Combining the Skinfold Method and Body Mass Index to Determine the Body Composition of Middle-Aged Men

Dr. Sujoy Birbanshi

Assistant Professor
Physical Education, Raja Birendra Chandra College
Kandi, Murshidabad, West Bengal, India

Abstract-
Aim: **The aim of this study was to determine the relationship between body mass index (BMI) and body fat percentage (% BF) among 518 mid-age men (ages, 35-45y) from different areas in West Bengal, India.**
Method: Five hundred eighteen men ranging the age between 35 and 45 years were selected from different districts of West Bengal as subjects of the study. Body mass Index, Percentage of body fat and Lean body mass were the selected parameters of the study. The anthropometric equation in kg/m^2 was used to measure BMI of the subjects calculated from height and body weight. Body composition was estimated by skin fold method using Harpenden's skinfold caliper. Four-site skin fold thickness was taken in mm. The Body fat percentage (BF%) & Lean Body Mass (LBM) were recorded using the formulae of Durnin and J. Womersley, 2007. The data were examined using Product-Moment method of Correlation as statistical technique using SPSS 20. The level of significance was set at 0.05.
Conclusion: The Result of the study indicates that significant relationship exists between Body Mass Index and percentage of Body Fat ($r = 0.259$, $p<0.01$); Body Mass Index and Lean Body Weight ($r = -0.120$, $p<0.01$) of the mid-age sedentary men.

Key words: **Mid Age Men, Sedentary Habits, Body Composition, Body Fat, Lean Body Mass, Body Mass Index (BMI)**

Introduction:
Researchers have discovered that body mass index (BMI) and body fat percentage (BF%) are insufficient indicators of cardiovascular morbidity and death. There isn't much evidence that BMI and BF% are correlated.
In order to define the thickness of subcutaneous fat in different body locations, skinfold measurements are utilised, although it should be emphasised that their applicability is restricted in individuals who are overweight or obese.
Obesity prevalence has grown over the past few decades, and it is now a significant worldwide health risk (James et al., 2001).
The measurement of body fat is crucial for implementing both therapeutic and preventative health treatments since excess body fat is linked to a higher risk of metabolic disease. Directly measuring body fat is difficult to do in epidemiological research, involves expensive equipment, and takes a lot of time (Vasudev et al., 2004).
According to Indian Council of Medical Research (2010) India is passing through the phase of economic transition. Even though the problem of undernutrition continues to be a major problem; the prevalence of over nutrition also is emerging as a serious problem, especially in the urban areas.
Unbalanced energy intake compared to expenditure is the primary cause of obesity and overweight. The balance between energy intake (calories consumed) and energy expenditure (calories burned) determines body's energy store (WHO Media Centre, 2012).
Obesity as a well-known risk factor for non-communicable diseases, and has been identified as a global public health concern (Kruger et al., 2005).
Furthermore, the lack of international epidemiological information means that for many countries the magnitude of the obesity epidemic in children and youth remains unknown, especially in developing countries (Janssen et al, 2005). The BMI is regarded by the World Health Organisation (WHO) as the most useful measure of overweight and obesity at the population level. Adults of all sexes and ages can use it (WHO 2012).
The WC, WHR, BAI, BMI, and DEXA may all be used to determine the body's excess body fat deposition. Although DEXA is a direct means of detecting body adiposity, epidemiological studies cannot utilise it because of the cost and time commitment. The WHO recommends using BMI to evaluate and quantify body obesity. In contrast to weight and height, BMI does not account for body fatness; it solely assesses excess weight (Wang C, Hou XH, Zhang ML, et al. 2010).
Additionally, it doesn't illustrate how fat is distributed among people or make a distinction between excess body fat and muscle or bone mass (Daniels SR. 2009). The inadequacy of BMI to accurately detect and quantify body fat led to the need for new ways of measuring and evaluating body fat that would be easy, economical, and practical to employ in resource-constrained locations in addition to in epidemiological research.

Materials and Methods:
Subjects: The study was conducted on 518 mid age males, ranging the age between 36 and 45 years.
Study area: The subjects were chosen from different districts namely, Birbhum, Bardhaman and West-Medinipur of West-Bengal, India.

Criterion measures: BMI was calculated by standard formula in kg/m^2; Body fat percentage was also measured by – four sites skin fold measurement of Durnin and J. Womersley, 2007. Four skin folds (biceps, triceps, sub scapular and supra-iliac) were measured on the right side of the body nearest to 1 mm by using skin-fold Caliper with constant tension. To compare the mean scores, of the parameters, for middle aged men population. Pearson‟s Product Moment Correlation was adopted to establish relationships among selected variables.

