Chapter I

INTRODUCTION

"To live is to choose. And if life is choices, then Jessy Owen's life is an extra ordinary example of what it is all about. Jesse's childhood was marred by chest disease, but he chooses to run".

KOFI ANNAN

In the ancient Greek Competitions, there was just one winner, who was crowned with an olive wreath and received a crater as his prize. But this in itself was not important, the best prize was rather the glory, being revered almost like a god, and deserving, like the gods, a statue and a hymn relating the winner’s achievements and preserving them praising his native city in which he became a role model to be imitated by his fellow citizen. The Greek were not concerned about records. Obviously, they could not calculate the exact time of a race or establish precise measurements, and therefore could make no comparison with earlier results. But if we look at the etymology of the world record, from the Latin recordary meaning "preserve in the memory".

In 1894 game were reinvented and it is evident that track and field athletics which basically comprises of walking, running, jumping,
throwing etc. are of the mother of all sports and have always dominated
the show at modern Olympic games.

Running is a cyclic movement in which two consecutive strides
or one double stride make up a complete cycle of movement. It is an
athletic event in itself and at the same time is important in numerous
other sports.

Scientific investigation have been playing an increasingly
important role in the training of athletics to attain excellence in
performance in different spheres of sports. Athletics concentrates on the
development of speed, flexibility, strength, ability, endurance etc. as a
part of preparation of their respective sport game.

Whether one is a sprinter or a distance runner, you need speed.
You also need stamina, which is the ability to endure, to hang in there.
Obviously a sprinter needs more speed than stamina and vice-versa.

Speed depends not only on a considerable amount of aerobic
activity but also on the resiliency and responsiveness of the circulatory
system, reaction time, flexibility and strength.

Sprintling is the fullest form of running performed over short
distances in which maximum or near maximum effort can be sustained.
Sprinting figures in the programme of all major athletic championships including the Olympic games, in which the standard sprint event for men and women are the 100m, 200 m, 400 m, hurdles, as well as 4 x 100 m and as well as 4 x 400 m relays.

There is no doubt that speed is the most essential element in the short distances of 100, 200, and 400 metres, but the 800 and 1500 meters now also require very fast basic speed, and the tactical races from 1500 metres upwards are frequently won in last few hundred metres with a sprint just before the finish.

It is frequently said that sprinters are born and not made, and although research indicates that this is true, "..... an average sprinter can become top class with the right training and competitions." Certainly there is no one physique which is dominant in sprinting and the elite include all builds, from lightly built wiry runners, though short stocky power houses and all rangy strides to the big muscular strength athletes. Techniques vary lighter men appear to float over the track, while muscular types power their way to the tape but all runners have one thing in common, fast natural movements with rapid cadence.

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As in all other branches of knowledge, techniques and training methods in track had to evolve slowly over the years, and are still evolving.

Many factors let to the improvement through the year. Performance that occurred before 1948 were run with out starting block, on rather poor (by today’s standard), unresilient tracks. Clearly starting blocks, light weight shoes, composition track surfaces, new starting techniques and modern training programmes have resulted in improved times from early track and field history.

In the track event’s an athletes objective is simply to cover a given distance (either on the flat or over obstacles) in the least possible time. The time actually recorded by the athletes is completely determined by the distance of event and by the athletes average speed to cover that distance. The speed at which the athlete runs is equal to the product of two factors:

1) The distance covered with each stride taken i.e. the stride length and
2) The number of strides taken in a given time i.e. the stride frequency (also referred to as stride cadence or rate of striding).

To make the switch from merely running to running fast times in the 100 and 200 meters, both coaches and athletes must understand the objective they are shooting for. The primary goal for all sprinters should be to improve their capacity to handle the increasing muscular demands of faster running. All athletes have speed potential—some more than other based upon their genetic makeup—but no athlete uses all of his or her potential.

Understanding proper sprinting mechanics, however, will help contribute to speed development. Mechanics has to do with the effects of energy and forces on the body. For sprinters, muscle power, neurological innervation, and length of limbs are the most important factors to consider. These factors influence the two main components that affect speed: stride length and stride frequency.

Stride length is governed by the power the sprinter puts into the stride, or the ground contact time. Stride length also has an effect on the angle of the force to the ground. When athletes overstride, or place the landing foot too far forward of their centre of mass, they create breaking forces that slow them down. While trying to lengthen their stride, by
overstriding athletes may actually cause their stride to shorten. The best way to improve stride is not changing technique but rather by improving the ability to produce power (i.e. speed and strength). Natural increases in stride length occur when greater power is applied to the ground due to improvements in stride frequency.

Stride frequency is limited by the physiological makeup of each athlete. It is governed by the firing ability of the nerves stimulating the muscles, the fiber type the muscles are made up of, and the length of the limbs. The more fast-twitch fibers one has, the greater stride frequency one can attain.

