

A Comparison of Plasma HDL-C Levels in Moderate Intensity Continuous Exercise Versus High Intensity Intermittent Exercise Among Young Adults

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Abstract

Background: Elevated levels of High Density Lipoprotein Cholesterol (HDL-C) has been associated with a decreased risk of coronary heart disease (CHD). An active lifestyle is necessary in order to improve lipid HDL-C, which includes physical exercise. Continuous and interval/intermittent training are widely used to improve performance in athletes. It is also used to promote a healthy lifestyle. Interval training is considered as 'better training', consists of repeated periods of high intensity alternating with lower intensity, whereas continuous exercise is characterized by constant submaximal workload. Both MICT and HIIT are known to improve the cardiovascular function and lipid profile. In recent studies it is been shown that HIIT is more beneficial to MICT in maintaining a good cardiovascular health and lipid profile. The present study is therefore intended to compare the HDL-C levels in young adults practicing moderate intensity continuous exercise (MICT) who are athletes and high intensity intermittent exercise (HIIT) who are badminton players.

Objectives:

1. To measure plasma HDL-C levels in athletes and badminton players
2. To compare the plasma HDL-C levels in young adults practicing moderate intensity continuous exercise (athletes) and high intensity intermittent exercise (badminton players).

Materials & Method: This study is done on 30 healthy athletes (18 males and 12 females) and 30 healthy badminton players (18 males and 12 females) of bangalore who are practicing regularly for atleast 3 years in the age group of 18 – 25 years. Subjects who are smokers, alcoholics and any H/O Diabetes Mellitus, Hypertension, musculoskeletal disorders and those on steroid therapy were excluded. Informed consent was taken. After general physical examination and history taking- HDL-C levels was assessed with 2 ml venous blood sample after 8 hours of fasting. Subjects were matched for Age, Sex and BMI. Descriptive statistics and Students 't' test is used for statistical analysis.

Results: HDL-C levels were significantly higher in players practicing high intensity intermittent exercise (Badminton) when compared to athletes with a P value of 0.039.

Conclusion: The HDL-C levels in Badminton players is more when compared to athletes hence HIIT is found to be more effective than MICT in maintaining a good cardiovascular health and promoting a healthy lifestyle.

Keywords: Badminton, High intensity intermittent exercise (HIIT), HDL-C, Athletes.

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Introduction

A sedentary lifestyle has been characterized as an independent risk factor for cardiovascular disease.¹ The Framingham Heart Study in 1970's identified HDL-C as a powerful risk factor inversely associated with

the incidence of CHD. Physical Exercise is one of the lifestyle integrations that has been recommended for improving HDL-C. Continuous and interval/intermittent training are widely used to improve performance in athletes. It is also done to promote healthy lifestyle in sedentary individuals.² Continuous training is defined as an exercise (e.g., running, cycling, swimming, etc.) lasting atleast 20 minutes and held at steady intensity during the entire bout.³ This continuous exercise can be performed at low and moderate intensities(MICT) . MICT is defined as continuous aerobic exercise with an intensity of 60–75% of maximum Heart Rate (HR_{max}) .High intensity interval exercise (HIIT) is characterised by relatively short bouts of high intensity workloads interspersed by periods of rest or low intensity activity Each HIIT session is done from 20 to 30 minutes with an interval period of upto 4 minutes at an intensity of >85% of maximum heart rate (HR_{max}).Both continuous and intermittent exercise have positive effects on cardiovascular health and lipid metabolism ⁴. A few studies have examined the cardiovascular and metabolic responses between the two types of exercises and it had shown contradictory results . The differences between these exercises are attributed to the variability of the exercise protocol (duration, type, and intensity, ratio of work at high intensity/low or complete rest), which in turn resulted in recruitment of different energy systems. Also since HIIT increases the post exercise fat oxidation it is said to improve the lipid profile better than MICT ⁵ . The increase in fatty acid translocase (FAT/CD36),a transport protein and plasma membrane fatty acid-binding protein (FABP_{pm}), found in the sarcolemma, the mitochondrial membrane, and in a cytoplasmic pool in skeletal muscle, contributes to the enhanced fat oxidation by increasing the rate of free fatty acid transfer across the muscle and mitochondrial membrane. HIIT has been used as a time-efficient program to improve physical fitness and cardiovascular disease risk factors . Furthermore, it was chosen as the most enjoyable physical activity program compared to MICT.⁶ This study is intended to compare the plasma HDL-C levels in young adults practicing moderate intensity continuous exercise (athletes) versus high intensity intermittent exercise(badminton players).

Materials and Method

Study Design: Cross-sectional study

Study Place: Bangalore

Study Population: Young healthy adults in the age group of 18-25 yrs who are athletes and badminton players.

