Functional Ability and Nutritional Status of Indian Elderly

Renu Tyagi* and Satwanti Kapoor

Department of Anthropology, University of Delhi, Delhi-110007, India

Abstract: The present study was conducted among the adult urban females. A total sample of 289 females including young adult females aged 20-25 years and older females aged 55-80 years was studied. Four anthropometric and five physiological variables were measured for all the subjects. Body mass index (BMI) and Waist hip ratio (WHR) were computed. Stature, grip strength, Forced Vital Capacity (FVC), and Peak Expiratory Flow Rate (PEFR) showed a decline with advancing age. However, weight, waist circumference, hip circumference, body mass index and waist hip ratio showed an increase with age. A decline in muscular strength, lung functions with a corresponding increase in fat mass and blood pressure was reported. More than 50 percent of the elderly females were found to be overweight/obese. More than 60 percent of the females were found to belong to pre-hypertensive/hypertensive category. Significant associations were found between the indices of adiposity, lung functions, muscular strength and blood pressure among the elderly ($p<0.01$).

Keywords: Health, nutrition, hypertension, lung functions, ageing.

INTRODUCTION

Health and longevity are likely to depend on numerous genetic, environmental and behavioural factors. There are many morpho-physiological changes that take place with advancing age. However, the cause and consequences of these changes are partly known. Metabolic syndrome is a part of sedentary life style, poor cardio-respiratory fitness, unhealthy diet and increased overweight and obesity. Higher level of physical activity and cardio-respiratory fitness decrease the risk of developing metabolic syndrome [1].

According to Census 2001, the population of elderly in India is 77 million which constitute about 8% of the total population of India [2]. Age-specific morbidity rates among the aged, reflected in disability indices, are decreasing, suggesting that biological age is younger for a given chronological age. This phenomenon represents an important trend towards compression of morbidity nearer to death.

As per WHO [3] more than 250 million people are obese worldwide. Obesity is not a disease but it is an important risk factor contributing to a range of serious non-communicable diseases. Obesity is associated with increased risks for almost every kind of cancer and with ageing women lose their relative advantage compared to men for cardiovascular diseases [3]. Obesity has a negative consequence for women's health throughout the life cycle with important psychosocial, economic and biological implications. Obesity influences the physical fitness of an individual. 50 % men had low fitness as assessed by cardio-respiratory functions which influences the cardio-vascular diseases and all cause mortality. After adjustment for age and baseline health status, higher levels of physical activity is associated with decreased mortality and hospitalization therefore the lifestyle factors may influence health outcomes even in the old-old population [4]. Research in the field of biological ageing is less attended in the developing nations. The present paper aims to study the nutritional status and functional ability along with its correlates among elderly females.

*Address correspondence to this author at the Deparment of Anthropology, University of Delhi, Delhi 110007, India; Tel: 011-27667329;
E-mail: renutyagiindia@gmail.com

MATERIALS AND METHODOLOGY

The present study has been conducted among 289 north Indian adult Punjabi speaking females in Delhi. This includes 30 females of 20-25 years of age and 259 females of 55-80 years of age. The young adults of 20-25 years have been taken as control group Information regarding personal details like age, occupation, and educational status were also obtained from all subjects with the help of an interview schedule. All the anthropometric measurements were taken by RT using the standard techniques of Weiner and Lourie [5]. Height, weight, waist circumference, hip circumference were recorded to the nearest 0.1 cm, 0.5 kg, and 0.1 cm, respectively. The functional ability of the subjects was assessed with the help of physiological variables namely blood pressure, lung functions and muscular strength. The lung functions, namely Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR) were taken with the help of portable Morgan medical microspirometer. The grip strength was taken to the nearest 0.5 kg using a dynamometer. Blood pressure, both systolic and diastolic, was measured with the help of Sphygmomanometer and Stethoscope. Body mass index (BMI) was computed as weight (kg)/height (m^2) and Waist hip ratio was taken as a ratio of waist circumference to hip circumference.

The age of the subjects was recorded according to comparisons with their birth cohorts, confirmation from family members and by recollection of significant socio-cultural and historical events. All the subjects were explained about the nature of the study and a well informed consent of the subjects was obtained prior to the start of the study.

