

# Determinants of fruit and vegetable consumption in primary schoolchildren

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## Summary

As a rule, children of primary school age eat less fruit and vegetables than German scientific societies recommend. Not all strategies for increasing the fruit and vegetable consumption are successful. To develop and plan effective school interventions, it is necessary to know about essential determinants of fruit and vegetable consumption.

In order to identify such determinants, a survey of 1,376 children (mean age nine years) was conducted in primary and special education schools in Lower Saxony. The pupils and their parents were queried using a questionnaire. The actual intake was documented using the validated food frequency questionnaire «What does your child eat?» of the Robert-Koch-Institute.

The results show that children whose parents offer them fruit and vegetables daily and who take fruit and vegetables with them to school eat significantly more of these than children for whom these are not available. The short-term school intervention to improve the knowledge of children about the health benefits of a diet rich in fruit and vegetables did not result in increased consumption of these foods.

Consequently, we can conclude that the availability and accessibility of fruit and vegetables has a decisive influence on consumption. Interventions that bring about a more frequent offering of fruit and vegetables at home, in the breakfast box or at school appear promising.

**Keywords:** fruit, vegetables, consumption, nutritional knowledge, children, nutritional behaviour

## Introduction

Current data from the KiGGS and EsKiMo studies [1–3] show that most children in Germany eat less than the amount of fruit and vegetables, which are recommended by the *Forschungsinstitut für Kinderernährung* (FKE; Research

Institute of Child Nutrition). In order to attain effective interventions in schools to increase fruit and vegetable consumption we must consider the basic conditions influencing the eating behaviour of children.

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## Nutritional behaviour in childhood

A variety of personal, social and environmental factors such as availability, influence the nutritional behaviour of children [4, 5].

◆ Table 1 gives an overview of predictors of daily fruit and vegetable consumption.

Determinants that have a particularly significant influence upon fruit and vegetable intake are taste preferences, availability and accessibility at home and in the living environment, parental fruit and vegetable consumption (modelling), knowledge about the recommended amounts for intake, portion sizes and meal structure, in addition to demographic aspects, such as age, sex and socio-economic status [6–9].

The promotion of healthy eating is particularly important during childhood and adolescence, as the basis for subsequent nutritional behaviour formed in this early phase of life [9, 10]. Food habits established in childhood often persist throughout a person's whole life [7]. In addition, there is a close relation between parents and children regarding the acceptance of foods, knowledge, preferences, consumption and the willingness to try new foods [7].

Preferences for certain foods are determined, for example, by the frequency with which these are offered to children; that is, whether they are „accustomed“ („mere exposure effect“) [7, 9, 11]. Particularly mothers still play a very important role in nutritional education. They cook the

Personal factors	Social environmental factors	Physical availability of F + V
Knowledge	Modelling (parents, grandparents and friends)	Availability at home
Attitudes	Active encouragement for consumption by the parents	Availability at school
Taste preferences	Family rules, request for consumption	Availability with friends
Preference of foods	Consent (e.g. to determine the amount independently)	
Self-efficacy	Parents' skills of preparing	
Perceived obstacles (hunger, time of day)	Given fruit and vegetables in school	

Table 1: Factors influencing fruit and vegetable intake of children [5]  
F = fruit; V = vegetables

dishes and serve the variety of fruit and vegetables, which they prefer themselves and thus pass on their preferred tastes, as well as their dislikes and general habits [9].

Children whose parents exhibit a healthy nutritional behaviour and offer a varied range of fruit and vegetables demonstrate greater consumption of these foods. Furthermore, an increased willingness to experiment with new, unknown food is observed [7–9].

### (Primary) school setting

Besides the parents, other persons (grandparents, siblings, friends) [7], as well as educational institutions (day care centres, schools) and environmental factors like television/advertising, influence the eating behaviour of children. In recent years, particularly educational institutions increasingly contribute to the nutritional education of children. The growing importance of the breakfast break, but above all with the upgrading of full-time schools and care centres with increased midday provisions, have enhanced the influence of these institutions on children's nutritional education [12]. Especially schools are suited for conveying nutrition-oriented contents and actions, because – due to the obligation to attend school – chil-

dren from all social backgrounds were reached, the pupils spend a lot of time in school, and take at least one meal there [13, 14]. By way of the children, nutrition education interventions can in turn inform the parents [15]. The number of health-promoting programmes of external institutions (e.g. „Class 2000“, aid nutrition certificate, actions of the country women's association etc.) implemented as instruction in schools is growing.

Since 2002, the Cancer Society of Lower Saxony offers the project „5 a day for kids“. The aim of the three-hour intervention is to increase the fruit and vegetable consumption of third and fourth graders in Lower Saxony.

