Advances in Consumer Research
https://acr-journal.com/
Volume-3 | Issue-2 | Feb 2026
Original Researcher Article

A Study Exploring How Bodyweight Exercises Influences Total Cholesterol Levels Among Overweight Female Teacher Trainees

Suma Joseph[1], Nidhu Neena Varghese[2], Thushara Philip[3], Anjaly Scaria4,Drisya S[5], A. Sankar Reddy[6], Seema Kaushik Sharma[7] , Chinsu Joy[8], George Abraham[9]
[1]Professor & Principal, Mount Carmel College of Teacher Education for Women, Kottayam, Mahatma Gandhi University, Kerala, India.
[2]Assistant Professor, M.Ed. Department, Mount Carmel College of Teacher Education for Women, Kottayam, Mahatma Gandhi University, Kerala, India.
[3]Assistant Professor of Physical Education, St. Joseph College, Irinjalakuda, Calicut University, Kerala, India.
4HSST of Physics, St. George Higher Secondary School, Muttar, Alappuzha, Kerala, India.
[5]PhD Research Scholar, School of Physical Education and Sports Sciences, Mahatma Gandhi University, Kottayam, Kerala, India.
[6]Senior Lecturer, Rayalseema College of Physical Education, Kadapa, Andhra Pradesh, India.
[7]Professor, Physical Education, Lakshmibai College, University of Delhi, India.
[8]Assistant Professor, Department of English, Hindustan Institute of Technology & Science, Padur, Tamil Nadu, India.
[9]Professor, YMCA College of Physical Education, Chennai, Tamil Nadu, India

ABSTRACT
A physically inactive lifestyle is associated with an increased risk of obesity, total cholesterol and metabolic disorders, especially in over weight women. While bodyweight exercise methods have been extensively studied in male populations, the physiologi cal and metabolic effects of own bodyweight exercise (BWE) in overweight women are understudied. The purpose of this study was to find out the impacts of own bodyweight exercise on total cholesterol level among overweight female teacher trainees. For this purpose forty (n = 40) female B.Ed students were selected as subjects and their age group ranged between 21 and 28 years (mean age: 24.64 ± 3.13 years, mean BMI: 28.28 ± 2.41 kg/m2). They were divided two equal groups, each group consisted of twenty (n = 20) subjects. The group I underwent body weight exercise (BEG) with moderate intensity, and group II acted as control (CG) and they did not give any special training apart from their curriculam. The training period for this study was three days in a week for twelve weeks. Total cholesterol was selected as a criterion variable of this study and measured by oxides enzymatic method using the Boechringer Mannheim kit. The analysis of covariance (ANCOVA) was applied as a statistical tool. In all cases 0.05 lev el of confidence was fixed to test the significance, which was considered as an appropriate. It was concluded from the results of the study that there was a significant improvement ($p \leq 0.05$) of the bodyweight exercise group as compared to control group. The total cholesterol of overweight yound women can reduse due to twelve weeks of own bodyweight exercises. Given its efficacy, body weight exercise (BWE) could be a valuable strategy for treating high cholesterol level and reducing the risks of physically inactive behavior. Future research should focus on long-term adaptations and individual variability in cholesterol level to optimize BWE programs for broader populations. According to the results, it can be indicated that 12 weeks of bodyweight exercises have improved total cholesterol levels in inactive overweight female teacher trainees..
Keywords: Bodyweight exercise, teacher trainees, moderate intensity, total cholesterol

INTRODUCTION:

Bodyweight exercise use against gravity as resistance to construct strength, endurance, and flexibility, requiring no external weights or gymnasium system, making them particularly on hand for workouts everywhere, each time, with examples inclusive of squats, push-ups, lunges, and planks. Those physical activities paintings a couple of muscle businesses simultaneously (compound moves), enhancing overall fitness, coordination, and balance whilst being effortlessly adaptable for any fitness degree, from amateur to superior (www. google.com /seek?q =what+is+frame+ weight+ sporting events). A physically inactive way of life characterised by means of prolonged physical state of being inactive is a primary risk factor for several metabolic and cardiovascular illnesses, along with obesity and dyslipidemia. This way of life negatively affects physiological functions through lowering cardiovascular efficiency, impairing metabolic fitness and increasing the risk of chronic illnesses. therefore, based exercise interventions which include body weight physical activities (BWE) have received attention due to their capacity advantages in combating these bad effects, specially in bodily inactive populations (Bull *et al*, 2020 and Abraham, 2010).

