CHAPTER II

REVIEWS OF RELATED LITERATURE

A study of relevant literature is vital step to get a full picture of what has been done with regard to the problem under study. Such a review provides the investigator to familiar with the past work and the work that is to be done. It gives new ideas, theories and comparative materials for the researcher. The related literature collected pertaining to the study has been described in this chapter.

2.1   REVIEWS ON REACTION ABILITY

Moraru Cristina-Elena and Radu Liliana-Elisabeta (2014) reported that co-ordination abilities facilitate the fast learning of new movements and the efficient adaptation to a variety of situations. Our paper aims to determine the level of co-ordination abilities and to analyze them. Our research comprised 34 subjects, aged between 11 and 14, who were tested using the 505 Agility Test, Ruler Test, jumps rope, Stork Test. Significance differences were detected between groups for agility, reaction time and co-ordination, and no significant differences for both balance tests. We noticed that the level of co-ordination abilities was significantly higher in the case of athletes in three tests and not relevant in two tests.

Singh (2013) conducted a study of physiological body composition and psychomotor variables of basketball players at different levels of competition. Physical activity is an inherent trait of a human living. It develops its own in a natural way. It becomes all the way imperative to identify the nature and the degree of this natural talent and to nurture, modifies and refines it to get the cherished outcomes. The children perform a lot of activities such as running, jumping,

throwing, catching, kicking and striking etc. The activities are known as natural or universal skills. The twenty first century is the most rapidly of changing century of all time. Rapidity of changes created unusual demands on individuals and on system of education. Today education must not only include the body and knowledge, but also to develop inquiring minds that will enable them to comprehend and accept what is to come tomorrow. As Jacks, the british philosopher, put it, living becomes an art only, When work and play, labour and leisure, mind and body, education and recreation are governed by single vision of excellence and a continuous passion for achieving it. The developing tendencies in international sports, especially in team games are identified as the increase in game tempo, tougher body game and greater variability in technique and tactics. An increased performance level can only be achieved by working and training of all major components i.e. technique, co-ordination, tactics, physical fitness, physiological qualities and psychological qualities. The theory of motor co-ordination is the basis for understanding the motor of co-ordination abilities. Motor co-ordination is part and parcel of actions regulation. Co-ordination abilities have also important and strong links with the motor skills as the motor co-ordination focus the basis of both. These abilities enable the sportsperson to do a group or set of movement with better quality and effect. Psychomotor abilities enable the sports man to do a group of movements with better quality and effect. The speed of learning of skill and its stability is directly dependent on the level of various co-ordinative abilities.

Slater and Hammel (1995) undertook another study to compare reaction time measures to visual stimulates and arm movement. The purpose of study was to compare reaction time measure for arm displacement and visual stimulus. Compare reaction time measures for selected group of physical education measures and liberal art measures. Analysis of the data revealed that only a modest relationship exited

between the two reaction time measures. Significant difference in reaction time existed among several group for both reaction measures.

Lockie RGet.al., (2013) conducted a study to indicate planned and reactive agility are different athletic skills. These skills have not been adequately assessed in male basket ballers. To define whether 10-m sprint performance, and planned and reactive agility measured by the Y-shaped agility test, can discriminate between semi-professional and amateur basket ballers. 10 semi-professional and 10 amateur basket ballers completed 10-meter (m) sprints, and planned and reactive agility tests. The Y-shaped agility test involved subjects sprinting 5 m through a trigger timing gate, followed by a 45° cut and 5-m sprint to the left or right through a target gate. In the planned condition, subjects knew the cut direction. For reactive trials, subjects visually scanned to find the illuminated gate. A one-way analysis of variance ($P < 0.05$) determined between-group differences. Data was pooled (n = 20) for a correlation analysis ($P < 0.05$). The reactive tests differentiated between the groups; semi-professional players were 6% faster for the reactive left ($P = 0.036$) and right ($P = 0.029$) cuts. The strongest correlations were between the 10-m sprints and planned agility tests (r = 0.590-0.860). The reactive left cut did not correlate with the planned tests. The reactive right cut moderately correlated with the 10-m sprint and planned right cut (r = 0.487-0.485). The results re-emphasized that planned and reactive agility are separate physical qualities. Reactive agility discriminated between the semi-professional and amateur basket ballers; planned agility did not. To distinguish between male basket ballers of different ability levels, agility tests should include a perceptual and decision-making component.

