Chapter I
INTRODUCTION

By nature human being are competitive and ambitious for the excellence in all athletes’ performance. Not only every man but also every nation wants to show their supremacy by challenging the other man or nation. This challenge stimulates, inspires, and motivates the entire nation to sweat and strives to run faster, jump higher, throw farther and exhibit greater speed, strength, endurance and skills in the present competitive sports world.

This can only be possible through scientific, systematic and planned sports training as well as channelizing them into appropriate games and sports by finding out their potentialities.¹

Though volleyball was originally invented to be a recreational game; it has now developed into a high competitive sport, requiring a high degree of fitness. The requisite level of fitness will vary depending upon the level of competition. Participation in top-notch competitive volleyball requires that a person should be in a state of optimum fitness.

On emphasizing the requirements of a volleyball player, once Japan’s national team coach Matsudaira said, “I would like to be able to select a team who have the individual skill of Czechoslovakian team, power of the Soviet team, the ability and team play of a Japanese team, and the jumping ability of Cuban team and the competitive and fighting spirit of a Korean team.”

From the above statement, it is evident that these components of performance are essential for volleyball players. Nicholls recommends power, speed, agility, coordination, flexibility, muscular and cardio-respiratory endurance and concentration as well as quick thinking and reaction time as the factors basic to performance in volleyball.

The ingredients of success volleyball players are power, speed, and judgement of the distance and space concentration training, agility, flexibility, peripheral vision and ability to remain high up for a sufficiently long period. Quickness is the prime necessity in the modern volleyball both in attack and in defence.

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Horak suggest the requirement of the performance in this sport is the development of a high degree of conditional and coordinative abilities. Therefore, the factors like power, speed, endurance, agility, and quickness which determine performance in this sport must be considered.⁵

Volleyball requires a high level development of physical, psychological, physiological, and motor skill traits so as to give the best possible performance. A player should have appropriate physical structure and body size suitable for this game. This game demands quick and alert well-coordinated players with great stamina to master its complex skills and playing situation. The skill must be developed up to maximum level to get optimum performance with minimum energy expenditure.⁶

Motor skill includes the functional performance of sports skills. Sports skills comprise of more complex, coordinated or specialised abilities associated with particular sports. A game of volleyball require high proficiency in its various skills such as serving, volleying, setting, spiking and blocking etc. which should be learnt and mastered so as to give an outstanding performance.⁷

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Speed, agility, and quickness (S.A.Q.) training has become a popular way to train athletes. Whether they are school children on a soccer field or professional in a training camp, they can all benefit from speed, agility, and quickness training. This method has been around for several years, but it is not used by all athletes primarily due to a lack of education regarding the drills. Speed, agility, and quickness training may be used to increase speed or strength, or the ability to exert maximal force during high-speed movements. Some benefits of speed, agility, and quickness training include increases in muscular power in all multiplanar movements; brain signal efficiency; kinaesthetic or body spatial awareness; motor skills; and reaction time.8

Speed, agility, and quickness training can cover the complete spectrum of training intensity, from low to high intensity. Every individual will come into a training programme at a different level; thus training intensity must coincide with the individual’s abilities. Low intensity speed, agility, and quickness drills can be used by everyone for different applications. SAQ drills can also be used to teach movement, warm-up, or to condition an athlete. No significant preparation is needed to participate at

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this level of speed, agility, and quickness training. Higher intensity drills require a significant level of preparation. A simple approach to safe participation and increased effectiveness is to start a concurrent strength-training program when starting speed, agility, and quickness training.\(^9\)

Speed has long been considered as just one single entity: how fast an object goes from point A to point B. Only recently has speed been studied and broken down into stages such as acceleration, the planning out phase, deceleration, etc. Much of this research has been carried out by sports coaches involved in straight-line running, so that the jumping, turning and zigzagging speed necessary in volleyball has been somewhat neglected.

Those involved with the development of SAQ programmes have sought to fill this void so as to develop all types of speed, particularly for team sports such as volleyball. SAQ programmes break speed down into three main areas of skill: speed, agility and quickness. Although these may appear to be quite similar, they are in fact very different in terms of how they are trained, developed and integrated into a player’s performance. When these skills are successfully combined and specialist SAQ equipment is utilised, they provide the coach with the tools to make good player into an
outstanding one. It is remarkable what players can achieve with an SAQ programme.\textsuperscript{10}

Speed of execution and technical precision are fundamental athletic goals and are, of course, interrelated. Movement speed is the result of explosive force but is often incorrectly believed to be independent from – or incompatible with-strength. In fact, explosive speed-strength applied to functional motor skills is the basis for speed, agility, and quickness.

Running is the basis of many sports and has a ballistic quality common to other movements. However, most sports involve much more than linear sprinting at a top speed. The ability to change direction and velocity is often more important. Changes in direction involve explosive braking actions that are executed by rapidly and forcibly lengthening the muscles. The inability to withstand such extreme stretch – loading, as it is called, can result in injury, technical inefficiency, and outright nonathleticism. This is especially important when considering that the body is alternately supported on one leg during speed, agility, and quickness manoeuvres. It is, therefore, a serious error to focus one’s testing and

training exclusively on linear speed mechanics while neglecting decelerative mechanics and oblique angles of acceleration.

Changing speed and direction also requires the muscles to shorten in an elastic or reactive manner, immediately after lengthening. In this sense, many speed, agility, and quickness drills can be considered single-leg plyometric movements with horizontal emphasis. Therefore, reactive types of single leg movements should be progressively addressed in conjunction with heavy resistance training and testing.\textsuperscript{11}

Most sport skills involve rapid force generation. As a case in point, force is applied for one to two seconds during many athletic tasks, whereas absolute maximum force production requires up to six to eight seconds. Even in nonballistic movements, performance is usually determined by the ability to develop force quickly and achieve a "critical power out-put" (velocity with given resistance).

