ORIGINAL ARTICLE

IJPHY

EFFECTIVENESS OF RETROWALKING AND FORWARD WALKING TREADMILL TRAINING ON LEVEL OF C-REACTIVE PROTEIN AND ABDOMINAL ADIPOSITY IN UNTRAINED YOUNG ADULTS: PROTOCOL FOR A COMPARATIVE STUDY

[*1]Ajith Soman
[2]Muhammad Najeeb Kallidukkil
[3]Sunil Chandy
[4]Haripriya Santhakumar
[5]Bibin Scaria

ABSTRACT

Background: Retro walking has been shown to require increased metabolic cost and cardiopulmonary demand compared with forward walking at the same speeds. Levels of C reactive protein and abdominal adiposity are related directly to the risk of cardiovascular disease. The study aims to compare the effect of retro walking treadmill training and that of forward walking treadmill training on C-reactive protein levels and abdominal adiposity in untrained young adults.

Methods/design: In this comparative experimental study, 250 participants will be recruited by using purposive sampling and allocated randomly to two groups. One group will undergo retro walking treadmill training for five sessions a week for six weeks, and the other group will undergo forward walking treadmill training for the same period. The waist-hip ratio will be calculated, and blood samples to measure CRP levels will be taken before and after the 6-week intervention.

Results: The data will be tabulated and subjected to statistical analysis, by the paired and unpaired t-tests and the Wilcoxon Signed Rank test.

Conclusion: To our knowledge, it is the first experimental study to compare the effect of retro walking treadmill training and forward walking treadmill training on C-reactive protein levels and abdominal adiposity in untrained young adults. The results of the study will throw light on which type of training, to what extent, might help lower cardiovascular risk in young adults.

Keywords: treadmill walking, retro walking, C- reactive protein, abdominal obesity.

Received 14th November 2018, accepted 23rd March 2019, published 09th April 2019

www.ijphy.org

10.15621/ijphy/2019/v6i2/181909

[2]Lecturer, Department of Health Rehabilitation Sciences, College of Applied Medical Science, Shaqra University, Kingdom of Saudi Arabia; najeeb500@gmail.com
[3]Assistant Professor, Department of Clinical Lab Science, College of Applied Medical Science, Shaqra University, Kingdom of Saudi Arabia; sunil15chandy@gmail.com
[4]Associate Professor, Laxmi Memorial College of Physiotherapy, Mangaluru, Karnataka, India; haripriyaajithsoman@gmail.com
[5]Lecturer, Department of Clinical Lab Science, College of Applied Medical Science, Shaqra University, Kingdom of Saudi Arabia; bibinscariap@gmail.com

CORRESPONDING AUTHOR

[*1]Ajith Soman

Assistant Professor, Department of Health Rehabilitation Sciences, College of Applied Medical Science, Shaqra University, Kingdom of Saudi Arabia.
ajithsoman78@gmail.com

BACKGROUND

The current literature available on forward and backward walking has mostly studied the biomechanics and energy expenditure of these forms of walking. The demands on the cardiopulmonary system and metabolic cost have been seen to be more in backward walking or retrowalking when compared to forward walking. Most of the studies on retrowalking have used the treadmill for training and locomotion.

The cause of the difference in metabolic cost between the two modes of walking has been postulated to be due to decreased stride length, increased stride frequency, and the fact that during retrowalking, the quadriceps muscles act concentrically rather than eccentrically, which increases the energy cost when compared to forward walking [1].

Abdominal obesity or central obesity is a condition where excess fat deposits around the abdomen to the degree that it has detrimental effects on the health of the person. Waist- to- hip ratio(WHR) is the measure of abdominal obesity, and is measured as the waist circumference divided by the hip circumference. For men, the desired value of the WHR is 0.9 or less, and for women it is 0.8 or less, exceeding which the risk for cardiovascular diseases and other obesity-related issues escalate sharply in both genders [2].

Cardiovascular disease and central obesity are strongly related to each other [2]. The debate is still on regarding which measures of obesity are more associated with health risks. When compared to the body mass index, which measures general adiposity, measures of abdominal obesity namely,waist circumference(WC), waist to height ratio(WHtR) and waist-hip ratio(WHR) have been seen to be better indicators of the risk of cardiovascular diseases, diabetes, and death [2-3]. Obesity rates among children and young adults are high worldwide, and this has the potential for increasing the risk of cardiovascular diseases in this population. Metabolic syndrome and cardiovascular disease are closely associated with abdominal adiposity, especially visceral adipose tissue(VAT) [4].