One of the most misunderstood concepts in training for sprinters is speed endurance. It refers to the ability of an athlete to mover at their maximum rate for an extended distance. It does not have anything to do with how efficiently one uses oxygen.

General conditioning entails improving strength and flexibility in all muscle groups and improving lung and heart capacities. More specific conditioning involves developing strength and power in the muscle groups primarily used in sprinting: gluteals, hamstrings, quadriceps, gastrocnemius and soleus (Achilles complex), dorsiflexors or ankles, flexors or toes, and shoulder joint development for arm
actions. Advanced conditioning also involves acclimating the body to the specific energy requirements sprinters need.

Flexibility is a component of sprint mechanics. It corresponds to the elasticity of an athlete's muscle, tendons, and joints. There are different ways to increase flexibility, including static stretching, resistance stretching, proprioceptive neuromuscular facilitation (PNF), and dynamic exercises.

Sprinting speed depends upon stride length and rate of striding or cadence. The cadence in good sprinting is 4.5 (and sometime possible 5) strides per second. Stride length among sprinters varies between about 7' and 8.5' (2.10 and 2.60 metres). Improving either stride length or cadence (without off setting the other) will increase sprinting speed. Stride length, therefore, offers the best opportunity for improving sprint speed.

Speed can be improved by increasing the length of the running stride while maintaining the same rate of leg movement. A trained runner will usually have a longer stride by 7 to 8 inches over an untrained runner. Stride length can be an acquired skill. Success in speed has been attributed to having a long stride that carries the runner low to the ground. The common fault regarding stride length is over striding. Over striding does not produce a faster rate of speed.
Stride speed or Cadence, is a natural quality of sprinters, which can be little influenced by training. Stride length (even if we ignore length of limb) is dependent on mobility in the hip joint and on leg strength. The more power the leg drive, the greater the stride length. Sprinting demands a high degree of muscular strength in the form of power.

Echer (1975) is of the opinion that speed is the product of two factors, stride length and stride frequency. Increasing either factor (without an offsetting decrease in the other factor) automatically increases a runner's sprinting speed. From the training point of view it appears that stride length is the most important of the two factors. Stride length can be increased by increasing the leg strength. Stride frequency however is an inborn quality. Although it might be possible to improve stride frequency slightly through training, it appears that this improvement also being about a corresponding shortening of stride length.

The emphasised aspects of sprinting technique appears to have changed over the last few years, turning it in to a technically complicated movement. It is evident that the maximum speed phase occupies 65% of a 100 m race, with 30% taken up by acceleration and less than 1% by reaction time. Attention must therefore be paid to the development of maximum speed, which is not only a problem of
effective conditioning but more importantly, of the development of a "correct" sprinting technique.

Scientifically speaking, sprinting involves complex patterns of movement and is not so cumbersome as it appears. It is affected by leg swing, propulsive force, body balance, frequency of stride and stride length. As the body is moving forward quite fast, the legs also should swing faster in order to form a base under the moving centre of gravity. To maintain the speed for a longer duration length of stride and frequency of stride play an important role. As the sprinter reaches his maximum speed he finds it fairly difficult to maintain the speed for a longer duration and at this point, automatically the length of the stride is increased in order to maintain the attained speed. The increase in length of the stride affects the frequency of the stride inversely. So training methods should be so framed that all the above factors are improved which will ultimately lead to better speed attainment.

Jordon and Spencer (1974) reasoned, in sprinting the ability to sustain speed is the important factor. Starting leg speed and the length of stride are more mechanical features. But as one reaches the phase of sustaining speed, it is essential to maintain speed from and length of stride against the pressures of maintaining tension.
Dyson (1985) on the basis of his protracted investigation listed the most important factors which contribute to speed and maximum efficiency in sports as follows.

1) The weight of the athlete.

2) The build of the athlete.

3) The strength factors

4) The co-ordination and flexibility of the athlete and

5) The length and frequency in stride in correct proportion.

From a training stand point, stride length is much more important than stride frequency, but the increase in stride length must be in a natural way. The athlete who extends his stride in an unnatural way will usually end up over striding, planting his foot ahead of his C.G, thus reducing his stride frequency. The stride length must be natural in order to apply greater force from the lower body to the ground and to get greater ground reaction force for forward propulsion.

It is also important to note that in efficient running, the leading foot is never stretched awkwardly for a longer stride. Stride length is the product of driving the entire body forward and is dependent upon strong
abdominal muscle and high knee action. It almost goes without saying that fast running does require a long stride.

Many studies have been conducted on stride length and stride frequency but they are almost entirely limited to their inter-relationship. It is obvious that sprinting performance depends not only on stride length and stride frequency but athlete’s physical characteristics and motor components like agility, flexibility, strength etc. are also quite important contribution.

