sweetened soups	Ice cream
Marmalade and jam	Coffee and tea with sugar
Cold drinks, carbonated beverages, and iced lollies	Chocolate drink
Catsup and mustard	Sweets

The products were given scores reflecting the frequency of intake (22); once a month, ¼; twice a month, ½; once a week, 1; two to three times a week, 3; once a day, 7; two to three times a day, 14; and four times a day, 21. Included as unsuitable but not high-sucrose intake was also consumption of berries, fruit, and juice more than once a day and ice cream more than once a week. The total sum of scores was calculated for each child and divided by seven to give the average number of unsuitable consumptions per day.

Table 2. Dichotomization of explanatory social factors in multiple regression analyses of intake pattern of sugary products on 15 social variables in 167 children; *n* within parentheses and missing values in italics; all data relate to the time when the children were 4 years old

1. Social background factors		
A. Mother's education	High school: yes (72)/no (86)	*9*
B. Mother's age	≥ 38 years (21)/< 38 years (145)	*1*
C. Father's education	High school: yes (77)/no (75)	*15*
D. Father's age	≥ 43 years (18)/< 43 years (145)	*4*
2. Family factors		
E. Siblings	Yes (143)/no (24)	
F. Oldest child	Yes (74)/no (92)	*1*
G. Native language	Swedish: yes (145)/no (22)	
H. Day-care mainly at home	Yes (87)/no (80)	
I. Frequency of visits to the dentist (the parent)	> Once a year: yes (63)/no (104)	
3. Information factors		
J. Number of occasions of information	≥ 2 (72)/0–1 (95)	
K. Kind of information	Both oral and written (108)/one type or none (59)	
L. Information about food suitable for children's teeth	Yes (59)/no (88)	*20*
4. Conceptual factors		
M. Causes of caries	Food: yes (57)/no (110)	
N. Importance of food for children's teeth	Very important: yes (89)/no (74)	*4*
O. Importance of genetic factors for teeth	Very important: yes (30)/no (126)	*11*

Sugary products behavior

In the present study only such intakes were considered as are known to be unsuitable from a cariologic point of view. Details are presented in Table 1.

Social factors

The social factors and their codings are listed in Table 2. The factors were grouped into 1) social background factors (A–D); 2) family factors (E–I); 3) information factors (J–L); and 4) conceptual factors (M–O). Only a few data were missing with regard to parents' education (5.4% for mothers and 9.0% for fathers), information concerning knowledge about food suitable for children's teeth (12.0%), and importance of genetic factors for children's teeth (6.6%). Originally, however, more data were missing about the parents' education. For these families a renewed contact in 1994 concerning education in 1983 resulted in complementary data in 44 cases for the mothers and 37 cases for the fathers.

Dental health care at CHC

In Malmöhus County, information on dental health care was given in 1983 by dentists (50%), dental hygienists (10%), and dental assistants (40%). The objective was to give advice on eating habits, oral hygiene, and fluorides, to give instructions on oral hygiene, and to identify those at risk of caries for referral to dental clinics (23). This program was offered to the parents at their visits to CHC when the children were 6, 18, and, sometimes, 30 months of age.

Statistical methods

The dichotomization of the social factors was based either on logical grounds or on a search for the most discriminating cut-off point (most significant outcome of a Mann–Whitney test) with regard to sugary products scores.

By means of multiple regression analysis, explanatory values (R^2 adjusted for the number of explanatory variables) of the social variables for dietary behavior were estimated. Coefficients with a p value at the 5% level were considered statistically significant.

Calculations were made both for the total material and for the subgroups of healthy and diseased children. For the total material, all 15 explanatory variables were included in the first model. Then, the least contributing factor or group of factors was excluded stepwise, to end up with a final group of statistically significant factors. This technique makes as many individuals as possible participate in the final analysis. Adoption of the traditional stepwise multiple regression analysis would have caused only individuals without missing data for any of the 15 variables to be included.

For the groups of healthy and diseased children, the same procedure was applied, although in fewer steps.