Overweight/obesity was evaluated using internationally accepted World Health Organization [6] BMI guidelines. The following cut-off points were used:

1874-9127/10 2010 Bentham Open

Table 1. Distribution of Anthropometric Measurements Among Adult Females

Variables	Young Adult Females (n= 30) Mean ± SD	Older Females (n=259) Mean ± SD
Stature (cm)	154.3 4.28	147.7 6.59
Weight (kg)	49.8 7.20	55.2 12.5
Waist circumference (cm)	69.5 6.38	84.1 10.6
Hip circumference (cm)	89.9 7.47	98.6 11.1
Body mass Index (kg/m^2)	20.9 3.12	25.2 5.39
Waist hip ratio	0.77 0.04	0.85 0.07

Normal weight BMI = 18.5-24.9 kg/m^2

Overweight,

BMI = 25.0.-29.99 kg/m^2

Obese, BMI 30.0 kg/m^2

The subjects were classified into different blood pressure categories according to the JNC VII standards [7]. The normal blood pressure was taken as <120 mmHg (Systolic) and <80mmHg (Diastolic). Subjects with blood pressure values of 120-139mmHg (Systolic) and 80-89 mmHg (Diastolic) were categorized as pre-hypertension. Stage-I hypertension was taken as 140-159mmHg (Systolic) and 90-99 mmHg (Diastolic) whereas Stage-II hypertension was considered as cases who had >160mmHg Systolic and >100mmHg diastolic blood pressure respectively. In the present study subjects were divided into three categories, normal blood pressure, pre-hypertensive and hypertensive. The hypertensive category includes subjects who are stage I and stage II hypertensive. The subjects were classified under four categories on the basis of self perception of their health status viz poor, average, good and best.

The data was analyzed using SPSS 10.0 version. Mean, standard deviation and correlation were calculated for different measurements.

RESULTS

Distribution of morphological variables is displayed as Table **1**. The young adult control group females were found to be taller than the older females. However, weight of the older females was found to be more than the young adult females. Waist and hip circumference were found to be higher among older females as compared to the young females.

Table **2** displayed mean and standard deviation for all the physiological measurements among the females. Blood pressure, both systolic and diastolic, was found to be relatively higher among the older females than the young adult females. The forced vital capacity, peak expiratory flow rate and average grip strength were found to be relatively lower among the older females than the younger adult group females.

The indices of general and regional adiposity viz Body mass index and waist hip ratio respectively were observed to be higher among the older females than their younger counterparts (Table **3**).

More than 50% of the older females were found to belong to the overweight/obese categories as compared to only 3.3 % of the younger females (Table **4**).

As per JNC VII systolic blood pressure cut off value, more than 41% and 28% elderly females were classified as pre-hypertensive and hypertensive respectively. However, on the basis of diastolic blood pressure standards, 30.5% and 32 % females were categorised as pre-hypertensive and hypertensive respectively. On the other hand only 3.3 percent of young adult females as per diastolic cut off values were

Table 2. Distribution of Physiological Measurements Among Adult Females

Variables	Young Adult Females (n= 30) Mean ± SD	Older Females (n=259) Mean ± SD
Systolic blood pressure (mmHg)	111.7 7.57	129.8 20.8
Diastolic blood pressure (mmHg)	75.7 8.52	82.9 13.5
Forced Vital Capacity (FVC-in litres)	2.08 0.34	1.19 0.40
PEFR (L/min)	180.7 41.99	91.6 24.93
Average grip strength (kg)	20.6 2.90	12.2 5.28

Table 3. Indices of Adiposity Among Females

Variables	Young Adult Females (n= 30) Mean ± SD	Older Females (n=259) Mean ± SD
Body mass Index (kg/m^2)	20.9 3.12	25.3 5.39
Waist hip ratio	0.77 0.04	0.86 0.07

Table 4. Prevalence of Overweight /Obesity Among Young Adult Females and Older Females

BMI Category	Young Adult Females %	Older Adult Female %
Overweight	--	32.4
Obese	3.3	17.8

Table 5. Percentage Distribution of Females According to Blood Pressure Category*

Blood Pressure	Older Adult Females	Young Adult Females
Systolic blood pressure		
Normal	29.7	80
Pre-hypertensive	41.7	20
Hypertensive	28.6	--
Diastolic blood pressure		
Normal	37.5	70
Pre-hypertensive	30.5	26.7
Hypertensive	32.0	3.3

*JNC VII, 2003.

found to be hypertensive But none of the young adult females were found to be hypertensive (Table **5**) as per the cut off value of systolic blood pressure.

