



Assessment of Adolescent Food Habits in Switzerland

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Several physical, psychological and behavioural changes may affect food habits during adolescence and have long-term consequences on adult health status. Also, as food habits are related to lifestyle and physical activity, all should be assessed together. This paper describes a self-administered food frequency questionnaire (FFQ) designed to assess semi-quantitatively food habits of adolescents, and evaluates its use in a study of lifestyle and physical activity.

A FFQ was developed, tested in 20 adolescents and compared with a modified version of the diet history method (a combination of a 3-day dietary record and an interview with a dietitian). This validated semi-quantitative questionnaire was later included in a larger questionnaire on lifestyle and physical activity in a study of 3540 adolescents aged 9–19 years. In the validation study with 20 adolescents, the FFQ showed a good agreement with the modified version of the diet history. During the survey several consumption frequencies were found to be low. In the group of adolescents aged 14–19 years old, dairy products were consumed daily by less than 50% of the sample. About 53% girls but only 33% boys consumed one fruit daily. For one vegetable portion, these proportions were 17 and 8%, respectively.

The self-administered food frequency questionnaire correctly describes food consumption in adolescents. Moreover, it was well accepted by the target group, easily understood and completed with very few problems. The results show that a significant proportion of adolescents didn't consume milk, fruit and vegetable on a daily basis.

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INTRODUCTION

Adolescence is accompanied with major physical, psychological and behavioural changes that may affect an individual all life long. Physical activity and fitness are positive factors for health maintenance of the adolescent and the future adult (Baranowski, 1992; Rowland, 1994). Nutritional needs are high during adolescence; they are not very precisely known, they are a combination of requirements for growth and activity. Diet undergoes several modifications in a changing environment: increase in food consumed away from home, peer influence, changes in activity

The authors wish to thank M. Gyger and C. Hum for their collaboration in the development of the food frequency questionnaire.

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pattern. Snacking and breakfast skipping are frequent in adolescents (Cavadini, 1996). We need to know their food habits in order to give dietary advice, at the individual or population level. Several techniques (Bingham, 1987; Cameron *et al.*, 1988; Debry, 1980; Decarli, 1994; Willet, 1990) have been used for the evaluation of food habits and food intake: interview, questionnaire, 24-h recall, duplicate portion analysis, diet history, consumption frequency, food diary, food weighing, video recording or photography, etc. All these techniques have their shortcomings: several are often difficult to implement, time consuming and inaccurate.

The objective of this paper is first, to describe the development of a self-administered food frequency questionnaire for the semi-quantitative evaluation of food consumption of adolescents. This food frequency questionnaire is then compared with a modified version of the diet history method: a combination of a 3-day dietary record and an interview with a dietitian. The use of this self-administered food frequency questionnaire within a study of adolescent physical activity and fitness and life-styles is presented. Lastly, the paper shows consumption frequencies of different food groups and drinks recorded with the questionnaire.

DEVELOPMENT OF THE FOOD FREQUENCY QUESTIONNAIRE

Methods

A self-administered food frequency questionnaire focuses on the evaluation of the frequency of consumption of a limited group of foods and drinks on either a daily, weekly or monthly basis. It must be easily understandable and does not allow for a quantitative analysis of food consumption. There is no "gold standard" method to validate a dietary survey, as different methods might be better suited in different situations (Bolton-Smith *et al.*, 1991; Crawford *et al.*, 1994; Fox *et al.*, 1990; Horwath, 1993; Treiber *et al.*, 1990). The aim of the validation was to test if consumption frequencies obtained with the self-administered food frequency questionnaire were comparable with those obtained by a more detailed, complete method: a modified version of the diet history method (Cameron *et al.*, 1988). This latter consisted of a 3-day food record combined with a checklist of food.

The test was done in a group of 20 adolescents (11 girls, 9 boys) aged 16–19 years. It included 19 food groups as described in Appendix 1 and required about 15 min to be completed. At least 1 week after filling up the questionnaire, the subjects were asked to record a food diary during three consecutive days (2 week days and 1 weekend day). Based on this diary, a dietitian interviewed each subject during 1 h to record the diet history of the previous month using a checklist of food. Size of food portions was measured by weight or estimated with household units, consumption frequencies were measured and all foods were coded. Consumption of foods, food groups and nutrients were calculated.

