RESEARCH ARTICLE

A PILOT STUDY ON CORRELATION OF NUTRITIONAL STATUS AND DIET QUALITY IN THE ELDERLY

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ABSTRACT

This study aimed to assess correlation between nutritional status and diet quality of elderly subjects. A sample of 60 subjects (65 years; n= 37 males and n= 23 females) were selected from Banasthali Vidyapith, Rajasthan. Mini nutritional assessment (MNA) was used to ascertain nutritional and health status. Diet quality of the elderly subjects was assessed using self developed and standardized elderly dietary index (EDI) for Indians. Mean BMI was higher in females than males. Around 40% females were in pre-obese category, whilst more than 20% males were in this category. As per MNA scores, 85% of the subjects were at risk of malnutrition. There was a significant and positive correlation (p<0.05) between MNA scores and EDI scores. It can be concluded that nutritional status of elderly is positively correlated with diet quality.

INTRODUCTION

Old age is generally accompanied by deterioration of health because ageing process leads to less resistance to diseases in the body (Tosato *et al*, 2007). Therefore, health and nutritional assessment of the elderly persons are becoming increasingly important. Loneliness, lack of income and decreased physical activity are such factors that can adversely affect the nutritional status of elderly subjects (Patterson *et al*, 2002). A high prevalence of malnutrition (15-60%) in older adults has been reported worldwide (Cape *et al*, 2007). In order to maintain good nutritional status and prevent development of malnutrition, continuous monitoring of health and nutritional status is important. According to (WHO (1995), traditional measurements of nutritional status assessment may fail to provide true picture of nutritional status in older people. Mini nutritional assessment (MNA) has been observed to be such a tool which provides a single and rapid assessment of nutritional status in older people in clinical as well as in home based settings. This tool evaluates the risk of malnutrition so that early nutrition intervention can be initiated when necessary (Vellas *et al*, 2000).

Traditionally, food intake tends to decrease with advancing age to compensate for the diminished energy needs associated with lower energy expended in physical activity and basal metabolic rate (Manson *et al*, 2004). Food intake assessment is a crucial part of the assessment of the nutritional status of the elderly, as the knowledge of actual nutrient requirement of the aged remains uncertain. Although various dietary intake assessment methods are available, they do not reflect comprehensive information about overall diet quality. Hence older persons require a concentric approach for evaluating their diet quality. Dietary indices are important tools to evaluate not only the diet quality, but also the relationship between dietary habits and several health outcomes (Kourlaba *et al*, 2009).

The assessment of quality and variety of the entire diet enables the examination of association between whole foods and health status (Wirt and Collins, 2009). Analysis of overall diet quality is a valuable approach in the dietary assessment that has been used in nutritional epidemiology over the past several years (Kant, 2004). In order to prevent non-communicable chronic diseases and nutritional deficiencies, diet quality indexes emerged as a valuable tool (Jamie *et al*, 2010). But in India, diet quality indexes for elderly have not been comprehensively researched and developed. Therefore, in the present endeavour, self developed and validated EDI was used as a part of pilot study. The pilot study results would help to apply this tool on a larger sample. With changing life-style and food habits, the quality of diet may have profound effect on elderly health and nutritional status. Therefore, in present endeavour, this correlation was studied as there is paucity of data regarding correlation based study of nutritional status with diet quality on this particular population age group of elderly. Hence, the first objective of this study was to assess nutritional status using MNA and diet quality by EDI for Indians and second was to

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evaluate correlation between nutritional status and diet quality of older adults.

MATERIALS AND METHODS

Study population

This study was carried out between August to December, 2013. A total of 60 subjects (65 years), wherein n= 37 males and n= 23 females were selected from Banasthali Vidyapith, Rajasthan using quasi random sampling technique. This pilot study was the initial step of a larger study to be done on 500 subjects. Ten percent of the original sample size is considered sufficient to conduct a pilot study (Edwards and Talbot, 1999), hence the small sample size of 60. Subjects who were willing to participate and living within their own homes were recruited. For those, who did not consent, the next door was approached. Following this, list of various venues to reach the elderly subjects was prepared like temples and parks. At the initial visit, participants were asked for eligibility requirements for the study. Elderly subjects with known eating disorders, swallowing problems or bed ridden were excluded.

