Agreement between an online dietary assessment tool (myfood24) and interviewer-administered 24hour dietary recall in British adolescents aged 11-18 years old

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Abbreviations: interviewer-administered 24hour dietary recall (multiple-pass method (MPR)): interview (MPR)

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Abstract (250)

myfood24 is an online 24hour dietary assessment tool developed for use among British adolescents and adults. Limited information is available regarding the validity of using new technology in assessing nutritional intake among adolescents. Thus, a relative validation of myfood24 against a face-to-face interviewer-administered 24hour multiple-pass recall (MPR) was conducted among 75 British adolescents aged 11-18 years old. Participants were asked to complete myfood24 and an interviewer-administered MPR on the same day for two non-consecutive days at school. Total energy intake (EI) and nutrients recorded by the two methods were compared using intraclass correlation coefficients (ICC), Bland-Altman plots (using between and within-individual information) and weighted Kappa to assess the agreement. Energy, macronutrients and other reported nutrients from myfood24 demonstrated strong agreement with the interview MPR data and ICC ranged from 0.46 for sodium to 0.88 for EI. There was no significant bias between the two methods for EI, macronutrients and most reported nutrients. The mean difference between myfood24 and the interviewer-administered MPR for EI was -55 kcal (-230kJ) (95% CI: -117, 7 kcal, (-490 to 30 kJ); *P*=0.4) with limits of agreement ranging between 39% (-797kcal (3336kJ)) lower and 34% (687 kcal (2874kJ)) higher than the interviewer-administered MPR. There was good agreement in terms of classifying adolescents into tertiles of EI (κ_w=0.64). The agreement between day1 and day2 was as good for myfood24 as for the interviewer-administered MPR reflecting the reliability of myfood24. myfood24 has the potential to collect dietary data of comparable quality to that of an interviewer-administered MPR.

Introduction

Assessing nutritional status in large prospective epidemiological studies with the available traditional dietary assessment methods is challenging. Hence such studies require a large number of participants and repeated measures over a period of time to account for changes in diet and to adequately reflect usual long-term diet[1]. Adolescents are considered to be one of the most challenging age groups in terms of reporting dietary data [2, 3], as they are more likely to have unstructured eating habits, they tend to eat away from home more than adults and they find the methods used to report food intake difficult to complete [3]. As adolescents are often the most enthusiastic in terms of adopting new technology and using the internet [2], using a novel approach to assess the food intake of this age group through the use of technology may motivate and engage adolescents in measuring individuals' diet, for research or personal use [2, 4].

Using new technology for dietary assessment offers several possible advantages. For instance, it has the potential to improve data quality, it can help standardise the questions and questioning sequence, it makes the processing of data easy, it produces immediate results, and it increases privacy and confidentiality [5, 6, 7]. Recently, most technology based self-administered dietary assessment methods have been developed specifically for adults [8, 9, 10, 11, 12, 13], while a limited number have been designed for adolescents. For instance, the Food Intake Recording Software System version (FIRSSt4)[14], which is available now as ASA24-kids, was developed in the US for self-completion by children 10 year old and older. In Belgium, the Young Adolescents' Nutrition Assessment on computer (YANA-C) [15, 16] was developed for use among 11 to 14 year olds and a web-based version has been improved and adapted for use among young adolescents, namely the Children's and Adolescents' Nutrition Assessment and Advice on the Web (CANAA-W)[17]. In the UK, the Synchronized Nutrition and Activity Program (SNAP^{TM}) for self-completion by 7 to 15 year old children[18] provides similar information to the food frequency questionnaire, and the Interactive Portion Size Assessment System (IPSAS) has been adapted and extended for use among 11 to 24 year olds (INTAKE24). INTAKE24 is an online multiple pass 24hour dietary recall tool developed for use in the Scottish food and nutrition survey[19].

Recently, myfood24 (Measure Your Food On One Day) has been developed[20]. It is a UK online 24hour dietary assessment tool designed to address the need for a valid, reliable, low-burden and user-friendly dietary assessment method suitable for use amongst different age groups (adolescents and adults), with the aim of standardising the method used for the whole population. There is still limited knowledge regarding the accuracy of fully automated 24hour dietary recalls and more research is therefore required to investigate their validity, particularly among different age groups[6]. Thus, this study aims to assess the agreement between myfood24 and an interviewer-administered 24hour multiple-pass dietary recall (interview (MPR)) for use among British adolescents aged 11 to 18 years old.

Methodology

Sample size

A sample size calculation was based on mean and standard deviations of energy intakes (EI), of 1795 kcal (7511 kJ) (SD = 502kcal (2100kJ)), as reported by adolescents (11 to 18 years old) in the National Diet and Nutritional Survey (NDNS) 2008/2011[21]. Seventy participants were required to give 90% power to detect a 10% (200 kcal (837 kJ)) difference in mean EI reported by the two methods at a significance level of 0.05. This number would also provide an adequate precision for Bland-Altman limits of agreement test[22]. Allowing for 9% attrition, the aim was to recruit 77 participants. To ensure a representative sample of adolescents from each age group, an effort was made to balance the sample in terms of age and gender.