Many movements have a reactive or ballistic nature regardless of whether they are initiated from a dynamic or static position. This phenomenon referred to as the stretch-shortening cycle (SSC) and is

\textsuperscript{11} Lee E. Brown, Vance A. Ferrigno, and Juan Carlos Santana, "Training for Speed, Agility and Quickness", p.6.
especially prevalent in athletics. SSC actions exploit the myotatic reflex as well as the elastic qualities of tendons and muscle, and the resulting performance is independent of maximum strength in elite athletes. In contrast, the role of strength in determining movement speed increase with resistance. The implications of this are obvious when considering that the mass of the athlete’s body, equipment, or opponent must be overcome explosively-by a single support leg during speed, agility, and quickness manoeuvres.

These facts collectively illustrate that the evaluation of explosive strength is the starting point for determining the role of speed, agility, and quickness training in an athlete’s preparation.¹²

How fast will man run? Will he ever dash through 100 meters in five seconds flat? Not impossible, says one of the world’s best known authorities on physiology and biomechanics.

Professor Peter Weyand, Southern Methodist University (Texas), known for his expertise in terrestrial locomotion and human and animal performance, told TOI that humans would soon have the “ability to modify and greatly enhance muscle fibre strength.” This is crucial, as it would

¹²Ibid. p.7.
actually reduce the difference between the muscle properties of human and the world's fastest animal, the cheetah, to almost zero.

Jamaica's Usain Bolt, who won the Olympic 100m gold clocking a world record of 9.69 seconds, has now brought up the question – will man get faster and faster? And going by what Weyand says, will be one day outrun the cheetah? "Probably not," said Weyand. "The same laws of physics apply to all runners. However, biologically speaking, speed is conferred by an ability of the limbs to hit the ground forcefully in relation to body's weight, an attribute conferred largely by the properties of the scales of the runner".

Men can run as fast as some of the fastest animals, courtesy advances de by science, according to Professor Peter Weyand from Southern Methodist University (Texas), an expert in terrestrial locomotion and human animal performance, He told TOI, "The fast four-legged runners or quadrupeds do seem to be advantaged versus bipeds in terms of the mechanics allowed by their anatomy. These mechanics help quadrupeds to get the most out of the muscles that they have in a way that bipedal runners probably cannot."
Scientists believe man can’t run faster than 30mph, with the best at about 27mph. A cheetah, on the other hand, reaches speeds thrice that. Weyand said he expected speed to continue to improve and faster runners to emerge.

A runner’s ability to deliver more force to the ground relative to his body weight makes for real speed. Bolt touched the ground less than one-tenth of a second with each stride and paced a force four or five times his body weight in that period.

Former Delhi University champion athlete and senior cardiologist at Apollo Hospital, Dr Deepak Natarejan, said Bolt’s supremely powerful muscle fibre and the synthetic running mat that minimizes friction added to the new world record.

“This man has supremely powerful muscle fibres controlled by the central nervous system. When the command is sent from the brain to the muscles and tendons, Bolt explodes. His calm composure and body type does not point to use of banned drugs,” Nararajan said. Is it the diet, training or body type of present day runners that make them so fast? Weyand said
our history was very brief and there was no way of knowing if humans might not have been even faster centuries ago.\textsuperscript{13}

By the term speed one generally gets the impression that we are talking about speed in running activities but speed also concerns many body parts and varies from one part to another. Speed refers to quickness of actions and one’s ability to perform rapidly successive movements in a single direction over a short duration. According to Barrow and McGee (1971), speed is defined as “one’s ability to perform successive movement of the same pattern at a fast rate”.

Speed of muscle contraction is an inherited quality but it can be greatly improved through training by proper techniques and by practising speedy movements and their proper coordination. Speed is greatly affected by one’s age, height, weight, muscle viscosity, mechanical and structural features like length of limbs and flexibility of joints. It is an important motor performance factors in majority of physical activities and sports, more so in basketball; football; swimming; track & field events and volleyball etc.\textsuperscript{14}

\textsuperscript{13} The Times of India (New Delhi), August 20, 2008, p.1.

In volleyball Speed ability primarily signifies the ability to execute motor movements with high speed. These movements may be cyclic or acyclic in nature. Theiss and Schnabel (1987) give the following definition of speed:

“It is the performance prerequisite to do motor actions under given conditions (movement task, external factors, individual prerequisites) in minimum of time”.

In spite of the complex and specific nature and low trainability speed ability is of high importance in all sports. Speed performances appear in different form in various sports. These have a different nature in cyclic sports as compared to acyclic sports.15

Crucial part of any player’s game is the ability to over the ground efficiently and economically over the first few yards, and then to open up stride length and increase stride frequency when working over 40-50 yards. Speed means the maximum velocity a player can achieve and maintain; it can also be measured by the amount of time it takes a player to over a particular distance. Most humans can only maintain maximum velocity for a short period of time or over a limited distance.

Training to improve maximum speed requires a great deal of focus on correct running mechanics, stride length and frequency, the leg cycle and hip-weight/position. Drills such as the dead leg run and stride frequency drills that are used to help develop an economical running technique can all be easily integrated in a training session.

The best sprinters spend very little time in contact with the ground, and what contact they do make is extremely efficient and powerful. Focusing on the mechanics of running helps to control this power and use it efficiently and sparingly. Training when fresh is also crucial for an athlete/player to attain their maximum speed. Many athletes can only produce top speed for a few weeks of the year, but the inclusion and practice of correct running mechanics on the training field will greatly benefit players in the game situation. How often have you been a soccer player run as if they were playing a dulledrum – that is, with poor arm mechanics? Running like this will have a detrimental effect on the overall technique and most importantly, the speed at which the player travels.\textsuperscript{16}

Speed, agility and neuromuscular coordination are components of physical training that are extremely important for athletes in all sports and

events. Speed is defined as the rate of motion or the velocity of the body or any one of its parts. While average velocity is the most frequently used measure of speed, speed can also be measured in terms of acceleration and maximal or peak velocity.

