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Article *in* European Journal of Clinical Nutrition · August 2002

DOI: 10.1038/sj.ejcn.1601371 · Source: PubMed

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The Adolescent Food Habits Checklist: reliability and validity of a measure of healthy eating behaviour in adolescents

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Objective: Amid concerns about the quality of young people's diets, this paper describes the development of a measure of healthy eating behaviour for use with adolescents.
Design: Items for the measure were selected from a larger pool on the basis of responses from a pilot study. The 23-item checklist was validated using measures of dietary fat and fibre intake, fruit and vegetable consumption, dietary restraint, nutrition knowledge and a measure of family income.
Setting: Participants came from seven secondary schools in the north-west of England.
Subjects: A total of 1822 adolescents aged between 13 and 16 y took part in the study, representing 84% of those invited to participate.
Results: Correlations between measures indicate a good level of convergent validity, and the checklist is also shown to have high internal and test–retest reliability.
Conclusions: The focus on choices available to adolescents means that the checklist will provide a useful addition to food frequency-type approaches to the measurement of adolescent eating behaviour.
Sponsorship: This research was funded by the Medical Research Council and the Economic and Social Research Council's Health Variations Programme.
European Journal of Clinical Nutrition (2002) **56,** 644–649. doi:10.1038/sj.ejcn.1601371

Keywords: food habits; adolescence; psychometrics; diet

Introduction

The eating behaviour of young people has come increasingly under the spotlight in recent years amid claims that many adolescents in Western countries have a poor diet (Anderson *et al*, 1994; Neumark-Sztainer *et al*, 1998; Cavadini *et al*, 2000). Particular areas of concern have included high levels of dietary fat (Crawley, 1993) and a low fruit and vegetable intake (Hurson & Corish, 1997; Prescott-Clarke & Primatesta, 1998). In the light of these concerns there has been an interest in novel approaches to measurement of the diet and eating behaviour of young people. Most instruments focus on nutrient intake, which has been measured using various methods of dietary recall, dietary records and food frequency questionnaires (Crawley & While, 1996; Milligan *et al*, 1998; Samuelson *et al*, 1996; Devaney *et al*, 1995). These approaches have been shown to have reasonable levels of validity and reliability (Sjoden *et al*, 1986; Hann *et al*, 2001) and may provide appropriate methods for the examination of outcomes related to the effects of dietary intake or to studies of the nutritional status of young people. However, where the research interest is in food-related behaviours and attitudes, and predicting or influencing levels of involvement in healthy eating practices, then an approach more linked to patterns of behaviour may be fruitful.

Variation in young people's dietary intake is likely to reflect foods available and the values and circumstances of parents, school and peers, as much as the adolescents' own motivations (Adams, 1997; Feunekes *et al*, 1998; Lytle *et al*,

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Contributors: **The study was conceived and designed by all the contributors. Data were collected by FJ and JG. Interpretation of the results, statistical analyses and writing of the paper was carried out by FJ and JW. All the contributors commented on and approved the final draft.**
Received 8 May 2001; revised 24 October 2001; accepted 29 October 2001

1996). Nonetheless, there are many opportunities for young people to make personal food choices, which makes it important to examine the more voluntary aspects of healthy eating. Most adolescents are economically active, at least to the extent of having the resources to buy snacks, and they consume snack foods more frequently than adults (Anderson *et al*, 1993). Some adolescents will be involved in the purchase and preparation of food at home, and many will choose their own meals at school. Adolescents can also refuse food offered to them. Looking at patterns of eating behaviour in situations in which young people are likely to be able to make personal choices may provide a useful complement to assessing dietary intake.

There have been a number of approaches to the measurement of healthy eating from a behavioural rather than a simply nutritional perspective. Some studies have focused on measuring a small number of specific 'healthy' or 'unhealthy' practices such as snacking or eating breakfast (Steptoe & Wardle, 1999; Monneuse *et al*, 1997; Speed *et al*, 1998; Wardle *et al*, 2000a). These measures have not, however, attempted to assess a broad range of food habits, or the balance between healthy and unhealthy practices in an individual's eating patterns, but have tended to be more concerned with the covariance of a small number of food habits with other behaviours. Kristal *et al* (1990) developed a more comprehensive adult measure of fat-related healthy habits, which was later expanded to incorporate fibre-related items (Shannon *et al*, 1997). This scale asks questions about modification of foods so as to lower their fat content, avoidance of high-fat foods, substitution of low-fat alternative foods, and selection of fruit, vegetables and other high-fibre foods. Although the scale has the advantage of focusing on food choices in relation to specific situations, its orientation towards North American foodstuffs and inclusion of items relating to the purchase and preparation of food, limits its value with British adolescents. Another fat avoidance scale designed for use with a Mexican-American population (Knapp *et al*, 1988) presents similar obstacles for use with British young people.

