RESEARCH PAPER — FOOD SCIENCE RESEARCH JOURNAL
ISSN-0976-1276 ■ Visit us : *www.researchjournal.co.in*
Volume 10 | Issue 1 | April, 2019 | 1-11
DOI : 10.15740/HAS/FSRJ/10.1/1-11

Assessment of elderly nutritional status

Namrata Jain and Vimla Dunkwal

Assessment of elderly nutritional status was conducted in Bikaner city. Three hundred elderly aged 60-70 years belonging to different economic groups were selected purposely from following centers - Geriatric Research and Care Centre P.B.M, Helpage India (N.G.O.), Senior Citizen Society, Associated Group of Hospitals and a common site *i.e.*: "*Vradh Jan Bhraman Path*" near Town hall, Bikaner. Information was gathered from elderly through interviewing them using standardized performa. Eighty nine per cent irrespective of male and female elderly were vegetarian, Information regarding food allergy shows that (95%) respondents did not feel any kind of allergy from certain food stuffs. 22 per cent of the elderly consume specific foods mostly in winter type of specific foods consumed were *Ajwain, Danamethi, Sonth, Singhada, Gond, Till, Haldi, Khajoor, Anjeer, Kalimirch* and *Gur* were consumed in form of *Ladoos.* Cereals consumed by subjects found to be 54.15 and 85.40 per cent of the balance diet, the pulse intake was 76.48 and 88.40 per cent of the suggested value given by NIN, (2010). Mean intake of green leafy vegetables suggested both male and females consumed similar amounts, the consumption of roots and tuber was found to be very less and the mean daily consumption of other vegetable in elderly was 59.16 and 75.84 per cent of RDA for both the genders. Intake of fruits among elderly was only 37.30 and 38.76 per cent of the balance diet. Consumption of milk was higher than the recommended balance diets. The mean intake of fats and oils was 25.31 and 26.19 while sugar and jiggery were 18.50 and 18.57 which was comparable with recommended balance diet. The average daily intake of energy was found to be 67.02 and 81.12 per cent for male and female of the recommended dietary allowances (NIN, 2010). Protein intake among subjects was satisfactory, fat intake of elderly male and female was 49.06g and 47.53g, respectively, the intake of dietary fibre in both the group was very less. Calcium intake of the elderly male and female was about 74.58 and 74.60 per cent of the prescribed RDA, while per cent adequacy of iron intake depicts very less uptake for male (36.63%) and female (41.43%) elderly. The mean intake of vitamin C and β carotene was found almost similar for male and female [(36.73 mg and 36.58 mg) (2389.53ug and 2592.22ug)], respectively. Nutrients like energy, carbohydrate, fibre, calcium and iron had significant difference in consumption. The mean anthropometric measurements of elderly suggested weight of males and females was 71.77kg and 67.98kg, respectively which is more than the weight of a reference Indian man and women, height of male and females were found 163.80 cm and 156.43 cm, respectively and these values were less than the height of reference Indian man and women. The mean waist hip ratio of males and females was found to be 0.85 and 0.80 and the mean body mass index of male and females was noted to be 27.01 kg/m² and 27.91 kg/m² respectively. Majority of subjects were found in pre obese category.

Key Words : Nutritional status

How to cite this article : Jain, Namrata and Dunkwal, Vimla (2019). Assessment of elderly nutritional status. *Food Sci. Res. J.,* **10**(1): 1-11, **DOI : 10.15740/HAS/FSRJ/10.1/1-11**.Copyright@ 2019: Hind Agri-Horticultural Society.

MEMBERS OF RESEARCH FORUM

Author for correspondence :
Namrata Jain, Department of Food and Nutrition, College of Home Science, **Bikaner (Rajasthan) India**

Associate Authors' :
Vimla Dunkwal, Department of Food and Nutrition, College of Home Science, **Bikaner (Rajasthan) India**

INTRODUCTION

Old age consist of ages nearing or surpassing the average life span of human being. Euphemisms and terms for old people include seniors, senior citizens, older adults and the elderly (American Psychological Association,

2010). The ageing process is of course a biological reality which has its own dynamics, largely beyond human control. In the developed world, chronological time plays a paramount role. The age of 60 or 65 years, roughly equivalent to retirement ages in most developed countries, is said to be the beginning of old age. In many parts of the developing world, chronological time has little or no importance in the meaning of old age. Other socially constructed meanings of age are more significant such as the roles assigned to older people. In some cases it is the loss of roles accompanying physical decline which is significant in defining old age (Gorman *et al.*, 2000). However, the increasing number of healthy and active people at the younger end of the aging spectrum has led to the need for more definitive age groupings. Thus, the specific age groups of 65 to 75 and over are often referred as the 'young old' and the 'old old', respectively or the 'aging' and the 'aged' (Mahan and Arlin, 1992).