Speed can be assessed relatively to specific body segment, e.g., speed of arm movement, to the total body, and to the external objects propelled by the body. Assessment can be simple, such as timing the individual through a set distance, or it can be complex, using cinematography, elaborate timing device, or fundamental equation to calculate acceleration, sequentially, at fixed segment in the total movement.

Although speed is an inherent characteristic, determined largely through genetics, it is possible to train the sprinter to develop greater speed. The degree of improvement, however, is considerably less than would be found with either strength or endurance training. Since speed is specific to the activity, the training must be specific. In addition, since general factors such as strength, reaction time, and flexibility influenced speed, training programs should include specialized development in these areas. Biomechanical factors are also extremely important in the development of
speed and should be carefully analyzed to determine where the athlete should concentrate his training.\textsuperscript{17}

Most sports outside of track sprinting do not offer the platform to showcase maximum running speed, yet sprint training does underlie the foundation of numerous sports activities. Just think of how many critical game situations in various sports are won or lost by the ability-or lack thereof-to shift into a higher gear when needed. Increasing maximum running speed has a direct correlation with increasing one’s power output. The fastest runners are those athletes who spend less time on the ground, which is greatly determined by the athletes’ strength and power in relation to their body composition. Although maximum speed is rarely achieved in sports, proper running mechanics and speed training will improve any athlete’s sport speed.

Unfortunately, many people ascribe to the philosophy that speed is born, not made, these persons acquiesce to the notion that it is a waste of time to diligently pursue a sound speed-development program. By following the S.A.Q. drills training programme, there is no question that one’s

explosiveness, agility, acceleration, and maximum running speed can and will be improved with proper training.\textsuperscript{18}

The speed used in sports rarely allows 100 percent of maximum speed to be used. In most cases, quick burst of speed are required to catch a ball or overtake an opponent. These short bursts of speed that are specific to the individual activity are what are referred to as "sport speed." In essence, sport-specific speed is a blend of agility, acceleration, and speed.

Stride frequency is defined as the number of strides taken in a given amount of time or distance. By improving stride frequency, the athlete will be able to decrease the time between his or her strides while at the same time maintaining or even increasing stride length. This will result in increased overall speed. Good technique is fundamental to increasing stride frequency.

Sprint-assisted training is one technique that can also be used to improve stride frequency. Assisted sprinting will allow the athletes to develop the feel of running at a faster velocity than they would be capable of running normally. This added dimension of supramaximal speed will enable the athletes to improve their running mechanics at a faster pace than would

\textsuperscript{18} Lee E. Brown, Vance A. Ferrigno, and Juan Carlos Santana, "Training for Speed, Agility and Quickness", p.18.
Be possible unassisted. By not having to run at 100 percent capacity, but still being able to achieve a speed that is at or slightly above their unassisted best, the athletes can learn to relax at high speed more easily.

Some of the traditional assisted methods of training include downhill running and towing. All athletes should be well versed in the mechanics of proper sprinting form before attempting this type of training. All downhill-running sessions must be preceded by a proper warm-up and stretching routine, followed by low-to medium-intensity acceleration sprints. For athletes new to this type of training, it might be beneficial to begin with low-intensity sprints on a flat surface.

Stride length is the distance covered in one stride during running. Research has found that optimum stride length at absolute speed is related to the athlete's leg length (normally 2.3 to 2.5 times the athlete's leg length). A common mistake of many young athletes is to try to take steps that are too long in an effort to attain top speed. When this happens, athletes have a tendency to over stride and ultimately slow themselves down. Most athletes will develop their optimal stride length as proper technique, strength, and power improves.
Stride length can be developed by improving the athlete's elastic strength. Elastic strength is the ability to quickly transition from eccentric to concentric muscle action, especially during the plant phase of running. There are numerous modalities used to improve elastic strength, including resistance training, plyometric and resisted running, weighted vests, running chutes, and harnessed and uphill running. Coaches must be careful not to get too carried away with the different form of "resisted methods" of training. One of the potential negative effects of over utilized resisted running training could be a decrease in mechanical efficiency. There does not appear to be one single mode of resisted running training that is superior to the others. A coach's decision to try these devices will be based on the training level of the athlete, economics, and time available to train the athletes, space allotment, and familiarity with the aforementioned mode of training.\(^9\)

Different games and sports require specific speed of movement. In volleyball the speed with which the spiker kill the ball, the swiftness of the defender in retrieving the ball with a dive or roll, in basketball the speed with which attacker drives in and shoots the ball, jumps and take a rebound and the swiftners and lightning speed of movements of a badminton player are a few illustrations of speed of movement of human limbs but the relative

\(^9\) Ibid., pp. 20-21.
speed of contraction of different muscles varies greatly among individuals. In other words, speed varies with individual's body movements. Speed of response of the body as a whole or as a part is important in a variety of performance. It determines how quickly a performer responds completely and correctly to a given situation.\textsuperscript{20}

Though speed and reaction time are two independent components, they are related closely. In volleyball speed of movement of various body segments and running speed for a very short distance (acceleration rate) are of great importance. Fast movement of the hands and arm are essential to defend the court. Quick acceleration is important in both the offensive and defensive moves of the game. The effectiveness of tactical attack and block depends on the rate of acceleration.\textsuperscript{21}

Speed is a component found in just about every sport, with the possible expectation of bowling. While baseball is a relatively slow sport, the sprint to first base to beat out a drag bunt or the attempt to break home on a hit-and-run play requires bursts of speed. Fencing is an art of fitness and agility, but the weapon is moved with great speed in both offensive and


defensive maneuvers as well as in making quick advance and retreats. Speed, therefore; is an essential component that must be emphasized in every conditioning program.

