

Influence of Plyometric Resistance Exercises on Metabolic Syndrome Risk Factors in Obese College Students

Dr.A.MAHABOOBJAN¹, Mr.HUSSAINSAB K.P.², Dr.V.SOWMIYA³

¹*Professor, Department of Physical Education, Bharathidasan University, Tiruchirappalli, Tamilnadu, India..*

²*Ph.D. Scholar, Department of Physical Education and Yoga, Bharathidasan University, Tiruchirappalli, Tamilnadu, India.*

³*Asst. Professor, Vinayaka Missions College of Physical Education, Vinayaka Missions Research Foundation, Deemed to be University, Salem, Tamilnadu, India.*

KEYWORDS

Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol.

ABSTRACT:

The purpose of the study was to find out the influence of plyometric resistance exercises on metabolic syndrome risk factors in obese female college students. To achieve the purpose of the study, thirty female students were selected from various departments of Bharathidasan University, Tiruchirappalli, Tamilnadu. The age of the subjects were ranged between 18 to 21 years. The subjects were randomly assigned in to two equal groups namely, plyometric resistance exercises training group (PRETG) (n=15) and control group (CG) (n=15). The dependent metabolic syndrome risk factors such as, Waist Circumference (cm), Blood Glucose (mg/dL), Triglyceride (TG, mg/dL), HDL-C (mg/dL), LDL-C (mg/dL) and Total Cholesterol (mg/dL) were selected for this study and the unit of measurement in cm, mg/dL, TG, mg/dL, mg/dL, mg/dL and mg/dL respectively. All the subjects were tested prior to and immediately after the experimental period on the selected dependent variable. The experimental groups underwent respective training period for five days per week for of twelve weeks. The control group was not given any sort of training except their routine. All subjects were tested on selected criterion variables. The collected data from the factors were statistically analysed with 't' test to find out the significant improvement between pre and post test. In all cases the criterion for statistical significance was set at 0.05 level of confidence ($P < 0.05$). The result of the study indicates that the difference exist on Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol of obese female college students due to the influence of 12 weeks of plyometric resistance exercises training.

1. Introduction

Plyometric training (PT) is a category of explosive body weight resistance exercises which focuses on exploiting the additional force output of the stretch reflex of a muscle to increase speed and power. A period of rapid concentric contraction in the muscle after a rapid eccentric lengthening of the muscle fiber under load enhances the force generated by the muscle (Khelifa, 2010). PT is explosive in nature, therefore accurate measurement of performance is vital to detect significant worthwhile changes. It is measured in a number of ways. Most commonly, force plate measures (contact time, ground reaction forces, take-off velocity) and electromyography to evaluate muscle activation patterns, are used to assess performance with plyometric exercise. Relative measures such as reactive strength indices are also used when other methods are not possible, too expensive or impractical (Garcia, 2011).

The metabolic syndrome is defined by different criteria by several organizations including the World Health Organization, the European Group for Study of Insulin Resistance, the ATP III, the American Association of Clinical Endocrinologists, the International Diabetes Foundation, and the recent American Heart Association (AHA) and National Heart, Lung, Blood Institute update of the ATP III criteria. The various definitions exist because of differing opinions on the thresholds that should be used for specific criteria, such as blood pressure or fasting glucose levels. In addition, there is a lack of consensus on which components are fundamentally necessary and most clinically relevant for diagnosis. All of the definitions nonetheless include a measure of central obesity, glucose level, dyslipidemia, and hypertension. The focus of management is to achieve a normal level for each of the clinical and laboratory components that constitute the definition. Because the normal thresholds for some of the components vary by gender, and within each component there are gender-specific issues, the clinician

must consider these issues in order to successfully prevent or manage the syndrome in women (Alberti et al., 2005).