In India the problems and issues of its grey population has not been given serious consideration and only a few studies on them have been attempted in our country. To reap the advantage of demographic dividend the focus is mainly on the children and the youth and fulfillment of their basic need for proper development. The traditional Indian society and the age old joint family system have also been instrumental in safeguarding the social and economic security of the elderly people in the country. However with the rapid changes in the social scenario and the emerging prevalence of nuclear family setup in India in recent years the elderly people are likely to be exposed to emotional, physical and financial insecurity in the years to come which helping them to cope up with problems associated with the old age (Situation analysis of the elderly in India, 2011). Nutritionists all over the world agree that the elderly constitute the most vulnerable segment of population from stand point of nutrition. A priority given by the research worker to this area is perhaps due to the fact that the elderly group in developing countries from a small segment in the regions with very low life expectancy. However, in recent years owing to gradual increase in life expectancy and overall improvement in health and living condition of the people, more and more aged people are being added to this population. A complex interaction between an individual and his or her environment over time is an appropriate concept of human ageing. In relation to external variable which affect ageing perhaps none is more important than nutrition. There is a evidence in many animal models that life expectancy can be significantly extended by restricting food intake. Nutritional factors have been shown to contribute substantially to many diseases that occur in late life. The risk of developing serious nutritional deficiencies also increases with advancing age. This is related to age associated reductions in total food intake accompanied with the presence of debilitating disease. The presence of malnutrition increases functional dependency, morbidity, mortality and utilization of health – care resources. Dietary intake of many vitamins is inadequate in older people (Garry and Hunt, 1986 and Suter and Russell, 1987). These include an intake of 50 per cent or less for folic acid, thiamine, vitamin D and vitamin E. The deficiencies identified on the basis of inadequate intake are invariably significantly higher than the prevalence of biochemical deficiency of most vitamins. The micronutrients (minerals and vitamins) play important role in the diet of elderly. Minerals and vitamins are integral part of metabolism and required for maintenance of good health. Fruits and vegetables are good sources of vitamins and minerals. They also contain antioxidants and phytochemicals which prevent free radical damage and thus prolong the process of aging. The major antioxidant vitamins are β-carotene, vitamin A, vitamin E and Vitamin C. Moreover, they are found to have preventive effect on degenerative changes in blood vessel, heart, joints and eye lens. The minerals that play important role in geriatric nutrition are sodium, potassium, calcium, iron, zinc, etc. The intake of these minerals should be enhanced as there is tendency for lower absorption but intake of sodium should be restricted as hypertension is very common in elderly. There is beneficial effect of antioxidant vitamins and zinc supplementation on progression to advanced age related macular degeneration. Adequate fluid intake is also a must proper nutrition in elderly (Evans, 2006).

There is a relative scarcity of available literature on such information particularly from arid areas. Keeping this point of view, present study is aimed to assess the nutrition status of elderly of Bikaner district Rajasthan.

METHODOLOGY

Locale of the study and selection of sample:

The study was conducted on elderly both male and female residing in Bikaner city., A total number of 300 elderly aged 60-70 years belonging to different economic

groups were selected for the present investigation purposely from Geriatric Research and Care Centre P.B.M, Helpage India (N.G.O.), Senior Citizen Society, Associated Group of Hospitals of Bikaner City and a common site *i.e.*: "*Vradh Jan Bhraman Path*" near Town hall, Bikaner.

Nutritional status:

The nutritional status of the subjects had been assessed on the basis of following points.

Dietary assessment:

At the beginning of the study dietary assessment of all the subjects was carried out to assess their food and nutrient intake. Detailed information regarding the dietary pattern of the subjects was noted by using structured interview schedule encompassing 24- hour dietary recall method and food frequency questionnaire. A 24-hour dietary recall method for 3 consecutive days was adopted to find out the intake of various foods consumed by the subjects.

Food frequency questionnaire:

This method was designed to obtain qualitative information about usual food consumption patterns. The questionnaire consisted of two aspects a list of foods and a set of frequency to use response categories. The lists of food were mostly focused on specific food groups of foods, particular food or foods consumed and the frequency of consumption. The aim of food frequency questionnaire was to assess the frequency of certain food items or food groups consumed during a specific period of time example daily, weekly or monthly.

Anthropometric assessment:

Anthropometry is the process measuring various dimension of the body. Physical dimension of the body are much influenced by nutrition than the genetic backgrounds of other biological factors. The anthropometric measurements give valuable information regarding the nutritional status. Anthropometric measurements taken were weight, height, BMI and waist hip ratio.

Analysis of data:

The data obtained from various analyses were organized and statistically analyzed by using suitable statistics to find out significance of the results (Gupta, 1998).

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Dietary assessment:

The process of ageing also affects other nutrient needs. Requirements of some nutrients may be reduced, while some data suggest that requirements for other essential nutrients may in fact rise in later life. There is thus an urgent need to review current recommended daily nutrient allowances for this group. Older persons are particularly vulnerable to malnutrition. Moreover, attempts made to provide them with adequate nutrition to encounter many practical problems.

