www.jnsd.tums.ac.ir

Original Article Open Access

Validation of a Short Semi-Quantitative Food Frequency Questionnaire for Adults: a Pilot study

Mahsa Ahmadnezhad.[a,b], Zahra Asadi[a], Hamid Heidariyan Miri[C], Mehrangiz Ebrahimi Mameghani[b], Majid Ghayour-Mobarhan[d], Gordon Ferns[e]

[a] Department of Food Processing, Research Institute of Food Science and Technology, Mashhad, Iran
[b] Doctorate of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran
[c] Psychiatry and Behavioral Sciences Research Center, Ibn-e-Sina Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

A B S T R A C T

Article History
Received:
12/10/2016
Revised:
20/1/2017
Accepted:
02/02/2017

Keywords:
Food frequency questionnaire; Validation, Reproducibility; Validity; 24 hour recall

Objective: We aimed to assess the validity and reproducibility of a short food frequency questionnaire (FFQ) in a pilot study.

Methods: Thirty individuals, age range 35-65 years completed twice the short semi quantitative food item FFQ with six month interval along with two 24 hour dietary recall (24 HR). Food and nutrient intakes were compared using Pearson's and intra-class correlation and Bland-Altman analysis. Also, to assess the internal consistency for the FFQ Cronbach's alpha was measured.

Results: The results showed acceptable internal consistency with Cronbach's alpha 0.67. Pearson's correlation coefficient for reproducibility varied between 0.25 for hot beverages up to 0.72 for dairy products with a mean 0.51 and likewise for ICC, fluctuated between 0.05 for legume up to 0.74 for dairy products with a mean 0.5. The mean ICC and Pearson's correlation coefficient for validity in food groups were 0.39 and 0.47. Also, the validity and reproducibility of questionnaire was assessed for nutrients. The mean Pearson correlation coefficient, ICC were assessed sequentially 0.42 and 0.36 for validity in nutrients and reproducibility in nutrients assessed by Pearson's correlation coefficients 0.59 and ICC 0.62 ($P<0.05$).

Conclusion: Our results indicated that this questionnaire provides a reasonable measure of macronutrients and micronutrients. However questions which related to consume legumes and protein intake need further investigation and it is recommended that further research with larger population and more 24HR in future.

Citation: Mahsa Ahmadnezhad, Zahra Asadi, Hamid Heidariyan Miri, Mehrangiz Ebrahimi Mameghani, Majid Ghayour-Mobarhan, Gordon Ferns. **Validation of a Short Semi-Quantitative Food Frequency Questionnaire for Adults: a Pilot.** J Nutr Sci & Diet 2017; 3(2): 49-55.

Introduction

In prospective cohort studies related to health status in the community, nutritional epidemiology has given us strong evidence for an association between dietary intakes with chronic disease [1]. One of the usual means for assessing long term dietary intake in large experimental survey are food frequency questionnaires (FFQ), they enable researchers to evaluate dietary pattern and nutrient intake over a long period of time [2, 3]. FFQ is a highly efficient tool that is quick and easy to administer, and is inexpensive, making it appropriate for studies with large population. In

Corresponding author:
Mehrangiz Ebrahimi-Mameghani Ph.D. Nutrition Research Center, School of Nutrition & Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran. Email: ebrahimimamagani@tbzmed.ac.ir

addition the FFQ is a valuable tool for measuring habitual diet over a specific period via short-term food records [4].

Because diet plays an important role in health [5-7] and nutritional intakes are associated with increasing prevalence of obesity, diabetes and cardiovascular disease, it is necessary to estimate in communities in order to reduce the cost of treatment and mortality rate, resulting from chronic disease [8-10].

Since the characteristic of the FFQ depends on features of food and cultural food consumed within a particular population, a valid and reliable FFQ for one population may not be usable in other populations, therefore, before application of unspecified FFQ it must assess for validity and reproducibility [11, 12].