Body weight training may be changed besed at the fitness degree. We had been born to move, and mobility and stability are an vital part of the way we flow and lifestyles

in fashionable, bodyweight exercising may have many wonderful outcomes to your body and even in lipid profile. The moves worried in body weight sporting activities can help to boom that mobility and project the body's 'stabilisers' by means of using entire movements (Panackal *et al*., 2012). These days, absolutely everyone is time-negative, so finding quick, powerful exercises is vital, bodyweight exercises do not require a dedicated fitness center, so you can in shape in a workout every time you have got a few spare time, anywhere you are. body weight workout routines additionally allow to combine aerobic and resistance training and which cn do within the most green manner. It is completely viable to construct muscle without weights with studies assisting the efficacy of body weight sports. Bodyweight sports are a form of resistance education, consequently they can stimulate the muscle groups to conform, get robust and grow (counts *et al*, 2016).

It is miles entirely feasible to build muscle with out weights with numerous research helping the efficacy of body weight exercises (Asaithambi *et al*., 2012). Bodyweight sporting activities are a shape of resistance training, consequently they can stimulate the muscle groups to conform, get robust and grow. Muscle boom 'can occur impartial of an external load', studies published in Physiology & Behaviour concluded, as long as you perform body weight sporting events through their complete variety of movement. (Counts *et al*, 2016).

The importance of BWE packages for sedentary ladies stems from several key elements. First, this form of training affords an efficient and on hand method for improving physical health in people with low degrees of physical activity. Via combining slight intensity efforts with relaxation durations, BWE allows for cardiovascular conditioning and the improvement of muscular power whilst preserving metabolic performance. Secondly, BWE has been associated with stepped forward fats metabolism, fats oxidation and body composition, making it a potential approach to lessen the chance of weight problems and metabolic syndrome. Further, BWE can enhance exercising participation and motivation because of its time performance, for this reason getting rid of common boundaries to bodily interest (Gibala *et al*, 2019). Notwithstanding the growing frame of studies demonstrating the effectiveness of BWE, maximum studies have focused often on male participants, leaving a gap in know-how the effects on women. Given the physiological variations in metabolic and cardiovascular responses between the sexes, investigating the results of BWE in physically inactive women is important for the improvement of targeted training protocols.

A trainee teacher (or student instructor/instructor intern) is someone actively gaining knowledge of to end up a certified educator, enrolled in a proper application (like a B.Ed.) who profits hands-on enjoy with the aid of teaching in real lecture rooms beneath mentor supervision, applying idea, developing abilities, and working toward complete certification. They're no longer but fully certified however are completing supervised practicals (practicum/scholar teaching) whilst gaining knowledge of study room control, pedagogy, and problem content material. (www. google.com /search?q= trainer+ trainees+ that means). "Obese female trainer trainees" refers to aspiring lady educators whose body Mass Index (BMI) suggests they bring about excess frame weight, a focal point of research exploring their health, capability societal roles, and challenges in training, regularly evaluating them to common-weight peers and inspecting elements like pressure, diet, and sedentary habits impacting their weight status (www.google. com/search ?q=over+ weight+woman+ instructor+trainees).

