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1 **VALIDATION OF A FOOD FREQUENCY QUESTIONNAIRE TO MEASURE INTAKES OF**
2 **INULIN AND OLIGOFRUCTOSE**

3

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7

8 KW designed the study. AD, SK, EL, CEM recruited subjects. CEM, SD conducted all
9 dietary, nutrient and inulin intake analysis. KW, SD conducted all data analysis. All
10 authors contributed to data interpretation. KW, SD wrote the manuscript, which was
11 reviewed and approved by all authors.

12

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19

20 **Running title**

21 Inulin and oligofructose FFQ

22

23 **Abbreviations**

24 FD food diary; FFQ food frequency questionnaire; FCID Food Commodity Intake
25 Database; GI gastrointestinal; PCC Pearson's correlation co-efficient

26

27 This submission represents original work that has not been published previously and
28 is not currently being considered by another journal.

29

30

1 **ABSTRACT**

2

3 **Background and Objectives:** Inulin and oligofructose are prebiotic carbohydrates
4 associated with numerous health benefits. The aim of this study was to accurately
5 measure inulin and oligofructose intakes and to develop and validate a food
6 frequency questionnaire (FFQ).

7

8 **Subjects and Methods:** A 7-d semi-weighed food diary (FD) was used to measure
9 intakes in 66 healthy subjects. A 23-item FFQ was developed to measure short-term
10 inulin and oligofructose intakes over the same seven days and was completed twice
11 on two separate days.

12

13 **Results:** There were no significant differences in inulin intake (4.0 ± 1.3 vs 4.0 ± 1.4
14 g/d, $P= 0.646$) or oligofructose intake (3.8 ± 1.2 vs 3.8 ± 1.3 g/d, $P=0.864$) when
15 measured using the 7-d FD or the FFQ. Bland-Altman analysis demonstrated low
16 mean differences between the FD and FFQ in measuring intakes of inulin (-0.09 g/d)
17 and oligofructose (-0.03 g/d). The FFQ categorised 89% of subjects into the same or
18 adjacent tertiles of intakes as the 7-d FD. For the majority of food items, kappa
19 values indicated '*substantial*' or '*almost perfect*' agreement for assignment of
20 'portion size' and 'frequency of consumption' between the FFQs completed on
21 separate days.

22

23 **Conclusions:** The FFQ is a valid and reliable method for measuring short-term inulin
24 and oligofructose intakes for use in dietary surveys and clinical trials.

25

26 **Keywords:** Food frequency questionnaire; fructo-oligosaccharides; validity;
27 reliability; inulin; oligofructose

28

1 **INTRODUCTION**

2 Inulin-type fructans are non-digestible carbohydrates consisting of D-fructose
3 monomers linked by $\beta 2 \rightarrow 1$ bonds to form linear oligomers and short polymers.
4 Although terminology varies, inulin can describe a variety of molecules covering the
5 full range of polymerisation, from 2-60, whereas oligofructose can refer to shorter
6 chain lengths ranging from 2-10 (Roberfroid, 2005).

7
8 Inulin and oligofructose are associated with numerous health benefits via their
9 prebiotic effects, defined as 'the selective stimulation of growth and/or activities of
10 one or a limited number of micro-organisms in the gut microbiota that confer health
11 benefits to the host' (Roberfroid *et al.*, 2010). Supplements of inulin or oligofructose
12 increase gastrointestinal (GI) concentrations of bifidobacteria (Meyer & Stasse-
13 Wolthuis, 2009), and they may positively influence appetite (Cani *et al.*, 2009),
14 immune function (Lomax & Calder, 2009) and mineral absorption (Scholz-Ahrens *et*
15 *al.*, 2007). Despite these effects, high intakes can induce GI symptoms, including mild
16 flatulence and borborygmi (Bruhwylter *et al.*, 2009).