Agility and neuromuscular coordination are critical to assess of any athlete. This area, more than any other, must receive priority attention when training programs are designed. It is important to use the activity itself in most phases of the training program, since this will help reinforce the movement patterns. Even with strength training, it is helpful and probably more beneficial if the type of training activity can be performed in a way that imitates the actual sports activity. The swimming motion, the pitcher his throwing motion and the place-kicker his kicking motion. This will reinforce the movement patterns and should develop a more functional strength.²²

Commonly speaking, agility means ability of quick and swift movements, and ability of quick apprehension of body movements. As used in physical education and sports, agility may be defined as “one’s controlled ability to change body position and direction rapidly and accurately”.

Agility is affected greatly and differentially by the types of stimuli. Body agility is drastically better in response to an anticipated known stimulus as compared to agility performance of an individual in response to a stimulus requiring movements in the unknown directions. For examples, a sprinter reacting to the starting gun is much faster than a defensive halfback reacting to the changes in speed or direction of a pass receiver whose body is usually in a position that restricts rapid maximum reaction in almost all directions. There are three main types of agility items – change of direction of body parts (various items demanding change of position of the hands or feet), change of direction in running (dodge or maze run), and change of body position (for example, squat thrusts). Agility, being one’s ability to change direction or position of the body or parts of the body rapidly and precisely, is closely associated with coordination which is defined as harmonious interplay of muscles groups during a motor performance that indicates some degree of skill. In other words, to be agile, one must also be well coordinated. According to Kirkendall et. al. (1987), it is quite difficult to measure agility and coordination as two separate items. Agility also depends upon coordinating quickly and accurately the big muscles of the body in a particular activity. The level of one’s agility is a result of both innate capacity (genetic) training & experience. Agility is more effective
when it is combined with high levels of speed, strength and endurance. Agility may be greatly improved with specific training. Some authors use the term coordination and dynamic balance synonymously with agility. However, it is a general agreement that individuals possessing sufficient strength; endurance; balance; hand-eye, foot-eye and overall body coordination; and flexibility, are also good in their agility ability. In the other words, agility has been taken as a separate single identity defined by the individual’s ability to change position and direction rapidly and accurately and that agility is highly correlated with other general motor ability components like coordination, balance, flexibility, muscular strength, power and endurance.\(^{23}\)

Sports rarely are performed straight ahead, but rather require changes of direction in which lateral movements are used in the several planes of movement simultaneously. Be it the world cup or Wimbledon, the ability to move side to side and up and down rapidly is essential to championship athletic performance.

Most sports are played in short bursts of 30 feet or less before a new course of action is needed. And because these movements are initiated from

various body positions, athletes must be strong, explosive, and quick from every possible postural alignment.\textsuperscript{24}

Agility is defined as the ability to decelerate, accelerate, and change direction quickly while maintaining good body control without decreasing speed. Agility is closely related to balance because it requires athletes to regulate shifts in the body's center of gravity while subjecting them to postural deviation.

Athletes who develop their multidirectional quickness are more likely to excel. Whether it is a basketball player cutting toward a pass or a football linemen pulling to make a trap block on a defensive linemen, agility is a critical and often overlooked component of athletic performance. In sports such as basketball and volleyball, lateral speed, agility and quickness can be just essential to success as strength and speed.

Improvement in agility is directly correlated to enhance athletic timing, rhythm, and movement. Little wonders then that today's scouts, coaches, and players place such a high premium on this athletic attribute.

\textsuperscript{24} Lee E. Brown, Vance A. Ferrigno, and Juan Carlos Santana, "Training for Speed, Agility and Quickness", p. 80.
Great agility isn’t just a bonus for volleyball, soccer, and other sport players who must move swiftly on their feet, it is a requirement.\textsuperscript{25}

Agility is the ability to change direction without the loss of balance, strength, and speed or body control. There is a direct link between improved agility and the development of an individual’s timing, rhythm and movement.

Agility should not be taken for granted and can actually be taught to individual players. Training ensures that a player develops the best offensive and defensive skills possible with the greatest quickness, speed and control and the least amount of wasted energy and movement. Agility also has many other benefits for the individual, helping to prevent nagging injuries and teaching the muscles how to fire or activate properly and to control minute shifts in ankle, knee, hip, back, and shoulder and neck joints for optimum body alignment.

Another very important benefit of agility training is that it is long-lasting. Unlike speed, stamina and weight training, it does not have to be maintained to retain the benefits. Consider the elderly person who can still ride a bicycle 40 years after having last ridden one. Training acts like an

\textit{Ibid}
indelible mark, programming the body’s memory of muscular movement patterns.

THE ELEMENTS OF AGILITY

There are four elements to agility:

- Balance

- Co-ordination

- Programmed agility

- Random agility.

With in each of these there is also speed, strength, timing and rhythm.

Balance is a foundation of athleticism. Here the ability to stand, stop and walk is developed by focusing on the centre of gravity and it can be taught and retained relative quickly. Examples include: standing on one leg, walking and standing on a balance beam, standing on an agility disc, walking backward with your eyes closed, and jumping on a mini trampoline and then freezing. It does not take too long to train balance: it only requires a couple of minutes, two or three times a week, with the emphasis placed early in the morning and early in a training session when the players are fresh and
alert. This is when the nervous system and muscles are more respective to patterns of movement used in balance.

Co-ordination is the goal of mastering simple skills under more difficult stress. Co-ordination work is often slow and methodical with an emphasis on correct biomechanics during athleticism demanded movements. Training can be done by breaking a skill down into its component parts then gradually bringing them together. Co-ordination activities include footwork drills, tumbling, rolling and jumping. More difficult examples are walking on a balance beam while playing catch: running along a line while a partner lightly pulls and pushes in an attempt to move the player off the line; and jumping on and off an agility disc while holding a jelly ball.

