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Research Article

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Correlation of Body composition, Physical activity with aging: a cross-sectional study for urban adult Indian women

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ABSTRACT

With simple random sampling technique for 450 women of age group 41-55 years, with the general objective of finding out the relationship between Body composition, Physical activity with aging in Gwalior city of India ,descriptive cross-sectional study was conducted . The group was further subdivided into three age groups of 41-45, 46-50, and 51-55 years. Hypothesis testing F test and Correlation were applied to analyze the data.
There was significant difference in Body fat percentage score across the three subgroups (p = 0.030). The high mean body mass index (BMI-27.31 (±4.8)) for the total population is an alarming indication for the increasing overweight population in India. The same was supported by a higher average waist-hip ratio of 0.87. The mean weight of 450 women was 65.3 kg (±11.5).GPAQ score differed significantly across the three age groups (p = 0.000).With very high contribution in GPAQ score from house works, majority of the women were found moderately physically active and Sports, fitness and recreational activities were found very less. The older age group was found less physically active. The Findings were that body fat% were positively correlated (p<0.000) and GPAQ score were negatively correlated (p< 0.000) with ageing. The average body age of the study population for Adult women was observed 56 (± 9.9) years against the actual chronological average age of 47.7 years (±4.8), which is around 8 years more. Results emphasized the need for more physical activity for adult women from sports, fitness, and recreational activities in addition to housework for maintaining their body composition and to avoid early aging.

Key words: Body composition, Physical activity, Ageing, BMI, GPAQ.

Introduction

India is accommodating 104 million older people (60+years), which constitute 8.6% of total population (census 2011). Out of this population the females of age group 60+years were more than males. It is assumed that the number of elder people in India shall reach to 158.7 million by year 2025[1].For India similar type projection was confirmed by United Nations with forecasting that population of 60 years and more will be doubled by 2050, and which shall constitute about 19.6 % of the total population[2]

Policy maker of many countries and World health organization (WHO) have raised their concerns for health of increasing populations of senior citizens. WHO described that Health is not only related to absence of infirmity or disease from body but it is the absolute well- being with mental, physical, and social well being of a subject.

Ageing starts in early adulthood with gradual and continuous natural changes in the body. Many natural functions of body begin to decline gradually during early middle age. With ageing molecular and cellular damage also starts over time at biological level. Decline of muscle

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mass and body fat after 60 years are some well identified age-related changes in body composition[3],[4],[5].

As compared to younger adults, old adults have less muscle mass and high percentage of body fat. Older adults may appear thin and have little subcutaneous fat. Such changes in adults with increasing age are associated with increased risk of disease, disability, and death, which may create health problem in society.

Studies provides strong evidence that middle age is the most active period of life; However, it is also a period when habit of taking unhealthy diets and sedentary lifestyles may develop , which may increase the risk of malnutrition and chronic diseases[6].

The change in a country's population distribution towards old age is called population aging, this phenomenon already started in high-income countries like Europe and Japan (in Japan, 30% of the population is over 60 years old) and is now low and medium. And low Income group countries may experience the same phase in near future. In 2017, the number of people over the age of 60 years in the world was more than double as compared to 1980, and further it is expected that this number will be doubled by 2050[7].

Fat and lean body mass consists the total weight of the body. Bones, muscles, tissues, organs, body water and muscle mass all together make the lean body mass. Visceral fat is found in the stomach and around the main body. Visceral fat is hardly noticeable because it is not visible to the naked eye. Excess visceral fat is thought to be associated with increased fat in the blood, which can lead to high cholesterol, heart disease and other conditions. To prevent these conditions, it is important to achieve standard level by reducing the visceral fat content. Subcutaneous Fat accumulates around stomach as well as around upper arms, thighs and hips, which can be cause of body shape distortion. It is the fat below the skin. Though it not directly connected to cause of disease but may increase pressure on heart and other complications.

There are two types of muscles; Muscles in the body, such as the heart, and muscles attached to bones that enable us to perform various movements and functions. It accounts for 30% to 40% of the total quality. Skeletal muscle injuries or diseases can affect our lives. It is important to keep your muscles asstrong andhealthy as possible. Many existing studies show that skeletal muscle mass can be increased through exercise and other activities.

According to the National Family and Health Survey in India, overweight and obesity (BMI ≥ 25) among women aged 15-49 increased from 7.3% in 1998-99 to 11.1% in 2005-06 increased significantly. For the physical activity level point of view weight and age are two important factors [8] .Research shows that Physical activity tends to stabilize in adulthood and decrease in the elderly [9], [10].The sedentary lifestyle led by the elderly can lead to premature ill health, disease, and insecurity.

Evidence from pattern of many studies, proved that Physical activity is very important aspect in promoting healthy ageing [11], [12]. Some effects of chronic conditions may be prevented and reversed by Regular and sufficient physical activities and it may provide multiple physical and mental health benefits in the lifespan [13].