Dietary survey:

Table 1 data revealed that 89 per cent subjects irrespective of elderly male and female were vegetarian and only 10 per cent were non-vegetarian comprising

Table 1: Dietary survey of the respondents

Sr. No.	Food preferences	Male (191) (%)	Female (109) (%)	Overall (300) (%)
Food habit				
1.	Vegetarian	170 (89)	97 (88.99)	267 (89)
2.	Non-vegetarian	21 (10.99)	9 (8.25)	30 (10)
3.	Ovo vegetarian	0	3 (2.75)	3 (1)
Food allergy				
1.	Yes	3 (1.57)	12 (11)	15 (5)
2.	No	188 (98.42)	97 (88.99)	285 (95)
Specific food for summers/ winters				
1.	Yes	27 (14.13)	39 (35.77)	66 (22)
2.	No	164 (85.87)	70 (64.23)	234 (78)

Note- figures in parenthesis indicates percentage of subjects

with 21 males and 9 females, remaining 1 per cent were ovo vegetarian. It was recorded that they were not consuming non vegetarian food due to spiritual belief and poor digestibility. Further view on food allergy portrayed in Table 1 shows that 95 per cent respondents did not experience any kind of allergy from certain food stuffs. Although 5 per cent suffered with food allergy and it was found to be more prevalent in females (11%).

Some time people take certain food stuffs in different weather for their medicinal purposes. Table 1 depicts that majority of subjects *i.e.* 78 per cent were not consuming food stuffs with medicinal value while 22 per cent of the elderly consumed specific foods mostly in winter and consumption of medicinal value products was higher in female as compared to male (35.77% v/s 14.33%). Type of specific foods consumed were *Ajwain, Danamethi, Sonth, Singhada, Gond, Till, Haldi, Khajoor, Anjeer, Kalimirch* and *Gur* were taking in form of *Laddoo.*

Food intake:

All the individuals need a wide range of nutrients to lead healthy and active life. The nutritional status of any individual is directly associated to his/her food intake. The components need to be chosen judiciously so that it provides all the nutrients in adequate amount and appropriate proportions (ICMR, 1989). The daily intake of various food stuffs is unfolded in Table 2 and discussed below with respect to the recommended balance diet (NIN, 2010).

Cereals:

Cereals are the main source of energy. They also contribute significance quality of proteins, minerals and B-group vitamins at low cost. These are the cheapest and widely available sources of nutrients particularly in developing countries like India (ICMR, 1989). Wheat, pearl millet and rice were main cereals consumed by subjects. It is evident from the Table 2 that mean intake of cereals of male and female elderly was 189.55g and 192.15g found to be 54.15 and 85.40 per cent of the balance diet, respectively. Statistically there was no significant difference among the subjects for cereal consumption. The results also revealed that between both the groups females were taking more cereals as compared to males.

Pulses:

Pulses are the major source of protein in Indian diet (ICMR, 1989). In the present study most of the subjects were found to be consuming pulses like Bengal gram, green gram, red gram and moth bean. The data generated for the pulses intake are presented in Table 2. The pulse intake of male and female elderly was noted to be 38.24g and 35.36g which was 76.48 and 88.40 per cent of the suggested value given by NIN, 2010. Statistically there

Table 2 : Mean food intake and per cent adequacy of elderly male and female

Group		Mean food intake of the elderly male and female per day								
		Cereals g	Pulses g	Green leafy vegetables g	Roots and tubers g	Other vegetables g	Fruits g	Milk and milk product ml	Fats and oil ml	Sugar g
Male	Mean intake	189.55	38.24	36.38	19.37	118.32	74.60	426.43	25.31	18.50
	S.D.±	48.46	10.91	41033	33.11	45.64	69.93	151.20	5.68	10.72
	S.E.±	3.51	0.78	2.99	2.39	3.30	5.06	10.94	0.41	0.77
	B.D.	350	50	50	100	200	200	300	25	20
	B.D (%)	54.15	76.48	72.76	19.37	59.16	37.3	142.14	101.24	92.5
Female	Mean intake	192.15	35.36	36.23	17.74	113.76	77.52	441.74	26.19	18.57
	S.D. ±	71.09	10.92	43.49	32.89	46.48	60.27	149.92	6.26	11.22
	S.E.±	6.80	1.04	4.16	3.15	4.46	5.77	14.36	0.60	1.07
	B.D.	225	40	50	100	150	200	300	20	20
	B.D (%)	85.40	88.40	72.46	17.74	75.84	38.76	147	130.95	92.85
	't' value	0.37^{NS}	2.19^{NS}	0.21^{NS}	2.39^{NS}	0.82^{NS}	0.36^{NS}	0.84^{NS}	1.24^{NS}	0.54^{NS}

RDA- Recommended dietary allowance (NIN, 2010); S.D.± Standard deviation ; S.E.± Standard error of mean ; NS=Non- significant; BD- Balance diet

was no significant difference among the subjects for pulse consumption. The results also revealed that among both the groups females were taking more pulses as compared to males.

