CHAPTER – II

REVIEW OF RELATED LITERATURE

A study of relevant literature is an essential step to get a full picture of what has been done with regard to the problem under study. Such a review brings out a deep and clear perspective of the overall field. The review of literature is instrumental in selection of the topic, transaction of hypothesis and deductive reasoning leading to the problem. It helps to get a clear idea and support the findings with regard to the problem under study.

The following materials collected from the views expressed by various personalities provide back ground information to the study and help us to understand the effect of various combinations quickness and reaction training combined with varied frequency of high intensity training on selected performance variables among inter collegiate male sprinters. The views of the experts and research workers in the field of physical education are given primary importance in the present study. The review of the literatures has been classified under the following headings.

1. Studies related to quickness and reaction exercise
2. Studies related to Speed
3. Studies related to Velocity
4. Studies related to Stride Length
5. Studies related to Stride Frequency
6. Studies related to Speed Endurance
7. Studies related to Mental Toughness
8. Studies related to Arousal Level

2.1 STUDIES RELATED TO QUICKNESS AND REACTION EXERCISES

Kelly (2017) conducted study was to identify and compare rates of wartime related surgical cases at times of high and low casualty time periods, and then compare these case numbers with those performed during a two weeks medical readiness training Exercise in honduras. The collection of data and then compared with cases performed over a two week period during a medical readiness training Exercise in 2011 to 2012Honduras. Sixty one cases were identified as having definitive treatment using ringed external fixation at the Military Treatment Facility during the high and low volume eras. During the high volume era, 47 ringed external fixators were used as a definitive treatment. moderates can provide a concentrated case volume to allow maintenance of complex surgical skills related to the management of severe combat-related extremity injuries. These training exercises will be vital to maintain surgical skills during a low-volume combat casualty flow era.

Cauderay (2015) analyzed the study is to evaluate the effect of prescribed exercise training in obese children. We reviewed 19 studies, 10 RCT and 9 observational studies, published in the last 5 years. In the majority of these studies obese children were treated as ambulatory patient, in tertiary centers. Only two studies described a community based program. In half of the studies, drop-out was not reported and the rate of attendance was rarely described. On the other hand, the content of each session was well described, but exercise training intensity was below international recommendations. The analysis and interpretation of the current literature about exercise therapy in child obesity is difficult. The differences in program settings, in participant compliance and in measured outcomes, make the studies difficult to compare. Instead of focusing on intensity, program implementation

should emphasize the special needs of obese children including their social background and the local network available

Bahman (2014) examined a study was to evaluate the effectiveness of a specific training program on a simple reaction time of male gymnasts. In this longitudinal study, fourteen adolescent gymnasts mean age 12.6 years were randomly selected to work out for 15 months in the artistic group. Simple reaction time was assessed by visual and auditory tests using computer software. The training resulted in a significant ($P < 0.001$) reduction in visual and auditory reaction time. This study suggested an improvement in both reaction time tests over a long time of specialized training program. Artistic gymnasts had overall developed results of the tests that might be derived from exercise induced arousal, concentration and movement complexity in this sport.

Yildirim (2010) examined a study to find out the assess whether reaction time in persons with intellectual disabilities can be improved with an exercise program. 50 children and adolescents subject aged range was 14.7 yr, range with mild intellectual disability without downs syndrome were randomly divided into control 20 boys, 5 girls and experimental 19 boys, 6 girls groups. The experimental group participated in a structured physical fitness program for 12 weeks. Reaction time was assessed at baseline and after 12 weeks. Significant improvements in reaction time were observed in the exercise group but not for the control group. Results indicated that reaction time can be improved with an exercise program in youth with intellectual disability.

2.2 STUDIES RELATED TO SPRINTING

Martin (2015) directed a study to find out physiological impact of a school based sprint interval training. (SIT) intervention in replacement of standard physical education (SPE) class on cardio respiratory fitness (CRF) and glucose homeostasis during the semester following summer vacation. Participants (n=49) were randomly allocated to either intervention , average aged 16.9 or control group The main finding of the present study is that 7-weeks of SIT exercise is an effective method of maintaining Cardio respiratory fitness and fasting insulin homeostasis amongst school going adolescents. SIT exercise demonstrates potential as a time efficient physiological adjunct to standard PE class in order to maintain CRF during the school term.

SofieDebaere (2013) investigated a study to find characterize the specifics of the sprint technique during the transition from start block into sprint running in well trained sprinters. Twenty one sprinters (11 men and 10 women), equipped with 74 spherical reflective markers, executed an explosive start action.. The results showed that during the first stance, power generation at the knee plays a significant role in obtaining an effective transition, representing 31% of power generation in the lower limb, in the absence of preceding power absorption. Furthermore, the sprinter actively searches a more forward leaning position to maximize horizontal velocity. Since success during sprinting from the second stance onwards involves high hip and ankle activation, the above-mentioned three characteristics are specific skills required to successfully conclude the transition from start block into sprint running.