Morning and evening walk, use cycle for small distance, dancing, exercise, and engaging in hobbies are some popular ways to stay active in life. Doing physical activities during work, leisure time can also be beneficial. The objective of this study is to find out the Correlation between Physical activity, body composition, and aging.

Methods

Study population

The participants are Indian women of age 40 to 55years in Gwalior city, were selected for this study. Women with physical disability, Diabetic problem, pregnant were not considered in this study. The samples were selected for this cross sectional study was from the population residing in locale of the study and fulfilling the inclusion criteria of, adult women from urban area who aged between 40 to 55 years. Cluster sampling was used to create three clusters of people from a population. In this model, a simple random sample is created from various groups in the population. Total 450 samples are drawn from the total populations which are further categorized into three sub age groups i.e. 40 -45 years, 46 - 50 years, and 51 - 55 years and number of subjects in each group was 150.

Tool development:

For capturing back ground information like age, sex, marital status, and socio-economic condition like education level, income, and occupation, a questionnaire was prepared and that was used to record participant's response during a face-to-face interview. Dependent and independent variable various scales were clubbed together and further questionnaire was prepared in both Hindi and English for better understanding by subjects. Following scales and questionnaire were used to develop the tool for the study

Socio economic: Kuppu Swamy Scale [14] (2018).

Anthropometric Measurements:

Standard methods [15] were used to measure height, waist, and hip circumference of subjects. Height was measured with a vertical anthropometric measuring tape and fiber glass tape was used for Waist hip Ratio circumference measurement. Tolerance of ±0.1 cm in height, waist and hip measurements and ±0.1 kg for weight measurements were considered.

Weight and BMI in this study were measured by using the bioelectrical impedance method with the help of Body composition Omron Karada Monitor (HBF-375) machine made by Omron Health Care Co., Kyoto, Japan. With entering height of participant in the equipment in the beginning, subjects were asked to stand straight upon the machine without shoes and slippers after sometime the weight displays on the screen.

BMI= Weightin Kgs / Height in meters^2

As per World health organization recommendations, BMI 18.50 kg/m2 or less indicates underweight and chronic energy deficient subject, While BMI 25.00 to 29.90 kg/m2 is referred as overweight and BMI 30.00 kg/m2 or more is considered obese[16].

Physical Activity: Physical activity of the subjects was calculated on the basis of well-structured questionnaire developed by WHO, known as GLOBAL PHYSICAL ACTIVITY QUESTIONNAIRE (GPAQ) [17]. As per this questionnaire information on physical activity participation was recorded for three settings as well as sedentary behavior comprising of 16 questions and for each question codes are given to make the data cleaning easy and fast the recorded responses are based on the time given for physical activities during a normal week. Activities were divided into three zones as per following:

a. Work
b. Travel (to go from one place to another)
c. Recreational or entertainment activities.

Above three were further divided according to the activity level such as Moderate work and Vigorous work.

The subjects were asked to give valid answers for at least one domain for analysis of GPAQ data. In GPAQ physical activity is measured in terms of MET (metabolic Equivalents) demand of a subject, where 1 MET is the energy required by a person for sitting quietly and this is equivalent to the 1Kcal caloric consumption per kg per hour.

MET = metabolic rate / resting metabolic rate.

Table 1: Energy expenditure using GPAQ data (WHO, 2002)

MET value	Domain
4.0	Moderate activity work, walking ,cycling
8.0	Vigorous activity work , running , dancing

Assessment of Body composition:

Omron make HBF-375 Karada body scanner was used to find out the different body composition components like body fat, visceral fat, and subcutaneous fat, skeletal muscle and body age.

This method is comparatively simple, quick, and non-invasive. In this technique radioactivity exposure or submersion in water is not required. Due to above reasons this method is being used widely for finding out the body composition for all the age group from children to adults in many studies by healthcare professionals and researchers worldwide [18],[19],[20],[21],[22],.

Body fat percentage (%) = Body fat mass (kg) / Total Body weight × 100

Body - composition results were interpreted as per Lohman, 1986[23] and Nagamine, 1972[24], according to that for body fat% less than 20% is considered low, 20-30 % is normal, 30-35% high and more than 35 % is very high. And visceral fat was considered as normal, high, and very high for the value of 05-9.5, 9.6-14.5, and 14.6-30.0 respectively:[25].

While skeletal muscle percentage is skeletal muscle mass percentage to the total Body weight. For Women it is low, normal, high and very high for the value 5.0-25.8, 25.9-27.9, 28.0-29.0 and 29.1-60.0 respectively[26].

Body Age:

The age of the body depends on resting metabolism. Body age is calculated by the Omron Karada Scan body composition monitor, which uses your weight and body fat percentage to create an indication of whether your body weight is above or below average for your age. Understanding your body's age can help you improve your health. Even though height and weight are the same, body age varies depending on body composition and resting metabolism.