In principle it is therefore possible to exploit the sprinters individual differences by applying different training method, load and intensities to training in order to specialize in one particular distance.

Athlete inclined towards the 200 m concentrate more on the development of speed endurance and the technique to run freely and relaxed. This requires an increased stride length, without a significant reduction of stride frequency, achieved by employing a large volume of high intensity training runs over 100 to 300 distances.

According to Dintiman (1965) an increase in body flexibility through a specialized training programme should help increase running speed. Increased flexibility may produce a longer stride without reducing the rate of leg movement and, at the same time, decreases the
expenditure of energy and reduce the resistance that must be overcome while performing the running action.

The importance of strength in acceleration the limbs at high speed is well recognized and it determines, to a certain extent, the speed of running. An increase in leg strength may have a beneficial upon speed. Strength is essential to the development of stride length and power to the rate of leg movement. Such increase in strength can be obtained through properly administered programmes of resistance training. By developing greater muscular strength, elasticity, and joint mobility, the stride length may be increased naturally. Stride length is increased primarily by thrust of the leg against the ground acting behind the body’s centre of gravity and greater by thrust can’t be achieved by placing the forward foot ahead of the body’s centre of gravity.

The aim in sprinting is to accelerate to the maximum speed in the shortest possible time and maintain it for the full distance. It is a well known fact that speed depends upon the sprinters stride length and stride frequency and these two factors are inter related to a high degree to produce excellence in sprinting. Stride length can be improved by increasing leg strength and flexibility. Stride frequency however is largely an inborn characteristic.
Athletes who are going to win medals at any standard, are neither simply nor made. Thus, with sprinters, natural ability is no longer enough at any level but is, in sprinting especially, an essential basis upon which are carefully natural product is moulded. Strongly enough, natural talent is very readily recognized, but the “staff” which goes to make up the talent most difficult to analyse. One can for instance, talk of strength, power, natural speed, endurance, explosiveness, reflex’s, reaction times and so on, but not one of these really tells us why some run naturally faster than others.

The higher the level of sprint performance, the more important it is to combine different running conditions. The closer these conditions are to the event-specific performance, the more effective are the results. The usual ways to provide assisted or resisted running are by the means of down hill or uphill runs or by some type of a towing device. However, the various phases of a sprint race can be improved by the speedy system, a device made up of two harness, a rope and a pulley, including means to regulate the amount of assistance or resistance a required. The speed system has the advantage to simulating down hill or uphill runs on the flat track surface, which is essential for qualify sprinting.
The use of sprint drills in practice is utilized by coaches in order to facilitate the sprinting action with the goal of producing better sprinters. The rational for the employment of many drills is that the action of the drill produces a movement pattern consistent with the parameters experienced in sprinting. In a recent review, it was suggested that some of the drills currently utilised by sprinters can be potentially dangerous (Yessis 1994), while this remain to be seen, it is incumbent on sport scientist to test the appropriateness of some of there drills so that coaches and athletes can benefit from movement patterns that indeed facilitate superior transfer from drills to actual performance.

Korchemny (1994) advocated that speed development requires the application of drills which bring about memory to the motor neuron centres and muscles, as well as efforts which develop rhythm and timing of the target actions. There drills can be duplicate technical details and rehearsal of strength and speed of training actions. The main objective of the assignments is to create some kind of surplus in efforts whenever this relates to the strength and speed of execution of the target actions.

Combinations of more specific assignments, properly arranged in the training programme can enhance the development of specific skills and athletic abilities.
The speed development training menu consists of drills arranged dependent on the equipment used for training (sticks, weight pants etc.) and the training methods followed (contrast, assistance etc.). This menu is a collection of all available recommendations on preparation of training assignment for speed-related activities. It is a kind of “ala carte” for making your own selection of dishes for a dinner. This menu includes a variety of drills in the mode of strength development and training of stride cadence through the application of special and specific assignments. The training menu contains stick drills, dragging resistance drills, assistance training drills and contrast training organization.

There is a great range training methods available designed to improve different aspects of sprinting or running. The most effective method is a natural repetition of co-coordinated movements from idea execution in slow motion to rhythm form and maximum speed. Some exercise include all the elements of the running technique, such as high knee marching on toes, high knee action with extensions, skipping, skipping with extension, high knee running, high knee running with extensions etc.

Whitehead (1976) 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 athlete for speed.

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 weight tied on the ankle of foot bouncing up steps are excellent for the purpose of development of speed of sprinters.

Petrorshki Coach of Olympic Champion Bofzov (U.S.S.R) 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 Petrovsk is statement the facts sprinting and speed exercise 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 (uphill and down hill) sprinting, change in the running rhythm. Starting and acceleration should find an important place in the programme.