The risk factors which are currently established explain only partially the excess cardio-metabolic risk which is seen to be associated with abdominal obesity. Other mechanisms which are less extensively explored are thought to include low-grade inflammation of a systemic nature. Many studies have found a connection between abdominal adiposity and levels of C- reactive protein (CRP) in the blood. CRP, an acute stage protein, is an early marker of infection or inflammation. It is integrated into the liver and is customarily found at concentrations of under 10ml/L in the blood [5]. It is additionally generated by non-hepatic cells like neurons, atherosclerotic plaques, monocytes and lymphocytes in constrained concentrations [6]. Among the different inflammatory markers, CRP is most consistently connected to atherogenesis and thus to an increased risk of cardiovascular disease [7].

The efficacy of backward walking as a possible training method in healthy persons has been explored in many studies. For instance, the trial conducted by Flynn et al. (1994), which studied the metabolic cost of backward walking and running and found that backward walking and running produced greater submaximal heart rates, VO_2 responses, and blood lactate levels than forward running at similar speed [8]. Other authors like Anadkat(2015) and Ordway(2016) have found that retro walking produces gains in parameters like pain and disease-related disability in specific disease conditions, in addition to producing performance gains [9,10].

A need was identified to compare the efficacy of backward and forward walking, on inflammatory and metabolic outcome measures, since both were safe and easy to administer exercise modes which could potentially modify cardiovascular risk factors. Hence this study was designed with the primary aim of determining whether retro walking treadmill training or forward walking treadmill training would have a better effect on blood C- reactive protein levels and abdominal adiposity in untrained young adults.

Objective

To find out and compare the effect of retro walking and forward walking treadmill training on CRP levels and abdominal adiposity in untrained young adults within the age group of 18-35 years.

Hypothesis

We hypothesized that retrowalking would have more of an effect on blood CRP levels and waist-to-hip ratio than forward walking.

MATERIALS AND METHODS

Study design:

A comparative pre- post-experimental study without control is proposed where eligible subjects are randomly divided into two groups of 125 subjects each and outcomes are measured pre-intervention and following the respective treadmill training (post-intervention).Reporting of the study will follow the CONSORT guideline recommendations for reporting of clinical trials.Ethical approval will be obtained from the Institutional Ethical Committee.

Participants and recruitment

The study will include male subjects aged 18-35 years with a WHR more than 1. Individuals receiving drugs for medical conditions as well as participants with any cardiovascular, metabolic, respiratory, orthopedic and neurological conditions contraindicating exercise testing and training will be excluded from the study.

The trial would recruit young adults who are students or faculty of a medical university (Shaqra University, Kingdom of Saudi Arabia) who expressed interest to participate in the study on verbal promotion. Eligible individuals will be enrolled after screening using the American Heart Association/ American College of Sports Medicine (AHA/ ACSM) pre-participation questionnaire. Before initial assessment, eligible subjects will get a data bundle with detailed information about the study, which will include the

participants' rights taking part in a research project and a typewritten informed consent form. Once the written consent is provided, the subjects will be allocated to groups, assessed and interventions carried out.

Baseline assessment and allocation

The eligible and consenting participants will be randomly allocated to one of two groups using sequentially numbered opaque sealed envelopes. Before the intervention, baseline assessment of Waist Circumference (WC), Body Mass Index(BMI), Waist-Hip Ratio (WHR), and Waist-Height Ratio(WHtR) will be carried out by an assessor blinded to the outcomes of the study, and laboratory testing of C- Reactive Protein will be carried out.

Interventions

Before starting the interventions, subjects who were unfamiliar with forward or backward treadmill walking, as applicable, will be provided basic training by a physical therapist until they can walk on the treadmill confidently, and without support.

Retro walking treadmill training

The participant in the retro walking treadmill training group will participate in a supervised retro walking training program with five minutes each of warm- up and cool-down activities for three days a week for six weeks on a treadmill, walking at the maximum possible speed which was comfortable for them. The walking time will initially be fifteen minutes, progressing up to thirty minutes over the training period of six weeks.