Recruitment criteria

All adolescents were recruited through two high schools; 30 participants were recruited from a high school in the centre of Leeds and 40 were recruited from a high school in the north-west of Leeds. The inclusion criteria were being adolescent aged 11 to 18 years old, being able to speak, read and write English. Exclusion criteria were having any limitation that could inhibit the adolescent's ability to recall their diet or use a computer. Having experience of using the internet or computers was not required. Pupils who were interested in taking part were given an information sheet and consent form. Written parental consent was also obtained if the participants were younger than 16 years old. Ethical approval for the study was granted by the University of Leeds (Ethics reference: MEEC 11-046(Phase 2)).

myfood24

myfood24 is an online self-administered 24hour dietary recall/record tool, that has been developed to help researchers collect multiple automated dietary data in large scale epidemiological studies. To reduce completion time of the food intake report, the myfood24 consortium chose not to pursue the detailed Automated Multiple Pass Method (AMPM). In myfood24, users are requested to go through as few webpages as possible to complete the food recall; pop-ups and prompts are limited. myfood24 has kept some aspects of the AMPM by including an optional make-list function as the first pass, a detailed food search, prompts for commonly forgotten foods and a final review before submission.

myfood24 has the advantage of being linked to an extensive (~50,000 items) branded electronic food composition database[23, 24]. myfood24 has food portion images which were obtained from the Young Person's Food Atlas[25]. myfood24 was developed with the flexibility to be used as either a food diary or to be self- or interviewer-administered as required. More detailed information about myfood24's design and features have been provided in published reports[26].

In this study, myfood24 was used as a self-administered 24hour dietary recall method; with free use of myfood24's features and functions (no instructions were given to adolescents about how to use myfood24,

only brief polite points were presented on the first webpage of myfood24 (project instructions)). We wanted to reflect how the tool could be used in the future, where individuals will receive an email to use the system by themselves, with no additional guidance available.

Reference method: interviewer-administered 24hour multiple-pass recall (MPR)

Face-to-face interviews were administered for the 24hour dietary recall with an identical time frame to myfood24 to ensure that participants completed myfood24 for the same day as the reference method. All interviewers were postgraduate nutritionist students and they received training, a standardised protocol and material to conduct the multiple pass method[27]. All participants were interviewed at school in a separate area. The Young Person's Food Atlas[25] was used to estimate food portion size in the interviews MPR. After collecting the 24hour dietary recalls, the interviewer reviewed the report once it was completed. Data generated from the interviews MPR were coded by one of three trained coders using myfood24 in order to have the same database available. Each coder received training and a standardised protocol for coding which was developed by the researchers to deal with missing or ambiguous data. This was to increase consistency in coding and to minimize measurement errors related to coding and food composition databases. After coding all dietary recall interviews, a detailed review and verification for quality control was carried out by two members of the research team where any coding errors were corrected to match the reported interview. No data has been excluded and no changes were made to the student recalls from myfood24.

Data collection

After identifying adolescents who were willing to take part in the study, participants were asked to attend one of 14 groups at their school. They were asked to attend one session on two non–consecutive days over the course of two weeks for each session. The two days were selected based on the availability of students in school. Since the interview was not conducted on Saturday or Sunday, the recall only covered Monday to Thursday and Sunday (week and weekend days). In each session, participants were asked to report all food and drink consumed in the previous day in myfood24 using the school's computer and then attend an interview with one of two trained nutritionist interviewers in order to complete the interviewer-administered multiple-pass 24hour recall for the same day. The interviewers were blind to what the participants had entered into myfood24 and each participant was interviewed separately. All participants were given a unique username and password to use myfood24.

For logistical reasons, in order to manage the research in schools, each group of students was randomly assigned to attend a one hour session, three of them were asked to start with myfood24 (in order to avoid the learning effect with myfood24) and two with the interviewer-administer MPR first. Then they were swapped over when they had completed their first tool. On the second day, participants who started with the interviews on the first day were asked to start with myfood24 and vice-versa. When students asked for

help, the researcher advised them to check the instructions on the website, and encouraged them to select the most appropriate food they consumed (no help was given in selecting food or portion size). The target reference period was from midnight to midnight the previous day, with an identical time frame for both methods.

On the second day, after conducting the two methods, the participants completed an anonymous questionnaire to identify their backgrounds, attitudes towards technology, evaluation of myfood24 and tendencies to respond in a socially desirable way, using the Children's Social Desirability (CSD) scale which contains 14 items (Appendix-Table 1). At the end of the study each participant received a £5 voucher as a token of appreciation for their time and effort.

