



A STUDY OF AEROBIC AND ANAEROBIC TRAINING TOWARDS KHO-KHO WOMEN PLAYERS

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ABSTRACT

A comprehensive concurrent aerobic and anaerobic training programme may be prescribed with the aid of this study by physical educators and coaches. This research is very important and applicable to the lives of coaches of part-time sports teams. Questions like how much improvement in physical fitness components could be possible with the utilisation of concurrent aerobic and anaerobic training will be answered by this research. Physical education instructors and coaches may use this research to better tailor health and athletic performance improving concurrent aerobic and anaerobic training programmes to their students' unique requirements. This research will reveal how significantly different physical fitness metrics would be after 12 weeks of combined aerobic and anaerobic exercise. An effort like this would encourage researchers to dig further into the many facets of mixing aerobic and anaerobic exercise. There is a growing demand for guidance for effective concurrent training as the number of "fitness hopefuls" rises.

KEYWORDS: concurrent, physical fitness, Physical education, applicable, improvement, researchers

INTRODUCTION

During aerobic exercises, an athlete maintains a steady pace for a prolonged period. Oxygen is used to metabolize substrates from energy stores and to deliver energy to muscles. Anaerobic exercises, on the other hand, are high intensity events, such as sprinting, where the body has to

rely on nonoxygen sources of energy. Anaerobic metabolism in the cells produces waste molecules that can impair muscle contractions and cause fatigue. Aerobic workouts are designed to increase endurance and stamina. When planning an aerobic workout it is important to set a steady pace that can be maintained for a long period of time. In order for the workout to improve cardiovascular endurance the training should mimic the event or activity the athlete is training for. Combining anaerobic and aerobic training into one training program can significantly improve cardiorespiratory fitness.

Anaerobic conditioning program stresses the body in order to improve speed, strength, and endurance. By alternating between short bursts of high intensity activities like sprinting with short cool down periods of lower intensity activities like jogging, interval training pushes the body but does not give it the opportunity to recover entirely. This type of training program can improve an athletes' ability to tolerate and utilize the increased concentrations of lactic acid that form during anaerobic activities.

A successful training program is designed to meet the individual needs of an athlete. However, by combining aerobic and anaerobic workouts into one training plan, athletes can improve endurance, stamina, strength and power. Generally speaking, conditioning for sports performance should be specific to the demands of the sport in question. However, it's important not to get too caught up in the "specificity" concept as things aren't quite so simple in reality. Many individuals dismiss the importance of aerobic fitness for intermittent sports. The logic being that these activities are anaerobic and therefore, conditioning should largely be anaerobic in nature. Indeed, brief sprinting bouts derive energy from anaerobic metabolism (*i.e.* ATP/CP). However, it is through aerobic metabolic processes that CP is restored and hydrogen ions removed. Inefficiency in this regard will result in fatigue accumulation and reductions in repeated sprint performance.

Longer endurance track events, which rely on sub maximal aerobic pathways, athletes participating in short track events must rely on a combination of aerobic and anaerobic pathways (Neumann, 1992).

Improvements to muscular strength and aerobic fitness are desirable adaptations in both athletes seeking improved performance and the general public looking to obtain health benefits. The

combination of resistance and aerobic exercise into a single program, in an effort to attain adaptations specific to each, is known as concurrent training. Concurrent training, relative to resistance training alone, has been shown to result in decrements in strength (Dolezal&Potteiger1998; Hakkinen *et al.* 2003; Hickson *et al.* 1980), hypertrophy (Hickson *et al.* 1980; McCarthy *et al.* 2002), and power (Hakkinen *et al.* 2003; Hennessy & Watson 1994; Hunter, Demment& Miller 1987; Leveritt& Abernethy 1999). However, additional studies have found little to no decrements in strength training gains with the addition of endurance training (Balabinis, *et al.* 2003; McCarthy *et al.* 1995; McCarthy *et al.* 2002).

