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Department of Physical Education

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Contents

Effect of static and dynamic stretching on hip dynamic range of motion during instep kicking in soccer players

K.Dharmesh* Dr.D.Prasanna Balaji**

* Ph.D Scholar, National College, Department of Physical Education, Tiruchirappalli, Tamilnadu, India.
** Head and Director, Research, Department of Physical Education, National College, Tiruchirappalli, Tamilnadu, India.

Abstract

The purpose of this study was to examine the effects of static and dynamic stretching within a pre-exercise warm-up on hip dynamic range of motion (DROM) during instep kicking in professional soccer players. The kicking motions of dominant legs were captured from 13 professional male soccer players (height: 174.2 ± 6.3 cm; mass: 67.5 ± 7.3 kg; age: 19.6 ± 2.1 years) using a digital video cameras at 100 Hz. Hip DROM at backward, forward, and follow-through phases (instep kick phases) after different warm-up protocols consisting of static, dynamic and no-stretching on 3 nonconsecutive test days were captured for analysis. It was found that in the backswing phase, there was no difference in DROM after the dynamic stretching compared with the static stretching and the no-stretching method. There was a significant difference in DROM after the dynamic stretching compared with the static stretching and no-stretching method during (a) the forward phase with $p<0.03$, (b) the follow-through phase with $p<0.01$. It was concluded that professional soccer players can perform a higher DROM of the hip joint during the instep kick after dynamic stretching incorporated in warm-ups, hence increasing the chances of scoring and injury prevention during soccer games.

Key Words: *Angular displacement, flexibility, kinematics, warm-up*

Introduction

Flexibility refers to the range of motion (ROM) available at a joint, and it plays an important physical role as a general health-related physical fitness component, that is, activities related to daily living and upkeep of an independent lifestyle and especially for the sportive performance (12,21). Flexibility represents the ability to move a joint or a series of joints through a full, unrestricted, pain-free ROM. Gender, age, immoderate adipose tissue, skin, stiff muscle, ligaments, and tendons are factors impacting muscle flexibility and joint ROM (3,34). There are several stretching methods that have been used to achieve and maintain flexibility, including static, ballistic, dynamic, and proprioceptive neuromuscular facilitation (2,6,16). These stretching methods are applied in many different forms, including multiple variations of passive and active techniques (34). Stretching exercise may be performed in both the long-term and short-term. Long-term (chronic) preparation may include a well-developed training program to increase flexibility; the short-term (acute) preparation should include a warm-up to improve performance and flexibility before competition.

The most used method in warm-up routines is static stretching. It has been used because it seems to be easier and safer to apply than the other methods (34). Static stretching is a common method performed by strength and conditioning specialists and athletes to increase muscle length. This type of stretching takes the muscle to its end range and maintains this position for a specified duration (10). However, previous studies show that the acute static stretching method may negatively affect performance outcomes in contrast to dynamic stretching, which most research studies have shown to have a positive effect on performance (14,24,26,28,36). The effect of static stretching, specifically on muscle strength and power production, knee flexion, and extension 1 repetition maximum lifts, leg extension power, vertical jump, sprint speed, and agility have all been reduced in terms of performance shortly after a static stretching warm-up (4,6,9,24,33). In contrast, few studies have shown the positive effect of static stretching, which increases ROM; however, the studies were restricted to improving flexibility in healthy and injured individuals not in sport performance (34).

In fact, it seems that in most studies, the ROM of joints was measured statically. However, these findings may not be applicable to ROM during dynamic motion in sports. The specificity of sport performance and skill require dynamic capturing of motions during practice. Soccer which is the most popular team sport throughout the world demands a high level of flexibility and dynamic skills. One of these dynamic skills in soccer is the instep kick, which is most important when scoring goals and is widely studied (25,30). An instep kick is performed in well-coordinated intersegment and interjoint motions. The hip joint is one of the important lower body joints used during soccer instep kicking. Angular displacement of the hip joint which can be identified as dynamic range of motion (DROM) is at backswing and forward direction. Its angular displacement or DROM can have an effect on kick outcomes achieved at high ball speed, which is important in soccer kicking, because this gives the goalkeeper less time to react, thus improving one's chances of scoring (11,30).

Therefore, it is important that we identify stretching methods that produce a higher DROM during dynamic and active motions in soccer. The purpose of this study was to investigate the acute effect of static and dynamic stretching on DROM of the hip joint during the instep kick in professional soccer players. We hypothesized that dynamic stretching improves the DROM of the hip joint during the soccer instep kick.

Methods

Experimental Approach to the Problem

In a within-subject experimental design, professional soccer players conducted 3 different warm-up protocols on 3 nonconsecutive test days. The warm-up protocols differed only in the mode of stretching methods used, whereas all other exercises used in the warm-up were identical. The stretching modes used were static, dynamic, and no stretch (Independent variables). Soccer Instep Kicking was captured after each warm-up protocol and hip angular displacement during backward, forward, and follow-through phases (Dependent variables), which is instep kicking were selected for analyzing.

Subjects

Thirteen professional male soccer players (height: 174.2 ± 6.3 cm; mass: 67.5 ± 7.3 kg; age: 19.6 ± 2.1 years), who had no history of major lower limb injury or disease, volunteered to participate in this study. All participants had trained regularly for the state level or league teams, and each had at least 5 years of professional soccer practice. They also had a high level of fitness, conditioning, and skills in soccer. Subjects were informed orally about the procedures they would undergo, and each read and signed a medical questionnaire and an informed consent form.

Procedures

Subjects were divided into 3 groups, and they regularly performed 3 warm-up protocols on 3 nonconsecutive days. The protocol was performed in a manner that on the first day, 3 groups performed 1 of the 3 warm-up protocols and on the following days the duties in lieu of doing the stretching method was changed regularly by rotation as shown in Table 1. Finally, the results of all participants in all methods were collected separately, showing that all 18 participants had performed the entire research.

The protocol plan was jogging (low intensity) for 5 minutes, performing stretching programs (except for the no-stretch protocol), 2 minutes of rest, and eventually 5 soccer instep kicks. Because all participants preferred to kick the ball using their right leg, the right leg was considered the preferred leg. After 2 minutes of rest, players were randomly assigned to a series of 5 consecutive maximal velocity instep place kicks of a stationary ball with their dominant limb. Rest of 1 min was allowed between the kicks. A ball was kicked 11 m toward a target, in the middle of a goal post; essentially, this corresponds to the penalty kick in soccer. To minimize movement in the frontal plane, the participants were restricted to a 3-m straight run-up from a position directly behind the ball at an approach angle of 0 degree. A FIFA-approved size 5 soccer ball (mass = 0.435 g) was used for each kicking session.

