Chapter I

INTRODUCTION

Sprinting 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 events for men and women are the 100, 200, 400 metres and Hurdles and 4x100 metres and 4x400 metres relays.\(^1\) There were no sophisticated training means for the development of sprinting speed and athletes used to exhibit whatever they gained through daily physical work and whatever 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.

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In 1890 the world's fastest human was John Owen, who ran the 100 yard dash in 9.8 seconds. The 9.4 seconds 100 yard dash performance by George Simpson (1929), Dan Joubert (1931), and Jesse Owens (1933) were truly great feats in athletic area. Even more outstanding is the 10.2 seconds 100 metres world record set by Jesse Owens in 1936 which for more than three decades remained unbroken. In 1968 Jim Hines of USA surprised the world with a 100 metres performance of 9.95 seconds in Mexico Olympic Games. In 1983 in Helsinki World Cup Athletics another USA 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 a performance of 9.99 seconds at Los Angeles Olympic Games.

The glorious 100 metres sprinting rewrote the history in 1987 World Athletic Championships when Canadian Ben Johnson breezed the tape with a cracking time of 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. What more is waiting for us in 1988 Olympic at Seoul?

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 surface and equipments but to a much 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 the capacity of moving a limb or parts of the body's lever system or the whole body with the greatest possible velocity." Speed of whole body movement, or of individual 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 of 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 combinations 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 the involvement of strength, endurance
and mobility, and synchronised use of varied speed of joint action and the requirement of optimum speed. The two major factors that also determine the sprinting speed of an athlete are the stride length and stride frequency.

Petrovski, the coach of Olympic Champion Borzov (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 Petrovski's statement that 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 methods and avoiding monotonous repetitions of the same type of training, and adopting well proved methods, such as varied resistance.

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(uphill and down hill) sprinting, changes in the running rhythm, starting and accelerations should find an important place in the programme:

Whitehead expressed his strong belief in acceleration runs for the development of speed. He has suggested that an athlete should run a distance of about 80 metres three to four times gradually increasing his speed, repeating this in two or three sets of four repetitions, thrice a week in competitive season. This will bring about winning results. As running shorter distances with maximum effort requires anaerobic 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.

Strength is defined as the capacity to exert force or as the ability to do work against resistance.

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4 B. Tabashchnikov, "Sprint Problem" Track Technique 76 (Summer 1979): 2416.

Therefore, strength training programmes should observe the following principles if maximum benefits 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 workout.

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. Concentration is placed upon the muscles (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 conditioning beyond the pre-exercise level. Alternate day programmes 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 exercise, such as weight training, should 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 group.6,7

Otsason8 in his article "Limiting Factors in


8 Ibid.
sprinting" has expressed an opinion that, sprint success depends largely on the development of specific muscles responsible for the active driving action from the track. Accordingly the ankle flexors, leg and hip extensors receive particular attention in sprint training, while the non-specific muscle groups not directly related to the drive are neglected. Research workers at the Sports Institute of Russia disagree with this approach. They claim that undeveloped muscles that are not actively involved in the sprint action could well be the restricting factors in the improvement of performance. A study of 118 sprinters revealed that the strength of ankle flexors, lower leg extensors and upper leg extensors exceeded considerably the development of lower leg and upper leg flexors. It showed also that weaker muscle gained in strength as the sprint performance improved. A noticeable improvement in the strength of the lower and upper extensors (131-156%) through sprint training indicated that sprinting develops these muscles and consequently, the same muscle requires attention in conditioning training. Further, more injuries are obviously linked with uneven development of agonist and antagonist muscle. Sprinters should avoid strengthening one side
development and must find an optimal balance in strength and power training.

Power is a product of strength and speed. It is vital to sprinting and athletic success. It is also a component that can be improved and necessitate attention in four areas:

1. Application of force (strength development).
2. Development of Speed of Movement.
3. Technique involved in providing the right force-velocity relationship.
4. Coordination of movement.

Areas listed as 1 and 2 require programmes to improve overall strength and the strength of the muscles involved in sprinting action. The bulk of this selection deals with the development of explosive power through strength oriented programmes that simulate sprinting actions whenever possible and utilize heavy resistance, rapid, explosive contractions. It is essential to select exercises that are closely related to the movement of sprinting.