Results

Table 3 shows the mean values of sugary products scores per day in the total material and in the subgroups for different levels of mother's education. Children of mothers with university education had slightly higher

Table 3. Mean values of sugary products scores in 4-year-old children ($n = 167$) on the basis of mother's education and children's dental health; for calculation of scores, see Table 1; number of individuals within parentheses

	Education				
Group	University (U)	High school (H)	Grade school (G)	U + H	H + G
Total					
3.6	3.7	3.4	3.6	3.5	3.5
(158)	(19)	(53)	(86)	(72)	(139)
Healthy*					
2.9	3.2	2.7	3.0	2.9	2.9
(82)	(12)	(33)	(37)	(45)	(70)
Diseased†					
4.3	4.6	4.4	4.2	4.6	4.2
(76)	(7)	(20)	(49)	(27)	(69)

* No cavities or dental restorations.
† At least three treated approximal and/or occlusal surfaces in primary second molars.

scores than the others. Healthy children of mothers with just grade school education had somewhat higher scores than those of mothers with at most high school education, whereas the reverse situation prevailed for diseased children. The biggest difference in sugary products behavior was between healthy and diseased children, the latter group having between 40% and 60% higher scores.

In general, among the social background factors, parents' age appeared to be much more explanatory than parents' education. Among family factors, 'day-care mainly at home' and 'oldest child' were far more important than the other factors; they were not as good as parents' age but better than education. All three information factors proved to be nonsignificant. In the fourth group, conceptual factors, only 'importance of genetic factors for teeth' had a high explanatory power, very close to the age factors.

In Table 4 detailed results of the multiple regression analyses for the total material are presented with the variables in order of importance (p values). It should be borne in mind that a change in p value from one regression to the next depends both on the number of individuals and on the number of explanatory variables. The 15 variables together could explain 12.9% of the variation in the scores. The highest explanatory value was obtained after exclusion of the variables 'siblings', 'kind of information', and 'frequency of visits to the dentist' (15.6%), but several statistically not significant variables contributed to the value. The final regression (no. 12) contained three statistically significant variables: 'mother's age', 'father's age', and 'importance of genetic factors for teeth'. Higher age of the father and belief in genetic factors were risk factors. The complexity of interaction mechanisms is illustrated in regressions 7–9. When either father's or mother's education was excluded, the p value of the remaining factor increased considerably. All variables relating to the information on dental health care had p values above 0.5.

Table 5 shows the corresponding data for the subgroups of healthy and diseased children. The 15 variables explained 26.4% of the variation in scores for the healthy children, whereas there was no explanation at all for the diseased children. Three statistically significant variables remained after the exclusion procedures for the healthy children: 'mother's age', 'importance of genetic factors for teeth', and 'oldest child'. Belief in genetic factors was still a risk factor. In the diseased group 'mother's age' was the most important variable. However, when 'father's age' was excluded, the p value for 'mother's age' increased considerably, which illustrates the interaction between these two variables.

Discussion

The main result of this study was that only a few of generally accepted social variables could explain the variation in the sugar behavior among the 4-year-old children at a statistically significant level—that is, the social background factors parents' age and the conceptual factor 'importance of genetic factors for teeth'. Higher age of the mother was favorable, whereas higher age of the father and strong belief in genetics were negative factors. It was remarkable that neither the family factors nor the information factors turned out to be statistically significant. 'Oldest child' was significant in regressions 1–9 and 'day-care mainly at home' in regressions 2, 6, 7, and 9. It should, however, be noted that these factors contributed substantially to the total explanatory value as long as they were included. The parents' educational level contributed also when both variables were included, owing to the interaction between them.

The results further showed that diseased children, independent of mother's education, had considerably higher sugary products scores than healthy children, which was expected (6). But the interesting result was that the 15 variables gave an explanatory value for the healthy children that was twice as high as that for the total material, whereas the variables could not explain any variation at all for the diseased children. The explanatory value of the final statistically significant three variables for healthy children was again about twice the corresponding figure for the total group. Two of the variables were the same.

In the group of diseased children the explanatory value was zero when all variables were included, compared with 26% in the healthy group. It might be that other factors than those in this study govern the sugar behavior of the diseased, or that there are no discriminatory factors at all due to irrational behavior. The data confirm results from other health areas (24).