Findings

Personal data and anthropometric characteristics of the middle age men subjects are presented below.

Table 1 Descriptive Statistics of Personal data of Subjects and Selected Parameters

Parameters	Mean	Std. Error	Std. Deviation	Variance	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
Age	39.97	.144	3.27	10.71	.219	.107	-1.092	.214
Height	1.64	.003	.07	0.00	-.058	.107	-.268	.214
Weight	62.04	.311	7.08	50.13	-.418	.107	.114	.214
Body Mass Index	23.17	.138	3.15	9.94	-.110	.107	.243	.214
Body Fat Percentage	31.15	.169	3.84	14.78	-.412	.107	.045	.214
Lean Body Weight	40.84	.203	4.62	21.32	.212	.107	.756	.214

The value of the mean, standard deviation, standard error of the mean, minimum and maximum value, Skewness and Kurtosis value of middle aged men. Subject personal data and selected parameters like age, height, weight, body mass index (BMI), lean body weight and fat percentage of middle aged men respectively.

Table 2- Correlation among BMI and Body Fat Parentage and Lean Body Weight

		Body Mass Index	Body Fat Percentage	Lean Body Weight
Body Mass Index	Pearson Correlation	1	**.259****	**-.120****
	Sig. (2-tailed)		.000	.006
	N	518	518	518
****. Correlation is significant at the 0.01 level (2-tailed).**				

Comparisons of correlation between BMI and body fat percentage as well as BMI and lean mass by gender and age groups are displayed in Table 2.

Discussion

Body mass index (BMI) and body fat percentage (BF%) are insufficient indicators of cardiovascular morbidity and death. There isn't much evidence that BMI and BF% are correlated. The finding of the study indicates suggest that There was a significant correlation found between Body Mass Index (BMI) & Body Fat Percentage ($r = .259$, $p<0.01$); Body Mass Index (BMI) & Lean Body Weight ($r = -.120$, $p<0.01$).

Body mass index, or BMI, is the ratio of a person's weight to height. It's useful to understand the differences between a healthy weight, an overweight weight, and obesity. The body fat percentage is the result of dividing the total quantity of body fat by the individual's weight. It shows how much body fat there is overall in comparison to how much muscle there is. The body fat percentage offers a more accurate measurement than BMI does. Thus, the fundamental difference between BMI and body fat % is the measuring type and its importance.

Although alternative measurements of body fat provide more accurate findings, BMI increases dramatically with obesity due to changes in body composition; for example, those with more muscle mass or bigger bones would have higher BMI. BMI is a poor tool for determining a person's health, but it is a decent measure of general fitness for huge populations of individuals. The body fat percentage (BF%) is the result of dividing total fat by body weight. It helps determine body composition.

Body fat percentages vary between males and women. Men consistently have lower BF%s than women do. Therefore, the calliper is used to measure the belly, thigh, and chest in males, as well as the thigh, hip, and triceps in women, when determining BF%

using the skinfold technique. Because it indicates body compositions, the body fat percentage is consistently regarded as a more accurate assessment than the BMI.
BMI cut-off point for adiposity in middle-aged and older persons due to changes in body composition that happen over the lifetime, with an increase in BF and a decrease in lean mass (Di Renzo et al., 2022).

Conclusion

Obesity is an acute medical condition described as an abnormal build-up of body fat (BF). The World Health Organisation (WHO) considers a body mass index (BMI) of 30 kg/m2 to be obese. Since BMI and BF% were highly connected, changes in BMI might be a reflection of changes in BF%. Despite the fact that there is a rather significant link between the BMI and the measurement of body fat, there are certain restrictions based on a person's gender, age, and physical prowess **(Elizabeth Quinn, December 13, 2016).**
Results were still substantial, pointing to an internalization of fat with aging and centripetalization of fat. This study could not identify any underlying factors that may be contributing to the apparent redistribution of fat and aging-related loss of lean tissue **(Borkan et al., 1985**). According to **Rush et al., 2009**, analysed the relationship between BMI and BF% in persons from European, Maori, Pacific Islander, and Asian Indian backgrounds. Particularly in the ideal BMI range, the relationship between BMI and percent body fat is weak, curved rather than linear, and age-dependent. (**Meeuwsen et al., 2010)**.