Research indicates that strength training programmes, when properly altered, result in both increased
strength and explosive power. Weight training, hopping and jumping routines, and weighted ankle spats are all effective methods of improving these important qualities. Hopping and jumping exercises are popular in the training of sprinters and have been used successfully by Russian athletes. This procedure is valuable in the development of leg strength, leg endurance, explosive power and the strength of the supporting muscles of the knee and ankle. Hopping and jumping possesses the added advantage of simulating the sprinting action or involving similar muscle groups; thus, the principle of specificity of training ensures greater carry-over to the sprinting action.  

A person with high level of endurance can persist in various performance for longer duration. When endurance gives way to fatigue, several elements diminish which are very important for good performance: strength, timing, coordination, speed of movement, reaction time and general alertness. Increased endurance postpones the onset of fatigue; therefore, endurance contributes

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9 Unitas and Dintiman, How to be a Champion in any Sports, pp. 246-247.
to improved performance.\textsuperscript{10}

Ozolin's\textsuperscript{11} research indicates that variation in speed appears to be the best method to develop sprinting components, particularly speed endurance. The method is most successful when several speed variations are included in each repetition of the training exercise. It must be noted that varied speed training has been successfully used by American sprinters for a long time. One of their best known methods is repetitions which are started fast, followed by free and relaxed running in the middle, and concluded with a maximum speed finish. These "Ins and Outs" are performed over several different training distances.

In order to acquire the ability to run fast and cover over-increasing distance, numerous adaptive changes of the structure and function of the body are required. It not only enough to develop a relatively efficient leverage system for mobility of the legs but


\textsuperscript{11}Edvin Ozolin, "Speed Endurance," Track Technique 57 (September 1974): 1006.
certain physiological modifications are also required. Falls\textsuperscript{12} and Mathew and Fox\textsuperscript{13} in their research have shown that endurance training would develop all the requirements i.e., speed, aerobic capacity and anaerobic capacity essential for events where the performance time is the limiting factor.

In reviewing the progress in the sprinting and analysing the training methods 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 others deny it.

2. Opposing opinions are also common regarding the question of the development of general and specific speed.


This is mainly concerned with transferability 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 multi-gym 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 cannot be achieved.
Hence the research scholar felt the need to investigate the comparative effects of different training loads dominated by speed-strength, speed-endurance and strength-endurance training on sprinting performance.

Statement of the Problem

The purpose of the study was to compare the effects of training loads dominated by speed-strength, speed-endurance and strength-endurance on sprinting speed of high school boys.

Delimitations

1. The study was delimited to the ninth, tenth and eleventh class students of the Bilthai Higher Secondary School and Panisagar High School, Tripura.

2. The study was confined to the male students in the age group of 15-18 years.

3. The speed training means adopted in the study were combined loads dominated by speed-strength, speed-endurance and strength-endurance only.
Limitations

1. As the subjects selected for the study were day scholars, certain factors like diet, daily routine, lifestyle, habits etc., which might have an effect on the results 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 has assured the nullifying effect on these factors.

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

3. Non-availability of sophisticated instruments was accepted as a limitation in this study.

Hypothesis

It was hypothesised that training loads dominated by speed-strength, speed-endurance and strength-endurance will bring about differential training effects on 100 metres sprint performance.
Definition and Explanation of Terms

Speed

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

Rapidity with which a movement or successive movement of the same kind may be performed. Example: Flexing the fore arm, 50 yard dash.

For the purpose of the study definition of speed given by Barrow is applicable to the study.

Sprinting Speed

Sprinting speed can be defined as the ability to perform energetic movements 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.

**Strength**

The force that a muscle or muscle group can exert against resistance in one maximal effort.\(^{16}\)

**Endurance**

Endurance is the ability of an individual to sustain a work load for a relatively prolonged period.\(^{17}\)

**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.

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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. Even though in long distance races endurance is a dominant component yet speed is a vital factor in winning.

The coaches and physical education teachers for quite sometime have been trying to find out the ways and 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 loads dominated by speed-strength, speed-endurance and strength-endurance 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 combined training means dominated by speed-strength, speed-endurance and strength-endurance training.

2. The results 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 findings of the study might highlight the differential effects produced by the three types of combined loads, selected for this study on sprinting speed.