This short semi-quantitative food questionnaire is a part of large questionnaire consisting of demographic, physical exercise, tobacco, alcohol, anthropometrics measurement, cardiovascular risk-related questionnaire and anxiety and depression questionnaires to assess dietary pattern to the presence of CVD along with others factors [13]. Therefore, the duration of completing FFQ was important to ensure completion of all questions.

There have been few FFQ validated for the Iranian population; this include the Golestans FFQ which is part of the Golestan cohort study of esophageal cancer [14], Tehran lipid and Glucose study (TLGS) [15] and validated FFQ for folate intake statues in breast cancer patient [16]. In order to the variety of food culture in the Iranian population and the absence of a short FFQ, also previous FFQ that have been intended for Iranian population belonging to specific diseases like diabetes or cancer and they consist of more question rather than our questionnaire that need a greater deal of commitment and effort from participants, also may increase the number of non-responders, a locally validated tool was needed to assess long term dietary intake in Mashhad population.

Methods

To measure the validity of FFQ for measuring dietary pattern and nutrient intake among participant first the FFQ was complete by 5 dieticians of medical faculty of Mashhad University for content validity and acceptability of food items and questions included, then 30 individuals (43% male and 57% female) were randomly selected by computer generated random number among the MASHAD study population. Subjects who had history of chronic diseases, weight change, pregnant and lactating women were excluded.

All participants gave informed, written consent to contribute in the survey, which was reviewed and approved by the ethics committee of Mashhad University of Medical Sciences (MUMS). The FFQ consisted of 65 items, and could be completed in about 20 minutes. The FFQ was administered through interviews (not by self-reporting) in order to minimize errors in estimation portion and intake frequency. Two interviews with an interval of six-month between them were performed for data collection, together with a 24HR. The frequency of consumption of several food items was reported for the preceding year on a daily, weekly or monthly and never/seldom response was also mentioned if subject never consumed a given food item. The reported frequency of each food item was converted into a daily consumption and seldom/never was calculated as zero. The portion sizes were defined as the reference serving size, and are presented in house-hold measures and in grams. Food items were organized into 17 food group including: grains, snacks, fast food, dairy products, saturated fat, fruits, hot beverages, carbonated beverages, honey, sugars, leafy vegetables, other vegetables, pickles, animal protein, legumes, liquid foods, nuts. This classification done based on the similarity of their nutrients and previous studies carried (Table. 2) [17].

Statistical analyses

The two 24HRs were collected before answering the FFQ and the average of these was used in all analyses. For the estimate of nutrient intake, complex foods were categorized into simple food also due to variation in recipe preparation we estimated regular items based

Table 1. Characteristics of study population who were included in the final analysis

	n=30	n=9700	P value
Gender (%)			
Men	43.3	40	0.7
Women	56.7	60	
Educational Status Illiterate (%)	17.2	13.1	0.3
Age (y)	57.9±7.3	58.3±8.2	0.1
BMI (kg/m²)	28.0±4.7	28.0±5.2	0.9

Table 2. Studied food and food groups in the validation study	
Grains	Bread, rice, spaghetti, potato
Snacks	Biscuit, cake, ice cream, chips, chocolate
Fast foods	Pizza, red meat products
Dairy products	Whole milk, low fat milk, yogurt, cheese, cream,
Saturated fat	Butter, mayonnaise
Fruits	Trees fruit, seasonal fruit, fruit juice, dried fruit
Hot beverages	Tea, coffee
Carbonated beverages	Coke , diet coke, free alcohol beer
Honey	Honey
Sugars	Sugar, diabetic sugar
Leafy vegetables	Green vegetables, lettuce, spinach
Other vegetables	Tomato, cucumber, onion, garlic
Pickles	Sour and salty pickles
Animal protein	Red meat, poultry, fish and egg
Legumes	Legumes
Nuts	Nuts
Liquid Foods	Soup, Pottage