17
18 Given the health effects of inulin and oligofructose, measuring their intake from diet
19 is of considerable importance, but is impeded by a lack of food composition data.
20 Accurate data is available only for the major food commodity sources (Van Loo *et al.*,
21 1995; Campbell *et al.*, 1997), although recent data has reported the inulin content of
22 selected Australian fruits and vegetables (Muir *et al.*, 2007; Muir *et al.*, 2009).
23 However, there remains little data for composite foods.

24
25 Consequently, only two studies have ever quantified dietary inulin and oligofructose
26 intakes, both were from the 1990's and both used food composition data from Van
27 Loo *et al.*, (1995). The first reported the average daily inulin intake to be between 1-4
28 g/d in the US and 3.2-11.3 g/d across Europe (Van Loo *et al.*, 1995). Subsequently,
29 Moshfegh *et al.*, (1999) used data from two 24-h recalls, and also included intakes
30 from composite foods by using standard recipes from the Food Commodity Intake
31 Database (FCID). Mean daily intakes of inulin and oligofructose were 2.6 g/d and 2.5
32 g/d, respectively. Intakes in the United Kingdom have not been measured.

1

2 The problems associated with accurate dietary assessment are well documented
3 (Bingham et al., 1994). Although weighed food diaries may be relatively accurate,
4 they require high subject motivation and lengthy data handling. Food frequency
5 questionnaires (FFQs) can provide an accurate, rapid and inexpensive method of
6 dietary assessment and are frequently used in epidemiological studies. FFQs have
7 been developed that measure intake of all nutrients (McKeown et al., 2001; Lassale
8 et al., 2009), specific nutrients (e.g. folate, Pufulete et al., 2002), food commodities
9 (e.g. fruit, vegetables, Petkeviciene et al., 2009) or dietary components (e.g.
10 quercetin, Ranka et al., 2008). However, in a number of settings, short-term dietary
11 assessment is required. Therefore, some FFQs have been validated to measure
12 intakes over the short-term (e.g. 7 days, Eck et al., 1996; Eck et al., 1991) and can
13 therefore be used for dietary assessment during clinical trials (Xinying et al., 2004).

14

15 An FFQ that measured short-term intakes of inulin and oligofructose would allow
16 between-group comparisons in dietary surveys, as well as the measurement of
17 background dietary intakes in inulin or oligofructose supplementation trials. The aim
18 of this study was therefore to accurately measure inulin and oligofructose intakes in
19 a group of healthy subjects and to develop and validate an FFQ to measure short-
20 term intake.

21

22 **METHODS**

23 **Development of the FFQ**

24 Inclusion of items in the FFQ was determined following extensive review of the
25 literature. The standard food composition data available at the time of FFQ
26 development was used (Van Loo et al., 1995), and was consistent with that used in
27 the two previous dietary surveys (Van Loo et al., 1995; Moshfegh et al., 1999).
28 Subsequently published food composition data has not identified additional major
29 dietary sources of inulin and oligofructose (Muir et al., 2007; Muir et al., 2009).

30

31 Based upon this food composition data, eight fruit and vegetables were included in
32 the FFQ (asparagus; banana; chicory root; garlic; globe artichoke; Jerusalem

1 artichoke; leeks; and onions). Chicory coffee was also included because where
2 consumed it would likely have a large impact on intakes. The cereals wheat, barley
3 and rye contain small amounts of inulin and oligofructose but are widely consumed.
4 Therefore, wheat-containing composite foods were eligible for inclusion in the FFQ
5 where the UK National Diet and Nutrition Survey indicated their mean intake to be
6 greater than 100 g/week or where they were consumed by more than 50% of the
7 sample population (Henderson et al., 2002). This resulted in the inclusion of breads,
8 breakfast cereals, pizza, pasta, noodles, bulgar wheat/cous-cous, cakes/muffins,
9 pastry products, puddings and biscuits. Composite food sources of rye (e.g. rye
10 breads) and barley (e.g. breakfast cereals, beer) were also included in the FFQ. Some
11 of the composite food items were split to allow for ethnic and portion size variations
12 (e.g. 'bread, sliced' and 'other breads'). This resulted in an FFQ that included 23 food
13 items (8 fruits/vegetables; 15 composite foods).