Concurrent aerobic and anaerobic training stress all three energy systems. The three energy systems were phosphagen (PCr) pathway, the glycolytic pathway, and the oxidative pathway. These energy systems are used during exercise, ranging from short anaerobic bouts of exercise to longer aerobic bouts. Their relative contributions to overall energy provision depend on the intensity and duration of exercise and each person's fitness level. The development of true total fitness requires competency in each of the three energy pathways (Glassman, 2010). The use of all three energy systems is controlled by the duration, intensity, and exercises programmed for each workout of the day. Metabolic conditioning refers to activities such as riding a bicycle, running, swimming, rowing, speed skating, and/or cross-country skiing (Glassman, 2010). Glassman (2010) states that these activities should be performed at various durations and intensity levels (*anaerobic and aerobic*), but does recommend participating in more anaerobic activity than aerobic.

The human neuromuscular system demonstrates a high degree of plasticity allowing skeletal muscle tissue to adapt favorably to specific tasks to which it is subjected. The Specific Adaptations to Imposed Demands (SAID) principle states that adaptation a physiological system undergoes in response to a training program are distinct, limited to systems that are utilized, and dictated by the level of overload experienced (Baechle& Earle, 2008; Folland& Williams, 2007). Adaptive responses are dictated by a host of factors that include sex, initial fitness level, exercise intensity, duration, frequency, mode, and nutritional status. Ultimately a combination of these factors influences physical and biochemical adaptations of the system in accordance with the overload principle (Baechle& Earle, 2008).

Skeletal muscle evolves in response to exertion-based cellular stress through altered fatigue resistance, aerobic / anaerobic enzyme concentrations, maximal contraction velocity, and myosin fiber remodeling (Coffey & Hawley, 2007; Folland & Williams, 2007). Stress resulting from exercise can generally be classified into one of three areas; 1) aerobic / endurance, 2) anaerobic / interval, or 3) resistance training. Traditional aerobic / endurance exercise consists of long duration (*greater than 20 minutes*), continuous, rhythmic, large muscle contractions completed at submaximal intensities. Adaptations to endurance training include increased a-v O₂ difference (Saltin, 1971; Blomqvist & Saltin, 1983), stroke volume (SV) (Spina, *et al.*, 1992; Wilmore, *et al.*, 2001), mitochondrial content (Coffey & Hawley, 2007), capillarity (Blomqvist & Saltin, 1983), oxidative enzyme activity (Spina, *et al.*, 1996; Holloszy & Coyle, 1984), decreases in total muscle size and cross sectional area, as well as fiber type transitions (IIx ? IIa and II ? I) (Coffey & Hawley, 2007; Wilson, *et al.*, 2012). As a result, repetitive endurance training ultimately yields an increased capacity to load, transport, and utilize oxygen (Coffey & Hawley, 2007; Wilmore, *et al.*, 2001; Jones & Carter, 2000).

Anaerobic or interval exercise is classified as High Intensity Interval Training (HIIT) and consists of alternating work intervals performed near or above maximal intensities (> 90% VO₂max), interspersed with periods of low to moderate intensity exercise or complete rest. HIIT interval duration varies greatly between protocols lasting between several seconds to several minutes with a negative relationship existing between duration and intensity. Over the past decade, HIIT has been shown to be equal to and in many cases more effective than endurance training at improving VO₂max (Helgerud, *et al.*, 2007; Gormley, *et al.*, 2008) as well as lactate threshold (LT) velocity and time trial performance (Gibala, *et al.*, 2006; Gibala & McGee, 2008; Burgomaster, *et al.*, 2008; Esfarjani & Laursen, 2007; Edge, *et al.*, 2005). This enhanced improvement may be due to greater peripheral adaptations which are generally more pronounced following HIIT (Helgerud, *et al.*, 2007). HIIT has also been shown to result in increases in oxidative enzyme activity, markers of whole-body lipid oxidation, and decreased glycogen and phosphocreatine depletion (Burgomaster, *et al.*, 2008). Sprint Interval Training (SIT), a specific type of HIIT which is characterized by supramaximal exercise intensities and very brief work intervals, has received more attention over the past several years. SIT has proven an effective

method for improving aerobic fitness in a fraction of the time required with traditional endurance training (Gibala, *et al.*, 2006; Burgomaster, *et al.*, 2008; Hazell, *et al.*, 2010).

Development of Organized Sports

Organized sports have brought tremendous changes in the way people get involved with sports. Parents are using sports as medium to exert control over their children and giving enriching experience to their wards. Today's sports involve more private agencies, importance to more ethical practices and high-performance training solution by involving experts from various sports sciences.