Overall ldl cholesterol is a blood check measuring all cholesterol on your blood, summing up LDL ("bad"), HDL ("properly"), and a fragment of triglycerides, indicating your risk for coronary heart ailment; healthy degrees are normally under 2 hundred mg/dL, with stages varying by using individual danger elements, and it's critical for assessing cardiovascular fitness (www.google.com/seek q=total+cholesterol). Cholesterol is a fatty substance (a lipid) this is an critical part of the outer lining (membrane) of cells in the frame of animals (Emma, 2009). cholesterol is also located in the blood circulate of human beings. The ldl cholesterol in a person's blood originates from two predominant resources, nutritional consumption and liver manufacturing. dietary ldl cholesterol comes mainly from meat, poultry, fish, and dairy merchandise. Organ meats, together with liver, are specifically excessive in cholesterol content, even as ingredients of plant origin incorporate no ldl cholesterol (ACSM, 2000). After a meal, cholesterol is absorbed with the aid of the intestines into the blood movement and is then packaged internal a protein coat. This ldl cholesterol-protein coat complex is referred to as a chylomicron (Olson, 1998). The liver is able to eliminating cholesterol from the blood stream as well as production cholesterol and secreting cholesterol into the blood stream. After a meal, the liver removes chylomicrons from blood flow. In among food, the liver manufactures and secretes ldl cholesterol back into the blood circulation (Tymoczko, 2002). it is a waxy fat like substance that is important for everyday frame functioning (American heart association, 2008).

Cholesterol is used for the functions and the production of hormones. The liver is the foremost production factory for ldl cholesterol (about 70%). Diets high in saturated fats, extensively growth the quantity of ldl cholesterol within the blood circulation (wood *et al*., 1977). endorsed day by day consumption of fat ought to now not exceed 30% of energy, with a maximum of 10% being from saturated fat (Martin *et al*., 1977). Extended general cholesterol is a risk thing for coronary heart sickness. The build-up of plaque within the artery might also cause narrowing (excessive blood stress) or whole blockage (heart attack) of the vessel. As stages rise above 180 mg/dl, the risk for growing coronary heart sickness increases (Superko, 1991). high overall ldl cholesterol ends in plaque buildup (atherosclerosis) in arteries, narrowing them and restricting blood go with the flow, which considerably will increase the threat of significant activities like heart assaults, strokes, and peripheral artery ailment (PAD), often with out signs until a primary event occurs.excessive ldl cholesterol can be inherited. Meaning it may skip from parents to youngsters through genes. But high ldl cholesterol regularly is the end result of lifestyle

alternatives which include not getting sufficient exercise, not eating a balanced food regimen or ingesting big amounts of saturated fat.

The prevailing observe targets to research the physiological and metabolic diversifications on account of an 12-week BWE application in ladies teacher trainees with a particular cognizance on overall ldl cholesterol. The have a look at will explore 12 weeks physiological responses to evaluate the efficacy of BWE as a resistance training method for enhancing metabolic fitness in physically inactive people (Abraham, 2014). Particularly, it is hypothesized that the BWE application will result in a reduction in total cholesterol degree and body weight, contributing to universal improvements in body metabolism. By addressing these hypotheses, this have a look at seeks to provide precious insights for sports science, exercise physiology, and public health, specially in optimizing body weight resistance training interventions for inactive populations.

Materials and Method

The study uses an experimental research design with a pre-test and post-test training group to investigate the total cholesterol induced by 12 weeks of moderate intensity bodyweight exercise (BWE) in women teacher trainees. The aim of this study was to find out the impacts of bodyweight exercisws on total cholesterol among female tracher trainees. For this purpose, forty (n = 40) female teacher trainees studying B.Ed degree from the three teacher training colleges of Chennai City, Tamil Nadu. Their age group ranged between 21 and 28 years, were selected as subjects. They were divided into two equal groups, each group consisted of twenty subjects, in which group I underwent bodyweight exercise and group II acted as control and they did not take part any special training apart from their daily activity.