Forward walking treadmill training

The subjects allocated to the forward walking group will undergo a supervised forward walking treadmill training program with parameters similar to that of the retro walking training program. (Maximum comfortable speed, 15-30 minutes of training and 5 minutes each of warm- up and cool- down, three times a week, six weeks)

The warm-up and cool- down exercise periods will comprise of ankle- toe movements, gastroc- soleus stretching, hamstring stretching and heel- raise exercises, done for five minutes each.

Outcome measures:

All the outcomes will be measured by assessors who will be blinded to the outcomes of the study.

Primary outcome measures:

Measurement of C - Reactive Protein (CRP): Blood samples will be collected from each subject before the intervention and after the intervention period, and CRP estimated using the immunoturbidimetric method [11] using the Biochrom® Libra S22.

Waist to hip ratio (WHR): This is the ratio of the circumference of the waist to the circumference of the hips. This is calculated as waist circumference divided by hip circumference, measured in the same units [12].

Secondary outcome measures:

Body Mass Index (BMI): BMI is calculated by the Quetelet Index, i.e., the weight in kilograms divided by the square of height in meters (kg/m^2) [12].

Waist circumference: This was obtained by the method recommended by the World Health Organisation(WHO), at the highest point of the iliac crest, level with the anterior superior iliac spine, with a measuring tape while standing [11].

Hip Circumference (HC): HC will be measured at its widest part of the buttocks or hip, with a measuring tape, by the WHO recommended method [12].

Waist-Height Ratio (WHtR): WHtR of the subjects is measured by dividing their waist circumference, measured by the method mentioned above, by their height, measured using a standard stadiometer, both measured in the same units [12].

Sample size calculation

Sample size calculation was done with reference to the study conducted by Dangi et al. (2014)[13]where there was observed a mean difference of 0.0107 with a standard deviation of 0.06 in the waist-hip ratio pre-intervention to post-intervention [12]. With a confidence interval of 95%, a sample of 125 for each group was considered.

Statistical analysis:

The collected information will be summarized by using frequency, percentage, mean and standard deviation. To compare the outcome measures before and after the intervention paired t-test will be used. If data is not following a normal distribution,the Wilcoxon signed rank test will be used. To compare the difference in outcomes between the two intervention groups, the unpaired t-test will be used. A p-value <0.05 will be considered significant. All analyses will be carried out using SPSS software (IBM SPSS Version 20).

DISCUSSION

This comparative study was designed to compare the effects of retro walking and forward walking treadmill training on CRP levels and abdominal adiposity. Retro walking has been shown to elicit greater cardiovascular responses and has higher metabolic demands than forward walking [8]. These cardiovascular responses are brought about with no additional biomechanical load on the weight-bearing joints, which is an added advantage considering the increased prevalence of joint problems in obese people.

The CRP is a sensitive marker of systemic low- grade information. In addition to being a predictor for most of the cardiovascular and metabolic lifestyle diseases, CRP is also shown to be able to predict cardiovascular disease even independently of the traditionally known risk factors. It also adds prognostic information to these well-known risk factors and is recommended currently as the principal inflammatory marker in clinical practice and research [14].

Abdominal adiposity or central obesity is a risk factor for many cardiovascular, pulmonary, metabolic as well as other diseases.Abdominal adiposity has shown a direct relationship with ultrasensitive CRP concentrations, an inflamma-

tory marker, which is an indicator of cardiovascular risk in adults. Many studies on retro walking have focused on the biomechanical aspects of retro walking, rather than the metabolic and risk factor modification properties. Hence the significance of this study, which studies the ability of a retro walking program to modify an important inflammatory marker, in comparison to a more traditional exercise program.

Since there is an increase in concentrations of CRP with increasing adiposity, lowering the CRP levels is a health target. Measures of central obesity, such as the waist-hip ratio, waist circumference, and waist-height ratio have been seen to be better pointers towards lifestyle diseases than the body mass index [15].

Hooper et al.(2004) in their study comparing cardiovascular demands of forward and backward walking have observed that backward walking elicited greater maximal heart rate and greater maximal oxygen consumption than forward walking. If found to be effective on decreasing CRP levels, retro walking can be used as a mode of exercise which will place increased metabolic and cardiovascular demands on the body, thus modifying disease and risk factors, without placing undue biomechanical stress on the working joints.