portion size. After converting portion size to gram and calculate energy and nutrient intake of each person statistical test like Pearson correlation coefficient and ICC was undertaken using SPSS version 18. To assess the internal consistency for the FFQ Cronbach's alpha was measured. Descriptive analyses were used to determine the demographic of the study population. The normality of dietary intake variable first assessed after log transformation improved the normality of the data and was used for the analysis. Diet plan software version 7 was used to assess energy and nutrient intake for each individual. After definition of 17 food groups, Pearson's correlation coefficients and ICC were determined with 95% confidence to measure validity and reproducibility via relationship between two 24HR and two FFQ. In addition, Limit of agreement estimated by Bland-Altman plots. The Bland-Altman plots assessing the relative validity between short FFQ and 24HRs for each participant. The difference in intake between the average of two FFQ and 24HRs is plotted against the mean intake from two methods. The residual nutrient intake were added after calculating residual from regression model, adjusted nutrients computing as dependent variable and total energy as independent variable. A t-test was used to determine difference between male and female intakes.

Results

Participants who were selected from the MASHAD study population for assessing the FFQ included in analyses and demographic data for all participants were shown in table number

Table3. FFQ reproducibility (correlations between FFQ1 and FFQ2) and validity (correlations between FFQs and 24 hour dietary recalls) (n = 30)

	Reproducibility		Validity	
Food Groups	Pearson's correlation coefficient	Intra-class correlation	Pearson's correlation coefficient	Intra-class correlation
Grains	0.64**	0.67**	0.5**	0.48**
Snacks	0.42*	0.44**	0.42**	0.33*
Fast foods	0.47**	0.70**	0.36	0.17
Dairy products	0.72**	0.74**	0.62**	0.45*
Saturated fat	0.45**	0.3**	0.38**	0.35*
Fruits	0.58**	0.44**	0.66**	0.56**
Hot beverages	0.25**	0.25*	0.54*	0.52**
Carbonated beverages	0.68**	0.68**	0.78**	0.49**
Honey	0.65**	0.40*	0.85**	0.84**
Sugars	0.51**	0.49**	0.56**	0.68**
Leafy vegetables	0.67**	0.51**	0.55**	0.54**
Other vegetables	0.4*	0.71**	0.3	0.18
Pickles	0.48**	0.45**	0.31**	0.42**
Animal protein	0.53**	0.53**	0.38*	0.38*
Legumes	0.32	0.05	0.15	0.01
Nuts	0.37**	0.5**	0.3	0.19
Liquid Foods	0.54**	0.67**	0.49**	0.22

*p Value<.05; **p Value<.01.

Table 4. Correlations between intake in FFQ1 and FFQ2. (FFQ reproducibility)