14

15 To maximise correct identification of each food item, all composite foods included
16 suggestions of products (for example, 'Pastry products e.g. meat pie, cheese pasty,
17 apple pie, Danish pastry'). A photograph flashcard was available for asparagus, globe
18 artichoke, Jerusalem artichoke and chicory root for subjects who did not recognise
19 the item's name.

20

21 The FFQ requested a typical portion size for each of the 23 food items (small,
22 medium, large), which were described in household measures. The weight of each
23 was taken from standard food portion size tables for the UK (Crawley, 1988). Where
24 data was not available, the foods were purchased and the research team weighed an
25 agreed portion size.

26

27 The FFQ then requested the frequency of consumption of each item during the
28 previous 7-d. This period was chosen because the prebiotic effects and GI side-
29 effects of inulin and oligofructose result from current/recent intake, rather than
30 historic intake, and because this would facilitate the measurement of background
31 intakes in supplementation trials, which may be only 7-d in length, and is therefore

1 Measuring intakes over the previous 7-d is therefore likely to be of greater clinical
2 and research utility.

3

4 **Measurement dietary intake**

5 Healthy subjects were recruited through a circular email sent to all students and staff
6 at King's College London and through the snowballing technique. The inclusion
7 criteria were adults aged 18-50 years who identified themselves as healthy. Broad
8 inclusion criteria were used in order to recruit a representative population in which
9 to validate the FFQ (Cade, 2001). Exclusion criteria were any acute or chronic
10 diseases (e.g. diabetes, GI disorders), antibiotic use within the last 3 months, regular
11 medication use (except the contraceptive pill), prebiotic or probiotic use within the
12 previous month or following a special/restrictive diet. This study was approved by
13 the King's College London Research Ethics Committee and written informed consent
14 was obtained from all subjects.

15

16 Subjects' height and weight were measured and their BMI calculated. Subjects were
17 asked to complete a 7-d semi-weighed food diary (FD), and were provided with a FD,
18 electronic weighing scales accurate to 1 g (Soehnle, Switzerland). They were
19 instructed to record the weight and a detailed description of all food/drinks
20 consumed. Where food weighing was not possible (e.g. restaurants) subjects were
21 asked to estimate consumption using the validated Photographic Atlas of Food
22 Portion Sizes (Nelson et al., 1997; Nelson et al., 1996). Subjects were asked to
23 consume their normal diet over the 7-d period. Detailed verbal and written
24 instructions were provided by nutritionists.

25

26 Data from the 7-d FD were entered into a computerised dietary analysis package
27 (MicroDiet, v1.2, UK) to calculate nutrient intakes. Basal metabolic rate was
28 estimated using the modified Schofield equations (DH, 1991). Finally, energy
29 intake:basal metabolic rate (EI:BMR) was calculated (Black, 2000).

30

31 **Measuring inulin and oligofructose intakes**

1 Following completion of the 7-d FD, subjects were asked to complete the FFQ on day
2 8 (FFQ1) and again on day 9 (FFQ2). As the FFQ requested information on food
3 intake over the previous seven days, subjects were asked to complete them at the
4 end of the 7-d FD period in order that intake was being measured during the same
5 period by both methods.

6
7 Dietary analysis software does not currently contain information regarding inulin and
8 oligofructose content of foods. Therefore, intakes were calculated in a two-stage
9 process consistent with that used in a previous comprehensive dietary survey
10 (Moshfegh et al., 1999). Firstly, the quantity of all food and drinks from the 7-d FD
11 (e.g. banana, lasagne) was converted into the quantity of inulin and oligofructose-
12 containing commodities (e.g. banana, wheat, onions, garlic) using the 2004 revised
13 FCID (DoA/EPA, US). These were then converted into consumption using the
14 midpoint value for inulin and oligofructose content of each food commodity
15 (Moshfegh et al., 1999). The average daily intake of inulin and oligofructose over the
16 7-d period was then calculated for each subject.