The blood pressure showed statistically significant positive correlation ($p<0.01$) with age but the lung functions and the muscular strength showed significant negative correlations ($p<0.01$) with age. The lung function displayed statistically significant positive correlation ($p<0.01$) with grip strength but statistically significant negative correlations with the blood pressure. Statistically significant positive correlations were found between indices of adiposity (BMI and WHR) and blood pressure ($p<0.01$). However, these indices showed significant negative correlations with the lung functions and muscular strength but they displayed positive association with the blood pressure and age (Table **6**).

Common health problems found among elderly were vision problems, hearing loss, hypertension, diabetes, musculo-skeletal problems, cataract, skin problems and other respiratory problems. Vision problem emerged as the major health problem (85.5%) followed by the joints pain (79.3%) among the elderly females (Table **7**).

The subjective self perception about health of the older females categorised most of them to belong to average health category. Although 34% of the subjects reported themselves under the poor health category as well (Fig. **1**). However, when a cross tabulation of the overweight and obese category was made with the subjective health perception, a wide disparity could be seen like 46 obese females reported themselves to belong to the best health category (Table **8**).

DISCUSSION

The study found many age associated problems among the elderly females and the highest being vision problem followed by joints pain and high blood pressure. Respiratory efficiency was also found to be affected with age. National Sample Survey organization [8] and other studies [9, 10]

Table 6. Correlation Matrix of Functional Measurements and Indices of Adiposity with Age

	Systolic Blood Pressure	Diastolic Blood Pressure	Forced Vital Capacity	Peak Expiratory flow Rate	Average Grip Strength	Age	BMI	WHR
Systolic blood pressure	1	0.66**	-0.12*	0.24**	-0.11	0.27**	0.23**	0.34**
Diastolic blood pressure	.0.66**	1	0.05	-0.11	0.08	0.17**	0.22**	0.07
Forced Vital Capacity	-0.12*	0.05	1	0.59**	0.44**	-0.56**	-0.08	-0.21**
Peak Expiratory flow Rate	-0.24**	-0.11	0.59**	1	0.49**	-0.71**	-0.12*	-0.28**
Average grip strength	-0.11	0.08	0.44**	0.49**	1	-0.45**	-0.02	-0.27**
Age	0.27**	0.17**	-0.56**	-0.71**	-0.45**	1	0.24**	0.19*
BMI	0.23**	0.22**	-0.08	-0.12*	-0.02	0.24**	1	0.36**
WHR	0.34**	0.07	-0.21**	-0.28**	-0.27**	0.19*	0.36**	1

* $p<0.05$, ** $p<0.01$.

Table 7. Percentage Distribution of Different Health Problems Among Older Females

Vision Problem (%)	Hearing Problem (%)	Joints Problem (%)	Diabetes (%)	Hypertension (%)	Skin Problem (%)	Respiratory Problems (%)
85.5	26.7	79.3	34.2	47.6	5.8	19.8

Fig. (1). Subjective self perception scale for health status of the older adult females.

Table 8. Cross-Tabulation of Subjective Self Perception of Health with Overweight/Obesity

Nutritional Status as per BMI Category	Subjective Self Perception (SSP) About Health Status			
	Poor	Average	Good	Best
Overweight	26	31	24	3
Obese	19	8	2	46

reported a higher burden of non-communicable diseases among elderly population.

A decline in stature along with an increase in weight with advancing age is reported in the present study. A decline in stature with increase in age is well recognised irrespective of altitude [11], gender [12], ethnicity [13, 14] etc. An increase in BMI and WHR with advancing age indicates an increasing adiposity both general as well as trunkal which is clearly seen in the elderly females of the present study. With advancing age, there is a general trend to accumulate body fat both relative and absolute due to an increase in one's ability to mobilize stored fatty acids from the adipose tissues for energy fuel resulting in less fatty acids being burned up and as people get older, most of them reduce their physical activity level without much change in their food intake [15].

