Dietary Intake and Biochemical Indicators of Nutritional Status in an Institutionalized Egyptian Elderly Population

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Abstract

Background: Aging is a process associated with physiological changes such as in body composition, energy intake, and physical activity. Data on energy and nutrient intake adequacy among elderly is important for disease prevention, health maintenance and program development.

Objective: The aim of this study was to assess the nutritional status of institutionalized Egyptian elderly people.

Method: The nutritional status of 750 apparently healthy elderly people aged from (65-85 y) were randomly selected from subjects of eight institutions in Cairo and Giza governorates. Seven day dietary recall was used to describe usual dietary intake. Anthropometric variables and biochemical parameters were measured.

Results: The present results showed that dietary intake of both men and women when compared with the (RDA) showed an intake deficiency of fat. They also had lower mean intake in vitamin (A, C, E) and niacin. Both of men and women showed lower intake of calcium, zinc and selenium. The anthropometric measurements showed that women had higher BMI than men (p<0.05). The total body water (TBW) and fat free mass (FFM) were higher in men than in women, but percentage of body fat was higher in women than in men. Handgrip strength (Kg) was significantly higher in men than in women. Blood pressure was significantly higher in women than in men. Blood properties were evaluated by analyzed serum levels of glucose, total cholesterol, creatinine, vitamins A,C and E, calcium, zinc and selenium. No significant differences were found in hemoglobin and fasting blood glucose between men and women. The mean level of total cholesterol was significantly higher in women than in men. People who reported being food insufficient had significantly lower serum levels of calcium and the antioxidants vitamin E,C and selenium.

Conclusions: While the protein intake was adequate according to the recommended dietary allowance, the micronutrient intake was found to be lower than the RDA. It is essential for elderly people to eat a nutritionally adequate diet consisting of a variety of foods which contain high levels of antioxidants and micronutrient.

Key Words: Elderly – Dietary intake – Anthropometry – Nutritional status.

Introduction

The proportion of elderly people in the world is growing and the majority of them live in developing countries [1,2] given the widespread poverty found in developing countries. Many older people can be expected to have nutritional and health problems that will adversely affect their quality of life and ability to carry out daily tasks independently [3].

Therefore care should be given to the special nutrition requirements of elderly. Nutrition offers the means to improve health and well being when chosen carefully.

The assessment of nutritional status can be carried out by several methods. Firstly by evaluating body composition changes as it has a strong impact on health and disease. The amount of muscle mass decline with age and after the age of 50 years, the process seems to accelerate [4-6]. Knowledge in distribution of body fat and muscle mass is particularly important to obtain in old people with a multi-system reduction in reserve capacity, as a small decrease in fat free mass, may lead to significant problems in daily life [7-9].

Furthermore other indicators of nutritional status of older people which has been related to functional ability and strength should be assessed [10-12]. Handgrip strength may be a useful nutritional status indicator particularly where anthropometric measurement fail to distinguish undernourished from underweight persons [13].

The decrease in appetite due to decreased physical activity dental and oral problems or mood...
disorders with increased age results in overall lower energy intake which can lead to lowered intake of essential nutrients. At this stage, the elderly often show a rapid decline of health and nutritional status resulting from stress and loss of independence.

Assessing dietary intakes against some standard, for example the recommended dietary analysis, may help to identify individuals at risk. Secondly nutritional assessment can be determined by biochemical changes which may be the first sign for determination of poor nutritional status. However, clinical sings and symptoms precede measurable physiologic and biochemical parameters.

The aim of this study was to assess the nutritional status in apparently healthy elderly men and women in many institutions in Cairo and Giza governorate.

Material and Methods

Subject:

This study initially recruited 850 healthy elderly men and women who freely consented to participate. During the course of the study many subjects were excluded due to current illness. Seven hundred and fifty subjects (350 men and 400 women) with an age range of (65-85 years) completed the study course.

The protocol was approved by ethical committee of NRC. All cases were subjected to the following plan of study.

1- Seven days dietary intakes were recorded.
2- Anthropometric measurements were taken.
3- Blood samples were obtained for the determination of biochemical parameters.

1- Dietary intake:

Data of dietary intake was obtained from the seven days menus in the homes. In addition to the menu items, individual food intake assessment included portion size, amount of left over food if any and any additional snacks taken. Daily menu records were provided, in the form of single tabulated sheets for the main meals and additional snacks, with columns for portion size and waste. A trained field worker visited our subjects during the assessment period. Menu records scales and types of household measures used were checked and any additional or missing information was obtained. The total dietary intake expressed as the mean of the 7 days intake, was coded and analyzed using the world food dietary assessment computer program [14] thus converting the food intake into nutrients.