Nutrients	Correlation coefficient		Intra-class correlation (unadjusted)	Intra-class correlation (adjusted)
	Pearson (unadjusted)	Pearson (adjusted)		
Energy (Kcal)	0.75**		0.75**	
Protein (g)	0.67**	0.57**	0.67**	0.57**
Fat (g)	0.37*	0.42*	0.37*	0.41*
Carbohydrate (g)	0.78**	0.35	0.77*	0.35*
Starch (g)	0.75**	0.35	0.75*	0.34*
Total sugar (g)	0.28	0.21	0.28	0.21
Glucose (g)	0.43*	0.46*	0.42**	0.45**
Fructose (g)	0.44*	0.47**	0.43**	0.46**
Sucrose (g)	0.31	0.20	0.31*	0.20
Maltose (g)	0.73**	0.39*	0.73**	0.38*
Lactose (g)	0.81**	0.82**	0.79**	0.80**
Non-starch polysaccharides (g)	0.79**	0.67**	0.78*	0.66**
Fiber (g)	0.78**	0.65**	0.78**	0.64**
Saturated fat (g)	0.22	0.34	0.21	0.34*
Unsaturated fat (g)	0.82**	0.80**	0.77**	0.0.71**
Trans fatty acids (g)	0.43*	0.50**	0.42**	0.48**
Cholesterol (g)	0.43*	0.50**	0.41*	0.50**
Sodium (g)	0.83**	0.70**	0.83**	0.68**
Calcium (mg)	0.74**	0.78**	0.73**	0.78**
Phosphorus (mg)	0.76**	0.77**	0.76**	0.77**
Iron (mg)	0.77**	0.56**	0.77**	0.56**
Copper (mg)	0.73**	0.57**	0.72**	0.55**
Zinc (mg)	0.76**	0.71**	0.76**	0.71**
Chloride (mg)	0.85**	0.61**	0.85**	0.61**
Manganese (mg)	0.71**	0.60**	0.70**	0.60**
Retinol (Mg)	0.28	0.39*	0.20	0.33*
Carotene (Mg)	0.56**	0.58**	0.56**	0.58**
Thiamin (mg)	0.73**	0.56**	0.73**	0.56**
Riboflavin (mg)	0.71**	0.79**	0.67**	0.76**
Vitamin B12 (Mg)	0.57**	0.62**	0.56**	0.61**
Folate (Mg)	0.68**	0.63**	0.68**	0.63**
Vitamin C (mg)	0.51**	0.51**	0.51**	0.51**

*p Value<.05.

*p Value<.05. **p Value<.01.

one. The Cronbach's alpha 0.67 indicated acceptable internal consistency for the FFQ [18]. Table 3 and 5 presents the comparison of the average daily food groups and nutrients intakes by FFQ and 24HRs.Pearson correlation coefficients fluctuated between 0.25 for Hot beverages up to 0.72 for dairy products in reproducibility and mean of that was 0.51, subsequently ICC ranged from 0.05 for legumes to 0.74 for dairy products, mean=0.5 for reproducibility in food groups. In calculating reproducibility higher ICC and Pearson correlation coefficient were found for lactose after adjusted for energy.

The mean ICC and Pearson's correlation coefficient for validity in food groups were 0.48 and 0.4. (Table. 3). Of the 32 macro and micro nutrients investigated, the mean of Pearson correlation coefficients and ICC (0.63, 0.62) for reproducibility and (0.36 and 0.42) respectively were observed for validity (Tables. 4 and 5). The unadjusted pearson's correlation coefficients ranged from 0.85 for chloride to 0.22 for saturated fat while after adjusting for total energy, Pearson's correlation coefficients decreased for all groups, except fat, glucose, lactose, fructose, trans fat, saturated fat, cholesterol, calcium, phosphorus and retinol. The high correlation between the FFQ and 24HRs was >0.6 for 4 components (Energy and Fat, sucrose, saturated fat), and 4 food groups (dairy products, fruits, carbonated beverages, honey), also moderate validity (0.4-0.6) {grains,

Table 5. Correlations between intake in FFQ1 and FFQ2 and the average of two 24 hour dietary recalls. (FFQ validity)