Green leafy vegetables:

Many types of leafy vegetables like spinach, fenugreek, amaranthus, *Bathua,* cabbage, mint, coriander etc are consumed all over the country. These are rich source of iron, calcium, β-carotene, riboflavin, folic acid and vitamin C. Therefore, these nutrients should be consumed by the elderly for proper maintenance of health (ICMR,1989). Mean intake for green leafy vegetables was 36.48g and 43.49g which was 72.46 and 72.76 per cent of the balance diet observed non-significant difference statistically Table 2.

Roots and tubers:

Among various roots and tubers the potato and onion are the two major vegetables that could rarely be unavailable at any kitchen of the Indian homes. These are the richest source of energy among vegetables. Besides energy they also provide carbohydrate, β-carotene, vitamin C and calcium (Srilakshmi, 2008). However, in the present study potato, onion, carrot and radish were the most commonly consumed root and tubers in form of vegetables and salad by the subjects. The consumption of roots and tuber was found to be very less in both the groups *i.e.* 19.37 and 17.74 per cent for male and female of the balance diet given by NIN (2010), respectively. The reason for less consumption was that they were not easily digested and caused distension Table 2.

Other vegetables:

This group belongs to those vegetables which are not covered under green leafy vegetables and roots and tubers. The vegetables are good source of vitamin, minerals and fibres. It is not only providing variety to the diet but also add bulk to the diet (Srilakshmi, 2008). The mean daily consumption of other vegetable in elderly was found to be 118.32g and 113.76g which is 59.16 and 75.84 per cent of RDA Table 2. Statistically there was no significant difference among the subjects for vegetable consumption. The results also revealed that between both the groups females were taking more other vegetables as compared to males.

Fruits:

Fruits are the good source of vitamin C,β carotene, fibre, sugar and antioxidants. Fruits also provide fibre and pectin which provide bulk to the diet and help in bowel movement which is the commonest problem of sedentary lifestyle of elderly (Srilakshmi, 2008). In spite of such advantages the mean intake of fruits among elderly was only 74.60g and 77.52g which was 37.30 and 38.76 per cent of the balance diet (NIN, 2010). The probable reason for their low intake could be lack of concern, availability, denture problems and higher cost.

Milk and milk products:

Milk is always considered as an ideal food for infants, children and good supplementary food for adults and elderly. Milk is not only a source of good quality protein but also of calcium and riboflavin. The results unrolled in Table 2 that subjects mean consumption was 426.43 ml and 441.74 ml which was higher than the recommended balance diets (300 ml). Moreover, milk was consumed in the form of tea.

Fats and oils:

Fat is required in the diet to provide essential fatty acids, to improve palatability of the diet and are concentrated source of energy (9KCal/g). Presence of fat in the diet is important for the absorption of fat soluble vitamins like A,D,E,K (Srilakshmi, 2008). The mean intake of fats and oils was 25.31ml and 26.19 ml which was comparable with recommended balance diet as given by NIN, 2010.

Sugar:

These are the sweetening agents consumed by all the age groups in varying amounts. The mean intake of sugar and jaggery was 18.50g and 18.57g which was comparable with recommended balance diet. Maximum intake was incorporated in tea Table 2.

Similar study by Kimaya and Sharma (2013) showed that per cent adequacy for pulses, other vegetables, milk and milk products and fat in elderly male was higher than the recommended dietary intake whereas in elderly females per cent adequacy for other vegetables and fat was higher than the recommended dietary intake. However, in the present study only consumption of milk and milk products was higher both in male and female when compared with the recommended dietary intake

whereas pulses and other vegetables were consumed less and intake of fats and oils was at par with RDA. 't'-value shows that intake of cereal, pulses, green leafy vegetables, roots and tubers, other vegetables, fruits, milk and milk products, fat and sugar were found to be non-significant. Irrespective of gender an overall view of food intake indicated that diet of all subjects was grossly lacking in majority of food groups except milk and milk products, fats and oils and sugars.

Nutrient uptake:

Food is the conveyer of nutrients and is required for the maintenance, repair, growth and development of the body (Gopalan *et al.,* 2004). Low intake of any nutrient can lead to a significant contribution to poor anthropometric and biochemical nutritional status. Average nutritional composition of the diet was calculated in terms of raw weight and the results were compared with recommended dietary intake (NIN, 2010) as presented in the Table 3.