Statistical analyses

Analyses were performed using the Stata statistical software release 11 (Stata Corporation)[28]and for all analyses, the significance level was two-sided and set at 0.05. Descriptive statistics (mean and standard deviation (SD)) were used to define sample characteristics. The method of Bland and Altman was used to measure the extent of agreement between the two dietary assessment methods[29], of which there are two components: bias and precision. These were assessed by using the limit of agreement between methods. Both aspects of agreement were assessed using information from two observations of each method per individual, assuming that the within-subject variance is constant and the two measures for the same subject on different days are independent[30]. The intraclass correlation coefficient (ICC) between myfood24 and interview (MPR) was also calculated using a two-way mixed-effects ANOVA model, with a subject by method interaction [31]. In order to assess the ability of myfood24 to rank participants, dietary intake was classified into tertiles for both methods and a linear weighted Kappa (κ_w)[32] was used to evaluate the level of agreement over and above that which would be expected by chance and to take into account the amount of disagreement between the methods. This analysis was done for the average of the two days.

Secondary analyses were carried out to investigate whether there was a significant difference between the differences in EI (myfood24 - interview (MPR)) for the average of the two days and sex or age group (younger adolescents to older adolescents) using regression models; the difference in EI was the dependent variable, and sex (model-1) and age group (model-2) were the independent variables. Furthermore, a CSD score was calculated and possible scores ranged from 0 to 14, with higher scores indicating a higher tendency toward socially desirable responses[33]. A Spearman rank correlation was used to measure the association between CSD score and the differences in EI. All secondary analyses were done with the average of EI for the two days. Analyses were conducted on key nutrients presented by the myfood24 summary file.

Results

Characteristics of the study sample

In total, 75 adolescents took part in this study; thirty eight girls (51%) and thirty seven (49%) boys aged between 11 and 18 years old. Sixty six (88%) of them were of white ethnicity. An effort was made to balance the sample in terms of age and gender in each age group. Only five adolescents (7%), three girls and two boys, were unable to complete the second day. The recall covered two days including weekdays (Monday to Thursday) and a weekend day (Sunday). From the two days, 26 (18%) weekend days were included in the study (table 1). The mean social desirability score was 5.3 (95% CI: 4.8, 5.6) and there were no significant differences in adolescents' CSD scores between older adolescents compared to younger adolescents (mean difference 0.02, 95%CI: -1.2, 1.1, *P*=0.1), or girls compared to boys (0.3, 95%CI: -1.4, 0.9, *P*=0.6).

Reported nutrient intakes by myfood24 & interview (MPR) for each day

Table 2 illustrates the daily intake of energy (kcal (kJ)), macronutrients (g) and some nutrients (g), as reported by myfood24 and the interview (MPR) for day 1 and day 2 separately. Daily EI, macronutrients and most nutrients were similar on day 1 and day 2, with saturated fat and sugars slightly lower on the second day. In general, the interview (MPR) appeared to record slightly higher EI and macronutrient values than myfood24.

Agreement between myfood24 and interview (MPR)

Table 3 shows the limits of agreement and ICC for the EI (kcal), macronutrients (g), fibre (g), saturated fat (g), sodium (g), sugars (g), total vegetable (g) and total fruit (g). myfood24 underestimated EI compared to the interview (MPR); the mean difference was -55kcal (-230kJ) (95% CI -117, 7 kcal (-490 to 30kJ), *P*<0.398), with a limit of agreement of -797 to 687kcal (-3336 to 2874kJ). This difference is equivalent to 2.8% of average EI and the limit of agreement ranged from an underestimation of 39% to an overestimation of 34% for an average EI (Fig.1). Although there are significant differences between the two methods in the reported fibre and sugars intake, the ICC was high at 0.76 and 0.75 respectively. The ICC for EI and other reported nutrients were high between the two methods, and it ranged from 0.46 in sodium to 0.88 in EI. The ICC between the time points (day 1 and day 2) for the two methods were similar (Table 4), It was 0.5 (95%CI: 0.37, 0.63) for myfood24 and 0.49 (95%CI: 0.36, 0.62) for the interview (MPR) in the reported EI and similar ICC were also found for all other nutrients.

Agreement on ranking of energy and macronutrients

Table 5 presents the strength of agreement between myfood24 and the interview (MPR) on ranking of EI and macronutrients into the same tertiles for the average of the two days. The percentage agreement between the two methods was good, with the percentage classified into the same or adjacent tertiles ranging from 80% for protein (κ_w = 0.55) to 86% for carbohydrate (κ_w = 0.71).

Secondary analyses

Although girls had a greater difference in EI between the two methods than boys, no significant difference was found between the differences (-99.1kcal 95%CI: -207, 9.3; *P=0.07*). Also, no significant differences were found with younger adolescents compared to older adolescents in terms of the difference in EI between the two methods (9.8kcal, 95%CI: -101, 120; *P=0.86*). Furthermore, the correlation between CSD score and the difference in reporting EI between the two methods was tested to investigate whether the differences in reporting EI were related to the adolescents' social desirability. Adolescents' CSD was not associated with the difference between the two methods (Spearman rank correlation r = -0.07, 95% CI: -0.29, 0.17; *P= 0.58*).

