ANTHROPOMETRIC CHARACTERISTICS OF ELDERLY PEOPLE: OBSERVATIONS AT A LARGE DIARRHEAL HOSPITAL IN DHAKA, BANGLADESH

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Abstract. There is a lack of evidence-based information to assist health policy makers in preparing for appropriate health, nutrition, and social-support guidelines for the elderly in Bangladesh. We examined selected indicators of the nutritional status of elderly people attending the Dhaka Hospital of ICDDR,B, Dhaka, Bangladesh. The population constituted of 1,196 individuals (718 men and 478 women), aged 60 to 106 years, who attended the hospital between 1 January 1993 and 31 December 2003. Patients were recruited from a hospital-based systematic sampling, regardless of age and gender, that presented to the facility. Men were heavier, and taller than women were (p < 0.001 for both comparisons). Using MUAC cut-off of < 22 cm for females and < 23 cm for males, at least 50% of the elderly were peripherally wasted (malnourished). Among all the study population, 40% had a BMI within the optimal range (18.5-24.9 kg/m^2). Using the chronic energy deficiency (CED) classification, at least half of elderly (≥ 60 year) women were chronic energy deficient (BMI < 18.5). A significantly higher proportion of elderly women (7%) compared to men (2%) were overweight (BMI ≥ 25, p < 0.001). Among the elderly (≥ 60 year), males and females from a higher socioeconomic status (SES) had significantly higher BMI (p < 0.001, p = 0.001, respectively) and MUAC values (p < 0.001, p < 0.001, respectively) than their less well-off SES counterparts. We consider that, although our data were not valid for assessing the country situation, they are still useful as baseline information for longitudinal studies and for highlighting the need for studies in other geographical locations and in other population groups.

INTRODUCTION

Demographic studies in developing countries have observed that improvements in living conditions and health care, leading to an increasing average life expectancy, is increasing the growth of elderly population (Shahar *et al*, 2001; Anonymous, 2003; Jitapunkul *et al*, 2003; Cho *et al*, 2004; Gavazzi *et al*, 2004). It is anticipated that the increasing elderly population would develop various health and nutritional problems and require increasing health and social costs in resources in poor developing countries (Chilima and Ismail, 1998; Shahar *et al*, 2001; Suzana *et al*, 2002; Anonymous, 2003; Jitapunkul *et al*, 2003; Cho *et al*, 2004; Gavazzi *et al*, 2004). A clear understanding of trends in the nutritional status of the elderly would, in addition to helping to plan health care services, help to develop preventive programs. Currently, there is a serious lack of such information to assist health policy makers to prepare evidence-based

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health, nutrition, and social-support guidelines. Due to physiological and psychological changes in elderly, they are more vulnerable to poor health and malnutrition (Keller, 1993; Shatenstein et al, 2001). The developed countries have formulated efficient health care systems to meet the special needs of the elderly; however, such programs are lacking in Bangladesh and many other developing countries.

Anthropometry is a simple, practical, low-cost, noninvasive, reliable, and widely accepted tool used to assess nutritional status and to provide information on muscle mass and stored fat (Whitehead and Finucane, 1997; Vellas et al, 2001). Low body mass index (BMI), indicative of chronic energy deficiency (CED) and malnutrition, is associated with compromised immune function, increased susceptibility to infectious illnesses, and reduced survival among elderly (Campbell et al, 1990; Chandra, 1990; Dangour and Ismail, 2003). Similar to other developing countries, Bangladesh can be expected to experience the impact of an increasingly ageing population over the next few decades (ESCAP, 1989). However, information on the health and nutritional status of the Bangladeshi elderly is virtually nonexistent. Recently, we reported the etiology and presenting characteristics of elderly patients attending a large urban health care facility in Bangladesh with diarrheal diseases (Faruque et al, 2004). As a continuation of that study, we designed this study to examine, analyze, and describe the anthropometric characteristics of elderly people by their socioeconomic status and gender. These characteristics were then compared with the results of other age groups who attended the same facility. Such information may help health planning for elderly people to improve their quality of life in Bangladesh, and to encourage researchers to initiate further studies in different situations for the generation of representative national data.