2. Methodology

The purpose of the study was to find out the influence of plyometric resistance exercises on metabolic syndrome risk factors in obese female college students. To achieve the purpose of the study, thirty female students were selected from various departments of Bharathidasan University, Tiruchirappalli, Tamilnadu. The age of the subjects were ranged between 18 to 21 years. The subjects were randomly assigned in to two equal groups namely, plyometric resistance exercises training group (PRETG) (n=15) and control group (CG) (n=15). The dependent metabolic syndrome risk factors such as, Waist Circumference (cm), Blood Glucose (mg/dL), Triglyceride (TG, mg/dL), HDL-C (mg/dL), LDL-C (mg/dL) and Total Cholesterol (mg/dL) were selected for this study and the unit of measurement in cm, mg/dL, TG, mg/dL, mg/dL, mg/dL and mg/dL respectively. All the subjects were tested prior to and immediately after the experimental period on the selected dependent variable. A pilot study was conducted to assess the initial capacity of the subjects in order to fix the load. The experimental groups underwent respective training period for five days per week for of twelve weeks. The control group was not given any sort of training except their routine. All subjects were tested on selected criterion variables. The collected data from the factors were statistically analysed with 'f' test to find out the significant improvement between pre and post test. In all cases the criterion for statistical significance was set at 0.05 level of confidence ($P < 0.05$). The mean values of metabolic syndrome risk factors were shown in table 1.

3. Results

The results were presented in the following tables.

Table - I: Computation of 'F' Test on Metabolic Syndrome Risk Factors of Experimental Group and Control Group

Variable	Group	Pre Test	Post Test	F-value
Waist Circumference (cm)	Ex. Gr	83.80±8.14	77.33±8.36*	G×P: 13.951#
	Con. Gr	77.90±9.54	78.88±10.08	
Blood Glucose (mg/dL)	Ex. Gr	94.00±22.38	91.60±3.78	G×P: 0.819
	Con. Gr	85.90±6.90	90.40±8.14	
Triglyceride (TG, mg/dL)	Ex. Gr	100.40±48.08	74.30±29.87*	G×P: 8.120#
	Con. Gr	69.70±41.90	75.60±36.62	
HDL-C (mg/dL)	Ex. Gr	68.50±16.28	67.70±10.35	G×P: 0.330
	Con. Gr	76.20±12.56	77.60±11.42	
LDL-C (mg/dL)	Ex. Gr	111.70±23.62	106.10±21.99	G×P: 0.479
	Con. Gr	109.60±31.61	109.10±26.22	
Total Cholesterol (mg/dL)	Ex. Gr	200.60±29.26	184.20±23.24*	G×P: 2.180
	Con. Gr	199.80±39.16	196.90±26.24	

HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; G×P, group×period.

* $P < 0.05$, significantly different from pretest. # $P < 0.05$, significantly interaction among group and period.

4. Change in Metabolic Syndrome Risk Factors

Metabolic syndrome risk factors before and after plyometric resistance exercises program are shown in Table 1. In the plyometric resistance exercises training group, waist circumference ($F=13.951$, $P < 0.05$), and TG ($F=8.120$, $P < 0.05$) were decreased significantly over time and between groups. But blood glucose ($F=0.819$, $P=0.741$), HDL-C ($F=0.330$, $P=0.806$), and LDL-C ($F=0.479$, $P=0.307$) showed no relative influences between groups or over time. Although TC did not show significant effect between groups, plyometric resistance exercises for 12 weeks significantly decreased TC concentration over time. The pre

and post test mean values of experimental and control groups on Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol are graphically represented in the figure I and II.