The principal lower extremity muscle groups involved in soccer instep kicking stretched are the gastrocnemius, hamstrings, quadriceps and hip flexors, gluteals, and the adductors. Muscles are also the main force producers to move lower extremity segments during soccer instep kicking. The static stretches used are gastrocnemius, hamstrings (modified with subjects holding their own leg), hip flexor and quadriceps (modified with vertical thigh and trunk alignment), gluteals and the adductors. Subjects held the stretch for 15 seconds on each leg before changing immediately to the contralateral side. Subjects were told to stretch until they approached the end of the ROM but within the pain threshold. Subjects performed the dynamic stretches on alternate legs for 30 seconds at a rate of approximately 1 stretch cycle per second or unilaterally for 15 seconds, they then repeated this on the other leg at a rate of approximately 1 stretch cycle per second. The dynamic stretches used involve the Quadriceps femoris (quadriceps); Lateral lunge (adductors); Hip extensors (gluteals); Hamstrings (hamstrings); and Plantar flexors (gastrocnemius), described inYamaguchi and Ishii (35). Subjects were in-structed to try and attain the maximal ROM during the 15 seconds of dynamic stretching.

Table I. Different warm-up protocols and testing programs during 3 noncontiguous days*

	Day 1				Day 2					Day 3			
Group	5 min jogging	Stretching	2 min rest	Kicking (5min)	5 min jogging	Stretching	2 min rest	Kicking (5min)	5 min jogging	Stretching	2 min rest	Kicking (5min)
1	+	No Stretching	+	+	+	Dynamic (5 min)	+	+	+	Static (5 min)	+	+
2	+	Static (5 min)	+	+	+	No Stretching	+	+	+	Dynamic (5 min)	+	+
3	+	Dynamic (5 min)	+	+	+	Static (5 min)	+	+	+	No Stretching	+	+

A digital video cameras (Sony) were used to capture limb motion at 100 Hz. The video camera were adjusted so that the reference point was the penalty point. Reflective spherical markers were fixed securely by a single investigator onto the lateral side of the bony anatomical landmarks of the right and left legs, including the fifth metatarsal head, the heel, the lateral malleolus, the lateral epicondyle of the knee, the lateral greater trochanter and the center of ball. Kinovea software was used to analyze the kick. Finally, 1 kick could be selected with a good football impact and adequate center of goal targeting for final analyzing. Hip angular displacements during backswing, forward, and follow-through phases were selected as dependent variables and also analyzed as DROM. There are, therefore, 3 variables during soccer instep kicking which are DROM of the hip joint during (a) the backswing phase, which starts from the dominant leg toe-off until start flexion of the hip joint, (b) forward phase which starts from hip flexion after backswing phase until impact with the ball, and (c) follow-through phase, which started after impact with the ball until the end of hip flexion and start of hip extension.

Statistical Analyses

The effect of different stretching methods on DROM of the hip joint in all players was determined using 1-way analysis of variance for repeated measures. A significance level of $p<0.05$ was considered statistically significant for this analysis.When justified, paired t-tests were performed to confirm significant changes within each condition.

Results

Within-group analysis showed no significant difference in DROM after the dynamic stretching (2.3 ± 3.9^0) compared with the static stretching (0.9 ± 1.8^0) relative to the no stretching group during the backswing phase. There was, on the other hand, a significant ($p< 0.03$) difference in DROM after the dynamic stretching (4.1 ± 5.8^0) compared with the static stretching (-1.1 ± 6.3^0) relative to the no-stretching group during the forward phase.There was, in addition, a significant ($p<0.01$) difference in DROM after the dynamic stretching (3.2 ± 2.9^0) compared with the static stretching (-1.1 ± 7.1^0) relative to the no-stretching group during the follow-through phase. According to the whole phases (total DROM), there was a significant ($p<0.01$) difference in DROM after the dynamic stretching (7.7 ± 6.9^0) compared with the static stretching (-1.4 ± 7.9^0) relative to the no-stretching group during whole phases.

Discussion

The purpose of this study was to compare the effect of static and dynamic stretching methods, during warm-up on the hip DROM during the instep kick in professional soccer players. The findings of this study showed that significant increase in hip joint DROM after the dynamic stretching compared to static stretching during the (a) forward phase, (b) follow-through phase, and (c) all soccer instep kicking phases.

The present finding showed that there was no significant difference between dynamic and static stretching on hip DROM during the backswing phase. It seems that the reasons behind DROM are twofold: optimal agonist contracted muscle, which results from the movement of the segment around the joint creates more DROM or angular displace-ment and also optimum antagonist muscle (muscle to be stretched), which limits segment movement to the opposite direction. During the backswing phase, according to the literature, the kicking leg moves backward, with the hip extending up to 29^{0} supported by hip extensors as agonist muscles and limited by hip flexors as antagonist muscles, with a velocity of 171.9–286.5^{0}.s-1 (23,29). In addition, as a result of the backward movement of the shank, the angular velocity of the thigh is almost minimal at the same time that the shank velocity is negative. During the initial part of the forward swing phase, the angular velocity of the thigh is positive ;286–401^{0}.s-1, whereas a negative shank angular velocity 286–401^{0}.s-1 is observed (20,22). This is because of the immediate forward movement of the thigh as long as the shank moves backward. Depending on the role of the hip and the thigh during the backswing phase, it seems that hip extensors do not generate maximal energy to move the thigh backward around the hip joint. According to previous studies (5,7,15,28,35), which showed that dynamic stretching positively affected the target muscle and because of production of greater force and power than in static stretching and based on hip and thigh function during the backswing phase, it could be that different stretching methods did not have a determinant role in affecting hip extensors to move the thigh for more DROM around the hip joint, because hip extensors did not produce high force to move quickly.

In contrast to the backswing phase, during the forward phase, the dynamic method showed a higher DROM compared to the static stretching method. During the forward phase compared to the backswing phase, the hip starts to flex (reaching values of 20L at speeds of up to 745^{0}.s-1 (23,29). Therefore, it is clear that the thigh moves faster during the forward phase than during the backswing phase, because hip flexors as agonist muscle produce higher forces than because of quick thigh movements and also in more DROM around the hip joint. Dynamic stretching compared to static stretching probably affected hip flexors to perform a faster motion and more angular displacement. Further-more, this significant difference between dynamic and static stretching relative to no-stretching also provides evidence during the follow-through phase. It seems that the role of the thigh during the follow-through is similar with that during the forward phase.