Korhonen (2009) analyzed a study to find out the Cross sectional studies were conducted to examine sprint running, anaerobic energy production and muscle

properties in male sprinters aged 17-88 years. In addition, a 20 week training intervention was carried out to determine whether older runners can further improve their neuromuscular and performance characteristics by a greater emphasis on strength training. The differences in maximal, but not in explosive, isometric strength were eliminated when normalized for muscle thickness. Muscle thickness was the strongest predictor of GRF in the braking phase, while the countermovement jump explained most of the variance in push-off GRF. The results show that the deterioration in sprint performance with age is a complex phenomenon that may be affected by the interaction of changes in biomechanical, neuromuscular and metabolic factors.

Sylvie Fortier (2005) examined a study to find out (a) to examine if kinetic and kinematic parameters of the sprint start could differentiate elite from sub-elite sprinters and, (b) to investigate whether providing feedback (FB) about selected parameters could improve starting block performance of intermediate sprinters over a 6-week training period. Twelve male sprinters, assigned to an elite or a sub elite group, participated in Experiment 1. Eight intermediate sprinters participated in Experiment 2. All athletes were required to perform three sprint starts at maximum intensity followed by a 10m run.

2. 3 STUDIES RELATED TO VELOCITY

Matthew (2016) examined the study to assess whether force-velocity power relationships and optimal loading conditions could be profiled using a sled-resisted multiple-trial method over ground, if these characteristics differentiate between recreational athletes and highly-trained sprinters, and whether conditions for optimal loading could be determined from a single sprint. Consequently, this required

understanding of the friction characteristics underlying sled-resisted sprint kinetics. Chapter 3 presents a method of assessing these characteristics by dragging an instrumented sled at varying velocities and masses to find the conversion of normal force to friction force (coefficient of friction). Methods were reliable (intra class correlation coefficient of variation (0.05), and sprinters developed maximal power at much higher velocities.

Mackała (2015) examined the relationship between kinematics, motor abilities, anthropometric characteristics, and the initial (10 m) and secondary (30 m) acceleration phases of the 100 m sprint among athletes of different sprinting performances. The recorded times of the 10 and 30 m indicated that the strongest correlations were found between a 1-repetition maximum back squat, a standing long jump, standing five jumps, standing ten jumps, and speed in the 10 m sprint in competitive athletes. A strong correlation was also found between a 1-repetition maximum back squat and a standing long jump, standing five jumps, and standing ten jumps, but again only for sprinters. The most important factor for differences in maximum speed development during both the initial and secondary acceleration phase among the two sub-groups was the stride frequency.

Antti Mero (2013) reported a study to find out the force-time characteristics during the acceleration phase of the sprint start, eight male sprinters were used as subjects. Runs up to 3 m were analyzed from film, and force time parameters were measured on a force platform. In a starting stance the average reaction time of the group was 0.118 and the force production lasted .342 ± .022 s. The percentage of deceleration in running velocity during that phase was 4.8 ± 2.9%. In the propulsion phase the average horizontal force was great (526 ± 75 N), and it was produced for a

relatively long time (.171 ± .035 s). Significant correlation coefficients were observed between force production and running velocity. These results suggest that braking/propulsion phases occur immediately after the block phase and that muscle strength strongly affects running velocity in the sprint start.

Ralph Mann (2013) conducted a study to find out the Fifteen highly skilled sprinters were filmed while running at maximum velocity. Qualitatively, the unexpected knee flexor dominance during foot strike was generated to limit the braking action created during this portion of ground contact. The unanticipated hip flexor dominance during takeoff served to rotate the upper body forward and into the approaching air phase. In addition, both of these actions allowed efficient use of the two-joint muscles of the leg during the critical phases of ground contact. Finally, the minimizing or reversing of the knee extensor dominance during the later stages of takeoff served to protect the joint from injury. Quantitatively, the magnitude of hip extensor/knee flexor activity during foot strike was significantly related (r = .70, p = .01) to the prior occurrences of related leg injury in the subjects.

Laura (2012) assessed of this study was to quantify and explain lower limb net joint moments and mechanical powers, and ankle stiffness during the first stance phase of the push off. The lower-limb joints predominately extended and revealed a proximal-to-distal sequential pattern of maximal extensor angular velocity and positive power production. Pearson correlations revealed relationships ($P < 0.05$) between ankle stiffness (5.93 ± 0.75 N · m · $\deg^{-1}$) and selected performance variables. Relationships between negative power phase ankle stiffness and horizontal ($r = -0.79$) and vertical ($r = 0.74$) centre of mass velocities were opposite in direction to the positive power phase ankle stiffness (horizontal: $r = 0.85$; vertical: $r = -0.54$).

Thus ankle stiffness may affect the goals of the sprint push-off in different ways, depending on the phase of stance considered.

Brughelli (2011) determined a study to find out the sixteen semiprofessional Australian football players performed running bouts at incremental velocities of 40, 60, 80, and 100% of their maximum velocity on a Wood way non-motorized force treadmill. and the vertical displacement of the center of mass significantly decreased with increased running velocity (p , 0.05). A significant positive correlation was found between horizontal force and maximum running velocity (r = 0.47). For the kinematic variables, only stride length was found to have a significant positive correlation with maximum running velocity (r = 0.66). It would seem that increasing maximal sprint velocity may be more dependent on horizontal force production as opposed to vertical force production.