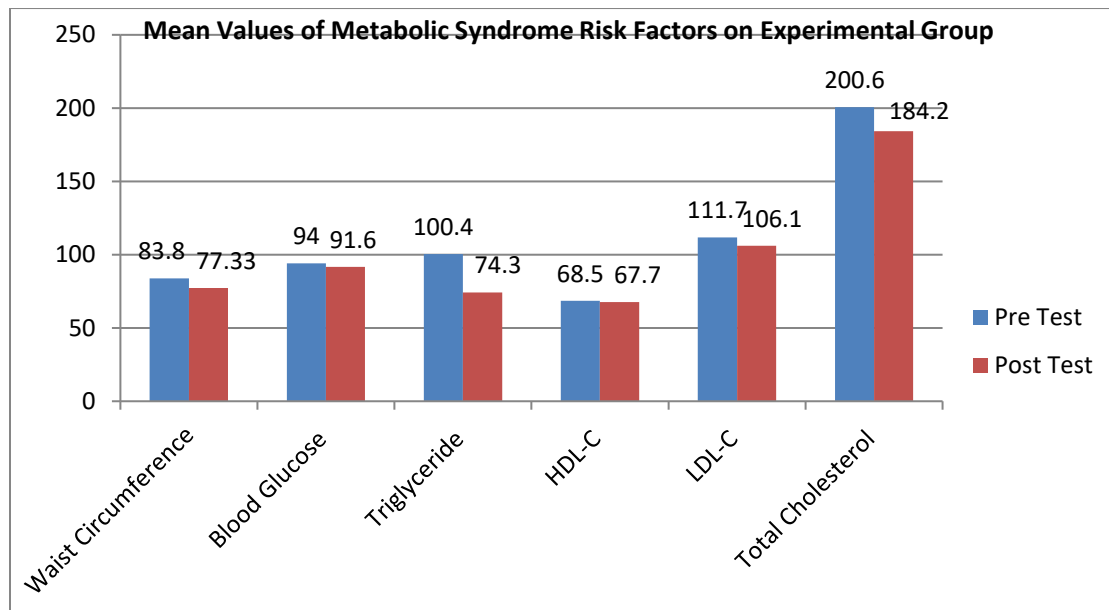


Figure I: Pre and Post Test Mean Values of Experimental Group on Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol

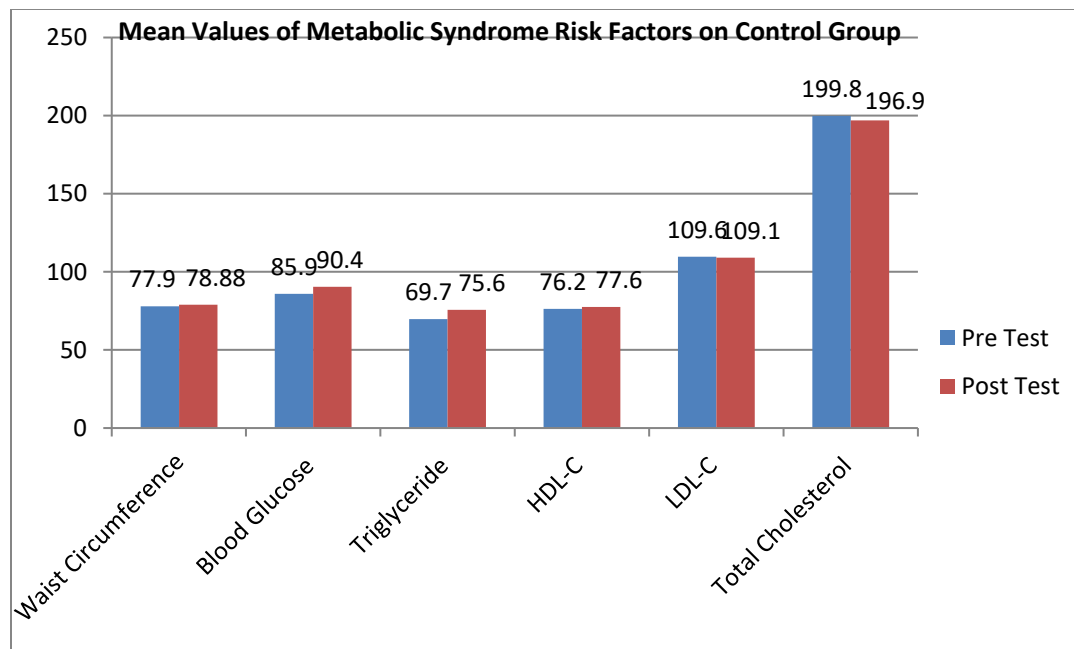


Figure II: Pre and Post Test Mean Values of Control Group on Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol

5. Discussion on Findings

The result of the study indicated that the differences in waist circumference, blood glucose, triglyceride, HDL-C, LDL-C and total cholesterol between the groups were not due to the change but were the direct influence of plyometric resistance exercises training. The effectiveness of plyometric resistance exercises training enhancing health and fitness development has been documented in various fields. The findings of the present study had similarity with the findings of Hewett, (1996), Garcia, (2011) and Cadore, (2013).

6. Conclusions and Future Scope

There was a significant improvement takes place on selected plyometric resistance exercises training improved the metabolic syndrome risk factors such as Waist Circumference, Blood Glucose, Triglyceride, HDL-C, LDL-C and Total Cholesterol of obese female college students. There were no relative effects on control groups. Adopting innovative training methods and coaching can contribute to the obese growth, further refining players skills and promoting the sports.

References

1. Alberti KG, et. al., (2005). The Metabolic Syndrome: A New Worldwide Definition. *Lancet*;366: pp.1059–1062.
2. Al Rashdan I, Al Nesef Y. (2010). Prevalence of Overweight, Obesity and Metabolic Syndrome among Adult Kuwaitis: Results from Community-Based National Survey, *Angiology*, 61(1): pp.42-8.
3. Al-Sarraj T, Saadi H, Volek JS, Fernandez ML. (2010). Metabolic Syndrome Prevalence, Dietary Intake and Cardiovascular Risk Profile among Overweight and Obese Adults 18-50 Years Old from the United Arab Emirates, *Metab Syndr Relat Disord*, 8(1): pp.39-46.
4. Cadore EL, Pinheiro E, Izquierdo M, Correa CS, Radaelli R, Martins JB, Lhullier FL, Laitano O, Cardoso M, Pinto RS. (2013). Neuromuscular, Hormonal, and Metabolic Responses to Different Plyometric Training Volumes in Rugby Players. *J Strength Cond Res* 27: pp.3001–3010.
5. Cha E, Burke LE, Kim KH, Shin YA, Kim HY (2010). Prevalence of the Metabolic Syndrome among Overweight and Obese College Students in Korea, *J Cardiovasc Nurs*, 25(1): pp.61-68.
6. Fernandes J, Lofgren IE. (2011). Prevalence of Metabolic Syndrome and Individual Criteria in College Students, *J Am Coll Health*, 59(4):pp.313-21.
7. Garcia-Masso X, Colado JC, Gonzalez LM, Salva P, Alves J, Tella V, Triplett NT. (2011). Myoelectric Activation and Kinetics of Different Plyometric Push-Up Exercises. *J Strength Cond Res* 25: pp.2040–2047.
8. Hewett TE, Stroupe AL, Nance TA, Noyes FR. (1996). Plyometric Training in Female Athletes. Decreased Impact Forces and Increased Hamstring Torques. *Am J Sports Med* 24: pp.765–773.
9. Kamadjeu RM, Edwards R, Atanga JS, Kiawi EC, Unwin N, Mbanya JC. (2006). Anthropometry Measures and Prevalence of Obesity in the Urban Adult Population of Cameroon: an Update from the Cameroon Burden of Diabetes Baseline Survey, *BMC Public Health*, 13;6:pp.228.
10. Kelishadi R, Gharipour M, Sadri GH, Tavasoli AA, Amani A. (2008). Cardiovascular Disease Risk Factors, Metabolic Syndrome and Obesity in an Iranian Population, *East Mediterr Health J*, 14(5): pp.1070-1079.
11. Khelifa R, Aouadi R, Hermassi S, Chelly MS, Jlid MC, Hbacha H, Castagna C. (2010). Effects of a plyometric training program with and without added load on jumping ability in basketball players. *J Strength Cond Res* 24: pp.2955–2961.
12. Lin JD, Chiou WK, Weng HF, Fang JT, Liu TH. (2004). Application of Three-Dimensional Body Scanner: Observation of Prevalence of Metabolic Syndrome, *Clin Nutr*, 23(6):1313-23.
13. Mahaboobjan A. (2015). A Review of Yogic Practices for Leading Risk Factors of Chronic Diseases, *International Journal of Multidisciplinary Research Review*, Vol-1, Issue No.10, pp.184-186.
14. Mahaboobjan A. (2016). Effect of Yogic Techniques on the Glycaemic Level: A Pilot, Randomized and Comparative Study between the Walking and Yoga in Adult Female with the

