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NUTRITIONAL STATUS OF INSTITUTIONALISED ELDERLY, WITH SPECIAL REFERENCE TO IRON

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SUMMARY Iron and nutritional status were determined in 96 subjects over 60 years of age living in two 'Homes for elders. The first group comprised of 31 males and 31 females, while the second group comprised of 34 females.

Their dietary intake of energy, protein and iron was determined using the 24-hour dietary recall method and the iron and nutritional status was assessed using haematological and biochemical parameters.

A higher proportion of females than males had deficient energy intakes, while protein intakes were low in both males and females. Iron intakes below the lowest values recommended by the WHO were seen in 7 males (22 6%) and 40 females (53.3%). The mean haemoglobin levels were low in both males and females, while a higher percentage of females than males had haemoglobin concentrations less than 10g/dl and transferrin saturation values less than 16%. Plasma ascorbic acid levels in the deficient range were seen in 22 males (76%) and 45 females (79%), while their mean plasma protein concentrations were within the normal range.

INTRODUCTION

Malnutrition, specially subclinical malnutrition, is commonly seen among the elderly, leading to poor health, apathy and disinterest in food. Subclinical malnutrition can easily precipitate to the stage of frank malnutrition under environmental and pathological stresses to which the aged are more prone. Institutionalisation has been suggested to be one of the factors that renders elderly people particularly vulnerable to deficiency (1).

Iron is an important nutrient required for the synthesis of haemoglobin and other body functions. Iron deficiency is a common problem in many developing countries (2), specially among the elderly, due to inadequate dietary intake, malabsorption or blood loss.

In Sri Lanka, most of the studies on nutritional status have been carried out on adults, preschool children and women in the reproductive phase of life and very little attention has been paid to nutritional problems of the elderly. In recent years, due to overall improvement of health and living conditions of people, more and more subjects are added to the elderly population. Therefore, it is important to ensure that a satisfactory nutritional status be maintained to achieve a better quality of life for these subjects. This paper deals with a study of the nutritional status of institutionalised elderly subjects with special reference to iron.

MATERIALS AND METHODS

Subjects

Thirty one males and thirty one females in the age group 60—94 years were selected randomly from a total of 200 inmates living in a Home for the Elders in Colombo. A second group of 34 females was selected randomly from a total of 90 inmates living in another home for elderly females in Colombo. The period of institutionalisation ranged from 1—30 years. Both males and females were subjected to a clinical examination. Subjects having acute or chronic infections or other serious illnesses were excluded from the study. Vitamin and iron supplements given to any subject included in the study were stopped for two weeks prior to sampling of blood.

Methods

The body weights were measured using a standardised weighing scale (Salter, U.K.) to an accuracy of $\pm$ 0.5 kg, while heights were measured using standardised scales to an accuracy of $\pm$ 0.2 cm. Their dietary histories were recorded on two occasions using the 24-hour dietary recall method (with the assistance of the staff of the institution) and the mean of two values taken. The daily energy and nutrient intakes were calculated using food composition tables (3,4).

The iron status of these subjects was assessed haematologically, by measuring the haemoglobin (Hb) concentration (5,6) and packed cell volume (PCV). The serum iron and total iron binding capacity (TIBC) were determined by the method of Persijn et al(7), using Sigma Diagnostic reagents. The percentage transferrin saturation was calculated as follows :

$$\text{Percentage transferrin saturation} = \frac{\text{Serum iron } (\mu g/dl)}{\text{Serum TIBC } (\mu g/dl)} \times 100$$

Plasma ascorbic acid concentration was determined by the method of Denson and Bowers (8) and serum albumin concentration by the bromcresol green dye-binding method (9) and total protein concentration using Biuret reagent.

Venous blood (10 ml) was collected at least 3 hr after the morning meal. An aliquot of blood was transferred to tubes containing disodium salt of ethylene diamine tetraacetic acid (1.5 mg/ml) and a portion of this blood was used for the measurement of Hb concentration and PCV. The remainder was centrifuged (3500 rpm for 10 min) and 0.5 ml of plasma was added to 5% trichloroacetic acid (2ml), mixed and stored overnight at 4° C. The solution was centrifuged the following day and 1.5 ml of the supernatant used for the determination of ascorbic acid.