The third element of agility training is called ‘programmed’ agility. This is when a player has already experienced the skill or stress that is to be placed on them and is aware of the pattern and sequence of demands of that experience. In short, the player has already been programmed. Programmed agility drills can be conducting at high speeds but must be learnt at low, controlled speeds. Examples are zigzag cone drills; shuttle runs and “T” cone drills, all of which involve change of direction along a known standardised pattern. There is no spontaneity. Once these types of drills are
learnt and performed on a regular basis, times and performances will improve and advances in strength, explosion, flexibility and body control will be experienced. This is true of players of any ability.

The final element – and the most difficult to master, prepare for and perform – is random agility. Here the player performs task with unknown patterns and unknown demands. The coach can incorporate visual and audible reactive skills so that the player has to make split-second decisions with movements based upon the various stimuli. The skill level is now becoming much closer to actual, game like situations. Random agility can be trained by games like tag, read and react (tennis ball drops and dodge). Dodge ball and more specific training such as jumping and landing followed by an immediate unknown movement demand from the coach.

Agility training is challenging, fun and exciting. There is the opportunity for tremendous variety, and training should not become boring or laborious. Agility is not just for those with elite sporting abilities – try navigating through a busy shopping mall!26

Agility and neuromuscular coordination refer to the manoeuvrability of the individual and the ability to perform in a smooth, balanced, and fluid motion.

Agility and neuromuscular coordination can be assessed by a number of different tests of general motor fitness or motor ability. These tests generally contain test items, such as the shuttle run, squat thrust, dodge run, obstacle race, balancing tasks, and specific sports skill tasks.

Agility and neuromuscular coordination must be developed specifically for the sport or activity, since each has his own unique demands. Considerable, repetition reflexes that respond in a smooth and integrated manner. In addition, attention should be given to developing strength, power, reaction time, flexibility, mental alertness, and the ability to concentrate on the task at hand.27

While enhance athletic performance is an overriding aim, dedicated agility can provide additional rewards. Even athletes who will never make spectacular Michael Jordan-like moves benefit from agility work.

A primary effect of agility training is increased body control resulting from a concentrated form of kinaesthetic awareness. This form of training appears to help athletes control small adjustments in neck, shoulder, back, hip, knee, and ankle joints for the optimal postural alignment during performance.

Moreover, agility training gives athletes a greater sense of control in making fast movements. Athletes in a variety of sports report excellent gains in athleticism through effective, frequent agility workouts. This seems to be especially true for less coordinated athletes, who demonstrate and feel a greater increase in control as a result of their training than do more coordinated peers.

While injuries will never be eliminated from sports, proper overall conditioning combined with functional agility training can help reduce their occurrence. Athletes with greater agility are often able to control the potential injury-causing mechanism as it begins. By controlling the body at that split-second—the critical instant of impact, twist, or turn—an injury can often be avoided or reduced in its severity. Athletes can’t be prepared for every awkward movement or collision, but by imitating multidirectional sports movements under low to moderate stress levels in practice, they can develop
a neuromuscular awareness that triggers the injury-preventive response in certain situations.

The rehabilitation process can also be speeded by a highly developed neuromuscular awareness. Athletes with such awareness can better read their body as they respond to treatment than can athletes who have less developed kinaesthetic sense.

To review, the potential payoffs of agility training include increased

- Power, balance, speed, and contraction;

- Intramuscular coordination;

- Explosiveness of the major muscle groups;

- Quickness;

- Ability to repeat high-intensity work; and

- Co-ordination of skills.

Fortunately, once developed, agility declines less quickly than does speed, strength, or endurance. Agility training leaves a more lasting mark
upon muscle memory. In athletic terms, an agility workout is like putting money in the bank.\textsuperscript{28}

The key to improving agility is to minimize loss of speed when shifting the body's center of gravity. Drills that require rapid changes of direction forward, backward, vertically, and laterally help improve agility as well as coordination by training the body to make those changes in movement more quickly. Over the past three decades, sports conditioning programs have incorporated more dynamic drills that maximize the development of high performance physical tools, including agility.

Agility drills can be divided into three categories. In programmable agility drills the athlete knows beforehand what the movement combinations will be. In reactive agility drills the athlete is required to respond instantly to the movement of another athlete or to the signals of a coach. In quickness drills the athlete is required to perform fast foot movements as quickly as possible.

Programmable, reactive, and quickness drills come in many forms. The number of movements and apparatuses that can be incorporated include

\textsuperscript{28} Lee E. Brown, Vance A. Ferrigno, and Juan Carlos Santana, "Training for Speed, Agility and Quickness". p.80.
line, back-pedal, bag, jump rope, rope, agility ladder, cone, plyometric box, slide board, and sidekick box drills.

For the greatest benefit, agility drills should be implemented as most appropriate for the training cycle and sport, from both a metabolic and performance-enhancement prospective. Workouts should progress at a proper level with regard to speed, distance, and volume. Strength training and other forms of conditioning should augment agility work in adequate proportions in a periodized program.

The goal of a quality agility-training program is to make adaptations as needed. Shifts from one mesocycle to another (hypertrophy > strength > power > competition > transitional) offer opportune times to adjust the level and type of agility work being performed. Agility drill selection should be based on the physiological and biomechanical needs of the athlete at that point in time, the available resources, and the training environment to ensure safe and effective training sessions. Keep these variables in mind as you design and implement your agility program.  