Energy:

Our body needs energy for maintaining body temperature, metabolic activities and supporting physical growth (Gopalan *et al.,* 1989). Cereals accounted for the major source of energy in the diet of the subjects. It was observed that the average daily intake of energy was 1474.49 kcal for males and 1379.17 kcal for females. This was found to be 67.02 and 81.12 per cent of the recommended dietary allowances (NIN, 2010). However, males had significantly much lower intake of energy as compared to counter parts.

Protein:

Protein is vital to any organism. Dietary proteins provide amino acids for the synthesis of body protein which are needed for various functions like tissue building, replacement of depleted protein and synthesis of functional molecules like enzymes, hormone and antibodies (Srilakshmi, 2008). Perusal of the Table 3 reveals that daily mean protein intake among subjects was 50.36g for males and 44.80g for females. When compared with RDA it was 77.47 and 89.60 per cent, respectively and found satisfactory.

Fat:

Fat is the class of compounds which are energy rich and are made up of fatty acids condensed with glycerol. These are stored in the body and utilized only on demand. Fat was found to be consumed in visible as well as invisible forms. Visible fat is commonly consumed in India as hydrogenated fats, oil and *Ghee*. These are concentrated source of energy providing 9 KCal/g (Srilakshmi, 2008). Data portrayed in Table 3 reveals that mean visible fat intake of elderly male and female was 49.06 g and 47.53 g, respectively. It was also observed that female consumed more than their counterparts when compared with the RDA.

Carbohydrate:

Carbohydrates have been consumed in various forms

Table 3 : Mean nutrient intake and per cent adequacy of elderly male and female

Group		Nutrient intake of the elderly male and female per day									
		Energy KCal	Protein g	Fat g	Carbohydrate g	Fibre g	Mineral g	Calcium mg	Iron mg	Vit C mg	β carotene ug
Male	Mean intake	1474.49	50.36	49.06	211.78	6.43	11.66	745.88	13.92	36.73	2389.53
	S.D.±	288.68	12.36	11.92	43.10	3.47	3.04	199.09	3.84	8.16	2236.95
	S.E.±	20.88	0.89	0.86	3.11	0.25	0.22	14.40	0.27	0.59	161.86
	RDA	2200	65	50				1000	38		
	RDA (%)	67.02	77.47	98.12				74.58	36.63		
Female	Mean intake	1379.17	44.80	47.53	195.78	5.14	10.10	671.40	12.43	36.58	2592.22
	S.D.±	262.16	9.56	11.07	46.42	1.14	2.14	195.55	3.42	8.42	2443.74
	S.E.±	25.11	0.91	1.06	4.44	0.10	0.20	18.73	0.32	0.80	234.06
	RDA	1700	50	40				900	30		
	RDA (%)	81.12	89.60	118.82				74.60	41.43		
	't' value	2.842**	4.05*	1.09 ^{NS}	3.00**	3.75**	4.69***	3.13**	3.36**	0.14^{NS}	0.73^{NS}

RDA- Recommended dietary allowance (NIN, 2010); S.D. Standard deviation ; S.E.± Standard error of mean; NS= Non-significant
"t" values with superscripts *,**and *** indicate significance of values DCP at p<0.05, p<0.01 and p<0.001, respectively

like starch, glucose, cane sugar, milk sugar etc. Carbohydrates chiefly derived from cereals and they are the chief source of energy in Indian diets (Gopalan *et al.*, 1989). The mean intake of the respondents was reported as 211.78g and 195.78g for male and female, respectively.

Dietary fibre:

Dietary fibre is defined as the portion of food derived from plant cells which is resistant to hydrolysis or digestion by the elementary enzyme system in human beings. Crude fibre is not digested by the enzymes of the stomach and small intestine. Fibre hinders glucose absorption by decreasing gastric emptying which may in term reduce hunger and prolongs the satiety, at the same time acts as an energy diluting element (Srilakshmi, 2008). Cereals, legumes, raw vegetables and green leafy vegetables were found to be among main source of fibre in the diets of the subjects. During present study mean intake of fibre in male and female respondents was noted to be 6.13g and 5.14g, respectively. Although there is no specific RDA of fibre for elderly but as per general guidelines *i.e*. 30g/ day or 12g/1000kcal (Srilakshmi, 2008), the intake of both the group was very less. The reason for its fewer intakes might be lack of awareness about its health benefits, gastrointestinal discomfort and dental problems.

Minerals:

A large amount of minerals and trace metals are present in the body. Some of these forms a part of body structural component and some others act as catalytic agents in many body reactions (Gopalan *et al.*, 2011). The mean mineral intake of the subjects was 11.66 g of male and 10.10g of female.

Calcium:

Calcium is an essential element required for several life processes. It is required for formation and maintenance of skeleton and teeth, normal contraction of muscles to make limb moveable, contraction of heart for its normal functions, nervous ability and blood clotting (Gopalan *et al.*, 1989). Cereals and milk and milk products contribute to the main source of calcium in the diet of subjects. Calcium intake of the elderly was found to be 745.88 mg and 671.40 mg, respectively which was about 74.58 and 74.60 per cent of the prescribed RDA Table 3.

