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***Research Article***

# RELIABILITY ESTIMATION OF ELDERLY DIETARY INDEX AS A TOOL TO ASSESS DIETARY QUALITY OF RURAL ELDERLY IN INDIA

***Monika Jain, Payal Jain and Khushboo Gupta**
*Department of Food Science and Nutrition, Banasthali Vidyapith, Rajasthan (India)*
**Author for Correspondence*

## ABSTRACT
During recent years, a massive increase in elderly population has taken place. Multidimensional problems are faced by elderly, which can have considerable nutritional and health ramifications. The prevalence of under nutrition among older people reaches high levels, so assessment of older people's nutritional status is important in clinical care. Various dietary quality indices are being used for dietary quality assessment of elderly. Elderly dietary index (EDI) is one of the important and easily applied tools among them. The study aimed to conduct dietary intake assessment and dietary quality evaluation using a standardized EDI. Reliability of EDI was also investigated with respect to dietary pattern of Indian rural elderly people. The sample of the study comprised of 30 aged people (n= 15 male, n= 15 female of 60+ years of age) selected from rural area of Banasthali (Tonk district), Rajasthan. Dietary intake of the subjects was estimated by 24 hour dietary recall method. Reliability of EDI was evaluated in terms of internal consistency which was assessed with two different methods (Split half and Chronbach's alpha). Energy and nutrients (protein, fat and calcium) intake was not appropriate when compared to recommended dietary allowances (RDA) in both male and female subjects. Significant difference ($p<0.05$) was observed in energy intake of male and female elderly subjects whereas no significant difference ($p>0.05$) was observed in all the other nutrients (fat, calcium and protein). There was a significant positive correlation ($p<0.05$) between EDI score and energy intake; while on the other hand, no significant correlation ($p>0.05$) of EDI score existed with other nutrients. Reliability was 0.570 by Split half method and 0.392 by Chronbach's alpha method. Because of low reliability, it can be interpreted that in the present study locale, this tool is not suitable. The original EDI should be modified according to area specific dietary guidelines, so that it can have better reliability.

***Keywords:*** *Elderly, Dietary Quality, Dietary Index, Nutritional Assessment, Reliability*.

## INTRODUCTION
The number of older adults (i.e., 65 years of age or older) is increasing rapidly worldwide. This demographic change has several implications at the public health level because several chronic diseases are more prevalent among older adults (Kourlaba *et al.,* 2009). Low food intake or consumption of compromised dietary variety by the elderly with poor appetite may lead to them being more vulnerable to malnutrition (Donini *et al.,* 2003). Along with this, the ability of rural elders to consume a healthful diet is affected by limitations faced by older adults (Clarkston *et al.,* 1997) coupled with lower educational and income levels and lack of proximity to transportation (Garry *et al.,* 1992). This increases the likelihood that rural older adults will consume such diets that fail to meet recommendations for the types and quantities of foods (Hays *et al.,* 2005). Hence the need for dietary quality and dietary intake assessment emerges. However, various dietary intake assessment methods are available, but they do not reflect comprehensive information about overall diet quality.

Dietary pattern analysis has emerged as an alternative approach for studying the potential impact of diet as a whole in relation to disease prevention (Jacobs and Steften, 2003). In this regard, varieties of indices have been proposed, but no gold standard has been adopted. Among all these dietary quality indices, Elderly Dietary Index (EDI) is a simple and easily applied tool for assessing the degree of adherence to specific dietary recommendations for older adults. It is based on dietary guidelines of U.S. Department of

Agriculture using modified food guide pyramid for older adults (Kourlaba *et al.*, 2009). When such type of a standardized tool use in another study area, then it should be thoroughly modified with area specific dietary guidelines, so that diagnostic accuracy of the tool can be upgraded. In this regard, concept of reliability emerges as an important aspect. Therefore, in the present investigation, the reliability of EDI was evaluated by two different methods and dietary intake assessment was also taken up.