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. All data collection was done only after obtaining written informed consent from the participants. Interview was taken up at a quiet place and in their local language. Interviews were conducted at the participants' convenience in the morning to avoid confounding effect that may be attributable to sun downing, "a phenomenon that is associated with increased agitation and confusion occurring late in the afternoon often among individuals with dementia" (de Jonghe *et al*, 2010). Interview took 15 to 20 minutes to complete.

Data collection tools

Background information proforma was used to collect baseline information of the subjects. Anthropometry assessment of subjects was undertaken. MNA was used to assess nutritional status of the subjects. Self developed and validated EDI for Indians was used to ascertain diet quality of elderly subjects.

Nutritional assessment

Anthropometric assessment

Height, weight, mid upper arm circumference (MUAC) and calf circumference (CC) were measured using standard procedures (Gibson, 2005). Body mass index (BMI) was computed using height and weight data and subjects were classified on the basis of principal cut-off values of WHO (2004). These data formed essential components of MNA tool.

Mini nutritional assessment

MNA, a single and rapid nutrition assessment tool, was developed to assess nutrition status as a part of the nutritional status evaluation of elderly. This tool has been devised by

Nestle' and leading geriatricians to identify geriatrics (>65 years) patients at risk of malnutrition and it eliminated the need for more invasive test such as blood sampling (van Nes *et al*, 2001). It is 18 items questionnaire and administered in two steps. In step 1, screening uses the six strongly correlated items that make up the MNA and takes less than 5 minutes. In first stage, if the MNA screening scores are 12, then the subject had an acceptable nutritional status; step 2 is use as an assessment for those persons who are at risk of malnutrition, consist of 12 questions and takes approximately 10 minutes to complete. The scoring system ranging from 0 to 30, categorized subjects as normal (having adequate nutritional status, score 24 points), border line (at risk of malnutrition, score 17 to 23.5) and undernourished (score 17 points).

Diet quality assessment by EDI for Indians

A self designed and standardized diet quality assessment tool was used to assess diet quality of study subjects. The validation and reliability details are a part of another research paper under review. Reliability was evaluated by two methods, viz., test-retest method (0.99) and Cronbach's alpha method (0.75). Face validity was approved by the testees and content validity (0.52) was also approved by subject matter experts.

Statistical analysis

The data was analyzed using SPSS-20.0 and M.S. Excel -2007 software. The results were expressed in terms of mean, standard deviation (SD) and percentage. Correlation between Indian EDI scores and MNA scores was computed and its significance was determined at 5% level.

RESULTS

Demographic details of the subject

The mean age of the study group was 67.6 ± 4.41 years. Mean ages of women and men were 66.3 ± 2.49 and 68.0 ± 4.63 years respectively. One third of the subjects were falling in the category of 65-75 years of age. Ten male and eight female subjects were illiterate. Thirty one male and eleven female subjects were married, seven male and ten female elderly subjects were widowed; whereas only one female subject was unmarried. Most of the subjects were living a retired life; whereas six subjects were working to keep themselves busy. The subjects' perception of their activity pattern was also recorded. Sedentary activity was the most prominent response.

Nutritional assessment

The mean values of anthropometric measurements have been depicted in table 1. The height of the male subjects ranged between 157.5 cm and 172.5 cm; whereas in female counterparts, it was between 145.0 cm and 162.5 cm. The lowest observed weight was 52 kg and highest was 70 kg. The former was female and latter was male subject. The mean height and weight of the elderly people aged 65-80 years were 162 cm and 57 kg respectively; whilst for >80 years elderly subjects, these mean values were 155 cm and 50 kg. The BMI of all the subjects varied from 16.0 kg/m^2 to 29.0 kg/m^2. Both

the lowest and highest values were observed in female subjects. As the age of the subjects increased, this index decreased. The mean BMI of 65-80 years subjects was 23.4 kg/m^2; whilst it was 21.4 kg/m^2 for >80 years subjects. Distribution of the subjects on the basis of BMI results has been shown in table 2. Variability was not observed in the prevalence of overweight and pre-obesity conditions in males and females. The mean MUAC was found higher in female subjects than male subjects. MUAC ranged from 17.0 cm to 29.0 cm. Both the highest and lowest values were obtained in females. Calf circumference is a significant indicator of muscle status. The values of calf circumference ranged between 28 cm to 40 cm. As per the cut off criteria, fourteen males and eleven females had calf circumference <31cm whereas twenty three males and twelve females subjects had calf circumference above this cut off value.