Study Period: April – May 2019

Study Group:

1. Young adults regularly practicing moderate intensity continous exercise (athletes)
2. Young adults regularly practicing high intensity intermittent exercise (badminton players)

Ethical Clearance and Informed Consent: Taken

Inclusion Criteria:

1. Healthy Men and Women
2. Age group of 18-25 yrs.
3. Practicing badminton for more than 3 years.
4. Athletes who are practicing for more than 3 years.

Exclusion Criteria:

1. H/O musculoskeletal disorders.
2. H/O acute infections.
3. H/O steroid therapy.
4. H/O Diabetes mellitus, hypertension.
5. H/O Endocrine disorders.
6. H/O Smoking.
7. H/O alcohol.
8. H/O substance abuse.

The study was started after the subjects fulfilled the inclusion criteria and were enrolled after obtaining consent .The study group includes a total of 60 participants in the age group of 18-25 years out of which 30 of them were athletes (18 males and 12 females) and 30 of them were Badminton players (17 males and 13 females). Collection of data and blood samples from the athletes and badminton players were done from the players who practiced regularly in Kanteerava Stadium, Bengaluru. History and General Physical Examination along with anthropometry was done to rule out any abnormalities .The subject's demographic details (Age, Sex, BMI) were taken . Subjects were matched for Age, Sex and BMI.

Anthropometry: The subject's body weight and height were measured and the body mass index (BMI) was calculated by dividing the weight (kg) by square of height (m^2).

Biochemical Parameters: HDL-C levels was assessed with 2 ml venous blood sample after 8 hours of fasting. Serum samples were centrifuged for 10 minutes to obtain the plasma HDL levels which was done by enzymatic colour test with the reagent OSR6587 using BECKMAN COULTER DxH500 machine at Infosys Lab, Victoria Hospital, Bangalore.

Participants: The participants were categorised based on type of exercise into 2 groups.

1. Young healthy adults practicing moderate intensity continuous exercise:

This group included athletes who were running 1500mts 3 times a week for atleast 20 minutes each session.

2. Young healthy adults practicing high intensity intermittent exercise:

This group included badminton players who were playing 3 times a week for atleast 20 minutes each session

Statistical Analysis: The data was analysed using descriptive statistics to match the subjects based on Age, Sex and BMI . Students ‘t’ test was done to compare the differences between the 2 subject groups .The statistical analysis was done in Microsoft Excel version 2010. Data is expressed as mean ± SD. P value <0.05 is considered significant.

Results

Table 1 : Gender Distribution of participants

Gender	Group I (Athletes)	Group II (Badminton)
Male	18	17
Female	12	13
Total	30	30

Table 1 shows the Gender design in Group-I (Athletes) and Group II (Badminton players). The participants comprised of 30 in group I which included 18 males and 12 females. Similarly there were 30 participants in group II which included 17 males and 13 females .

Table 2 : Comparison of study parameters by Gender

	Group I (Athletes)			Group II(Badminton)		
	Males	Females	p value	Males	Females	p value
AGE(Yrs)	20.0±1.5	19.3±1.61	0.10	21.3±2.0	20.6±2.1	0.10
BMI(kg/m ²)	21.7±1.5	20.5±1.3	0.12	21.9±3.1	21.8±1.6	0.45
PLASMA HDL-C(mg/dl)	43.1±6.1	43.6±5.5	0.40	46.8±7.4	47.2±5.8	0.44

p value <0.05 is significant

Table 2 shows the results for the subjects matched with Age, Sex and BMI by applying paired ‘t’ test in Microsoft Excel. The mean±SD value for age in Group I males were 20.0±1.55 and in females was 19.3±1.61 yrs and the p value was 0.10 which is not statistically significant .Similarly the mean±SD value for age in Group II males was 21.3±2.0 yrs and in females was 20.6±2.1 yrs and the p value was 0.45 which was not statistically significant. The plasma HDL-C levels in Group I male athletes was 43.1±6.1mg/dl and in females was 43.6±5.5mg/dl and the p value was 0.40 which is not significant .The plasma HDL-C levels in Group II males was 46.8±7.4mg/dl and 47.2±5.8mg/dl and the p value was 0.44. Hence from this Table we can see that in our study the sex and BMI did not influence the changes in HDL –C cholesterol and they were not statistically significant.

