Chapter 1

INTRODUCTION

"The wisest of our citizens will not be those, who merely enjoy the spectacle; but will be those who climb up out of the pit and onto the stage, and lose themselves in action."\(^1\)

Today, sports and physical education are considered as a great force contributing to international understanding and universal brotherhood. In the present politically conflicting times, the sports is also considered as one of the major adhesive forces in developing world peace.

Therefore, stresses on the promotion of physical education and sports from pre-schools to old age should be treated as one of the fundamental human right by national government.\(^2\)

Conquering is a form of achieving and appears to be a natural goal, winning is a form of conquering and is glorified, sometimes out of proportion to its real significance. The urge to surpass, surmount and excel is characteristic of almost everyone and is natural form of motivation. In sports it has become an


accepted practice to strive to win. The philosophy of sports participation has undergone a change as how an individual participates to win even his countrymen induce the sportsmen to win as sports has become a prestigious aspect to prove their superiority. This is contrary to earlier philosophy that is, "play the game for the sake of participation."  

Winning laurels at international sports arena has become a prestige issue linked with political system and as such nations vie with each other to produce top class sportsmen for international competitions. For this scientific research is systematically conducted to identify the factors that help in achieving level of skill which a player can attain through proper coaching and evaluation.  

Sports is one of the avenues for man kind, never ceasing to strive for excellence. Its uniqueness lies in the intimacy between the physical happenings of our bodies and their repercussion on our minds as well as in the general recognizability of the social and aesthetic values which sports engenders.

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Anthropological and historical research has established that physical recreation and sports have been fundamental aspects of all cultures throughout the history of the world.5

The desire to do one's best to excel, to attain the highest standards of performance, to be supreme in his chosen field in a worthy human ambition which leads to better standards the personal growth. Excellence in any area do not come easily. The trail is hard and steep. There are numerous obstacles to overcome and barriers to push forth. Achievement of high skill in any field (athletics, art, surgery, science, writing or teaching) demands commitment and sacrifice. The greatest barrier we comfort in our persuit of excellence is psychological in nature. Running a mile under four minutes was view as impossible until it was broken by Roger Bannister, when he clocked 3 minutes 59.5 seconds on 6th May, 1954. Since then 4 minutes barrier has been broken by approximately 500 athletes from all over the world. It was not the physiological make-up of runners that changed but it was their psychological knowledge of what was possible. As man's beliefs about limit change, the limits themselves change.6


Competitive sports make a tremendous demand on the physical condition, physical fitness and mental power of the participant. Only athletes or sportsmen or women in the finest condition may withstand the wear and tear of the competitive season. Only the fittest can play to be best of his ability.

"Behind every super-performance lies a life time of discipline, consuming passion and unique talent. All three are essential for changing the horizons of games and sports."

Today, the preparation of an athletes for top-notch achievement is completely dynamic state characterised by a high level of physical and psychological efficiency and degree of perfection of the necessary skills and knowledge, teaching and tactical preparation. An athlete arrives at this stage only as a result of corresponding training. Thus, athletes training today is a multisided process of expedient use of aggregate factors so as to influence the development of an athlete and ensure the necessary level of participation.7

In order to train a champion sprinters, the physical education teachers and coaches have to make a right choice in the selection of the athletes and then train them employing the

best methods of training and coaching so that increase in performance capacity may be guaranteed. These dual efforts of channeling potential to the most suitable games or sports of selecting suitable players is helped to a great extent by the recent development in anthropology as it applied to sports and games and construction of objective and valid tests of fitness and skill.  

By definition, a sportsman is one who challenges himself to show superior ability in tasks which do not best on any benefit other than the spiritual satisfactions of achieving something which was not achievable till when by the individual concerned.

With all round advancement in the science of sports the new disciplines are emerging with micro specializations. The elements of scientific basis of selection is being inducted in the procedure of selection of athletes at various levels in some of the advanced countries. The knowledge from many scientific disciplines is being used for improving the criterion for selection of talent. The physical educationists have designed that procedures for evaluating the fitness of young children. The structures of


performance for different games and events is being worked out. The general physical fitness of top ranking athletes has been evaluated. Proposals are coming up for the selection of the potential athletes with the designs of tests and the body size predictions. Human growth and performance is also an important field in this regard. The physiological factors limiting one's performance in sports are also well known. It is the understanding of interactions of athletes factors that can help us in design the way for selecting the children for appropriate game and training.  

No two persons are identical in this world. Individuals differ in mental abilities, physical abilities and personality traits. The individuals not only differ from one another but also differ from one ability to another within their own self. Thus, there are differences in individuals as well as with in the same individual regarding various abilities.