Volleyball requires a high degree of running manoeuvrability and total body agility so that the player is able to gain good court position and

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29 Ibid., pp.80-82.
complete with his opponents on both offensive and defensive manoeuvres. Fast acceleration is also required to be able to sprint to advantageous position while attacking and counter-attacking. Even more important is to lift the spiked ball and make drops by diving and rolling and again maintaining good court positions for further defence. In this way, the volleyball player has to change his body position quickly and accurately to receive the ball.\textsuperscript{30}

When a player accelerates, a great deal of force has to be generated and transferred through the foot to the ground. This action is similar to that when you roll a towel up (the ‘leg’), hold one ends in your hand and flicks it out to achieve a ‘cracking’ noise from the other end (the ‘foot’). The act of acceleration occurs in a fraction of a second and takes the body from a static position to motion. Muscles actually lengthen and then shorten instantaneously – that is, an ‘eccentric’ followed by a ‘concentric’ contraction. This process is known as the stretch shortening cycle (SCC) action. SAQ training concentrate on improving the neuro-muscular system that impacts on this process, so that this initial movement – whether lateral (to the side), linear (in a straight line) or vertical (upward) – is automatic, explosive and precise. The reaction time is the time it takes for the brain to

\textsuperscript{30} Gurbaksh Singh Sandhu, "Volleyball: Basic and Advance". p.27.
Receive and respond to a stimulus by sending a message to the muscles, causing it to contact. This is what helps a soccer player to cut right - left - right again and then burn down the sideline, or a goalkeeper to make a split - second reaction save. With ongoing SAQ training, the neuro-muscular system is programmed and restrictive mental blocks and thresholds such as slow, uncoordinated initial acceleration and limited range of movement are removed or improved. Consequently, messages from the brain have a clear path to the muscles so that the result is an instinctively quicker player.

Quickness training begins with 'innervations' isolated fast contractions of an individual joint. For example, repeating the same explosive movement over a short period of time, such as fast feet and line drills. These quick, repetitive motions take the body through the gears, moving it in a co-ordinated manner to develop speed. Integrating quickness training throughout the year by using fast feet and reaction-type drills will result in the muscles having increased firing rates. This means those players are capable of faster, more controlled acceleration. The goal is to ensure that players explode over the first 3 -5 yards. Imagine that the firing between the nervous system and the muscles are the gear in the car; the timing, speed and smoothness of the gear-change dictates whether or not the wheels, and thus
the car, accelerate away efficiently – with balance and co-ordination, so that
the wheels do not spin and the car does not lose control.31

The successful performance of an athlete relies heavily on his or her
ability to react quickly. Whether it is reacting to the auditory stimulus of a
starter’s pistol at the beginning of a race, out – jumping an opponent for a
rebound on the basketball court, or being able to juke a defender on the
football field, the quicker athlete usually maintains a competitive advantage.

“Quick,” as defined by Webster, means:

- Reacting to a stimulus with speed

- Done or taking place with rapidity

- Marked by speed, readiness, promptness of physical movement

- Moving swiftly, occurring in a short time, responding to or
  understanding something rapidly.

Speed, rapidity, and instancy are all words that are associated with
quickness. One common theme to all of these descriptions is “rate” or the
measure of something to a fixed unit. In this case, that fixed unit is time.

When an athlete performs a task or movement in a relatively brief period of time, he or she can be described may be quick.

Quickness, in and of itself, seems simple enough to explain. An athlete is either quick or not, right? Wrong! Although it is true that genetic potential plays an important role in an athlete's physical abilities, many bio motor skills that depend on quickness may be improved.

When discussing quickness, we all have a tendency to discuss speed, acceleration or agility in the same breath. "Did you see how quickly he accelerated?" We say, or, "Amazing how quickly she made those cuts!" and "Notice the quick leg turnover in that sprinter." All these characteristics are interconnected to some degree with quickness. But, are they components of quickness, or is quickness a mandatory requirement to enhance these characteristics needed for successful athletic performance?32

Athletes perform certain bio motor skills with an end result or purpose in mind. These "rehearsed" skills are recoded as patterns of motor movements in the brain. These recorded memories are referred to as neural engrams. In order to produce movement, the athlete calls on these engrams,

32 Lee E. Brown, Vance A. Ferrigno, and Juan Carlos Santana, "Training for Speed, Agility and Quickness", p.146.
Which signal the motor system of the brain to reproduce the pattern?

If performed slowly, even highly complex motor skills can be accomplished the first time (i.e., learning). The improvement must be slow enough at first to allow sensory feedback to occur and permit the proper adjustments necessary to guide a successful skill.

However, when faced with learning quick athletic movements, one must eventually perform the biomotor patterns associated with the movement as fast as possible. Successfully learning these motor skills is best achieved by successive and correct performance of the same activity.

New movements will always take a bit longer to correctly execute, while their patterns are recorded as a neural engrams. Once the engram has been developed, it can then be recalled and performed with increasing effectiveness and proficiency. This certainly explains how an athlete who has performed a skilled movement countless times can do it so effortlessly and in a relaxed state. This relaxed and “second nature” quality is paramount to enhancing reaction and response time.33

33 Ibid. p.147.
One of the definitions of quickness was "reacting to a stimulus with speed." Interestingly, one definition of reaction is "bodily response to or an activity aroused by a stimulus." Webster also defines speed as "quickness or rapid motion." It should be clear once again that "quickness" is related to speed, time, and reaction. The time it takes an athlete to react to a stimulus may mean the difference between winning and losing.

Reaction time may involve auditory or visual senses, it may involve upper or lower extremities, or, in some cases, it may involve all of the above. An ice hockey goalie, for example, must be able to react to a hockey puck being shot at him at very high velocity. Initially, he spots the puck visually and reacts by blocking its path to the goal by using his legs, arms, or both.

Offensive football players react to the cadence of the quarterback's auditory signals, but the defensive players react to the exchange of the ball from center to quarterback. Reaction time to both simple and complex situations must be made all the time in sports. Reaction time is a determining factor in most sports and may be improved with training.

Improving quickness has major implications for the enhancement of speed, acceleration, and reaction time. The faster one can teach the brain the
movement patterns required, the faster one can concentrate on improving the quickness with which that movement is performed, especially for new skills. Learning to be quicker is relatively simple. The key? Perform successive repetitions of technically correct movement patterns as fast as possible.34

The term skill is frequently used by coaches and teachers in the assessment and evaluation of players. For the most part, people have ascribed their own meaning to the word. Basically, it can be defined from two viewpoints, descriptive and operational.

