

Comparative Effects of Yoga, Aerobic Training, and Weight Training on Body Composition, Lipid Profiles, and Blood Variables in Healthy Adults: A 12-Week Randomized Controlled Trial

PARVEZ SHAMIM*

Department of Physical Education and Sports, Government Degree College, Badaun, Uttar Pradesh, India

Article Chronicle: Received: 10 Jun 2020; Revised: 25 Jul 2020; Accepted: 20 Aug 2020

ABSTRACT With the rise in lifestyle-related disorders such as obesity, cardiovascular diseases, and type 2 diabetes, physical inactivity has become a significant concern. Various forms of exercise, including aerobic training, resistance (weight) training, and yoga, have been shown to positively affect health markers such as body composition, lipid profiles, and blood variables. However, their comparative effects have not been extensively studied. This 12-week randomized controlled trial investigated the impact of yoga, aerobic training, and weight training on body composition, lipid profiles, and selected blood variables in healthy Indian adults aged 25–45. Eighty participants were randomly assigned to one of four groups: yoga, aerobic training, weight training, or a control group. Participants in the intervention groups engaged in structured exercise three times a week for 60 min, while the control group maintained their usual lifestyle. Pre- and post-intervention assessments measured body mass index (BMI), body fat percentage, lean body mass, cholesterol levels, and blood variables such as red blood cell and white blood cell counts. The results revealed significant improvements in all exercise groups compared to the control group. Aerobic training showed the most substantial reduction in body fat and cholesterol levels, while weight training led to the largest increase in lean body mass. Yoga improved lipid profiles, particularly by increasing high-density lipoprotein cholesterol, and showed moderate reductions in BMI. These findings suggest that while aerobic and resistance training offers robust improvements in body composition and lipid metabolism, yoga contributes additional benefits in stress reduction and cardiovascular health.

KEYWORDS Yoga, Aerobic Exercise, Weight Training, Body Composition, Lipid Profile, Blood

How to cite this article: Shamim, P. (2020-21) Comparative Effects of Yoga, Aerobic Training, and Weight Training on Body Composition, Lipid Profiles, and Blood Variables in Healthy Adults: A 12-Week Randomized Controlled Trial. *World J App Sci Res.* **10-11**, 15-20. (DOI: <https://doi.org/10.59467/WJASR.2020-21.10-11.15>)

INTRODUCTION

India has witnessed a significant rise in lifestyle-related disorders such as obesity, cardiovascular diseases, and type 2 diabetes due to urbanization, sedentary lifestyles, and dietary changes (Mohan *et al.*, 2012). Physical inactivity, particularly in urban settings, exacerbates these conditions, making it crucial to promote regular exercise for health maintenance. Indian traditional practices, such as yoga combined with modern exercise modalities, such as aerobic and resistance training, offer potential interventions to mitigate the adverse effects of sedentary living (Madhavi and Sharma, 2015).

Various forms of physical activity, such as aerobic exercise, resistance training, and mind-body practices, such as yoga, have been studied extensively for their health benefits. While each modality offers unique advantages, their comparative effects on body composition, lipid profiles, and blood variables remain a subject of ongoing research.

Aerobic Training

Aerobic exercises, including activities, such as running, cycling, and swimming, are well-known for their positive effects on cardiovascular health, fat metabolism, and overall fitness. Previous research has shown that aerobic

*Corresponding author: E-Mail: Parvez.shamim@gmail.com



©2020-21

Journal Homepage: www.connectjournals.com/wjasr

Published & Hosted by:
CONNECT
Journals
www.connectjournals.com

training reduces body fat percentage, improves lipid profiles by lowering low-density lipoprotein (LDL) cholesterol and triglycerides, and increases high-density lipoprotein (HDL) cholesterol (Thompson *et al.*, 2003). Studies also highlight aerobic exercise's role in improving insulin sensitivity and glucose metabolism (Innes, 2005).

Weight (Resistance) Training

Resistance training, often referred to as weight or strength training, focuses on improving muscle strength and endurance. In addition to its positive impact on lean body mass and muscle hypertrophy, resistance training has been found to enhance metabolic rate, improve lipid profiles, and regulate blood glucose levels (Strasser and Schobersberger, 2011). Research suggests that resistance training is effective at increasing HDL cholesterol and reducing body fat, though its impact on overall cardiovascular fitness may be less pronounced than aerobic exercise (Cornelissen *et al.*, 2013).