A higher WHR among the elderly females as compared to their young adult counterparts indicated a higher trunkal fat among the former group. An increase in WHR with advancing age is mainly due to a relatively more increase in waist circumference than the hip circumference [16]. An increasing value of WHR with age was found to be related to the higher level of follicle stimulating hormones [17]. An increase in adiposity with age among the present study elderly females could be explained due to a tendency of an increase in total adiposity and visceral fat with advancing age [18, 19]. More fat on trunk region has been found to be independently related to increasingly adverse cardiovascular risk factors [20, 21]. A positive association of BMI with blood pressure indicates an increased prevalence of hypertension with an increase in adiposity among the elderly females. The elderly females in the present study were found to gain weight with more trunkal fat in addition to the higher percentage of hypertension and pre-hypertension thereby predisposing them to the obvious cardiovascular risks.

Quality of life in old age is greatly influenced by functional health status. However, a decline in functional status was clear in the present study as assessed by declining lung function (both FVC and PEFR), a higher percentage of pre-hypertensive and hypertensive cases and a simultaneous decline in muscular strength. A decline in respiratory efficiency with advancing age was found by Kapoor and Tandon [11] in a study among high altitude population. A positive association of blood pressure with age was found among the females and similar result was found in other studies [14, 25]. A decline in grip strength with advancing age has been reported by earlier research [10, 12]. Santana *et al.* [22] and Ross [23] reported an age associated increase in fat mass and a decline in skeletal muscle mass and lung functions.

Significant negative association of lung functions with the blood pressure, indices of adiposity i.e. BMI and WHR and positive correlation of the lung functions with the grip strength in the present study reflects coexistence of better respiratory efficiency, better musculature and less adiposity and better health among normal blood pressure females. Association of lung functions with indices of adiposity could be due to many reasons viz mechanical effect on diaphragm (impeding descent into abdominal cavity) and on the chest wall (changes in compliance, elastic recoil and in working of breathing) [24].

Obesity is another increasing health problem among the older population as a higher percentage of the elderly females of the present study are found to be in the overweight/obese category. However some of the young adult females were also found to be obese. Obesity was also reported by Kapoor *et al.* [26] among younger females. Obesity in younger groups predisposes them to be obese in later years. An increasing prevalence of overweight and obesity has a direct influence on associated co-morbidities like hypertension, dyslipidaemia, type2 diabetes mellitus, the metabolic syndrome and cardiovascular diseases [19, 27, 28].

A dissimilarity between subjective self perception of health and nutritional status as per BMI standards indicated normal health in a substantial proportion of elderly females in the present study.

Blood pressure has been found to be age related consequently the respiratory efficiency decreased affecting the muscular strength. Better muscles strength speaks better aerobic capacity, higher respiratory efficiency and better cardiovascular health. Positive correlations of BMI, WHR with blood pressure indicated more weight with more trunkal fat. However, negative correlation of BMI and WHR with the lung functions depicts better respiratory efficiency and better aerobic fitness.

CONCLUSION

Significant association between adiposity, lung functions, muscular strength and blood pressure were found among the elderly females. The functional ability of the older females was found to decline with advancing age as indicated by a higher prevalence of hypertension, decline in respiratory efficiency and muscular strength with a simultaneous increase in percentage of overweight/obese. This emphasizes more attention towards a research based on strategies for a better quality of life for a continuously increasing proportion of the elderly population across the globe.

ACKNOWLEDGEMENTS

The authors are grateful to all the subjects who volunteered for the present study. The financial assistance to Renu Tyagi from the Department of Science and Technology (DST) is greatly acknowledged.

REFERENCES

[1] Hassinen Maija, Lakka AT, Savonen Kai, *et al*. Cardio-respiratory fitness as a feature of metabolic syndrome in older men and women. Am Diabetes Assoc 2008; 31: 1242-7..

[2] Census of India. Registrar General of India office, Government of India, India 2001.

[3] WHO. Regional office for the western Pacific. International Association for the study of Obesity. The Asia pacific Perspective: Redefining obesity and its treatment-Health communication, Australia, Sydney 2000.

[4] Khokhar A, Mehra M. Life style and morbidity profile of geriatric population in an urban community of Delhi. Ind J Med Sci 2001; 55: 609-15

[5] Weiner JS, Lourie JA. Practical human biology. NewYork: Academic Press 1981.

[6] WHO. Physical status: the use and interpretation of anthropometry. Technical report series no. 854, World Health Organisation, Geneva 1995.

[7] JNC VII (Joint National Committee (VII) Seventh report of the Joint National Committee on the prevention, detection, evaluation and treatments of high blood pressure. J Am Med Assoc 2003; 289: 2073-82.