We suggest that the main reason for the positive effect of dynamic stretching on DROM of the hip joint is its effect on agonist muscles rather than on antagonist muscles. Agonist muscles (hip flexors) produce more force after dynamic stretching compared to after static *stretching and are therefore able to move the segment (thigh) around the hip joint and increase the DROM. Previous studies also support our finding that dynamic stretching positively affects hip DROM compared to static stretching. Previously, 2 hypotheses have been proposed for the static stretching-induced decrease in performances (4,8,27,31): (a) mechanical factors involving the viscoelastic properties of the muscle that may affect the muscle's length–tension relationship and (b) neural factors such as decreased muscle activation or altered reflex sensitivity. Recent studies (27,31) have suggested that the primary mechanism underlying the stretching-induced decreases in force is related to increased muscle compliance that may alter the muscle length–tension relationship, increased sarcomere shortening distance and velocity, and decreased force production because of the force–velocity relationship. A stretching-induced change in the length– tension relationship may also account for the negative effect on agility performance. On the other hand, it seems that the positive acute effect of dynamic stretching is the result of some level of post activation potentiation (PAP) (17). Post activation potentiation is prevalently defined as the temporary increase in muscle contractile performance after a previous "conditioning" contractile activity (32). Post activation potentiation may raise the rate constant of cross bridge attachments (19), which in turn may enable a greater number of cross bridges to form, resulting in an increase in force production (3). Faigenbaum et al. (13) and Yamaguchi and Ishii (35) hypothesized that the increases in force output after dynamic stretching were caused by an intensification of neuromuscular function, and they hinted that the dynamic stretching had a PAP effect on performance.*

In summary, this study examined the acute effects of 2 different stretching methods during warm-up on the DROM of the hip joint during instep kicking in professional soccer players. Unique to this investigation, the warm-up protocols, which included dynamic stretching, enhanced the DROM to a greater degree than did static stretching alone. The possible reasons for these observations are as follows: (1) a positive effect of dynamic stretching on agonist muscles by allowing a greater number of cross bridges to form, resulting in an increase in force production, (2) effect on antagonist muscle (stretched muscle) by a motion similar to the main motion to move around the joint in more angular displacement compared to static stretching. Static stretching, on the other hand, when performed routinely during soccer pre-training and pre-competition warm-up, does not appear to be detrimental to subsequent DROM of the hip joint. However, the benefits of using static stretching in a warm-up remains questionable.

Practical Applications

A higher DROM in soccer seems to have a positive impact on angular velocity of lower extremity joints during whole phases of instep kicking especially in the forward and follow-through phases. Dynamic stretching during warm-ups, as compared to static stretching, is probably most effective as a preparation for the DROM required in sports such as soccer. It seems that dynamic stretching is more useful and optimal than static stretching for dynamic motions that needs more DROM around the joints. Consequently, the present finding suggests to coaches who train professional soccer teams that dynamic stretching produces more and maximal benefit and optimum muscular function to perform DROM during active movements as compared to static *stretching, especially in skills such as soccer instep kicking. This in turn will produce high ball velocity and increase one's chances of scoring a goal. Injuries related to lack of ROM may also be prevented with dynamic stretching. In active sports, coaches and trainers should use the DROM analysis and make appropriate modifications to the training to maximize the performance.*

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Comparative study of selected physical components of university male kabaddi, football and kho-kho players

Dr.S.Manikandan*

*Associate Professor, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India.

Abstract

Most of the skill performances and execution of techniques in the sports such as kabaddi, football and kho-kho were based on the basic fitness components. The purpose of the study was to determine the existence of statistically significant difference on selected physical components (speed, agility, power, flexibility and endurance) among kabaddi, football and kho-kho players. For this purpose, 90 players (30 kabaddi players, 30 football players and 30 kho-kho players) were selected. Their age ranged between 18 to 23 years. The selected variables were assessed using 50 metres dash, shuttle run, jump and reach, sit and reach, and harward step test. The data was analyzed by applying ANOVA and Scheffe's post hoc test. The result showed that there were significant difference in all the selected physical fitness components among Kabaddi, Football and Kho-Kho players. The Kabaddi players showed a better capability in speed, agility and power, while the Football player were better in endurance and the Kho- Kho player with greater flexibility.

Key Words: Speed, Agility, Power, Flexibility, Endurance

Introduction

The fitness components are qualities that sportsman must develop to physically prepare for sport competition. They are the building blocks of exercise and physical activity. sports training programs are designed to build these components in the proper proportions that match the requirements of each sport. A basic definition of physical fitness is "the ability to complete daily tasks with energy, reduce health risks due to inactivity, and be able to participate in a variety of physical activities." The 5 fitness components that are deemed health-related are: cardio, strength, endurance, flexibility, and body composition In addition speed, agility, power, balance, and coordination have been identified as performance-related. All of these qualities exist to some degree in most sports, but developing certain combinations is important in any given sport. While definitions are assigned to qualities that represent what "fitness" is, it can be operational zed in different ways for each sport. In other words, fitness for one sport is somewhat different for another. In today's society sports and physical fitness play an important role in physical well-being. In this material world man does not get enough time for doing physical activity. Spectral concept of health emphasize that the health of an individual is not static it is a dynamic phenomenon and a process of continuous change. The physical dimension of health is *probably the easiest to understand. The state of physical health implies the notion of perfect functioning of the body. Nowadays physical activities have a great role in maintaining better health. Meanwhile better health is only possible through doing some sort of physical activities. In this point of view, the combative sports like boxing, wrestling and judo are the good source of developing physical fitness and mental fitness. Comparing of selected physical fitness components of male boxers, wrestlers and judokas would reveal that significant difference exist as their physical fitness developed through participation in respective sports.*

Methods

Subjects and Variables

For the study total 90 males (30 kabaddi players, 30 football players and 30 kho-kho players) were selected from Annamalai University, Chidambaram. The age ranged between 18-23 years. The following tests were selected for the study 50 Meter dash, shuttle run, jump and reach, sit and reach and harward step test.

Statistical Technique

The data was analyzed by applying ANOVA. The level of significance was fixed at 0.05 level. Scheffe's post-hoc test was employed were F- ratio found significant.