The remainder of the blood was centrifuged and aliquots of serum were used to determine iron concentration, total iron binding capacity, albumin and total protein concentrations.

All estimations were carried out in duplicate and student's t-test was used to assess the statistical significance.

RESULTS AND DISCUSSION

All subjects included in our study were over 60 years of age and the mean age was 73.2 ± 8.0 years for males, 74.4 ± 7.4 years for the first group of females and 72.2 ± 8.6 years for the second group (Table 1). Both groups of females had lower mean body weights and heights than the males (Table 1). The mean body weight and height of males in our study were slightly lower than that reported for 60 year-old males in rural areas of Andra Pradesh (10), while that of females was similar.

TABLE 1. Age, heights and weights of institutionalised elderly subjects (the range is indicated within brackets)

		Age in years		Weight in kg.		Height in m	
		Mean	SD	Mean	SD	Mean	SD
Males	31	73.2 (60—94)	8.0	45.9 (32—65)	8.9	1.59 (1.47—1.73)	0.77
Females							
Group 1	31	74.4	7.4	41.5	9.3	1.46	0.65
Group 2	34	72.2 (62—95)	8.6	40.6 (26—60)	10.5	1.44 (1.35—1.58)	1.1

Eleven males (35.4%) had an energy intake less than 7700 kJ (Fig. 1), recommended by the WHO (11) for men over 60 years of age, weighing 50 kg and with a moderately low degree of physical activity (1.6x BMR). Nineteen females in group 1 (61%) and 33 females in group 2 (97%) had a daily energy intake lower than 6800 kJ recommended for women over 60 years of age, weighing 40 kg and with a moderately low degree of physical activity (1.6 x BMR). Four subjects (13%) in group 1 and 27 subjects (79.4%) in group 2 had energy intakes below a value of 6000 kJ recommended for women with a very low degree of physical activity (1.4 x BMR). Thus a markedly higher proportion of females than males had deficient energy intakes (10).

The safe level of intake of protein recommended by the WHO (11) is 37.5g/day for a male over 60 years of age, weighing 50 kg and 30g/day for a female in the same age group weighing 40kg, when protein with the quality and digestibility of milk or egg is used. However, the recommended values for Sri Lankan subjects is higher (12) as they subsist on a diet low in animal proteins, with a lower quality and digestibility than milk or egg. Only 7 males had intakes above 55g/day, the value recommended for Sri Lankan males, while 15 males (48%) had intakes between 45—55 g/day and 9 males (29%) had intakes less than 45 g/day (Fig. 2). The safe level of intake of protein recommended for Sri Lankan females is 47 g/day (12) and only 9 females in group 1 (29%) and 22 females in

group 2 (64.7%) had intakes above this value. Daily protein intakes of less than 35 g/day were noted among 7 females (22.6%) in group 1 and 8 females (23.4%) in group 2. Females in the second group had a higher mean protein intake than those in group 1. It must be noted that females belonging to group 2 were mostly vegetarians.

In contrast to energy and protein requirements, the recommended daily allowance of iron is higher in females than males (13). However, a corresponding increase in intake was not observed among females. Twenty eight females in group 1 (90.3%) and twelve females in group 2 (35%) had iron intakes below the lowest recommended value of 14 mg/day, while none of the subjects had intakes above 28 mg/day (Fig. 3). Moreover, this iron was derived mainly from plant sources, specially in group 2. In contrast, intakes above the recommended daily intake of 9 mg (13) were noted in 24 males (77.4%). Thus dietary deficiency of iron was commoner among females than males and could be attributed at least in part to decreased intake of animal foods due to greater aversion to such foods or to religious beliefs, The intake of green leafy vegetables, a cheaper dietary source of iron, was found to be low, specially among males and females in group 1.

The decreased dietary intake of iron and protein was reflected in the significantly lower concentrations of haemoglobin observed among both groups of females compared to males (Table 2). Seven females in group 1 (22.6%) and eleven females in group 2 (32.4%) had Hb concentrations below 10g/dl, while 3 males (9.7%) also had these low concentrations. Only 5 females in group 1 (16.1%) and 4 females in group 2 (11.7%) had haemoglobin levels greater than 12g/dl, the cut off value below which anaemia is likely to be present (2).