Soodan (2011) investigated a study to find out the describe motor nerve conduction velocity of selected nerves of both the upper and lower extremities in sportsmen. Thirty high-level sprinters (100mts & 200 mts) and thirty high level distance runners (3000mts) were volunteered to participate in the study. The anthropometric measurements taken were Body Height cms, Age yrs and Body weight kgs. The neuro physiological parameters taken were MNCV of Ulnar Nerve (upper extremity) and Common Peroneal Nerve (lower extremity) of both sides (i.e.dominant and non-dominant) of the body. The room temperature was maintained at 37 degree Celsius. Significant differences in motor nerve conduction velocities were found between dominant and non dominant limbs in each group. The motor nerve conduction velocity of ulnar nerve was found to be higher in sprinters as compared to the distance runners, and the MNCV for CPN is higher in distance

runners as compared to sprinters. The MNCV of ulnar and CPN were higher in dominant limbs (i.e. arms & legs) of both sides of the body as compared to non dominant limbs.

MikolaMisjuk (2011) reported a study to find out the estonian sprint runners have not achieved great success in inter national title competitions. We analyzed: 1) athletes' relative running velocity during different phases of the distance; 2) the loss of Estonian sprinters to the world best sprinters during different phases of the distance. The study compared Estonian Athletics Championships (2006) men's 100m sprint final results with Berlin World Athletics Championships (2009) men's 100m final results. In both competitions, interval times were measured for the following sections of the race: 0– 30m, 30–60m, 60–80m and 80–100m. We found out that Estonian sprinters' acceleration ability is relatively better than the other physical abilities necessary for achieving good results in 100m. Estonian sprinters loose most to the world best sprinters during the last part of the distance, 80–100m. However, the difference in running velocity of Estonian sprinters compared to the world best runners is approximately the same in all three last sections of the distance(30–60m,60–80and80–100m).

Bruno (2007) examined a study to find out the Success in the 400m requires the athlete to preserve the optimal technical characteristics of his/her stride despite intense fatigue. Using 50m intervals, the time courses of velocity and stride parameters (length and frequency) were evaluated for races of three groups of athletes, world class, national level and regional level. The better athletes were able to achieve higher absolute and relative velocities (% of their best performance over 200m). These were reached by way of both significantly greater stride length and

stride frequency. It is notable that peak values for the two parameters were observed in different parts of the race: between 50 and 100m for stride frequency and between 100 and 150m for stride length. In general, length rather than frequency is the stride parameter distinguishing the groups from each other. As the morphological characteristics of the subjects were similar, this could indicate greater maximal strength levels for the better athletes.

Schot (1992) investigated a study to find out the sprint starts of 12 skilled collegiate sprinter hurdlers were filmed for four different sprint start conditions. Ground reaction forces were collected for the first step out of the blocks and velocities through a 2-m speed trap immediately following the first support phase were recorded. The results indicated that the elongated starting positions resulted in greater horizontal displacement, greater propelling impulse, increased first step toe-off velocity, and greater average velocity through a 2-m speed trap. Arm orientation effects were less well defined. Forward lean tended to result in greater vertical velocity at block clearance and horizontal velocity at first step toe-off, whereas perpendicular arm positioning resulted in greater 2-m speed trap velocity.

2. 4 STUDIES RELATED TO STRIDE LENGTH

Haifeng (2017) conducted a study to find out the Pedestrian dead reckoning (PDR) can be used for continuous position estimation when satellite or other radio signals are not available, and the accuracy of the stride length measurement is important. This paper puts forward a stride length estimation algorithm based on a back propagation artificial neural network (BP-ANN), using a consumer-grade inertial measurement unit (IMU); it then discusses various factors in the algorithm. The experimental results indicate that the error of the proposed algorithm in estimating the

stride length is approximately 2%, which is smaller than that of the frequency and nonlinear models. Compared with the latter two models, the proposed algorithm does not need to determine individual parameters in advance if the trained neural net is effective. It can, thus, be concluded that this algorithm shows superior performance in estimating pedestrian stride length.

Mehmet (2016) conducted a study to find out effects of additional short and long running stride workouts on acceleration kinematics and jumping performances with respect to the competition phase. Thirteen voluntary male sprinters participated in this study (100 m PB: 10.45-11.30s). The sprinters were separated into three groups [control group (CG), short stride group (SSG), long stride group (LSG)] in a randomised order. Sprinters continued their competition phase training over a two-week period; however, the SSG and LSG run an additional 6 × 40 m three times per week. The pre- and post-training results regarding, acceleration kinematics and jumping performances were compared using the Kruskal Wallis tes the results of this study show that there is no significant effect of a two-week training regimen involving additional long and short stride running workouts on Turkish sprinters in the competition phase; however, long stride running workouts may be useful for sprinters who have short stride sprint characteristics

Geriatr (2016) conducted a study to find out the analyze anthropometric, muscle performance and foot trajectory determinants of stride length (SL) the elderly persons were asked to walk comfortably around a 40 meter elliptical circuit, using determined SL and maximum foot clearance (MaxFC) and minimum foot clearance (MFC) trajectory parameters. The SL determinants were evaluated by calculating the coefficient of determination considering a level of significance of $p \leq 0.05$. The

anthropometric variables demonstrated significant correlations (r>0.41) with the explanation of SL remaining incipient (r2 0.52), with DF-MS standing out (r2 =0.342). MaxFC represented a significant explanation for the data (r2 =0.396), while the low correlation of MFC was not significant (r=0.24, r2 =0.058). Conclusion: MaxFC and DF-MS are determinants of SL in self-reliant elderly Chileans. It is proposed that gait parameters could be normalized in accordance with trajectory and muscular performance