The scale presented here, the Adolescent Food Habits Checklist (AFHC), aims to provide a measure of adolescent healthy eating behaviour with reference to those situations in which young people are likely to have a degree of personal control. It addresses areas in which adolescents may be able to affect how closely their diets conform to guidelines on healthy eating, with reference to the avoidance of specific energy-dense foods, selection of low-fat alternatives, consumption of fruit and vegetables and snacking behaviour. In order to assess the convergent validity of the AFHC, a number of hypotheses were generated with regard to the associations between AFHC score and scores on other related measures. It was predicted that girls would score more highly on the AFHC than boys, since young women are known to involve themselves in healthy eating to a greater degree than young men (Anderson *et al*, 1994; Prescott-Clarke & Primatesta, 1998). Many of the items of the AFHC refer to low-fat eating behaviours, and so a strong, negative correlation was expected between dietary fat intake and AFHC score. Similarly, the relationship between AFHC score and daily fruit and vegetable intake was hypothesised to be strongly positive. Items on the checklist are relevant to dietary fibre intake through questions on fruit and vegetable consumption, and so a positive but weaker correlation was also predicted between dietary fibre and AFHC score. A positive correlation with family affluence was also predicted, as social class and income have both been associated with healthier eating practices (Margetts *et al*, 1998; Johansson *et al*, 1999). Furthermore the major role played by healthy eating in weight control (Nichter *et al*, 1995) meant that AFHC was hypothesised to be positively associated with dietary restraint. Finally, nutrition knowledge has been linked with a more healthy diet in some studies (Wardle *et al*, 2000b), and such an association was predicted here.

Method

Participants

Participants for this study were 1822 adolescents, aged between 13 and 16 (mean age 14 y 5 months) participating in a larger study of health and weight related behaviour in adolescents in the north-west of England, which received ethical approval from the Joint UCL/UCLH Committee on the Ethics of Human Research. Girls' and mixed-sex schools in Wirral and West Cheshire were classified for levels of social deprivation (high, intermediate and low) according to the number of pupils eligible to receive free school meals. A stratified sample of seven schools was selected, incorporating at least one girls' and one mixed school from each of the three levels. All pupils in school years 9 and 10 at the seven schools were invited to participate, and the sample was 68% female. Data were collected during class sessions by researchers who visited the school, and usable data were obtained from 84% of pupils enrolled in the eligible year groups at the seven participating schools. Missing data were predominantly because of absence from class on the day of the survey (15%). Less than 2% of those eligible refused to participate or were withdrawn by parents.

Materials

Adolescent Food Habits Checklist

Item selection. Items were selected for the AFHC on the basis of findings from a pilot study carried out with 178 adolescent girls attending an independent girls' school in the north-west of England (mean age 15 y 10 months). A preliminary pool of 70 items for the AFHC were generated with reference to existing literature, and dietary health recommendations and in discussion with health psychologists and nutritionists. Participants were asked to reply 'true' or 'false' or 'not applicable to me' with regard to whether they usually followed specific dietary practices. These practices included the purchase, preparation and consumption of specific

foods, as well as snacking habits. Items referred to both healthy and unhealthy behaviours. Participants were also asked to add any other things that they regularly did in order to make their diet more healthy.

Analysis of pilot data. Responses to the pilot questionnaire were analysed first using factor analysis with varimax rotation in order to establish whether there was a multidimensional structure underlying the patterning of food habits. Results from this analysis suggested a weak factor structure. A five-factor solution accounted for just 32% of the variance, and intercorrelations between factors were high. Internal reliability for the item pool as a whole was good (Cronbach's $\alpha = 0.91$). In light of the weakness of the factors, and other evidence that healthy eating patterns often do not form stable, replicable factors (Birkett & Boulet, 1995; Prewitt *et al*, 1997), items for the final scale were selected according to other criteria. It was decided to limit the scale to items pertaining to intake of fruit, vegetables and energy-dense foods. Items with a low item-total correlation ($r < 0.20$) and those which made reference to situations likely to be unfamiliar to adolescents were omitted from the scale. Four items referring to general aims to eat a diet that is low in fat, low in sugar, high in fruit and vegetables and healthy were retained. No items were added in response to comments from the pilot sample as no widely used practices emerged from these comments. This resulted in a 23-item scale, which had an internal reliability of Cronbach's $\alpha = 0.83$ in the pilot sample. The 23 items of the AFHC are shown in Appendix 1. A true/false response format was selected to make the checklist easier to complete. Ten items also had an alternative response, equivalent to 'not applicable'. Participants received one point for each 'healthy' response. The final score was adjusted for 'not applicable' and missing responses using the formula: AFHC score = no of 'healthy' responses × (23/no. of items completed).