The adequacy of diets with regard to energy and nutrients was evaluated using the Recommendation Dietary Allowances (RDA) of FAO (WHO) [15].

2- The anthropometric variables were measured for all subjects of the study:

Body weight was measured with a portable scale with one layer of clothing and without shoes to the nearest 0.1kg while the body height was measured with a tap to the nearest 0.5cm. Body mass index (BMI) was calculated from the weight and square of height (we/Ht²). Body fat percent (% Bf), fat free mass (FFM) and total body water (TBW) were calculated according to [16].

Functional status:

Handgrip strength: Handgrip strength is a measure of strength of the hand and the fore-arm muscles and is measured in kilograms using a hand grip dynamometer [17]. The test was performed while the subject was sitting comfortable with the shoulder adducted and neutrally rotated, the elbow supported on a table and flexed to 90 degrees, and the forearm and wrist in a neutral position. Residents were encouraged to perform their maximal isometric contraction.

3- Biochemical measurement:

Venous fasting blood samples were withdrawn from all subjects for biochemical analyses. Total cholesterol in serum was measured by enzymatic procedures according Allian et al. [18]. Creatinine was determined by the method of Jaffe [19]. Blood glucose was measured enzymatically according to Trinder [20]. Serum albumin using photometry determination according to Doumas et al. [21]. Serum calcium was determined by the method of Grinder et al. [22]. Evaluation of serum vitamins (C), A and E according to Jagota et al. and Desmet et al. [23-25]. Finally serum zinc was determined according to Sonia et al. [26]. Selenium was analyzed by graphite – Furance [27].

Statistical analysis:

Values were expressed as mean ± S.E. The data were statistically analyzed according to the student’s t-test. The significance of change was determined. A probability values p<0.05 was considered significant.
Results

Subjects:

Table (1) summarizes some characteristics of the elderly. More men than women were married. Only 49% of men were smoking tobacco and only 2% of women. The ability to walk outside of the elderly home without help and without resting and regular exposure to sunlight were higher among men than women. Table (2) shows data of anthropometric, body composition and blood pressure of elderly subjects. The results show that the mean height and body weight in men were higher than that of women. The average body mass index (BMI) was higher in women than in men with significant difference \( p<0.05 \). The total body water (TBW) was significantly greater in men than women \( p<0.05 \). While body fat percent was higher in women than in men. On the other hand the fat free mass was significantly higher in men than in women.

Table (1): Some characteristics of elderly men and women.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Women n=400</th>
<th>Men n=350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (y)</td>
<td>74.25±9</td>
<td>75.00±11</td>
</tr>
<tr>
<td>Marital status:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried (%)</td>
<td>9.26</td>
<td>4.34</td>
</tr>
<tr>
<td>Married</td>
<td>74.10</td>
<td>86.95</td>
</tr>
<tr>
<td>Divorced</td>
<td>14.81</td>
<td>7.2</td>
</tr>
<tr>
<td>Widowed</td>
<td>3.8</td>
<td>8.71</td>
</tr>
<tr>
<td>Education level:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate or merely read and write</td>
<td>25.9</td>
<td>43.48</td>
</tr>
<tr>
<td>Completed Primary school</td>
<td>37.04</td>
<td>22.35</td>
</tr>
<tr>
<td>Secondary education</td>
<td>27.78</td>
<td>10.87</td>
</tr>
<tr>
<td>Higher vocational degree (%)</td>
<td>9.25</td>
<td>23.91</td>
</tr>
<tr>
<td>Smoking:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current (%)</td>
<td>2.00</td>
<td>49.00</td>
</tr>
<tr>
<td>Former</td>
<td>5.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Edentulous (%)</td>
<td>79.00</td>
<td>88.00</td>
</tr>
<tr>
<td>Problem with chewing (%)</td>
<td>55.00</td>
<td>70.00</td>
</tr>
<tr>
<td>Regular exposition to sunlight (%)</td>
<td>65.00</td>
<td>82.00</td>
</tr>
<tr>
<td>Ability to walk outside (&gt;40 min) %</td>
<td>28.00</td>
<td>80.00</td>
</tr>
</tbody>
</table>

Mean systolic blood pressure was 150±20 mm-Hg in women, and 145±10 mmHg in men. However, the women showed to be hypertensive with diastolic blood pressure above 95 mmHg (Table 2). The mean values of energy and nutrient intakes for the studied group as compared to the RDA are shown in Table (3). The mean energy and carbohydrate were adequate in women than in men. The consumption of protein was higher than the recommended for both sexes. The mean intake of vitamins A, E for participants were considerably low and did not meet even half the RDA. Vitamin C intake was slightly less than the RDA. Regarding to the minerals the mean intake of calcium, zinc, and selenium fell below the RDA.