The training sessions were performed three times a week (Tuesday, Thursday and Saturday) with moderate intensity and a progressive loading approach. The training period for this study was three days in a week for twelve weeks. Participants were required to attend at least 90% of the scheduled sessions (minimum 32 out of 36 sessions) to be considered compliant with the intervention protocol. If a session was missed due to illness or personal reasons, make-up sessions were offered when feasible. In this study, no participants missed more than two sessions, and all met the attendance criteria. Total cholesterol was selected as a criterion variable of this study and it was measured by oxides enzymatic method using the Boechringer Mannheim kit. Blood samples were measured 48 hours before and after the last session of the training protocol on the 12-hours fasting status. Five ml of blood was drawn from each subject's arm vein. The bodyweight exercises promoting muscular and cardiorespiratory endurance, continuous training aids in caloric expenditure, a key to proper weight maintenance. The data were collected two days before and after the training period.

Participants completed dynamic warm-up exercises before each session and cool-down exercises after training to improve flexibility and recovery. Warm-up (5–10 min): Light endurance training (marching on the spot, arm circles) + flexibility exercises. The duration of the main workout ranged from approximately 25–30 min per session, depending on the training phase and progressive adjustments in volume and intensity. **There are the programme prescribed as bodtweight exercises including lower body& core, uppar body & cardio and full body & felexibility: Chair squats, Glute Bridges, Leg raises, Knee planks, Bird-dog, Wall Push-Ups, Doorway rows, walking jacks, Stair climbing, and Modified Burpees.** Cool down (5–10 min): Static stretching and breathing exercises to promote recovery.

The revised BWE program has been designed to be safe, progressive and engaging for women, focusing on full body muscle activation, taking into account the fitness level of participants. Mean and standard deviation were calculated total cholesterol for each group. And the data were analyzed by using analysis of covariance (ANCOVA) as statistical tool and the significance was set to priority at 0.05 levels.

Results

Table - I

Analysis of Covariance on Total Cholesterol of Bodyweight Exercise Group and Control Group

	BEG	CG	SOV	SS	df	MS	*F*
Pre-test Mean S.D.	229.26 10.37	223.1 10.53	BW	231.82 6022.6	1 38	14.26 153.5	1.06
Post-test Mean S.D.	207.46 9.27	226.51 11.86	BW	3518.58 3759.14	1 38	1693.03 89.32	12.61*
Adjusted Post-test Mean	206.2	224.72	BW	3271.85 3702.83	1 37	1714.8 87.17	16.92*

*Significant F = (df 1, 38) (0.05) = 4.10; ($P \leq 0.05$) F = (df 1, 37) (0.05) = 4.11; ($P \leq 0.05$)

The table I shows that the pre test mean values on total cholesterol for the bodyweight exercise group and control group are 229.26 and 223.1 respectively. And the obtained 'F' ratio of 1.06 for pre test which was lower than the required table value 4.10 with df 2 and 38 at 0.05 level of confidence on total cholesterol. The post test mean values on total cholesterol for the bodyweight exercise group and control group are 206.2 and 224.72 respectively. And the obtained 'F' ratio of 12.61 for post test which was higher than the required table value 4.10 with df 2 and 37 at 0.05 level of confidence on total cholesterol. The adjusted post test mean values on total cholesterol for the bodyweight exercise group and the control group are 206.2 and 224.72 respectively. The obtained 'F' ratio of 16.92 for adjusted post test which was higher than the required table value 4.11 with df 2 and 41 for significance at the 0.05 level of confidence on total cholesterol. The pre, post and adjusted post test mean value on total cholesterol of the bodyweight exercise group and the control group were graphically represented in figure 1& 2.

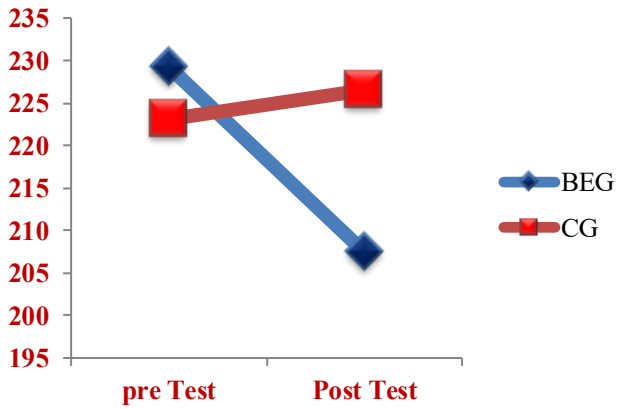

Figure 1: The pre and post test mean values of experimental (BEG) group and control group (CG) on Total Cholesterol