Iron:

Iron is an essential element for the formation of hemoglobin and plays an important role in the transport of oxygen. Iron deficiency anemia is quite prevalent in our country (ICMR, 2010). Data pertaining to iron intake portrayed in Table 3 which shows that mean intake of iron was recorded to be 13.92 and 12.43 mg/day. Per cent adequacy of iron intake depicts very less uptake for both male (36.63%) and female (41.43%) elderly. The low intake of iron than the suggested values might be due to infrequent use of iron foods in their diet and absorption due to senile changes. However, this must be viewed in the light of the fact that bioavailability of iron from cereals based diet is always low (ICMR, 2010).

Vitamin C:

Vitamin C is an essential nutrient for human being as they lack the capacity to synthesize it like many other animal species. It is involved in collagen synthesis, bone and teeth calcification and many other reactions in the body as a reducing agent (Gopalan *et al.*, 2004). The mean intake of vitamin C was found almost same for male and female *i.e*. 36.73 mg and 36.58 mg per day which was less than the RDA of adult man and women (40 mg/day).

carotene:

β carotene is necessary for clear vision in dim light. Lack of β carotene leads to night blindness. It also maintains the integrity of epithelial tissue. The mean intake of β carotene was reported as 2389.53 ug and 2592.22 ug per day of male and female elderly, respectively.

Therefore, as per the data, the consumption of nutrients like energy, carbohydrate fibre, calcium and iron observed significant difference at P> 0.01 while protein at P>0.05 and minerals at P>0.001 level. While fat, vitamin C and β carotene showed no significance difference in consumption.

These findings of nutrient intake are in close conformity with the results of the study conducted by Kimaya and Sharma (2013) who also observed higher intake of fat among the subjects of their study at Nagpur.

Perusal of data indicates that all the subjects of the study were consuming less amount of nutrients as compared to the recommended values except in fat intake. Thus, an overview on food and nutrient intake data

indicates that females had slightly better nutrient adequacy ratio as compared to males. This might be due to the fact that females are indulged more in household work especially in kitchen and more versatile in food preferences.

Anthropometric assessment:

Nutritional anthropometry is measurement of human body at different age levels and degree of nutrition. Anthropometric measurement is an important method assessing the nutritional status of the subjects as these measurements are partially dependent upon nutrient intake.These measures are non-invasive and are used to evaluate nutritional status. In the present study the mean anthropometric measurements of subjects by gender are portrayed in Table 4.

Weight:

Weight is the main indicator in assessment of nutritional status. On assessing this primary factor among the subjects of the present study, it was found that the mean weight of males and females was 71.77 kg and 67.98 kg, respectively which is more than the weight of a reference Indian man (60 kg) and women (55 kg) given by ICMR (2010). Therefore, the per cent difference was noted to be 19.61 and 23.60, respectively depicted in Table 5. This might be due the immobility and wrong food habits resulted in excess weight of elderly is more as compared to reference man and women.

Height:

The height of an individual is influenced both by genetic and environmental factors. Mean values of height of male and females were observed 163.80 cm and 156.43 cm, respectively and these values were less than the height of reference Indian man (173 cm) and women (161 cm) given by ICMR (2010). Table 5 shows the per cent difference which was higher (5.31) for male than for females (2.83). The reason may be due to sagging or pain in back causing shorter stature as compared to Indian reference man and women. The results reported by Choudhary and Dunkwal (2003) regarding height of elderly are in alignment with the present study.

Waist hip ratio (*WHR*):

The distribution of excess adipose tissue profoundly affects its role as a risk factor for CVD. Specially excess of truncal and intra-abdominal fat (central obesity) have important adverse influence on lipid levels, blood pressure, glucose tolerance and are in fact considered as risk factors for coronary disease (Walker *et al.*,1996 and Suk *et al.*, 2003). Central obesity is assessed by measuring

Table 4 : Mean anthropometric parameters of elderly

Group		Anthropometry of elderly male and female per day			
		Weight (kg)	Height (cm)	Waist hip ratio	BMI (kg/m²)
Male	Mean	71.77	163.8	0.85	27.01
	S.D.	14.44	7.9	0.08	5.06
Female	Mean	67.98	156.43	0.80	27.91
	S.D.	12.37	5.19	0.05	4.89
Total	Mean	73.93	167.87	0.87	26.52
	S.D.	15.10	5.92	0.09	5.10

S.D= Standard deviation

Table 5: Per cent difference of anthropometric parameters of elderly

Sr. No.	Anthropometry	Male	Female
1.	Weight (kg)	71.77	67.98
2.	Reference weight (kg)	60.00	55.00
3.	Per cent difference	19.61	23.60
4.	Height (cm)	163.8	156.43
5.	Reference height (cm)	173.00	161.00
6.	Per cent difference	5.31	2.83

ICMR (2010)

the waist hip ratio. A WHR greater than 0.95 in men and 0.80 in women indicates abdominal obesity (WHO, 1995). The mean waist hip ratio of males and females was recorded to be 0.85 and 0.80, respectively. In the present study the Table 6 explicated that the mean waist hip ratio of females was found to be 65.13 per cent greater than the normal limits (> 0.8) and rest 34.86 per cent were under normal limits. Whereas 86.91 per cent males fell under normal category (<0.95) and 13.08 per cent were recorded as high WHR.