Results

The data on selected fitness components were analyzed and tabulated in Table 1 through 3. The mean values on speed, agility, power, flexibility and endurance of kabaddi, football and kho-kho players were given in Table - I.

Table - I

Mean Scores on Selected Physical Fitness Components Ariables Kabaddi Football and Kho - Kho Players

Variables	Kabaddi	Football	Kho- Kho
Speed	6.68	7.13	7.04
Agility	9.90	10.69	10.63
Power	20.47	15.3	16.77
Flexibility	24.30	28.72	30.07
Endurance	68.18	78.09	74.84

The data on selected fitness components was analysed for statistically significant difference among kabaddi players, football players and kho-kho players using analysis of variance and it is given in Table - II.

Table - II

Anova on Selected Physical Fitness Components Variables Source of Variance

Variables	SS	DF	SV	MS	'F - Value
Speed	3.35	2	B	1.68	11.90*
	12.25	87	W	0.14	
Agility	11.77	2	B	5.85	35.87*
	14.19	87	W	0.16	
Power	425.35	2	B	212.67	23.04*
	803.13	87	W	9.23	
Flexibility	546.78	2	B	273.39	68.57*
	346.86	87	W	3.99	
Endurance	1530.47	2	B	765.24	18.03*
		87	W	42.43	

**Significant at F 0.05 level*

Table –II states that there is a statistically significant difference on all the fitness components (speed, agility, power, flexibility and endurance) confined to this study, as the obtained F ratio was found to be greater than the required table value of 3.10 at 0.05 level of confidence. Since, significant difference exists, the post hoc test was applied to find out the paired mean *difference among boxers, wrestlers and judokas on each of the fitness components selected in this study, and it is given in Table - III.*

Table - III

Scheffe's Post-Hoc Test on Selected Physical Fitness Components

Variables	Kabaddi	Football	Kho - Kho	MD	CD
Speed	6.68	7.13		0.45*	0.23
	6.68		7.04	0.36*	0.23
		7.13	7.04	0.09	0.23
Agility	9.90	10.69		0.79	0.02
	9.90		10.63	0.73	0.02
		10.69	10.63	0.06	0.02
Power	20.47	15.3		5.17	1.94
	20.47		16.77	3.7	1.94
		15.3	16.77	1.47	1.94
Flexibility	24.30	28.72		4.42	0.65
	24.30		30.07	5.77	0.65
		28.72	30.07	1.35	0.65
Endurance	68.18	78.09		9.91	7.01
	68.18		74.84	6.66	7.01
		78.09	74.84	3.25	7.01

Table - III reveals that kabaddi players demonstrated significantly better speed, agility and power performance compared to football and kho-kho players, in case of flexibility kho-kho players have notably better flexibility than kabaddi and football players. Football players have considerably superior endurance capacity than kabaddi players.

Discussion

In the present study kabaddi players demonstrated significantly better speed, agility and power performance compared to football and kho-kho, in case of flexibility kho-kho players have notably better flexibility than kabaddi and football players. Football players have considerably superior endurance capacity than kabaddi players. Earlier studies of Jagiełło, Kalina, and Tkaczuk (2001; 2004) well documented the development of the motor capacity. It is worth to emphasize one more issue by comparing the sportsmen of different sports. Only few studies made a comparison between different sports and revealed differences on fitness characteristics along the participation of different sports (Daniels & Thornton, 1990; Reynes & Lorant, 2004), where Gernigon and Le Bars (2000) stressed the compatibility of a competitive context and task orientation in such studies. Consequently, future studies might take a closer look at the relationship between the characteristics of participants and the chosen sport. Conclusions On the basis of the findings it was concluded that participation in different sports cultivates physical fitness but at a very much varied context of such chosen sports.

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A comparative study of selected physical fitness qualities among university men volleyball basketball and handball players

Dr. G. Santoshkumar*

Associate Professor, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India.

Abstract

Most of the skill performances and execution of techniques in the sports such as kabaddi, football and kho-kho were based on the basic fitness components. The purpose of the study was to determine the existence of statistically significant difference on selected physical components (speed, agility, power, flexibility and endurance) among kabaddi, football and kho-kho players. For this purpose, 90 players (30 kabaddi players, 30 football players and 30 kho-kho players) were selected. Their age ranged between 18 to 23 years. The selected variables were assessed using 50 metres dash, shuttle run, jump and reach, sit and reach, and harward step test. The data was analyzed by applying ANOVA and Scheffe's post hoc test. The result showed that there were significant difference in all the selected physical fitness components among Kabaddi, Football and Kho-Kho players. The Kabaddi players showed a better capability in speed, agility and power, while the Football player were better in endurance and the Kho- Kho player with greater flexibility.

Key Words: *Speed, Agility, Power, Flexibility, Endurance*

Introduction

Sport has a very prominent role in modern society. It is important to an individual to an individual, a group, a nation in deed the world. The word sports has a popular appeal among people of all ages and both sexes. The sports performance in international competition and tournament not only denote the high level of efficiency of an individual sportsmen but also give expression to the over all efficiency of a nation. "Physical education is the sum of those experience which come to the individual through movement"

Methodology

The purpose of this study was to compare the selected physical fitness variables among university men volleyball, basketball and handball players. To achieve this purpose of the study, twenty men volleyball players, twenty basketball players and twenty handball players from Department of Physical Education and Sports Sciences, Annamalai University were selected as subjects. The data were collected for all subjects on selected physical fitness qualities such as speed using 50 mts run. The one way analysis of variance was used to find out the significant difference among university men volleyball, basketball and handball players. The Scheffe's test was used as a post hoc test to find out the paired mean differences, if any. In all cases, .05 level of confidence was fixed to test the significance, which was considered as an appropriate.

Speed

The mean, standard deviation and 'F' ratio values on speed among university men volleyball, basketball and handball players have been presented in Table I.

Table I - The mean, standard deviation and 'f' ratio values on speed among university men volleyball, basketball and handball players

Groups	Mean	Standard Deviation	Obtained 'F' Ratio
Volleyball players	8.12	0.88	3.86*
Basketball players	7.19	0.94	
Handball players	7.41	0.92	

* Significant at .05 level of confidence.

(The table value required for significance with df 2 and 57 was 3.138)

Table I shows that the mean values of university men volleyball, basketball and handball players were 8.12, 7.19 and 7.41 respectively on speed. The obtained 'F' ratio 3.86 was greater than the table value 3.138 required for significance with df 2 and 57.