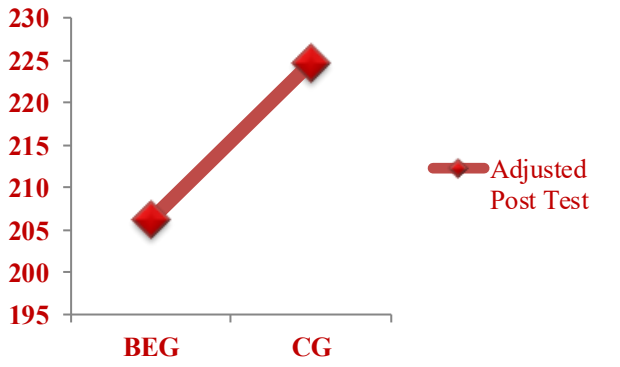

Figure 2: The improvement of the mean values of experimental group (BEG) on Total Cholesterol

DISCUSSION

The purpose of this study was to find out the impact bodyweight exercise on total cholesterol among over weight female tracher trainees. This study result revelas that there was a significant improvement in total cholesterol due to 12 weeks of bodyweight exercises. Physical activity is an important determinant of energy expenditure and regular exercise is essential for weight control and weight loss. The awareness about complications of obesity and the significance of exercise in reduction of cholesterol levels are becoming popular amongst people that are obvious with increase in the number of people walking for health, moving towards gyms and various physical activities. Systematic regular physical activities get beneficial effects to cholesterol level (Farrell & Barboriak, 1980 and Santiago *et al*., 1987).

The response of the lipid profile to an exercise session or training program is dependent on the type of exercise undertaken, its intensity and frequency, the duration of each session, and the time spent on such a program (Cox *et al*., 2001 and Abraham, 2011). Conflicting results exist suggesting one form of exercise as superior to another. No previous studies have attempted to find out the impact of bodyweight exercises on total cholesterol among female over wight teacher trainees. Whyte et al. (2010) and Thomas et al. (1984) pointed that interval training improves the plasma cholesterol level. Rad and Gholami (2010) found out that there was a significant improvement on lipoprotein level of female overweight women due to systematic exercise training programme.

Few Studies have observed a decrease in total cholesterol after six months of higher but not lower intensity exercise (Sillanpaa, 2009; Ashokan & Abraham, 2015 and Panackai & Abraham, 2015). Many studies reported that bodyweight training helps to normalize the level of total cholesterol, Larry *et al*. (2001) showed that short term interval exercise is beneficial for cholesterol. Endurance training increased HDL-C and decreased LDL-C. (Raz *et al*., 1985 and Thomas *et al*, 1985). A systematic training is very useful to normalize the plasma cholesterol (Kuno *et al*., 2012 and Durstine & Haskell, 1994). From this study we can say the bodyweight exercise is very useful to reduce the level of total cholesterol in overwight young female teacher trainees.

The present study results is showed that there ia a significant change in total cholesterol. One factor that could possibly justify the change of this parameter in the present study is the female subjects. It has been shown that changes in lipoprotein levels are usually less responsive to exercise in women than in men, partly due to lower cholesterol levels in women compared to men (Yektayer *et al*., 2011). The limitations of this study were lack of positive food intake, lack of nutritional status control, and lack of exposure to sunlight. Future studies should be carried out in a longitudinal fashion, taking into account the amount of sun exposure, nutrition status, and calorie intake of subjects.