17
18 For the FFQ, the calculation of inulin and oligofructose consumption was automated
19 through the development of a programmed spreadsheet (MS Excel, Microsoft, US).
20 This converted portion size and frequency for the 23 food items into the quantity of
21 inulin/oligofructose-food commodities consumed, and then into average daily inulin
22 and oligofructose intakes, using the same data as above.

23

24 **Statistical analysis**

25 Mean (SD) inulin and oligofructose intakes were calculated. Concurrent validity was
26 assessed by comparing intakes from FFQ1 with that of the 7-d FD using paired t-tests
27 and Pearson's correlation coefficients (PCC). Bland-Altman plots were also generated
28 and the mean difference (FFQ1-FD) and limits of agreements (2 SD of the mean
29 difference) were interpreted (Bland & Altman, 1986). The n (%) of subjects classified
30 into the same or adjacent tertiles by the FD and FFQ1 was calculated, and
31 misclassification was reported as the n (%) categorised into opposite tertiles by the
32 two methods.

1
2 Intra-observer reliability was assessed by comparing intakes measured using FFQ1
3 and FFQ2, using paired t-tests and Pearson's correlation coefficients. The agreement
4 between categorical variables (portion size, frequency) on FFQ1 and FFQ2 were
5 calculated using percentage agreement and the kappa statistic. Each kappa statistic
6 was compared with recognised standards of agreement as follows: '*no agreement*'
7 ($\kappa < 0$); '*slight*' ($\kappa = 0.21-0.40$); '*fair*' ($\kappa = 0.41-0.60$); '*moderate*' ($\kappa = 0.61-0.80$);
8 '*substantial*' ($\kappa = 0.81-1.00$) (Landis & Koch, 1977).
9 All statistical analysis was conducted on SPSS (v17 SPSS Inc, Chicago, US) and a P
10 value of ≤ 0.05 was considered statistically significant.

11

12 **RESULTS**

13 In total, 66 healthy subjects (17 males, 49 females) were recruited, with a mean age
14 of 31 yrs 2 months (SD 7 y, 11 m) and the sample included eight current smokers and
15 nine vegetarians (Table 1). Fifteen had a $\text{BMI} \geq 25 \text{ kg/m}^2$, of which eleven were female.
16 Males had significantly higher energy and fat intakes than females. The group
17 EI:BMR was 1.47 (0.34).

18

19 Mean inulin and oligofructose intakes were 4.0 (1.3) g/d and 3.8 (1.2) g/d
20 respectively. Wheat was the largest contributor to both inulin ($66.2\% \pm 16.5$) and
21 oligofructose ($69.2\% \pm 15.5$) intakes, with onion ($17.3\% \pm 10.6$ and $18.2\% \pm 10.8$), and
22 garlic ($5.4\% \pm 7.3$ and $2.5\% \pm 4.2$) also making significant contributions.

23

24 **Validity**

25 There were no significant differences in inulin intake (4.0 ± 1.3 vs 4.0 ± 1.4 g/d, $P =$
26 0.646) or oligofructose intake (3.8 ± 1.2 vs 3.8 ± 1.3 g/d, $P = 0.864$) when measured
27 using the 7-d FD or the FFQ1, respectively (Table 2). There was a positive correlation
28 between intakes from the 7-d FD and the FFQ1 for both inulin (PCC=0.406, $P = 0.001$)
29 and oligofructose (PCC=0.403, $P = 0.001$).

