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Age and gender related changes in body composition parameters among adults

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Abstract
Body composition assessment in terms of lean body mass and fat mass is the best long-term indicator of nutritional status. The significance of measuring body composition has increased due to the need to evaluate changes in the nutritional status, which can affect body reserves differentially. Age-related changes also include changes in body composition. The present study was conducted to determine age and gender related changes in body composition parameters among adults. In the study, hundred subjects comprising of male and females in the age group of 20-60 years were selected from urban areas in Ernakulam. A questionnaire was used to collect general details of the subjects such as back ground information, activity pattern, exercise and health status. Using In body 720 Body Composition Analyser, measures such as weight, total body water, protein, minerals, body fat mass, percent body fat, skeletal muscle mass, waist-hip ratio, visceral fat, basal metabolic rate, Body Mass Index (BMI) and obesity degree were determined. It was seen from the study that mean body weight and hence BMI was found to be highest in the age group of 31-40 years. Body weight did not increase with increasing age as expected. Accordingly mean value of WHR was highest in the age group of 31-40 years. Among male and female subjects, most of the female subjects had low skeletal muscle mass (19.68±2.614kg) and high body fat mass (22.97±9.254kg) whereas most of the male subjects had low body fat mass (18.23±6.774kg), percent body fat (25.08±6.489%) and high skeletal muscle mass (29.71±3.732kg). The results of the study are indicative of a high risk of young adult females towards an unhealthy body composition pattern.

Keywords: Body composition analyser, body mass index, skeletal muscle mass, body fat mass, waist hip ratio, obesity degree, percent body fat

1. Introduction
Ageing involves a group of processes that occur in living organisms, and it is associated with morphological, structural and functional alterations. These changes occur at the cellular level, the tissue level and the whole-body level. They affect internal stability and increase the risk of many common chronic and ageing-associated diseases, including type 2 diabetes mellitus, cardiovascular disease, respiratory diseases, and several types of cancer, osteoporosis and Alzheimer's disease [2].

At an individual level, ageing is a process that does not have a precise beginning, which occurs throughout the life of the individual and depends on genetic, biological and psychological factors. There is great individual variation in the ageing process, observed through changes in physical, psychological and social variables among individuals sharing the same chronological age [1]. Most of these differences have their origins in the conditions in which early and later life occur. During the life course men and women are exposed to different risk factors that affect their health in later years [4]. Among women, age-related changes in body composition have been observed particularly after menopause [3].

The process of ageing itself involves a great number of physiological and nutritional changes such as an increase in body weight and height loss. Furthermore, this leads to a reduction in fat-free mass, which is closely associated with increased fat mass. In fact, the reduction or stability in body weight may mask an increase in body fat mass as a result of aging and the loss of muscle mass in people. Therefore, the assessment of body composition parameters is of great significance.

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2. Methodology

2.1 Selection of Sample
A total number of 100 adults comprising of 52 males and 48 females belonging to the age group of 20-60 years were selected from the urban areas in Ernakulam by random sampling.

2.2 Conduct of the Study
Using a questionnaire details such as back ground information, activity pattern, exercise and health status were elicited. Height of the subjects was taken with the use of stadiometer. Using a body composition analyzer (Inbody720) measures such as weight, total body water, protein, minerals, body fat mass, percent body fat, skeletal muscle mass, waist-hip ratio, visceral fat, basal metabolic rate, body mass index and obesity degree were determined. The various parameters were then analyzed for their changes with age and gender.

3. Results and Discussion

3.1 Comparison of Fat Mass and Fat Free Mass among Subjects
Majority of the subjects had excess body fat mass (66%), percent body fat (82%) and normal skeletal muscle mass (59%) which correlates with their high mean body weight, Waist-Hip Ratio and Body Mass Index.

3.2 Comparison of Anthropometric Measures by Age
It was seen that in case of mean body weight among the different decades there was increase from 62.02± 13.62 kg to 69 kg from 20 -30 to 31-40 years. Thereafter there was a decrease between 41-50 years (63.70 ±9.107 kg) and a slight increase in the age group of 51-60 years (68.42 ±9.801 kg). Hence a definite pattern of weight change was not observed.
Similar pattern was observed in case of Waist-Hip Ratio (WHR) from 0.856± 0.062 to 0.9 from 20-30 to 31-40 years. Thereafter there was a decrease between 41-50 years (0.880 ±0.047) and a slight increase in the age group of 51-60 years (0.888 ±0.037).
In the case of Body Mass Index (BMI) like body weight and Waist-Hip Ratio, increasing Body Mass Index from 23.39± 4.298 kg/m^2 to 25.76 kg/m^2 from 20-30 to 31-40 years. Thereafter there was decreasing between 41-50 years (24.61±3.202 kg/m^2) and again slight increase in the age group of 51-60 years (25.42±3.969 kg/m^2).