TABLE 2. Haemoglobin and packed cell volume of institutionalised elderly subjects (the number of subjects is indicated within brackets)

	Males		Females			
			Group 1		Group 2	
	Mean	SD	Mean	SD	Mean	SD
Haemoglobin						
All subjects (g/dl)	12.3 (31)	1.8	10.8 (31)	1.4[a]	10.4 (34)	1.4[a]
< 10 (g/dl)	8.4 (3)	2.6	9.0 (7)	1.3	8.7 (11)	0.9
10—12 (g/dl)	10.8 (6)	0.7	11.0 (19)	0.5	10.8 (19)	0.5
> 12(g/dl)	13.0 (22)	0.7	12.8 (5)	0.4	12.5 (4)	0.4
Packed cell volume						
All subjects (%)	40.7 (31)	5.4	36.9 (31)	4.0	38.5 (34)	4.8

a = Significantly lower than males ($p < 0.001$)

The commonest clinical sign of nutritional deficiency was anaemia, as indicated by pallor, which was seen in 6 males (19.4%), 8 females in group 1 (25.8%) and 7 females in group 1 (20.6%). Glossitis and angular stomatitis were seen in a few subjects and night blindness was noted in 2 males and 1 female in group 2. Three males and one female in group 2 complained of haemorrhoidal bleeding which may have contributed at least in part to the low haemoglobin levels observed in these subjects. The mean PCV of both males and females was lower than values considered normal for geriatric subjects (6).

The serum iron levels of males and females was similar, while the TIBC was slightly higher in females, indicating iron deficiency(14). The mean percentage transferrin saturation of both groups of females was lower than males (Table 3). Eight females (15.4%) and 3 males (9.7%) had percentage transferrin saturation values less than 16%, another indication of iron deficiency(15). More males (51.6%) than females (40.4%) had a satisfactory iron status as indicated by transferrin saturation values greater than 25(15). Thus a much higher proportion of females than males were severely deficient in iron.

TABLE 3. Serum iron concentration total iron binding capacity and percentage transferring saturation in institutionalised elderly subjects (number of subjects is indicated within brackets)

	Males		Females			
			Group 1		Group 2	
	Mean	SD	Mean	SD	Mean	SD
Serum iron, (μg/dl)	74.4 (30)	22.3	67.6 (30)	23.3	84.6 (22)	24.2
Total iron binding capacity, (μg/dl)	288 (30)	58	299 (30)	53	323 (22)	59
Transferrin saturation (%)						
All subjects (%)	26.7 (30)	8.4	23.2 (30)	9.1	24.1 (22)	5.8
< 16%	13.2 (3)	3.7	12.3 (6)	4.8	15.6 (2)	0.50
16—25%	22.5 (11)	2.4	20.5 (14)	2.4	19.5 (9)	1.6
> 25%	32.7 (16)	5.5	33.5 (10)	6.2	28.7 (11)	3.8

The higher incidence of iron deficiency among elderly females is probably due to depletion of iron stores as a result of subsistence on diets with a lower content of bioavailable iron. Further, the low intakes in the elderly may not be sufficient to replenish the iron stores that were depleted during the child-bearing years. In contrast, a study on elderly subjects in Ireland revealed a higher incidence of anaemia among males than females (1).

The mean serum total protein and albumin concentrations were within the normal range in the both males and females studied (Table 4).

TABLE 4. Plasma ascorbic acid and serum protein concentrations in institutionalised elderly subjects (number of subjects is indicated within brackets)

	Males		Females			
			Group 1		Group 2	
	Mean	SD	Mean	SD	Mean	SD
Plasma ascorbic acid (mg/dl)						
All subjects	0.18 (29)	0.14 a	0.31 (27)	0.23	0.20 (30)	0.13b
< 0.3 mg/dl	0.13 (22)	0.07	0.14 (18)	0.06	0.15 (27)	0.09
Serum						
Total protein (g/L)	78.7 (28)	4.5	78.6 (26)	3.6	74.3 (21)	4.8
Albumin (g/L)	42.8 (30)	2.5	44.3 (26)	3.5	42.6 (21)	3.0

b = Significantly lower than females in group 1 ($p < 0.02$)

a = Significantly lower than females in group 2 ($p < 0.05$)

A significant finding in this study was the observation of low plasma ascorbic acid levels among the subjects studied. The plasma ascorbic acid concentration was less than 0.3 mg/dl (the value indicative of biochemical deficiency(16) in 22 males (76%) and 18 females in group 1 (67%) and 27 females (90%) in group 2 (Table 4). The decreased plasma ascorbic acid levels may reflect a reduced dietary intake of ascorbic acid-rich foods, specially fresh fruits and green leafy vegetables. These foods were not available to the majority of the subjects in the two institutions. Further, substantial losses in potency of ascorbic acid may have occurred during preparation of food on a large scale. A low dietary intake of ascorbic acid may also decrease the efficiency of absorption of iron from plant foods (17).