MATERIALS AND METHODS

Study location, study population, and data source

Data collected under the 'Hospital Surveillance System' of the Dhaka hospital of ICDDR,B describe the source population for this study (Stoll et al, 1982; WHO, 1987; Faruque et al, 1996; Albert et al, 1999;). The Dhaka hospital is located in Dhaka, the capital city of Bangladesh. The Hospital, established in 1962, currently provides care to approximately 110,000 diarrheal patients each year, the vast majority of whom comes from the socio-economically disadvantaged segment of the urban population. The aim of the surveillance system is to better understand patient characteristics in relation to clinical, etiological, and epidemiological perspectives, and it specifically monitors: (i) changes in enteric pathogen-population including antimicrobial susceptibility of major enteric bacterial pathogens, for example, V. cholerae, Shigella, and Salmonella; and (ii) socio-economic, housing, environmental, hygiene, and nutritional profiles of the patients. This system provides a database on diarrheal illnesses to generate relevant research questions and to help develop and design research studies. The hospital surveillance activities are approved by the research review and ethical review committees of ICDDR,B. Informed consent is obtained. For this study, we extracted all relevant information from the surveillance database of 3,595 individuals (2,089 men and 1,506 women), aged 40-106 years, who attended the hospital during 1 January 1993 to 31 December 2003.

Sampling and recruiting

The Hospital Surveillance System enrolls a systematic sample [every twenty-fifth (4%) until 1995, every fiftieth (2%) since 1996] of all patients attending the hospital with diarrhea, with or without associated complications or associated health problem.

Questionnaire and data collection

Adult patients or parents of children enrolled in the surveillance system were interviewed using a specially designed, pre-tested questionnaire that was comprised of multi-dimensional questions. A physician thoroughly examined the patients and relevant information was recorded in case report forms. Fecal samples or rectal swabs were collected on admission and examined for isolation and identification of diarrheagenic pathogens. The antimicrobial susceptibilities of major enteric bacterial pathogens were also determined (WHO, 1987). Trained research assistants administered the questionnaire, sent specimens to the laboratories, and collected all information. The surveillance system routinely collects socio-economic, demographic, housing, environmental, hygiene, and clinical examination findings; however, we used only anthropometric and socio-economic data for this analysis.

Data quality control and management

Data forms were visually inspected for missing data, consistency, and errors; research assistants then entered the edited data into personal computers. The principal investigator of the surveillance system (ASGF) was responsible for the day-to-day running of the activities, holding monthly meetings, and spot checks to ensure data quality. Data were entered using StatPac Gold version 3.2 (Walonick Associates, Minneapolis, MN) with several appropriate checks for logic and consistency.

Anthropometry

Trained research assistants performed anthropometry (weight, height, and mid-upper arm circumference) using standard techniques (Cogill, 2003) and appropriate instruments, and recorded the findings on prescribed forms. Values of measurements at the time of discharge, when patients were fully rehydrated, were used for this analysis. Height was measured only of those who could stand completely erect (*ie*, without any gross physical disability) at the time of measurement and thus were included into the study (except < 1% elderly). Body mass index (BMI = kg/m^2) was calculated as weight (kg) divided by height in meters squared (m^2). Height was measured in the standing position using a locally made, vertical height board placed vertically with a locally made, non-stretchable measuring tape that was fixed tightly between the footplate and head bar. Patients had minimal clothing, and their caps, shoes, and socks were removed at the time of height measurement. The subject stood upright, placed both heels and feet together, knees straight, while heels, calves, buttocks, trunk, shoulder blades, and the back of the head were in contact with the vertical surface of the height board. The head was kept in such a position that the Frankfort Plane was horizontal. Arms were hanging loosely by the sides with palms facing thighs. The neck was stretched, and the head plate was pressed gently and horizontally on the top of the head. The scale was read keeping eyes at right angle to its plane. The mean of two measurements, to the nearest 0.1 cm, was recorded as the observed value. Weight was also measured with minimal clothing using a Seca electronic weighing balance (Heavy Duty Floor Digital Professional Scale; Model 770) with accuracy to the nearest 100 grams, after voiding urine. Mid-upper arm circumference (MUAC) was measured using a locally available, non-stretchable plastic tape. The subjects were asked to stand erect, and the research assistant stood on his/her left side. The measurement was taken at the middle point of the left arm, between the tip of acromion and the olecranon process, with the forearm in horizontal position and close to the body. After identifying the middle point, the left arm was allowed to extend and hang loosely by the side, with the palm facing towards the body. At the midpoint, the tape was wrapped

gently but firmly to take measurement of the arm circumference to the nearest millimeter.

Age determination

The age was recorded to the nearest month. For those who could not remember their exact age, it was estimated by matching recall of particular historical events, such as the independence of Pakistan in 1947 or by relating to specific life events, namely the ages of first schooling, marriage, or the birth of first child, and so forth.