## MATERIALS AND METHODS

***Sample:*** Study sample comprised of 30 elderly people (n = 15 men; n = 15 women of 60 + years of age). Two separate lists of male and female residents above 60 years of age, in Banasthali Vidyapith were prepared and 15 from each list were randomly selected. For those who did not consent, the next name in the list was approached. Informed consent was obtained from all the participants of the study.

***Data collection:*** The investigator went to each subject to explain them the purpose of the study and to assure them that their responses would be kept confidential. To ascertain the dietary quality and dietary quantity of the elderly subjects, elderly dietary index and 24 hour dietary recall methods were used.

***Tools:***

***Dietary assessment:*** For dietary assessment of the subjects, 24 hour dietary recall method was used (Thimmayama, 1987). This technique aims to quantify dietary intake over the previous 24 hours. Respondent was asked to remember and report all the foods and beverages consumed in the preceding day. The interviewer used prompts to assist the respondent to estimate portion sizes of the item consumed. Raw ingredients of the food item were carefully recorded and then followed by standardization of the recipes in the food laboratory. Information obtained by this method is representative of usual intake of an individual. Percent consumption of energy, protein, fat and calcium intake was also calculated and compared with recommended dietary allowances (RDA) (Gopalan *et al.*, 2007).

***Elderly Dietary Index (EDI):*** EDI is a useful tool to assess dietary quality of older adults. This tool is based on dietary guidelines of U.S. Department of Agriculture. It consists of 10 components (i.e., questions about the consumption frequency of egg, sweets, fruits, vegetables, grains, legumes, edible oils, alcohol, and type of bread and dairy products) according to modified MyPyramid for older adults. Scores from 1 to 4 have been assigned to all components of the index. The EDI total score has a range of 10 to 40. Original EDI was used to study its suitability in assessing dietary quality of Indian rural elderly people. To improve the qualitative characteristics of a tool with respect to enhance diagnostic accuracy, concept of reliability emerges as a pivotal aspect. By using reliability concept, a tool is considered as internally consistent, stable and results in repeatable outcomes, which helps to increase the qualitative characteristics of a tool. Along with this, reliability can have an impact on the acceptance of a study; hence reliability assessment was undertaken.

***Reliability of tool:*** The reliability of a test refers to the consistency with which it yields the same rank for an individual taking the test several times. Reliability is generally assessed in terms of internal consistency.

*Internal consistency:* In this endeavour, two approaches were used to determine internal consistency, i.e., Split Half method and Chronbach's Alpha method. They form the reliability of a tool.

1. *Split- Half method:* Spearman - Brown Prophency formula was used for internal consistency evaluation.

$$r_w = \frac{2r_h}{1+r_h}$$

Where:

$r_w$ = correlation for the whole test

$r_h$ = correlation between the two halves of the test

This formula gives the predicted split- half (or odd even) reliability coefficient.

(Asthana and Agarwal, 1982)

2. *Chronbach's Alpha method:* It is a method of estimating reliability for a test that is composed of any combination of item types. It is more flexible method.

$$Coefficien\,t\alpha = \frac{k}{k-1}\left[1-\frac{\sum s_i^2}{s_t^2}\right]$$

Where:
k = number of separately scored test items
$\sum$ = the operational symbol meaning the sum of
$s_i^2$ = variance of subject's scores on a particular test item
$\sum s_i^2$ = sum of the item variances for all test item
$s_t^2$ = variance of the total test scores (ITAP, 2003)

***Data analysis:*** On the basis of EDI scores, subjects were classified as having unhealthy diet, moderate healthy diet and healthy diet. The data was analyzed using SPSS- 16.0 and M.S. Excel. The results were expressed in terms of mean and standard deviation (S.D.). Student's- t test was applied to assess the significant difference between mean intake of energy, protein, fat and calcium in male and female subjects. This test was also applied to study the difference between EDI scores of male and female subjects. Correlation between EDI scores and energy and nutrient intake was computed and its significance was determined at 5% level. Chi square test was also used to adjudge the relationship between EDI scores and energy and nutrient intake.

## RESULTS AND DISCUSSION

The mean age of the study group was 65.83±6.85 years. Mean ages of women and men were 66.0±7.14 and 65.6±6.82 years respectively. All the subjects were healthy and fit.