Table 3: Comparison of Study parameters by Group

	Group I (Athletes)	Group II (Badminton)	p value
Age	19.7±1.7yrs	20.4±1.8yrs	0.14
BMI	20.9±1.4kg/m ²	21.9±2.5kg/m ²	0.07
PLASMA HDL-C	43.3±5.7mg/dl	46.7±6.6mg/dl	*0.03

*p value <0.05 is significant

Table 3 shows the comparison of Age, BMI and plasma HDL-C levels in both the groups by applying unpaired ‘t’ test. The mean±SD values for Age in athelets was 19.7±1.7yrs and in badminton players was 20.4±1.8 yrs and the p value was 0.14 which is not significant. The mean±SD value for BMI in athelets was 20.9±1.4kg/m² and in badminton players was 21.9±2.5kg/m² and the p value was 0.07 which was also not significant. The

plasma HDL values of athletes was 43.3 ± 5.7 mg/dl and in badminton players was 46.7 ± 6.6 mg/dl and the p value was 0.03 which was statistically significant.

Discussion

Physical inactivity is an independent risk factor for chronic diseases. The World Health Organization (WHO) generally recommends adults to engage in physical activity for 150 min/week to maintain their cardiovascular health and to protect from the risk factors of Coronary heart disease (CHD). Moderate intensity continuous training (MICT) has been considered as the most effective modality for the prevention and management of cardio vascular diseases but in recent times, high-intensity interval training (HIIT), which refers to alternating short bursts of high-intensity exercise and recovery periods, has become a popular alternative primarily because of its time efficiency, as lack of time is a commonly cited barrier to exercise participation.⁷ With concern on maintaining a good lipid profile HIIT is more beneficial to MICT in promoting the secretion of catecholamines, epinephrine norepinephrine and growth hormone all of which promotes the fat decomposition and also to achieve effective weight loss. According to a study done by Alahmadi (2014: 3), exercises to reduce body fat levels can be done with both moderate-intensity continuous training (MICT) and High intensity intermittent training. In MICT there is increase in the mitochondrial biogenesis activity through activation of metabolic enzymes such as AMPK, CPT-1 and ACC whereas in High intensity interval training (HIIT) body fat levels are reduced by activating the cardio metabolic component which is found to be more effective.⁸ On comparing with MICT, in HIIT there is increased post exercise fat oxidation and energy expenditure (Excess post energy oxygen consumption-EPOC) which decreases the Total cholesterol and LDL cholesterol and increases the High Density Cholesterol (HDL).⁹ In a study done by Perry et al. (2008), they found that fat oxidation, or fat burning was significantly higher after 6 weeks of interval training. Studies have also shown that a combination of both aerobic and anaerobic exercise which is seen in HIIT are known to alter lipoprotein profiles and increase HDL, which is associated with anti-oxidant enzymes.¹⁰ Badminton by nature is a high intensity intermittent exercise and this sport is highly demanding, with an average heart rate (HR) of over 85% of the player's maximal HR. The intermittent actions during this game are demanding on both the aerobic and anaerobic systems which is around 60-70% on the

aerobic system and approximately 30% on the anaerobic system.¹¹ In our study we found that HDL-C levels in badminton players which is an HIIT exercise was significantly more than in athletes who were practicing MICT indicating that HIIT is superior to MICT in maintaining good lipid profile and in turn maintaining a good cardiovascular health.

Limitations: The study would be more effective if the sample size was more. Also, cardiovascular risk factors involves many aspects such as body composition, aerobic capacity but our study was restricted to see the effects of MICT and HIIT only on lipid metabolism.

Conclusion

As physical training is very essential to maintain a good cardiovascular profile in both sports personalities and common individuals there is a necessity to include physical activity in our daily life. There are various modalities of physical activities varying in intensity, duration, environment. The most common method of exercise practiced as of now is the moderate intensity exercise but recent research work has shown that high intensity intermittent exercise (HIIT) is now being followed as an alternative to MICT as it is time efficient and superior to MICT in cardiovascular functions and lipid metabolism. So in our study we compared the HDL-C levels which is a powerful risk factor for CHD in those practicing MICT (athletes) and those practicing HIIT (Badminton). A total of 60 participants were taken which included 30 healthy young adults who were regularly practicing MICT (Athletes-18 males and 12 females) and 30 healthy young adults who were regularly practicing HIIT (badminton players -17 males and 13 females). The study was done from the period of April-May 2019. Anthropometry which included height, weight and BMI was done. Plasma HDL-C levels were done by taking 2 ml venous blood sample after 8 hrs of fasting. The test was done in Infosys Lab, Victoria Hospital, Bangalore. The subjects were matched for age, sex and BMI. Student 't' test was used to compare the plasma HDL-C levels in 2 groups. The results of Plasma HDL-C was significantly higher in Group II (HIIT-Badminton). Therefore from our study we can conclude that HIIT is more beneficial to MICT. As the training modalities used in HIIT are short in time, the motivation and adherence of people to HIIT training will be more as compared to MICT. Badminton which is a simple indoor recreational sport, by its nature of High intensity intermittent exercise could be a time efficient way to

improve the cardiovascular function and to maintain a healthy lifestyle .

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Ethical Clearance: Taken.

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