Chapter I

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The science of sports training is relevant not only in performance of sports but also gives equal importance to other areas such as physical fitness, leisure sports and rehabilitation. In these areas, the training is mainly concerned towards the development of fitness and health. The science of sports training contributes tremendously towards the achievement of aims in sports arena. The recent trends of the sports sciences indicates that in the near future the subject matter of sports training will be expanded to its extreme to tackle the tasks of training in all the areas of sports and health. In this context two types of sports training i.e; resistance and plyometric training were implemented on physical, physiological and skill performance variables among female hockey players. Both the training methods are effective in strength developing.

Sports training aims at education and performance enhancement based on scientific principles through physical exercise. It is a basic groundwork of sportsman for elite performance. The development of physical fitness includes organic functions and increasing the strength and stability of the musculo-skeletal system (Hardayal Singh, 1991).

1.1 RESISTANCE TRAINING

Bompa (1999) opines that understanding the mechanics and physics of strength training and incorporating those principles into our training program will give our athletes a competitive edge.

Vinod Kumar (2004) suggests that resistance training is a vital component of all fitness programmes for individuals who exercise for the health benefits. Of course, athletes in sports requiring strength and power, such as weigh lifting; bodybuilding and sprinting must emphasize resistance training. However many other athletes also benefit from strength training, especially those in sports requiring a high level of muscular endurance.
Resistance training is an accepted training method for athletes in a variety of sports. With the proper exercise prescription, training goals such as increased muscle strength, muscle hypertrophy, improved body composition and improved sports performance may be achieved. *(Fleck & Kraemer, 1988)*

Strength Training is a method of improving muscular strength by gradually increasing the ability to resist force through the use of free weights, machines, or by using the person's own body weight. Strength training sessions are designed to impose increasingly greater resistance, which in turn stimulates development of muscle strength to meet the added demand. *(Mosby, 2009)*

Athletes are not just made but they are born, too. Human muscles have a mixture of two basic types of fibers, fast twitch and slow twitch. Fast twitch fibers have greater anaerobic capacity developing greater forces and contracting faster. In case of slow twitch fibers it is opposite i.e., having higher aerobic capacity. The distributions of muscle fiber depends upon the genes present in the body. Sprinters might have fast twitch fibers and the long distance runners have slow twitch fibers *(Kraemer, et al. 2002)*

Resistance training improves the muscle strength, power and endurance. Resistance training mostly increases the size of muscle fibers. During this training the muscle protein content increases rapidly which involves in metabolic reactions *(Power & Howly, 2007).*

Strength training can be resulted in hypertrophy of the muscle, partly through an enlargement of muscle fibers. In addition, training with high resistance can change the fiber type distribution in the direction of faster twitch fibers. There is also neuromotor effect of strength training and part of the increase in muscle strength can be attributed to changes in the nervous system. An improvement in muscular strength training through isolated movements seems closely related to training speeds *(Reilly, 1996).*
According to Loftice, et al. (2004) the goal of resistance training, is to "gradually and progressively overload the musculoskeletal system so it gets stronger" and also recommends that the training should be in progressive manner depending upon the capacity of an individual. It has been recommend that beginners starts with 8 to 10 exercises for the major muscle groups with more repetitions thrice in a week. Starting resistance training the people who have overweight should take suggestion from doctors. This type of training needs the selection of right equipment and must be conditioned before the weights. Resistance training can be used without recourse to the devices. Doing push ups is a good example and can be done in any place where there is enough space to do.

The importance’s of resistance exercise are well documented and continues to prove that it's an important activity for human beings to be engaged. In ancient times the human muscles got workout by building shelter, hunting, farming and all the other tasks which was necessary to live. Where as in this modern arena, we have engineered inactivity into our lives with labor saving devices which results in rare use of muscles. Nowadays hardly a person does cutting grass, climbing stairs, washing clothes, playing games and participating in recreational activities. Due to this reason the muscle strength gets diminished and the person becomes unhealthy (Mikel, et al. 2005).

Muscle strengthening is critically important for injury prevention, rehabilitation, and performance enhancement. The combination of strength development exercises at various loads, speed and frequencies dictates the outcome of the resistance training programme.

1.2 PLYOMETRIC TRAINING

Plyometrics have their roots in Europe, where it was initially termed as jump training. During the early 1970s the interest in jump training has increased in the Eastern countries. East Europeans dominated the world sport arena. The Eastern countries begin
to produce superior athletes in track and field, gymnastics and weight lifting which gave rise to practicing this training method.

In 1975 Fred Wilt the American Track and Field coach coined the term plyometrics. The elements ply means “increase” and metric means “measure” derived from Latin thus the combined meaning ‘measurable increase’ (Thomas, 1994). Plyometric rapidly got popular among the coaches and athletes as exercises aimed at linking strength with speed of movement to produce power. The necessity for power development in sports needs no argument. Strength and conditioning specialists dedicate a great deal of time, researching muscular power development techniques and implementing only those that produce significant results on athletes. Recent studies suggest that plyometric and resistance training exercises can increase vertical jump height, explosive power, and sprint speed by improving the production of peak muscle force and power. Presently many coaches and athletes have successfully used plyometric exercises as a method of training for performance enhancement.