30

31 Intakes were compared between the 7-d FD and the FFQ1 using Bland-Altman
32 distributions. For inulin, the difference between the two methods was -0.09 (1.5) g/d

1 and the limits of agreement ranged from -3.1 to +2.9 g/d (Figure 1a). For
2 oligofructose, the mean difference was -0.03 (1.4) g/d and the limits of agreement
3 ranged from -2.9 to 2.8 g/d (Figure 1b). There was no pattern in the placement of
4 outlying values, suggesting no systematic bias in measurement using the FFQ.

5
6 The FFQ categorised the majority of subjects into the same (50%) or adjacent (39%)
7 tertile of inulin intake as the 7-d FD. It also categorised the majority of subjects into
8 the same (44%) or adjacent (45%) tertile of oligofructose intake. Therefore only 11%
9 of subjects were misclassified into opposite tertiles.

10

11 **Intra-rater reliability**

12 There were no significant differences in inulin intake (4.0 ± 1.4 vs 3.9 ± 1.7 g/d, $P=$
13 0.505) or oligofructose intake (3.8 ± 1.3 vs 3.7 ± 1.5 g/d, $P=0.419$) between FFQ1 and
14 FFQ2, respectively (Table 2). In addition, there were strong positive correlations
15 between intakes from FFQ1 and FFQ2 for both inulin (PCC=0.759, $P<0.001$) and
16 oligofructose (PCC=0.748, $P<0.001$).

17

18 Comparing FFQ1 and FFQ2, the agreement between subjects' 'usual portion size'
19 ranged from 50% (Jerusalem artichoke) to 100% (beer, globe artichoke, chicory root,
20 chicory coffee). Although it could not be calculated for all food items, the resulting κ
21 values ranged from 0.39 to 1.00. Therefore, agreement was classified as '*almost*
22 *perfect*' (eight items), '*substantial*' (nine items), '*moderate*' (two items) or '*fair*' (one
23 item) (Landis & Koch, 1977; Table 3).

24

25 Comparing FFQ1 and FFQ2, the agreement between subjects' 'frequency of
26 consumption' ranged from 62% (breads) to 100% (globe artichoke, chicory root,
27 chicory coffee). It was rarely possible to calculate κ values, but where calculated,
28 they ranged from 0.55 to 0.86, with agreement being classified as '*almost perfect*'
29 (one item), '*substantial*' (three items) or '*moderate*' (two items) (Table 3).

30

31 **DISCUSSION**

1 Inulin and oligofructose are prebiotic carbohydrates naturally present in the diet,
2 and yet there are no convenient, yet accurate, methods of measuring dietary
3 intakes.

4
5 The reason for measuring inulin and oligofructose intakes using a 7-d semi-weighed
6 FD was to provide a standard against which to compare the data from the FFQ. The
7 sample is largely female, young and potentially educated and health conscious, and
8 therefore is unrepresentative of the entire UK population. Despite these limitations,
9 the actual inulin and oligofructose intakes are interesting, intensively recorded, and
10 the first reported in a UK population. Intakes of inulin (4.0 g/d) were generally higher
11 than in the US (2.6 g/d, Moshfegh et al., 1999; 1-4 g/d, Van Loo et al., 1995), but
12 were at the lower end of the range of intakes across Europe (3.2-11.3 g/d, Van Loo et
13 al., 1995).

14
15 These differences may relate to real differences in dietary intake between the
16 populations reported. For example, artichokes are concentrated sources of inulin but
17 contributed only 1.2% of inulin intake, compared with 6.3-7.1% in the European
18 sample (Van Loo et al., 1995), potentially reflecting higher intakes of such items
19 among non-UK Europeans. Although it contains relatively small quantities, wheat
20 was the largest contributor to inulin and oligofructose intake, supporting previous
21 findings (Van Loo et al., 1995; Moshfegh et al., 1999), likely due to its frequent
22 consumption in the Western diet.

23
24 Differences in the findings between studies may also relate to differences in dietary
25 assessment used, with the most comprehensive being the 7-d FD used here.
26 However, the high recording burden meant that our sample population was
27 inevitably much smaller, may have resulted in self-selection of healthier subjects and
28 may have resulted in subjects altering their food intake (Vuckovic et al., 2000). These
29 issues support the development of an FFQ that measures inulin and oligofructose
30 intake.