Test–retest reliability. The test–retest reliability of the 23-item AFHC was examined using a sample of 24 adolescents aged between 13 and 14 y (mean age 13 y 8 months). Participants completed the AFHC twice, with a delay of 2 weeks between the two completions. The correlation between score at T1 and score at T2 was very high ($r = 0.90$ $P < 0.001$).

Dietary fat and fibre intake
Levels of dietary fat and fibre intake were measured using a version of the Dietary Instrument for Nutrition Education (DINE; Roe *et al*, 1994). This food frequency questionnaire was slightly modified for self-report use with adolescents.

Daily intake of fruit and vegetables
Participants were asked how many portions of fruit (fresh, frozen or tinned) they ate in a usual day, and how many portions of vegetables (fresh, frozen or tinned, not including potatoes) they ate in a usual day. Responses to these two questions were summed to provide a score for daily intake of fruit and vegetables. This assessed proximity to the minimum five portions of fruit and vegetables a day recommended for a healthy diet (World Health Organization, 1990).

Dietary restraint
A shortened, five-item version of the restraint subscale of the Dutch Eating Behaviour Questionnaire (DEBQ; Van Strien *et al*, 1986) was included. The scale was abbreviated on the basis of factor loadings reported by the authors and others (Van Strien *et al*, 1986; Wardle, 1987).

Nutrition Knowledge
Nutrition knowledge was measured using an adapted version of the Nutrition Knowledge Questionnaire (Parmenter & Wardle, 1999). This questionnaire examines knowledge of dietary guidelines, fat content of common foods and diet–disease relationships.

Household affluence
Participants responded to four items, asking about housing tenure, eligibility to receive free school meals, and family ownership of one or more cars and a computer. This scale has been found to correlate significantly with the Townsend area level indicator of deprivation (Townsend *et al*, 1988; Wardle *et al*, in press).

A number of demographic questions were included in order to characterise the participants in the study. These included sex, age, ethnicity and whether individuals had been trying to gain or lose weight in the past 12 months.

Results

Characteristics of the sample are indicated in Table 1. Over 90% of participants were white, and around one-third came from low-income families as indicated by their eligibility to receive free school meals. Girls were, on average one month older than boys in the sample ($F(1, 1787) = 7.7$, $P < 0.01$). The most striking difference between boys and girls in the sample was in the numbers attempting to change their body size in the past 6 months (χ^2(d.f. = 2) = 173.3, $P < 0.001$). Girls were more than twice as likely as boys to be trying to reduce their body size (55 *vs* 22%), whilst almost four times as many boys as girls were trying to increase their body size (8 *vs* 2%).

Internal reliability of the AFHC in the main study was high (Cronbach's $\alpha = 0.82$), and similar to that found in the pilot sample. Data were analysed separately for boys and girls (Table 2). Significant sex differences emerged for all the variables except family affluence ($F(1, 1796) = 3.0$, NS). Girls reported more healthy habits than boys ($F(1, 1821) = 92.3$, $P < 0.001$). They also had lower levels of dietary fat ($F(1, 1812) = 164.6$, $P < 0.001$) and fibre ($F(1,$

1811) = 49.0, $P < 0.001$), and consumed more fruit and vegetables ($F(1, 1818) = 10.1$, $P < 0.01$). Higher levels of dietary restraint ($F(1, 1812) = 218.8$, $P < 0.001$) and nutrition knowledge ($F(1, 1590) = 9.5$, $P < 0.01$) were also associated with being female.

