RELATIONS OF SIX MINUTE WALK DISTANCE WITH BODY MASS INDEX AND WAIST HIP RATIO

Physiotherapy

Parul Sharma	Department of Physiotherapy, Delhi Pharmaceuticals Science and Research University, New Delhi
Shweta Sharma	Department of Physiotherapy, Manav Rachna International University, Faridabad, Haryana
Vinika Chaudhary	Department of Physiotherapy, Amity University, Uttar Pradesh

ABSTRACT

BACKGROUND: The six minute walk test is used to measure functional capacity. The primary measurement is the total distance walked.
OBJECTIVE: The objective of the study was to find the relation between six minute walk test distance with body mass index (BMI) and waist hip ratio (WHR) in normal healthy adults.
MATERIALS AND METHODS: 40 healthy female subjects were randomly selected and their WHR, WC, BMI and six minute walk test distance were measured.
RESULTS: Six minute walk distance is related with BMI and WHR. Six minute walk test distance has a positive relation with BMI, negative relation with WHR.
CONCLUSION: When BMI increases, six minute walk distance also increases as BMI is positively correlated with six minute walk distance. When WHR increases, six minute walk distance decreases as six minute walk test distance is negatively correlated with WHR.

KEYWORDS

BMI, WHR, Obesity

Walking test have been around since the 1960's when the 12 minute walk test was popularized by aerobe fitness enthusiast Keneth H Cooper, as a quick and easy fitness test. The six minute walk test is used to measure functional capacity .The six minute walk test is chosen because it is easier to administer, better to administer, better tolerated and better reflects activities of daily living than other walk tests. Six minute walk test is indicated to measure functional status in COPD, cystic fibrosis, heart failure, peripheral vascular disease, and in elderly patients. The primary measurement is the total distance walked (Paul 2003).

Obesity is a problem of increasing prevalence in children that may lead to many health problems in adulthood (Roush, Guy& Purvis, 2006). Obesity is understood as an abnormal increase in body fat .This is measured in practice using the body mass index .i.e. weight in kilograms divided by the square of the height in meters.

The guidelines of German obesity society and the World Health Organisation define overweight as a BMI of at least $25kg/m^2$. BMI between 25 and 29.9 is defined as pre-obesity. BMI of at least $30kg/m^2$ is defined as obesity (Feller, Boeing & Pischon, 2010).

Waist circumference (WC) is a simple measurement that constitutes one of the criteria of metabolic syndrome and has been well recognized in adults to be a useful risk indicator (Marlowe, Apicella & Reed, 2005). Waist circumference is a simple method of assessing the level of visceral fat. Increased waist circumference is also associated with increased risk of diabetes (Feller et al. 2010).

Waist hip ratio has been used as an indicator or measure of health of a person and the risk of developing serious health conditions.WHR is a measurement of obesity, which in turn is possible indicator of other serious health conditions.

A WHR of 0.7 for women and 0.9 for men have been shown to correlate strongly with general health and fertility. Women with 0.7 ranges have optimal levels of estrogen and are less susceptible to major diseases such as diabetes, cardiovascular disease and ovarian cancers.

Men with WHRs around 0.9 similarly have been shown to be more healthy and fertile with less risk of prostate cancer and testicular cancer.

WHR has been found to be a more efficient predictor of mortality in older people than waist circumference or BMI (Marlowe, et al. 2005). WHR has been associated with increased blood pressure, increased triglycerides and decreased lipoprotein cholesterol (Bittner V, Weiner DH, Yusuf S, Rogers WJ, McIntyre KM, Bangdiwala SI, Kronenberg MW, Kostis JB, Kohn RM, Guillotte M, Greenberg B, Woods PA & Bourassa MG.1993). Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, breathing difficulties during sleep, certain types of cancer, and osteoarthritis. Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications.

Methodology

This was an experimental study consisted of 40 subjects were selected from department of physiotherapy, Guru Jambheshwar University of Science and Technology, Hisar. Healthy young female adults were included. The WHR, WC, BMI and six minute walk test distance were measured. Then subjects were asked to walk for 6 minutes on a 15m long pathway. Subjects were not allowed to talk and walk in groups while performing test as a precaution.

Procedure

6 minute walk test-A 15 m path was selected for the test. Subjects were asked to walk on a 15m path for 6 minutes continuously with their normal walking speed. Distance covered by them was measured after 6 minutes. Distance covered by normal healthy adults is between 300m to 700m.