Statistics were done using non-parametric tests. Spearman rank-order correlation coefficients for each food group were calculated between the food frequency questionnaire and the modified diet history. Wilcoxon signed ranks test was used to test differences in evaluation of frequencies between the two methods. Pearson chi-square test was used to test differences in consumption frequencies between gender.

Results

Table 1 shows the mean consumption frequencies of 19 different food groups obtained with the food frequency questionnaire and with the dietary history, and the correlations and *p*-values between the two methods for the 19 food groups.

Using the modified diet history as a reference method, most of mean frequencies of consumption obtained with the questionnaire were comparable with no clear trend in either under- or overconsumption. The Spearman correlation coefficients were significant or almost significant for the majority of food items (see Table 1).

For meat products like ham and delicatessen, hamburgers, hot-dogs and for pizzas, fruits and fruit juices, the mean frequencies of consumption were higher with the food frequency questionnaire than with the modified diet history. In the case of hamburger, hot-dog and pizza the discrepancy might be explained by the fact that, for calculation, these foods were broken down in subcategories, bread, meat, etc. The questionnaire seemed to overestimate consumption of all kinds of drinks, except alcoholic beverages. The overestimation of drink consumption with the food frequency questionnaire might be related to a poor evaluation of portion sizes, as the tested version of the questionnaire included no specific question on food or drink portion size. This is the reason why a portion size was assigned to each food in the final version of the questionnaire. On the other hand, the mean frequencies of consumption for confectionery, pastry, cakes, chocolate and candies were underestimated by the food frequency questionnaire. There is no obvious explanation for this observation. One might speculate that these food items were consumed at special events, i.e. a birthday party or eaten at various daily occasions apart from meals and that these events were better identified by the diary and the interview than by the questionnaire. Another explanation might be in relation with the social desirability that led the adolescents to minimize their consumption of "indulgent food" in the questionnaire while the dietitian again better assessed this during the frank interview.

STUDY OF ADOLESCENT PHYSICAL ACTIVITY, FITNESS AND FOOD HABITS

The Institute for Social and Preventive Medicine of the University of Lausanne conducted this research project on behalf of the Service of Sports and Physical Education of the Swiss Canton of Vaud, and the Federal Sports School of Macolin (Switzerland). The main objectives were to measure physical fitness of adolescents aged 9–19 years in the Swiss Canton of Vaud, to standardize physical fitness tests to facilitate future inter-country comparisons and to study relationships between physical activity, food habits, health and lifestyle. Three kinds of variables were recorded: anthropometric measures, fitness as assessed by a battery of tests and finally self-reported data including sport and physical activities, health status and lifestyles, including food habits. All questions related to nutrition and food habits were handled in collaboration with the Nestlé Research Center. A sub-group (7%) of that sample participated in an in-depth investigation including a record of physical activity by means of a pedometer, a biological evaluation as well as a detailed dietary survey. This part of the study is not described in this paper. The ethics committee of the University of Lausanne has accepted the project.

TABLE 1
Weekly mean consumption frequencies obtained with the food frequency questionnaire (FFQ) and the modified diet history (MDH), and Spearman correlation coefficients between the two methods