31

1 It was not possible to use biomarkers to measure concurrent validity in the current
2 study due to the absence of such a marker of inulin and oligofructose intake. It was
3 therefore necessary to validate the FFQ against a standard dietary assessment
4 method. The FFQ demonstrated good validity, with population intakes almost
5 identical to the FD and correlations between the two methods similar to those
6 reported in other validation studies (Cade et al., 2004). The Bland-Altman analysis
7 demonstrated very low mean differences between the FD and FFQ for measuring
8 inulin (-0.09 g/d) and oligofructose (-0.03 g/d) intakes within a population, but with
9 relatively large limits of agreement, its assessment of intakes in individuals may be
10 subject to error. However, when ranking into tertiles, only 11% of subjects were
11 misclassified, which is similar to values obtained in other validation studies
12 (Petkeviciene et al., 2009; Ambrosini et al., 2009).

13

14 The reliability of the FFQ would also appear to be good, with no differences in inulin
15 and oligofructose intakes when measured on different days (FFQ1, FFQ2) and strong
16 correlations between the two. Agreement between FFQ1 and FFQ2 for both 'portion
17 size' and 'frequency' indicates that the FFQ is highly reproducible for measuring
18 inulin and oligofructose intake.

19

20 In order that all dietary assessment related to a similar time period, FFQ1 and FFQ2
21 were completed one day apart, and followed completion of a 7-d FD. This could
22 result in elevated measured validity due to improved recall of intake following the 7-
23 d FD and elevated reliability due to memory of the information recorded on FFQ1
24 (Cade et al., 2004). However, these aspects of design were to ensure dietary
25 assessment over similar periods, and are a necessary limitation of other validation
26 studies of FFQs that measure short-term intake (Eck et al., 1996; Eck et al., 1991).

27

28 A number of issues must be considered when undertaking dietary assessment using
29 any FFQ, and these also created methodological dilemmas in the current study.
30 Some subjects omitted information (i.e. portion size, frequency), and such omissions
31 were coded as zero, as it has been shown that this is most frequently the actual
32 intake (Michels & Willett, 2009). Interestingly, in the current study, one subject

1 recorded consumption of 42 medium slices of bread on FFQ1, but failed to complete
2 the portion size on FFQ2, resulting in a large loss of information. Therefore, omitted
3 information should be minimised wherever possible. Given the natural variation in
4 inulin and oligofructose content of foods (Van Loo et al., 1995), another limitation is
5 the use of the midpoint value, and is a problem in all studies that rely on such food
6 composition data. Furthermore, the FFQ measures the intake of inulin and
7 oligofructose that is naturally occurring in foods. Due to their potential health
8 benefits, inulin and oligofructose are now being added as functional ingredients in
9 food products such as yoghurts and breakfast cereals. The availability, formulation
10 and use of such food products varies widely between different countries (Franck,
11 2002). Therefore, those wishing to use the FFQ should first identify the availability of
12 such fortified food products and record their intake alongside the FFQ in order to
13 ensure accurate assessment of inulin and oligofructose intakes.

14

15 Although 7-d weighed FD may be the most accurate dietary assessment method,
16 they may change actual dietary intake and are impractical in many clinical trial
17 settings. The 24-h dietary recall requires trained investigators and may not collect
18 data that sufficiently reflects actual dietary intake. Although FFQs were not original
19 designed to do so, they may facilitate short-term dietary assessment, as long as they
20 are stringently validated. Therefore, despite the limitations discussed, we conclude
21 that the FFQ developed here is a rapid, valid and reliable method for measuring
22 inulin and oligofructose intakes. It will facilitate short-term dietary surveys and will
23 be particularly important for the measurement of dietary inulin and oligofructose
24 intakes in supplementation trials.