Herdimana (2015) conducted a study to compare characteristics between transtibial amputee when wearing endo skeletal prosthetic leg equipped with a multi-axis and energy store-return ankle joint technology and exo skeletal prosthetic leg without the technology during walking. A cross-over design study has been conducted towards the 14 transti bial amputees age 27.50 years (±7.37) and with bod y mass index 20.19 kg/m2. Gait characteristics are evaluated using a Digital SLR camera with 120 frames per second video recording. The measured gait parameters are include the time required during the stance phase and swing phase, right and left step, and stride length. The result is the using of endo skeletal prosthetic foot with the ankle joint technology can produce faster but more consistence movement for both normal and amputated leg.

Mc Callion (2014) conducted a study to find out the compared stride length, stride frequency, contact time, flight time and foot-strike patterns (FSP) when running barefoot, and in minimalist and conventional running shoes. Habitually shod male athletes (n = 14; age 25 ± 6 yr; competitive running experience 8 ± 3 yr) completed a rando mised order of 6 by 4-min treadmill runs at velocities (V1 and V2) equivalent to 70 and 85% of best 5-km race time, in the three conditions. Synchronous recording

of 3-D joint kinematics and ground reaction force data examined spatiotemporal variables and FSP. Stride duration and flight time, when shod and in minimalist footwear, were greater than barefoot (713 ± 48 and 701 ± 49 vs. 679 ± 56 ms, $p < 0.001$; and 502 ± 45 and 503 ± 41 vs. 488 ±4 9 ms, $p < 0.05$, respectively). When running barefoot, stride frequency was significantly higher ($p < 0.001$) than in conventional and minimalist footwear. In conclusion, differences in spatiotemporal variables occurred within a single running session, irrespective of barefoot running experience, and, without a detectable change in FSP

Schubert (2014) conducted a study to find out the high number of recreational runners sustain a running-related injury each year. To characterize how running mechanics change when stride frequency and length are manipulated. A second search of the databases was repeated in June 2012 to 2013 ensure that no additional studies met the criteria after the initial search. Inclusion criteria for studies were an independent variable including manipulation of stride frequency or length at a constant speed with outcome measures of running kinematics or kinetics. Two reviewers independently appraised each article using a modified version of the Quality Index, designed for assessing bias of nonrandomized studies. Ten studies met the criteria for this review. There was consistent evidence that increased stride rate resulted in decreased center of mass vertical excursion, ground reaction force, shock attenuation, and energy absorbed at the hip, knee, and ankle joints. All but 1 study had a limited number of participants, with several methodological differences existing among studies. Although speed was held constant during testing, it was individually self-selected or fixed. Most studies used only male participants. Despite procedural differences among studies, an increased stride rate (reduced stride length) appears to

reduce the magnitude of several key biomechanical factors associated with running injuries.

Kong (2008) conducted a study to find out the intended to take a biomechanical approach to understand the success of Kenyan distance runners. Anthropometric, gait and lower extremity strength characteristics of six elite Kenyan distance runners were analyzed. Stride frequency, relative stride length and ground contact time were measured at five running speeds (3.5 – 5.4 m/s) using a motion capture system. Their maximal isometric strength was lower than other runners (knee extension: 1.4 - 2.6 Nm·kg-1, knee flexion: 1.0 – 1.4 Nm·kg-1) but their H:Q ratios were higher than athletes in other sports (1.03 ± 0.51 at 60°/s, 1.44 ± 0.46 at 120°/s, 1.59 ± 0.66 at 180°/s). The slim limbs of Kenyan distance runners may positively contribute to performance by having a low moment of inertia and thus requiring less muscular effort in leg swing. The short ground contact time observed may be related to good running economy since there is less time for the braking force to decelerate forward motion of the body. These runners displayed minor gait asymmetry, though the difference may be too small to be practically significant. Further investigations are needed to confirm whether the bilateral symmetry in strength and high H:Q ratios are related to genetics, training or the lack of injuries in these runners.

Gwyn (2000) conducted a study to find out the it has been well documented that marked improvements in the hypokinetic gait pattern of Parkinson's disease Three-dimensional kinematic, kinetic and electro myographic gait analysis was carried out on 14 patients and 14 matched controls in baseline conditions and with two types of visual cues: taped step length (SL) markers and an individualized subject-mounted light device (SMLD). These alterations were generally accompanied

by modifications of lower limb kinematics and kinetics towards control subjects. Perceived task load was higher in all conditions and was further elevated by the use of the SMLD for both groups. Patients produced larger overall reaction times, although reaction time was not different between baseline and SL marker conditions. Reaction time was increased in both groups when using the SMLD.