Discussion

This study demonstrates that myfood24 is an appropriate, reliable and easy [20, 34] to use tool among British adolescents aged 11-18 years old. myfood24 has the potential to collect dietary data of comparable quality to that of an interview (MPR) which is considered to be the gold standard in the US and is the most widely used method. There were strong ICCs between myfood24 and the interview (MPR) for EI and most reported nutrients. The relative bias in energy intake between the two methods was small and not important.

There are a limited number of studies that have assessed the validity or relative validity of 'interactive computer' and 'web-based' 24hour recall [10, 11, 35, 36, 37] and specific limitations exist when adolescents are the target age group. Studies comparing self-administered with interviewer-administered computerised 24hour recall have observed a small but significant underestimation of energy and fat intake with the self-administered tool in general[6].

Most of the studies comparing a computerised approach to an interview or food diary have found larger differences and considerably wider variation between the methods for key nutrients compared to self-reported recalls in our study. For example, the EI reported by the computerised 24hour recall YANA-C was higher by 13% (262 kcal) when it was compared against a one day food record (n=136), with a limit of agreement ranging from 86% (1681 kcal) to - 60% (-1157kcal). While EI reported in YANA-C was higher by 5.5% (102 kcal) with a limit of agreement ranging from 68% (1261 kcal) to -57% (-1058 kcal) when compared to the interview (n=101), and the researcher guided the pupils when completing YANA-C [15]. When YANA-C was compared with the interviewer-administered YANA-C data for (n=236) adolescents from 8 European cities, the EI was higher than the interviewer by 3% (61 kcal), with a limit of agreement ranging from 41% (903) to -47% (–1025 kcal)[16].

A recent study compared INTAKE24 (un-aided) with an interviewer-administered 24hour recall on the same day for four non-consecutive days conducted among 11 to 16 year old adolescents. The findings showed that the average EI reported by INTAKE24 was lower than the interviewer-administered 24hour recall by 3%, with a mean ratio of 0.97; the limit of agreement ranged from 82% (upper mean ratio 1.82) to - 48% (lower mean ratio 0.52)[38]. Findings from the YANA-C and INTAKE24 studies were consistent in terms of absolute differences with the results for myfood24. However, the limits of agreement were narrower in myfood24 compared to other tools, possibly reflecting the additional information provided by using brand specific nutrients. ASA24-Kids-2012 was less accurate than interviewer-administered 24h dietary recall when compared with observed intakes, nonetheless both methods performed poorly among children aged 9 to 11 years old[39]. However, in a feeding study in which the true intake for three meals was known, 81 adults (20 to 70 years old) completing ASA24 reported 80% of the foods and drinks actually consumed compared with 83% in AMPM[40].

Adolescents in this study tend to underestimate fibre and sugar intake using myfood24 compared to the interview MPR. Similarly, with INTAKE24 adolescents underestimated non-milk intrinsic sugar by 11%, and it was found that high sugar drinks was one of the most commonly omitted food items in the tool[38]. Furthermore, it was noticed that adolescents in this study, particularly young adolescents, found it difficult to estimate both the amount of cornflakes consumed and the amount of milk consumed with the cornflakes since the food photographs available in myfood24 only included bowls of cereal without milk. Therefore, adding some information in 'project instruction' (first screen in myfood24) about how to estimate corn flakes portion size would be useful (e.g. give an example for the standard portion size of corn flakes with and without milk), as well as emphasise the importance of reporting all sugary drinks and added sugar (extrinsic sugars).

In this study, sodium and total vegetables had the lowest ICCs and this is likely to be related to choice of different food codes between the two methods that did not match well (far matches) or omissions/intrusions'. In INTAKE24, for example, the vegetable group had the largest percentage of food omissions (17%) among adolescents aged 11-16 years old[38]. Alternatively, it may relate to food items with a greater number of options, with respondents selecting items closer to the top of the list of search results rather than scrolling through the whole list to find the best match. This was suggested as being the case in an assessment of adults' responses to the ASA24[40]. Similar mechanisms may explain the lower ICC for some nutrients and food groups."

In this study, no significant differences were found between males and females in the differences in term of reported EI between the two methods. This may highlight an advantage of using new technology in a dietary assessment method, as most adolescents nowadays share the same social characteristics, in particular regarding their use of the internet [41]. Also, boys and girls have become similar in terms of their

computer activities[42]. In addition, no significant differences were found between younger adolescents and older adolescents in the differences between the two methods when reporting EI.

Despite there being no statistically significant differences between the younger and older adolescents, some difficulties were noticed in our study among year seven adolescents (11 years old) when they were reporting their food intake, particularly when identifying certain types of food, such as whole milk or semi-skimmed milk, or the cooking method used. This corresponds with other studies [17, 43] which found that adolescents 11 to 12 years old should complete the tools with assistance from an adult. Due to adolescents' limited knowledge of food names and types, their ability to self-report their food intake without support is limited[3]. Therefore, we recommend that adolescents less than 12 years old would require assistance from the researcher or parents to obtain more accurate data, regardless of the dietary assessment method used (traditional methods or an online dietary assessment method, especially if the new method contains large database). However, the assistance could be provided at a group level (for example at school classes) when using an online dietary assessment tool, as there is no difference between 11-12 years old adolescents and adults in technical understanding of websites[44].