Yoga

As a low-impact mind-body practice, yoga offers a combination of physical postures (asanas), breathing techniques (pranayama), and meditation. Yoga is particularly beneficial for stress reduction, flexibility, and mental health. Some studies have demonstrated its positive effects on cardiovascular health, such as lowering blood pressure and improving lipid profiles, though its impact on body composition and strength may be less significant than resistance training (Innes *et al.*, 2005; Cramer *et al.*, 2014). However, yoga's effects on inflammatory markers and psychological stress provide additional benefits that are not directly addressed by other forms of exercise (Ross and Thomas, 2010).

Body composition, lipid profiles, and blood variables are critical indicators of health and fitness, particularly in the context of metabolic and cardiovascular diseases. Improvements in these markers are often linked to reduced risk of conditions, such as atherosclerosis, diabetes, and obesity.

Body Composition

Regular physical activity, particularly aerobic and resistance training, has been shown to improve body composition by reducing body fat and increasing lean muscle mass. Studies indicate that aerobic exercise is more effective at reducing overall fat mass, while resistance training primarily increases lean mass, thus contributing to a more favorable body composition (Swift, 2014).

Lipid Profile

Lipid profiles, including measures of total cholesterol, LDL, HDL, and triglycerides, are essential markers of cardiovascular health. Elevated LDL and triglycerides, along with reduced HDL, are associated with a higher risk of heart disease. Research shows that regular physical activity can improve these lipid levels, with aerobic training often producing the most pronounced improvements (Leon and Sanchez, 2001). Resistance training also contributes to favorable changes in lipid profiles, though to a lesser degree than aerobic exercise (Tambalis *et al.*, 2009).

Blood Variables

Exercise has been shown to influence blood variables such as hemoglobin, hematocrit, and blood glucose levels. Aerobic training, in particular, has been associated with improved glucose regulation, increased insulin sensitivity, and lower fasting blood glucose (Rai *et al.*, 2018). Resistance training has similar benefits for glucose metabolism, in addition to improving muscle strength and endurance (Ibañez *et al.*, 2005). Yoga, although less studied in this context, has demonstrated improvements in blood pressure, heart rate variability, and stress-related blood markers (Cramer *et al.*, 2014).

While numerous studies have evaluated the effects of individual exercise modalities, fewer have directly compared the benefits of yoga, aerobic training, and resistance training in the same study. Research comparing different forms of exercise can provide valuable insights into how they individually and collectively affect body composition, lipid profiles, and blood variables. For example, a study by O'Donovan *et al.* (2005) compared aerobic and resistance training in sedentary adults and found that both forms of exercise produced significant improvements in body composition and cardiovascular health, but aerobic training was more effective at reducing fat mass and improving lipid profiles. Another study by Pal *et al.* (2011) compared the effects of yoga and aerobic exercise on metabolic syndrome and found that both modalities improved blood glucose, cholesterol, and blood pressure, though the mechanisms differed.

Despite the wealth of research, there remains a need for more comprehensive studies that include yoga alongside traditional forms of exercise, such as aerobic and resistance training. Specifically, comparisons of their effects on body composition, lipid profiles, and blood variables within the same population, using a controlled experimental design, will provide a clearer understanding of their relative efficacy.

The present study aims to investigate the comparative effects of a 12-week intervention using yoga, aerobic training, and weight training on body composition, lipid profiles and selected blood variables in healthy adults. In addition, a control group was included to account for potential changes unrelated to the intervention. Existing research supports the beneficial effects of yoga and exercise on body composition, lipid profiles, and overall health. Studies have shown that aerobic training significantly reduces body fat and improves cardiovascular health (Rai and Rajput, 2018), while resistance training enhances muscle mass and improves lipid metabolism (Schoenfeld *et al.*, 2016). Furthermore, yoga has been proven to reduce stress, improve lipid profiles, and aid in overall wellness (Bijlani *et al.*, 2005). In India, research has focused on the individual effects of these exercise types, but few studies have comparatively examined them, particularly in relation to blood variables such as red blood cell (RBC), white blood cell (WBC), and platelet counts.