2. 5 STUDIES RELATED TO STRIDE FREQUENCY

Laura (2015) conducted a study to find out the investigate whether post stroke participants can walk at different combinations of stride frequency and stride length and how these adaptations affect the backward and medio-lateral margins of stability. Six trials of 2 min walking on a treadmill at different combinations of stride frequency and stride length. Treadmill speed was set at the corresponding speed, and subjects received visual feedback about the required and actual stride length. For trials at a high stride frequency, in particular, the increase in the backward and medio-lateral margins of stability was limited. In conclusion, training post-stroke individuals to increase stride frequency during walking might give them more opportunities to increase the margins of stability and consequently reduce fall risk

Daniel (2015) conducted a study to find out the Endurance runners. Higher magnitudes of posteriorly directed braking forces were associated with increases in foot landing position relative to the hip ($P=0.0005$) but not the knee ($P=0.54$), increases in foot landing position relative to the knee were associated with higher magnitudes ($P<0.0001$) and rates of loading ($P=0.07$) of the vertical ground reaction force impact peak. Finally, the mean metabolically optimal stride frequency was 84.8±3.6 strides min −1, with 50.4% of the variance explained by the trade off between minimizing braking forces versus maximum hip flexor moments during

swing. The results suggest that runners may benefit from a stride frequency of approximately 85 strides min−1 and by landing at the end of swing phase with a relatively vertical tibia

Cornelis (2013) conducted a study to find out the experienced runners would select a stride frequency closer to the optimum (minimal energy costs) than would novice runners. Ten healthy males (mean9s: 2492 year) with no running training experience and 10 trained runners of similar age ran at constant treadmill speed corresponding to 80% of individual ventilator threshold. Self-selected stride frequency (mean9s; strides.min 1) for novice (77.892.8) and trained runners (84.495.3) were lower (P B0.05) than optimal stride frequency (respectively, 84.995.0 and 87.194.8). The difference between self-selected and optimal stride frequency was smaller (P B0.05) for trained runners. In both the groups optimal stride frequency established with heart rate was not different (P-0.3) from optimal stride frequency based on V-O2. In each group and despite limited variation between participants, optimal stride frequencies derived from V_ O2 and heart rate were related (r -0.7; PB0.05). In conclusion, trained runners chose a stride frequency closer to the optimum for energy expenditure than novices. Heart rate could be used to establish optimal stride frequency

Nicolas (2011) conducted a study to find out the An emphasis on active modes of transportation, that is, walking and cycling, has recently been renewed amid concerns for the environment and public health. However, the focus of research and practice that these modes have traditionally received is secondary to that received by motorized modes. As a consequence, the data on pedestrians (in particular, microscopic data) required for analysis and modeling are lacking. For instance,

accurate data on the length of individual stride are not available in the transportation literature. This paper proposes a simple method to extract frequency and length of pedestrian stride automatically from video data collected no intrusively in outdoor urban environments. The walking speed of a pedestrian oscillates during each stride; the oscillation can be identified through the frequency analysis of the speed signal. The method was validated with real-world data collected in Rouen, France, and Vancouver, Canada, where the root mean square errors for stride length were 6.1 and 5.7 cm, respectively. A method to distinguish pedestrians from motorized vehicles is proposed and used to analyze the 50 min of the Rouen data set to provide the distributions of stride frequency and length.

Scott (2010) conducted a study to find out the Water treadmill exercise is often incorporated into rehabilitation programmes for horses yet little is known about the biomechanical and physiological responses to water walking. To establish whether stride frequency (SF) reached steady state as a result of 6 introductory water treadmill sessions and then to investigate the effect of increasing water height on SF, stride length (SL) and heart rate (HR). Nine horses with no previous experience of water treadmills completed 6 sessions of walking for between 15 and 30 min. Each horse was fitted with a leg mounted accelerometer to measure SF. The effect of session on SF was tested using univariate ANOVA. When SF during introductory sessions 4–6 were compared, there was no significant effect of session on SF (P>0.05). In the second part of the experiment, SF was 0.57 0.03 strides/s at control, 0.54 0.03 strides/s at the PIP joint, 0.51 0.02 strides/s at the carpus and 0.52 0.03 strides/s at the ulna. Stride frequency at carpal and ulna height was significantly lower than at control (P0.05). Horses reached steady state gait within the first 6 sessions of water treadmill

exercise. Walking in water at the level of the carpus or ulna resulted in a lower SF compared to walking in water at hoof height.

John Mercer (2008) conducted a study to find out the to determine if rate of oxygen consumption (VO2) during running is influenced by an interaction of stride frequency (SF) and running speed. During each 15-minute run, subjects ran for 5 minutes at speeds of 3.13, 3.58, and 4.02 m/s. During the first 15-minute run, subjects were allowed to freely select a preferred stride frequency (PSF). The remaining two 15-minute runs consisted of running using SF that was ±1 5% of PSF at each speed. Using repeated measures ANOVA, it was determined that VO2 was different across speeds (p0.05). VO2 was less during running at PSF than when using the 15% lower SF at 3.13 m/s and 3.58 m/s ($p<0.05$). VO2 was not different between other SF comparisons. PSF did change across speeds, but the change was subtle (about 4% per m/s increase in speed). It seems that there is an optimal SF range across speeds vs. a unique optimal SF at each speed that is important to maintain during distance running.