The state of current sports (Brown, 2007) and issues prevalent in sports today can be understood and interpreted only if we examine the society they are played in and how sports have developed. Sports in some ways affects the lives of most people in our society whether it is through playing or watching sports, getting caught up in the excitement of a tournament or supporting the activity. The developing and developed societies in the world have established their indigenous sports cultures and societies. Asian countries seem to be in the developing phase of establishing sports cultures. In India, both modern and indigenous sports are looking up and establishing their own identity in the sports society of the world.

Development of Sports in India

Today it appears that the demand on athletic trainers, coaches, and athletes to excel in their sport is becoming greater and greater. In response to this demand, athletes are spending more time practicing, as well as expending more energy conditioning so that they are in the best shape possible for competition. Accompanying these increased demands are advances in sports research, sports sciences and allied areas. In addition, individuals who participate in high-level athletics have become more specialized in their respective sports. By implementing the new advances in sports and specialization of athletes in today's sports environment, athletes can hopefully increase their chances of winning & performing at higher levels.

The sports performance of the Indians is on the rise, as can be seen by the recent achievements from the recent Olympics. The athletes are performing at a better standard as a result of better and more scientific training facilities, better nutrition, advanced medical facilities. India is

thriving in performance of a few selected sports like Cricket, Tennis, Golf, and Badminton to name a few.

However, under the scheme of “Assistance to National Sports Federations”, the government has been providing financial assistance to the recognized National Sports Federations (NSFs) for supporting girls/women’s exposure, training and participation at national/ international level. In April 2016, the Central Sector Scheme, Khelo India – National Programme for Development of Sports was approved by the government.

As far as the games of Indian origin are concerned, the picture seems to be fading out. It is clearly evident that Indians are outperformed by foreigners in Indian games too. Indian Hockey is the living example of how the game is dying out, how developed nations have outdone Indians and what scientific approach, advanced research can do in the development of any game.

Most certainly Indian games like Hockey, Kabaddi, Kho-Kho, and Mallakhamb need to look within and analyze how science and research in these areas will bring about the desired changes in the sports performance in Indian games. The game of Kabaddi is a traditional sport which is played since ages in India. In Asian games India got gold medal from very first and India was unbitten by any country. But the real popularity of kabaddi reached to new level with the introduction of pro-Kabaddi. Pro Kabaddi change the whole dimension of kabaddi in India. Since its inception in 2014, the Pro Kabaddi League has essayed its role as a feeder for Indian Kabaddi and has laid out a platform for some of the best talent all across the country to showcase their talent and even carve out a career for them. (Ghosh&SenSarma, 2018) The fraternity of Kho-Kho is trying to take up the sports to Olympics. Until now India has dominated Kho-Kho at the Asian And SAF championships. Countries like England, Canada, Sri Lanka, Bangladesh, Pakistan, Sri Lanka, Nepal, Japan and Thailand are taking up this game as the major sport; these countries possess more scientific support and advances. In the bid to reach Olympics, Indian Kho-Kho fraternity must realize the need of scientific development of the game.

Importance of Sports Performance Profiling

Analysis of the performance is very vital in every sport, so it gives strong basis to apply these scientific methodologies to each sport. The success in competition does not determine the performance capacity of an athlete. High performance in skill and fitness does not provide a complete picture of performance abilities. At the international level while preparing for major competitions prepare systematic and scientific data. This data includes accurately assessed skill levels, physical fitness, physiological parameters, psychological traits and socio-economic conditions. These attributes play a vital role in high performance.

Information collected thus, is utilized by seasoned coaches to prepare the training schema that enhance not only the fitness but also ensures success in the competition performance. The whole process needs to advance techniques of identifying, recruiting and retaining professional athletes. (Garret. W.E. Jr, 2000) (Marques, 2009) specified in his study that the experts in sports science and fitness professionals must consider fitness and anthropometric characteristics of the athletes so that they can develop individual specific and playing position related training programs.

The traditionally available talent hunt systems concentrate on specific fitness levels and distinct physiological characteristics of athletes in individual sports. However, there is inadequate knowledge about foreseen performance abilities in team sports. (Tan, 2009) measured and studied the performance profiles of volleyball players by relating it to positions of play and performance during the game. Both male and female volleyball players displayed differences in anthropometric characteristics based on some playing positions. Few positions showed differences in the levels of speed and agility. The best players were different than the rest of the players on a few measures of anthropometry and physiology.