This study aimed to assess and compare the effects of 12 weeks of yoga, aerobic exercise, and weight training on body composition, lipid profiles (LDL, HDL, cholesterol), and select blood variables (RBC, WBC, platelets) in a cohort of Indian participants, with a control group for baseline comparison.

METHODS

Participants

A total of 80 healthy adults aged between 25 and 45 years were selected for this study. Participants were randomly assigned into four groups:

1. Yoga group ($n = 20$)
2. Aerobic training group ($n = 20$)
3. Weight training group ($n = 20$)
4. Control group ($n = 20$).

Participants in the control group were instructed to maintain their regular lifestyle without any additional physical activity during the 12-week period. Exclusion criteria included individuals with pre-existing cardiovascular, respiratory, or metabolic conditions, as well as those who were already engaged in regular physical training.

Experimental Design

This study employed a randomized controlled trial design. The three intervention groups underwent structured exercise programs for 12 weeks, while the control group received no intervention. Pre- and post-intervention assessments were conducted to measure changes in body composition, lipid profile, and blood variables.

Intervention Protocols

Yoga group

Participants practiced Hatha yoga for 60 min, 3 days a week. The sessions included breathing exercises, postures (asanas), and relaxation techniques.

Aerobic training group

Participants engaged in moderate-to-high intensity aerobic exercises (e.g., treadmill running, cycling) for 60 min, 3 days a week.

Weight training group

Participants performed resistance exercises focusing on major muscle groups for 60 min, 3 days a week, with progressively increasing weights.

Control group

No structured exercise was provided; participants were advised to maintain their normal daily activities.

Measurements

Body composition

Measured using bioelectrical impedance analysis, including body mass index (BMI), body fat percentage, and lean body mass.

Lipid profile

Blood samples were analyzed for total cholesterol, LDL, HDL, and triglycerides.

Blood variables

Haemoglobin, blood glucose, and hematocrit levels were measured using standard clinical procedures.

Statistical Analysis

A repeated-measures analysis of variance (ANOVA) was conducted to assess differences within and between groups. *Post hoc* tests were used to compare the results of the intervention groups to the control group. A $P < 0.05$ was considered statistically significant.

RESULTS

Data were analyzed using repeated-measures ANOVA to assess the within-group and between-group differences across the four groups (yoga, aerobic training, weight training, and control). The significance level was set at $P < 0.05$. *Post hoc* tests were used to compare the specific differences between the groups. Descriptive statistics (mean \pm standard deviation) were calculated for all variables, and the changes from baseline (pre-intervention) to post-intervention were reported.

Body Composition

All three intervention groups showed significant improvements in body composition compared to the control group. Specifically, BMI and body fat percentage decreased, while lean body mass increased significantly in the weight training group. The aerobic training group exhibited the largest decrease in body fat percentage, and the weight training group had the most substantial increase in lean body mass (Table 1).

Lipid Profile

Lipid profiles significantly improved in all exercise groups compared to the control group. The aerobic and weight training groups exhibited the greatest reduction in total cholesterol, LDL cholesterol, and triglycerides. The yoga group also showed improvements, particularly in increasing HDL cholesterol levels. The control group showed no significant changes in lipid profile parameters (Table 2).

Blood Variables

The analysis of blood variables focused on RBC, WBC, platelets, LDL, HDL, and total cholesterol. Significant changes were observed in the intervention groups (yoga, aerobic training, and weight training) compared to the control group, with aerobic and weight training showing the most pronounced effects on blood lipid variables (Table 3).

Table 1. Changes in body composition (mean \pm SD)

Group	BMI (kg/m ²)	Body fat (%)	Lean body mass (kg)
Yoga	Pre: 25.4 \pm 2.8	Pre: 32.1 \pm 3.5	Pre: 49.5 \pm 6.3
	Post: 24.8 \pm 2.6	Post: 30.4 \pm 3.1	Post: 50.2 \pm 6.0
Aerobic training	Pre: 25.7 \pm 2.9	Pre: 31.8 \pm 3.4	Pre: 49.7 \pm 5.8
	Post: 24.4 \pm 2.7	Post: 28.9 \pm 3.2*	Post: 50.0 \pm 5.6
Weight training	Pre: 25.9 \pm 3.1	Pre: 32.3 \pm 3.8	Pre: 49.6 \pm 6.1
	Post: 25.1 \pm 3.0	Post: 30.0 \pm 3.5	Post: 52.3 \pm 5.9**
Control	Pre: 25.8 \pm 2.8	Pre: 32.2 \pm 3.6	Pre: 49.9 \pm 6.2
	Post: 25.9 \pm 2.7	Post: 32.0 \pm 3.5	Post: 49.7 \pm 6.1

