Open Access

Original Article

Relationship of Body Composition with Height and Weight in Attendants of Cancer Patients

Muhammad Sohaib Nadeem, Ujala Ali*, Bushra Riaz, Tallat Noreen***, Mansoor Wahid, Lubna Gohar***

Department of Medicine, Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Department of Physiology, Army Medical College/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Department of Physiology, Pak International Medical College, Peshawar Pakistan, ***Department of Physiology, Rawal Institute Islamabad, Pakistan,

ABSTRACT

Objective: To discern the relationship of height and weight with body composition in healthy attendants of cancer patients.
Study Design: Cross-sectional study.
Place and Duration of Study: Combined Military Hospital, Rawalpindi Pakistan, from Oct to Dec 2022.
Methodology: A total of 226 healthy adults aged 19-47 years having similar daily physical activity levels were included. The body composition of study participants was evaluated using a bioelectric impedance analysis (BIA) machine. The weight of all participants was recorded with the help of a weighing machine. The participants' height was measured using a Harpenden Stadiometer and recorded.
Results: Our study showed that weight had a significant positive correlation with body fat mass (rs value=0.83), skeletal muscle mass (rs value=0.763), total body water (rs value=0.704), fat-free mass (rs value=0.75) and per cent body fat (rs value 0.716). On the other hand, height had a negative but non-significant association with fat mass (rs value= 0.025) and a negative significant association with per cent body fat (rs value=-0.16). Height had a positive and significant association with fat-free mass (rs value=0.553), total body water (rs value=0.501) and skeletal muscle mass (rs value=0.505).
Conclusion: Weight, if used alone, is not a good indicator of obesity or emaciation, and height has a negative association with fat mass.

Keywords: Anthropometric indices, Body fat mass, Fat-free mass, Height, Muscle mass, Per cent body fat, Total body water, weight.

How to Cite This Article: *Nadeem MS, Ali U, Riaz B, Noreen T, Wahid M, Gohar L. Relationship of Body Composition with Height and Weight in Attendants of Cancer Patients. Pak Armed Forces Med J 2023; 73(6): 1687-1690. DOI: https://doi.org/10.51253/pafmj.v73i6.9597*

INTRODUCTION

Anthropometric indices serve as important non-invasive tools in evaluating and monitoring various medical conditions and also serve as a baseline to assess physical fitness, gauge fitness improvement, and evaluate growth and nutritional status.[1] Initially, anthropometric values were employed to identify individual health problems and find their solution.[2] More recently, these values have been employed to appraise fat distribution and as a surrogate for physical fitness. Anthropometric indices are used to determine cardiovascular disease risk and calculate nutritional deficiencies.[3,4]

Generally speaking, central and visceral obesity is more prevalent in Asian adults. World Health Organization (WHO) has defined thresholds for overweight and obesity.[5,6] However, in Asians, even at scores well below these levels, there are much higher metabolic disease risks, most probably due to more centripetal fat distribution and higher per cent body fat.[7,8]

Correspondence: Dr Muhammad Sohaib Nadeem, Department of Medicine, Combined Military Hospital, Rawalpindi Pakistan
Received: 26 Nov 2022; revision received: 21 Feb 2023; accepted: 25 Feb 2023

Combined Military Hospital Rawalpindi is the main oncology centre for military personnel and their dependents. A very large and diverse population from the country visits for oncology treatment. This study aims to find the association between the body composition of healthy attendants of oncology patients and anthropometric indices. As the Radiation Oncology department of CMH Rawalpindi has a very broad catchment area, the results of our study will be generalizable to the whole of Pakistan and have good validity. Many studies have been done on anthropometric indices and body composition. However, the majority of these studies have been carried out on people already diagnosed with some cardiovascular disease, metabolic disorder or cancer. Our study is different because it concentrates on young, healthy, fit and disease-free participants. Our study's results will improve community health by advising dietary modifications to those with higher fat content, exercise, lifestyle modification and non-pharmacological interventions.