The biochemical measurements are shown in Table (4). The mean average of hemoglobin, serum albumin and creatinine were within the normal range. Blood glucose level among women was 130±18 (mg/dl) while in men was 125±24 (mg/dl). The mean values of total cholesterol was significantly higher in women than in men \( p<0.05 \). Serum calcium was lower in women than men, the difference was significant \( p<0.05 \), while serum level of both zinc and selenium concentration were lower in women than that in men. Also the results showed that the levels of serum vitamin A, E and C were significantly lower in women than in men.
Nutrient intake:

Both developing and developed countries population of elderly.

But iron content of the diet appeared to be just metric and biochemical data, the results of dietary not satisfactory and lower than the RDA. Regarding were given by Suzuki and Ishida that of women. Similar observations to our results have reduced the RDA of energy intake below than adequate food supply provided in their institutions. Elderly men subjects despite adequate protein intake, while the intake of fat was adequate in comparison to the RDA. Micronutrient and selenium fell below the RDA in both sexes our subjects had lower intake of vitamins A,E,C and niacin. Also minerals such as calcium, zinc and selenium fell below the RDA in both sexes but iron content of the diet appeared to be just adequate in comparison to the RDA. Micronutrient deficiencies have been shown to be common in elderly people due to a reduced food intake resulting from a lack of variety in the foods they eat. Physiological changes and oral problem such as impaired dentition, fewer natural teeth and dental caries all of them are associated with aging [30,31]. Dental caries was a prevalent condition seen among our population of elderly.

These results are similar to findings from other studies among community living elderly people in both developing and developed countries [6,30-34].

Taking into consideration that the dietary requirements of the elderly are still inadequately defined, it is quite obvious that without anthropometric and biochemical data, the results of dietary examinations alone cannot provide correct information on the nutrition status of the elderly.

Anthropometry and body composition:

The mean height was 1.65±0.073m for men and 1.50±0.1 m for women. In a study by Marcenes et al. and Kuczmarski [35,36] the mean body height of elderly people was found to be lower when compared to that of younger adults. This difference was partly caused by secular growth changes, and can also be the results of senile kyphosis and shortening of the spinal vertebrae. Senile kyphosis could results in underestimation of body height in some of our subjects.

The mean weight was 68.90±9.79kg for men and 67.81±9.9kg for women. Among the elderly women had higher BMI above 25kg/m². Body mass index has shown to be a poor indicator of body composition [37]. It also has been reported that obesity which is measured mainly by BMI is usually accompanied by increased in total cholesterol, as we seen in our study (Table 4). The percent of body fat of our subjects was calculated by applying the equation using the BMI, and was found to be 29.58 ± for men and 32.41 ± for women with significant difference (p<0.05). The predicted values for fat free mass (FFM) formulas including height i.e. equation using BMI was as follows 46.58±1.11 for men and 43.13±0.92 for women. Total body water is the most frequently utilized variable to assess FFM.

Total body water was significantly higher in men than in women. Extensive cross-sectional studies demonstrate decreasing TBW with age (16).

Handgrip strength is the most common assessment method for upper extremity muscle strength [38] and also may be a useful nutritional status indicator, particularly where anthropometric measurements fail to distinguish undernourished from underweight [13]. In our study men had higher grip strength than women as shown in Table (2). Similar sex difference were seen in other studies carried out in developing as well as in industrialized countries [10,11,39-42].

The results of the blood pressure showed that women had a higher blood pressure than men. A high BMI which was found in women has strong independent effects on blood pressure [43,44]. Also De Backer et al. [45] found that several nutrition related disorders for the elderly including high systolic blood pressure (44.6%) high diastolic blood pressure (25.1%) and obesity (24.5%).