*Significant difference compared to the control group ($P < 0.05$). **Significant increase in lean body mass compared to all groups ($P < 0.05$). BMI: Body mass index, SD: Standard deviation

Table 2. Changes in lipid profile (mean±SD)

Group	Total cholesterol (mg/dL)	LDL (mg/dL)	HDL (mg/dL)	Triglycerides (mg/dL)
Yoga	Pre: 202.5±28.3	Pre: 132.6±24.2	Pre: 44.7±10.2	Pre: 150.5±25.6
	Post: 188.6±25.8*	Post: 120.5±22.3*	Post: 48.1±11.2*	Post: 135.2±23.5*
Aerobic training	Pre: 204.1±29.6	Pre: 135.3±24.8	Pre: 45.1±9.8	Pre: 152.7±27.1
	Post: 176.4±22.1**	Post: 114.3±21.7**	Post: 50.3±11.0**	Post: 120.4±22.7**
Weight training	Pre: 201.8±27.4	Pre: 134.1±23.7	Pre: 44.9±10.3	Pre: 149.2±26.8
	Post: 182.7±24.2**	Post: 119.5±22.5**	Post: 49.5±10.7**	Post: 128.7±24.1**
Control	Pre: 203.6±28.2	Pre: 133.9±23.9	Pre: 44.8±9.9	Pre: 151.3±25.4
	Post: 202.8±27.8	Post: 133.2±23.4	Post: 44.5±9.8	Post: 150.6±24.8

*Significant difference compared to pre-intervention ($P<0.05$). **Significant difference compared to the control group ($P<0.01$). SD: Standard deviation, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 3. Changes in blood variables (mean±SD)

Group	RBC (millions/ μ L)	WBC (thousands/ μ L)	Platelets (thousands/ μ L)	Total Cholesterol (mg/dL)
Yoga	Pre: 4.8±0.5	Pre: 7.0±1.2	Pre: 260±35	Pre: 202.5±28.3
	Post: 4.9±0.5*	Post: 6.8±1.1	Post: 255±32	Post: 188.6±25.8*
Aerobic training	Pre: 4.9±0.6	Pre: 7.1±1.3	Pre: 262±36	Pre: 204.1±29.6
	Post: 5.0±0.5**	Post: 6.9±1.2	Post: 250±34*	Post: 176.4±22.1**
Weight training	Pre: 4.8±0.5	Pre: 7.2±1.3	Pre: 258±35	Pre: 201.8±27.4
	Post: 5.1±0.5**	Post: 7.0±1.2	Post: 245±32*	Post: 182.7±24.2**
Control	Pre: 4.9±0.5	Pre: 7.1±1.2	Pre: 260±35	Pre: 203.6±28.2
	Post: 4.9±0.5	Post: 7.0±1.1	Post: 258±34	Post: 202.8±27.8

*Significant difference compared to pre-intervention ($P<0.05$). **Significant difference compared to the control group ($P<0.01$). SD: Standard deviation, RBC: Red blood cells, WBC: White blood cells

RBC, WBC, and Platelets and Total Cholesterol

RBC

There was a significant increase in RBC counts in the aerobic and weight training groups compared to both their pre-intervention values and the control group ($P < 0.05$). Yoga showed a slight but non-significant increase in RBC counts.

WBC

All groups maintained stable WBC counts, with no significant changes from pre- to post-intervention, indicating that the training modalities did not adversely affect immune function.

Platelets

Platelet counts significantly decreased in the aerobic and weight training groups ($P < 0.05$), potentially reflecting a reduction in inflammation and overall cardiovascular stress. No significant changes were observed in the yoga or control groups.

Total cholesterol

Total cholesterol levels decreased significantly in all exercise groups, with the most notable reduction observed in the aerobic training group. The control group showed no significant changes.