Grieve (2007) conducted a study to find out the Fifty males and females between 1 and 35 years. A few adolescents were better described by a linear equation and either log-log or linear equations can be used for children. The product of maximum step frequency and the square root of the stature are approximately constant after 5 years of age. The time of swing initially shows a positive regression with the time for a complete cycle of one leg. The child abandons this pattern in favour of an approximately constant time of swing and by 4-5 years of age the negative linear regression of the adult appears. The time of swing is usually much less than half the natural period of either the whole leg about the hip or of the lower leg

and foot about the knee. The effects of wearing shoes upon step frequency and time of swing were investigated.

John (2002) conducted a study to find out the nvestigate the characteristics of shock attenuation during high-speed running. that shock attenuation increased linearly with running speed and running kinematic changes were characterized primarily by stride length changes. Furthermore, the change in shock attenuation was dueto increased leg not head peak impact acceleration across running speeds.

Claire (1996) conducted a study to find out the Force platform measurements revealed that the stiffness of the leg spring increased by 2.3-fold from 7.0 to 16.3 kNm^{-1} between the lowest and highest stride frequencies. The angle swept by the leg spring decreased at higher stride frequencies, partially offsetting the effect of the increased leg spring stiffness on the mechanical behavior of the spring-mass system. We conclude that the most important adjustment to the body's spring system to accommodate higher stride frequencies is that leg spring becomes stiffer.

Barrey (1993) conducted a study to find out the velocity-dependent changes in stride length and stride frequency of horses performing the same incremental exercise test first on a track with a rider and then on a treadmill with a 0 and 3.5% slope successively. There were strong linear relationships between stride length and speed in all experimental conditions ($R^2 > 0.96$). The comparison of the regression coefficients revealed significant differences ($p < 0.01$) between track and treadmill locomotion; stride length was longer on both the horizontal and inclined treadmill than on the track. The incline of the treadmill did not significantly ($p > 0.01$) influence stride parameters.

Norman (1988) conducted a study to find out the speed and stride frequency change with body size. We use this information to define 'equivalent speeds' for animals of different size and to explore the factors underlying the six fold difference in mass specific energy cost of locomotion between mouse and horse-sized animals at these speeds. Speeds and stride frequencies within a trot and a gallop were measured on a treadmill in 16 species of wild and domestic quadrupeds, ranging in body size from 30 g mice to 200 kg horses. We found that the minimum, preferred and maximum sustained speeds within a trot and a gallop all change in the same rather dramatic manner with body size, differing by nine-fold between mice and horses (i.e. all three speeds scale with about the 0-2 power of body mass). Data show that both these costs increase directly with the stride frequency used at equivalent speeds by different-sized animals. The increase in cost per stride with increasing speed may be related to differences in mechanical advantage of the limb muscles (necessitating higher muscle forces for the same ground reaction force) as stride length increases both in the trot and in the gallop

2. 6 STUDIES RELATED TO SPEED ENDURANCE

Vorup (2016) conducted a study to find out the effects of combined strength and speed endurance (SE) training along with a reduced training volume on performance. To achieve the purpose of this study nine subjects for combined strength and speed endurance training or seven subjects for control group. For 8 weeks, CSS replaced their normal moderate-intensity training no changes were observed. Adding strength and speed endurance training, along with a reduced training volume, can improve short-term exercise capacity and induce muscular adaptations related to anaerobic capacity in endurance-trained runners.

Kamal (2015) conducted a study to find out the effectiveness of the interval extensive training method and fartlek training method on the referees' speed endurance. This research was a quantitative study and employed a quasi experimental design. The population of this research was 75people = 37 had C3 licence, 13 people had C2 licence, 24 people had C1 licence and 1 person had FIFA licence. The fartlek training method could improve speed endurance capabilities 20x150 meters with 7,89> 2,26 (Mean pretest 30,88 and posttest 30,17 second). There was a significant difference between the interval extensive training method and fartlek training method on speed endurance.

Tønnessen (2011) conducted a study to find out effect of 10 weeks' 40-m repeated sprint training program that does not involve strength training on sprinting speed and repeated sprint speed on young elite soccer players. Twenty young well-trained elite male soccer players of age ranged 16 to 24. selected , body mass 67.2 (±9.1) kg, and stature 176.3 (±7.4) cm volunteered to participate in this study. All participants were tested on 40-m running speed, 10 × 40 -m repeated sprint speed, 20-m acceleration speed, 20-m top speed, countermovement jump (CMJ), and aerobic endurance (beep test). Participants were divided into training group (TG) (n = 10) and control group (CG) (n = 10). The result of the study indicate that a weekly training with repeated sprint gave a moderate but not statistically marked improvement in 40-m sprinting, CMJ, and beep test. The results of this study indicate that the repeated sprint program had a positive effect on several of the parameters tested. However, because the sample size in this study is 20 participants, the results are valid only for those who took part in this study. Therefore, we advice to use repeated sprint training similar to the one in this study only in periods where the players have no speed

training included in their program. Furthermore, the participants in this study should probably trained strength, however, benefits were observed even without strength training is most likely to be caused by the training specificity

Iaia (2010) conducted a study to find out speed endurance training consisting of exercise bouts at near maximal intensities in already trained subjects. improve intense short-duration/repeated high-intensity exercise performance lasting 30 s to 4 min, as it occurs in a number of sports. When combined with a basic volume of training including some aerobic high-intensity sessions, speed endurance training is also useful in enhancing performance during longer events, athletes from disciplines involving periods of intense exercise can benefit from the inclusion of speed endurance sessions in their training programs