The world of training methodology has crossed many milestones as a result of different types of research in general and their application to the sports development in particular. In the modern scientific age, athletes are being trained by highly sophisticated means for better achievement in their concerned sports.

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They are being exposed to the exercises and training methods which have proved beneficial for achieving higher standards. Much progress has been made in the recent years in the acquisitions of knowledge about training means and techniques of sports skills. In sports training specialised exercises are being prescribed for the fullest and optimum development for a particular game.¹¹

Champion performance is not something that just happens many coaches have explained the secret of a champion athletes than they have developed through systematic conditioning and well planned training programmes. The success in competitive sports calls for maximum fitness.

Main aim of modern sports competition is to detect and diagnose the human ability at an early stage of life and channelize it in the right direction to realise the achievement aimed at in a particular sport/game. "Excelling," "doing better," surpassing are some of the expressions which are generally used to denote competition a sort of deliberate and conscious animosity that has existed for centuries and shall continue to exist.

So long as betterment remains the goal of the society. Consciously or betterment remains the goal of the society. Consciously or unconsciously, every one is competing in one or the other.¹²

Competitive sports is a place where the young and super challenging athletes fight for supremacy and records. The athletes are sophisticatedly prepared by expert sports scientists and coaches to tussle among themselves, hence to win and then to enjoy their dreams and fruits of the efforts put in for years together. The fact is that today's athletes are simply stronger, faster and more efficient then yesterday's and tomorrow's may be still better.

Competition is one of the out growths of matter in life. It is a natural human activity which is in entable in life, and the education process should assist in the preparation of individuals for the battle of life. Competition provides the means by which one can show one's worth through success.¹³

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Optimum performance can only be recorded in a competition. After all, there are no awards offered for world records in training. The athlete prepares to improve his competitive performance and therefore, all the training is a pursuit towards this end. The concept of periodization implies producing and reproducing the high point of performance in a particular competition. This has become very essential and a rather complex phenomenon in the light of increased number of competitions and political, economic and social implications besides the glory of victory attached to each one of such competitions.

Training and competition aim at raising the standard of athletic performance. Competition is the most scientific application of training. Competitions are of great significance for the build up distinctiveness of the competition performance. Preparatory or build up competitions are a part of training, whereas main or major competition is an end in itself within on training cycle. Preparatory competitions are intelligently spaced within the training cycle to enable the athlete to progressively achieve his peak performance in main competition. The ultimate aim is to improve the abilities, skill and mental qualities that determine performance and hence, are important load forms. Nevertheless, a mere practise trials in a training session will not inculcate the mental qualities. The competitions are organised to stimulate
the actual competitive situations, those put the best demands on
the athlete causing development of mental qualities such as aspiration, anxiety, confidence and competitive urge.

During the process of training, one can only stimulate
the situations similar to the competition, which only approximately
correspond to a real competition. It is only in actual competition
that an athlete because of his competing experience and its
emotional demands, emerges more completely exhausted than
in training. Consequently, the stimulus conducive for adaptation
to high and maximum loading is more effective than that which
can be reproduced in training. Competition is the most specific
training to assist the athlete to master the emotional excitement
and to surpass his current limits of performance. Above all, mental
qualities specific to competition can become evident only in difficult contests. It is not unusual to hear of an athlete performing
superbly in training yet experiencing disasters in actual competi-
tions. This means that he has failed to master himself in
competition, reacting negatively to the insecurity threatened by
competition. Once back in the quietness and security of the training
situation, all is well again; that is why sometimes we come
cross unexpected but interesting results of competitions.14

14 Frank W. Dick, Sports Training Principles (London :
Competition is one of the outgrowth of modern society. It is the challenge which stimulates, inspires and motivates men and women to sweat and run faster, jump higher, throw farther and exhibit greater strength, endurance and skills to exhibit superiority over the others. Every individual or a team which participates in any sports/games wants to win as our society attaches a great significance to winning. According to Renwes \(^{15}\) "performance is the key note of all sports its basic principles, since sports have become prestigious aspect to prove one's superiority, the philosophy of participation in games and sports has undergone a great change."