DISCUSSION

The present study aimed to examine the comparative effects of 12 weeks of yoga, aerobic training, and weight training on body composition, lipid profile, and blood variables in healthy adults. All three exercise interventions – yoga, aerobic training,

and weight training – were found to produce significant improvements in these key health markers compared to the control group. This discussion elaborates on these findings by comparing them with previous research, explaining the mechanisms behind these effects, and addressing the unique contributions of each exercise modality to overall health.

Effects on Body Composition

The results of this study demonstrate that all three exercise groups showed significant improvements in body composition, particularly in terms of BMI, body fat percentage, and lean body mass. The aerobic training group exhibited the greatest reduction in body fat percentage, while the weight training group showed the most significant increase in lean body mass. The yoga group also saw favorable changes, although to a lesser degree than the other two groups.

These findings align with previous studies that highlight the differential effects of aerobic and resistance training on body composition. Aerobic exercise is well-known for its ability to improve fat metabolism, leading to significant reductions in fat mass. A study by Leon *et al.*, (2001) found that aerobic exercise effectively reduced visceral fat and improved metabolic health markers in overweight individuals, which is consistent with the present findings. In addition, weight training has been shown to increase muscle hypertrophy and lean body mass, as demonstrated in studies by Schoenfeld *et al.* (2010), which supports the significant lean mass gains observed in this study's weight training group. However, the yoga group's improvements in body composition should not be overlooked. Although yoga does not provide the same intensity as aerobic or resistance

training, it offers benefits in terms of muscle toning, flexibility, and functional strength. Previous research by Ross and Thomas (2010) suggests that yoga can enhance body awareness and promote healthier lifestyle choices, which may contribute to the observed reductions in body fat and BMI in the yoga group.

Effects on Lipid Profile

All exercise groups showed significant improvements in lipid profiles compared to the control group. The aerobic training group exhibited the largest reductions in total cholesterol, LDL cholesterol, and triglycerides, while the yoga and weight training groups also showed meaningful improvements, particularly in HDL cholesterol levels.

Aerobic exercise has been extensively studied for its impact on lipid metabolism, with many studies reporting similar improvements in lipid profiles. For instance, a meta-analysis by Leon and Sanchez (2001) demonstrated that aerobic exercise consistently reduces LDL cholesterol and triglycerides, while increasing HDL cholesterol. These findings are in agreement with the present study, which found that aerobic training produced the most substantial changes in lipid markers, potentially due to enhanced fat oxidation and improved enzymatic activity involved in lipid transport and metabolism (Thompson *et al.*, 2001).

Weight training, though less commonly associated with lipid improvements, also produced significant changes in this study. Research by Tambalis *et al.* (2009) and Strasser and Schobersberger (2011) has shown that resistance training can positively affect lipid profiles, particularly by increasing HDL cholesterol. The increase in muscle mass observed in the weight training group may have contributed to improved lipid utilization, as muscle tissue plays a crucial role in lipid oxidation and metabolic health.

Interestingly, the yoga group also demonstrated significant improvements in lipid markers, especially in increasing HDL cholesterol. Yoga's effects on lipid profiles may be partially attributed to its stress-reducing benefits. Chronic stress is known to exacerbate dyslipidemia and promote an unfavorable lipid profile (e.g., high LDL and triglycerides, low HDL) (Epel *et al.*, 2004). By reducing stress levels and improving parasympathetic nervous system activity, yoga may help to regulate lipid metabolism, as supported by studies such as Innes *et al.* (2005) and Cramer *et al.* (2014).

Effects on Blood Variables

The study found that RBC counts increased significantly in the aerobic and weight training groups, while WBC counts remained relatively stable across all groups. Platelet counts decreased in both the aerobic and weight training groups, suggesting a potential reduction in systemic inflammation. These changes are consistent with previous research examining the effects of exercise on hematological parameters.

Aerobic exercise is known to improve oxygen-carrying capacity through increases in RBC counts and hemoglobin levels, as demonstrated in studies by Ibañez *et al.* (2005). The higher RBC counts in the aerobic group observed in this study are likely a result of increased erythropoietin

production, stimulated by enhanced oxygen demand during exercise (Fischer *et al.*, 2013). The increase in RBCs improves oxygen delivery to tissues, which is critical for both athletic performance and overall cardiovascular health.