| | FFQ (N=20) | | MDH (N=20) | | Range | FFQ vs. MDH | |
|--------------------------------|------------|------|------------|-----|-----------|-------------|--------|
| | Mean | SD | Mean | SD | | r | p |
| Milk (all kinds) | 6.0 | 6.4 | 5.8 | 4.6 | (0-21) | 0.599 | 0.009 |
| Yoghurt, dessert | 6.5 | 5.7 | 5.9 | 3.2 | (0.2-22) | 0.283 | 0.218 |
| Cheese | 4.3 | 2.5 | 5.4 | 4.7 | (0.1-7) | 0.464 | 0.043 |
| Bread (all kinds) | 8.2 | 4.3 | 9.2 | 4.1 | (0.1-15) | 0.243 | 0.290 |
| Ready-to-eat cereals | 3.9 | 6.0 | 3.3 | 3.9 | (0-21) | 0.910 | <0.001 |
| Rice and pasta | 3.8 | 2.5 | 3.2 | 1.4 | 0.1-8) | 0.460 | 0.045 |
| Meat (all kinds) | 4.5 | 3.2 | 6.8 | 2.7 | (0.1-9) | 0.378 | 0.099 |
| Ham, delicatessen, ... | 4.9 | 3.5 | 2.3 | 1.2 | (0.1-9.9) | 0.265 | 0.247 |
| Fish | 1.8 | 1.9 | 1.7 | 0.7 | (0-6) | 0.739 | 0.001 |
| Eggs | 1.1 | 1.5 | 0.9 | 0.8 | (0-4) | 0.754 | 0.001 |
| Legumes | 0.8 | 1.7 | 0.6 | 0.8 | (0-7) | 0.704 | 0.002 |
| Fruits and fruit juices | 19.8 | 14.3 | 10.0 | 6.6 | (0.2-49) | 0.710 | 0.002 |
| Vegetables and salads | 10.5 | 5.8 | 12.1 | 4.8 | (0.1-22) | 0.720 | 0.002 |
| Pastries, cakes, biscuits, ... | 2.5 | 3.4 | 4.7 | 4.6 | (0-14) | 0.426 | 0.064 |
| Salty snacks | 1.3 | 1.6 | 0.9 | 1.7 | (0-4) | -0.004 | 0.985 |
| Hamburger, Hot-dog, pizza | 3.1 | 2.7 | 0.5 | 0.4 | (0-8) | 0.429 | 0.062 |
| Chocolate, candy | 5.2 | 5.4 | 10.0 | 6.4 | (0-22) | 0.670 | 0.004 |
| Soft drinks and syrup | 20.2 | 9.0 | 11.1 | 7.8 | (5-43) | -0.234 | 0.308 |
| Beer, Wine, ... | 1.0 | 1.6 | 2.4 | 2.4 | (0-4) | 0.279 | 0.224 |

Sample Description

A self-administered questionnaire was distributed to 3540 adolescents (girls: $N=1778$, boys: $N=1762$) during school courses. The sample selection was made by random choice of classes among a selection of schools from various locations and socio-economical backgrounds. The sample included pupils aged 9–19, and was divided in three groups: grade 4 and 6 (mean age 11 years, range: 9–13 years); grade 8 (mean age 14 years, range: 12–16 years); grade 10 and 11 (mean age 17 years, range: 14–19 years).

Self-administered Questionnaire

The questionnaires were completed anonymously at school during a 1-h session. The different topics addressed included physical and sports activity, leisure time activities, health status and problems, food consumption (with the food frequency questionnaire previously described) and meal pattern. The time needed to fill the whole questionnaire was 40 min. Approximately 10 min were necessary to answer questions related to food habits.

Three different sets of questions pertaining to food habits were elaborated. For the youngest participants (grades 4 and 6), we limited the number of food groups to 13: milk, yoghurt, cheese, bread, pasta, meat, vegetables, fruits, fruit juices, water, soft drinks, tea and chocolate. To simplify data collection and to obtain simpler, but more reliable data, we asked only three frequencies of consumption: never, sometimes and often. In the questionnaire targeting the middle-age group (grade 8), we used 19 food groups by dividing meat into beef and poultry, and by adding rice, fish, hamburger, pizza and coffee to the previous list. Again, we asked only three frequencies of consumption: never, sometimes and often. In the questionnaire targeting the oldest age group (grades 10 and 11) we split some food groups in order to have a more detailed list of 36 food groups. More detailed information was collected on bread, meat, potatoes, fruits and drinks as described in Appendix 2. More emphasis was also put on the evaluation of food with low consumption frequency by adding a frequency of consumption per month and by simplifying the record of daily consumption frequency. Finally, in order to obtain a semi-quantitative information, an estimation of portion size for each item was introduced.

Results—Consumption Frequencies

Table 2 shows the consumption frequencies of the major food groups and drinks. The frequencies illustrated for girls and boys are those corresponding to the answer “often” in the two younger age groups and the answers “1–3 times/week” and “1 time/day or more” in the older age group.

In the younger age groups (grades 4–8), consumption frequency of yoghurt, bread and pasta and chocolate is higher in boys than in girls. On the contrary, consumption frequency of vegetable is higher in girls, whereas that of fruit and plain water is higher only in girls of grade 8.