### Basic question

This survey addresses the question of the relationship between the availability of fruit and vegetables at home, taking these foods to school, and the actual consumption in Lower Saxony. Furthermore, the effects of the knowledge regarding to the health benefits of fruit and vegetables and the recommendations for intake imparted in the project „5 a day for kids“ will be analysed in relation to the actual fruit and vegetable consumption. These findings will

serve to improve the effectiveness of the concept of „5 a day for kids“ and other knowledge-based interventions for enhancing fruit and vegetable intake.

### Method

Within the scope of the project evaluation, 69 classes with a total of 1,376 pupils, their parents, and 69 teachers took part in the survey. The majority of these classes (65) belonged to primary schools with third and fourth graders. Four classes of level five to seven belonged to special education schools. The mean age of the children was  $9.0 \pm 0.9$  years. 51 % of the study population were females.

### Questionnaire

For the collection of data, three different instruments were used: parent and pupil questionnaire, together with a food frequency questionnaire for documenting the food intake of the children.

The parent questionnaire documented socio-demographic data, such as the household size, parents' country of birth, nationality, school education, and professional training. In addition, the parents were asked whether they

### The project «5 a day for kids»

Project offered by the Cancer Society of Lower Saxony since August 2002

**Aim:** Increasing fruit and vegetable consumption and improving eating habits in general

**Target group:** Third and fourth graders of primary schools in Lower Saxony

**Duration:** Three hours of instruction

**Content:** 1. Theoretical unit: Imparting knowledge about vitamins, phytochemicals, dietary fibre and portion size  
2. Product knowledge unit: in the supermarket  
3. Practical unit: preparation of a cold meal

make fruit, vegetables and fruit juice available daily, whether the offering of fruit and vegetables varies, and whether they give their children fruit and/or vegetables to bring to school. The parents were given the questionnaire before their children took part in the project „5 a day for kids“.

With the pupils' questionnaire, in addition to the socio-demographic data, information about age, size and weight was obtained. Furthermore, the children were asked for their knowledge on the subject of fruit and vegetables. The pupils' questionnaire was distributed after the intervention.

The eating behaviour of the schoolchildren was queried using the food frequency questionnaire (FFQ) „What does your child eat?“ of the Robert-Koch-Institute, which was applied in the KiGGS survey of children and adolescents, at three points in time: before (baseline), one month (Follow-up 1) and three months (Follow-up 2) after intervention.

1,376 children and their parents were given the questionnaire „What does your child eat?“. 930 FFQs were returned filled out before the intervention. At the time of Follow-up 1, 669 questionnaires were passed back and at the time of Follow-up 2, 545 FFQs.

The response rates were therefore 68 %, 49 % and 40 %. For 450 schoolchildren, all FFQs for the three points in time were returned. For 407 pupils taking part, all five questionnaires (parent and pupil questionnaire, three FFQs) were returned completely.

#### Data evaluation

The data was analysed using the SPSS Statistics Software (Version 20.0). The *Kolmogorov-Smirnov* Test was used to test the normal distribution. Differences between the groups were tested for statistical significance with the *Mann-Whitney U-Test* for continuous variables. The relationships between the dependent and independent variables were described by binary logistical regression analysis, performed with the SPSS Statistics Software (Version 21.0). A significance level of  $p \leq 0.05$  was assumed for all analyses.

#### Results

A significant increase in fruit and vegetable consumption in the course of measurements with the FFQs over the period of three months could not be demonstrated.

For the follow-on analysis, data from the FFQs were taken, which documented the food intake of the

pupils before the intervention. In this way, important predictors influencing the fruit and vegetable intake of children were determined. The differences in the consumption of fruit, vegetables and juice and their overall amount between children whose parents made these readily available and who take fruit and vegetables to school and those who were not offered these foods are made clear in ♦ Table 2. Children for whom fruit and vegetables are available ate significantly and relevantly more of these.

Furthermore the relationship between the daily consumption of at least one portion of fruit or vegetable (according to the FFQ) and the factors:

- „knowledge“ of the children (personal factor, querying of schoolchildren following the intervention)
- physical availability of fruit and vegetables at home (parent questionnaire before the intervention) and
- „bringing to school“ (social environmental factor, parent questionnaire before the intervention) was analysed (♦ Table 3).

Statistically significant results were found relating to the physical availability (fruit and vegetables at home) and the factor „bringing to school“.

In addition, the correlation between the consumption of at least one portion of fruit or vegetable and factors such as the emigration background of the parents, value of nutrition for the children and existing food allergies were examined. No significant correlations were found here (data not shown).