The remarkable improvement in the standard of athletic performances during the few decades represent a unique biological phenomenon. It was inconceivable even a decade ago, that some of the earlier established athletic records could be improved upon within such a short span. Apart from the phenomenal progress in training methods, techniques, and improvement in tools, equipment, track and various other associated factors which contribute in shaping a world class athlete, genetically endowed human potential seem to play a great role in the final outcome. Every thing else being equal, however, the nature of the contributory

role of the genetic factors in sports events still a mystery. Perhaps in a few years with rapid advance in the field of genetics a clear picture may soon change.\textsuperscript{16}

Search and selection of potential athletes in specific field based on scientific knowledge is a matter of routine in many developed countries. Unfortunately in India, this aspect has not been given serious consideration. Consequently athletes are selected from the "available pool" mainly on the basis of their performance records in various sports meets. It is often forgotten that such "talents" have already reached their peak performance with little scope for further spectacular improvement inspite of intense grooming schedules. Therefore, a fresh look need to be taken to improve upon the methods of selection of Indian athletes. They need to be identified at a very young age.\textsuperscript{17}

Training in games and sports is no longer a myth and it has no casual approach, but it provides opportunities for scientific process and verification. Training has been accepted as a highly specialised science involving the use of scientific methods and physical invetigations.


\textsuperscript{17} Ibid., p. 29.
Even through the best training to improve sport performance is to practice the movements at a same rate and intensity as during an actual game situation, there are other types of training activities which are supplementary for improving performance. Despite the vast amount of research that has been done in athletic training, most of what were known have been gained empirically through sweat and tear and on the training ground rather than what has been discovered in the laboratories of human performance, physiology and psychology. It is only after training method has been found by coach or teacher or athlete or both that the physiologist and psychologist confirm its worth.

In games and sports, systematic training and conditioning of sportsmen play vital role in building up peak performances. Therefore, specific training in games and sports has become a necessity for superior performance.

Today, there is not a single sport in the world at competitive level for which resistance training in some form or other is not used as a conditioning exercise. The day of general fitness training for top class sports are as much in the past as the scores of records that have been broken in recent years by athletes using more specific training methods. It is now recognised that muscular strength is the foundation upon which first class
performance is built.  

The process of coaching, through constant honing and polishing, wears down all the knob and make what often seemed like ordinary abilities into co-ordinated smoothly functioning organism. Different and appropriate methods are used to coax every centimeter, every fraction of a second, every ounce of energy out of the athlete who is considered to be almost a machine.

Bosen says, "success in all athletics is concerned with strength and speed of movement" all these factors are very much related.

In every item of sport, human achievement has been improving and old world records which once were regarded as the ultimate in that particular sport and humanly impossible to be broken have topped one by one in the succeeding competition. The cause of this seemly super human performances in the introduction of scientific approach to human psychology and physiology and the application of fruits of intensive and extensive research in these fields of physical training.

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In sports and games conditioning and training play vital roles in the improvement of human performance, specially at the competitive levels. Therefore, specialised training in sports and has become necessity for superior performance.21

In recent years greater stress has been laid on the quality rather than the quantity of training. The sports scientists and experts of sports want their sportsman to extract maximum achievement for their training procedures without causing too much strain on them. This is possible only if coaches and teacher of Physical Education apply the performance of the athletes.22

Physical education scientists are striving to understand the various factors affecting skeletal and muscular activity, during a variety of human movements with the help of electromyography and are engaged in analysing the bio-mechanics of the performance of top athletes by focusing their attention upon the analysis of sports skills. They are consistently studying factors like strength, limb length, mass, inertia proportions and angular and linear velocity, that influence these movement to get a better insight


into the complexities of human motion and performance. The latest approach is aimed at the construction of a mathematical model of a skill in a form which is suitable for computer analysis so that it could be stimulated under several carefully controlled conditions for predicting more effective technique for higher performances.23

The will to perform always urges forward and induces progress. The limits reached today shall be moved further tomorrow. The will to perform is what makes a man enter untrodden territory and confront the unknown. When personal conditions are favourable and environmental conditions are excellent, optimum performance can be turned into maximum performance into a record. The desire to perform is a basic derive, in-born and active in every person. It is the derive that leads to the development of natural qualities. The effect in triggers of leads to an improvement of capabilities and broadening of knowledge thus contributing to perfection of personality.24


The standard of performance has been showing improvement and more and more records are being created in the events included in the Olympic and the world championships. To a certain extent this is due to improvement in track surfaces and the equipment but to a greater degree these achievements have been made possible due to improvement in the methodology of training and coaching.

"Speed in training theory is defined as a capacity of moving a limb or parts of the body's lever system or the whole body with the greater velocity."

Speed is not only necessary in sports activities where man compels to show his superiority but also in activities with which nature has blessed mankind. Speed is the rapidity with which one repeats successive movements of the same pattern. Great speed is muscle contraction is not always conductive to the greatest efficiency of movement. It seems that there is an optimum speed at which muscle contract with the greatest conservation of energy for the amount of work done.