The results of the study showed that there was a significant difference on speed among university men volleyball, basketball and handball players.

Since, three groups were compared, whenever the obtained 'F' ratio for adjusted post test was found to be significant, the Scheffe's test to find out the paired mean differences and it was presented in Table II.

Table II - The Scheffe's test for the differences between paired means on speed

Volleyball players	Basketball players	Standard Deviation	Obtained 'F' Ratio	Obtained 'F' Ratio
8.12	7.19	-	0.93*	0.41
8.12	-	7.41	0.71*	0.41
-	7.19	7.41	0.22	0.41

* Significant at .05 level of confidence.

The table II shows that the mean difference values between college university volleyball players and basketball players and volleyball players and handball players on speed 0.93 and 0.71 which were greater than the confidence interval value 0.41. And also the mean difference value between university men basketball players and handball players on speed 0.22 which was less than the confidence interval value 0.41.

The results of the study showed that there was a significant difference between university men volleyball players and basketball players and volleyball players and handball players on speed. There was no significant difference between university men basketball players and handball players on speed.

Conclusion

There was a significant difference among university men volleyball, basketball and handball players on speed.

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Effect of Aerobic Training on Selected Physical and Physiological Variables of Adult Obese Men

Mr.N.Ganapathy*, Dr.M.Rajashekaran**

** Ph.D Scholar, Bharathiar University, Coimbatore, Tamilnadu, India.*

*** Professor, Department of Physical Education and Sports Science, Annamalai University, Chidambaram, Tamilnadu, India.*

Abstract

The study was designed to investigate the effect of Aerobic Training on Selected Physical and Physiological Variables of Adult Obese Men. To achieve the purpose of the study forty adults from Coimbatore were selected as subjects and segregated into two groups of twenty subjects each as experimental group and control group following random procedure. The experimental group underwent Aerobic Training over a period of twelve weeks where as control group did not participate in any of the training except their regular play. Speed was selected as Physical Variables whereas Resting Pulse Rate was selected as Physiological variables and they were assessed before and after the experimental period by using 50mts sprint. ANCOVA was used to analyze the collected data. The results of this study showed that there was a significant difference between experimental group and control group on speed and resting pulse rate.

Key Words: *Aerobic, Obesity, Speed, Resting Pulse Rate, Analysis of Co variance (ANCOVA)*

Introduction

Aerobic training is a process whereby the heart and lungs are trained to pump blood more efficiently, allowing more oxygen to be delivered to muscles and organs. Aerobic training is a determining factor in performance in events with duration greater than 2mins. On the athletics track this would include all events in excess of 800m. Physical fitness is generally achieved through correct nutrition, exercise, and enough rest. A one rep maximum is the test to determine maximum muscular strength. Speed of an object is the magnitude of its velocity (the rate of change of its position). Endurance is the ability of an organism to exert itself and remain active for a long period of time, as well as its ability to resist, withstand, recover from, and have immunity to wounds, or fatigue. Obesity has become a major health, social and economical burden of today's world (James et al., 2004). It has now been well established that obesity directly increases cardio metabolic risk by altering the secretion of adipokines and, indirectly, by promoting insulin resistance and its associated metabolic disorders, such as Type-2 diabetes (Kopelman, 2000). For the physiological system of body to need fit, they must function well enough to support the specific activity the individual in performing. Moreover, different activities make different demands upon the organism with respect to circulatory, respiratory, metabolic and neurological process, which are specific to the activities. The lungs, heart and blood perform a vital function on the body's supply system. They supply to the muscles with necessary fuels, oxygen and carry waters such as carbon dioxide and lactic acid. Consequently, the cardio respiratory system in the athlete needs to be developed.

Methodology

The purpose of the study was to find out whether there would be any significant improvement on selected variables as an effect of aerobic training on selected physical and physiological variables of adult obese men. To achieve the purpose of the study forty students will be selected as the subjects for this study from Coimbatore. The participants are randomly selected from students and assigned to Group - I (Aerobic Training Group) and Group - II (Control Group). Each group consisted of 20 subjects.After assigning the group all the students are administered with the criterion variable which is considering as a pre test. The experimental groups are treated with packages of exercise for the period of twelve weeks and the control group did not participate in any training. After the treatment period was over all the subjects were administered with the criterion measures which was considered as post test.

Table I - Type of Variables, Tests and Unit of Measurements

S. No.	Variables	Tests / Equipments	Units of Measurement
1	Speed	50 Mts Run	Seconds
2	Resting Pulse Rate	Radial Pulse Rate	Beats per minute

Aerobic Training Programs

The training period, the experimental groups underwent their respective training programs three days per week (Alternative days) for 12 weeks. During the training days they worked out for 45 to 60 minutes approximately including warming up and warming down periods. Another group acted as control group and they were instructed do not to participate in any strenuous physical exercises and specific training throughout the training program. However, they performed their regular activities as per the curriculum. Each group consists of 20 students.The Aerobic exercises such as long distance running, jump rope training, sit-ups, press-ups, crunches, pull ups, star jumps are crucial part of its training.

Collection of Data

The data were collected on the selected test items as per the methods described. The pre test was conducted before the experimental period. After Twelve weeks of the Experimental period, the post test was conducted and the data were collected for the study.

Test scores were subjected to statistical analysis The ANOCOVA were calculated for the physical and physiological variables. To find out significance of the difference or the change that occurred between pre-and-post tests.

Table II - Computation of Analysis of Covariance of Speed

Group	Aerobic	Control	Source of Variance	Sum of Squares	df	Mean Squares	F
Pre Test Mean	8.91	8.78	Between	0.15	1	0.15	0.13
			Within	44.12	38	1.16	
Post Test Mean	7.81	8.68	Between	7.56	1	7.56	8.48*
			Within	33.91	38	0.89	
Adjusted Post Test Mean	7.758	8.73	Between	9.45	1	9.45	102.92*
			Within	3.39	37	0.09	

*Table F-ratio at 0.05 level of confidence for 1 and 38 (df) = 4.08, 1 and 37 (df) = 4.08. * Significant*

As shown in Table III, obtained F ratio of 0.13 on pre test means of the groups was not significant at 0.05 level. This shows that there was no significant difference among the means of the groups at the initial stage and the random assignment of the groups was successful.