Per cent body fat may remain constant or increase with age but ageing is associated with substantial redistribution of fat tissue among depots (Cartwright *et al.*,2007).There is a decline in the volume of subcutaneous fat, from late middle age until the 80s or later and a redistribution of fat from subcutaneous to visceral depots. This age associated decline in the size of adipose depots is accompanied by the accumulation of fat outside adipose tissue (in muscle, liver and bone marrow) and loss of lean body mass. Data from NHANES show that waist circumference increases with age and is larger in older than in younger adults of both sexes upto the age of 70 years (Ford *et al.*,2003). Similarly, in the Baltimore Longitudinal study of aging, age related differences in waist–hip ratio were also reported in all BMI categories examined in both men and waomen (Shimokata *et al.*, 1989). Changes in waist circumference were followed up in adults (9025 men and 9950 women aged 25–64 years) and mean waist circumference was seen to increase by 2.7 cm in men and 4.3 cm in women over a 15 year period (Lahti Koski *et al.*, 2007).

Body mass index (*BMI*):

Body mass index as a measurement of body obesity has been proven useful, clinically applicable and is claimed to represent the degree of body fat content. The mean body mass index of males and females was noted to be 27.01 kg/m² and 27.91 kg/m², respectively in Table 4. Majority of subjects were in pre obese category (32.33%) with BMI ranging from 26.0 to 29.99kg/m^2 among whom 28.27 per cent were males and 39.43 per cent were females when classified as per WHO classification (2000) as depicted in Table 7. Consecutively subjects suffering from obese grade I, II and III were 21.33 per cent, 3 per cent and 2 per cent, respectively. Among all subjects per centage of female was more as compared to male in obese grade I (23.85% v/s 19.89%) and almost similar percentage of male and female was recorded in overweight (9.42% and 10.09%) and obese grade II and III (3.14% and 2.75% and 2.09% and 1.09%). On the

Table 6: Distribution of the subjects according to their waist hip ratio

Waist hip ratio (WHR)	Classification	Percentage
Male		
<0.95	Normal	166 (86.91)
≥0.95	High	25 (13.08)
Female		
<0.8	Normal	38 (34.86)
≥0.8	High	71 (65.13)

Note- Value in parenthesis indicates the per cent of subjects

Table 7: Distribution of subjects according to their body mass index **(n= 300)**

Body mass index (kg/m²)	Classification	Percentage (Number)		
		Male (n= 191)	Female (n= 109)	Overall
<18.5	Underweight	13 (6.80)	4 (3.66)	17 (5.66)
18.5-24.99	Normal range	58 (30.36)	20 (18.34)	78 (26)
25.0-25.99	Overweight	18 (9.42)	11 (10.09)	29 (9.66)
26.0-29.99	Pre-obese	54 (28.27)	43 (39.44)	97 (32.33)
30.0-34.99	Obese grade I	38 (19.89)	26 (23.85)	64 (21.33)
35.0-39.99	Obese grade II	6 (3.14)	3 (2.75)	9 (3)
≥ 40	Obese grade III	4 (2.09)	2 (1.83)	6 (2)

Note- Value in parenthesis indicates the percentage of subjects (WHO, 2000)

classification criteria overall 5.66 per cent elderly were under weight comprised of 6.80 per cent males and 3.66 per cent females and 30.36 per cent male and 18.34 per cent female were found in normal range which constituted 7.8 per cent of elderly.

Similar results were reported by Chibber *et al.* (2007) who also found mean BMI of the elderly women as 21.59 in their study.

Overall results of anthropometric assessment revealed that weight of elderly was found more than the reference man and women and height was recorded less than the reference Indian standards. Percentage of waist hip ratio was higher in females than males when compared with normal limits and results of body mass index explicated that majority of subjects were in pre obese category.

Conclusion:

It can be concluded that the number of elderly people in developing countries is almost 3-4 times of that of developed countries. Without the safe, secure and dignified status in the family, the elderly are finding themselves vulnerable. An overview on food and nutrient intake data indicates that females had slightly better nutrient adequacy ratio as compared to males.

Overall results of anthropometric assessment revealed that weight of elderly was found more than the reference man and women and height was recorded less than the reference Indian standards. Percentage of waist hip ratio was higher in females than males when compared with normal limits and results of body mass index explicated that majority of subjects were in pre obese category.