Self-reporting of dietary intake is susceptible to social desirability bias, which is rarely evaluated in the development of new dietary assessment tools[45]. The association between CSD score and the differences in EI between the two methods has been investigated in this study. The CSD score was developed based on the Marlowe-Crowne Social Desirability (MCSD) scale for adults[46]. Higher scores on the MCSD scale were related to lower accuracy of reporting EI, with under reporting of fats, sweets and total EI[47]. In this study, the mean tendency towards social desirability among adolescents was 5.3 out of 14 and it was not associated with the difference EI between the two methods.

Regarding study strengths, this study has followed the general principles of an appropriate relative validity study design, as the test method and the reference method have measured the same underlying concept over the same time period[48]. Moreover, two days were used to ensure the accuracy and reproducibility of myfood24. There are considerable advantages in collecting replicate observations so that the repeatability of the methods can be observed. The current study has also examined whether social desirability response bias is a source of measurement error in validation.

In terms of the limitations of this study, 'relative' instead of 'absolute' validity was applied by comparing myfood24 with a face-to-face interview MPR, thus measurement error may have occurred as the two methods are not totally independent from each other, and the subject is not totally independent on the two different days. However, measurement error cannot be independent in all dietary assessment methods and it is difficult to measure the absolute validity of dietary intake [49]. The main validation study for myfood24 is being conducted in a large sample of adults against reference measures (an interviewer-administered MPR) and biomarkers of nutritional exposure including urinary nitrogen (for protein); potassium; sucrose and fructose; and total energy expenditure.

The process of collecting dietary information using one method may affect the response to the other method, since participants may become more conscious about their diet and improve their recall in the second method[1]. In order to limit this effect on the use of myfood24 and to test the tool in a way that will be used in practice, we had intended that all students would complete myfood24 before the MPR. However, due to the availability of the interviewers, computers and students a pragmatic approach was taken. An unbalanced design was used in the order of administration of the two methods, with more participants completing myfood24 first than the interviewer-administered MPR. However, no statistical differences were found in the order of the administration of the two methods, which was explored in a subsample analysis (supplementary table 2). An alternative approach would have been to randomize the order of the two instruments, since it is possible that students would be more conscientious about completing the first instrument and perhaps have lost interest for the second method. However, the mode of delivery of the two methods was different and so potentially minimizing any such effect.

The aim of this study was to evaluate adolescents aged 11 to 18 years old and their ability to use myfood24, rather than their ability to use any underlying database. Therefore, the same food database has been used in the two methods which may enhance the agreement and correlation between them, but provides a clearer comparison of the tool itself.

Limited numbers of dietary assessment methods have been found to be reproducible and valid for use among adolescents[50]. A review by Forrestal of 28 studies found that retrospective methods, especially 24hour dietary recalls, are preferred for use among adolescents[51]. In general, there is a tendency for a higher estimate of energy intake by two non-consecutive 24hour recalls compared to a 5-day estimated food record. The 24 hour recall is a valid method for assessing dietary intake at the group level, and even young children could estimate their energy intake with 78% accuracy when compared with food records [50, 52, 53]. At group level, multiple pass 24hour recall accurately reflected mean energy intake with no difference between the mean of three days energy intake and total energy expenditure (TEE) estimated by DLW [54].

Although using new technology for reporting dietary intake has many advantages, using new technology as a recall seems not to rectify the issue of potential under reporting EI among adolescents or adults[3, 6]. This may be due to the cognitive processes involved in dietary recall. It has been suggested that what one eats is stored in the generic memory and rarely encoded into long term memory[3]. Also, adolescents underestimate EI by 18-42% when using a food record[55]. Findings from a focus group study found that adolescents preferred to report their food intake at the end of the day as they still remembered what they had consumed, rather than via a 24hour recall or food record[56]. However, that was not possible for the validation study; although myfood24 has the option to be used as a recall or food record it would have been impractical to perform the interviewing at the end of the day. Therefore, further study is required to

investigate the accuracy of reported adolescents' food intake using myfood24 at the end of the day, comparing the findings with estimated energy expenditure.

Conclusion

myfood24 is an online 24hour dietary assessment method developed to meet the need for an accurate national online dietary assessment tool. The findings of this study confirm that myfood24 has the potential to collect accurate dietary data that are comparable in quality with an interviewer-administered 24hour recall (MPR) among adolescents 11 to 18 years old whilst being less laborious in terms of the data collection method. However, using an online dietary assessment tool may not be feasible for adolescents less than 12 years old without assistance. myfood24 is currently being validated in adults against nutritional biomarkers. Further research is required to test the feasibility of using myfood24 in a large epidemiological study with different age groups so as to standardize and automate dietary measurement within the UK population.