In the older age group, bread and plain water show the highest daily frequency of consumption in girls and boys (more than 75% adolescents). Milk, soft drinks and fruits are consumed daily by slightly less than 50% of adolescents. Significant proportions of adolescents consume cooked vegetables, salad and fruits at a frequency

TABLE 2
Percentage girls and boys consuming different food groups and drinks at different frequency levels

| Food consumed | Grades 4 & 6 767/710 | Grade 8 378/376 | Grades 10 & 11 622/661 | |
|--------------------------------|----------------------------|-----------------------|------------------------------|----------------------------|
| | Often (%) | Often (%) | 1–3 × /week (%) | 1 × /day or more (%) |
| 1 cup of milk | 66·2/67·1 | 70·6/72·9 | 16·4/16·3 | 41·5/51·9*** |
| 1 pot of yoghurt | 41·7/55·6*** | 43·6/57·4*** | 28·8/29·0 | 32·7/29·6 |
| 1 slice of bread | 51·8/83·9*** | 70·7/81·4*** | 9·5/7·1 | 70·7/79·4*** |
| 1 croissant | na. | na. | 27·7/29·8 | 4·7/10·4 |
| 1 bowl Ready to Eat cereals | na. | na. | 25·1/24·2 | 28·9/29·1 |
| 1 bowl of rice | na. | na. | 56·4/49·8 | 1·6/2·0 |
| 1 bowl of pasta | 55·4/71·2*** | 52·7/69·1*** | 65·9/59·5*** | 1·6/3·9 |
| 1 slice of steak | na. | na. | 46·8/58·2*** | 1·2/2·1 |
| 1 slice of chicken | na. | na. | 52·1/52·0 | 0·7/1·1 |
| 1 sausage | na. | na. | 15·8/31·3*** | 0·5/0·5 |
| 1 piece of fish | na. | na. | 42·9/46·1 | 0·6/0·6 |
| 1 hamburger | na. | na. | 9·8/22·4*** | 0·2/0·8 |
| 1 hot-dog | na. | na. | 5·3/11·3*** | 0·2/0·6 |
| 1 pizza | na. | na. | 19·6/36·5*** | 0·3/1·0 |
| 1 portion of french-fries | na. | na. | 15·0/29·5*** | 0·2/0·6 |
| 1 portion of potatoes | na. | na. | 57·2/59·5 | 0·8/1·2 |
| 1 port. of cooked vegetables | 64·4/59·5°* | 85·4/69·4°*** | 38·6/50·2*** | 17·0/8·0*** |
| 1 bowl of salad | na. | na. | 23·6/32·1*** | 37·7/24·8*** |
| 1 fruit | 64·5/60·3 | 78·3/67·6*** | 21·1/26·3* | 52·8/33·4*** |
| 1 glass of fruit juice | 44·5/46·7 | 62·4/55·1 | 23·8/23·9 | 41·5/35·2* |
| 1 glass of plain water | 69·9/69·7 | 81·0/72·3** | 4·5/9·1** | 88·0/74·9*** |
| 1 glass of diet soft drink | na. | na. | 10·9/14·4 | 41·3/32·1*** |
| 1 glass of regular soft drink | na. | na. | 24·3/16·2 | 35·2/55·5*** |
| 1 glass of sports drink | na. | na. | 3·1/13·3*** | 0·9/4·2 |
| 1 glass of alcoholic drink | na. | na. | 27·5/36·5*** | 1·4/4·0 |
| 1 cup of tea | 51·5/49·6 | 58·2/55·1 | 25·7/17·5*** | 29·1/16·2*** |
| 1 cup of coffee | na. | na. | 15·1/15·1 | 17·4/17·3 |
| 1 biscuit, 1 slice of cake | na. | na. | 44·4/43·4 | 20·3/16·5 |
| 1 bowl of crisps, salty snacks | na. | na. | 23·0/34·2*** | 2·9/4·0 |
| 1 chocolate bar | 27·2/32·7** | 34·7/45·2** | 37·3/38·3 | 14·5/16·3 |
| 1 ice cream | na. | na. | 20·4/32·5*** | 1·8/2·5 |

% girls/% boys; °: including potatoes; na.: not asked.

Gender comparison (Pearson chi-square): * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

of 4–6 times per week, 25, 30 and 20% of girls and boys, respectively. Frequency of consumption at the level of one to three times per week is higher in boys than in girls for several meat items, for pizza, french-fries, salty snacks, alcoholic drinks and ice cream. Daily consumption frequency of milk, bread and regular soft drinks is higher in boys, while that of vegetable, salad, fruits, fruit juice, water, diet soft drinks and tea is higher in girls.