***Dietary assessment:*** Dietary assessment data shows that (table 1) energy and nutrients (protein, fat and calcium) intake was not appropriate when compared to RDA in both male and female subjects; higher deviation from RDA was observed in energy, protein and fat whereas calcium intake was appropriate in men but not in women. Majority of the subjects were consuming energy between 1000 to 1500 kcal/day.

**Table 1: Mean energy and nutrients intake of the subjects**

| S. No. | Nutrients | Group | RDA | Actual intake Mean ± S.D. |
|---|---|---|---|---|
| **1** | Energy (Kcal/day) | M | 1810 | 1563.2 ± 483.40 |
| | | F | 1665 | 1216.1 ± 367.74 |
| **2** | Protein (g/day) | M | 65 | 45.9 ± 15.43 |
| | | F | 60 | 42.9 ± 11.90 |
| **3** | Fat (g/day) | M | 60 | 42.5 ± 20.78 |
| | | F | 55 | 30.5 ± 9.57 |
| **4** | Calcium (mg/day) | M | 1000 | 939.4 ± 627.00 |
| | | F | 1000 | 773.2 ± 351.74 |

*M- Male; F- Female*

Low energy consumption up to 1000 kcal/day was observed in 6 subjects, whereas energy consumption over the RDA was observed in 4 subjects. Similar dietary and nutritional inadequacies were reported by Fogarty and Nolan (1992). Their results revealed similar picture of inadequate intake of calcium, retinol; insufficient intake of protein and overconsumption of fat in elderly people aged 60-75 years. Protein intake ranged between 17-75 g/day and no distinct pattern could be observed for male and female subjects. Fat consumption was found lower in females as compared to male subjects and it was nearly half of the RDA. The mean percent consumption of energy and nutrients were compared with RDA and lower consumption of nutrients and energy was observed which is depicted in figure 1. Significant difference

($p<0.05$) was found in energy intake of male and female subjects whereas no significant difference ($p>0.05$) was observed in other nutrients. Quantitative difference was big with respect to other nutrients (protein, fat and calcium), but it was not significant. This could have occurred due to inadequate sample size which shows type II error. Similar result was observed in the study of Side *et al.*, (1991) reported more consumption of energy dense foods by elderly male subjects than their female counterparts.