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400 # Tables

401

402 **Table 1:** General characteristics for all adolescents (11-18 years)

403 (Mean values and 95% confidence intervals & Number and Percentage)

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General characteristics (n=75)	Mean	95% CI
Age	14.6	14.1, 15.1
Child Social Desirability score (CSD *)(n=70) †	5.3	4.8, 5.9
	N	**%**
Gender (girls)	38	50.7
Ethnicity (White)	66	88.0
(Asian)	2	2.7
(Black or Black British)	7	9.3
Academic year (age range)		
Year 7 (11-12y)	10	13.3
Year 8 (12-13y)	11	14.7
Year 9 (13-14y)	10	13.3
Year 10 (14-15y)	11	14.7
Year 11 (15-16y)	10	13.3
Year 12 (16-17y)	12	16.0
Year 13 (17-18y)	11	14.7
Access the internet (daily)	65	86.7
Access the internet at home (yes)	74	98.7
Completed two days' food recall	70	93.3
Food intake is similar to usual intake (yes)		
Recall days		
Weekdays	119	82.1
Weekend day	26	17.9
Day one	56	74.7
Day two	57	76.0

405 *Possible score range from 0 to 14 with higher score indicate higher social desirable responses

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Table 2: Some nutrient intake reported by myfood24 and interview-administered 24hour multiple pass dietary recall (MPR)*

Nutrients intake/day	myfood24		Interview (MPR)	
	Mean	SD	Mean	SD
Day 1 (n=75)				
Energy (kcal (kJ))	1999.9 (8514.3)	925.9 (4020.2)	2058.1 (8745.2)	871.2 (3813.7)
Protein (g)	70	37.7	72.1	39.4
Carbohydrate (g)	272.2	135.4	283.2	125.5
Fat (g)	73.2	41.8	74.3	37.9
Saturated fat (g)	28.1	20.3	28.6	16.9
Fibre (g)	14.8	6.9	15.4	7.2
Sodium (g)	2.9	1.7	2.7	1.3
Sugars (g)	126.5	97.0	134.2	83.7
Total vegetable (g)	98.3	90.1	89.5	85.9
Total fruit (g)	153.7	207.9	163.1	213.7
Day 2 (n=70)				
Energy (kcal (kJ))	1869.1 (7820.3)	656.2 (2745.5)	1920.5 (8035.4)	612.2 (2561.4)
Protein (g)	66.2	26.2	68.0	22.7
Carbohydrate (g)	256.6	98.3	267.8	99.3
Fat (g)	63.4	30.3	68.3	26.6
Saturated fat (g)	23.8	14.1	27.7	13.7
Fibre (g)	13.8	6.1	14.9	7.3
Sodium (g)	2.4	1.2	2.7	1.6
Sugars (g)	104.2	52.9	125.7	65.8
Total vegetable (g)	80.3	91.9	82.4	80.6
Total fruit (g)	164.9	210.3	153.0	184.8

* Daily intake of energy (kJ & kcal) and macronutrients; protein, carbohydrate and fat (g) as recorded by myfood24 and the Interview administer 24hour recall (MPR) for the equivalent day.

445 **Table 3:** Agreement between myfood24 and interview administered 24hour multiple pass dietary recall (MPR) with multiple observation per individual*
446

Nutrients intake	Myfood24 - Interview (MPR) (n=75, using both days)					Intraclass correlation between myfood24 and Interview (MPR)	
	Mean differences	95% CI	*P value*	Limit of Agreement		ICC†	95% CI
				Lower	Upper		
Energy (kcal (kJ))	-54.95 (229.90)	7.2, -117.1 (30.1, -489.9)	0.40	-797.3 (-3335.9)	687.3 (2874.4)	0.88	0.84, 0.92
Protein (g)	-1.62	2.0, -5.2	0.60	-44.6	41.4	0.77	0.70, 0.83
Carbohydrate (g)	-11.13	22.8, -0.5	0.10	-152.1	129.8	0.81	0.74, 0.86
Fat (g)	-2.92	1.2, -7.0	0.16	-51.7	45.9	0.75	0.67, 0.81
Saturated fat (g)	-2.10	0.2, -4.2	0.05	-27.5	23.3	0.70	0.60, 0.77
Fibre (g)	-0.92	-0.1, -1.7	0.03	-10.2	8.4	0.76	0.68, 0.82
Sodium (g)	-0.02	0.2, -0.3	0.84	-2.9	2.9	0.46	0.35, 0.59
Sugars (g)	-14.35	-0.3, -28.4	0.02	-120.8	92.1	0.75	0.68, 0.82
Total vegetable (g)	3.67	15.8, -8.5	0.62	-141.4	148.7	0.47	0.30, 0.57
Total fruit (g)	0.89	28.1, -26.3	0.95	-324.1	325.9	0.67	0.57, 0.76

* Daily intake of energy (kJ & kcal) and macronutrients; protein, carbohydrate and fat (g) as recorded by myfood24 and the Interview administer 24hour recall (MPR) for all days.