WHR- WHR was calculated by first measuring the waist circumference and then the hip circumference with the help of measuring tape. The waist circumference was measured at a level midway between the lowest rib and iliac crest, and hip circumference at the level of greater trochanters, with the legs close together. The waist hip ratio equals the waist circumference divided by the hip circumference. A WHR of 0.7 for women and 0.9 for men indicates general health and fertility.

BMI- It was calculated by dividing weight in kilograms to square of height in meters. Normal range for BMI is $18kg/m^2$ to $24.9kg/m^2$, people having BMI below are considered to be underweight. And people having BMI above $25kg/m^2$ to $29.9kg/m^2$ are considered to be overweight and people having BMI above $30kg/m^2$ are considered to be obese.

Instrumentation

A 15m long pathway for 6- minutes walk test was required along with a measuring tape and a stop watch.

Data Analysis

Pearson's correlation coefficient test was used to find the relation between six minute walk test distance with BMI and WHR. For positive correlation the value of coefficient should come between 0 and 1 and for negative correlation the value of coefficient should come between 0 and -1.

Mean of six minute walk test distance of 40 subjects is 424.150m. Mean of BMI of 40 subjects included in th this study is 20.846kg/m^2 Mean of WHR of 40 subjects included in this study is 0.768.

Table 1

Variable	Minimum	Maximum	Mean	Standard Deviation
Distance	300m	645m	424.50m	58.696m
WHR	0.685	0.875	0.768	0.043
BMI	14.453	28.398	20.846	3.077

Table 2

Variables	BMI	WHR
Distance	0.040	-0.160

CORRELATION COEFFIECENT (PEARSON)

Result
The result of this study suggests that six minute walk distance is related with BMI and WHR. Six minute walk test distance has a positive relation with BMI has a negative relation with waist hip ratio.

Discussion
The result showed a negative relation between six minute walk test distance and WHR. This means that when WHR increases six minute walk distance decreases and indicates a decrease in functional capacity and exercise capacity.

According to Adeniyi, Uloko & Sani-Suleiman (2010) a negative relation exist between WHR and six minute walk test distance in patients of type 2 diabetes i.e. distance decreases with increase in WHR.

In another study done by Esmaillzadeh, Mirmiran & Azizi (2004), it was concluded that WHR is a better indicator for cardiovascular risk factors then BMI and WC. WHR is the most widely used indicator of abdominal obesity, high WHR is associated with an increased visceral fat area. A study done by Roush et. al. in 2006, concluded that no relation exists between six minute walk distance and BMI in healthy third grade school children. But in our result the relation between BMI and six minute walk distance is positive it may be because of including underweight subjects in the study.

In a study done by Wing, Matthews, Kulle, Meilahn & Plantinga (1991), which concluded that WHR is associated with those behaviours and psychosocial, attributes that influence cardiovascular risk. Hence the negative relation between WHR and six minute walk test distance attribute that an increase in WHR is associated with obesity so distance decreases with increasing WHR.

The relation that exists between BMI and six minute walk test distance showed up a positive correlation. So when BMI increases six minute walk distance also increases. A study done by Adeniyi e. al. in 2010, concluded that a negative relation exist between BMI and six minute walk test distance in T2DM , that is when distance increase BMI decreases and exercise capacity also increases. According to Mohammad S. (2014), there were increasing trends between obesity indices and the severity of cardiovascular risk factors and the prevalence of morbidity conditions (all P-values for trend <0.05). Patients with a greater number of co morbidities also had higher BMI, WC, and WHR measurements. A study done in 2015 by Dinakar & Sridevi (2015) concluded that low exercise capacity in patients with T2DM was associated with higher adiposity & poor glycaemic control. Therefore these factors should be given consideration when prescribing exercises for patients with T2DM in order to ensure safety and efficiency of the exercise session. A study done in 2016 by Lore Metz et al and concluded that there is a significant linear relation between VO$_{2peak}$ and the distance covered during the 6 MWT ($p < 0.001$; $r = 0.349$). The determinant of VO$_{2peak}$ was body mass index, waist-to-hip ratio and fat free mass. A study done by Salin, Hirvensalo, Magnussen,Telama, Hutri-Kähönen, Viikari & Tammel (2017), it was found that increasing daily steps to 2000 steps was associated maintain BMI at the same level as four years before. Since individuals' metabolic rate declines with age, PA should be increased with age to maintain BMI at the same level as previously.

