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DEVELOPING AND VALIDATING FOOD FREQUENCY QUESTIONNAIRE TO ASSESS DIETARY CALCIUM INTAKE IN ADULTS

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ABSTRACT

Assessing calcium intake is necessary for epidemiological studies on osteoporosis. Objective of the study to evaluate a food frequency questionnaire assessing calcium intake in adult. Estimates of calcium intake from the food frequency questionnaire was compared with those from five day dietary records from randomly selected 100 healthy both men and women aged 40 – 70 yrs. The mean calcium intake estimated using FFQ (725.14 ± 106.44)mg/day did not differ significantly from 5Day Dietary Record (707.14 ± 107.96)mg/day. The coefficient of correlation between these two methods was 0.99, a statistically significant value. This food frequency questionnaire could be used in epidemiological studies to assess calcium intake in adults. The specificity in identifying low calcium intake in subjects makes it useful also as an educational tool in diet counselling and for prescribing calcium supplementation.

Keywords: questionnaire, calcium, food frequency, osteoporosis, dietary records.

INTRODUCTION

Bone metabolism is a dynamic and continuous process to maintain a balance between the resorption of old and injured bone initiated by osteoclasts and the formation of new bone under the control of osteoblasts. (Simsek B et al, 2004). Through childhood and early adulthood, formation exceeds resorption so that bone density increases and then plateaus until the age of 30 to 40 years. After that, resorption exceeds formation and bone density decreases through the rest of life, which in turn may lead to osteoporosis (Vipla Puri. 2003).

In India, osteoporosis is beginning to receive attention as a public health problem. Osteoporosis is a major health and economic problem. Expert groups predict the number of osteoporosis patients in India at approximately 26 million (2003 figures) with the numbers projected to increase to 36 million by 2013. (International osteoporosis Foundation Osteoporosis society of India, 2003.

The pathogenesis of osteoporosis involves the interplay of many factors- Nutritional, Environmental, Genetic factors. (Delmas PD. 1993). The cause of osteoporosis is multifactorial. Besides genetic differences and endocrine factors, lifestyle behaviour such as physical activity level and dietary composition, especially calcium intake, plays an important role in preventing osteoporosis. In the absence of a national dietary survey, data available from several general dietary studies among Indians of different age categories often show calcium intakes below 500 mg/day. Low calcium has been found to be one of the risk factors for osteoporosis amongst Asian women.

Assessing the calcium intake of Indians would be important to identify individuals at risk so that appropriate intervention programs can be targeted. There remains no 'gold standard' for the assessment of dietary intakes. In epidemiological surveys, a dietary assessment tool that is simple to administer, less demanding on the subjects and less tedious to analyse is often required. The food frequency questionnaire (FFQ) appears to provide the advantage of fulfilling these criteria in assessing nutrient intakes. Despite limitations of structured questionnaires of this type, a major advantage of the FFQ is its feasibility for establishing long-term habitual dietary intake. FFQs are used widely in epidemiological studies in the West. Observational epidemiological studies of diet or nutrition reported from India have relied on dietary assessment consisting of check lists for different foods and food categories.

The dietary calcium intake in Indian population is less than the RDA, which may have unfavourable effects on the health. Therefore the present study was planned with the objective to develop a valid calcium food frequency quantitative questionnaire (FFQ) to estimate the dietary calcium intake in adult Indian population.

MATERIALS AND METHODS

Adults between the age group of 40 -70 yr in and around Chennai (Porur) where chosen for the study and was carried for a period of 3 months (January – March 2011). The inclusion criteria for the present study were healthy individuals with no disease condition affecting the nutritional status, food intake, and ability to record the

dietary intake, subjects not on any calcium supplementation. Informed consent was obtained from each subject participating in the study.

CALCIUM FOOD FREQUENCY QUESTIONNAIRE

The calcium questionnaire was constructed by listing the foods from the nutritive value of Indian foods, National institute of nutrition. The questionnaire consisted of the foods that have more than 30 mg of calcium per 100 gm. All the food groups were included. There was no inclusion of calcium supplements, calcium fortified foods, soft drinks. Servings were listed in three quantitative groups identified as small, medium, large and with grams of food. The portion sizes were divided into small, medium and large as follows: small = 0.5 × standard/medium portion size; medium = 1.0 × standard/medium portion size; and large = 1.5 × standard/ medium portion size. Subjects were also asked to indicate the relative weekly frequency of use of each item. Although the calcium questionnaire can be self-administered, in this study it was administered by the investigator, a trained dietician. The calcium questionnaire was administered to subjects before asking to complete the dietary record, and special care was taken to check for completeness and clarity of both the Calcium Food frequency questionnaire and the Dietary record.