25

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31 subjects for participating in this study.

32

1 **CONFLICT OF INTERESTS**

2 This research received no specific grant from any funding agency in the public,
3 commercial or not-for-profit sectors. There are no conflicts of interest.

4

5

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- 18

1 **TABLE 1** Characteristics of 66 healthy subjects

2

Mean (SD)	Males (n=17)	Females (n=49)	P value (t-test)	Total (n=66)
Age (y, m)	32y, 10m (7, 11)	30y, 7m (7, 5)	0.305	31y, 2m (7, 6)
BMI (Kg/m ²)	24.1 (3.8)	22.9 (2.9)	0.156	23.2 (3.1)
Nutrient intake				
Energy (kcal/d)	2406 (413)	2019 (458)	0.003	2119 (476)
Protein (g/d)	95.3 (17.7)	80.2 (46.0)	0.194	84.1 (41.1)
Fat (g/d)	90.7 (19.0)	76.7 (18.7)	0.010	80.3 (19.6)
Carbohydrate (g/d)	283.0 (68.9)	248.7 (60.8)	0.057	257.5 (64.2)
NSP (Englyst, g/d)	10.4 (7.0)	12.9 (7.5)	0.234	12.3 (7.4)

3 Nutrient intake was measured using a 7-d semi-weighed FD

4

1 **TABLE 2** Comparison of mean (SD) inulin and oligofructose intakes measured using
 2 the 7-d semi-weighed food diary (7-d FD), FFQ1 and FFQ2.
 3

n=66	Intake measured using different methods (g/d)			P value	
	7-d FD	FFQ1	FFQ2	7-d FD vs FFQ1	FFQ1 vs FFQ2
Inulin	4.0 (1.3)	4.0 (1.4)	3.9 (1.7)	0.646	0.505
Oligofructose	3.8 (1.2)	3.8 (1.3)	3.7 (1.5)	0.864	0.419

4
 5

1 **TABLE 3** Agreement (n, %) and kappa values for the categorical assignment of ‘usual
 2 portion size’ and ‘frequency of consumption’ between FFQ1 and FFQ2.

Food item	Portion size*		Frequency (N=66)	
	Agreement, n/N (%)	κ	Agreement, n (%)	κ
Breads (loaf)	56/57 (98.3)	0.94	41 (62.1)	-
Other breads	41/45 (91.1)	0.81	47 (71.2)	-
Rye breads and crispbreads	17/22 (85.0)	0.77	57 (86.4)	-
Wheat cereals	31/38 (81.6)	0.64	45 (68.2)	-
Pizza	24/28 (85.7)	0.78	65 (98.5)	-
Pasta	45/50 (90.0)	0.75	43 (65.2)	-
Noodles	23/25 (92.0)	0.80	59 (89.4)	-
Bulgar wheat, couscous	10/14 (71.4)	0.39	60 (90.9)	-
Cakes, muffins, doughnuts	36/42 (85.7)	0.75	49 (74.2)	-
Pastry products	25/32 (78.1)	0.58	52 (78.8)	-
Flour-based puddings	8/12 (66.7)	-	63 (95.5)	0.75
Biscuits	29/33 (87.9)	0.80	47 (71.2)	-
Biscuit-based products	18/19 (94.7)	0.87	53 (80.3)	0.55
Beer	26/26 (100)	1.00	55 (83.3)	0.86
Onion	47/57 (82.5)	0.71	44 (66.7)	0.58
Banana	39/43 (90.7)	0.56	46 (69.7)	0.62
Asparagus	15/16 (93.8)	0.90	65 (98.5)	-
Garlic	40/46 (87.0)	0.72	48 (72.7)	0.67
Jerusalem artichoke	1/2 (50.0)	-	66 (100)	-
Globe artichoke	5/5 (100)	1.00	65 (98.5)	-
Leeks	20/22 (90.9)	0.81	62 (93.9)	-
Chicory root	2/2 (100)	-	66 (100)	-
Specialist chicory coffee	2/2 (100)	1.00	66 (100)	-

3 *Where foods were not consumed by all 66 subjects, a ‘usual portion size’ was not
 4 recorded and therefore the total number of responses (N) was less than 66.
 5 However, for ‘frequency of consumption’ missing values were assumed ‘zero’ and
 6 therefore the total number of responses (N) was always 66.