The descriptive viewpoint defines a skilled movement as one in which a predetermined objective is accomplished with maximum efficiency and a minimum outlay of energy. The evaluation of a skill, based on a descriptive definition, relies on subjective judgement.

The operational viewpoint defines skilled movement based on an examination of the mechanisms involved in performing the act. Therefore, a skilled response is one in which the recaptor-effector-feedback processes are highly organised, both spatially and temporally. When a skilled act is executed, the performer successfully integrates the sequence of actions and is constantly utilizing and translating information from the senses to the

34 Ibid., pp.147-148.
effectors. The spatial-temporal relationship is also effective. In other words, a player uses the information from the environment, draws on past data and translates incoming data to affect a completed act. The player also uses feedback and effectively organizes the sequence of activities. Thus, the skilled act requires spatial awareness as well as temporal organisation for a well-executed performance.

According to information processing theory, it is believed that man's control of behaviour is organized as a multiple level process. Therefore, it is believed that a skilled act is learned through a hierarchical manner. It is assumed that an unskilled act lacks this type of organisation. In learning a skill a player must deal with several intricate movements or segments. However, some of the movement patterns may already have been acquired through previous experiences and delegated to a lower level. New movements will require attention, that is, the higher levels of the central processing system. As a skilled task being learned, various segment of the task must become automatic and be delegated to a lower central processing system is free to deal with additional requirements of the task.
In summary, the learning of a skilled movement involves utilisation of the receptor and perceptual capacity and limitations. These mechanisms attend to and select for processing certain stimuli in the environment.35

Skill denotes the level of effectiveness with which a movement or motor action can be done. Skill is defined as automatisation of a motor action. Technical skills in sports, therefore, represent automatisation of motor procedures. A sportsman tries to learn a technique or motor procedure and through continues and systematic process he is able to acquire the skill i.e., automatisation of the motor procedure. In other words, one can say that skill is the capacity of the sportsman to realise technique in actual motor action. Technique training aims at the development of technical skills and not at the development of technique. As the process of skill acquisition is the process of motor learning therefore, technique training is essentially purposeful manipulation or exploitation of motor learning for best results through organisation of training means and methods.

In sports, we come across sportsmen with varying degree or level of skill who are attempting to follow the same motor procedure or technique. Their skill or lack of skill does not convey much about the effectiveness or

correctness of the technique. Skill can be assessed and evaluated by the use of different procedures e.g., biomechanical procedures of skill assessment.\(^{36}\)

The science of testing sports skills is not very old. It is only during the last 55 years or so that attempts have been made to develop skill testing in sports. As usual with the new branch of development, there have been frequently revisions of the tests constructed for evaluating sports skills. Many factors have resulted in quick progression of developments in skill testing procedures. Some of the factors resulting in the revisions of skill tests include improvements in measurement procedure, development of new-skill patterns, new identification of skill items, revision of game rules and playing procedures etc. Hence, many of the old skill tests have become irrelevant, redundant and obsolete. Thus, it is very important to use the knowledge of the procedures involved in test construction for sports skill testing. In other words, it is very important to ascertain validity, reliability and objectivity of the tests before their administration for skill testing. In addition, it is equally important to use relevant norms and standards for comparing and evaluating the results of the skill testing. The researcher must be conversant with the fact that norms to be used must have been developed on the population for which they are to be used; otherwise their conclusion will be quite irrelevant.

In the absence of regional norms of a particular skill test, it becomes necessary that first of all norms are developed before the sports skills of a regional group could be properly evaluated. Skill tests have many important functions. They may be used for selection, evaluating training effects, prediction, comparative evaluation and motivation etc. Unlike general motor ability testing of physical education/sports students, the sports skill testing is comprised of more complex, coordinated and specialized abilities involved in particular sports such as basketball, volleyball, badminton, soccer, handball, gymnastic, track & field etc.  

The measurement of sports skills is evaluated with the help of a number of psychomotor tests, which are standardised or developed often individually. The achievement of performance in sports skill is measured by specific skill tests, rating scales and sports performance etc. These tests enable to measure change in trainee’s psychomotor behaviour in the form of a variety of sports skills like basketball passing, volleyball serving, archery shooting, football forward pass, volleyball blocking, softball speed throw, gymnastic skill (forward roll to stand, backward roll to knees etc.), tumbling skill, acrobatic skill, handball services placement, soccer dribbling /juggling, swimming skills, tennis rallying etc. Testing in sports skills is based on skills

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test, which are standardized by creating an environment similar to the respective game environment. Before applying such tests, the validity of skill tests is evaluated on the basis of consistency between testing and performing environments. For example, volleyball passing skill is measured by repeated volleying of volleyball against a wall over a specified period of time and noting the number of successful trials per unit of time.\textsuperscript{38}

Sport training is a complex phenomenon and is very scientific in nature. One must know the crucial factors, which play an important role in achieving success in volleyball game.

Many factors determine successful performance in volleyball, a lot is said and heard about the contribution of each of them, but scientific investigations have not been undertaken in India to prove the worth of each of them.

In as much as the research scholar has been a national level volleyball player himself and presently associated with the teaching of science of sports training and volleyball to bachelor and master degree students, he thinks it

\textsuperscript{38} ibid., p.19.
would be worthwhile to find out the effect of S.A.Q. drills on skills of volleyball players.

**Statement of the Problem**

Most of the investigation attempts to assess the value of physical exercises and drills training programme as a means of altering physical efficiency and sports performance ability. The activities generally involve high-energy expenditure and are commonly believed to be effective in contributing to physical efficiency and sports performance ability. The review of literature does not reveal any studies investigating the effect of speed, agility and quickness drills training programme on the skills performance ability of the volleyball players. The scholar himself is a volleyball player and hence wants to find out the effect of S.A.Q. drills training programme on skills performance ability of volleyball players at senior and junior level.