The obtained F ratio on post test means was 8.48, which was significant at 0.05 level, the obtained F value was greater than the required F value of 4.08 to be significant at 0.05 level.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done and the obtained F value 102.92 was greater than the required value of 4.08 and hence it was accepted that there was significant differences among the adjusted means on the engineering college obese men students.

Table III - Computation of analysis of covariance of resting pulse rate

Group	Aerobic	Control	Source of Variance	Sum of Squares	df	Mean Squares	F
Pre Test Mean	79.30	80.05	Between	5.62	1	5.62	1.25
			Within	171.15	38	4.50	
Post Test Mean	78.35	80.15	Between	32.40	1	32.40	7.83*
			Within	157.10	38	4.134	
Adjusted Post Test Mean	78.68	79.81	Between	12.47	1	12.47	20.46*
			Within	22.55	37	0.60	

*Table F-ratio at 0.05 level of confidence for 1 and 38 (df) = 4.08, 1 and 37 (df) = 4.08. *Significant*

As shown in Table VII, obtained F ratio of 1.25 on pre test means of the groups was not significant at 0.05 level. This shows that there was no significant difference among the means of the groups at the initial stage and the random assignment of the groups was successful.

The obtained F ratio on post test means was 7.83, which was significant at 0.05 level, the obtained F value was greater than the required F value of 4.08 to be significant at 0.05 level.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done and the obtained F value 20.46 was greater than the required value of 4.08 and hence it was accepted that there was significant differences among the adjusted means on the engineering college obese men students.

Conclusion

The twelve weeks aerobic training programme on the adult obese men has proved to be effective on selected physical and physiological variables and it's significant at 0.05 level of significance.

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Consequence of sand and land plyometric training on speed and explosive power among south zone inter university tournament participated male players

Mr.G.T.Selvaganesh * Dr.S.Manikandan**

*Assistant Director of Physical Education, Kalasalingam University, Krishnankoil, Tamilnadu, India.

**Associate Professor, Department of Physical Education & Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India.

Abstract

The purpose of this study was to compare the effects of 2 different training protocols- Sand and Land Plyometric training on vertical jump and speed among south zone inter university tournament participated players. Sixty subjects were randomly assigned between 18 and 21 years of age volunteered as participants to 1 of 3 groups: Sand Plyometric training group (n = 20), Land Plyometric training group (n = 20), and control group (n = 20). 12 weeks of training, 3 days a week was employed on the subjects and Pre & post test on vertical jump and speed was administered. Data were analyzed by analysis of co-variance (ANCOVA). Scheff's test was used as a post hoc test to determine which of the paired mean differ significantly. Results showed that all training treatments elicited significant ($p < 0.05$) improvement in all tested variables. However, the Sand Plyometric training group produced improvements in vertical jump performance and leg strength that were significantly greater performance in compare with the land and control group. This study provides support for the use of a traditional and plyometric drills to improve vertical jumping ability and explosive performance in general.

Key Words: Plyometric training, Speed and Explosive power

Introduction

Plyometric exercise has been in practice for many years, (EDWIN RIMMER, 2000) to develop the explosive power of athletes. It is a type of training that develops the ability of muscles to produce force at high speeds (produce power) in dynamic movements; these movements involve a stretch of the muscle immediately followed by an explosive contraction of the muscle. This pattern of muscle contraction is known as the stretch-shorten cycle (SSC) (NORMAN 1979.). Plyometric exercises include vertical jumps, during which the athlete jumps as high as possible "on the spot," and bounds, during which the athlete leaps as high and as far as possible, thus moving the body in the horizontal and vertical planes. It is generally accepted that the more specific training exercises to a competitive movement, the greater the transfer of the training effect to performance (DELECLUSE, 1995). Athletes such as sprinters, who require power for moving in the horizontal plane, engage in bounding plyometric exercises, whereas athletes such as high jumpers and volleyball players, who require power to be exerted in the vertical direction, train using vertical jumping exercises (CHU, 1992). Plyometric is a means of encouraging the muscle to achieve maximal force *rapidly and therefore serving to increase explosive-reactive power through a range of motion and is a popular training approach (Lockwood, 2004).*

Materials and Methods

Subjects

Sixty male south zone inter university participated players were randomly selected from Kalasalingam University, Krishnankoil, Tamilnadu, The age ranged between 18-21 years.

Procedures

The Plyometric training program is designed and is divided into three groups mainly, group - I Sand Plyometric training (n = 20), group - II Land Plyometric training (n = 20), and group III control (n = 20). The Plyometric training box is 40cm height and 80cm with. The land Plyometric box is placed a smooth surface and sand Plyometric box is placed a designed Pit with filtered river sand the size of the pit 3 feet length, 3 feet Width and 2 feet depth. Subjects in each training group trained 3 days per week. A session and 60 min per day. All subjects continued with their normal specialization training and their games.

Result

Table I - Analysis of Variance & Covariance of Pre, Post and Adjusted Post Test on Speed

	CG	SPTG	LPTG	SOV	SS	Df	MS	F- ratio
Pre-Test Means	7.56	7.56	7.58	BG	0.005	2	0.003	0.01
SD (+)	0.35	0.38	0.38	WG	8.06	57	0.42	
Post -Test Means	7.52	6.81	7.27	BG	5.11	2	2.55	14.28*
SD (+)	0.32	0.46	0.46	WG	10.19	57	0.17	
Adjusted Post Test Mean	7.52	6.82	7.25	BG	5.06	2	2.53	58.73*
				WG	2.41	56	0.04	

Table - I shows the pre-test means of CG, SPTG, and LPTG on speed. The F-value needed for significance for df (2, 57) at _ < 0.05 level was 3.15. The obtained F-value for the pre-test mean on speed was 0.05 which was not found to be significant. In post test analysis the F-ratio on the speed variable was 14.28. The analysis of covariance adjusted the differences in pre test means with post test means between the Sand and land plyometric training and control groups. The F-value needed for significance for df (2, 56) at _ < 0.05 levels was. The F-value obtained from testing the adjusted means between the sand and land plyometric training and control groups on speed was 58.73which was statistically significant.