To examine convergent validity, correlations between AFHC and the other variables were calculated (Table 3). As predicted, among both boys and girls a strong negative correlation was observed between AFHC score and levels of dietary fat. Similarly, daily fruit and vegetable intake and AFHC score was strongly associated for both sexes. The correlation with dietary fibre was less strong but still highly significant and in the predicted direction for girls and boys. Dietary restraint was positively associated with healthy habits, and those participants who had a higher level of knowledge about dietary health and nutrition engaged in more healthy practices. AFHC score was also associated with affluence, such that adolescents from more affluent families reported more healthy eating behaviours.

Table 3 Correlations between AFHC and validation measures

	Girls (n = *1246*)	*Boys* (n = *576*)	*Total* (n = *1822*)
Fruit and vegetable intake	0.44	0.45	0.45
DINE — dietary fat	− 0.41	− 0.46	− 0.46
DINE — dietary fibre	0.18	0.24	0.16
DEBQ — dietary restraint	0.39	0.43	0.43
Nutrition knowledge questionnaire	0.14	0.18	0.17
Family affluence	0.16	0.13	0.14

All correlations significant at $P < 0.001$.

Table 1 Sample characteristics

	Girls (n = *1246*)	*Boys* (n = *576*)	*Significance of gender differences*
Age (s.d.)	14 y 5 months (6.9 months)	14 y 4 months (7.7 months)	$F(1, 1787) = 7.7$, $P < 0.01$
Ethnicity			
White	1149 (92.1%)	517 (89.8%)	$\chi^2[1] = 0.03$, NS
Non-white	85 (6.8%)	59 (6.4%)	
Missing	14 (1.1%)	22 (3.8%)	
Deprivation			
Eligible for free school meals	393 (32.0%)	184 (33.1%)	$\chi^2[1] = 0.21$, NS
School type			
Single sex	636 (51.0%)	—	N/A
Mixed sex	612 (49.0%)	576 (100%)	
Trying to change body weight			
Lose weight	688 (55.2%)	129 (22.4%)	$\chi^2[2] = 173.3$, $P < 0.001$
Gain weight	27 (2.2%)	48 (8.3%)	
Stay the same/do nothing	512 (41.1%)	364 (63.2%)	
Missing	19 (1.5%)	33 (5.7%)	

Table 2 Scores for each measure divided by gender

	Girls (n = *1246*)	*Boys* (n = *576*)	*Total* (n = *1822*)	*Significance of gender differences*
Adolescent Food Habits Checklist				
Mean	11.7	9.4	11.0	$F(1, 1821) = 92.3$, $P < 0.001$
(s.d.)	(4.7)	(5.0)	(4.9)	
Fruit and vegetable intake (servings per day)				
Mean	3.9	3.5	3.8	$F(1, 1818) = 10.1$, $P < 0.01$
(s.d.)	(2.2)	(2.3)	(2.3)	
DINE — dietary fat score				
Mean	27.1	34.2	29.4	$F(1, 1812) = 164.6$, $P < 0.001$
(s.d.)	(9.7)	(12.9)	(11.3)	
DINE — dietary fibre score				
Mean	26.4	29.6	27.4	$F(1, 1811) = 49.0$, $P < 0.001$
(s.d.)	(8.8)	(9.8)	(9.3)	
DEBQ — dietary restraint				
Mean	12.0	8.4	10.9	$F(1, 1812) = 218.8$, $P < 0.001$
(s.d.)	(5.2)	(3.9)	(5.1)	
Nutrition knowledge questionnaire				
Mean	12.0	11.5	11.8	$F(1, 1590) = 9.5$, $P < 0.01$
(s.d.)	(2.7)	(3.0)	(2.8)	
Family affluence				
Mean	3.5	3.6	3.5	$F(1, 1796) = 3.0$, NS
(s.d.)	(1.4)	(1.4)	(1.4)	

Several analyses were carried out in order to further investigate the source of gender differences in AFHC scores. To examine whether the inclusion of single-sex girls' schools, but not boys' schools, may be a factor in the observed gender differences, the effect of single sex education on girls' AFHC scores was examined. No significant effect of school type emerged ($t(1244) = 1.34$, NS). In order to examine the possibility that dietary restraint and nutrition knowledge might mediate gender differences, a stepwise multiple regression was carried out examining the relationship between gender and AFHC score whilst controlling for these two variables. Entering gender alone shows that it accounts for 4.8% of the variance in AFHC score. If dietary restraint and nutrition knowledge are entered first they account for 20.4% of the variance ($F(2, 1586) = 204.6$, $P < 0.001$). Entering gender at step two shows a significant but very small effect (additional variance = 0.6% $F(1, 1585) = 12.9$, $P < 0.00$). This indicates that dietary restraint and nutrition knowledge account for a large proportion of the sex differences in AFHC scores, but gender still makes a small independent contribution.