Deficiency of vitamin C has also been reported in other studies on elderly subjects(18). Burr and coworkers have suggested that the decreased plasma ascorbic acid levels may not only be the result of reduced dietary intake, but also reflect changes in utilisation with advancing age(19).

The mean plasma ascorbic acid concentration of males was significantly lower ($p < 0.02$) than that of females in group 1, but not in group 2 (Table 4). Loh and Wilson have reported lower plasma ascorbic acid levels in males compared to females (18).

It must be emphasized that the two institutions studied were those managed by two different religious organisations and were better looked after than elderly subjects in many of the state-managed institutions and those living in the poorer communities, who may be at a greater risk of nutritional deficiency than the subjects studied.

Therefore, attention need be paid to improve the nutritional status of elderly subjects, by providing them a balanced diet in a more digestible and palatable form in order to achieve a better quality of life.

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Fig. 1 Daily energy intakes of institutionalised elderly subjects

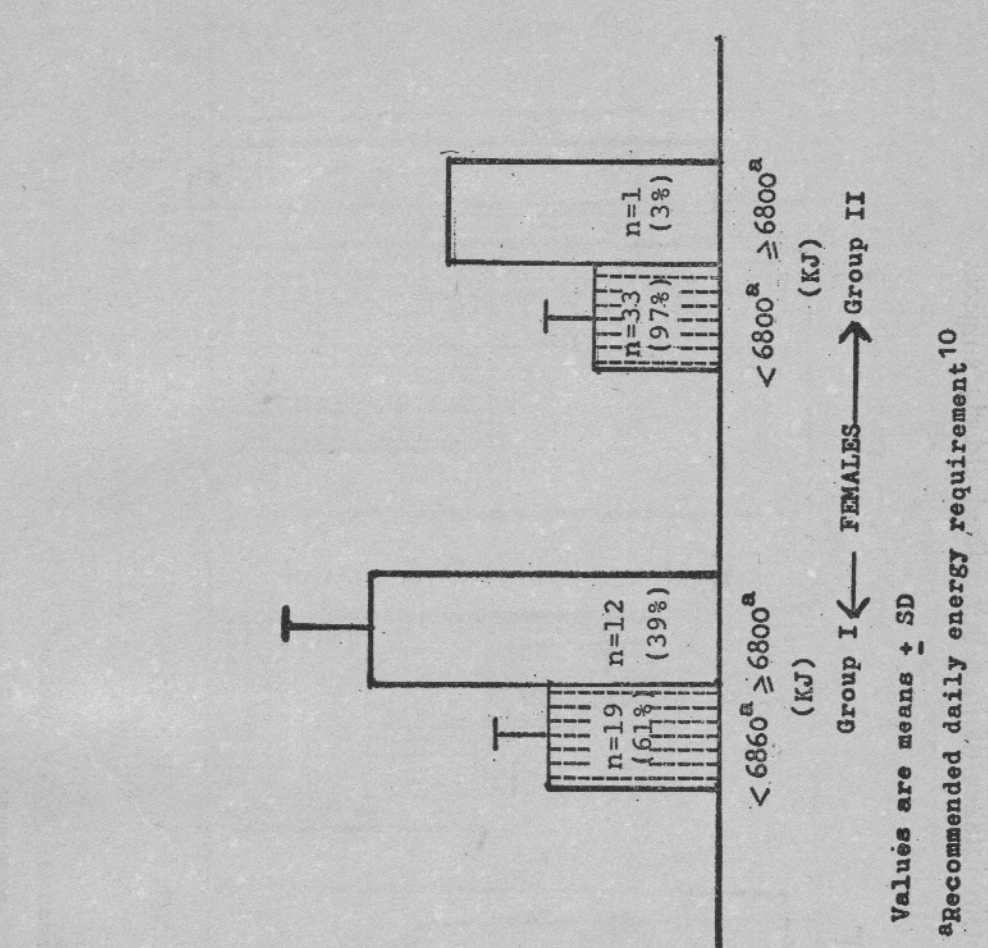
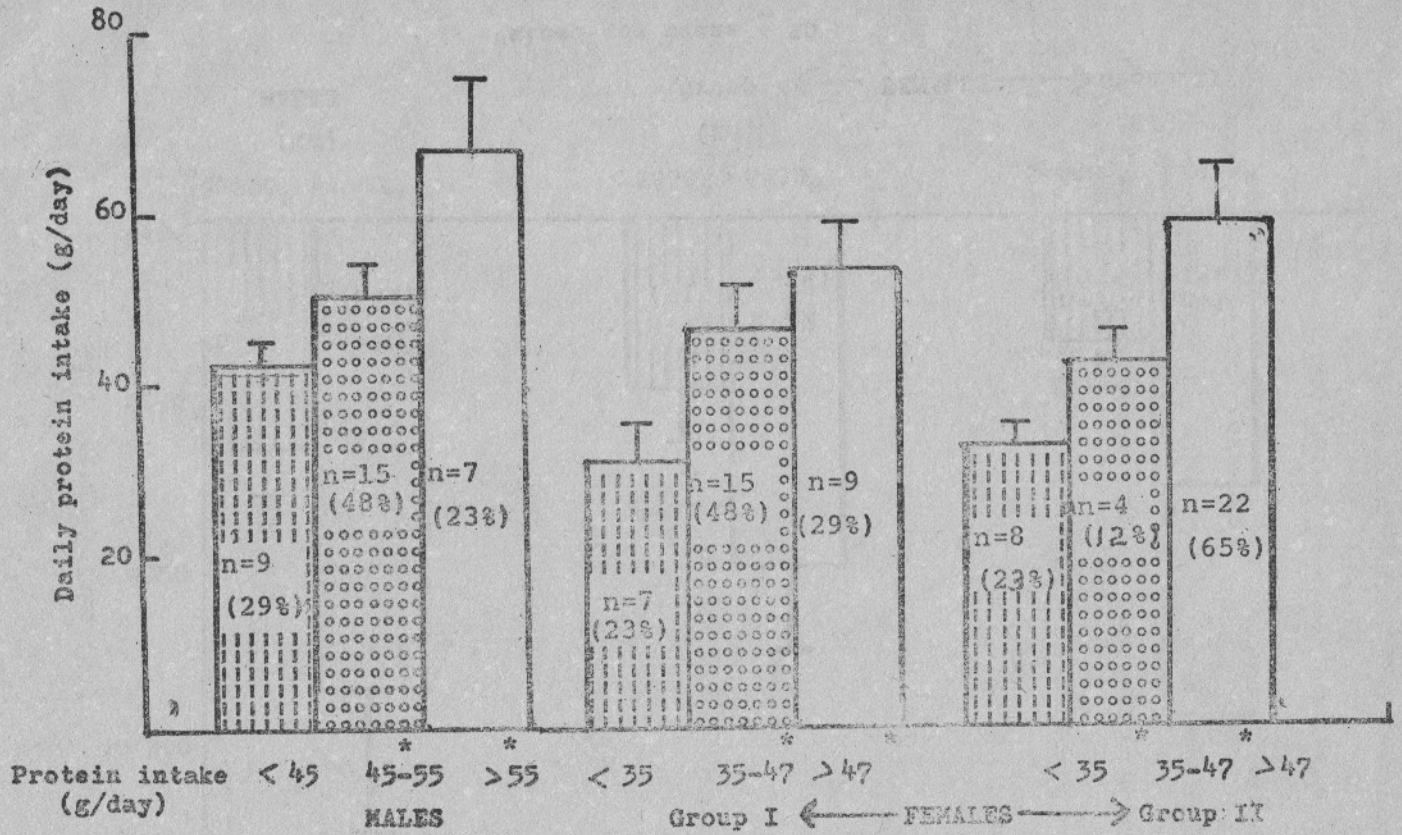


Fig. 2 Daily protein intakes of institutionalised elderly subjects



*Recommended daily intake[7]

Values are means ± SD

Fig. 3 Daily intake of iron among institutionalised elderly subjects