CONCLUSION

This pre-post comparative study without control aims to bring about a novel knowledge on whether and to what extend retro walking can help improve the primary and secondary outcome measures from pre-intervention to post-intervention.

REFERENCES

[1] Terblanche E, Page C, Kroff J, Venter RE. The effect of backward locomotion training on the body composition and cardiorespiratory fitness of young women. Int J Sports Med. 2005; 26: 214-219.

[2] Lapice E et al. Abdominal adiposity is associated with elevated C- Reactive protein independent of BMI in healthy non-obese people. Diabetes care. 2009; 32(9): 1734-1736.

[3] Freiberg MS, Pencina MJ, D'Agostino, Lanier K, Wilson PW, Vasan RS. BMI vs. waist circumference for identifying vascular risk. Obesity (Silver Spring) 2008; 16: 463– 469.

[4] Kim MS et al. Increased Abdominal Adiposity in Adolescents and Young Adults with Classical Congenital Adrenal Hyperplasia due to 21-Hydroxylase Deficiency. J Clin Endocrinol Metab. 2015; 100(8):E1153-9. doi: 10.1210/jc.2014-4033.

[5] C- reactive protein concentrations as a marker of inflammation or infection for interpreting biomarkers of micronutrient status. (Internet). World Health Organization 2014.Availablefrom:httpp://apps.who.int/iris/bitstream/10665/133708/1/WHONMHNHDE-PG14.7eng.pdf.

[6] PepysMG, Hirschfield GM. C-reactive protein: a critical update. J Clin Invest. 2003; 111(12): 299.

[7] García-Lorda P, Bullo M, Balanza R, Salas-Salvado J. C-Reactive Protein, Adiposity And Cardiovascular Risk Factors In A Mediterranean Population. Int J Obes. 2005 Mar 30: 468-474.

[8] Flynn, TW, Connery, SM, Smutok, MA, Zeballos, RJ, and Weisman, IM. Comparison of cardiopulmonary responses to forward and backward walking and running. Med Sci Sports Exerc.1994;26:89–94.

[9] Anadkat H, Soman A, Dhanesh Kumar K U. Effectiveness of Retro walking treadmill training on pain and disability in Knee osteoarthritis: A Randomized controlled trail. Int J Pharm Bio Sci.2015; 6(4):43-50.

[10] Ordway JD, Laubach LL, Vanderburgh PM, Jackson KJ. The effect of backwards running training on forward running economy in trained males. Journal of strength and conditioning research. 2016; 30(3):763-767.

[11] Salazar J, Martínez MS, Chávez M, Toledo A, Anez R, Torres Y, Apruzzese V, Silva C, Rojas J and Bermudez Vl. C-reactive protein: clinical and epidemiological perspectives. *Cardiol Res Pract*. 2014;2014:605810.

[12] WHO (2011). Waist Circumference and Waist- Hip Ratio: Report of a WHO Expert Consultation, Geneva, 8-11December 2008. Technical report, World Health Organisation.

[13] Dangi A, Nirbhavane U. Comparison of forward walking versus backward walking on level surface on body composition in obese individuals in the age group of 20- 40 years. IJSRP.2014: 4(4); 2250-60.

[14] Lakka TA, Lakka H, Rankinen T, Leon AS, Rao DC, Skinner JS, Wilmore JH, Bouchard C. Effect of exercise training on plasma levels of C-reactive protein in healthy adults: the HERITAGE Family Study. Eur Heart J. 2005; 26(19): 2018- 25.

[15] Ying Lee CM, Huxley RR, Wildman RP, Woodward M. Indices of abdominal obesity are better discriminators of cardiovascular risk factors than BMI: a meta-analysis. J Clin Epidemiol. 2008.61(7): 66- 53.

Citation

Soman, A., Kallidukkil, M. N., Chandy, S., Santhakumar, H., & Scaria, B. (2019). EFFECTIVENESS OF RETROWALKING AND FORWARD WALKING TREADMILL TRAINING ON LEVEL OF C-REACTIVE PROTEIN AND ABDOMINAL ADIPOSITY IN UNTRAINED YOUNG ADULTS: PROTOCOL FOR A COMPARATIVE STUDY. *International Journal of Physiotherapy,* 6(2), 28-31.