METHODOLOGY

The cross-sectional study was conducted at the Oncology Department, Combined Military Hospital, Rawalpindi Pakistan, from October to December 2022, after getting formal written approval from the Institutional Review Board/Ethical Review Committee (Serial number 300). The sampling technique employed was convenience sampling. The sample size was calculated using a sample size calculator, clincalc.com, where according to a loco-regional study, the population mean was 5.5±1.[9]

Inclusion Criteria: Healthy individuals without any metabolic or chronic diseases, aged between 18-60 years, giving informed consent to participate, were enrolled.

Exclusion criteria: Individuals with chronic diseases or metabolic disorders.

A total of 226 individuals were included. Written informed consent was obtained from all the participants of the study. Before enrolment into the study, a short history was taken about any previous medication use or diseases of the musculoskeletal system, cardiovascular system or metabolic illnesses. A bioelectric impedance analysis machine (InBody370S) was used to check and record the participants' body composition.

The weight of the individual participants was checked and noted after removing heavy and extra clothes and standing barefoot on the weighing machine. The weights of all participants were noted using the same weighing machine. Height was recorded while standing straight on the Harpenden Stadiometer while standing barefoot with weight equally distributed on both feet and putting heels side by side.

Table-I: Spearman correlation of Different Body Composition Parameters with weight, in males (n=226)

		BFM - Body Fat Mass (Kg)	MM - Total Muscle Mass (Kg)	TBW-Total Body Water (Kg)	FFM- Fat Free Mass (Kg)	PBF -Percent Body Fat (%)
Weight (in kilogram)	rs	0.830**	0.763**	0.704**	0.750**	0.716**
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001

**p-value statistically significant (<0.05)*

Table-II: Spearman correlation of Different Body Composition Indices with Height, in males (n=226)

		BFM - Body Fat Mass (Kg)	MM - Total Muscle Mass (Kg)	TBW-Total Body Water (Kg)	FFM- Fat Free Mass (Kg)	PBF -Percent Body Fat (%)
Height (cm)	rs	-0.025	0.505**	0.501**	0.553**	-0.160*
	p-value	0.710	<0.001	<0.001	<0.001	0.016

**p-value statistically significant (<0.05)*

The participants were standing such that the heels, buttocks and shoulder blades were in contact with the stadiometer's vertical backboard, or at least the buttocks and heels touched the vertical backboard. Feet were angled at sixty degrees, facing outwards. Arms were made to freely hang by the sides while the palms were facing the legs. The horizontal bar was brought down till it touched the hair and compressed it to the scalp/ head crown. All objects that can hinder the bar from touching the scalp/head crown were removed from the head. The upper horizontal bar of the scale was levelled with the vertex of the participant so that it was parallel to the ground. The participant's height was then read on the scale on the lower side of the horizontal bar. Height was rounded off to the nearest 1 mm (0.1 cm).

Statistical Package for Social Sciences (SPSS) version 22.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Spearman's rank correlation was applied to find out the correlation.

RESULTS

Two hundred and twenty-six individuals (n=226) were enrolled in the current study with a mean age of 31.04±6.13 years and a mean weight calculated as 72.82±10.65 kg. Table-I shows that the weight of males had a positive and significant correlation with all body composition parameters. The mean height of the participants was 171.68+4.74 cm. Height, on the other hand, has a positive and significant association with total body water (TBW), skeletal muscle mass (SMM), and fat-free mass (FFM), which has a significant and negative association with per cent body fat, as presented in Table-II.