Gonzalez AMT et.al., (2013) conducted a study to compare starters (S) with nonstarters (NS), on their ability to maintain strength, power, and quickness during a competitive National Basketball Association (NBA) season. Twelve NBA

players were assessed at the beginning and end of the competitive season. However, because of trades and injury, only 7 (S = 4, NS = 3) players (28.2 ± 3.4 years; 200.9 ± 9.4 cm; 104.7 ± 13.9 kg; 7.2 ± 1.9% body fat) participated in both testing sessions and underwent analysis. Anthropometric performance (repetitive vertical jump power [VJP], squat power [SQT power], and reaction time) and subjective feelings of energy, focus, alertness, and fatigue were recorded during each testing session. Results were interpreted using magnitude-based statistics to make inferences on true differences between starters and nonstarters using the unequal variances t-statistic. Starters played an average of 27.8 ± 6.9 minutes per game and nonstarters played an average of 11.3 ± 7.0 minutes per game. During the course of the season, changes in VJP indicated that starters were likely to increase VJP (= 77.3 ±78.1 W) compared to nonstarters (= -160.0 ± 151.0 W). There also appeared to be a possible beneficial effect on maintaining reaction time in starters (= 0.005 ± 0.074 seconds) compared with nonstarters (= 0.047 ± 0.073 seconds). In addition, no clear differences in SQT power were seen between starters (= 110.8 ± 141.4 W) and nonstarters (= 143.5 ± 24.7 W). Changes in subjective feelings of energy indicated that starters were very likely to maintain their energy over the course of a season. It also appeared possible that starters were able to have a more positive response to subjective measures of fatigue and alertness than nonstarters, with only trivial differences between starters and nonstarters in regards to maintaining focus. Results of this study suggest that NBA players may enhance lower-body power, repetitive jump ability, and reaction during a competitive season, which appear to be enhanced with the stimulus of playing time.

Jaowad Ali, et.al., (2012) conducted a comparative study of Male Combative Athletes on Reaction Ability. To achieve the purpose of the study, 150 subjects fifty (50) from each game, (Judo = 50, Boxing = 50 and Wrestling = 50)

were randomly selected from the police sports camps of Uttarakhand and Uttar Pradesh states. The reaction ability among the groups was measured by Ball reaction test (Hurtz, 1985). To observe the differences among three groups on their Reaction Ability, Analysis Of Variance (ANOVA) was used at the significant level of 0.05 level. The results of the study have shown that the athletes of judo and boxing & judo and wrestling differed significantly on reaction ability. No significant differences were found between boxing and wrestling players on their reaction ability.

Scanlan Aet.al., (2014) conducted a study to explore the influence of physical and cognitive measures on reactive agility performance in basketball players. Twelve men basketball players performed multiple sprint, Change of Direction Speed Test, and Reactive Agility Test trials. Pearson's correlation analyses were used to determine relationships between the predictor variables (stature, mass, body composition, 5-m, 10-m and 20-m sprint times, peak speed, closed-skill agility time, response time and decision-making time) and reactive agility time (response variable). Simple and stepwise regression analyses determined the individual influence of each predictor variable and the best predictor model for reactive agility time. Morphological ($r = -0.45$ to 0.19), sprint ($r = -0.40$ to 0.41) and change-of-direction speed measures ($r = 0.43$) had small to moderate correlations with reactive agility time. Response time ($r = 0.76$, $P = 0.004$) and decision-making time ($r = 0.58$, $P = 0.049$) had large to very large relationships with reactive agility time. Response time was identified as the sole predictor variable for reactive agility time in the stepwise model ($R(2) = 0.58$, $P = 0.004$). In conclusion, cognitive measures had the greatest influence on reactive agility performance in men basketball players. These findings suggest reaction and decision-making drills should be incorporated in basketball training programmes.

Daulatabad Vandana S (2013) aimed to quantify sprinter's reaction time and compared it with age-matched controls. Database of 30 male sprinters and age-matched controls for reaction time (auditory, visual and whole body reaction time) was compiled. Sprinters included those who had participated indifferent state and national athletic meets. After compilation of this data, it was statistically analyzed using unpaired T-test. Our study indicated a highly significant (P value < 0.01) relationship in auditory and visual reaction time between athletes and controls. Our study also revealed that athletes reacted and responded quickly than controls. Whole body reaction time for front and back were highly significant (P value <0.01). Reaction time for right side was significant (P value <0.01), whereas whole body reaction time did not differ on left side in these two groups. Considering the findings of this study, the results suggest that sprinters reacting abilities are faster and quicker than controls, which definitely affects sprint performance. The above finding is of great interest for coaches and athletes in sports involving reacting skills.

2.2   REVIEWS ON ORIENTATION ABILITY

AmitPanwar, et.al., (2013) compared the inter-collegiate and inter-university level girl basketball players in selected co-ordinative abilities namely orientation ability, differentiation ability, balance ability and rhythm ability. The subjects selected for the study were fifteen inter-collegiate and fifteen inter-university level players whose age ranged between 20-25 years. The orientation ability was tested using numbered medicine ball run test, differentiation ability was evaluated using backward medicine ball throw test, balance ability was assessed using long nose balance test and for testing rhythm ability straight and rhythm run test was employed. The means of the two groups were compared employing t-test at 0.05 level of confidence. The analysis of data revealed that the subjects belonging to the two groups did not differ significantly in any of the co-ordinative ability.

