PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 2 (1): 33-35, 2003

Reproducibility and Validity of the Food Frequency Questionnaire Methodology in an Urban Middle Income Group Community of Delhi, India

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Abstract: The food frequency questionnaire (FFQ) method is utilized as a tool in epidemiological studies in which evidence is sought for an association of diet in etiology of a disease. Limited studies have been undertaken to assess the reproducibility of the FFQ methodology in Indian situation. The present study was conducted in an urban middle-income population of Delhi, India. The data on pattern of consumption of food items in standard food groups was collected from 169 subjects, utilizing a pre-tested semi-structured FFQ (Phase I). The consumption pattern of food items in the major food groups was also assessed prospectively for 7 days by the 24-hr dietary recall methodology in each subject. The data was collected again utilizing the similar methodology and tools from the same study subjects after 12 months (Phase II). Reproducibility and validity of the FFQ was assessed by calculating percent agreement between data of Phase I and Phase II utilizing statistical tests. Results revealed that there was a perfect agreement (100% agreement) for the food group i) cereals, ii) fats and oils, and iii) sugar and jaggery. A very good agreement (75-100%) for the food groups i) pulses, ii) green leafy vegetables, iii) fruits, iv) milk products, v) eggs, and vi) flesh foods. Only a good agreement (50 – 75%) was found for the food groups i) roots and tubers, ii) other vegetables, and iii) milk. None of the food groups had fair or poor agreement between the Phase I and Phase II.

Key words: Reproducibility, validity, food frequency questionnaire, food consumption pattern

Introduction

The food frequency questionnaire (FFQ) method is being increasingly used in developed countries as a tool in epidemiological studies where evidence is sought for an association of diet in general, rather than with specific nutrients in a chronic disease (Morgan *et al.*,1978). However, in the Indian situations, concern has been raised about the reproducibility and validity of the dietary data reported from FFQ method due to varied food consumption pattern. The present study was aimed to assess the reproducibility and validity of the FFQ methodology in the urban middle-income group (MIG) population of Delhi, India.

Materials and Methods

The study was conducted in a MIG population residing in an urban area of Delhi, India. The sample consisted of 180 normal healthy subjects (males and females). The inclusion criteria were that they were residents of the study area; were 30-60 years of age; and were free from any known chronic illness so as to affect their dietary consumption pattern. The subject who developed a chronic disease during the study period was excluded from the study. Also, no proxy interviews were accepted. The study was undertaken in two phases. The Phase I was conducted in May-June 1998. The data was collected from the subjects utilizing FFQ and 24 hour dietary recall method prospectively for 7 days. Phase II of the study was conducted in May - June 1999, after 12 months of the data collection of the Phase I.

Under the FFQ, frequency of consumption of any food item (during the past two years) from the twelve major food groups i.e. cereals, pulses and legumes, green leafy vegetables, roots and tubers, other vegetables, fruits, milk, milk products, eggs, flesh foods, sugar and jaggery and fats and oils was inquired. Frequency of consumption of any food item was categorized as 1 – 7 days per week, 1 – 2 days per month, or never. Assistance of spouse living in the same family and sharing the same kitchen was seeked to substantiate the data on dietary consumption pattern of the subject, wherever required.

To assess the reproducibility, statistical tests were applied on the data collected in Phase I and II for the FFQ methodology. Percentage agreement between FFQ responses received in Phase I - Phase II were calculated by cross tabulation of the data. The agreement analysis was interpreted as follows: perfect agreement: 100%; very good agreement: 75 – 99%; good agreement: 50 – 74%; fair agreement: 25 – 49%; and poor agreement: < 25%. Perfect agreement was responses of subjects giving the same responses in both the phases. The interpretation was qualitative (subjective) in nature.

Taking into account genuine issues related to reporting and the need of logical understanding, the data collected

on the FFQ in Phase I and Phase II in terms of days per week and days per month was classified into four sub groups which were as follows:

Frequency of consumption	Classification of the responses
5-7 days per week	4
1-4 days per week	3
1-2 days per month	2
Never	1

The data was collected from each subject using the 24-hour dietary recall method prospectively for 7 days. This was reported as the consumption of the various food groups as consumed per week. This was obtained by adding the consumption of the food group reported each day. The data was obtained in the frequency of one to seven days in a week and never. The resultant data was further classified into three groups for the agreement analysis. The data was classified as follows:

Frequency of consumption	Classification of the responses
5-7 days per week	3
1-4 days per week	2
Never	1

Taking into account genuine issues related to reporting and the need of logical understanding, the data collected on the FFQ in terms of days per week and days per month was classified into three sub groups, which were as follows:

Frequency of consumption	Classification of the responses
5-7 days per week	3
1-4 days per week	2
1-2 days per month or never	1

The percent agreement between the FFQ and the 24-hour dietary recall methodology collected prospectively for 7 days was utilized to assess the validity of the FFQ method. The agreement analysis was interpreted similar to the agreement analysis interpreted for the FFQ data. Perfect agreement was when the subjects gave the same responses in a particular phase for the FFQ as well as the 24-hour dietary recall methodology.