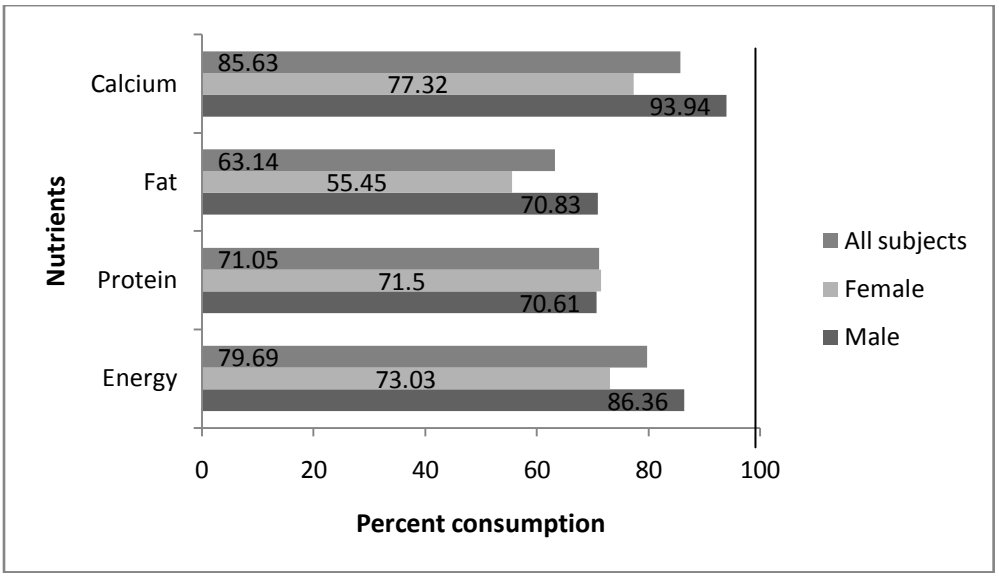


**Figure 1: Percent consumption of energy and nutrients with respect to RDA**

Subjects had been accustomed to consumption of cereal foods (mainly whole wheat, bajra, makka, etc.) chiefly. Their subsidiary foods consist mostly of homemade vegetables like mangodi, besan-gatte, papad, etc., with small amount of salad. Only few subjects were consuming milk regularly, but majority of the study subjects were taking butter milk, lassi, etc., as a regular part of their diet. Consumption of pulses and fruits was rare in most of the subjects. Male group had higher consumption of fruits and milk products than the female group. Similar results were obtained in the study of Jain *et al.*, (2013) pertaining to dietary assessment of rural elderly women who had poor food intake and consequent low nutritional status. In the present study, the food pattern seemed imperfect for the elderly. Hence by observing their dietary intake, it can be suggested that a diet for the elderly should include adequate protein, vitamins and calcium, but be low in fat, so their health and nutritional status can be improved.

***Dietary quality assessment by EDI:*** Distribution of subjects on the basis of their age and tertiles of EDI scores has been shown in table 2.

**Table 2: Age group wise distribution of subjects according to tertiles of EDI**

| S. No. | Age (Years) | Tertiles of EDI | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1st (10-28 points) Unhealthy Diet | | 2nd (29-31 points) Moderate Healthy Diet | | 3rd (32-40 points) Healthy Deit | |
| | | N | % | N | % | N | % |
| **1** | 60-65 | 17 | 85 | 3 | 15 | 0 | 0 |
| **2** | 65-70 | 6 | 100 | 0 | 0 | 0 | 0 |
| **3** | 70-75 | 3 | 100 | 0 | 0 | 0 | 0 |
| **4** | >75 | 1 | 100 | 0 | 0 | 0 | 0 |

None of the subject was falling in the category of healthy diet (3rd tertile) whereas only three subjects aged 60-65 years were taking moderate healthy diet (2nd tertile). Majority of the subjects (n = 27) fell in unhealthy diet category. In this regard, Leff (2003) explained that the common causes of poor food intake were impairment in sense of taste, smell and sight, poor dentition, depression, dementia, social isolation, poverty and other psychological factors. Good nutrition in old age is essential for healthy ageing but data

shows otherwise. It may be due to loss of appetite, chewing or swallowing problem or physical and psychological discomfort. Stratified analysis by sex showed that male subjects have higher EDI scores (25.0) than their female counterparts (24.2), however the difference was of low quantam. Adherence to healthful good quality diet was calculated to be 62% on the basis of averaged mean EDI score (24.6) of males and females (maximum possible EDI score = 40). Sharkey *et al.*, (2002) reported that nutritional and dietary inadequacy represents a potential health threat to the entire elderly population and the risks are greater among rural elderly females. Comparative analysis of EDI scores of males and females on the basis of its components has been depicted in figure 2. It illustrates the weekly frequency of consumption of foods or food groups which are the components of EDI. On the basis of egg component of EDI, both male and female subjects scored equally, while all the other components varied. EDI scores of male and female subjects were not significantly different ($p>0.05$). It can be interpreted that diet quality of rural elderly people residing in Banasthali is not appropriate. Hence, much attention needs to be paid to their dietary quality.