Table 4. Results of multiple regression analyses of sugary products scores on 15 social variables (A–O) for 4-year-old children ($n = 167$); for definitions see Tables 1 and 2. n = number of individuals; b = beta-coefficient; negative coefficients indicate that belonging to the left coding of the dichotomized variables in Table 2 entails a risk; R^2 = adjusted explanatory value in percentage

		Regressions											
Regressor	No. = n =	1 109	2 109	3 122	4 122	5 122	6 122	7 123	8 124	9 144	10 152	11 152	12 152
B	b	11.3	11.3	11.8	11.9	11.9	12.0	12.4	12.2	11.4	10.8	9.91	9.84
	p	0.015	0.013	0.007	0.006	0.005	0.005	0.004	0.005	0.001	0.001	0.003	0.003
D	b	−7.67	−7.47	−9.08	−9.15	−9.07	−9.09	−9.23	−9.39	−9.02	−8.74	−9.18	−8.64
	p	0.11	0.098	0.032	0.028	0.029	0.029	0.025	0.025	0.017	0.013	0.009	0.015
O	b	−4.62	−4.58	−6.70	−6.72	−6.71	−6.55	−6.81	−6.58	−5.77	−5.17	−5.81	−5.76
	p	0.15	0.14	0.023	0.022	0.022	0.024	0.018	0.023	0.031	0.044	0.023	0.025
H	b	−5.15	−5.19	−4.77	−4.77	−4.57	−4.75	−4.87	−3.75	−4.42	−3.81	−3.63	
	p	0.053	0.046	0.054	0.053	0.061	0.049	0.040	0.11	0.038	0.061	0.075	
F	b	8.25	8.04	5.98	5.98	6.27	6.41	6.46	5.17	4.68	3.37		
	p	0.006	0.003	0.019	0.018	0.012	0.010	0.009	0.030	0.034	0.11		
C	b	−4.80	−4.89	−3.58	−3.69	−3.74	−3.61	−3.90	−2.44				
	p	0.12	0.10	0.20	0.17	0.16	0.18	0.14	0.29				
A	b	6.01	6.07	4.10	4.15	3.83	4.12	3.94		1.99			
	p	0.072	0.056	0.16	0.15	0.17	0.14	0.15		0.36			
N	b	3.85	3.85	1.88	1.92	2.19	2.15						
	p	0.16	0.14	0.44	0.42	0.36	0.36						
J	b	−0.90	−0.91	−1.59	−1.58	−1.56							
	p	0.72	0.71	0.51	0.51	0.51							
M	b	−1.24	−1.20	−1.73	−1.72								
	p	0.68	0.67	0.51	0.51								
G	b	−2.32	−2.35	−0.63									
	p	0.62	0.60	0.88									
L	b	0.47	0.47										
	p	0.72	0.72										
E	b	0.81											
	p	0.83											
K	b	−0.62											
	p	0.83											
I	b	0.35											
	p	0.90											
R^2		12.9	15.6	13.8	14.5	14.9	15.4	15.4	13.5	11.7	10.3	9.3	8.0

In our study there was just a small advantage in having the combination of an older mother and a younger father, as was also the case for the total group.

Of the three conceptual factors, the only statistically significant one was 'importance of genetic factors'. There is obviously a risk that those who believe in genetic factors get high sugary products scores because they might think that eating habits do not matter.

The negligible contribution of the information factors, for two of which also the positive fraction was a risk factor, calls for particular attention. Information should be essential in providing people with *knowledge* and having them understand the importance of the particular message as basis for developing *correct attitudes* leading to *desirable behavior*, with regard to the individual's personal capability and living conditions. It seems necessary to make people aware of the information's importance rather than merely teaching facts. The counseling staff should try to ascertain what factors lie behind a certain negative behavior of the recipient. It is also a matter of finding out where in the behavioral chain the break occurs. This is facilitated by a two-way communication in which the recipient of the information becomes convinced about the importance of his participation for solving his particular problems.