Table 1 Mean anthropometric measurement of the subjects.

Parameters	Males	Females	All subjects
		Mean±SD	
Height (cm)	163.1±5.54	155.9±4.68	159.5±5.11
Weight (kg)	58.5±9.38	55.8±7.67	57.1±6.05
BMI (kg/m^2)	22.3±3.02	24.3±3.22	23.3±3.12
MUAC (cm)	21.5±1.70	22.1±0.97	21.9±1.33
Calf circumference (cm)	30.5±2.89	30.8±2.06	30.6±2.47

Table 2 Classification of subjects on the basis of BMI.

Classification	BMI (kg/m^2)	Males n	Males %	Females n	Females %	All subjects n	All subjects %
Moderate thinness	16.00-16.99	-	-	1	4.34	1	1.66
Mild thinness	17.00-18.49	3	8.10	-	-	3	5.00
Normal range	18.50-24.99	24	64.86	12	52.17	36	60.00
Over weight	25.00	2	5.40	1	4.34	3	5.00
Pre-obese	25.00-29.99	8	21.62	9	39.13	17	28.33
Total		37	100	23	100	60	100

Table 3 Distribution of subjects on the basis of tertiles of Indian EDI.

Dietary index	Interpretation	Sex	n	%
Indian EDI	Unhealthy diet (scores: 15-38)	M	3	5.0
		F	1	1.6
		Total	**4**	**6.6**
	Moderate healthy diet (scores: 39-42)	M	20	33.3
		F	15	25.0
		Total	**35**	**58.3**
	Healthy diet (scores: 43)	M	14	23.3
		F	7	11.6
		Total	**21**	**35.0**

M- Male
F- Female

Mini nutritional assessment

Various health and nutrition related aspects were covered by MNA. Appetite evaluation showed that nearly half of the subjects in both the groups had no appetite related problem. Forty eight percent male subjects and seventy seven percent female subjects mentioned moderate loss of appetite. Weight loss during the last 3 months was reported more by male subjects compared to the female group. Examination of eating habits revealed that 97% male as well as female subjects were eating twice daily. More than 95% of male subjects were taking fruits and vegetables daily; whereas only 82% females were indulging in this practice. Fluid intake was more in male subjects as compared to female subjects. Self perception of

nutritional status was also evaluated and it was found that female elderly considered themselves as malnourished. On the basis of MNA screening scores, 8 males and 1 female had normal nutritional status. Remaining 30 male and 21 female subjects were at possible risk of malnutrition. Therefore, MNA full assessment was done for the latter 51 subjects. Finally, 5 male and 6 female subjects were categorized as malnourished. On the other hand, 25 male and 15 female subjects were at risk of malnutrition.

Diet quality assessment by EDI for Indians

Distribution of subjects on the basis of their sex and tertiles of EDI for Indians has been shown in table 3. Stratified analysis by sex showed that male subjects have higher Indian EDI score (42.21) than their female counterpart (39.01). EDI scores of all the subjects ranged from 32 to 51. The latter was male and former was female subject. Unhealthy diet was followed by only less than 7% subjects and these subjects were belonging to young-old age group (65-74 years), whilst in middle (75-84 years) and old-old group (85 years), none of the subjects was taking unhealthy diet. More than half of the subjects were taking moderate healthy diet and majority of the subjects in this category belonged to 65-74 years of age group. Healthy diet was followed by more than one third subjects and majority of the subjects were belonged to young old age group (65-74 years). None of the subject from >85 age group were fall in healthy diet category. Subjects had been accustomed to consumption of cereals foods (whole wheat, pearl millet, maize, etc.) chiefly. Majority of the subjects were most likely to consume fruits, vegetables and grains and consumption of non- vegetarian foods was limited. The consumption of milk was low. Instead, buttermilk was mostly taken by the subjects.

Correlation between MNA scores and EDI scores

In order to ascertain relationship of nutritional status with diet quality of the elderly subjects, Karl Pearson correlation test was applied between MNA scores and EDI scores. There was a positive and significant ($p<0.05$) correlation (r=0.69) between MNA scores and diet quality of the subjects.