***Reliability assessment of EDI:*** Based on the existing literature, no particular tool has been proposed to assess diet quality of Indian rural older adults taking into account the specific recommendations proposed for this age group. Up to now, dietary indices evaluating adherence to either dietary guidelines for adults or the Mediterranean diet pattern have been used to explore associations between dietary patterns and dietary quality among older adults (Trichopoulou *et al.*, 2003; Knoops *et al.*, 2004). Rural older adults are more prone for obesity or overweight and have high rates of chronic disease and are less likely to access preventive healthcare (Fogarty and Nolan, 1992). Older adults living in rural areas have diets that fail to meet the recommended dietary guidelines, so there is a need of certain kind of reliable dietary quality assessment tool. There are a large number of risk factors which have their significant impact on nutritional status, which is reflected in variety of items, included in various screening tools, but there is no such type of gold standard tool for dietary quality assessment of Indian rural elderly people (Phillips *et al.*, 2010). When we use such type of a standardized tool specifically based on dietary guidelines of other countries, then there is a greater need to assess reliability according to our study locale. Hence, in the present study, reliability of EDI was evaluated for the dietary quality evaluation of rural elderly people of Rajasthan. It was evaluated by two different commonly used methods to analyse its internal consistency. Reliability was 0.570 by Split- half method and 0.392 by Chronbach's alpha method. Value of 0.60, 0.70 and 0.80 are considered acceptable, adequate and good for confirmatory purposes (Garson, 2009). Reliability determined by Chronbach's alpha method is less acceptable. Dietary quality scores were also evaluated in association with dietary nutrient intake. It showed that there was no significant association between energy and nutrient intake with EDI scores (table 3). Significant positive correlation ($p<0.05$) was found in EDI and energy intake ($r= 0.386$) whereas no significant correlation ($p>0.05$) was found in all other nutrients. It can be interpreted that in present study locale, this tool is not suitable. It can be concluded that original EDI tool should be modified according to area specific dietary recommendations of older adults, so that it has better reliability.

On the basis of our findings, it can be inferred that specialized attention should be given to elderly and their nutritional recommendations, so their nutritional and health status can be maintained. In addition, present study suggests that EDI is an easy tool for assessing the dietary quality of elderly, but it needs to be modified according to area specific dietary recommendations, so that it will reveal consistent results. In the community setting, it needs to be adapted according to the culture and validated using large sample size.

**Table 3: Association of EDI score with energy and nutrients intake of the subjects**

| Variables | Chi-square (cal) |
|---|---|
| Energy and EDI score | $0.99^{NS}$ |
| Protein and EDI score | $0.78^{NS}$ |
| Fat and EDI score | $0.57^{NS}$ |
| Calcium and EDI score | $0.96^{NS}$ |

*Chi square (tab) = 9.49*
*NS Non significant*

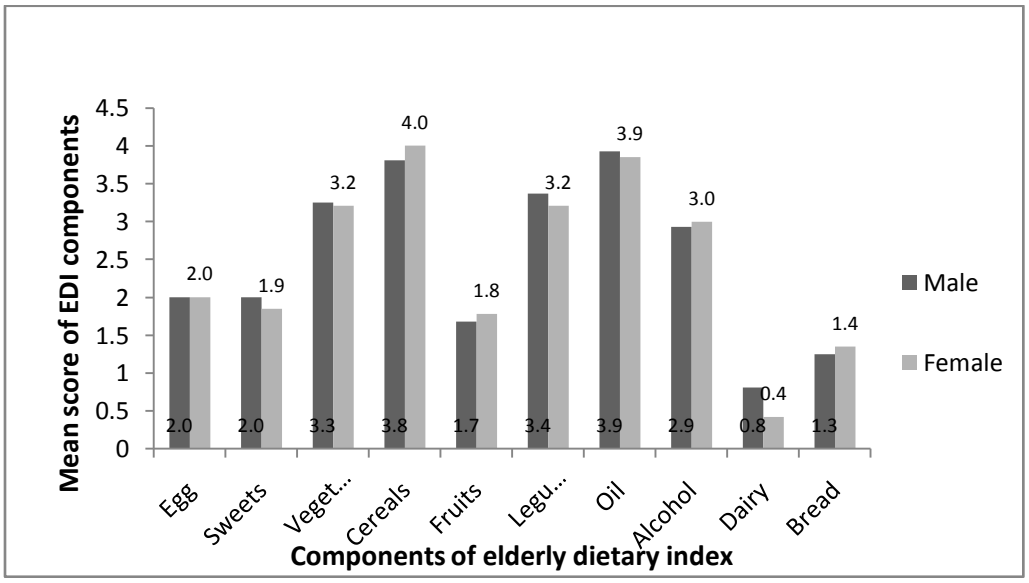


**Figure 2: Genderwise comparison of individual EDI component scores**

## REFERENCES

**Asthana B and Agarwal RN (1982).** Measurement and evaluation in psychology and education (Vinod Pustak Mandir, Agra).

**Clarkston WK, Pantano MM, Morley JE, Horowitz M, Littlefield JM and Burton FR (1997)**. Evidence for the anorexia of aging: Gastrointestinal transit and hunger in healthy elderly vs. young adults. *American Journal of Physiology* **272** R243-R248.