[8] National Sample Survey Organisation (NSSO). Sarvekshana 1991; vol XV (1-2) Issue no.49.

[9] Chacko A, Joseph A. Health problem of the elderly in rural south India. Ind J Commun Med 1990; 15: 70-3.

[10] Kapoor S, Kapoor AK, Tyagi R. Socio-biological aging: an inevitable Phenomenon.-Help Age. Indian-Res Dev J 2000; (3), 5-10.

[11] Kapoor S, Tandon K. Physical activity, altitude and ageing. In Understanding people of India- Anthropological insight, Proceedings of National Seminar, University of Delhi, India 2003.

[12] Tyagi R, Kapoor S. Ageing in structural and functional dimensions among institutionalized and non-institutionalized senior citizens. Anthropology 2004; 42(2): 141-6.

[13] Tyagi R, Kapoor S. Morpho-physiological changes with age among high altitude females. Man India 1999; 79: 173-8.

[14] Kapoor AK, Tyagi R, Satwanti K. Nutritional Status and cardio-respiratory functions among adult Raji males, a hunter and Gatherer tribe of the Indian Himalayas. Anthropol Sci 2009; 117(1):1-7.

[15] Shavers S. Essentials of Exercise physiology. New Delhi, India: Surjeet publication, 1983.

[16] Tyagi R. Socio-biological aspects of ageing phenomenon among Institutionalized and non- institutionalized senior citizens, Ph.D. Thesis (unpublished), University of Delhi, India 2001.

[17] Sowers MF, Crutchfield, Jannausch ML, Russel-Aulet M. Longitudinal changes in body composition n women approaching midlife. Ann Hum Biol 1996; 23(3): 253-65.

[18] Baumgartner RN, Stauber PM, McHugh D, Kochler KM, Garry PJ. Cross- sectional age differences in body compositions in persons 60+ years of age. J Gerontol 1995; 50: 307-16.

[19] Zamboni M, Armellini F, Harris T *et al.* Effect of age on body fat distribution and cardio-vascular risk factors in women. Am J Clin Nutr 1997; 66: 111-5.

[20] Huang B, Rodreiguez BL, Burchfield CM, Chyou Po-H, Curb JD, Sharp DS. Association of adiposity with prevalent coronary heart disease among elderly men: the Honololu heart program. J Obes 1997; 21 (5): 340-8.

[21] Ming Wei, Kampert JB, Barlow CE, *et al*. Relationship between low cardio-respiratory fitness and mortality in normal weight, overweight and obese men. JAMA 1999; 282(16): 1547-53

[22] Santana H, Zoico E, Turcato F, *et al* . Relation between body composition, fat distribution, and lung function in elderly men. Am J Clin Nur 2001; 73(4): 827-31.

[23] Ross R, Katzmarzyk PT. Cardio-respiratory fitness is associated with diminished total and abdominal obesity independent of body mass index. J Obes 2003; 27: 204-10.

[24] Lazarus R, Sparrow D, Weiss ST, Effects of obesity and fat distribution on pulmonary functions: the normative aging study. Chest 1997; 111: 891-8

[25] Tungdim MG, Kapoor S, Kapoor AK. Mropho-physiological changes among high altitude aged. Ind J Gerontol 2002; 16(3-4): 329-43.

[26] Kapoor S, Tyagi R. Ethnicity and obesity, Paper presented at European Congress on Obesity (ECO-2007). Budapest 2007.

[27] Calle EE, Rodriquez C, Walker TK, Thun MJ. Overweight, obesity and mortality from cancer in a prospectively studied cohort of US adults. N Engl J Med 2003; 348: 1625-38.

[28] Gupta R, Gupta VP, Sarna M, *et al*. Prevalence of coronary heart diseases and risk factors in an urban Indian population: Jaipur Heart watch-2. Indian Heart J 2002; 54(1): 59-66.

[29] Neil GT, Tomlinson B, Hang WL, Athena SSC. Age related anthropometric remodelling resulting in increase and redistributed adiposity is associated with increase in prevalence of cardio-vascular risk factor in chinese subjects. Diabetes Metab Res Rev 2006; 22: 72-7.

Received: September 26, 2009 Revised: October 19, 2009 Accepted: October 28, 2009