2. 7 STUDIES RELATED TO MENTAL TOUGHNESS

Rather (2017) conducted a study to find out the compare the mental toughness of high and low altitude intervarsity football players. 40 football players, 20 high altitude (north zone level) football players and 20 low altitude (north zone level) football players were selected through random sampling for this study. The age of the players ranged between 21-25 years and had been practicing in their sport/game for an average of 9 years. Mental toughness questionnaire was used. The mental toughness questionnaire was distributed among the participants approximately 14 hours before the competition. The independent samples t-test was associated with a statistically significant difference for mental toughness $t(38) = 5.59$, $p < .001$. It was concluded that High Altitude Football Players possess high mental toughness than Low Altitude Football Players.

Sunil Kumar (2016) conducted a study to find out the mental toughness among India, Srilanka And Nepal Kho-Kho players. The subject for this study was from 12th south Asian .games 2016, which was organized by india in guwahati (Assam). Total 36 (thirty six) male volleyball players, 12 players of India, 12 players of Srilanka and 12 .player of Nepal were selected. The finding of the study reveal there is no significant difference between India and Srilanka, Nepal volleyball players. The insignificant difference was found may be due to the reason that the Indian , Srilanka, Nepal players undergone with very good training, tough schedule, more confident , mentally tough, moreover they are highly motivated to win the gold medal in 12th South Asian Games.

Luke Maher (2016) conducted a study to find out the Self-esteem, mental toughness and athletic identity are all psychological factors. Rosenberg self-esteem scale, Sport mental toughness scale and an Athletic Identity subscale developed from the Academic and Athletic identity scale. Results revealed that team athletes scored significantly higher on levels of athletic identity than individual athletes, no significant difference was found on levels of mental toughness and self-esteem between the two groups. Furthermore it was revealed that the most experienced individuals had significantly higher levels of self-esteem and athletic identity than the least experienced. Also, it was revealed that individuals who put in the greatest number of hours of practice per week had the highest levels of mental toughness and athletic identity

Pandey (2015) conducted a study to find out the Field hockey is an invasive territorial and long duration playing game that involves considerable aerobic energy contribution superimposed with brief though frequent anaerobic efforts along with

mentally strong and tough players to win matches and championships. Due to vital importance of mental toughness in sports and particularly in hockey this paper focused on the comparison of mental toughness between national and interuniversity level female hockey players. Total 32 female hockey players in which 16 national players were selected from M.P. Hockey Academy, Gwalior and 16 interuniversity hockey players were selected from L.N.I.P.E., Gwalior of age 18 to 23 years as subjects for this study. Mental toughness was checked by Dr. Alan Goldberg (2004) Mental Toughness Questionnaire.. The findings of this research paper showed that there were significant differences between NLFHP and ILFHP on the four sub-factors of mental toughness (MT) namely rebound-ability, ability to handle pressure, concentration ability, and motivation but on the sub-factor of confidence no significant difference was observed. This could be attributed to the fact that NLFHP were mentally tough than the ILFHP

Bagchi (2014) conducted a study to find out the mental toughness and will to win between batsmen and bowlers in cricket. To obtain data for this study, the researcher had selected (N=40) male cricketers of 18 to 28 years of age group (20.17 ± 2.37 years) to act as subjects. They were further divided into two groups which includes twenty (n= 20) batsmen and twenty (n=20) bowlers. Mental toughness was measured with questionnaire developed by Goldberg (1998) and Will to win was measured with questionnaire prepared by Kumar and Shukla (1988). It is concluded from the findings that no significant differences were found between batsmen and bowlers on the sub-variables i.e. confidence, concentration, handling pressure, rebound ability, motivation, overall mental toughness and will to win.

Omar (2013) conducted study to critically analysing the mental toughness concept among athletes, especially in South East Asia. Some of what athletes thought were good, but would be best if we could re-analyzed again for improvement. Thus, this paper suggested four mental toughness issues need to be re-structured which seldom realized by coaches and athletes. The four are: 1) To improve mental toughness, one should improve their self-awareness, 2) To improve mental toughness, one should incorporate psychological skills together with physical and tactical skills, 3) To improve mental toughness, one should remained positive, 4) To improve toughness, research and development (R & D) consortium of South East Asia should be formed. Recommendations are also suggested in this paper

Robert Weinberg (2013) conducted a study to find out the mental toughness is a term that has been long talked about but often misunderstood. Fortunately, in the past 12 years, researchers have begun to study this phenomenon. Although there are differences among researchers, mental toughness appears to contain four critical attributes including motivation, coping with pressure, concentration, and confidence. The paper concludes with some suggestions for future research including focusing on the early development of mental toughness as well as developing interventions to test the effectiveness of mental toughness training.

Lee Crust (2011) conducted a study to find out role and importance of genetics, environmental factors, and psychological-skills training in the development of mental toughness is discussed. as athletes become more emotionally mature, they should become increasingly involved in making decisions regarding their own development. Athletes should be encouraged and supported in reflecting upon setbacks and failures that occur as a natural part of the developmental process.