Speed of whole body, movement, or of individuals joint actions is a decisive factor of successful performance in many sports. While speed is frequently the product of co-ordinated sequence of strength expression of joint actions, the development of speed is not synonymous with the development of strength.
In speed dependent sports, it is important that speed at technical performance is introduced early. However, this must not compromise the basic technical model. Speed is considered under the heading of "conditioning training" in many programmes, due to the possible combination of speed with strength, endurance and or mobility. However, it may equally be considered as a sophisticated extension of technical training. Practices for the development of speed are specific to the technical demand of a sport. Such demands vary according to involvement of strength, endurance and mobility, and synchronised use of varied speed of joint action and the requirement of optimum speed.25

Sprinting is the fullest form of running, performed over short distance in which maximum or near maximum effort can be sustained.

Sprinting figures in the programme of all major athletic championship including the Olympic games, in which the standard sprint events for men and women are the 100, 200, 400 metres and hurdles and 4x100 metres and 4x400 metres relays. There were no sophisticated training means for the development of sprinting speed and athletes used to exhibit what ever they gained through daily physical work and what ever speed characteristics

they inherited from their parents. As the saying goes that sprinters are never made, they are born. This saying is now being modified to indicate the sprinter is born with some inherent speed but he can be shaped as a still better runner as a result of systematic and scientific training. In 1890, the world's fastest human was John Owen, who ran 100 yards dash in 9.8 seconds. The 9.4 seconds 100 yards dash performance by George Simpson (1929), Dam Joubert (1931) and Josse Owens (1933) were truly feats in athletic area. Even more outstanding is the 10.2 seconds 100 meters world record set by Jesse Owens in 1936, which for more than three decades remained unbroken. In 1968 Jim Hines of U.S.A. surprised the world with a 100metres performance of 9.95 seconds in Mexico Olympic Games. In 1983 in Hilsinki world cup athletics another U.S.A. sprinter Kelvin Smith stunned the world with a performance of 9.93 seconds. After one year Carl Lewis of U.S.A. was almost near the mark with the performance of 9.99 seconds at Los Angles Olympic Games.

The glorious 100 metres sprinting re-wrote the history in 1987 World Athletic Championships when Canadian Ben Johnson breasted the tape with a cracking time 9.83 seconds (world record) and just behind him the hero of 1984's Olympic Champion Carl Lewis with a creditable time of 9.93 seconds.26

The two major factors that also determine the sprinting speed of an athlete are stride length and stride frequency.\textsuperscript{27}

Whitehead\textsuperscript{28} expressed his strong belief in acceleration runs for the development of speed. He suggested that an athlete should run a distance of about 80 metres 3 to 4 times gradually increasing his speed, repeating this in or three sets of four repetition, thrice a week in competitive season. This will bring about winning results. As running shorter distance with maximum effort requires an aerobic capacity. Speed of acceleration and sprint endurance, all these characteristics are improved by acceleration. Therefore, now-a-days acceleration runs are used by most of the coaches and physical education teachers to train their athletes for speed.

Robinson and others\textsuperscript{29} pointed that power is very important in vigorous performance because it determines how hard a person can hit, how far he can throw and how high he can jump. Strength and speed can both be stressed by applying strong force through rapid motion as done in explosive weight training.


In sports activities some amount of resistance (if not external than one's own body weight) has to be over come. The strength therefore, is an important factor on which the sports-performance depends. Depending upon the magnitude and type of resistance to be tackled in various sports, the sportsmen of different sports need different levels and types of strength to achieve good performance. The greater, the resistance, the stronger should be the sportman. Strength is needed not only for competition but also for successfully carrying out the training programmes. A high level of speed, endurance, techniques tactics and other coordinative abilities is impossible if the sportsman lacks the requisite amount of strength.\(^{30}\)

To build strength means to build muscle. To build muscle requires a planned programme of resistance exercise on a basis of over load. The relationships are not a new discovery, but only recently have basketball coaches recognised the value of building strength and only a few utilize the information which is available for practical coaching purposes. The procedure is simple but they require regular and persistent application to produce the desired result.\(^{31}\)


Other forms of resistance running include harness running, running in heavy boots, running with sacks of sand on the back and running with weighted belts. Basically the athlete performs the movement with a belt secured about the waist. The belt is attached to ropes which are held by the partner who provides a resistance proportionate to their being effective movements coming from the performer. Harness runs can be performed for a period of time or for a distance. It is most helpful if the coach can apply the resistance as he can place certain emphasis on movement by calling to the performer from behind e.g. greater ankle extension, higher knee lift etc. The resistance does not have to be applied by a partner. It can be applied by weighted sleighs which have the advantage that degree of resistance can be measured and standardized.32

Whitehead33 gives examples of coaches who have strong faith in resistance running as one of the important phase of the training, coaches like Arthur Lydiard in New Zealand and Percy Cerutty in Australia, Gundar Haegg in Sweden and Jim Alford


in Wales, all had something in common the insistence of frequent hill running as part of their athlete training whether the hills are mud, snow, sand or coal seems not to matter provided athletes are required to run up then fast, using their arms vigorously and repeat the runs often.