**Donini LM, Savina C and Cannella C (2003)**. Eating habits and appetite control in the elderly: The anorexia of aging. *International Psychogeriatrics* **15**(1) 73-78.

**Fogarty J and Nolan G (1992).** Assessment of the nutritional status of rural and urban elderly living at home. *Irish Medical Journal* **85**(1) 14-16.

**Garry PJ, Hunt WC, Koehler KM, VanderJaqt DJ and Vellas BJ (1992).** Longitudinal study of dietary intakes and plasma lipids in healthy elderly men and women. *American Journal of Clinical Nutrition* **55**(3) 682-688.

**Garson G (2009).** Validity. Statnotes: Topics in multivariate analysis. Available : http://faculty.chass.ncsu.edu/garson/pa765/statnote,htm [Accessed 2 October, 2009].

**Gopalan C, Ramashastri BV and Balasubramanian SC (2007).** Nutritive value of Indian foods. *National Institute of Nutrition, Indian Council of Medical Reseearch, Hyderabad.*

**Hays JC, Keller HH and Ostbye T (2005).** The effects of nutrition-related factors on four-year mortality among a biracial sample of community-dwelling elders in the North Carolina piedmont. *Journal of Nutrition for the Elderly* **25**(2) 41-67.

**ITAP (2003).** Procedures for estimating internal consistency reliability. *Iowa Technical Adequacy Project (ITAP),* 1-10.

**Jacobs DR Jr and Steffen LM (2003).** Nutrients, foods, and dietary patterns as exposures in research: A framework for food synergy. *American Journal of Clinical Nutrition* **78**(suppl 3) S508-S513.

**Jain M, Goel P, Jain P and Gupta K (2013).** Nutrition and health appraisal of rural elderly women using mini nutritional assessment. *Journal of the Indian Academy of Geriatrics* **9**(2) 65-69.

**Knoops KT, de Groot LC, Kromhout D, Perrin AE, Moreiras-Varela O, Menotti A and van Staveren WA (2004).** Mediterranean diet, lifestyle factors, and 10- year mortality in elderly European men and women: The HALE project. *The Journal of the American Medical Association* **292**(12) 1433-1439.

**Kourlaba G, Polychronopoils E, Zampelas A, Lionis C and Panagiotakos DB (2009).** Development of a diet index for older adults and its relation to cardiovascular disease risk factors: The elderly dietary index. *Journal of the American Dietetic Association* **109** 1022-1030.

**Leff BA (2003).** Involuntary weight loss in the elderly. *Advanced Studies in Medicine* **3** 31-38.

**Phillips MB, Foley AL, Barnard R, Isenring EA and Miller MD (2010).** Nutritional screening in community-dwelling older adults: A systematic literature review. *Asia Pacific Journal of Clinical Nutrition* **19**(3) 440-449.

**Sharkey JR, Branch LG and Zohoori N (2002).** Inadequate nutrient intakes among homebound elderly and their correlation with individual characteristics and health related factors. *American Journal of Clinical Nutrition* **76(**6) 1435-1445.

**Side X, Mingtang S, Shuquan Z, Zhaomei M, Yinzhi X, Yujun L, Zun W and Kui J (1991).** Anthropometric and dietary survey of elderly Chinese. *British Journal of Nutrition* **66**(3) 355-362.

**Thimmayama BVS (1987).** A handbook of guidelines in socio- economic and diet survey (National Institute of Nutrition, Hyderabad).

**Trichopoulou A, Costacou T, Bamia C and Trichopoulos D (2003).** Adherence to a Mediterranean diet and survival in a Greek population. *New England Journal of Medicine* **348** 2599-2608.