Conclusion
It is concluded from the study that when BMI increases six minute walk distance also increases as BMI is positively correlated with six minute walk distance and when WHR increases six minute walk distance decreases as six minute walk test distance is negatively correlated with WHR.

References
1. Adeniyi, A.F. , Uloko, A.E. , Sani-Suleiman, I. (2010). Relationship Between the 6-minute Walk Test and Correlates of Type 2 Diabetes : Indication for caution in exercise prescription. Ajpars, 2(1), 21–24.
2. lameri, H. F., Sanai, F. M., Al Dukhayil, M., Azzam, N. A., Al-Swat, K. A., Hersi, A. S., & Abdo, A. A. (2007). Six Minute Walk Test to assess functional capacity in chronic liver disease patients. World Journal of Gastroenterology, 13(29), 3996–4001.
3. Bassali, R., Waller, J. L., Gower, B., Allison, J., & Davis, C. L. (2011). NIH Public Access, 5(1), 97–101.
4. Bittner V, Weiner DH, Yusuf S, Rogers WJ, McIntyre KM, Bangdiwala SI, Kronenberg MW, Kostis JB, Kohn RM, Guillotte M, Greenberg B, Woods PA & Bourassa MG.(1993). Prediction of mortality and morbidity with a 6-minute walk test in patients with left ventricular dysfunction. JAMA. 1993; 270(14):1702–1707.
5. care, P. E.-R., & 2003, undefined. (2003). The six-minute walk test. Rc.Rcjournal.Com, 783–785.
6. Dinakar, S., & Sridevi, S. (2015). a Study To Find the Correlation Between Six Minutes Walk Distance and Blood Glucose Level in Diabetic Patients. Int J Physiother Res, 3(4), 1099–4.
7. Esmaillzadeh, A., Mirmiran, P., & Azizi, F. (2004). Waist-to-hip ratio is a better screening measure for cardiovascular risk factors than other anthropometric indicators in Tehranian adult men. International Journal of Obesity, 28(10), 1325–1332.
8. Feller, S., Boeing, H., & Pischon, T. (2010). Body mass index, waist circumference, and the risk of type 2 diabetes mellitus: implications for routine clinical practice. Deutsches Ärzteblatt International, 107(26), 470–6.
9. Ingle, L., Rigby, A. S., Nabb, S., Jones, P. K., Clark, A. L., & Cleland, J. G. F. (2006). Clinical determinants of poor six-minute walk test performance in patients with left ventricular systolic dysfunction and no major structural heart disease. European Journal of Heart Failure, 8(3), 321–325.
10. Lore Metz et al.,A new equation based on the 6 min walking test to predict VO2 peak in women with obesity. Disabil Rehabil. 2017 Mar 27:1-6. doi: 10.1080/09638288.2017.1304582
11. Morinder, G., Mattsson, E., Sollander, C., Marcus, C. and Larsson, U. E. (2009), Six-minute walk test in obese children and adolescents: Reproducibility and validity. Physiother. Res. Int., 14: 91–104. doi:10.1002/pri.428
12. Marlowe, F., Apicella, C., & Reed, D. (2005). Men's preferences for women's profile waist-to-hip ratio in two societies. Evolution and Human Behavior, 26(6), 458–468.
13. Roush, J., Guy, J., & Purvis, M. (2006). Reference values and relationship of the Six Minute Walk Test and Body Mass Index in healthy third grade school children. Internet Journal of Allied Health Sciences & Practice, 4(3), 6p–6p 1p.
14. S Adamu, M. (2013). Metabolic Syndrome in Relation to Body Mass Index and Waist to Hip Ratio; A Study in Kumasi Metropolis. Journal of Obesity & Weight Loss Therapy, 4(1), 1–9.
15. Salin, K., Hirvensalo, M., Magnussen, C., Telama, R., Hutri-Kähönen, N., Viikari, J., … Tammelin, T. (2017). Changes in Daily Steps and Body Mass Index and Waist to Height Ratio during Four Year Follow-Up in Adults: Cardiovascular Risk in Young Finns Study. International Journal of Environmental Research and Public Health, 14(9), 1015.
16. Troosters, T., Gosselink, R., & Decramer, M. (1999). Six minute walking distance in healthy elderly subjects. European Respiratory Journal, 14(2), 270–274.
17. Wing, R. R., Matthews, K. A., Kuller, L. H., Meilahn, E. N., & Plantinga, P. (1991). Waist to Hip Ratio in Middle-Aged Women. Arteriosclerosis, Thrombosis, and Vascular Biology., 11, 1250–1257.