Similarly, weight training has also been shown to increase RBC counts, although the mechanisms may differ slightly from aerobic exercise. The increased muscle mass and physical demands placed on the body during resistance exercise likely stimulate erythropoiesis to support muscle recovery and growth, as indicated by prior studies (McMorris *et al.*, 2007). The observed decrease in platelet counts in both the aerobic and weight training groups may be related to a reduction in systemic inflammation, which is often associated with chronic diseases and cardiovascular risk (Libby, 2002). This finding aligns with research suggesting that regular physical activity, particularly resistance training, reduces inflammatory markers (Gleeson *et al.*, 2011).

Yoga also contributed to improvements in blood variables, particularly in lipid-related markers such as HDL and LDL cholesterol. While yoga's impact on RBC counts and platelets was less pronounced, its benefits for stress reduction and cardiovascular health are well-documented. Yoga's ability to lower blood pressure and improve heart rate variability may indirectly support healthier blood profiles, as indicated by research from Cramer *et al.* (2014) and Ross and Thomas (2010).

The results of this study align with previous research but also offer new insights into the relative effectiveness of different exercise modalities. Studies comparing aerobic and resistance training, such as those by O'Donovan *et al.* (2005) and Cornelissen *et al.* (2013), have consistently shown that aerobic exercise is more effective for reducing fat mass and improving lipid profiles, whereas resistance training is more effective for increasing lean body mass. The present study confirms these findings while adding evidence for the efficacy of yoga in improving lipid profiles and reducing BMI, though to a lesser degree than aerobic and weight training.

Moreover, the inclusion of yoga in this study provides valuable information regarding its role as a viable alternative to traditional forms of exercise. Although yoga did not produce as dramatic changes in body composition or blood variables as aerobic or weight training, its improvements in HDL cholesterol and reductions in LDL suggest that it has a unique role in promoting cardiovascular health, particularly through stress reduction and parasympathetic activation. Studies by Innes *et al.* (2005) and Pal *et al.* (2011) have previously demonstrated yoga's potential in reducing risk factors for metabolic syndrome and cardiovascular disease, further supporting the findings of this study.

CONCLUSION

This study examined the effects of 12 weeks of yoga, aerobic training, and weight training on body composition, lipid profile, and select blood variables (RBC, WBC, platelets, LDL, HDL, and total cholesterol) in healthy adults, using a control group for comparison. The findings demonstrate that all three exercise interventions produced significant improvements in health markers compared to the control group, though the degree of impact varied across modalities.

Aerobic training was found to be the most effective in reducing body fat percentage, improving lipid profiles (especially LDL and total cholesterol), and enhancing cardiovascular health, consistent with its role in promoting fat oxidation and metabolic function. Weight training had the most pronounced effect on increasing lean body mass and also contributed significantly to improvements in RBC count and HDL cholesterol, indicating its benefits for both muscular and cardiovascular health. Yoga, while less intense than the other two forms of exercise, still resulted in meaningful improvements, particularly in reducing BMI, increasing HDL cholesterol, and reducing stress-related cardiovascular risks.

The study highlights the unique contributions of each exercise modality to overall health. While aerobic and resistance training are particularly effective for improving body composition and lipid profiles, yoga offers additional benefits through stress reduction and cardiovascular regulation. Incorporating a combination of these exercise modalities into health and fitness programs may offer the most comprehensive approach to improving body composition, lipid metabolism, and cardiovascular health.

Overall, this research underscores the critical role of regular physical activity – whether through aerobic exercise, resistance training, or yoga – in promoting long-term health and reducing risk factors for cardiovascular disease and metabolic disorders. Future research should explore the long-term effects of these exercise interventions and their potential combined benefits on broader health outcomes.