CONCLUSION

As health and fitness practitioners, designing exercise programs that alter the individual's total cholesterol in a positive way is an important component to be included in program objectives. Physical exercise is the performance of any activity to develop or maintain physical fitness and

overall health. Prevailing evidence supports the concept that physical activity can help slow the progression of coronary heart disease (CHD). In summary, total cholesterol can be improved during the age between 21 and 28 years of female overweight teacher trainees and favour the prescription of bodyweight exercise. The result of the study indicated that there was a significant improvement on total cholesterol due to twelve weeks of bodyweight exercise as compared to control group.

The findings of this study indicate that the exercise induces significant improvements in total cholesterol in physically inactive women with overweight. The results demonstrated a notable reduction in body weight percentage also even it was not taken as a criterion variable, as well as positive alterations in lipid profiles, including a decrease in total cholesterol. These findings suggest that BWE is an effective and time-efficient training modality for improving lipoprotein level especially for total cholesterol in physically inactive populations.

Practical Implications

The findings of this study highlight the potential of bod yweight exercise (BWE) as a time-efficient and accessible exercise strategy for improving total cholesterol level in sedentary women especially below 30 age. The BWE can be incorporated into clinical exercise prescriptions for managing obesity and metabolic disorders. Healthcare professionals may recommend BWE as a non-pharmacological intervention to reduce cardiovascular risk, while fitness trainers can implement structured BWE programs to enhance fat loss and functional strength in clients with limited access to gym facilities. Additionally, public health initiatives could integrate BWE into community-based programs to promote physical activity and metabolic health in inactive populations. Future research should focus on optimizing BWE protocols for different age groups and fitness levels to enhance its real world applicability.

Funding support

The author (s) declare that no financial support was received for the research and/or publication of this article.

Conflict of Inerest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest..

.

REFERENCES

1. Abraham, G. (2011). Effect of isotonic and isometric training on strength and power parameters, Indian journal of yoga exercise & sports science and physical education, 5 (1 & 2), 42-47.
2. Al-Mhanna, S. B., Franklin, B. A., Jakicic, J. M., Stamatakis, E., Pescatello, L. S., & Riebe D. (2025). Impact of resistance training on cardiometabolic health-related indices in patients with type 2 diabetes and overweight/obesity: a systematic review and meta-analysis of randomised controlled trials. Br J Sports Med, 59, 733–46. doi: 10.1136/bjsports-2024-108947, PMID.
3. American college of sports medicine. (2000). ASCM's guidelines for exercise testing and prescription. (6th Ed), Baltimore: Lippincott, Williame & Wilkine.
4. American Heart Association. (2008). Cholesterol", http://www.americanheart.org.
5. Asaithambi, K., A. G Venkatesan., &, George Abraham. (2012). Influence of resistance training and plyometric training on explosive power among university student, International Journal of Physical Education, Sports and Yogic Sciences, 1 (4), 49-51.
6. Ashokan, K., &, G Abraham. (2015). Influence of different intensity aerobic dance on bmi among young boys, International Journals of Multidisciplinary Research Academy, 5 (10), 591-598.
7. Batrakoulis, A., & Fatouros, I.G. (2022). Psychological adaptations to high-intensity interval training in overweight and obese adults: a topical review. Sports,10, 64. doi: 10.3390/sports10050064, PMID:
8. Batrakoulis, A., Jamurtas, A.Z., Draganidis, D., Georgakouli, K., Tsimeas, P., & Poulios., A. (2021). Hybrid neuromuscular training improves cardiometabolic health and alters redox status in inactive overweight and obese women: A randomized controlled trial. Antioxidants, 10, 1601. doi: 10.3390/antiox10101601, PMID.
9. Brittany, R. Counts., Samuel, L. Buckner., Scott, J. Dankel. , Matthew, B. Jessee ., Kevin, T. Mattocks., J. Grant Mouser ., Gilberto, C. Laurentino ., Jeremy., & P Loenneke. (2016). The acute and chronic effects of "NO LOAD" resistance training, Physiol Behav,1, 164 (Pt A):345-52.
10. Bull, F.C., Al-Ansari, S.S., Biddle, S., Borodulin, K., Buman, M.P., & Cardon, G. (2020). World Health Organization guidelines on physical activity and sedentary behaviour. Br J Sports Med, 54,1451–62. doi: 10.1136/bjsports-2020-102955, PMID.
11. Cox, K. L., Burke, V., Morton, A. R., Gillam, H. F., Beilin, L. J., Puddey, I. B. (2001). Long term effects of exercise on blood pressure and lipids in healthy women aged 40-65years:the sedentary women adherence trial (SWEAT). J Hypertens, 19, 1733–43. doi: 10.1097/00004872-200110000-00006.
12. Durstine, J. L., & Haskell, W. L. (1994) Effects of exercise training on plasma lipids and lipoproteins. Exer Sport Sci Rev. 22. pp. 477-521.
13. Emma Leah. (2009) "Cholesterol". Lipidomics Gateway. www.lipidmaps.org
14. Emre Yamaner., Tuna Turğut., Ayşe Aksoy., Burhan Demirkıran., Mine Akkuş Uçar., Burhan Başoğlu., Furkan Çamiçi., Muhammed Said Yanar., Alpay Bülbül., Ahmet Ferdi Koç., Tülay Ceylan., Levent Ceylan., & Hamza Küçük. (2025). Impact of an 8-week high-intensity bodyweight interval training on body composition and blood lipid metabolism in young women with overweight. Frontiers in public health, 17, 13, 1578569. doi: 10.3389/fpubh.2025.1578569
15. Farrell, P., & Barboriak, J. (1980) The time course