The best way to develop strength is through an organised programme of weight training. Today only a small number of coaches are using weights on an organised basis to supplement their athletic programmes.\textsuperscript{34}

One should remember that weight training is not a substitute for athletics, but merely and adjunct which can be conveniently used, especially off season, weight training may even be done without weight.\textsuperscript{35}

We might define a sprint as any distance which can be run at maximum speed.

Creek\textsuperscript{36} explains that like all the athletics skills, sprinting demands effort plus style and good style involves the study and practice of techniques. While maximum effort depends upon


\textsuperscript{36}F.N. Creek, Teach Yourself Athletics (London: English University Press Ltd., 1968), p. 16.
will power and stamina. Good style is the result of intelligent training and coaching, coupled with a sound knowledge of the event and of course a high degree of natural ability.

The only way to develop pure strength is through a form of progressive resistance exercise using weights or some other forms of resistance. At the moment most track and field athletes use barbell etc. with disc as the common method for applying a resistance.

Weight training carried out in haphazard irregular and sloppy fashion will not reward a player with satisfactory results. As in most endeavours, he will gain strength from weights proportionately to the efforts he puts forth, if he does not give weight training in sincere efforts, there will be little or no gain in strength. On the other hand an athlete can drive a great deal of strength, power, endurance, and general fitness by lifting weights in a conscious manner and on a regular basis.

The most obvious and most valuable assets to be derived from lifting weights are gains in strength and power. Experts agree that strength gains are dependent on three factors namely:

a) The amount of stress applied to the muscles,
b) Length of time the stress is applied,
c) The frequency with which the stress is applied.
In training with weights the load on the muscle can be recorded accurately. The number of repetitions or the durations of the over load effort can be controlled and accurately recorded, as well as the frequency of the training sessions.37

Resistance running is also one of the methods which is used now-a-days for the development of speed. As a matter of fact, it improves leg power which highly effected the speed in sprinting. Ken-O-Bosen suggested resistance running in pairs, running with ankle weights tied on the ankle of foot bouncing up steps are excellent for the purpose of development of speed of sprinters.

Today almost every nation in the world attaches great importance to the development of sports in order to improve the nation's health and for the well being of the future generations. Hence, a large number of governmental and para governmental organisations in close collaborations with private bodies, administer and supervisor even G.D.R. and U.S.S.R. also try to project the superiority of their political ideology and their political and social system through achievement in the field of sports. The increased number of athletes participating in the great quadrennial sports world is also an indication of the popularity and development of sports. Further more, the non ending criteria of new shows

37 Hooks, Application of Weight Training to Athletic, p. 19.
a continuous upward trend and improvement in the standard of sports performance.  

Clarke pointed out that speed also depends upon strength. This is nearly another way of saying that stronger can lift more rapidly than can be a weaker one or than the strength or motor limits the speed of an automobile. If all these aspects are equal of an individual the stronger the individual faster he can run.

The game of hockey winner is most successful when he has sprinting speed to reach the ball, accompanied by speed of movement to dodge his opponent and to change the direction according to the situation.

It is probably safe to say that there are no sports today that do not boost of weight trained athletes. Even distance runners and others to whom economy of body weight is vitally important have found that work with weight training apparatus will improve chronically weak muscle group and result in better and more

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injury free performance.  

Alteration in body composition as a result of high resistance weight training programme are found to be nearly identical for both men and women. There is an increase in lean body weight and a decrease in total body fat with relatively little change in total body weight.  

While athletes throughout the world are flocking to the gymnasium to build up strength through weight training. Some of the Indians will feel that lifting weights make one stiff and muscle bound and they still speak of slim and sleek sprinters.  

Speed plays a vital role in all games and sports but plays a very dominant role for sprinters. For a sprinter to give good performance he must possess acceleration speed, sprinting speed, speed of movement and reaction time. Even through these four components of speed affects the performance of a sprinter yet the contribution made by reaction time to enhance speed performance is still not very certain. There is no doubt regarding the

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contribution of acceleration speed, sprinting speed and speed of movement to bring about better performance on the part of sprinters. Therefore, to attain optimum performance in activities where speed is the main factor acceleration speed, sprinting speed, speed of movement and reaction time should be woven together.