Nutrients	Correlation coefficient		Intra-class correlation (unadjusted)	Intra-class correlation (adjusted)
	Pearson (unadjusted)	Pearson (adjusted)		
Protein (g)	0.20	0.05	0.18	0.05
Fat (g)	0.63**	0.30	0.59**	0.30*
Carbohydrate (g)	0.54**	0.11	0.53**	0.11
Energy (Kcal)	0.61**		0.61**	
Starch (g)	0.57**	0.31	0.56**	0.31*
Total sugar (g)	0.42*	0.37*	0.32*	0.29
Glucose (g)	0.40*	0.42*	0.37*	0.39*
Fructose (g)	0.42*	0.44*	0.37*	0.39*
Sucrose (g)	0.65**	0.45*	0.39*	0.43**
Maltose (g)	0.54**	0.39*	0.65*	0.30*
Lactose (g)	0.37*	0.37*	0.32*	0.33*
Non-starch polysaccharides (g)	0.29	0.27	0.19	0.19
Fiber (g)	0.30	0.30	0.20	0.20
Saturated fat (g)	0.65**	0.42*	0.52**	0.42**
unsaturated fat (g)	0.24	0.23	0.24	0.24
Trans fatty acids (g)	0.38	0.1	0.38	0.1
Cholesterol (g)	0.56**	0.45*	0.55**	0.45**
Sodium (g)	0.51**	0.20	0.45**	0.19
Calcium (mg)	0.40*	0.44*	0.40*	0.44**
Phosphorus (mg)	0.35	0.32	0.35*	0.32*
Iron (mg)	0.29	0.35	0.26	0.33*
Copper (mg)	0.19	0.43*	0.17	0.42**
Zinc (mg)	0.31	0.13	0.03	0.01
Chloride (mg)	0.52**	0.28	0.43**	0.26
Manganese (mg)	0.22	0.25	0.11	0.12
Retinol (Mg)	0.49**	0.42*	0.49**	0.41*
Carotene (Mg)	0.49**	0.44*	0.47**	0.42*
Thiamin (mg)	0.38*	0.35	0.38*	0.34*
Riboflavin (mg)	0.31	0.31	0.29	0.28
Vitamin B12 (Mg)	0.19	0.22	0.18	0.20
Folate (Mg)	0.25	0.36	0.21	0.34
Vitamin C (mg)	0.50**	0.49**	0.35*	0.34*

Two-way random and average measures correlations were used.

*p Value<.05. **p Value<.01.

snacks, hot beverages, sugars, sugars, leafy vegetables, liquid foods} considered in food groups and {Maltose, Fructose, Glucose, Total sugar, starch, carbohydrate, cholesterol, sodium, chloride, retinol, carotene, vitamin C } in nutrient respectively. Weak correlations in validity <0.4 were also observed for several food groups (nuts, legumes, animal protein, pickles, other vegetables, fast foods and saturated fat) and nutrients (unsaturated fat, trans fat, protein, lactose, non-starch polysaccharides, fiber, calcium, phosphorus, iron, copper, zinc, manganese, thiamin, riboflavin, vitamin B12 and B9). After adjusting for energy, 2 out of 32 macro and micronutrient showed non-significant ICC (sucrose, total sugar) whereas among 17 food groups liquid foods, nuts, other vegetable, fast foods, legumes shown the least values for ICC. Analysis of Bland-Altman plots illustrates that, although the correlation and ICC for protein and fiber were weak but a few participants fell outside the limit of agreements (LOA).

Discussion

The mean correlation coefficients and ICC were consequently (0.51-0.5) in food groups which are higher than the BIGCS study [4]. Hafenberger and et al affirm that the correlation in the validation studies should be ≥ 0.3, preferably more than 0.4 and optimally 0.5-0.7 [19]. No significant differentiation between nutrient intake in women and men was observed. Our results demonstrated similar validity and reproducibility compared to that reported by other investigators [20, 21].

As previous studies standardized their FFQ along with 24HR, we designed our study to following them [22, 23]. In different studies number of FFQ and 24HR fluctuated and at least one 24HR recorded to the analyses with FFQ [24]. Indeed, high number of 24HR, reveal higher reality of nutrient intakes compeer with FFQ [24].

Like previous study in Iran higher correlation was observed among more frequent consumption items such as grains, dairy products, fruits, vegetables and carbonated beverages; moreover, items like legumes, fast foods, nuts and hot beverages which are less frequent consume and within high person variability had weak correlation compare with other items [25].