The purpose of the study was to investigate the “Effect of S.A.Q. Drills on Skills of Volleyball Players.”
Objectives of the Study

The specific objectives of the present study were:

➢ To study overall effectiveness of specific S.A.Q. drills training on skills of volleyball players.
➢ To compare difference between the experimental group and control group on skills performance, before, intermediate, and after the training.
➢ To suggest effective training programme to volleyball players.

Delimitations

1. The study was delimited to 50 junior and 50 senior male volleyball players from Delhi state participating in junior & senior national, school national and university level championships conducted by the VFI, SGFI & AIU.
2. The study was also confined to training programme of S.A.Q. drills of 84 days or 12 weeks.
3. The study was also confined to three performance variables:
   a. Speed.
   b. Agility.
   c. Quickness.
Limitations

1. As the subjects selected for the study were all within the Delhi city. The factors like diet, lifestyle, and daily routine habits, etc., which might have had an effect on the results of the study, was considered as limitation.

2. The meteorological variations such as air temperature, atmospheric pressure, relative humidity etc. during the training period could not be controlled and their possible influence on the study was also recognised as a limitation.

3. The emotional stages of the subjects and motivational factors, which might have had influence on the result of the study, were also accepted as a limitation.

4. Certain factors like training and the genetic factors that might have affected the results of the study were also consider as the limitation of the study.

Hypothesis

On the basis of the literature reviewed, an available research finding, expert’s opinion and scholar’s own understanding of the problem. It was
hypothesised that S.A.Q. drills training shall have positive effect on skills of volleyball players.

Definitions and explanation of Terms

Speed

Johnson and Nelson defined speed as the rate at which a person can propel his body or part of his body through space.\(^{39}\)

According to Jack H. Wilmore Speed is easily defined as the rate of motion or the velocity of the body, or any one of its parts.\(^{40}\)

Both definitions offered by Jonson & Nelson and Wilmore are accepted for the purpose of the present study.

Agility

Johnson & Nelson defined Agility as the physical ability, which enables an individual to rapidly change body position and direction in precise manner.\(^{41}\)


According to Lee, Vance, and Juan Agility is the ability to decelerate, accelerate, and change direction quickly while maintaining good body control without decreasing speed.\textsuperscript{42}

The definition given by Lee, Vance, and Juan seems to be more suitable for the study.

**Quickness**

According to Lee, Vance, and Juan “It is an ability of an individual to react to stimuli with speed”.\textsuperscript{43}

Lee, Vance, and Juan defined Quickness as “Moving swiftly, occurring in a short time, responding to or understanding something rapidly”.\textsuperscript{44}

Both definitions offered by Lee, Vance, and Juan seem to be relevant to this study.

**Drill**

A measured series of sets closely monitored by a coach and designed to blend individual skills into an orchestration of team skills to gain a desired

\textsuperscript{42} Ibid., p. 80.

\textsuperscript{43} Ibid., p. 147.

\textsuperscript{44} Ibid., p. 146.
unified effect.\textsuperscript{45}

Drill may be defined as teaching or training by having the learners do a thing over and over for practice.\textsuperscript{46}

The first definition from coaches’ manual- I seem to be more suitable for the study.

**Skill**

Skill is defined as automatisation of a motor action. Technical skills in sports, therefore, represent automatisation of motor procedures.\textsuperscript{47}

A series of gross movements, postures and series of related finer movements to effectively performs a required physical task.\textsuperscript{48}

Both definitions offered by Hardyal Singh and from coaches’ manual - I seem relevant to this study.


Significance of the Study

Competitive sports have assumed great importance in India and there is increasing demand that a specific S.A.Q. drill for various sports should be constructed for all levels and sports training should start at younger age. This make the Competitive sports have assumed great importance in India and there is increasing demand that a specific S.A.Q. drill for various sports should be constructed for all levels and sports training should start at younger age. This make the study of determining the effect of S.A.Q. drills on skills of volleyball players more important. Moreover, India is lagging behind the other countries in competitive sports. This country is not able even to maintain his position in sports in which it was dominating. The reason is that the country is far behind in facilities for sports, research in sports and physical education etc. Hence no such specific drills based training programmes have been developed even for a single sport. This is an urgent demand of the competitive era. It is therefore, necessary to find out the effect of S.A.Q. drills training programme on skills of volleyballer players. This will help the coaches, physical educators and trainers to select and train in a specific manner to achieve top – notch performance.

Physical educationalists and sport scientists have been constantly examining sports performance in relation to the individual skill and fitness
standards. They try to discover those factors that contribute to high performance so that the findings could be utilized in the practical aspects of coaching and training. The present study will contribute as under:

1. The study will enable to prepare a model of S. A. Q. drills for volleyball players in India.

2. With regard to teaching and training of volleyball, the findings of the proposed study may highlight the significance of speed, agility, and quickness for volleyball players.

3. The findings of the study will be helpful in the identification of talent and their subsequent selection for advanced training in volleyball.

4. Coaches will be able to use this reference in whole or in part for their desired sports. It has been design to examine each section of speed, agility, and quickness training and assist the coach in writing a program that will be sport-specific

5. The findings of this study may also in general assist the physical education teachers, coaches, and experts in the assessment of performance status of their players.
6. This study may give an opportunity and encouragement to the interested coaches to conduct further studies on different aspects of volleyball.

7. The finding of the study may add to the quantum of knowledge in the area of training methods and results of the study may be of great value for designing suitable training programme for the movement of performance abilities.

8. The finding of the study may add to the existing bond of knowledge for physical educationalist, coaches and useful to those who involve themselves in organization of sports competition and training.

9. The study may help the athletes himself to understand his potentialities in respect to physiological, motor and psychomotor fitness.

10. It will provide the coaches to acquire a deeper insight into their own interactive process.

11. Further, the study may help physical education teachers and coaches by way of informing them the specific fitness requirement for team game players.