Statistical analysis

Two statistical packages, Statistical Package for Social Sciences, version 10.2 Windows (SPSS, Chicago, IL), and Epi Info (version 6.0, USD, Stone Mountain, GA) were used for data analysis. For our analyses, elderly individuals were defined as those aged 60 years or older (United Nations, 1982). Persons with a monthly family income of more than US$ 50, and those with US$ 50 or less, were defined as individuals with higher and lower socio-economic status (SES), respectively. Data were summarized for group comparisons. Measures of central tendency or frequencies were determined for all nutritional indicators. Categorical data were analyzed using chi-square test. An independent sample two-tailed t-test was used to examine differences between continuous data. All analyses were carried out at a significant level of $p < 0.05$.

RESULTS

General findings

During the study period, 32,363 patients were enrolled in the Surveillance System, of whom 3,595 (11%) were 40 years and older. Out of 1,196 eligible elderly (aged 60-106 years) patients (4% of total), 718 were men and 478 were women. The mean age of men and women were similar (66.4 years versus 66.6 years, respectively).

Table 1 describes the age groups and means (SD), or frequencies of selected anthropometric and derived measurements, by gender. It can be seen that men were heavier (weight), and taller (height) than women within the same age group ($p < 0.001$, $p < 0.001$, respectively). The weight, height, MUAC, and BMI were significantly greater among younger subjects, aged 40-49 years, as compared with the elderly individuals, aged 70 years or older, both for men ($p < 0.001$ for all comparisons) and women ($p < 0.001$ for all comparisons). Men and women, aged 60-69 years, had higher values for weight, MUAC, and BMI compared with those aged 70 years or older ($p = 0.001$, $p < 0.001$ and $p < 0.001$, respectively, for men; and $p = 0.019$, $p = 0.007$ and $p = 0.034$, respectively, for women). However, differences in height between the two groups (60-69 years versus ≥ 70 years) did not differ by gender.

Prevalence of malnutrition

Of the study subjects (≥ 60 years), 40% (40% for men and 39% for women) were within the optimal range for BMI (18.5-24.9). Over half (54%) of the elderly women were malnourished, using the chronic energy deficiency (CED) classification (BMI < 18.5, Figs 1 and 2). The proportion of men and women, classified as having severe chronic energy deficiency (BMI < 16), were similar among 60-69 years old (16% vs 22%, $p = 0.05$) and ≥ 70 years old (25% vs 21%, $p = 0.50$). The overall proportion of overweight was very small; however, a significantly higher proportion of elderly women (≥ 60 years) compared with men (7% vs 2%) were overweight (BMI ≥ 25, $p < 0.001$). It was also the case for women aged 60-69 years who were significantly more overweight than men were (9% vs 2%; $p < 0.001$). Among elderly (≥ 60 years), males and females from a higher socioeconomic status had higher BMI ($p < 0.001$, $p = 0.001$, respectively) and MUAC values ($p < 0.001$, $p < 0.001$, respectively) than their less well-off SES counterparts (Figs 3 and 4). Using a MUAC cut-off of < 22 cm for females and < 23 cm for males (Table 1), at least

Table 1
Anthropometric characteristics of elderly, by age and gender, Dhaka, Bangladesh, 1993-2003.