LITERATURE CITED

American Psychological Association (2010). *Technical and research reports*, A Publication Manual of the American Psychological Association, Washington, D.C., U.S.A.

Cartwright, M.J., Tchkonia, T. and Kirkland, J.L. (2007). Aging in adipocytes: potential impact of inherent, depotspecific mechanisms. *Experimental Gerontol.*, **42** (6) : 463 471.

Central Statistics Office (2011). *Situation analysis of the elderly in India*, Ministry of Statistics and Programme Implementation, Government of India.

Chibber, R., Ben-Mahmud, B. M., Chibber, S. and Kohner, E.M. (2007). Leukocytes in diabetic retinopathy. *Curr. Diabet. Rev.*, **3** (1) : 3-14.

Choudhary, S. and Dunkwal, V. (2003). Nutritional status of the old aged women (60-70 years) of Bikaner city. M.Sc. Thesis, S.K.Rajasthan Agricultural University, Bikaner, Rajasthan (India).

Evans, J.R. (2006). Antioxidants, vitamins and mineral supplements for slowing the progression of age related macular degeneration. *Cochrane Database Systematic Rev.*, **19** (2) : CD000254.

Ford, E.S., Mokdad, A.H. and Giles, W.H. (2003). Trends in waist circumference among U.S. adults. *Obesity Res.*, **11**(10) : 1223 1231.

Garry, P. J. and Hunt, W. C. (1986). Biochemical assessment of vitamin status in the elderly: effects of dietary and supplemental intakes. Academic Press, Orlando, FL, 117-137.

Gopalan, C., Rama Sastri, B.V. and Balasubramanian, S.C. (1989). Nutritional value of Indian foods. *Hyderabad, National Institute of Nutrition*, 47-73pp.

Gopalan, C., Ramasastri, B.V. and Balasubramanium, S.C. (2004). Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, pp. 48–50.

Gopalan, C., Ramasastri, B.V. and Balasubramanium, S.C. (2011). Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.

Gorman, J. M., Kent, J. M., Sullivan, G. M. and Coplan, J. D. (2000). Neuroanatomical hypothesis of panic disorder, revised. *American J. Psychiatry*, **157**(4) : 493-505.

Gupta, S. P. (1998). *An easy approach to statistics*. S. Chand and Company Ltd., New Delhi, India.

ICMR (1989). *Nutrient requirement and recommended dietary allowances for Indians*. A expert group of ICMR., Hyderabad NIN.(ICMR).

ICMR (2010). Nutrient requirement and recommended dietary allowances for Indians. Indian Council of Medical Research, Hyderabad, India.

Kimaya, R. and Sharma, R. (2013). Macronutrient status of the elderly (60-80 years) from Central India. *African J. Food, Agric., Nutr. & Develop.*, **13**(2): 7504-7526.

Lahti Koski, M., Harald, K. and Mannisto, S. l. (2007). Fifteen year changes in body mass index and waist circumference in Finnish adults. *European J. Cardio-vascular Prevention & Rehabilitation*, **14** (3) : 398 - 404.

Mahan, L.K. and Arlin, M.T. (1992). *Foods nutrition and diet*

therapy. 8th Ed. W.B. Saunder s Company, Philadelphian. 294pp.

NIN. (2010). *National institute of nutrition-dietary guidelines for Indians*.2nd Ed. Hyderabad, India.

Shimokata, H., Tobin, J.D. and Muller, D.C. (1989). Studies in the distribution of body fat: I. Effects of age, sex and obesity. *J.Gerontol.*, **44**(2): 66-73.

Srilakshmi, B. (2008). *Nutritional science*. New Age International (P) Limited Publishers, New Delhi, India.

Suk, S.H., Sacco, R.L., Boden-Albala, B., Cheun, J. F., Pittman, J.G., Elkind, M.S. and Paik, M.C. (2003). Abdominal obesity and risk of ischemic stroke the Northern manhattan stroke study. *Stroke*, **34**(7) : 1586-1592.

Suter, P. M. and Russell, R. M. (1987). Vitamin requirements of the elderly. *American J. Clinical Nutr.*, **45** (3) : 501-512.

Walker, S. P., Rimm, E. B., Ascherio, A., Kawachi, I., Stampfer, M.J. and Willett, W.C. (1996). Body size and fat distribution as predictors of stroke among US men. *American J. Epidemiol.*, **144** (12) : 1143-1150.

W.H.O. (1995). *World health organization and WHO study group on the control of food borne trematode infections.* Control of Foodborne Trematode Infections: Report of a WHO Study Group (No. 849).

W.H.O. (2000). *World health organization*. The World Health Report 2000: Health Systems: Improving Performance.

Received : *08.09.2018;* **Revised :** *15.02.2019;* **Accepted :** *01.03.2019*