REFERENCES:

1. Borkan, G. A., Hults, D. E., Gerzof, S. G., & Robbins, A. H. (1985). Comparison of body composition in middle-aged and elderly males using computed tomography. American Journal of Physical Anthropology, 66(3), 289–295. https://doi.org/10.1002/ajpa.1330660306
2. Colditz GA, Willet WC, Rotnitzky A, Manson JE. Weight gain as a risk factor for clinical diabetes mellttus in women. Ann Intern Med. 1995; 122:481-6.
3. Daniels SR. The use of BMI in the clinical setting. Paediatrics 2009;124:S35-41. [PubMed] [Google Scholar]
4. Di Renzo, L., Itani, L., Gualtieri, P., Pellegrini, M., El Ghoch, M., & De Lorenzo, A. (2022). New BMI Cut-Off Points for Obesity in Middle-Aged and Older Adults in Clinical Nutrition Settings in Italy: A Cross-Sectional Study. Nutrients, 14(22), 4848. https://doi.org/10.3390/nu14224848
5. Durnin JVGA, Womersley J. Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. Br J Nutr. 1974; 32:77-97.
6. Elizabeth Quinn, December 13, 2016 "BMI: What Does the Body Mass Index Measure?" Use This BMI Calculator to Find Out Your Body Mass Index. https://www.verywell.com/bmi-what-is-bmi-or-body-mass-index-3120088
7. Frankenfield D C, Rowe W A, Cooney R N, et al. (2001). Limits of body mass index to detect obesity and predict body composition. Nutrition 17, 26-30.
8. Gary A. Borkan,David E. Hults,Stephen G. Gerzof,Alan H. Robbins., 1985 "**Comparison of body composition in middle-aged and elderly males using computed tomography**" First published: March 1985Full publication history DOI: 10.1002/ajpa.1330660306 View/save citation Cited by (CrossRef): 33 articles Check for updates Citation tools
9. Holvoet P, Kritchevsky SB, Tracy RP, Mertens Ann, Rubin SM, Butler J, et al. The metabolic syndrome, circulating oxidized LDL, and risk of myocardial infarction in well-functioning elderly people in the health, aging, and body composition cohort. Diabetes. 2004; 53:396-400.
10. Huang Z, Willet WC, Manson JE, Rasner B. Body weight, weight change, and risk for hypertension in women. Ann Intern Med. 1998; 128:81-8.
11. James, P. T., Leach, R., Kalamara, E., & Shayeghi, M. (2001). The Worldwide Obesity Epidemic. Obesity Research, 9(S11), 228S-233S. https://doi.org/10.1038/oby.2001.123
12. Meeuwsen, S., Horgan, G. W., & Elia, M. (2010). The relationship between BMI and percent body fat, measured by bioelectrical impedance, in a large adult sample is curvilinear and influenced by age and sex. Clinical Nutrition, 29(5), 560–566. https://doi.org/10.1016/j.clnu.2009.12.011
13. Nagaya T, Yoshida H, Takahashi H, et al. (1999). Body mass index (weight/height2) or percentage body fat by bioelectrical impedance analysis: which variable better reflects serum lipid profile? Int J Obes Relat Metab Disord 23,771-774.
14. Rush EC, Freitas I, Plank LD. Body size, body composition and fat distribution: comparative analysis of European, Maori, Pacific Island and Asian Indian adults. Br J Nutr. 2009;102(4):632–641. doi: 10.1017/S0007114508207221. [PubMed] [Cross Ref]
15. Rush, E. C., Freitas, I., & Plank, L. D. (2009). Body size, body composition and fat distribution: Comparative analysis of European, Maori, Pacific Island and Asian Indian adults. British Journal of Nutrition, 102(04), 632. https://doi.org/10.1017/S0007114508207221
16. Stevens J, Cai J, Pamuk ER, Williamson DF, Thun MJ, Wood JL. The effect of age on the association between body-mass index and mortality. N Engl J Med. 1998; 338:1-7.
17. Vasudev, S., Mohan, A., Mohan, D., Farooq, S., Raj, D., & Mohan, V. (2004). Validation of body fat measurement by skinfolds and two bioelectric impedance methods with DEXA--the Chennai Urban Rural Epidemiology Study [CURES-3]. The Journal of the Association of Physicians of India, 52, 877–881.
18. Wang C, Hou XH, Zhang ML, et al. Comparison of body mass index with body fat percentage in the evaluation of obesity in Chinese. Biomed Environ Sci 2010;23:173-9. [PubMed] [Google Scholar]
19. World Health Organization: Obesity and overweight: fact sheet N0 311; 2012. http://www.who.int/mediacentre/factsheets/fs311/en/index.htm