In brief, this short semi-quantitative FFQ is a tool that was used for the assessment of dietary intake in MASHAD study population that has appropriate levels of reproducibility and validity. Although, the observed values for ICC and Pearson's correlation coefficients in some items was lower than 0.3, most of food groups and nutrients showed considerable values for ICC. Nevertheless, on the point are some limitation that should be considered when evaluating data obtained from dietary assessment tools like recalling data and change dietary habit in different season and over estimation compared to reference method this FFQ is a valid tool to quick assess dietary intakes and could be used in epidemiological studies. Moreover long term period of study might be the reason of weak reproducibility, also disagreement might be due to complex food and consume seldom like legume in Iranian stew more over 24HRs depends on memory so disremember some details is very common [19].

Validation study should ideally be carried out using recovery biomarkers such as doubly labeled water, marker of potassium and nitrogen in 24 hour urine collection to validate total energy intake, potassium and protein intake respectively. More 24HR would probably lead to higher agreement [26]. This study was conducted as a pilot study further investigation needs to develop this questionnaire. This information indicates that MASHAD study's FFQ has acceptable level of reproducibility and validity so it could be considered as a suitable tool in Mashhad urban population.

Acknowledgment

The research team would like to appreciate the participant of study who generously shared their time.

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Funding: This study was support by grant from Mashhad University of Medical Sciences.

References

1. Milner J. Strategies for cancer prevention: the role of diet. British Journal of Nutrition. 2002;87(S2):S265-S72.
2. Willett W. Nutritional Epidemiology. 2nd edNew York: Oxford University Press. 1998.
3. Yildiz F, Kotzekidou P, Michaelidou A, Nocella G. Functional food in Mediterranean and Middle Eastern countries: history, scope and dietary habits. 2007.
4. Athanasiadou E, Kyrkou C, Fotiou M, Tsakoumaki F, Dimitropoulou A, Polychroniadou E, et al. Development and Validation of a Mediterranean Oriented Culture-Specific Semi-Quantitative Food Frequency Questionnaire. Nutrients. 2016;8(9):522.
5. Giovannelli J, Dallongeville J, Wagner A, Bongard V, Laillet B, Marecaux N, et al. Validation of a short, qualitative food frequency questionnaire in French adults participating in the MONA LISA-NUT study 2005-2007. Journal of the Academy of Nutrition and Dietetics. 2014;114(4):552-61.
6. Eilat-Adar S, Mete M, Fretts A, Fabsitz R, Handeland V, Lee E, et al. Dietary patterns and their association with cardiovascular risk factors in a population undergoing lifestyle changes: The Strong Heart Study. Nutrition, Metabolism and Cardiovascular Diseases. 2013;23(6):528-35.
7. Field AE, Peterson KE, Gortmaker SL, Cheung L, Rockett H, Fox MK, et al. Reproducibility and validity of a food frequency questionnaire among fourth to seventh grade inner-city school children: implications of age and day-to-day variation in dietary intake. Public health nutrition. 1999;2(3):293-300.
8. Sun J, Buys N, Shen S. Dietary patterns and cardiovascular disease-related risks in Chinese older adults. Frontiers in public health. 2013;1.
9. Denova-Gutiérrez E, Tucker KL, Flores M, Barquera S, Salmerón J. Dietary patterns are associated with predicted cardiovascular disease risk in an urban Mexican adult population. The Journal of nutrition. 2016;146(1):90-7.
10. Guo J, Li W, Wang Y, Chen T, Teo K, Liu L, et al. Influence of dietary patterns on the risk of acute myocardial infarction in China population: the INTERHEART China study. Chinese medical journal. 2013;126(3):464-70.
11. Chen Y, Ahsan H, Parvez F, Howe GR. Validity of a food-frequency questionnaire for a large prospective cohort study in Bangladesh. British journal of nutrition. 2004;92(5):851-9.
12. Ahn Y, Kwon E, Shim J, Park M, Joo Y, Kimm K, et al. Validation and reproducibility of food frequency questionnaire for Korean genome