DISCUSSION

Ageing is a universal and inevitable, normal biological phenomenon associated with physiological changes that lead to functional deterioration of organs with an increased susceptibility to disease (Singh *et al*, 2005). With longevity comes debility, as is evitable from our study. Increasing age had a deleterious effect on elderly individuals as studied by other researchers (Verhaeghen *et al*, 2003). National Sample Survey Organization (NSSO) employment unemployment survey (2007-2008), revealed that only 50% of elderly men and 20% of women aged 60 years or more were literate through formal schooling. In contrast, illiteracy was not a common observation in the present investigation. Diverse results were observed for marital status of the study subjects. In this context, 2001 census of India showed that 33.07 percent of the elderly in India were without life- partners and the widowers among men were 14.98 percent as against 50.6 percent widows among

women (Irudaya Rajan, 2006). Present study depicted that majority of the study subjects were living a retired life. A study reported that a major part of older persons in India are poor and economically dependent and a total of 44.13% were found to be economically dependent on their children/spouse (Ryan, 1992).

In the present study, the majority of subjects do not meet the standards of height and weight and decline was noticed after 80 years. Das reported that as age advances beyond the period of menopause and retirement, height becomes shortened due to decrease vertebral height and anatomical distortion of the skeleton. Thus it can be a misleading index of stature (Das, 2007). Cline *et al* (2005) also reported a decline in height among older individuals. The BMI was found higher in female subjects than male subjects in present investigation. Similar results of higher BMI in females over males were observed in the study of Hanchinal (2008). MUAC and calf circumference declines in the elderly as the age advances. Szulc *et al* (2005) reported poor musculature and increased risk of falls among elderly in their study. Thus the subjects were not only underweight, their anthropometric measurements also reflected their poor nutritional status; these happening more so in the people above 85 years. Our results show a trend to reduction in most of the important anthropometric measurements with advancement of age, similar trend was reported by other investigators (Alfonso-Rosa *et al*, 2013; Jain *et al*, 2013).

The MNA results revealed that majority of the subjects were at risk of malnutrition in the present endeavour. Similar results regarding prevalence of malnutrition in elderly subjects using MNA was reported by Baweja *et al* (2008). It was also observed that nearly half of the elderly suffered from mild dementia in present study. These data are also in conformation with the observations of Grover *et al* (2010), who reported that feeling of depression, lack of interest, sadness, disturbed sleep, poor concentration, agitation and suicidal thoughts were common among elderly. Guigoz (2006) showed the mean prevalence of malnutrition as 1% in community healthy elderly, 4% in outpatients/home care, 5% in home living Alzheimer's diseases patients, 20% in hospitalized patients and 37% in institutionalized elderly.

Diet indices represent a measure of healthy eating pattern and are known by various names, including diet quality index or healthy eating index etc. Diet indices are easy to use, interpret and therefore, be more easily understood by the public (Michels and Schulze, 2005). In this study, diet quality of the subjects was assessed by self developed and validated EDI. In the present endeavour, majority of the study subjects were following moderate healthy diet. Unhealthy diet was also followed by some of the subjects. Sayhoun *et al* (1997) found that older adults with impaired dentition had lower overall diet quality scores and consumed fewer servings of fruits than those with occluding pairs of teeth. According to USDA, CNPP (1995) one-third or less of the people consumed the suggested number of servings from the 5 major food groups.

CONCLUSIONS

Adequate nutrition and a well-balanced diet are of vital importance even during old age so as to prevent and control the common hazards of ageing. Many factors like poor income, decreased mobility, social isolation, depression and cognitive impairment affect the health and nutritional status of elderly and many elderly are at risk of malnutrition or already malnourished. Malnutrition is caused not only by inappropriate dietary quantity but also by poor dietary quality. Therefore, standardized diet quality index should be routinely use for the screening of dietary intake and assessment of nutritional status of elderly.

Limitations

The small sample size is the limitation of the study. So it is important to replicate and extend our observations to large population.

Recommendations

On the basis of our findings, the following recommendations can be offered:

- Evaluation of diet quality should be an integral part of geriatric nutritional assessment.
- Specialized attention should be given to elderly and their dietary and nutritional recommendations, so that their nutritional and health status can be maintained.
- A comparative study can be done in different settings like urban and rural area.

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