Statistical analysis –

Mean and standard deviation of various parameters were calculated. ANOVA and post hoc Tukey test was applied to finding out variation in variables among the three age

groups and coefficient of correlation was used to test null hypothesis.

Results and Discussions

Anthropometric measurements

The anthropometric summary characteristics of the 450 sampled women in the aging study are shown in table 2. Average age is 47.7 years (±4.8). The average weight of 450 subjects was 60.5 kgs, (±9.5) for age group of 40-45 years, average weight was 59.1 Kgs, for 46-50 age group the average weight was 62.3 kg and 51-55 years age group the weight was 60.1 kg. Average height of Study population was approximately 154.23 (±6.9) cm, and for age group of 40-45, 46-50, and 51-55 years average height was 154.3 cm, 154.2 cm and 154.2cm respectively.

The average BMI of total population was 25.43 (±4.5) and was 24.8, 26.2 and 25.3 for 40-45 years, 46-50 years and age 51-55 years respectively. In the similar type study by Kaur G et al observed BMI was 27.5±3.2 and 29.4±7.3 for 41-50 and 51-60 years respectively[27]. Over weight and obesity in total population was 37%. A similar study done in Telangana state of India by B. Babu Rao et al have also found 34.7% over weight and obese population[28] in urban area . And similar results were found in the study conducted by Tiwari R et al in Gwalior city of Madhya Pradesh observed that 34.40% of males and 31.30% females were either obese or overweight[29] .

Average Hip circumference for the population was 44.4 (±4) inches, and for age group of 40-45, 46-50, and 51-55 Years average hip size was 43.50, 45.0, and 44.70 inches respectively.

Average waist measurement was 37.63 (±4.2) inches and for age group of 40-45, 46-50, and 51-55 Years average waist size was 36.60, 38.30, and 38.0 inches respectively.

Mean of the Waist and hip ratio (WHR) was 0.847(±0.1) for total population and was 0.84, 0.85 and 0.85 for 40-45 years, 46-50 years and age 51-55 years respectively. Results revealed that WHR is increased with age and average population falls in moderate health risk zone. In a similar type study conducted by Kaur G et al [30] mean WHR was 0.85 for women age group of 41 to 60 years.

As per Table 3, average body fat percent among the women of 40-45 years was 30.63 (±4.80), 46-50 years was 32.23 (±4.47) and 51-55 years was 31.88 (±4.46). Study done by Kulkarni B et al [32] indicated average BF% 33.8 (0.65) for adult women of comparative age group in Hyderabad city of India. Body fat percentage score differed significantly across the three groups (p= 0.03). There was significant difference in body fat among group 40-45 years and 46-50 years (p=0.02). and for 40-45 Years and 51-55 years it was significant at 10% level (p=0.00), the mean difference in body fat percentage between for 46-50 years and 51-55 years was not significant.

Visceral Fat percent differed significantly across the three groups (p= 0.03). Average Visceral Fat percent among the women of 40-45 years was 10.40 (5.22), 46-50 years was 12.22 (6.29) and 51-55 years was 11.39 (5.88). There was significant difference among group 40-45Yrs and 46-50 years (p=0.02). The mean difference in Visceral Fat percent between for 40-45 years and 51-55 years was not significant; mean difference for age groups 46-50 years and 51-55 years was also not significant.

Subcutaneous Fat percent differed significantly across the three groups (p= 0.01).Average Subcutaneous Fat percent among the women of 40-45 years was 30.86 (6.91), 46-50 years was 33.14 (5.94) and 51-55 years was 31.99 (5.53). There was significant difference for Subcutaneous Fat among group 40-45 and 46-50 years (p=0.02). The mean difference in Subcutaneous Fat percent between 40-45 years and 51-55 years and 46-50 years and 51-55 years was not significant.

Table 2: Anthropometric measurement of the subjects

Factor	All cases	40-45 years	46-50 years	51-55 years
N	450	150	150	150
Age, mean (SD)	47.7 (4.8)	____	____	____
BMI, mean (SD)	25.43 (4.5)	24.8	26.2	25.3
WEIGHT IN KG, mean (SD)	60.5 (9.5)	59.1	62.3	60.1
HEIGHT IN CM, mean (SD)	154.23 (6.9)	154.3	154.2	154.2
HIP IN INCH, mean (SD)	44.4 (4.0)	43.50	45.0	44.70
Waist in Inch, mean (SD)	37.63(4.2)	36.60	38.30	38.0
WAIST_HIP RATIO, mean (SD)	0.847(0.1)	0.84	0.85	0.85

Skeletal Muscle percent differed significantly across the three groups (p = 0.00). Average Skeletal Muscle among the women of 40-45 years was 22.34, 46-50 years was 22.28, and 51-55 years was 20.34. There was no significant difference for Skeletal Muscle among group 40-45 and 46-50 years. The mean difference in Skeletal Muscle between age groups 40-45 Years and 51-55 years was significant (p=0.00), the mean difference in Skeletal Muscle between age groups 46-50 Years and 51-55 years was significant (p=0.00).