It would be worth while to review the factors affecting sprinting in order to identify areas of research in developing the factors for further improvement in the sprinting ability. The important factors may be identified as the structure of the body of the athlete, age, temperament, technique of sprinting, condition of track and use of equipment such as starting blocks. The profile of sprinters seems to be that of a man of average height with good musculature specially around the thigh region. Speed is natural gift. It is characterised by:

a) The natural speed of contraction

b) Neuro-muscular coordination

c) Explosive power which can be developed.

Development of speed is one of those cases where organism had to adopt itself to the steadily growing force of "excitation" of the stresses. This force is the frequency with which excitation acts persuit time. 44

Bush and Weiskopt\textsuperscript{45} have explained that speed strength relaxation and the proper mental attitudes are all essential factors in sprinting success, but if a runner does not possess natural speed he will never be a champion sprinter. While we agree that sprinters, as a rule are born and not developed, their speed can be improved through the effective execution of the basic mechanics of running and conditioning. A champion sprinter is the product of long training and practice.

Speed has varied application in the field of sports. A football player need speed to reach the ball as quickly as possible and to pierce through the distance. On the other hand a defender needs speed of recovery to guard his goal and even goal keeper needs speed of movement to control the ball as quickly as possible.\textsuperscript{46}

Petrovshki\textsuperscript{47} coach of Olympic champion Borzov (USSR) claims that a large amount of running performed below the competitive speed adjusts the organism to perform accordingly, therefore the potential speed limit is not achieved. It is obvious from

\textsuperscript{45}Jim Bush and Don Weiskopt, "Developing a Champion Sprinter," \textit{Athletic Journal} 56 (1976) : 16.


\textsuperscript{47}B. Tabash Chnikov, "Sprint Problem," \textit{Track Technique} 76 (Summer 1976) : 2416.
Petrovski's statement the fast sprinting and speed exercises are essential to the development of sprinters, particularly after four or five years of training in the 18 to 19 age range. It is also essential at this age to develop strength and power by using sprint specific method and avoiding monotonous repetitions of the same type of training and adopting well proved methods such as varied resistance (up hill and down hill) sprinting, change in the running rhythm, starting and acceleration should find an important place in the programme.

Weight training is not usually thought as an end in itself but as a means to an end. The primary objective is not to learn to lift as much weight as possible but to increase strength and powerful application to some other sport. Weight training may be either of isometric contraction, isotonic or isokinetic contraction.

Along with the development of theory and methods of general sports training, it is necessary to effectively investigate the various aspects of training also because due to too much of peculiarity of each sports, the various important aspects of training can not be fully explored alone by the traditional theory and methods of sport training in general. Certain differential aspects and regularities about training procedure is studied at every minute structural level rather than at general level.
Lifting of weight is practiced for different reasons, some individuals participate in highly specialized form of physical activities because body building is their objective. To these the size of the skeletal muscle is of paramount importance. The aim of body builders in the attainment of systematical hypertrophy of all muscle groups capable of being subjected to maximal shortening against heavy resistance. An athlete can derive a great deal of strength, speed, power, flexibility, and co-ordination through a weight training programme. Weight lifting is also used as a form of conditioning exercises for maintaining or improving physical fitness or increasing athletic power in general.48

Wilmore49 while discussing modes of testing, said "there is an increasing awareness of the importance of selecting the appropriate test mode when testing athletes in various sports i.e. a mode which must closely approximate the actual sports activity."

The concept of specificity can also be applied to the test protocol. When subjects are trained by hill running, the increase


in \( VO_2 \text{max} \) is greater than when using a treadmill protocol which increases power by increase in speed. Thus due care should be taken to match the protocol for the testing made or device are closely as possible to the conditions under which the individual trains.

Hooks\(^{50}\) suggested different weight training programmes for different sports like track and field events, basketball, football, swimming etc. taking in account their different requirements of fitness.

Heighton\(^{51}\) opinion that if speed is to be developed, strength development is must because once strength is developed upto some extent as strength is a must to perform any type of activity. He suggests weight training as a better method for development of speed, agility and endurance.

Dentiman\(^{52}\) is of the opinion that although running speed is considered mostly an innate quality, it has been well established that it can be improved through training. The strength of the

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\(^{50}\) Hooks, *Application of Weight Training to Athletics*, p. 172.