Table II - Analysis of Variance & Covariance of Pre, Post and Adjusted Post Test on Explosive Power

	CG	SPTG	LPTG	SOV	SS	Df	MS	F- ratio
Pre-Test Means	46.20	5.30	45.75	BG	8.10	2	4.05	0.12
SD (±)	5.75	5.84	5.67	WG	1891.15	57	33.15	
Post -Test Means	47.40	51.00	48.90	BG	130.80	2	65.40	1.88
SD (±)	6.13	5.75	5.76	WG	1976.6	57	34.67	
Adjusted Post Test Mean	49.64	51.45	48.90	BG	203.89	2	101.94	160.24*
				WG	35.62	56	10.63	

Table - II shows that the pre-test means of CG, SPTG, and LPTG on explosive power. The F-valueneeded for significance for df (2, 57) at _ < 0.05 levels was 3.15. The obtained F-value for thepre-test mean on explosive power was 0.12. It was found to not be significant. In post testanalysis the F-ratio on the variables such as explosive power was 1.88. The analysis ofcovariance is adjusting the differences in pre-means with post-test means between the Sand andland plyometric training and control groups. The F-value needed for significance for df (2, 56) at 0.05 levels was missing number!. The F-value obtained from testing the adjusted meansbetween the Sand and land plyometric training and control groups on explosive power were 160.24. It was found to be significant.

Discussion

The use of plyometric training has been advocated for several years as a means of improving performance in sports and activities in which lower-body power plays a key role in success (FATOUROS, 2000). During a plyometric movement, the muscles undergo a very rapid switch from the eccentric phase to the concentric phase. This stretch-shortening cycle decreases the time of the amortization phase that in turn allows for greater than normal power production (POTTEIGER, 1999). The muscles stored elastic energy and stretch reflex response are essentially exploited in this manner, permitting more work to be done by the muscle during the concentric phase of movement (HEDRICK, 1996). Training programs that have utilized plyometric exercises have been shown to positively affect performance in power-related movements such as jumping (BLATTNER, 1979). In the present study, improvements were seen in vertical jump height, vertical jump power, and Margaria power, which support these earlier studies. The increases in power following a plyometric training program could be due in part to increases in muscle fiber size. Improvements in muscle force production have been associated with increases in muscle fiber size (GOLLNICK, 1981).

Conclusion

The present study reveals that the 12 weeks of plyometric training in a land and sand environment, sand plyometric training shown significant differences among the three groups with respect to speed, and explosive power measures. It is also concluded that the *subjects with sand training group had shown greater improvement comparable to the subjects with land and control groups regard to all the parameters.*

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Training outcomes of yogic practices and aerobic dance on selected health related physical fitness variables among tamilnadu male artistic gymnasts

D. Boopathy*, Dr. D. Prasanna Balaji**

*Ph.D Scholar, National College, Department of Physical Education, Tiruchirappalli, Tamilnadu, India.
**Head and Director, Research, Department of Physical Education, National College, Tiruchirappalli, Tamilnadu, India.

Abstract

The purpose of the study was to find out the effect of selected Yogic Practices and aerobic dance on health related Physical Fitness variables among men artistic gymnasts. Forty five students were selected from various Schools in Tiruchirappalli, Tamilnadu. The age of the subjects ranged from 14 to 17 years. The selected subjects were divided in to two experimental groups by random. Group-I underwent Yogic practices in selected asanas and pranayama for a period of six weeks; Group II underwent Aerobic dance practice and Group III acted as a control group for three alternate days in a week for a period of six weeks. The dependent variables selected for this study were Cardio Vascular Endurance, Muscular Strength/Endurance, Flexibility and Body Composition. The dependent variables namely Cardio Vascular Endurance measured by Cooper's 1- mile run/walk test, Flexibility measured by Sit and Reach test, Muscular Strength/Endurance measured by Bent Knee Sit ups and Body Composition measured by Skin Fold Caliper. The data were collected from each subject before and after the training period and statistically analyzed by using dependent't' test and analysis of co variance (ANCOVA). It was found that Aerobic dance group was found to be better in improving Cardio Vascular and Muscular strength/Endurance when compared to the Yogic practices group. Yogic practices group was found to be better in improving Flexibility when compared to the Aerobic Dance group. Both yogic practices and Aerobic Dance groups were developed the body composition equally.

Key Words: *Yogic Practices, Aerobic Dance, Health related physical fitness*

Introduction

Yoga has hoary past. The importance for the spiritual attainment has been recognized throughout the ages by all the systems of Indian philosophy. There is no doubt that the essence of yoga has been considered in the spiritual upliftment of man. One may question as to how then yoga is related to the physical education and whether yoga will not be pulled down from its highest pedestal in doing this. It is necessary, therefore, to clear the concepts of yoga and physical education first.

The word 'Aerobics' is a common terminology primarily used to refer specifically to synchronized systematic movements of one's body. During the last decade women wanted to get the benefit of the aerobic workout and hence associate with jogging and searched for other way of exercises besides disliking running by themselves. This spawned in past aerobics enthusiasm. Aerobics combined with an aerobic workout allowing them to enjoy and thus keep them exercising long enough to improve their aerobic capacity.

Fitness improves general health and it is essential for full and vigorous living. The physical fitness over a long span examination of the same reflects the status of health.Physical examination assesses the growth pattern and functional efficiency of the body in terms of strength, cardiovascular endurance, flexibility, speed agility, balance and neuro muscular-coordination.

Literally translated in Greek Gymnastics means "to exercise naked" however, most people recognize gymnastics is a physically demanding sport filled with intricate tricks and impressive stunts performed with style and grace by both genders. Through men and women have the chance to showcase several skills during performances, women's gymnastics composed of several different events.The sport Gymnastics is a complex combination that involves physical strength, flexibility, power, agility, coordination, grace, balance and control.

Methodology

Forty –five students were selected from various Schools in Tiruchirappalli, Tamil Nadu. The age of the subjects ranged from 14 to 17 years. The selected subjects were divided in to two Experimental groupsand one control group by random. During the training period experimental groups underwent their respective training program in addition to their regular program of the course study. Group I underwent yogic practices in selected asanas and pranayama; Group II underwent Aerobic dance and Group III acted as a Control group for three alternative days in a week for a period of six weeks. The dependent variables selected for this study were CardioVascular Endurance, Muscular Endurance/ Strength, Flexibility and Body composition. . The dependent variables namely CardioVascular Endurance measured by Cooper's 1- mile run/walk test, Flexibility measured by Sit and Reach test, Muscular Strength/ Endurance measured by Bent Knee Sit ups and Body Composition measured by Skin Fold Caliper.