DISCUSSION

Our study demonstrated that weight positively and significantly correlated with body fat mass ($p<$ 0.001, rs value=0.83). A similarly significant and positive association was noted with skeletal muscle mass ($p<0.001$, rs value=0.763), total body water ($p<0.001$, rs value=0.704), fat-free mass ($p<0.001$, rs value=0.75,) and per cent body fat ($p<0.001$, rs value 0.716). This points toward the fact that with increasing weight, all components of body composition tend to increase, so the corresponding fat percentage will not increase. It also shows that weight is not an indicator of obesity, as the weight of a very muscular individual may also be on the higher side. Similarly, a seemingly underweight individual may have a better muscle mass and a lower percentage of body fat. In a nutshell, we cannot take weight as an indicator of obesity or emaciation as all components of body composition contribute to the individual's total weight. This agrees with the study performed in Kerala, a state of India, in 2016 by Chithira *et al*.where 100 adults (52 male participants and 48 female participants) from the age range of 20-60 years were enrolled by random sampling. They started a significantly positive association of weight with TBW (r=0.75), SMM (r=0.75) and BFM (r=0.63).[10] Differences in adipose tissue distribution in both genders depend on dissimilarities in the function of enzymes, which determine lipid storage and uptake. The enzyme lipoprotein lipase acts as a rate-limiting step to build fat, a derivative of circulating triglycerides and fatty acids.[11] Lipoprotein lipase activity in females is higher in gluteal fat, but in males, it is more in adipose tissues of the viscera and abdomen.[12] In addition, testosterone suppresses the effects of the enzyme lipoprotein lipase on the subcutaneous fat of thighs in males.[13,14]

Our study showed that height had a negative but non-significant association with fat mass (p = 0.71, rs value=-0.025) and per cent body fat (p=0.016, rs value=-0.16) but positive and significant association with fat-free mass ($p<0.001$, rs value=0.553), total body water (p=0.001, rs value=0.501) and skeletal muscle mass ($p<0.001$, rs value=0.505). This implies that the body's fat content decreases with increasing height, and muscle content tends to increase. Similar results were obtained in a study conducted in Germany by Froelich *et al*. on 116 subjects in which a significant but negative association was found between height and fat mass (rs value=-0.223, p-value<0.001).[15] This result may be because as height is higher in males, so is the muscle mass to provide antagonizing muscle power to enable larger skeletons to move and maintain posture.[16] The participants had a significantly negative association with percentage body fat as testosterone does not encourage fat deposition, but it augments muscle proliferation, and this factor cannot be ignored.[17] Low levels of serum testosterone are associated with disorders like diabetes mellitus, certain metabolic syndromes, cardiovascular diseases and disorders of lipid metabolism like dyslipidemia and atherosclerosis. This explains the extraordinary association of body testosterone levels with body composition indices and its role in maintaining the equilibrium of lipid metabolism.[18-20] Ageing induces testosterone drop, which decreases muscle mass and strength, and osteoporosis with decreased bone density. It also leads to a proportionate increase in body fats, cholesterol and adipose tissues.

CONCLUSION

If used alone, weight is not a good indicator of obesity or emaciation, and height negatively affects fat mass. The taller the person is, the lower the percentage of body fat.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MSN & UA: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

BR & TN: Study design, data interpretation, critical review, approval of the final version to be published.

MW & LG: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Gaesser GA, Angadi SS. Obesity treatment: Weight loss versus increasing fitness and physical activity for reducing health risks. iScience 2021; 24(10): 102995. https://doi.org/10.1016/j.isci.2021.102995.
2. Rostron ZP, Green RA, Kingsley M, Zacharias A. Associations between measures of physical activity and muscle size and strength: A systematic review. Arch Phys Med Rehabil 2021; 3(2): 100124. https://doi.org/10.1016%2Fj.arrct.2021.100124.
3. Diana V, George-Sebastian I. The relationship between body mass index and body fat percentage, estimated by bioelectrical impedance in a group of Romanian female students. J Phys Educ Sport 2021; 21(2). http://doi.org/10.36836/2021/2/31.
4. Romejko K, Rymarz A, Sadownik H, Niemczyk S. Testosterone deficiency as one of the major endocrine disorders in chronic kidney disease. Nutrients 2022; 14(16): 3438. https://doi.org/10.3390/nu14163438.
5. Kim J, Lee WH, Kim SH, Na JY, Lim YH, Cho SH, et al. Preclinical trial of noncontact anthropometric measurement using IR-UWB radar. Sci Rep 2022; 12(1): 1-2. https://doi.org/10.1038/s41598-022-12209-1.
6. Harbuwono DS, Pramono LA, Yunir E, Subekti I. Obesity and central obesity in Indonesia: evidence from a national health survey. Med J Indones 2018; 27(2): 114-120. https://doi.org/10.13181/mji.v27i2.1512.