#### Discussion

The results of the present investigation show that, in particular, social factors and especially the availability play an important role for the fruit and vegetable consumption of children. The daily

	Fruit at home		p <sup>a</sup>	Vegetables at home		p <sup>a</sup>	Fruit/vegetables in school		p <sup>a</sup>
	Yes n = 765	No n = 60		Yes n = 674	No n = 149		Yes n = 597	No n = 230	
Fruit <sup>1</sup> , g/day	261 ± 233	86 ± 109	***	263 ± 237	183 ± 187	***	286 ± 237	150 ± 181	***
Vegetables <sup>2</sup> , g/day	151 ± 125	100 ± 106	***	161 ± 128	82 ± 79	***	160 ± 124	116 ± 119	***
Fruit juice <sup>3</sup> , g/day	273 ± 363	105 ± 162	***	265 ± 354	240 ± 356	ns	277 ± 366	220 ± 323	***
Total amount Fruit/vegetables/ juice, g/day	686 ± 486	291 ± 222	***	689 ± 484	506 ± 448	***	722 ± 488	487 ± 425	***

<sup>1</sup> Fresh fruit, cooked fruit and tinned fruit

<sup>2</sup> Cooked vegetables, deep-frozen vegetables, tinned vegetables, green salad, uncooked vegetarian food and uncooked vegetables

<sup>3</sup> Fruit juice, fruit nectar and vegetable juice (also diluted)

All values are mean values ± standard deviation

ns = not significant

\* p ≤ 0,05

\*\* p ≤ 0,01

\*\*\* p ≤ 0,001

<sup>a</sup> Calculated with the Mann-Whitney-U-Test

Table 2: Fruit, vegetable and juice intake in g/day in relation to the offering at home and in school

Personal and environmental factors	minimum 1 portion fruit daily OR (98 % CI)	minimum 1 portion vegetable daily OR (98 % CI)
Children's knowledge	0.76 (0.35–1.65)	0.99 (0.50–1.95)
„Given in school“	<u>4.15</u> (2.70–6.36)	<u>1.70</u> (1.13–2.55)
Fruit at home	6.99 (2.91–16.76)	1.82 (0.81–4.06)
Vegetables at home	<u>1.69</u> (1.00–2.86)	<u>3.01</u> (1.78–5.09)

Table 3: Relationship between daily fruit/vegetable intake and influencing factors

Odds ratio and confidence interval of a binary logistic regression analysis, n = 706

OR = odds ratio; CI = confidence interval  
significant OR values are underlined

offering of fruit and vegetables at home as well as in terms of breakfast at school represents a decisive determinant for encouraging children to consume these foods.

In addition, results of other studies indicate that not only the general availability of these foods in the living environment, but also the form in which they are served, is important. When fruit or vegetables are ready to eat, for example cut into small pieces or in the form of sticks, children consume greater amounts [17].

Furthermore, there are indications that the cognitive conveyance of information about the health benefits of fruit and vegetables and the corresponding recommendations for their consumption are also associated positively with consumption [17]. However, the results of the present study could not confirm this correlation. The knowledge-based intervention „5 a day for kids“ could not initiate a change in behaviour.

The implementation of structural prevention measures, such as

(cost-free) school fruit programmes, is also viewed as a promising predictor for promoting fruit and vegetable consumption in schoolchildren. The present investigation illustrated that pupils whose parents give them fruit and vegetables for school breaks in fact also consume more of these foods. The institutional provision of fruit and/or vegetables has shown significant (sustained) effects in other European countries [18–20]. In Germany, up to now only seven federal states have taken part in

the EU school fruit programme. The obligatory evaluation for the school year 2010–2011 showed an increase in fruit and vegetable intake in nearly all participating federal states. Nevertheless, in this connection it must be mentioned that the data on consumption were frequently based upon estimates of parents or teachers [21]. In spite of this methodological problem, extending the institutional offering of fruit and vegetables appears to be a meaningful measure for increasing the intake of these foods.

Based on the obvious finding that parents have very considerable influence on the food habits of their children – including their fruit and vegetable consumption – interventions in schools should involve parents in a participatory manner during formulating their concepts.

### Limitations

In order to describe and determine the correlations between fruit and vegetable consumption and influencing factors more specifically, it would have been necessary to formulate the questions of the parent questionnaire more in detail, for example which fruit and vegetable varieties are available at home, how these are made available to children, and whether these are offered “ready-to-eat”. In addition, data on the food intake of parents could be included in the parent questionnaire in order to allow analysis of the relevant correlations.

The focal point of the evaluation was the documentation of the short-term and medium-term effects of the project „5 a day for kids“ on actual consumption. Consequently, the survey instrument FFQ was the focus of attention. For the parents, repeatedly filling out this form required considerable effort. The low response rate is an indication that the parents were unable or unwilling to take the time required to answer the ques-

tions of the survey sheet. Further, more extensive, and more detailed questionnaires would therefore probably have resulted in a still lower response rate.

Beyond that, the results lead us to assume that a certain selection effect is present, and primarily those parents with particular interest in healthy nutrition of their children filled out all survey instruments. This is reflected in the high fruit-vegetable intake of the children. In addition, the role of social desirability as a reason for the significantly higher mean fruit and vegetable consumption compared with the KiGGS and EsKiMo studies cannot be excluded.

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### Conflict of Interest

The authors declare no conflict of interest according to the guidelines of the International Committee of Medical Journal Editors.

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