3.3 Comparison of Fat and Fat Free Mass by Age
It was indicated that the mean value of skeletal muscle mass is highest in the age group of 51-60 years (26.66±5.198 kg). There was no relation observed between age and skeletal muscle mass. The mean value of the body fat mass and percent body fat was highest in the age group of 31-40 years (23.25±9.908 kg and 33.13±9.547% respectively). There was no statistically significant difference observed between age and body fat mass.

The mean value of the percent body fat is highest in the age group of 31-40 years (33.13±9.547 %). There was no statistically significant difference observed between age and percent body fat.

3.4 Comparison of Anthropometric Measures by Gender
Mean body weight of the male subjects (71.12±10.43 kg) were higher than female subjects (59.55±12.08 kg). This may be due to the higher skeletal muscle mass among males. There was a statistically significant difference observed between gender and body weight.

3.5 Comparison of Fat Mass and Fat Free Mass by Gender
Mean skeletal muscle mass was found to be higher in male (29.71±3.732 kg) than female (19.68±2.614 kg) and it was statistically significant.
It was observed that mean body fat mass and percent body fat was observed to be higher in female (22.97±9.254 kg and 37.28±8.211kg respectively) than male (18.23±6.774 kg and 25.08±6.489 kg) and it was statistically significant. So it was found that males were found to be healthier than females

3.6 Degree of Obesity among Male and Female
Obesity degree was higher among female (114.6 ±24.09) than male (112.7 ±14.69). This may be due to the high amount of body fat mass, percent body fat and low level of skeletal muscle mass among female subjects. There is no statistically significant difference observed between age and obesity degree.

3.7 Correlation between Body Composition Parameters
In the study percent body fat is positively correlated with weight, body fat mass and body mass index and waist-hip ratio. It is negatively correlated with total body water, protein, minerals, skeletal muscle mass and basal metabolic rate. Basal metabolic rate is negatively correlated with body fat mass and percent body fat. Waist hip ratio and obesity degree are positively correlated with all the body composition parameters except minerals.
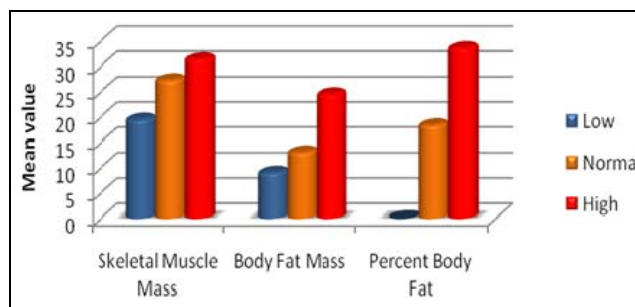

Fig 1: Comparison of Fat Mass and Fat Free Mass among Subjects

Table 1: Comparison of Anthropometric Measures by Age

Parameters	Age Group (years)	Mean and SD	F – value	df	p – value
Body weight (kg)	20 - 30	62.02 ±13.62	2.028	3 & 96	0.115
	31 - 40	69.48 ±16.83			
	41 - 50	63.70 ±9.107			
	51 - 60	68.42 ±9.801			
Waist-Hip ratio (WHR)	20 - 30	0.856 ±0.062	2.829	3 & 96	0.043
	31 - 40	0.900 ±0.065			
	41 - 50	0.880 ±0.047			
	51 - 60	0.888 ±0.037			
Body Mass Index (BMI) (kg/m^2)	20 - 30	23.39±4.298	1.494	3 & 96	0.221
	31 - 40	25.76±5.528			
	41 - 50	24.61g±3.202			
	51 - 60	25.42±3.969			

Table 2: Comparison of Fat and Fat Free Mass by Age

Parameters	Age Group (years)	Mean and SD	F - value	df	p - value
Skeletal muscle mass (kg)	20 - 30	23.37±6.225	1.419	3 & 96	0.242
	31 - 40	25.59±7.583			
	41 - 50	24.38±4.840			
	51 - 60	26.66±5.198			
Body fat mass (kg)	20 - 30	19.41±8.178	1.040	3 & 96	0.379
	31 - 40	23.25±9.908			
	41 - 50	19.53±6.747			
	51 - 60	20.50±8.925			
Percent body fat (%)	20 - 30	30.87±9.221	0.538	3 & 96	0.657
	31 - 40	33.13±9.547			
	41 - 50	30.48±8.944			
	51 - 60	29.59±10.89			

Table 3: Comparison of Anthropometric Measures by Gender

Parameters	Gender	Mean and SD	t – value	df	p – value
Body weight (kg)	Male	71.12±10.43	5.137	98	0.000
	Female	59.55±12.08			
Waist-Hip Ratio (WHR)	Male	0.889±0.038	1.888	98	0.062
	Female	0.869±0.067			
Body Mass Index (BMI) (kg/m^2)	Male	24.79±3.218	0.178	98	0.859
	Female	24.64±5.195			