Indices (unit)		Age groups			
		40-49 yr	50-59 yr	60-69 yr	≥ 70 yr
Age		42.7±2.7	52.2±2.7	61.6±2.4	74.8±6.5
Age, Male		42.7±2.7	52.3±2.7	61.7±2.4	74.2±6.2
Age, Female		42.7±2.7	52.1±2.6	61.5±2.3	75.8±6.9
Weight (kg) Male		52.3±9.9	51.2±9.9	47.7±8.6	45.5±7.5
Weight (kg) Female		45.4±9.3	43.8±9.4	41.1±9.4	38.9±8.4
Height (cm) Male		161.9±6.4	161.2±6.1	159.7±6.1	159.4±6.4
Height (cm) Female		150.0±5.7	148.4±5.8	147.0±5.7	146.0±5.4
MUAC (cm) Male		24.3±2.6	24.0±2.7	22.9±2.6	21.8±2.4
MUAC (cm) Female		23.3±3.1	22.9±3.1	22.2±3.4	21.2±3.0
MUAC <23.0 cm	% Male	31.7	37.3	50.0	66.8
MUAC <22.0 cm	% Female	34.4	37.5	49.7	62.5
BMI Male		19.9±3.2	19.7±3.3	18.7±2.9	17.9±2.5
BMI Female		20.2±3.8	19.9±3.9	19.1±4.0	18.2±3.3
BMI <16	% Male	7.6	9.3	15.5	25.1
BMI <16	% Female	10.7	13.2	21.7	21.3
BMI 16-16.9	% Male	10.2	12.0	14.5	15.9
BMI 16-16.9	% Female	11.1	10.6	17.1	19.7
BMI 17-18.4	% Male	20.3	22.8	25.1	22.2
BMI 17-18.4	% Female	16.6	18.4	13.2	17.2
BMI 18.5-24.9	% Male	53.7	48.6	42.6	35.6
BMI 18.5-24.9	% Female	48.7	47.7	39.1	38.5
BMI ≥25	% Male	8.3	7.3	2.2	1.3
BMI ≥25	% Female	12.8	10.1	8.9	3.3
Normal BMI,	MUAC	24.7±1.9	24.7±1.9	24.3±1.9	23.7±2.0
CED 1	MUAC	22.5±1.6	22.1±1.4	22.1±1.4	21.6±1.3
CED 2	MUAC	21.0±1.5	21.2±1.4	20.7±1.2	20.6±1.4
CED 3	MUAC	20.0±1.8	19.7±1.6	19.3±1.6	19.2±1.7

The values are mean ± SD, unless stated otherwise

50% of the elderly were peripherally wasted (malnourished).

DISCUSSION

The results of our study provided useful information, even if preliminary, on the anthropometric characteristics of elderly people living in urban Bangladesh. The pattern of gender differences in anthropometric characteristics of the elderly, as observed in this study, was similar to patterns reported from the other developed (de Groot et al, 1996; Lehmann and Bassey, 1996; Rea et al, 1997) and developing countries (Strickland and Ulijaszek, 1993; Chilima and Ismail, 1998; Suzana et al, 2002). In our study, most of the measurements indicated increasingly poorer nutritional status with increasing age. The younger subjects were significantly heavier and taller than the more elderly because of a higher prevalence of more body fat, excess body muscle, and healthier bony skeleton, respectively (Woo et al, 2001; Perissinotto et al, 2002). Due to better socioeconomic condition, access to health care, optimal living environment, healthy life
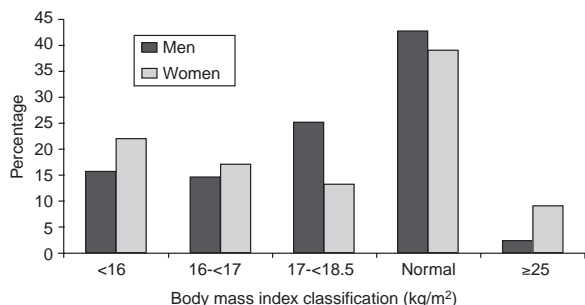
Fig 1–Percent of men and women according to different BMI categories in 60-69 years old.
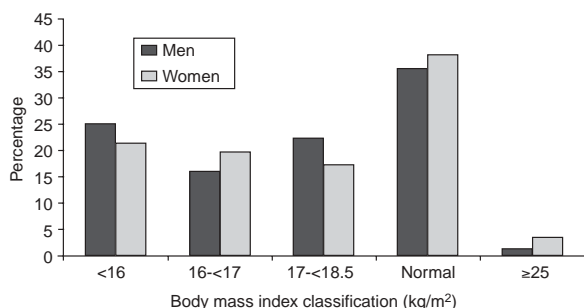

Fig 2–Percent of men and women according to different BMI categories in ≥ 70 years old.
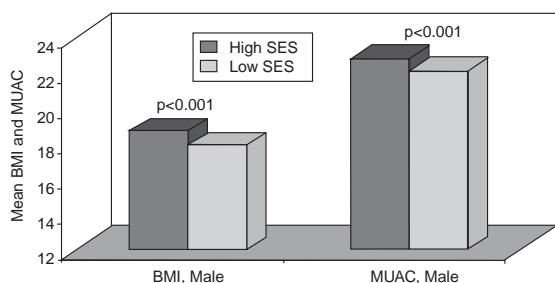

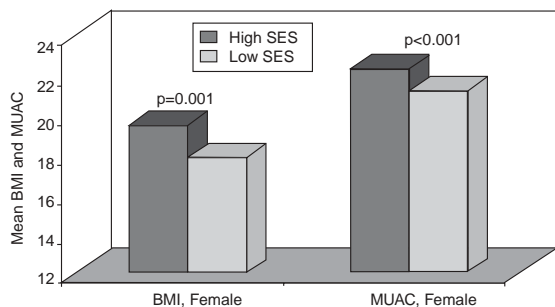Fig 3–Mean BMI and MUAC for men, aged ≥ 60 years.