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**Table (4): Biochemical parameters of nutritional status in elderly (Women and Men).**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Women n=400</th>
<th>Men n=350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>12.00±1.1</td>
<td>13.14±0.9</td>
</tr>
<tr>
<td>Serum albumin (mg/dL)</td>
<td>4.10±0.1</td>
<td>4.40±0.2</td>
</tr>
<tr>
<td>Fasting glucose (mg/dL)</td>
<td>130.00±18</td>
<td>125±24</td>
</tr>
<tr>
<td>Serum creatinine (mg/dL)</td>
<td>0.76±0.24</td>
<td>0.97±0.061</td>
</tr>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>263±5*</td>
<td>192.4±5.1</td>
</tr>
<tr>
<td>Serum Vit. A (µg/dL)</td>
<td>27.6±3.25*</td>
<td>33.5±2.8</td>
</tr>
<tr>
<td>Serum Vit. E (mg/dL)</td>
<td>0.57±0.1*</td>
<td>0.82±0.09</td>
</tr>
<tr>
<td>Serum Vit. C (mg/dL)</td>
<td>0.66±0.11*</td>
<td>0.79±0.2</td>
</tr>
<tr>
<td>Serum calcium (mmol/L)</td>
<td>2.18±0.033*</td>
<td>2.3±0.06</td>
</tr>
<tr>
<td>Serum zinc (µg/dL)</td>
<td>74±0.7</td>
<td>75±1.2</td>
</tr>
<tr>
<td>Serum selenium (µg/dL)</td>
<td>46±2.3*</td>
<td>68±1.8</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SE.

* Difference between elderly women and men significant at p<0.05.  

**Discussion**

**Nutrient intake:**

This study provides energy and nutrient intake data from older persons independently living in elderly home in Egypt. The results of dietary intake have shown that elderly men subjects despite adequate food supply provided in their institutions have reduced the RDA of energy intake below than that of women. Similar observations to our results were given by Suzuki and Ishida [28]. Energy intake often decreases in old age [29]. The present study showed that both of men and women have had adequate protein intake, while the intake of fat was not satisfactory and lower than the RDA. Regarding the vitamins and minerals intake we noticed that our subjects had lower intake of vitamins A,E,C and niacin. Also minerals such as calcium, zinc and selenium fell below the RDA in both sexes but iron content of the diet appeared to be just adequate in comparison to the RDA. Micronutrient deficiencies have been shown to be common in elderly people due to a reduced food intake resulting from a lack of variety in the foods they eat. Physiological changes and oral problem such as impaired dentition, fewer natural teeth and dental caries all of them are associated with aging [30,31]. Dental caries was a prevalent condition seen among our population of elderly.

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Biochemical data:

The initial hemoglobin, albumin and creatinine levels of the studied elderly were within the reference range of normal, which confirm to them being chosen as generally healthy. The mean level of blood glucose was higher in women than in men. Our results are in accord with that obtained by Suzuki and Ishida [46]. The condition is the failure to maintain the concentration of blood glucose within the normal range. In an adult population uncontrolled diabetes mellitus is associated with a large excess of cardiovascular diseases [46]. There is a very strong correlation between obesity and developing diabetes and the risk of developing this condition [47].

Serum total cholesterol level was higher in women than in men. This increase in total cholesterol in women may be belonging to the stage after menopause and accordingly the risk for hypertension and coronary heart disease increased as reported by Hershcopf et al. [48]. The results showed that serum calcium was lower in women than in men. This difference was not significant. This results agree with the ten state nutrition Survey (1970), which showed also that calcium intake was lower than the RDA (1200mg/day). It has been noticed that the nutrient intake among this sector of people was generally low, and specifically the consumption of milk and dairy products to a great extent. The importance of zinc that it participates in enzymatic protect against free radical toxic derivative of oxygen [49]. In our study selenium was significantly higher in man than women. Selenium should be considered as a potential factor to lower total homocysteine levels. The results of biochemical examination indicated that a higher proportion of subjects had reduced levels below acceptable levels of vitamins A,E and particularly vitamin C. In the elderly the levels of vitamins in the body are affected by many factors, beside the efficiency in dietary supply. This is particularly true for vitamin C, the losses of which during thermal food processing may vary between 30-60% [50]. Also Stahelin [51] reported that the older people who eat insufficient food had significantly lower serum levels of the antioxidant vitamin A,E, C and selenium.

Conclusion: We conclude that an appropriate nutrition intervention program is needed to improve the nutritional status for this special population group. Programs for this group may be grade towards (A) Screening for and assessing nutritional programs, and (B) nutritional counseling, health promotion and disease prevention. Efforts should be made in educating the public on the conditions associated with aging including effective care. The importance of micronutrients in the promotion of health and prevention of later-life disorder should also be received considerable attention in diet-disease, national program.

References

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