epidemiologic study. European journal of clinical nutrition. 2007;61(12):1435-41.
13. Ghayour-Mobarhan M, Moohebati M, Esmaily H, Ebrahimi M, Parizadeh SMR, Heidari-Bakavoli AR, et al. Mashhad stroke and heart atherosclerotic disorder (MASHAD) study: design, baseline characteristics and 10-year cardiovascular risk estimation. International journal of public health. 2015;60(5):561-72.
14. Malekshah A, Kimiagar M, Saadatian-Elahi M, Pourshams A, Nouraie M, Goglani G, et al. Validity and reliability of a new food frequency questionnaire compared to 24 h recalls and biochemical measurements: pilot phase of Golestan cohort study of esophageal cancer. European journal of clinical nutrition. 2006;60(8):971-7.
15. Mirmiran P, Esfahani FH, Mehrabi Y, Hedayati M, Azizi F. Reliability and relative validity of an FFQ for nutrients in the Tehran lipid and glucose study. Public health nutrition. 2010;13(5):654-62.
16. Pirouzpanah S, Taleban F-A, Sabour S, Mehdipour P, Atri M, Farrin N, et al. Validation of food frequency questionnaire to assess folate intake status in breast cancer patients. Razi Journal of Medical Sciences. 2012;18(92):31-41.
17. Mohammadifard N, Sajjadi F, Maghroun M, Alikhasi H, Nilforoushzadeh F, Sarrafzadegan N. Validation of a simplified food frequency questionnaire for the assessment of dietary habits in Iranian adults: Isfahan Healthy Heart Program, Iran. ARYA atherosclerosis. 2015;11(2):139.
18. Turconi G, Celsa M, Rezzani C, Biino G, Sartirana M. Roggi,(2003). Reliability of a dietary questionnaire on food habits, eating behaviour and nutritional knowledge of adolescents. European journal of clinical nutrition.57:753-63.
19. Haftenberger M, Heuer T, Heidemann C, Kube F, Krems C, Mensink GB. Relative validation of a food frequency questionnaire for national health and nutrition monitoring. Nutrition journal. 2010;9(1):36.
20. Watson JF, Collins CE, Sibbritt DW, Dibley MJ, Garg ML. Reproducibility and comparative validity of a food frequency questionnaire for Australian children and adolescents. International Journal of Behavioral Nutrition and Physical Activity. 2009;6(1):62.
21. Xia W, Sun C, Zhang L, Zhang X, Wang J, Wang H, et al. Reproducibility and relative validity of a food frequency questionnaire developed for female adolescents in Suihua, North China. PLoS One. 2011;6(5):e19656.
22. Tang Y, Liu Y, Xu L, Jia Y, Shan D, Li W, et al. Validity and reproducibility of a revised semi-quantitative food frequency questionnaire (SQFFQ) for women of age-group 12-44 years in Chengdu. Journal of health, population, and nutrition. 2015;33(1):50.
23. Selem SSAdC, Carvalho AMd, Verly-Junior E, Carlos JV, Teixeira JA, Marchioni DML, et al. Validity and reproducibility of a food frequency questionnaire for adults of São Paulo, Brazil. Revista brasileira de epidemiologia. 2014;17(4):852-9.
24. Schatzkin A, Kipnis V, Carroll RJ, Midthune D, Subar AF, Bingham S, et al. A comparison of a food frequency questionnaire with a 24-hour recall for use in an epidemiological cohort study: results from the biomarker-based Observing Protein and Energy Nutrition (OPEN) study. International journal of epidemiology. 2003;32(6):1054-62.
25. Esfahani FH, Asghari G, Mirmiran P, Azizi F. Reproducibility and relative validity of food group intake in a food frequency questionnaire developed for the Tehran Lipid and Glucose Study. Journal of epidemiology. 2010;20(2):150-8.
26. Cade J, Thompson R, Burley V, Warm D. Development, validation and utilisation of food-frequency questionnaires–a review. Public health nutrition. 2002;5(4):567-87.