Fig 4–Mean BMI and MUAC for women, aged ≥ 60 years.

style, better health status, and a more positive balance between calorie intake and expenditure, the younger age group was more able to store excess body fat compared with the more elderly group. The elderly are mostly unemployed, dependent, and deprived of adequate care and calorie intake at the family level, which might also contribute to their poor nutritional status (Launer and Harris, 1996).

Age-related physiological changes in the structure of body are well documented. With increasing age, a decline in height is attributed to age-related shortening of spinal column that is due to the loss of individual vertebral bone height, reduced disc spaces, and increased laxity of vertebral support ligaments (Merck and Co, 2005). Kyphosis (abnormal spinal curvature) also causes reduced height because of osteoporotic compression fractures, degenerative disease, or slippage of one vertebra forward on another (Chumlea and Baumgartner, 1989; Shatenstein et al, 2001). Moreover, severe osteoporosis due to hormonal disorders, vitamin D deficiency, or congenital phosphatemia that causes bowing of the leg bones may further add to the problem (Haboubi et al, 1990; Rea et al, 1997; Jitapunkul and Benchajarconwong, 1998).

Most of the declines in weight are reported to be due to lower water content with advancing age (Rico et al, 1993). The elderly had lower MUACs than the younger age groups, in both males and females, which could be due to loss of fat and lean muscle associated with aging (Lipski et al, 1993). The prevalence of malnutrition was more common among the relatively older elderly women, which suggests worsening nutrition with advancing age (Yassin and Terry, 1991). Our results are consistent with the findings of other researchers in that MUAC changes very little among elderly persons as age advances further (Reid et al, 1992).

Age-related declines in BMI have been reported in United Kingdom, which suggests

a progressive loss of muscle bulk as age advances (Yassin and Terry, 1991; Rico *et al*, 1993; Lehmann and Bassey, 1996; Hughes *et al*, 2002). However, that was not observed among healthy, active Chinese elderly in Hong Kong, probably because of their higher body fat and protein stores, and less energy expenditure (Woo *et al*, 1998, 2001). That women are significantly more overweight with increasing age more often than men has also been reported (Rea *et al*, 1997). Probably, this small fraction of elderly women is genetically more capable of retaining nutrients and/or posses better metabolic efficiency (Woo *et al*, 1993; Rea *et al*, 1997). Following menopause, many women experience a natural increase in obesity, due to the accumulation of fat around their internal organs (Brochu *et al*, 2000; Nicklas *et al*, 2005). However, a decline in the prevalence of overweight with advancing age has also been observed (Fischer and Johnson, 1990; Donini *et al*, 2003; Santos *et al*, 2004).

The impact of an ageing population in developing countries is clearly understood by the increasing old-age dependency ratio (Chanana and Talwar, 1987). Bangladesh is progressing through the second phase of demographic transition (Mostafa and van Ginneken, 2000). There is an appreciable decline in the crude birth and crude death rates, infant mortality, and under-five mortality. Moreover, the process of an increasingly ageing population has started in Bangladesh. In 1961, 5.2% of the population was aged 60 years or older; the proportion has increased to 6.1% in 1995, and is expected to reach 9.1% (13.2 million) in 2010 (Hossain, 1997; Mitra *et al*, 1997; Mostafa and van Ginneken, 2000). Our study provides an anthropometric profile of elderly population living in urban Bangladesh and indicates high prevalence of malnutrition among them.

There are a number of limitations of our study, and the results should be interpreted with caution. First, our data came from a single health care facility and all had a diarrheal illness. Diarrheal disease is more common among the poorer population, particularly those living in the slums of urban Dhaka. This was also reflected in the very low family income of the subjects. Therefore, our population may not be representative of the Dhaka population. The urban and rural populations are likely to differ in many characteristics, including SES and nutritional status. The type of family support, and health care support provided to elderly living in urban and rural areas are also likely to differ. However, about 10% of the total population lives in Dhaka and the Dhaka Hospital is the largest facility that provides care to diarrheal patients. The relatively large size of our study population would suggest some usefulness of our data. We consider that, although our data cannot be considered as assessing the national situation, they are useful as baseline information for longitudinal studies and for highlighting the need for studies in other geographical locations and in other population groups.

ACKNOWLEDGEMENTS

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