of alterations in plasma lipid and lipoprotein concentrations during eight weeks of endurance training. Atherosclerosis. 37. pp. 231-8.
16. George Abraham. (2014). Impact of moderate velocity resistance training on explosive strength among adolescents, International Journal of Fitness, Health, Physical Education & Iron Games1 (1), 268-270.
17. George, A. (2010). Analysis of anthropometry, body composition and performance variables of young Indian athletes in southern region, Indian journal of science and technology, 3 (12), 39-42.
18. Gibala, M. (2009). Molecular responses to high-intensity interval exercise. Applied Physiology, Nutrition, and Metabolism. 34. pp. 428- 432.
19. Gibala, M.J., Bostad, W., & McCarthy. (2019). D.G. Physiological adaptations to interval training to promote endurance. Curr Opin Physiol, 10, 180–4. doi: 10.1016/j.cophys.2019.05.010
20. Gosselin, L. E., Kozlowski, K. F., Devinney-Boymel, L., & Hambridge, C. (2011) Metabolic response of different high intensity aerobic interval exercise protocols. Journal of Strength and Conditioning Research.
21. https://www.google.com/search?q=over+weight+female+teacher+trainees+meaning&sca_esv=a75bef579f6fe821&rlz=1C1YTUH_enIN981IN982.
22. https://www.google.com/search?q=teacher+trainees+meaning&rlz=1C1YTUH_enIN981IN982&oq=teacher+trainees+&aqs=chrome.
23. https://www.google.com/search?q=total+cholesterol&rlz=1C1YTUH_enIN981IN982&oq=total+cholesterol&aqs=chrome.
24. https://www.google.com/search?q=what+is+body+weight+exercises&rlz=1C1YTUH_enIN981IN982&oq=what+is+body+weight+exercise.
25. https://www.menshealth.com/uk/building-muscle/a756325/10-best-bodyweight-exercises-for-men.
26. Kokkinos, P., Holland, J., & Narayan, P. (1995). Miles run per week and high-density lipoprotein cholesterol levels in healthy middleaged men: a dose-response relationship. Arch Intern Med. 155. pp. 415-20
27. Kuno Hottenrott., Sebastian Ludyga., & Stephan Schulze. (2012). Effects of high intensity training and continuous endurance training on aerobic capacity and body composition in recreationally active runners. Journal of Sports Science and Medicine. 11. pp. 483-488.
28. Larry Durstine. J., Peter, W. Grandjean., Paul, G. Davis., Michael, A. Ferguson.,Nathan, L. Alderson., & Katrina, D. DuBose1. (2001). Blood Lipid and Lipoprotein Adaptations to Exercise. Sports Med, 31 (15). pp. 1033-1062.
29. Martin, R., Haskell, W., & Wood, P. (1977) Blood chemistry and lipid profiles of elite distance runners. Ann N Y Acad Sci, 301. pp. 346-60.
30. Mojdeh Khajehlandi., & Robabeh Mohammadi. (2021). The Effect of Pilates Training on Body Composition, Lipid Profile, and Serum 25-Hydroxy Vitamin D Levels in Inactive Overweight Women, Zahedan Journal of Research in Medical Sciences, 23, 2, e100502.