\(^{52}\) George B. Dentiman, "Increasing Running Speed through Flexibility and Weight Training," *Scholastic Coach* 34:6 (February 1965) : pp. 3-4.
muscles involved in the running action determines, to some extent the maximum speed of the individual. One cannot hope to achieve success in sprinting without the muscular strength, necessary for legs to move with speed.

The effect of strength, easily demonstrable through the feats of performance by overcoming higher degree of resistance. According to Barrow and McGee.

Strength is pre-requisite to all activities since it takes a certain amount to be agile, to have power and run fast. Thus leg strength seems to be a determining factor to success in sprinting. One cannot hope to achieve success in sprinting without the muscular strength necessary to move the leg forward with speed. Further more a sprinter needs more of explosive power and less endurance than middle and long distance runners.

Tabaschnik and Sultanov\(^5^3\) in their studies indicated that each sprinter has individual speed dynamics, shown in different combination capacity, ability to relax etc. These individualities depend largely on genetic differences as well as physical development and training levels of an athlete. In principles, therefore, it is possible to exploit the sprinter's individual differences by

applying different training methods, load and intensities of training in order to specialize in one particular distance.

Lack of minimum muscular strength may lead to certain chronic illness. Kraus and his co-worker\textsuperscript{54} state that "lack of sufficient muscular activity not only means insufficient emotional release but at the same time it decreases muscular strength.

Dentiman\textsuperscript{55} also discussed some specialized programmes for the improvement of sprinting speed in his article entitled "Factors Affecting Sprinting Speed," Part II. These are downhill running, towing treadmill running, training on uphill running and stair case sprinting.

Uphill running improves speed through an increase in the rate of leg movement, leg strength and power and physical endurance. It can serve as a training supplement or part of the regular programme specially during off season training.

The hill should be graded between 15 and 30 degree and any where in length from 40 to 60 yards. It is best if the


\textsuperscript{55} George B. Dintiman, "Factors Affecting Sprinting Speed Part II," Track Technique 59 (March 1975) : 1869.
hill can be circuited, so the runner need not stop or change direction.  

Strength is defined as the capacity to exert force or as the ability to do work against resistance. Therefore, strength training programmes should observe the following principles if maximum benefit in terms of improved sprinting speed and performance are to be attained.

1. Since muscle shortening (hamstrings in particular) does occur after heavy resistance work, a series of stretching exercises should always follow each work out.

2. Strength training should be used in conjunction with actual sprint training, both in season and off season, rather than as a replacement for sprint training. When two programmes are used simultaneously sprinting speed is significantly improved.

3. Contraction is placed upon the muscle (upper and lower torso) involved in the running action. Exercises are then chosen to activate and strengthen these muscle groups.

4. General principles of conditioning must be followed with the hypertrophy cycle providing enough rest between work outs to allow maximum exhalation or regeneration that elevates

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conditioning beyond the pre exercise level. Alternate day programme are used only for sprint training, flexibility exercises form training, stride training and other special supplementary programmes.

5. If speed is the desired outcome exercises must be performed explosively.

6. Heavy resistance exercises, such as weight training be follow the sprint training session or formal practice in track and field, football, basketball, soccer and baseball.

7. Injuries are linked with un-even development of agonist and antagonist muscles. Sprinter should avoid strengthening one sided development (agonist) and must find an optimal balance in strength and power training for both agonist and antagonist muscle groups. 57, 58

The only way to live successfully and to lead our life without limitation is not a formula which can be sold. We can't buy it with money. It comes to us free without money and without price. There is a price of course, which requires our own application to certain laws. It is not guaranteed to be an easy way but it


is guaranteed to be the only way to real success.

Some successful athletes of the world toiled and trained hard to get their picture on page one of the newspaper, or on the first covers of popular magazines. This inflates and briefly tililated their ego, but it never satisfied them for long. Still there is no limit to their progress, with a growing inner hunger to reach the unreached. So they are restless and discontented. Similarly, there is nothing that the public forget so quickly as yester's Olympic news.

In reviewing the progress in the sprinting and analysing the training method of sprinting the following attract attention:

1. The functional and competitive structure of sprinting is usually divided in three important variables i.e. speed, strength and endurance. Unfortunately, the correlation between the three forms remains unsolved. Some researchers claim that such correlation exists and other deny it.

2. Opposing opinions are also common regarding the question of the development of general and specific speed. This is mainly concerned with transfer ability of general speed to a specific action which considering that some speed exercises could have negative effect whereas some strength or endurance exercises might influence positively the motion structures.
3. The exact requirement of speed training, strength training and endurance training for sprinting competition structure appears to be controversial and hence requires systematic investigation.