- 1 - κ values could not be calculated as they require a symmetric 2-way table in which
- 2 the values of the first variable match the values of the second.
- 3
- 4

1 **FIGURE LEGENDS**

2

3 **Figure 1a** Bland-Altman plot of inulin intakes measured using a 7-d semi-weighed FD
4 and FFQ1 (n=66). The mean difference (FFQ1-FD, solid line) is -0.09 g/d and the
5 Bland-Altman limits of agreement (2 SD of the mean difference, dashed lines) are -
6 3.1 to 2.9 g/d.

7

8 **Figure 1b** Bland-Altman plot of oligofructose intakes measured using a 7-d semi-
9 weighed FD and FFQ1 (n=66). The mean difference (FFQ1-FD, solid line) is -0.03 g/d
10 and the Bland-Altman limits of agreement (2 SD of the mean difference, dashed
11 lines) are -2.9 to 2.8 g/d.

Figure 1a

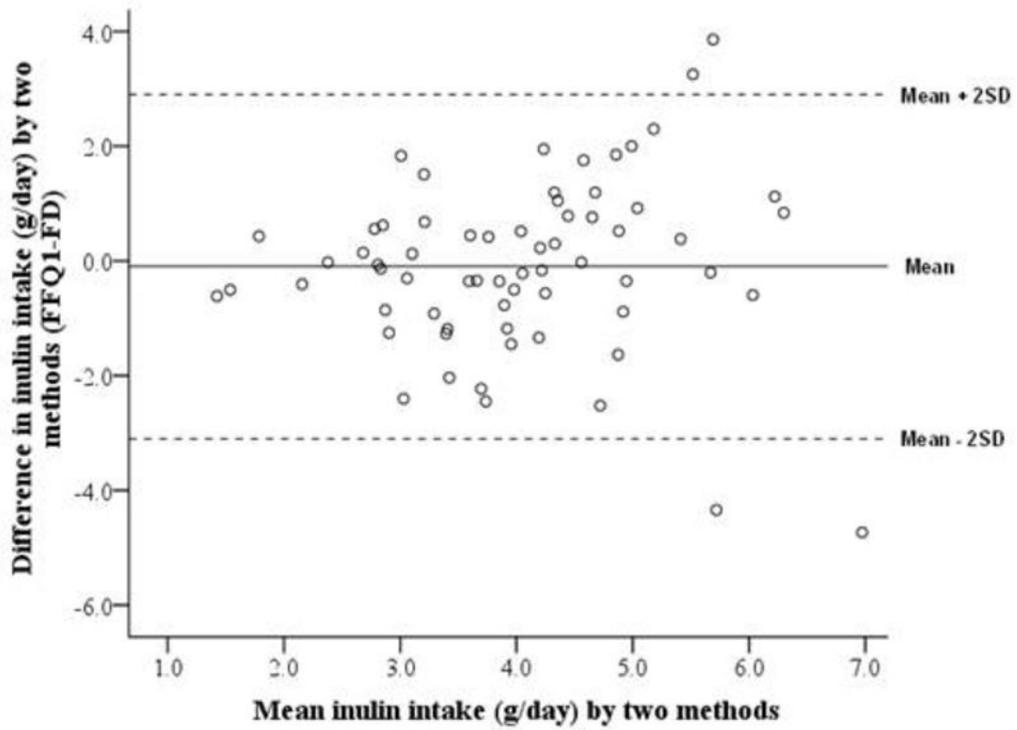


Figure 1b