31. Olson, R.E. (1998) "Discovery of the lipoproteins, their role in fat transport and their significance as risk factors". Journal of Nutrition, 128 (2). pp. 439S–443S.
32. Panackal, M. B., & George Abraham. (2015). Impact of different modes of circuit training on anaerobic power of adolescent boys, International journal of fitness, health, physical education and iron games, 2 (1), 66-70.
33. Panackal, M. B., T. Daniel., & George Abraham. (2012). Effects of different training methods on power output among school team players, International journal of advanced scientific and technical research, 2 (5), 56-63.
34. Rad, S., & Gholami, M. (2010). Impact of exercise training and/or diet on the lipoprotein–lipidprofiles in young overweight women. Br J Sport s Med, 44, i20.
35. Raz, I., Rosenblit, H., & Kark, J. (1988) Effect of moderate exercise on serum lipids in young men with low high density lipoprotein cholesterol. Arteriosclerosis. 8. pp. 245-51.
36. Santiago, M., Alexander, J., & Stull, G. (1987) Physiologic responses of sedentary women to a 20 week conditioning program of walking or jogging. Scand J Sports Sci, 9, pp.33-39.
37. Sillanpaa, E., Hakkinen, A., Punnone, K., & Laaksonen, D.E. (2009). Effects of strength and endurance training o metabolic risk factors in healthy 40-65 year old men. Scand J Med Sci Sports, 19, 885–95. doi: 10.1111/j.1600-0838.2008.00849.x.
38. Superko, H. (1991). Exercise training, serum lipids and lipoprotein particles: is there a change threshold?. Med Sci Sports Exerc, 23. pp. 677-85.
39. Thomas, T., Adeniran, S., & Etheridge, G. (1984). Effects of different running programs on VO2max , percent fat and plasma lipids. Can J Appl Sport Sci, 9. pp. 55-62.
40. Thomas, T., Adeniran, S., & Iltis, P. (1985) Effect of interval and continuous running on HDL-cholesterol, apoproteins A-I and B, and LCAT. Can J Appl Sport Sci, 10. pp. 52-59.
41. Tymoczko, John. L., Stryer Berg Tymoczko., Stryer Lubert., & Berg Jeremy Mark. (2002). Biochemistry. San Francisco, W.H. Freeman. pp. 726–727.
42. Whyte, L. J., Gill, J. M. R., & Cathcart, A.J. (2010). Effect of 2 weeks of sprint interval training on health-related outcomes in sedentary overweight/obese men. Metabolism Clinical and Experimental, 59. pp. 1421-1428.
43. Williams, P.T., Wood, P.D., Haskell, W.L., & Vranizan, K.M. (1982) The effects of running mileage and duration on plasma lipoprotein levels. JAMA, 247. pp. 2674-2679.
44. Wood, P., Haskell,W., & Stern, M. (1977). Plasma lipoprotein distributions in male and female runners. Ann N Y Acad Sci, 301. pp. 748-763.
45. Yektayar, M., Mohhamadi, S., Ahmadi, K., & Khodamoradpour, M. (2011). Effects of Three Different Modes of Exercise Training on Plasma Lipoprotein Profile in Healthy Men. J Med Sci Kordestan, 16, 26-36.
46. .

.