Plyometrics exercises utilize the force of gravity to store energy in the muscles and utilized immediately in an opposite direction, so that the natural elastic properties of the muscles produce kinetic energy. The ability to apply force rapidly with speed strength is the major goal of plyometric training. The speed strength ability is known as power. For an exercise to be truly plyometric, it must be a movement proceeded by an eccentric concentration. This stimulates the proprioceptors sensitive to rapid stretch simultaneously loading the serial elastic components. Some amount of flexibility is important before beginning the plyometric training program. Plyometrics should not be considered an end in itself, but as part of an overall program. (Tirumalaikumar, 2002).

Plyometrics can be characterized by quick and powerful movements using a countermovement that involves the stretch-shortening cycle which has three phases namely eccentric contraction, amortization, and concentric contraction phases. The eccentric phase involves stretch of the agonist muscle group, while the concentric phase involves rapid shortening contraction of the same muscle group. However amortization
is the brief transition between the eccentric and concentric phases. Such exercises include bounding, box jumps, depth jumps, standing and multiple jumps, and hops. The reason for performing plyometric exercises was to increase the power in the subsequent movements, which is accomplished by natural elastic components of a muscle and tendon through the stretch reflex. A rapid eccentric muscle action stimulates the stretch reflex and the stored elastic energy produces the force produced during the subsequent concentric action. This is possible if the amortization phase was short.

An athlete should first warm up dynamically before a plyometric training workout. Warm up includes calisthenics, light skipping and sprinting motions which supports the muscle’s ability to perform exercises and also it prevents from the injury. A different variety of jumps and explosive movements with proper recovery is accepted. The volume and the intensity of the exercises should be maintained during the training programs. Plyometric training should be performed in a progressive manner starting with simple exercises and later to more complex and specific skill. Plyometric training is a specific work out for the enhancement of explosive power. It improves the relationship between maximum strength and explosive power. Plyometric training also improves physiological performance through elastic strengthening loads. During this process the elastic components of the muscular system increases the tension of the rebound force. The stretch reflex also may increase the stiffness of the muscular spring.

Plyometrics training specifically targets the muscles fast twitch fibers which are responsible for speed and higher power production. Before starting a plyometric program, the previous training experience, age, physical maturity, conditioning, flexibility and strength should be analysed. Prepubescent athletes should perform only low intensity plyometrics. Full range of motion, good strength is the prerequisite for performing plyometrics. Sports participation and appreciation have become integral part of lives. Competitive sports make tremendous demands on the physical conditioning, vitality, endurance and mental powers of the participants. Only the players of fitness can play to the best of their ability. Each sport has its own pattern, muscle load, tempo and duration. In addition to the contentment the physical fitness is also an additional healthy remark in
sports participation. These are the advantages for players who take part in various sports events. However the concern for physical fitness is a common interest of every human being starting from infancy to aged. Today the people of every country are more concerned with physical fitness than ever before as it has become the vital part of winning sports competitions.

1.3 HOCKEY

Hockey is a popular sport played in more than 132 countries by either sex. The official name is hockey, however, in some countries in order to differentiate from ice hockey it was termed as field hockey. The origin of the word hockey is not clear. In hockey the players attempt to place a ball into their opponent's goal using wooden sticks. Historical records show that game was played in various antique civilizations and believed to be an ancient sport. The evidences of 4,000 year old drawings in Beni Hasan tombs, in Nile Valley, Egypt confirmed the sport has been played. The Persians, the Romans, the Ethiopians, as well as the Aztecs also played their own variation of the game.

Women field hockey was first played at British universities and schools. In 1887 Molesey Ladies founded the first club. During 1894 Irish Ladies Hockey Union was framed and that’s the first national association. After that it rebuffed by the Hockey Association. In the international arena the women game popularized quickly in 1927 on many countries and thus the International Federation of Women's Hockey Associations (IFWHA) was formed. Today the number of female hockey teams grew rapidly around the world equal to the men standard.

Women’s hockey was introduced for the first time in Moscow Olympics during 1980. The Indian women, making their maiden appearance in the first Women’s Olympics Hockey Tournament and put up a fairly good performance but could get only a fourth position. Out of 5 matches played, 2 were won, 2 lost and 1 drawn. Six goals were scored and five conceded. Indian women hockey teams participated in Olympics, Commonwealth Games & Asian Games was satisfactory. India won its first gold medal
in the women hockey in 1982 Asian Games, New Delhi again silver medal in the Bangalore Asian Games in 1998 and India won the gold medal in Commonwealth Games.

Hockey is a game with different type of athletic movements and as a result it requires different types of training for elite performance. Hockey players must meet the very physically challenging demands perhaps it is a multi sprint sport. Hockey is being played on a ground with the same number of players for a similar duration and physiologically it is close to soccer. In hockey power is required for acceleration, speed and quick changes in direction. Strength allows the players to shoot more powerfully with accuracy and pass over a greater range of distances. The distinctive demands of hockey are strength endurance and explosive power.