The duration of training session in the six weeks was between 45 to 60 minutes approximately, including warming up and cooling down. Group III acted as a control.They did not participate in any specific training par with experimental group. All subjects involved in this study were carefully monitored throughout the training program to be away from injuries. They were questioned about their health status throughout the training program. None of them reported any injuries. However, muscle soreness appeared in the earlier period of the training program and was reduced in due course.

The training program scheduled with the duration and load was based on the results of the pilot study. The training program was carried out for a period of six weeks and the schedule was presented in table I.

Table - I : Training schedule for yogic practices and Aerobic dance

Days	Duration	Yogic Practices	Aerobic Dance
Monday Wednesday Friday	1st & 2nd weeks	10mts-Stretching 20mts- Asanas 10mts- Ujjayi pranayama 10mts-Relaxation	10mts - Warm- up 35mts - Low impact Aerobic Dance 5mts - Relaxation

Days	Duration	Yogic Practices	Aerobic Dance
Monday Wednesday Friday	3rd & 4th weeks	10mts-Stretching 25mts- Asanas 15mts- Ujjayi pranayama 10mts-Relaxation	10mts -Warm- up 40mts - High impact Aerobic Dance 5mts - Relaxation
Monday Wednesday Friday	5th & 6th weeks	10mts-Stretching 25mts- Asanas 15mts- Ujjayi pranayama 10mts-Relaxation	10mts -Warm- up 45mts - Step Aerobic Dance 5mts - Relaxation

Results and Discussion

The influence of independent variables on each criterion variables were analyzed and presented below. The mean and dependent 't' test values on selected health related Physical fitness of yogic practices, aerobic dance and control groups have been analyzed in Table-II.

Table - II

Summary of Mean and dependent 't' test for the Pre test and Post test on selected variables of Experimental and Control groups.

Variables	Mean	Yogic Practices Group	Aerobic Training Group	Control Group
Cardiovascular Endurance	Pre test Mean	450.50 ± 9.70	449.60 ± 6.91	442.80 ± 6.82
	Post test mean	427.33 ± 7.53	403.83 ± 7.03	446.20 ± 7.31
	't' test	**10.23***	**2.44***	**1.03**
Muscular Endurance	Pre test Mean	24.16 ± 1.65	24.08 ± 2.66	25.00 ± 3.24
	Post test mean	26.64 ± 2.13	28.12 ± 2.61	24.96 ± 3.44
	't' test	**6.957***	**19.81***	**0.125**
Flexibility	Pre test Mean	25.76 ± 1.92	25.20 ± 2.75	25.72 ± 3.19
	Post test mean	29.72 ± 2.64	27.40 ± 3.11	25.76 ± 3.14
	't' test	**10.23***	**11.00***	**0.137**
Body composition	Pre test Mean	26.28 ± 0.51	26.31 ± 0.30	26.59 ± 1.14
	Post test mean	24.70 ± 0.16	24.32 ± 0.30	26.52 ± 1.14
	't' test	**13.50***	**14.77***	**1.23**

**Significant at.05 level. The table value required for 0.5 level of significance with df24 is 2.06*

The obtained 't' ratio value of experimental groups is higher than the table value and it is understood that both yogic practice and aerobic dance had significantly improved the performance of selected criterion variables. Since the obtained 't' ratio value of experimental groups are greater than the value. The analysis of covariance selected criterion variables due to the both the practices have been analyses and presented in table III.

Table - III : Analysis of covariance of Yogic practices, Aerobic dance and control group on selected variables

Variables	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' ratio
Cardiovascular Endurance	Pre test	356.487	1	0.0	0.01*
	Groups	758.846	2	0.0	0.03*
	Error	3725.513	71	0.0	
Muscular Endurance	Pre test	401.356	1	0.0	0.01*
	Groups	198.048	2	0.0	0.03*
	Error	158.004	71	0.0	
Flexibility	Pre test	505.728	1	0.0	0.01*
	Groups	192.750	2	0.0	0.03*
	Error	129.872	71	0.0	
Body composition	Pre test	19.523	1	0.0	0.01*
	Groups	55.803	2	0.0	0.03*
	Error	14.587	71	0.0	

**Significant at.05 level of confidence. (The table value required for significance at.05 level with df 1 &71 are 3.98 and 3.13 respectively).*

The table III shows that the obtained F-ratio value is higher than the table value 3.13 with df 2 and 71 required for significance. Since the value of F-ratio is higher than the table value, it indicates that there is significant difference among the adjusted post-test means of Yogic practices, aerobic dance and control groups. To find out which of the three paired means had a significant difference, the Scheef's post hoc-test was applied and the results are presented in Table IV.

Table –IV

Scheff's test for the differences between theadjustedpost tests paired means of selected criterion variables.

Variables	Adjusted post mean values			Mean Differences	Confidential Interval
	Yogic practice group	Aerobic dance group	Control group		
Cardiovascular Endurance	425.91	448.51		20.72*	5.13
	425.91		405.19	22.6*	5.13
		448.51	405.19	43.32*	5.13
Muscular Endurance	26.87	28.42		425.91*	1.06
	26.87		24.43	0*	0
		28.42	24.43	425.91*	0
Flexibility	29.52	27.76		425.91*	0.96
	29.52		25.60	0*	0
		27.76	25.60	425.91*	0
Body composition	24.58	24.38		425.910	0.32
	24.58		26.40	0*	0
		24.38	26.40	425.91*	0

**Significant at.05 level.*

Table IV shows that the adjusted post test means differences on selected criterion variables between the yogic practices and aerobic dance group, the values are greater than the confidence interval value 5.13, which shows significant difference at .05 level of confidence.

Conclusion

From the analysis of the above data, the following conclusions were drawn.

Yogic practices group significantly improved the health related physical fitness variables

Aerobic dance group significantly improved the health related physical fitness variables

Control group did not improve all the dependent variables

There was significant difference among yogic practices and aerobic dance group in improving the selected dependent variables such as CardioVascular Endurance, Muscular Strength/Endurance, Flexibility and Body Composition.

Aerobic dance group was found to be better in improving cardiovascular endurance and muscular endurance/ strength when compared to the yogic practices group.

Yogic practices group was found to be better in improving flexibility when compared to the Aerobic dance group

Both yogic practices and aerobic dance groups were developed the body composition equally.

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Dr. C. Suresh Kumar
Director of Physical Education
Sri Krishna College of Engineering and Technology
Coimbatore - 641 008

Mobile No. : 9443441213 - Phone : 0422 2678001 (7 Lines)
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