Table 4: Comparison of Fat Mass and Fat Free Mass by Gender

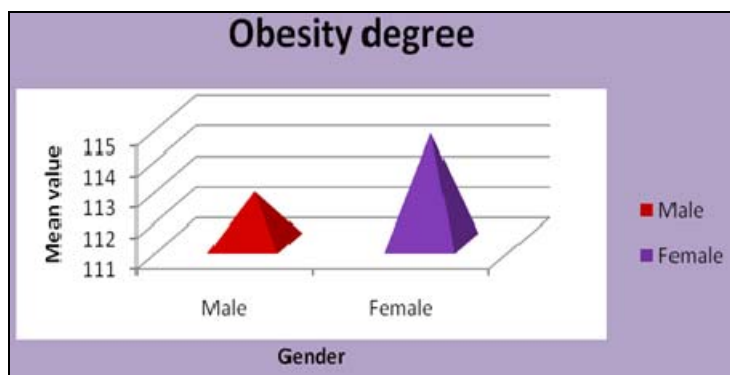| Parameters	Gender	Mean and SD	t – value	df	p – value
Skeletal muscle mass (kg)	Male	29.71±3.732	15.445	98	0.000
	Female	19.68±2.614			
Body fat mass (kg)	Male	18.23±6.774	2.938	98	0.004
	Female	22.97±9.254			
Percent body fat (%)	Male	25.08±6.489	8.272	98	0.000
	Female	37.28±8.211			

Fig 2: Degree of Obesity among Male and Female

Table 5: Correlation between Body Composition Parameters

	TBW	Protein	Minerals	Weight	SMM	BFM	BMI	PBF	BMR	WHR	Obesity
TBW	1.000	10.00**	0.988**	0.750**	10.00**	-0.039	0.257**	-0.503**	10.00**	0.334**	0.203*
Protein	10.000**	1.000	0.986**	0.747**	10.000**	-0.043	0.256*	-0.505**	10.000**	0.337**	0.201*
Minerals	0.988**	0.986**	1.000	0.742**	0.986**	-0.038	0.225*	-0.488**	0.989**	0.305**	0.172
Weight	0.750**	0.747**	0.742**	1.000	0.746**	0.632**	0.800**	0.184	0.749**	0.712**	0.769**
SMM	10.000**	10.000**	0.986**	0.746**	1.000	-0.045	0.254*	-0.507**	10.000**	0.336**	0.199*
BFM	-0.039	-0.043	-0.038	0.632**	-0.045	1.000	0.908**	0.867**	-0.040	0.684**	0.926**
BMI	0.257**	0.256*	0.225*	0.800**	0.254*	0.908**	1.000	0.645**	0.255*	0.819**	0.998**
PBF	-0.503**	-0.505**	-0.488**	0.184	-0.507**	0.867**	0.645**	1.000	-0.503**	0.448**	0.685**
BMR	10.000**	10.000**	0.989**	0.749**	10.000**	-0.040	0.255*	-0.503**	1.000	0.333**	0.200*
WHR	0.334**	0.337**	0.305**	0.712**	0.336**	0.684**	0.819**	0.448**	0.333**	1.000	0.804**
Obesity	0.203*	0.201*	0.172	0.769**	0.199*	0.926**	0.998**	0.685**	0.200*	0.804**	1.000

4. Summary and Conclusion
The mean value of the body weight was found to be higher in the age group of 31-40 years. The mean value of the body weight did not increase with increasing age as expected. Mean BMI was seen to be higher in the age group of 31-40 and 51-60 year age groups. No definite pattern was observed. There was no statistical significance observed between age and BMI. The mean value of the WHR was higher in the age group of

31-40 years. There was a significant difference between waist-hip ratio and age. Body weight of the male subjects was higher than females. Gender was seen to have an influence on WHR. Among the various age groups, body fat mass and percent body fat was higher in the age group of 31-40 years. There was no statistically significant difference observed between age and body fat mass and percent body fat.

Most of the female subjects had low skeletal muscle mass (19.68±2.614 kg), high body fat mass (22.97±9.254 kg) while most of the male subjects had low body fat mass (18.23±6.774 kg), percent body fat (25.08±6.489 %) and high skeletal muscle mass (29.71±3.732 kg) when compared with female subjects. It was seen that there was a high degree of correlation among all the body composition parameters. The results of the study are indicative of a higher risk of the subjects of the study especially females towards a unhealthy body composition pattern which can pave the way towards onset of non-communicable diseases which may be attributed to their unhealthy lifestyle pattern.

5. Reference

1. Fernandez-Ballesteros R. Active Aging. The contribution of Psychology. Hogrefe & Huber, Gottingen. 2008.
2. Hughes V, Frontera W, Roubenoff R, Evans W, Singh M. Longitudinal changes in body composition in older men and women: role of body weight change and physical activity. Am J ClinNutr. 2002; 76(2):473-481.
3. Kanaley JA, Sames C, Swisher L, Swick AG, Ploutz-Snyder LL, Steppan CM *et al*. distribution in pre- and postmenopausal women: the impact of physical activity, age, and menopausal status. Metabolism. 2001; 50(8):976-982
4. Lavery D, Lee M. Effects of early life on elderly health. Today's Research on Aging. 2009; 16:1-5.