7. Williams R, Periasamy M. Genetic and environmental factors contributing to visceral adiposity in Asian populations. Endocrinol Metab 2020; 35(4): 681-685. https://doi.org/10.3803/enm.2020.772.
8. Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, et al. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. Circulation 2021; 143(21): e984-1010. https://doi.org/10.1161/cir.0000000000000973.
9. Lee SY, Ahn S, Kim YJ, Ji MJ, Kim KM, Choi SH, et al. Comparison between dual-energy X-ray absorptiometry and bioelectrical impedance analyses for accuracy in measuring whole body muscle mass and appendicular skeletal muscle mass. Nutrients 2018; 10(6): 738. https://doi.org/10.3390/nu10060738.
10. Chithira KR. Age and gender related changes in body composition parameters among adults. Int J Home Sci 2016; 2(3): 349-52.
11. Khetarpal SA, Vitali C, Levin MG, Klarin D, Park J, Pampana A, et al. Endothelial lipase mediates efficient lipolysis of triglyceride-rich lipoproteins. PLoS Gen 2021; 17(9): e1009802. https://doi.org/10.1371/journal.pgen.1009802.
12. Wajchenberg BL. Subcutaneous and visceral adipose tissue: their relation to the metabolic syndrome. Endocr Rev 2000; 21(6): 697-738. https://doi.org/10.1210/edrv.21.6.0415.
13. De Pergola G. The adipose tissue metabolism: role of testosterone and dehydroepiandrosterone. Int J Obes (Lond) 2000; 24(2): S59-63. https://doi.org/10.1038/sj.ijo.0801280.
14. Wawrzkiewicz-Jałowiecka A, Lalik A, Soveral G. Recent Update on the molecular mechanisms of gonadal steroids action in adipose tissue. Int J Mol Sci 2021; 22(10): 5226. https://doi.org/10.3390/ijms22105226.
15. Froelich MF, Fugmann M, Daldrup CL, Hetterich H, Coppenrath E, Saam T, Ferrari U, et al. Measurement of total and visceral fat mass in young adult women: a comparison of MRI with anthropometric measurements with and without bioelectrical impedance analysis. Br J Radiol 2020; 93(1110): 20190874. https://doi.org/10.1259/bjr.20190874.
16. Millward DJ. Interactions between growth of muscle and stature: mechanisms involved and their nutritional sensitivity to dietary protein: the Protein-Stat revisited. Nutrients 2021; 13(3): 729. https://doi.org/10.3390/nu13030729.
17. Baik M, Jeong JY, Park SJ, Yoo SP, Lee JO, Lee JS, et al. Testosterone deficiency caused by castration increases adiposity in male rats in a tissue-specific and diet-dependent manner. Genes Nutr 2020; 15(1): 14. https://doi.org/10.1186/s12263-020-00673-1.
18. Zhang X, Zhao H, Horney J, Johnson N, Saad F, Haider KS, et al. Recent testosterone drop-off and risk of cardiovascular events. Aging Male 2020; 23(5): 1611-1619. https://doi.org/10.1080/13685538.2021.1896700.
19. Romejko K, Rymarz A, Sadownik H, Niemczyk S. Testosterone Deficiency as One of the Major Endocrine Disorders in Chronic Kidney Disease. Nutrients 2022; 14(16): 3438. https://doi.org/10.3390/nu14163438.
20. Mammi C, Calanchini M, Antelmi A, Cinti F, Rosano G, Lenzi A, et al. Androgens and adipose tissue in males: a complex and reciprocal interplay. Int J Endocrinol 2012; 2012: 789653. https://doi.org/10.1155/2012/789653.

....