THE REFERENCE METHOD

Normally, nutrient intakes estimated from a FFQ are compared to those derived from multiple days of food diaries or 24-h diet recall interviews (24HR). After completing the FFQ, subjects were asked to keep a five day dietary record, recording everything they ate and drank. A 5 day dietary record (5 DDR) was chosen so as to include the three weekdays and two weekends, because of the variations in the dietary intake. Weight was estimated with the help of household measures (i.e., bowls, cups, glasses, teaspoons and tablespoons). The subjects were instructed on the methods of recording data.

STATISTICAL ANALYSIS

Calcium intakes were computed separately for FFQ and 5 DDR, and only then were comparisons done. The database for calcium content estimate was represented by the food tables of the Nutritive value of Indian foods. Means, standard deviations and ranges were calculated for calcium intakes measured by the FFQ and food records methods. The agreement between the two methods was assessed as proposed by Bland and Altman (1986) calculating the mean and standard deviation of the differences. In order to see how well the FFQ and the 5 DDR agreed, the data was plotted in a scatter Diagram and to analyze the differences between the measurements by the two methods. Comparison of calcium intake between different groups like age, socioeconomic status, and occupation was done using one way ANOVA.

RESULTS AND DISCUSSION

The 100 adults, 36 male and 64 female who completed the food frequency questionnaire and the 5 day dietary record had a mean age of 54.28±8.7yr. The characteristic profile of the subjects in shown in table I. Majority of the subjects were moderate workers and belonging to middle income group. The mean calcium intake obtained from the 5 day dietary record was 707.14±107.96 mg/day and that from the food frequency questionnaire was 725.14±106.44 mg/day. In order to see how well the FFQ and the 5DDR, the first step was to plot the data in a scatter diagram and to analyze the differences between the measurements by the two methods. If the methods agreed exactly, the points would all lie on the same line of equality, but of course real data virtually never agree exactly. Figure I show the scatter diagram to analyze the differences between the measurements by the two methods. The mean values did not differ significantly and both the methods yielded normally distributed calcium intakes. We found however that all our data points were quite near to the line of equality. The coefficient of correlation between the two methods was 0.99 (p<0.001). Figure II depicts the differences between the 5 day dietary record and the FFQs. The values were plotted against the average of the two measurements and were found that the two methods were well likely to agree for an individual. The maximum difference was found to be 13.2 mg/day and the minimum difference -53.6 mg/day. The mean difference was 18.2±17.8 mg/day which was minimal.
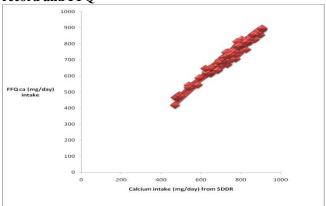
Table I Characteristic profile of the subjects (N=100)

Characteristics		Male (n=36)	Female (n=64)
Age (yr)	40-50	17	23
	51-60	8	21
	61-70	11	20
Socio Economic Status*	Low income	8	16
	Lower middle income	5	6
	Middle income	14	22
	High income	9	20
Social habits	Tobacco	6	17
	Smoking	10	-
	Alcohol	10	-
	Smoking and alcohol	6	-
	Nil	4	47
Menstrual history	Normal	-	30
	Irregular	-	18
	Menopause	-	16
Occupation	Heavy worker	15	24
	Moderate worker	18	32
	Sedentary worker	3	8
BMI (Kg/m²)**	Normal	31	37
	Underweight	2	12
	Overweight	2	13
	Obese	1	2

*Kuppusamy classification **WHO classification

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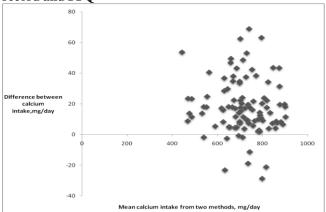
Figure I -Scatter plot of daily calcium intake from diet record and FFQ

All our data points were quite near to the line of equality, which proves that both the methods estimated the calcium intake similarly.

Figure II -Differences against mean for 5-days diet record and FFQ

To consider how well the two methods were likely to agree for an individual, the differences between the mean calcium intake values of the methods, 5DDR and the FFQs were plotted against the average of the two measurements. The maximum difference was found to be 13.2 mg/day and the minimum difference -53.6 mg/day. The mean difference was 18.2±17.8 mg/day which was found to be minimal proving that both the methods agree equally.

CONCLUSION

Calcium has an important role in bone health, particularly in preventing osteoporosis, a disease that affects mostly post-menopausal women. Assessing calcium intake is essential for adults to prevent osteoporosis. There are not many specific questionnaires to assess the calcium intake for Indian population because of this reason the present study has been conducted. The FFQ presented in this study is a valid tool for calcium intake assessment for south Indian population. The specificity in identifying low calcium intake subjects makes it useful also as an educational tool in diet counselling and for prescribing calcium supplementation.

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