Discussion

The development of a measure of healthy eating habits designed specifically for use with adolescents is likely to be a useful complement to existing methods of dietary assessment. In contrast to other published measures of healthy eating behaviours the AFHC refers to food choice situations in which adolescents are likely to have a degree of personal control. Furthermore, the AFHC focuses specifically on areas of the adolescent diet which present cause for concern, particularly the consumption of energy dense foods and fruit and vegetable intake. Items were selected from a large pool generated by dietitians and health psychologists, and adolescents in the pilot group had the opportunity to contribute, which ensured items were relevant both to recommendations for a healthy diet and to the decision-making opportunities available to adolescents. The resulting instrument has a high level of internal and test–retest reliability.

All *a priori* predictions regarding associations of the checklist with other measures were supported at a high level of significance, indicating good convergent validity. High correlations between the AFHC and dietary fat and fruit and vegetable intake suggest that AFHC is successful in measuring an adequately representative sample of adolescent's healthy eating activities, with regard to behaviours linked to fat and fruit and vegetable consumption.

In common with the findings of other studies, greater involvement in healthy dietary habits was associated with being female. The link between dietary restraint and healthy eating appears to account for a high proportion of these gender differences, with the better nutrition knowledge of girls playing a further small role. Nonetheless, a weak relationship between gender and healthy habits remains even after controlling for both of these factors. One possibility is that girls' greater involvement in healthy eating is due in part to differences both in the value placed on health and beliefs about the importance of diet between males and females (Wardle *et al*, 1997).

The observed association between family affluence and healthy habits is consistent with the findings of others that social status and income predict healthier food attitudes and a better diet (Margetts *et al*, 1998; Johansson *et al*, 1999). Amongst adolescents this relationship may be mediated in part by snacking behaviour, since a disadvantaged home life has been linked to less regular meal patterns and a higher consumption of sweet and fatty snacks in US adolescents (Siega-Riz *et al*, 1998).

The AFHC should provide a useful tool for the examination of healthy eating behaviours in adolescents. In particular, the orientation of the AFHC towards situations in which adolescents are likely to have a degree of personal choice in their eating behaviour gives it an advantage over standard food-frequency-type questionnaires, which may be much influenced by social circumstances and the decision-making of others. The AFHC measures active investment on the part of the adolescent in their diet, and so may be of value in examining the underlying cognitions, attitudes and circumstances that lead to involvement in healthy eating.

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Appendix: The Adolescent Food Habits Checklist

1. If I am having lunch away from home, I often choose a low-fat option. *True/False/I never have lunch away from home*
2. I usually avoid eating fried foods. *True/False*
3. I usually eat a dessert or pudding if there is one available. *True/False*
4. I make sure I eat at least one serving of fruit a day. *True/False*
5. I try to keep my overall fat intake down. *True/False*
6. If I am buying crisps, I often choose a low-fat brand. *True/False/I never buy crisps*
7. I avoid eating lots of sausages and burgers. *True/False/I never eat sausages or burgers*
8. I often buy pastries or cakes. *True/False*
9. I try to keep my overall sugar intake down. *True/False*
10. I make sure I eat at least one serving of vegetables or salad a day. *True/False*
11. If I am having a dessert at home, I try to have something low in fat. *True/False/I don't eat desserts*
12. I rarely eat takeaway meals. *True/False*
13. I try to ensure I eat plenty of fruit and vegetables. *True/False*
14. I often eat sweet snacks between meals. *True/False*
15. I usually eat at least one serving of vegetables (excluding potatoes) or salad with my evening meal. *True/False*
16. When I am buying a soft drink, I usually choose a diet drink. *True/False/I never buy soft drinks*
17. When I put butter or margarine on bread, I usually spread it thinly. *True/False/I never have butter or margarine on bread*
18. If I have a packed lunch, I usually include some chocolate and/or biscuits. *True/False/I never have a packed lunch*
19. When I have a snack between meals, I often choose fruit. *True/False/I never eat snacks between meals*
20. If I am having a dessert or pudding in a restaurant, I usually choose the healthiest one. *True/False/I never have desserts in restaurants*
21. I often have cream on desserts. *True/False/I don't eat desserts*
22. I eat at least three servings of fruit most days. *True/False*
23. I generally try to have a healthy diet. *True/False*