DISCUSSION

The development of the self-administered food frequency questionnaire described in this article was necessary for the following reasons. A tool was needed in French. The age of the target population was very heterogeneous precluding the use of one single instrument. The information was asked to each adolescent, without help of any family member. Finally, the evaluation of food habits was only a part of a larger survey focused on physical activity and fitness and we had no means to use a more time consuming method like a dietary record, which has often been the case in studies of food habits of adolescents (Rigaud *et al.*, 1997; Roma-Giannikou *et al.*, 1997).

The development of the self-administered food frequency questionnaire and its validation shows that it is possible to obtain a reliable estimation of food habits of adolescents. Some food items or drinks were slightly under- or overestimated by the questionnaire, when compared with a modified diet history. In order to reduce as much as possible these biases and to obtain a semi-quantitative information, a portion size for each item was added in the final questionnaire used in the survey.

This food frequency questionnaire requires little time and is easy to apply. Moreover, its inclusion within a large survey shows that it is a convenient instrument, well accepted across different age groups during adolescence. Three different versions of the instrument were designed, with different levels of difficulty and accuracy for three age groups, in order to take into account the different levels of food or cooking awareness of preadolescents and adolescents. One must keep in mind that the information collected with such a food frequency questionnaire gives us a reliable estimation of food consumption frequency at the level of the group but not at the level of the individual. To obtain such information, more time consuming methods are needed like a dietary record during several days in combination or not with an interview by a dietitian.

The use of these questionnaires, within a larger survey focused on the assessment of the relationships between physical fitness, physical and sports activity, food habits, health and lifestyles gave us a good evaluation of food consumption frequencies among Swiss adolescents. Less than half of the adolescents consume dairy products daily, which means that 50% of adolescents might be at risk for low calcium intake. Bread is the food showing the highest consumption frequency, especially among boys. Nevertheless, the global daily consumption frequency of bread, cereals, rice and pasta is below recommendations (USDA, 1995). Water and soft drinks are the more frequently consumed beverages: girls more frequently consume water, while boys more frequently consume regular soft drinks. Girls consume meat items less frequently and fruits and vegetables more frequently. All these observations confirm results from a previous study in the German speaking part of Switzerland (Cavadini, 1996; Narring, 1994). Our results are comparable to adolescent food habits observed in other European countries where low milk, fruit and vegetable consumption was observed: i.e. in Spain (Péres-Llamas, 1996), in Sweden (Samuelson, 1996) and in the U.K. (Watt & Sheilhan, 1996). They are also comparable to results from the U.S.A. where percentages of children and adolescents that do not meet nutritional recommendations for food groups like fruit, vegetables and cereals are high (Munoz, 1997). In our study, the percentages of daily consumption frequencies are low for several food groups, especially in the older age group for fruits and vegetables. These observations point out to the need to promote healthy food habits in preadolescents and adolescents.

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Received 23 April 1998

APPENDIX 2: FOOD FREQUENCY QUESTIONNAIRE AS APPLIED FOR THE OLDEST AGE GROUP (GRADE 10–12)

Q40 Do you usually eat the following food? (1 answer per line!)

| Portion or food | Never | 1–2 times /month | 1–3 times /week | 4–6 times /week | Once /day | Twice or more /day |
|--------------------------------|-------|------------------------|-----------------------|-----------------------|--------------|--------------------------|
| 1 cup of milk | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 pot of yoghurt | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 pot of cream | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 piece of cheese | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 slice of bread | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 slice of rusk | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 croissant | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 bowl ready to eat cereals | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 bowl of rice | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 bowl of pasta | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 slice of steak | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 slice of chicken | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 sausage | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 piece of fish | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 egg | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 portion of peas or beans | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 hamburger | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 hot-dog | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 pizza | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 portion of french-fries | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 portion of potatoes | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 port. of cooked vegetables | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 bowl of salad | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 fruit | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of fruit juice | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of plain water | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of diet soft drink | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of regular soft drink | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of sports drink | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 glass of alcoholic drink | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 cup of tea | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 cup of coffee | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 biscuit, 1 slice of cake | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 bowl of crisps, salty snacks | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 chocolate bar | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 ice cream | 1 | 2 | 3 | 4 | 5 | 6 |