4. The latest development of new speed level by using the stimulus of changing condition is not to be overlooked. This can be achieved by setting new levels at assisted running (down-hill) resisted running (up-hill, dragging etc.) or being trained with mechanical resistance (weight training or multigym exercise) and to avoid fatigue during competition a proportionate amount of endurance training is a great requirement.

Therefore, it appears that there are still many gaps in the theory of speed training for better sprinting performance and until these are filled, significant improvement in sprinting performance can not be achieved.

Hence the research scholar felt the need to investigate the comparative effects of different training methods (up hill running, weight training, Harness running, down hill running etc.) dominated by speed, strength, speed endurance and sprinting speed.

**Statement of the Problem**

The purpose of the study was to compare the effectiveness of up-hill running, resistance running (Harness running) and weight training on sprinting speed.
Delimitations

1. The study was confined to the male students of the Ranchi University, Ranchi, Bihar.

2. The study was further delimited to the males in the age group of 17 to 25 years.

Limitations

1. As the subjects selected for the study were day scholars, certain factors like diet, daily routine, life style, habit etc. which might have an effect on the result of the study could not be controlled and hence no attempt was made to control these factors.

   However, it was assumed that the random selection of the subjects assured the nullifying affect on these factors.

2. The experimental period was 10 weeks only which was considered adequate to indicate the training effect on sprinting speed.

3. No special motivation was provided to the subjects, however, they were requested to put in their best. The differences in the performance due to lack of motivation was identified as a limitation of the study.
Hypothesis

It was hypothesised that there would an improvement in sprinting speed by employing different resistance means i.e. up-hill running, resistance running (Harness running) and weight training.

Definition and Explanation of Terms

Weight Training

This term refers to the exercise phase of the activity where weight, in the form of barbells and dumbbells, is used to condition and alter the size of various segments of the body. This is undoubtedly, the most popular phase. Here the under developed individual strives for average or about average size in terms of muscular bulk and body weight and size, the athletes strives for increased strength and condition to become a better performer in chosen sports. 59

Weight training is defined as those exercises that are designed to strengthen specific muscle by causing them to overcome a fixed resistance, usually in the form of a barbell or dumbbells. 60


Intensity

It is the weight percentage used in strength training in relation to maximum performance capacity. Absolute strength indicates the 100 per cent intensity.

Duration

It is in terms with total stimulus of the strength for a particular training session.

Time utilized in each set may be added to find the sum.

Density

It is denoted by the recovery intervals in between the sets and also for the change of the exercise.

Number of Sets

Each exercise is performed with a few number of sets for a thorough build up of a particular muscle group.

Training

Training is a programme of exercise and other physical activities designed to improve physical development and condition and performance in motor skill.61

Harness Running

For the purpose of this study Harness running may be defined as one of the training means in which resistance to be carried by the subjects is in the form of dragging weight.

Speed

Speed is the ability or capacity of an individual to perform successive movements of the same pattern at fast rate.  

Sprinting Speed

Sprinting speed can be defined as the ability to perform energetic movement at maximum speed over a short distance.

For the purpose of the study, the sprinting speed may be defined as the ability of an individual to cover a distance of 100 metres as fast as possible.

Significance of the Study

The world of games and sports is ever expanding and progressing at a very fast pace. It is dynamic in nature and progressive in outlook. It is not confined to "what has been," its target is to march ahead.

Through different types of researches and scientific advancement in general and their application in the field of sports in particular games and sports have undergone revolutionary changes and crossed many milestones.


63 Ibid.
The main factor responsible for this improvement is the development of new training methods based on scientific principles.

Sprinting speed has varied application in the field of games and sports. Particularly in short distance races and horizontal jumps, the speed is a vital factor in winning.

The coaches and physical education teachers for quite some time have been trying to find out the way & means which will help them to train most economically and efficiently keeping the importance of sprinting speed in games and sports, particularly in short distances. The research scholar felt the need to investigate the comparative effects of different training methods, up-hill running, resistance running (Harness running) and wt. training dominated by speed, and explosive strength training on sprinting performance.

For the reasons stated above the result of the study may be of vital importance in the following ways:

1. The study will help the teachers of physical education and coaches by informing them about the training effects produced by the different training means i.e. up-hill running, Harness running and weight training.

2. The result of the study might reveal which of the training means employed in the study are superior to the others in improving sprinting speed.
3. The finding of the study might highlight the differential effects produced by the three types of training methods, selected for this study on sprinting speed.

4. The physical education personnel and coaches will be able to select as to what type of training will be best suitable for their athletes.

5. Based on the result of the study, teachers of physical education and coaches will be able to organize their training programme effectively.