Body composition results indicated for high percentage of Body fat, visceral fat and Subcutaneous fat in the population and low percentage for Skeletal Muscle. High percentage of fat indicates the increasing trend of obesity in urban women population. It was also observed that Skeletal Muscle percentage was decreasing with increasing age. Similar type results were explained by Janssen et al , which said that Skeletal Muscle downfall is associated with ageing and same may be seen at large scale , after the fifth decade[31] with lower body Skeletal Muscle occurring.

The body age of the study population and we found that the average body age of the study population was 56 (± 9.9) years which is around 8 years and 3 months more than the actual chronological age, for age group of 40-45 Years age group average Body age was 52.02 years, for 46-50 age group the average body age was 56.98 years and 51-55 years age group the average body age was 58.90 years.

As per table 4, correlation analysis revealed that with the increase in body age respondents will have more body fat, visceral fat and subcutaneous fat (p= 0.000),i.e. the visceral , Subcutaneous and Body fat, were positively correlated with ageing which implies that Body age these components body composition are highly correlated with each other. Correlation analysis with Body age and Skeletal Muscle are negatively correlated, i.e. with the increase in body age respondents' Skeletal Muscle were decreased(p< 0.000), which implies that Visceral fat and Body age are highly correlated with each other.

Table 4: Correlation of Body age and Body composition

Factor	Correlation coefficient	p-value
Body Age	N=450	
Body Fat %	0.570	0.000
Visceral Fat	0.529	0.000
Subcutaneous Fat	0.528	0.000
Skeletal Muscle	-0.173	0.000

GPAQ score differed significantly across the three groups (p= 0.000). As per table-5, observed average GPAQ score among the women of 40-45 years was 1228.87 (269.68), 46-50 years was 1056.13 (277, 84) and 51-55 years was 959.06 (480.00).There was significant difference of 172.74 score GPAQ points among group 40-45 and 46-50 years (p=0.00). The mean difference in GPAQ score between 40-45 and 51-55 years was 269.81 was significant (p=0.00), the mean difference in GPAQ between age groups 46-50 and 51-55 years was 97.07 Points that was significant (p=0.00); over all the older the age group they trend to physically less active than the younger age groups.

Table 5: Daily GPAQ score difference among women of different age groups

Factors	All cases	40-45yrs	46-50yrs	51-55yrs
N	450	**150**	**150**	**150**
GPAQ SCORE	1081.35	1228.87 (269.68)	1056.13 (277.84)	959.06 (480.00)

Table 6: Correlation of Body age and Physical activity

Factor	Correlation coefficient	p-value
Body Age	N=450	
GPAQ	-0.499	0.000

As per table 6, Correlation analysis with Body age and GPAQ score were negatively correlated, i.e. as body age increases respondents will have lower GPAQ (p< 0.000), which implies that GPAQ score and Body age are highly correlated with each other.

Similar type of results as we found in present study, were claimed in many other studies and their results revealed that change in body composition in elders may also affected by physical activity. In another study done

Table 3: Body composition parameters measurements of the subjects

Factors	All cases	40-45yrs	46-50yrs	51-55yrs
N	450	**150**	**150**	**150**
Body Fat %	31.58	30.63 (4.80)	32.23 (4.47)	31.88 (4.46)
Visceral Fat	11.31	10.40 (5.22)	12.22 (6.29)	11.39 (5.88)
Subcutaneous Fat	31.99	30.86 (6.91)	33.14 (5.94)	31.99 (5.53)
Skeletal Muscle	21.65(4.22)	22.34(4.32)	22.28(4.46)	20.34(3.52)
Body Age, mean(SD)	56.0(9.9)	52.02(8.99)	56.98 (9.38)	58.90(9.96)

by Grewal D.K.et al (2018) found that increase in fat with ageing were primarily due to reduction of basal metabolic rate and physical activity of a person. Adding habits of exercise regularly may provide ways to stay mentally and physically active.

Conclusion

Results reveal that Subcutaneous, visceral and body fat% were positively correlated and Skeletal Muscle was negatively correlated with the ageing. High value of BMI, WHR, visceral fat, Body fat and subcutaneous fat in the population and low value for Skeletal Muscle, indicates Overweight and obesity are on the rise among urban women. Average populations were moderately physically active. In GPAQ score major contribution was of routine works done by women in their houses and more vigorous and recreational activities are recommended to have more physically fit population. GPAQ score were negatively correlated with aging, i.e. as the age increases respondent's physical activity level decreases.

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