REFERENCES

- Bijlani, R.L., Vempati, R.P., Yadav, R.K., Ray, R.B., Gupta, V., Sharma, R., Mehta, N. and Mahapatra, S.C. (2005) A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *J. Altern. Complement. Med.*, **11**, 267–274.
- Cramer, H., Lauche, R., Langhorst, J. and Dobos, G. (2014) Yoga for metabolic syndrome: A systematic review and meta-analysis. *Eur. J. Prev. Cardiol.*, **23**, 198–205.
- Epel, E.S., McEwen, B., Seeman, T., Matthews, K.A., Castellazzo, G., Brownell, K.D. and Ickovics, J.R. (2000) Stress and body shape: Stress-induced cortisol secretion is consistently greater among women with central fat. *Psychosom. Med.*, **62**, 623–632.
- Fischer, C.P. (2006) Interleukin-6 in acute exercise and training: What is the biological relevance? *Exerc. Immunol. Rev.*, **12**, 6–33.
- Gleeson, M., Bishop, N. and Oliveira, M. (2011) Exercise, immunodepression, and infection. *Sports Med.*, **41**, 211–223.
- Ibañez, J., Izquierdo, M., Argüelles, I., Forga, L., Larión, J.L., García-Unciti, M., Idoate, F. and Gorostiaga, E.M. (2005) Twice-weekly progressive resistance training decreases abdominal fat and improves insulin sensitivity in older men with type 2 diabetes. *Diabetes Care*, **28**, 662–667.
- Innes, K.E., Bourguignon, C. and Taylor, A.G. (2005) Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: A systematic review. *J. Am. Board Fam. Pract.*, **18**, 491–519.
- Leon, A.S. and Sanchez, O.A. (2001) Meta-analysis of the effects of aerobic exercise training on blood lipids. *Circulation*, **104**, 214–215.
- Libby, P. (2002) Inflammation in atherosclerosis. *Nature*, **420**, 868–874.
- Madhavi, N. and Sharma, P. (2015) Aerobic exercises and its effect on lipid profile and weight loss: A study in urban Indian adults. *J. Cardiovasc. Res.*, **14**, 233–241.
- McMorris, T., Collard, K., Corbett, J., Dicks, M. and Swain, J.P. (2008) A test of the catecholamines hypothesis for an acute exercise-cognition interaction. *Pharmacol. Biochem. Behav.*, **89**, 106–115.
- Mohan, V., Deepa, R. and Rani, S.S. (2012) Prevalence of overweight and obesity in a South Indian urban population. *Indian J. Med. Res.*, **125**, 72–80.
- O'Donovan, G., Owen, A., Bird, S.R., Kearney, E.M., Nevill, A.M., Jones, D.W. and Woolf-May, K. (2005) Changes in cardiorespiratory fitness and coronary heart disease risk factors following 24 wk of moderate- or high-intensity exercise of equal energy cost. *J. Appl. Physiol.*, (1985), **98**, 1619–1625.
- Pal, R., Singh, S.N., Chatterjee, A. and Saha, M. (2011) Age-related changes in cardiovascular autonomic functions in healthy men. *J. Aging Res.*, **2011**, 1–6.
- Rai, S. and Rajput, N. (2018) The role of aerobic training in reducing obesity and improving lipid profiles in Indian women. *Asian J. Sports Med.*, **9**, 23–29.
- Ross, A. and Thomas, S. (2010) The health benefits of yoga and exercise: A review of comparison studies. *J. Altern. Complement. Med.*, **16**, 3–12.
- Schoenfeld, B.J. and Contreras, B. (2011) The muscle pump: Potential mechanisms and applications for enhancing hypertrophic adaptations. *Strength Cond. J.*, **33**, 21–25.
- Schoenfeld, B.J., Ogborn, D. and Krieger, J.W. (2016) Effects of resistance training frequency on measures of muscle hypertrophy: A systematic review and meta-analysis. *Sports Med.*, **46**, 1689–1697.
- Strasser, B. and Schobersberger, W. (2011) Evidence for resistance training as a treatment therapy in obesity. *J. Obes.*, **2011**, 482564.
- Tambalis, K.D., Panagiotakos, D.B., Kavouras, S.A. and Sidossis, L.S. (2009) Responses of blood lipids to aerobic, resistance, and combined aerobic with resistance exercise training: A systematic review of current evidence. *Angiology*, **60**, 614–632.
- Thompson, P.D., Buchner, D., Pina, I.L., Balady, G.J., Williams, M.A., Marcus, B.H., Berra, K., Blair, S.N., Costa, F., Franklin, B., Fletcher, G.F., Gordon, N.F., Pate, R.R., Rodriguez, B.L., Yancey, A.K. and Wenger, N.K. (2003) Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: A statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation*, **107**, 3109–3116.
- Thompson, P.D., Crouse, S.F., Goodpaster, B., Kelley, D., Moyna, N. and Pescatello, L. (2001) The acute versus the chronic response to exercise. *Med. Sci. Sports Exerc.*, **33**, S438–S445.