Results

A total of 180 subjects (Males: 56; Females: 124) with a mean per capita income Rs. 4000 were enrolled for the study. For eleven subjects complete data for both the Phases could not be collected hence, these subjects were excluded for the final data analysis. The mean age of the study subjects was 39.5 ± 9.4 years. All the study subjects were educated. About 84% of them were graduates or post-graduates.

The Phase I was compared with the data obtained in the Phase II of the study. Results of the agreement analysis revealed that there was a perfect agreement (100% agreement) for the food group i) cereals, ii) fats and oils, and iii) sugar and jaggery. There was very good agreement (75-100%) between the two phases for the food groups i) pulses, ii) green leafy vegetables, iii) fruits, iv) milk products, v) eggs, and vi) flesh foods. The food groups i) roots and tubers, ii) other vegetables, and iii) milk had a good agreement between the Phases I-II. None of the food groups had fair or poor agreement (Table 1).

Table 1: Percent Agreement for Reproducibility of the Food Frequency Questionnaire (n=169)

Food Groups	Percent Agreement	Interpretation
Cereals	100.0	Perfect
Pulses	85.2 (79.0-90.0)	Very Good
GLVs	75.9 (64.1-87.7)	Very Good
Roots & Tubers	60.9 (54.3-67.5)	Good
Other Veg.	69.6 (62.1-77.1)	Good
Fruits	75.7 (68.7-82.7)	Very Good
Milk	63.3 (56.6-69.7)	Good
Milk Products	86.5 (78.1-94.9)	Very Good
Eggs	87.3 (81.1-93.5)	Very Good
Flesh foods	93.7 (88.3-99.1)	Very Good
Fats & Oils	100.0	Perfect
Sugar & Jaggery	100.0	Perfect

The analysis for the validity of the FFQ revealed that there was a perfect agreement (100%) for the food groups i) cereals, ii) fats and oils; and iii) sugar and jaggery. The food groups i) pulses, ii) roots and tubers, and iii) fruits had a very good agreement (75-100%) in the two Phases. The food groups i) other vegetables, ii) milk, iii) milk products, iv) eggs and v) flesh foods had a good agreement in all the three phases (Table 2).

Discussion

The present study was conducted amongst 169 subjects belonging to the urban areas of India. Comparison of the results revealed that there was a perfect (100%) agreement for the food group Cereals. The dietary pattern of the Indian population essentially constitutes Cereals, which are the major source of energy, and hence a daily consumption was present, resulting in a perfect agreement in the Phase I and Phase II. A very good agreement was found for the foods groups Pulses, Green Leafy Vegetables, Fruits, Milk Products, Eggs, and Flesh Foods. Majority of Delhi population is vegetarian, and hence, the consumption of eggs and flesh foods is negligible. Infrequent consumption of non-vegetarian foods resulted in a very good agreement for the two food groups. Thus the study revealed that the FFQ for all the food groups was reproducible. Validity results revealed that the FFQ there was either good, very good or perfect agreement for all the food groups.

No study has been undertaken in the Indian situations for the reproducibility and validity of the dietary data reported from food frequency method, and hence the results of the present study cannot be discussed

Table 2: Percent agreement for Validity of the Food Frequency Questionnaire

Food Group	Phase I	Phase II	Interpretation
Cereals	100.0	100.0	Perfect
Pulses	78.1 (71.7-84.5)	87.5 (82.5-92.5)	Very Good
Roots & Tubers	72.3 (65.4-79.2)	92.8 (88.8-96.8)	Very Good
Other Vegetables	54.4 (46.8-62.0)	65.7 (58.4-73.0)	Good
Fruits	71.4 (64.5-78.3)	76.2 (69.7-82.7)	Very Good
Milk	52.5 (44.7-60.3)	63.4 (55.9-70.9)	Good
Milk Products	47.3 (38.6-56.0)	59.5 (51.0-68.0)	Good
Eggs	65.8 (57.2-74.4)	68.1 (59.6-76.6)	Good
Flesh Foods	72.6 (65.3-79.9)	72.0 (64.7-79.3)	Good
Fats and Oils	100.0	100.0	Perfect
Sugar & Jaggery	100.0	100.0	Perfect

comparatively in the Indian context. However, various studies conducted in developed countries have documented the validity and reproducibility of the food frequency method (Hammond *et al.*, 1993; Salvini *et al.*, 1989; Stiggelbout *et al.*, 1989). A study conducted amongst British children for the validity of the FFQ, documented FFQ to be a valid instrument for classifying children into broad patterns of consumption and in assessing children's risk factors for coronary heart disease (Hammond *et al.*, 1993). Another study conducted to assess the reproducibility and validity of the FFQ amongst 179 women with an interval of 12 months documented the FFQ to be a reproducible and valid questionnaire (Salvini *et al.*, 1989).

Findings of the present study revealed that there is reproducibility and validity of the Food Frequency Questionnaire Methodology in the Indian population residing in Delhi. There is a need to undertake multi-centric studies with larger sample size in different regions of the country.

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