It could therefore be questioned whether the staff at CHC had a relevant education for counseling such a heterogeneous group as parents in general. Counseling staff in dentistry seem to rank satisfactory dietary habits higher than sufficient oral hygiene and use of fluorides for occurrence of caries in young children but tend to have a somewhat defeatist opinion about the possibilities of implementing good behavior (20). It could also be questioned whether the information was correctly designed for parents at the time of the study; many certainly had limited, if any, experience of caries

Table 5. Results of multiple regression analyses of sugary products scores on 15 social variables (A–O) for 83 healthy and 84 diseased 4-year-old children; for definitions see Tables 1 and 2. n = number of individuals; b = beta-coefficient; negative coefficients indicate that belonging to the left coding of the dichotomized variables in Table 2 entails a risk; R^2 = adjusted explanatory value in percentage

		Regressions					
		Healthy			Diseased		
Regressor	n =	61	77	77	48	82	82
B	b	11.0	7.14	6.72	10.8	12.6	6.55
	p	0.007	0.018	0.025	0.30	0.068	0.18
D	b	−3.47			−6.84	−7.45	
	p	0.57			0.44	0.20	
O	b	−7.59	−7.44	−7.22	−6.79		
	p	0.008	0.004	0.005	0.35		
H	b	−5.61	−2.65		−6.24		
	p	0.026	0.19		0.30		
F	b	7.84	4.22	4.13	0.58		
	p	0.004	0.043	0.049	0.94		
C	b	0.19			1.08		
	p	0.94			0.90		
A	b	3.90			6.28		
	p	0.20			0.44		
N	b	1.93			5.02		
	p	0.42			0.39		
J	b	−0.15			−2.74		
	p	0.95			0.57		
M	b	−1.38			2.10		
	p	0.66			0.71		
G	b	−9.81			−2.42		
	p	0.18			0.75		
L	b	0.81			−0.59		
	p	0.50			0.83		
E	b	2.19			−5.94		
	p	0.54			0.45		
K	b	−2.77			−5.21		
	p	0.40			0.37		
I	b	−2.26			−2.88		
	p	0.40			0.60		
R^2		26.4	16.3	15.5	0.0	1.7	1.0

and other problems with teeth, which is interesting from a sociologic point of view. The timing of the information is also important. Should the first information be given very early before a negative behavior is established—that is, during pregnancy? Blinkhorn (25) postulated that the dental profession has a naïve and rather insular approach to patient education, which too often is unplanned, haphazard, and not relevant to a particular patient and also difficult to understand.

Interest and receptivity are of great importance for the perception of information. Social background factors and family factors influence receptivity. Age and educational level of the parents are important social background factors. The age of the mother and that of the father were in fact the most significant factors in this study. With regard to education, it was positive to have both a mother and a father with an education higher than grade school, but, strangely enough, the highest sugary products scores were in the group with university-educated mothers. Despite this, the diseased group had the highest sugary products scores at all educational levels. One explanation could be that mothers with university education and an active professional life do not have time to be strict about eating habits. Perhaps they compensate by applying other good habits, such as sufficient oral hygiene. Unfortunately, despite optimal knowledge, barriers exist that prevent alterations of dietary behavior (26).

Among the family factors, two variables were statistically significant: 'oldest child' and 'day-care mainly at home'. It proved to be an advantage to be the oldest child, which includes being the only child. Most likely this is because the parents have been able to spend more time with the first and/or only child and therefore are

more receptive to information. These children are also free from possible negative influence from older siblings. When the second or further children come, the parents may not be that receptive because they think they already are capable of taking care of their children's teeth. It was, however, a risk to spend the day mainly at home, a result that is difficult to interpret. It is possible that collective schedules and routines contribute to a positive behavior.

It is evident that parents with a high educational level are more prone to perceive information from various sources. As a consequence, the information gap between those who cannot absorb information due to initially little knowledge and those with initially rich knowledge becomes wider.

The important conclusions of the present study are that very few of traditionally conceived social variables seem to influence 4-year-old children's sugar behavior and that parents of children with high caries activity comprise a heterogeneous group from an information point of view. First of all, we must know which variables have the most pronounced steering effect on the behavior of diseased individuals. Only under such conditions is it possible to develop and refine the information process for this parental group. Unfortunately, the group might be characterized by a complex of behaviors so irrational that its components are not distinguishable. This might help to explain why individualized prevention of dental disease has never proved cost-efficient (27). Behavioral contracting (28) could perhaps be used as a tool in this connection.

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