Negative experiences, as well as the confidence-boosting outcomes of achieving goals, provide opportunities for personal growth, and allow important lessons to be learned. Various practical suggestions are provided.

Graham Jones (2007) conducted an investigation of mental toughness in a sample population of athletes who have achieved ultimate sporting success. Eight Olympic or world champions, 3 coaches, and 4 sport psychologists agreed to participate. Qualitative methods addressed 3 fundamental issues: the definition of mental toughness, the identification of its essential attributes, and the development of a framework of mental toughness. Results verified the authors' earlier definition of mental toughness and identified 30 attributes that were essential to being mentally tough. These attributes clustered under 4 separate dimensions (attitude/mindset, training, competition, post competition) within an overall framework of mental toughness. Practical implications and future avenues of research involving the development of mental toughness and measurement issues are discussed.

John Wayne Creasy & Richard Stratton (2005) examined study on The purpose of this study was to identify the components of mental toughness as perceived by you. The procedures for this study were divided into a two-phase approach. Phase One consisted of each participant completing a questionnaire for the purpose of evaluating the importance and teach ability (trainability) of 20 separate components of mental toughness. Phase Two consisted of follow-up, semi-structured interviews that provided further insight into the perspectives of the participants. The results of this study indicated the essential components of mental toughness based on their importance to the construct. The results also indicated the degree of teach ability (trainability) of each component. A unique relationship between teach ability and

trainability was also revealed in this study. These findings provide a better understanding of the components of mental toughness and support the need for its development in sport.

Thelwellet et al., (2005) conducted a study to comprised of interviewing six male soccer players and comparing their soccer definition of mental toughness to the definition which was proposed by Jones et al., (2002). From the results it was found that there was a high amount of overlap between the two definitions, however the soccer sample saw mental toughness as always being able to cope better than their opponents as opposed to just generally coping better. It was found that the majority of participants were not uniform in their understanding of what mental toughness actually was. From the results it was found that the soccer players characterized mental toughness as being able to react positively to situations and being able to remain calm under pressure (Crust, 2007). However, from the six participants it was actually found that only half of them enjoyed being under pressure while performing.

Gucciardi, (2008) conducted a study to find out The characteristics represented 11 bipolar constructs such as tough attitude vs. weak attitude, concentration versus distraction and resilience versus fragile minded. The situations related to the different events that the athlete experienced which helped develop mental toughness (e.g. injury, fatigue).Behaviors related to what the athletes would do in situations that required mental toughness. This research was unique to the area of mental toughness as it looked at how you develop mental toughness (processes) and what outcomes come out from it.

Clough(2002) conducted a study to find out the Despite its rising prominence in the academic literature, the underlying inputs, processes and outputs of mental

toughness remain relatively unexplored (Hardy, Bell, & Beattie, 2014). As such, the purpose of the study is to present a systems-approach model of mental toughness that classifies attributes of mental toughness within the aggregated system of inputs, processes and outputs. To this end, lay participants (n = 138) were requested to provide a list of attributes of mental toughness in the form of a written questionnaire. Following guidelines for conducing Deductive Thematic Analysis (DTA) by Braun and Clarke (2006), and on the basis of similar frameworks by

Hagerty et al. (2001) analyzed and organized into inputs, processes and outputs. The resultant systems-approach model included a number of inputs (personal resources, stressors), processes (strength, accommodation) and outputs (surviving, striving, thriving) of mental toughness. Based on these findings, mental toughness was subsequently defined as a resistance to psychological disintegration under stress. As this model advances current theoretical knowledge, implications for future conceptualization, measurement and development of mental toughness are discussed

2. 8 STUDIES RELATED TO AROUSAL

Daniel (2013) conducted a study to find out the arguments associated with trait psychology, in particular in the field of sport psychology. He describes the existing research including several models and their ability to predict behavior, emphasizing the viability of a mental health model. In addition, Morgan discusses a role of perception and cognition in sports and physical activity. Finally, trait theory is placed in a realistic perspective, to be applied in a multidimensional framework in studying prediction of behavior. The article by Daniel M. Landers involves a reexamination of the arousal-performance relationship. The role of attention in performing most sports skills is discussed, with particular emphasis on the attention

narrowing phenomenon. In addition, Landers discusses the measurement of anxiety, recommending that it be viewed as a multidimensional construct consisting of physical, behavioral and cognitive components.

James (2007) conducted a study to find out the Mental preparation, or "psych-up" strategies have been assumed to promote physical arousal. The present experiment examined the role of arousal changes in the use of psych up strategies on a physical strength task and a reaction time-decision task for subjects varying in competitive experience. Eighty-four subjects were reliably divided into high, moderate, or low competitive experience groups and randomly assigned to one of three mental preparation strategies. Mental preparation strategies improved athletes' performance on certain tasks, however these strategies do not necessarily achieve their effects through increased autonomic arousal.

2.9 SUMMARY OF THE LITERATURE

The reviews helped the investigator to get a clear view of the research by providing the knowledge of the difficulties and flaws that the investigator would face during the research and the remedial efforts that the investigator should take to avoid and rectify them. It also helps the investigator to perform the research efficiently in a proper way without performing a trial and error method which would be a setback for the research.