Various researches have surveyed the traits of fitness, physiology, psychology and anthropometry of the leading players from various sports.

These studies throw a light on sports specific and position specific requirements in games such as handball, tennis, soccer, rowing, basketball etc. It is found that players in different sports and different positions have different physical and physiologic profiles. Profiling of players is one of

the major reasons for continues rise in the performance standard of the game. However, in India; this support has been apparently limited to only top-class athletes and very few sports. Some studies have thrown light on anthropometric, physical variables of Indian players according to their games (Sodhi. H. S, 1984) (Naik, 2009) (Pawar.v, 2012) (Kalidasan.R, 2011).

Development of Kho- Kho

It is very difficult to trace the history of game Kho-Kho. There is no history or concrete evidence for the game Kho-Kho but its origin is as old as Mahabharata, the strategies and tactics may have taken from the Mahabharata. The word kho derived from Sanskrit word SYU which means get up and run. SaintsreshthaTukaram and Saint Eknath are said to have mention this game. The game of Kho- Kho originated in the very soil of Maharashtra. For this reason, at a certain distance, children may be asked to seat facing each other in the opposite direction and make a barking sound.

This may be beginning of children's chase, chase from this farm protection. The senior statistician Kai Ramesh Varalika made such arguments in his book titled Kho-Kho.

Kho- Kho is a game that has been played in Maharashtra for the last many years. But there is no doubt that the game is very old. During the time of SayajiraoGaikwad of GaikwadSansthan, Baroda, this game got a boost and Kho- Kho competitions were organized through Jumma Dada Gymnasium.

Experts say that the former VidyutKridaMandal in Mumbai has won the competition and won an attractive trophy. Baroda can be called the home of Kho- Kho game and after that Kho- Kho has been played in Pune, Mumbai, Nagpur, Kolhapur, Amravati, Dhule for the last one hundred years. Although the game is well played in Vidarbha, Kolhapur, Karnataka and some southern states, Maharashtra is considered to be the true promoter and propagator of the game.

Kho- kho played in pre-independence times, the number of defenders for defense was not fixed, any object or person was placed in place of wooden poles, the measurements of the ground were not fixed, one point was deducted in case of mistake in attack. This game was played during entertainment, festivals and festivities, so there were no special rules for this, so it was seen as a game of Shiva Shivi or catch.

At the same time, according to the self-reliant principles laid down by LokmanyaTilak, indigenous sports gained importance and this time the Deccan Gymkhana Pune was created. In 1914, some rules were made that fixed the boundaries of the field but replaced the new ones with new ones. In 1919 the ground length was increased by 44 by 17 yards. In the year 192324, an Inter-school sports association was established for the development of sports and Kho- Kho sport got a new twist. In 1924, the rules were amended at Vijayhind Baroda and in 1928, the All India Board of Physical Education was established. AbasahebNatu, Pune, MahabalGurujiNashik, Karmarkar, Vaidya, Dr. MirajkarMiraj, in collaboration with experts in Kho- Kho, developed a course on rules and Kho- Kho game.

Concurrent Strength and Aerobic Endurance Training

Hickson (1980) in their study determined how individuals adapt to a combination of strength and endurance training as compared to the adaptations produced by either strength or endurance training separately. There were three exercise groups: a strength group (S) that exercised 30--40 min .day-1, 5 days . week-1, and endurance group (E) that exercised 40 min . day-1, 6 days . week1; and an S and E group that performed the same daily exercise regimens as the S and E groups. After 10 weeks of training, VO_2max increased approx. 25% when measured during bicycle exercise and 20% when measured during treadmill exercise in both E, and S and E groups. No increase in VO_2max was observed in the S group. There was a consistent rate of development of legstrength by the S group throughout the training, whereas the E group did not show any appreciable gains in strength. The rate of strength improvement by the S and E group was similar to the S group for the first 7 weeks of training, but subsequently leveled off and declined during the 9th and 10th weeks. Their findings demonstrated that simultaneously training for S and E will result in a reduced capacity to develop strength, but will not affect the magnitude of increase in VO_2max .