In last three decades, India has not seen any victory at the world level due to several reasons. Restructuring the administrative system, creating infrastructure & world class facilities coaching / training programme, several scheme uniform selection policy. The national championship and the Premier Hockey League should be revitalized to widen the base for a talent search. To compare our teams with the international standards and to compete with the foreign teams proper selection must be done in order to measure the skill and performance level.

Hockey is a fast paced game where the strongest players come into view. Resistance training gives emphasis to power particularly in lower body. Plyometric training is a very effective form of power training perfectly suited to hockey. Hockey players perform specific plyometric drills for increased motor performance, co-ordination and explosive power. Plyometric training combines elements of both speed and strength in single movement which helps the hockey players to react immediately to a particular situation. By considering the importance of resistance training and plyometric training the study was formulated.

1.4 OBJECTIVES OF THE STUDY

1. The major objective of the study was to determine the changes on selected physical, physiological and skill performance variables due to the effect of resistance and plyometric training.
2. To find out which training has significantly influenced the selected physical, physiological and skill performance variables.

1.5 STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effect of resistance and plyometric training on selected physical, physiological and skill performance variables among female hockey players.

1.6 SIGNIFICANCE OF THE STUDY

1. This study helps to assess the physical, physiological and skill performance variables among female hockey players.
2. The result of the study helps to introduce the training packages for female hockey players.
3. The result of the study will motivate the players to practice the game hockey.

1.7 HYPOTHESES

On the basis of available literature the scholar has formulated the following hypotheses:
1. It was hypothesised that there would be a significant improvement in selected physical variables due to the influence of resistance and plyometric training among the female hockey players.
2. It was also hypothesised that there would be a significant improvement in selected physiological variables due to the influence of resistance and plyometric training among the female hockey players.
3. Further it was hypothesised that there would be a significant improvement in selected skill performance variables due to the influence of resistance and plyometric training among the female hockey players.
1.8 DELIMITATIONS

This study was delimited in the following aspects.

1. The study was delimited to forty five female hockey players from PKR College of Arts and Science for Women and Gobi Arts and Science College, Erode district, Tamilnadu.
2. The study was confined to female hockey players with the age group from 18 to 21 years.
3. This study was delimited to only resistance training and plyometric training.

1.9 LIMITATIONS

This study was limited to the following aspects.

1. The previous experiences, motivational factors and various physical activities on the subject’s playing ability were not taken into account.
2. Hereditary and environmental factor, which contribute to both physical and mental efficiency was not under control.
3. No attempt was made to determine whether the subjects had the same degree of motivation during the various stages of training and testing periods.
4. Variations in performance due to diet, climatic conditions, ground conditions and other environmental factors that might affect the study, were not taken into consideration.
5. Since the human elements are involved in the test administration even slight error in measurement and timings which might affect the results were also considered as limitations of the study.
6. The fatigue factors of the players and the carry over knowledge of the skills which might affect the performance in the tests were considered as limitations of the study.
1.10 DEFINITION OF TERMS

1.10.1 Training

Training is an educational process framed by scientific principles, aiming at bringing the sportsperson for elite performance in high level competitions (Singh, 1991).

1.10.2 Resistance Training

Resistance training is done with the weight machines to improve muscular strength and endurance by doing the exercises repeatedly (Dick, 1980).

1.10.3 Plyometric Training

Plyometric Training are exercises which enables a muscle group to react quickly to produce maximal strength (Thomas, 1994)

1.10.4 Speed

Speed is the ability to move the whole body to a distance in a shortest period (Dick, 1980)

1.10.5 Agility

Agility is the rapid change of body direction to a particular stimulus (Jenson, 1980).

1.10.6 Endurance

Endurance is the ability of the muscle to work for a longer duration under the condition of fatigue (Fox, 2006).

1.10.7 Strength

Muscular Strength refers to the ability of the muscles to perform maximum effort to do the movement (Morrow, 2005).

1.10.8 Flexibility

Flexibility is defined as the maximum range of movement occurs in a joint (Singh, 1991).

1.10.9 Vital Capacity

The amount of air expelled from the lungs after a deep inspiration (Fox, 2006).

1.10.10 Systolic Blood Pressure
Systolic blood pressure is the maximum arterial pressure occurs at the walls of the blood vessels during cardiac cycle (Fox, 2006).

1.10.11 Diastolic Blood Pressure

Diastolic blood pressure is the lowest arterial blood pressure occurs at the walls of the blood vessels during cardiac cycle (Fox, 2006).

1.10.12 Resting Pulse Rate

Measurement of heart rate when an organism is under physical and mental rest can be resting pulse rate (Morehouse & Miller, 1976).

1.10.13 Dribbling

Moving the ball with alternate right and left tapping with the fore hand stick (Richard, Aggiss, 1984).

1.10.14 Hit

Striking the middle of the ball with the face of the stick when the left foot is leading forward, so that the ball travels the maximum distance in minimum time at the right angle towards the target (Richard, Aggiss, 1984).

1.10.15 Scoop

To raise the ball in the air, so that it covers maximum distance in minimum possible time, beating the maximum number of opponents by keeping the stick in a push position behind and under the ball. (Richard, Aggiss, 1984).