- Type 2 Diabetes Mellitus, *International Journal of Multidisciplinary Research and Modern Education*, Volume II, Issue II, pp.138-142.
15. Mahaboobjan A. (2017). Different Packages of Yogic Practices on Triglycerides among Diabetic Patients, Impact of Two National Seminar on Road Map to 2020 Olympics Organised by SRMV Maruthi College of Physical Education” ISBN: 978-81-923573-4-8, pp.124-130.
 16. Mahaboobjan A. (2017). Impact of Two Different Packages of Yogic Practices on High Density Lipoprotein among Diabetic Patients, World Yoga Conference – 2017 Organized by Tamil University, pp.146-152.
 17. Misra KB, Endemann SW, Ayer M. (2006). Measures of Obesity and Metabolic Syndrome in Indian Americans in Northern California, *Ethn Dis*, 16(2):pp.331-337.
 18. Morrell JS, Lofgren IE, Burke JD, Reilly RA., (2012). Metabolic Syndrome, Obesity and Related Risk Factors among College Men and Women, *J Am Coll Health*, 60(1): pp.82-89.
 19. Oğuz A, Temizhan A, Abaci A, Kozan O, Erol C, Ongen Z, Celik S. (2008). Obesity and Abdominal Obesity; An Alarming Challenge for Cardio-Metabolic Risk in Turkish Adults, *Anadolu Kardiyol Derg*, 8(6): pp. 401-406.
 20. Rosenbaum P, Gimeno SG, Sanudo A, Franco LJ, Ferreira SR; (2005). Analysis of Criteria for Metabolic Syndrome in a Population-Based Study of Japanese-Brazilians, Japanese-Brazilian Diabetes Study Group. *Diabetes Obes Metab*, 7(4): pp.352-359.
 21. Kamadjeu RM, Edwards R, Atanga JS, Kiawi EC, Unwin N, Mbanya JC. (2006). Anthropometry Measures and Prevalence of Obesity in the Urban Adult Population of Cameroon: an Update from the Cameroon Burden of Diabetes Baseline Survey, *BMC Public Health*, 13;6:pp.228.
 22. Shah SM, Nanan D, Rahbar MH, Rahim M, Nowshad G. (2004). Assessing Obesity and Overweight in a High Mountain Pakistani Population, *Trop Med Int Health*. 2004 Apr;9(4): pp.526-532.
 23. Perichart-Perera O, Balas-Nakash M, Schiffman-Selechnik E, Barbato-Dosal A, Vadillo-Ortega F. (2007). Obesity Increases Metabolic Syndrome Risk Factors in School-Aged Children from an Urban School in Mexico City, *J Am Diet Assoc*, 107(1): pp.81-91.
 24. Al-Qahtani DA, Imtiaz ML. (2005). Prevalence of Metabolic Syndrome in Saudi Adult Soldiers, *Saudi Med J*, 26(9): pp.1360-1366.
 25. Gupta R, Gupta VP, Bhagat N, Rastogi P, Sarna M, Prakash H, Deedwania PC. (2008). Obesity is Major Determinant of Coronary Risk Factors in India: Jaipur Heart Watch Studies, *Indian Heart J*. 60(1): pp.26-33.