udley and Djamil (1985) evaluated the effect of concurrent performance of both modes of training on the in vivo force-velocity relationship of human muscle and on aerobic power, for which twenty-two male and female subjects trained for 7 wk for endurance (group E), for strength (group IS), or for both strength and endurance (group C) were considered. Endurance training consisted of five 5-min sessions three times a week on cycle ergometer with a work load

that approached the subject's peak cycleergometer O₂ uptake (peak CE VO₂). Strength training consisted of two 30-s sets of maximal knee extensions per day performed on an isokinetic dynamometer three times a week at a velocity of 4.19 rad X s⁻¹. Group C performed the same training as groups IS and E, alternating days of strength and endurance training. Subjects (groups C and IS) were tested pre- and posttraining for maximal knee-extension torque at a specific joint angle (0.52 rad below horizontal) for seven specific angular velocities (0, 0.84, 1.68, 2.81, 3.35, 4.19, and 5.03 rad X s⁻¹). Groups C and E were tested for peak CE VO₂ pretraining, at 14-day intervals, and posttraining. Group IS showed significant increases in angle-specific maximal torque at velocities up to and including the training speed (4.19 rad X s⁻¹). Group C showed increases (P less than 0.05) at velocities of 0, 0.84, and 1.68 rad X s⁻¹ only. Peak CE VO₂, when expressed in relative or absolute terms, increased (P less than 0.05) approximately 18% for both groups E and C. A common belief among many clinicians and trainers is that intensive simultaneous training for muscle strength and cardiovascular endurance is counterproductive. Nelson *et al.* (1990) tested this premise, with 14 healthy, untrained men trained four days per week for 20 weeks on a bicycle ergometer for endurance (END Group, n = 4), on an isokinetic device for increased torque production (ITP Group, n = 5), or on both devices (COMBO Group, n = 5). The ITP and COMBO groups had equal torque gains throughout the study (234 +/- 45 and 232 +/- 23 N.m, respectively). After 11 weeks, both END and COMBO groups had similar gains in maximal oxygen consumption (VO₂max) (*in milliliters per kilogram of body weight per minute*). During the last half of the study, however, the END Group had a significant gain in VO₂max (p less than .05) of 4.7 +/- 1.2 mL.kg⁻¹.min⁻¹, whereas the COMBO Group had a nonsignificant gain (p greater than .05) of 1.8 +/- 0.6 mL.kg⁻¹.min⁻¹. In harmony with this finding, the END Group showed a significant increase (p less than .05) in citrate synthase activity (15.5 +/- 7.9 μmol.g⁻¹.min⁻¹), whereas the COMBO Group had no significant increase. They concluded that simultaneous training may inhibit the normal adaptation to either training program when performed alone. The extent of the interference probably depends on the nature and intensity of the individual training program.

CONCLUSION

To achieve the purpose of the study, thirty (30) female Khokho players from Guntur District, Andhra Pradesh, were recruited as study participants. The age of the participants were ranged

from 18 to 20 years. All participants were informed about the nature of study and their consent was obtained for cooperation till the end of the experiment. The selected participants were medically examined by a qualified physician and certified that they were medically and physically fit enough to undergo the concurrent aerobic and anaerobic training regimen. The selected participants were randomly segregated into two groups of 15 each. Group-I acted as control, and Group-II underwent concurrent aerobic and anaerobic training.

The independent variable confined to this study was concurrent aerobic and anaerobic training. The criterion variables confined to this study was selected physical fitness components (*maximum speed, cardiorespiratory endurance, agility, arm-shoulder strength endurance, abdominal strength endurance, leg explosive power, and flexibility*) were assessed using standard tests and procedures, prior to and immediately after the training regimen.

The experimental group trained two sessions a day, four days a week for twelve weeks, which was considered adequate enough to cause changes on selected dependent variables. While, the control group did not participate in any specialized training during the period of study. In the morning aerobic training was administered, whereas in the evening anaerobic training was incorporated.

The experimental design used for the study was random group design, and the data collected prior to and after experimental period of twelve weeks from both control and experimental groups were statistically examined for the difference between pretest and posttest scores on selected physical fitness components of experimental group using dependent 't' test. To compare the level of efficiency of concurrent aerobic and anaerobic training with that of control group on selected physical fitness components, the data collected from both groups prior to and post experimentation were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). The pretest means on respective dependent variable was used as a covariate data. The level of significance was accepted at $P < 0.05$ in all cases.

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