†Intraclass correlation coefficients (rho) between myfood24 & Interview (MPR)

Fig. 1 Bland and Altman plot for energy intake for the two methods (myfood24 – Interview administer 24hour recall (MPR)) including both days measurements, (n=75, using both days)

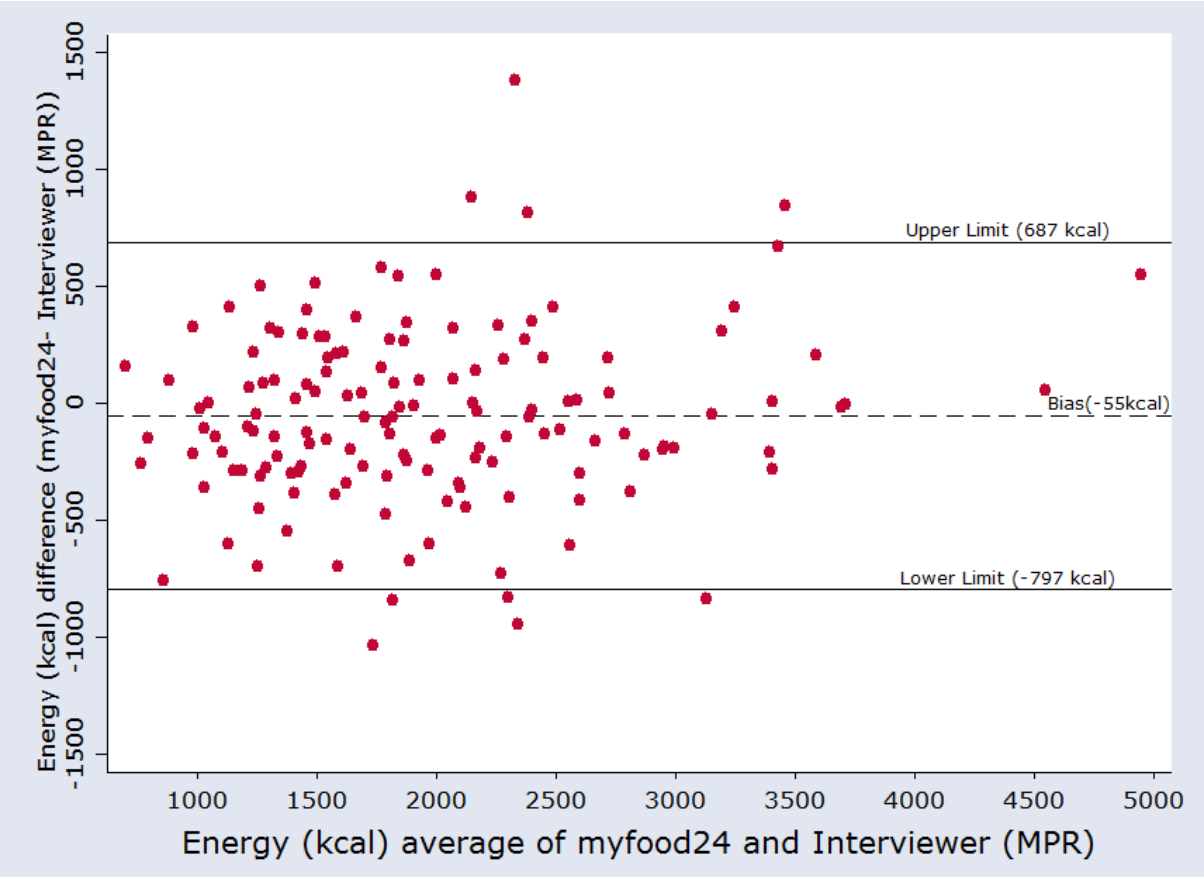

Table 4: Agreement between day1 and day 2 using the same method

Nutrient Intake	myfood24	Interview (MPR)
	ICC (95%CI)	ICC (95%CI)
Energy (kcal)	0.50 (0.37, 0.63)	0.49 (0.36, 0.62)
Protein (g)	0.49 (0.31, 0.59)	0.44 (0.30, 0.58)
Carbohydrate (g)	0.48 (0.34, 0.60)	0.46 (0.33, 0.60)
Fat (g)	0.52 (0.39, 0.65)	0.47 (0.34, 0.61)
Saturated fat (g)	0.52 (0.39, 0.65)	0.46 (0.33, 0.60)
Fibre (g)	0.45 (0.31, 0.59)	0.51 (0.38, 0.64)
Sodium (g)	0.30 (0.20, 0.45)	0.30 (0.20, 0.46)
Sugars (g)	0.39 (0.24, 0.53)	0.35 (0.21, 0.50)
Total vegetable (g)	0.27 (0.12, 0.42)	0.27 (0.12, 0.43)
Total fruit (g)	0.54 (0.42, 0.66)	0.51 (0.38, 0.64)

Table 5: Agreement on ranking of energy and macronutrient intakes into tertiles of intake for the average of the two days (n=70)

Nutrient	Same or adjacent*	κ_w (95%CI)	Agreement†
Energy	83%	0.62 (0.59, 0.74)	Substantial
Protein	80%	0.55 (0.52, 0.58)	Moderate
Carbohydrate	87%	0.71(0.67, 0.76)	Substantial
Fat	81%	0.58 (0.48, 0.68)	Moderate