From here it may be concluded that there is an optional ratio between stride length and stride frequency for every sprinter, which is extremely important for the acceleration of the body. Many sprinters find out for themselves the ratio that is based for them by plenty of training.

Until recent years methods of coaching and training athletes had been dominated by superstitious beliefs, pat rules for training amounting to ritual, and an obscure hodgepodge of clichés. In the early years of the development of sport each trainer had his own “secrets” and each new champion was supposed to have discovered a magic formula. It was the common practice to attack great importance to the idiosyncrasies of successful athletes. The situation was made worse, so far as advancement of techniques and training method was concerned, by the publication in popular magazines of learned treatises on training written by men who knew nothing about their subject matter.
Early advancement is techniques and training method were nearly invented by athletes, who frequently had to defy their trainers in order to improve beyond the standards of their day.

Today the mystic veils have been removed. The modern coach is a college graduate, versed in kinesiology, physiology, anatomy, hygiene and physics.

The modern coach keeps abreast of physiological studies relating to fatigue and exercise, and he is always on the look out for new ideas relating to any phase of this work.

One of the most profound changes in track coaching resulting from the new open-mindedness is the recognition of the need for flexibility of training-the study of the athlete as an individual. This is in marked contrast to the earlier style of training in which each coach had his "system" which every of his athletes followed. Coaches still have systems, but they are characterized by the latitude they allow for variation according to the needs of the individual.

Coaching track is a living art. There will never be an end to learning for the coach. Although techniques may some day be an exact science, teaching them will never be, for each athlete is a new problem.
Statement of the Problem

The purpose of the study was to investigate comparative effects of selected training menus (Stick drills, resistance training drills, running A, B, C and specific exercise with barbells) on speed development.

Delimitations

1. The study was confined to the male students ranging between 15 to 17 years of age.

2. In all only 45 subjects were selected.

3. The study was delimited to the following three training means:
   a) Stick drills and resistance training drills.
   b) Stick drills and running A, B, C.
   c) Stick drills and specific resistance training with barbells.

4. The study will be further delimited to the following variables: speed, power, stride length, stride frequency, acceleration and flexibility.

Limitations

1) As the subjects selected for the study were day scholars, certain factors like diet, daily routine, life style, habit, climatic conditions
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 effect 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.

4) Non-availability of sophisticated equipment might be considered as a limitation of this study.

**Hypothesis**

1) It was hypothesised that there would be significant difference from pre-test and post-test scores on the selected variables following different training menus.
2) There would not be any significant difference among the different menus on the selected variables.

**Definition and Explanation of terms.**

**Speed**

Speed can be defined as the ability on the basis of the mobility of the nervous system and the muscular apparatus to perform movement at a velocity.

**Power**

Power is the rate of work. In sports we are only concerned with the work that is performed, but also by the time it takes to do that work.

**Stride length**

Running stride is a complete cycle of motor consisting of a period of weight bearing or support on one foot followed by a period of non-weight bearing or float, then a period of weight bearing on the other foot and another period of float.
Stride frequency

The number of stride an athlete taken in a given time is called as stride frequency.

Flexibility

Flexibility is the ability of an individual to move the body and its parts through as wide range of motion as possible without undue strain to the articulation and muscle attachments.

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 individuals 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.
Running A, B, C

Basically these exercise give stress to the switching over an important from the established ‘back leg pushing action’ in sprinting to the ‘Front leg pulling action’.

It is a fundamental running exercise which may include High knee action, Back touch, Galloping, Bouncing and Bounding etc.

Stick drills.

Drills can be applied for speed development and learning of sprinting actions through the modes of target performance.

The main aim of stick drills are stride length determination, optimal cadence development, maximal frequency development and modelling of racing efforts.

Significance of the Study

The standard of sports and sportsmen in India are of great concern to many because of the poor performances in the National and International arena. The reasons may be the lack of scientific knowledge, the use of available knowledge, financial conditions,
training methods, lack of sophisticated equipment and facilities, proper
guidance and many others.

Apart from the above mentioned factors there are certain
underlying causes with in the individuals, the physical, physiological,
and psychological factors which are not taken care of. Hence in this
study an effort has been made by the investigator regarding basic factors
called stride length and stride frequency of an athlete and its
contribution to the achievement or performance of an athlete or to see
the extent of the role played by these factors on different track and field
events.

1. The outcome of this study will provide the knowledge about the
   stride length and stride frequency and their role in aiding the
   athlete to run faster by cutting precious fraction of seconds in
   sprint races.

2. The study will high lights the important effects of stick drill
   exercise in increasing the stride length and stride frequency
   which ultimate improve speed.

3. The study will further help the physical education teachers and
   coaches by pointing out the selection of different training menus
   for the speed development.