*Percentage of adolescents classified into same or adjacent quintile

†Strength of agreement: 0.00-0.20 (slight), 0.21-0.40 (faire), 0.41-0.60 (moderate), 0.61-0.80 (substantial), 0.81-1.00(almost perfect)

Supplementary table

Table 1. Items on the Children's Social Desirability (CSD) Scale

1	When you make a mistake, do you always admit that you are wrong? (Y)
2	Have you ever felt like saying unkind things to a person? (N)
3	Are you always careful about keeping your clothing neat and your room picked up? (Y)
4	Do you sometimes feel like staying home from school even if you are not sick? (N)
5	Do you ever say anything that makes somebody else feel bad? (N)
6	Are you always polite, even to people who are not very nice? (Y)
7	Sometimes do you do things you've been told not to do? (N)
8	Do you always listen to your parents? (Y)
9	Do you sometimes wish you could just play around instead of having to go to school? (N)
10	Have you ever broken a rule? (N)
11	Do you sometimes feel angry when you don't get your way? (N)
12	Do you sometimes feel like making fun of other people? (N)
13	Do you always do the right things? (Y)
14	Do you sometimes get mad when people don't do what you want them to do? (N)

The Y or N in parentheses after each item indicates whether the yes or no answer is the socially desirable response.

Supplementary Table 2

Table 2. Analysis of the reported nutrients intake by the order of administration method (n=61)*

Nutrients Intake	First method	Value reported by the two methods		myfood24 - Interviewer MPR	*Differences between the methods order †*	*P value*
		myfood24	MPR			
		Mean (±SD)	Mean (±SD)	Mean (95%CI)	Mean (95%CI)	
Energy (kcal)	MPR (n=26)	2096.3(1020.1)	2183.5 (1004.9)	-87.2 (-220.8, 7.1)	34.1 (-197.9, 266.1)	0.77
	myfood24 (n=35)	1828.0 (886.3)	1949.3 (805.1)	-121.3 (-296.8, 54.2)		
Protein (g)	MPR (n=26)	71.1 (31.9)	75.4 (39.5)	-4.2 (-14.2, 5.7)	-1.6 (-13.9, 10.7)	0.80
	myfood24 (n=35)	65.5 (36.2)	68.1 (40.5)	-2.7 (-10.6, 5.2)		
Carbohydrate (g)	MPR (n=26)	287.6 (161.9)	313.1 (160.9)	-25.5 (-56.8, 5.9)	-10.9 (-53.8, 31.9)	0.61
	myfood24 (n=35)	248.5 (120.2)	263.1 (98.5)	-14.5 (-44.2, 15.1)		
Fat (g)	MPR (n=26)	79.5 (43.3)	78.4 (38.5)	1.1 (-11.9, 14.1)	6.2 (-7.8, 20.2)	0.37
	myfood24 (n=35)	65.8 (40.7)	70.9 (37.9)	-5.1 (-12.8, 2.6)		
Saturated fat (g)	MPR (n=26)	30.2 (18.2)	28.9 (17.6)	1.2 (-5.2, 7.5)	3.8 (-3.1, 10.6)	0.27
	myfood24 (n=35)	24.9 (21.1)	27.5 (16.6)	-2.6 (-6.3, 1.1)		
Fibre (g)	MPR (n=26)	15.4 (5.9)	16.4 (6.5)	-1.0 (-2.5, 0.4)	-0.1 (-2.1, 2.0)	0.95
	myfood24 (n=35)	12.9 (7.1)	13.9 (6.8)	-0.9 (-2.5, 0.5)		
Sodium (g)	MPR (n=26)	2.9 (1.6)	2.6 (1.4)	0.23 (-0.2, 0.7)	0.0 (-0.8, 0.8)	0.99
	myfood24 (n=35)	2.9 (1.8)	2.6 (1.3)	0.2 (-0.4, 0.8)		
Sugars (g)	MPR (n=26)	124.5 (108.0)	148.5 (109.1)	-23.9 (-50.4, 2.5)	-20.3 (-52.7, 12.1)	0.21
	myfood24 (n=35)	118.9 (93.5)	122.6 (68.9)	-3.7 (-24.4, 17.1)		
Total vegetable (g)	MPR (n=26)	110.9 (101.6)	91.5 (103.9)	19.5 (-27.6, 66.5)	20.9 (-31.1, 73.1)	0.42
	myfood24 (n=35)	89.6 (91.4)	91.1 (81.6)	-1.5 (-31.3, 28.4)		
Total fruit (g)	MPR (n=26)	139.3 (232.4)	138.7 (197.5)	0.6 (-80.1, 81.3)	29.0 (-65.0, 123.1)	0.53
	myfood24 (n=35)	128.5 (174.7)	157.0 (233.1)	-28.5 (-85.8, 28.8)		

* For 14 participants information regarding the sequence of administration is missing.

†mean differences between adolescents who started with interviewer-MPR and others who started with myfood24.
There were no significant differences in the reported dietary intake by the order of administration.

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