Franciosi E et.al., (2012) conducted a research study to find out the athletes with mental retardation (MR) is achieving an important role, the literature concerning basketball tests and training is still poor. The aims of this study were to verify whether the basketball test battery could be an appropriate modality to classify the players in the Promotion (Pro) category, to assess basketball abilities before (PRE) and after (POST) an 8-month training in players with MR in relation to Competitive (Comp) and Pro categories, to analyze the variation of specific basketball abilities based on subjects' MR diagnosis. Forty-one male basketball players with MR (17 Comp and 24 Pro; age range 18-45 years; MR: 15% mild, 54% moderate, 29% severe, and 2% profound) were assessed PRE and POST training through the basketball test battery, which assessed 4 ability levels of increasing difficulty (from I to IV), each one characterized by the analysis of fundamental areas (ball handling, reception, passing, and shooting). Level I was significantly changed after the intervention period regardless of the Category, whereas shooting was affected by the interaction between Category and Intervention. The results showed significant differences between categories in the scores of individual global, level I, level II, level III, and in all fundamental areas. Individual global score in both categories significantly increased. The players of Comp significantly improved in level III, in ball handling, reception, passing, and shooting scores. The players of Pro improved significantly in level II, in ball handling, reception, and passing scores. Individual global, ability levels I-III, and fundamental area scores were negatively correlated to the MR level indicating that the players with a lower MR obtained higher ability scores. In conclusion, it was found that the basketball test battery could be useful for improving orientation ability and monitoring training in both Comp and Pro players.

Mangine GTet.al., (2014) studied the relationship between visual tracking speed (VTS) and reaction time (RT) on basketball specific measures of performance. Twelve professional basketball players were tested prior to the 2012-2013 season. VTS was obtained from one core session (20 Trials) of the multiple object tracking test, while RT was measured via fixed- and variable-region choice-reaction tests, using a light-based testing device. Performance in VTS and RT, were compared to basketball specific measures of performance (assists [AST], turnovers [TO], assist-to-turnover ratio [AST/TO], steals [STL]) during the regular basketball season. All performance measures were reported per 100 min played. Performance differences between backcourt (guards; n=5) and frontcourt (forwards/centers; n=7) positions were also examined. Relationships were most likely present between VTS and AST (r=0.78; p<0.003), STL (r=0.77; p<0.003), and AST/TO (r=0.78; p<0.003), while a likely relationship was also observed with TO (r=0.49; p<0.109). RT was not related to any of the basketball specific performance measures. Back-court players were most likely to outperform frontcourt players in AST and very likely to do so for VTS, TO, and AST/TO. In conclusion, VTS appears to be related to a basketball player's ability to see and respond to various stimuli on the basketball court that results in more positive plays as reflected by greater number of assists and steals, and lower turnovers.

Amarpreet Singh (2013) conducted a study to find out the traditional psychological approach shows that the relationship is dualistic. The faculty of reason is separate from and independent of what we do with our bodies. The purpose of the study is to study the Co-ordinative Abilities of Basketball Players at different levels of Competition. For the purpose of the study 150 Basketball players were selected as subjects (50 All India interuniversity players, 50 inter college players and 50 under-19 school players). The subjects were thoroughly acquainted with the testing

procedure as well as the purpose and significance of the study. The finding of the present study shows that there were significant differences between all the three levels of basketball players. The findings of the present investigation show that there exists a significant difference between all the three levels of basketball players for their orientation ability. The findings are supported with the completed research studies that differences were found between swimmers and track and field athletes for their Orientation ability.

Jun-wei Yang, et.al., (2013) found the development of the movement techniques, only by the simple mechanical operation or increasing or prolonging the training time can we no longer achieve the effect of developing the competition ability of athletes. Through mathematical analysis on the orientation of offensive and defensive, and combining the objective rules of basketball movement with the development characteristics of modern measuring technology towards the tactics of basketball movement, a model is built which can measure the optimal orientation. At the same time, by organically combining the athletes' perceptual cognition and rational cognition and doing linear optimal planning for multidimensional single target, a quantitative reference has been provided for the coach's training plan and tactics deployment.

Spiteri Tet.al., (2014) examined the relationship between one or two measures of strength and change of direction (COD) ability reporting inconsistent relationships to performance. These in consistences may be the result of the strength assessment utilized and the assumption that one measure of strength can represent all "types" of strength required during a COD task. Therefore the purpose of this study was to determine the relationship between several lower body strength and power measures, COD and agility performance. Twelve (n=12) elite female basketball athletes completed a maximal dynamic back squat, isometric mid-thigh

pull, eccentric and concentric only back squat, and a counter-movement jump, followed by two COD tests (505 and T-Test) and a reactive agility test. Pearson product moment correlation and stepwise regression analysis were performed on all variables. The percentage contribution of each strength measure to an athlete's total strength score was also determined. Our results demonstrated that both COD tests were significantly correlated to maximal dynamic, isometric, concentric and eccentric strength (r = -0.79 to -0.89), with eccentric strength identified as the sole predictor of COD performance. Agility performance did not correlate with any measure of strength (r = -0.08 to -0.36), while lower body power demonstrated no correlation to either agility or COD performance (r = -0.19 to -0.46). These findings demonstrate the importance of multiple strength components for COD ability, highlighting eccentric strength as a deterministic factor of COD performance. Coaches should aim to develop a well-rounded strength base in athletes, ensuring eccentric strength is developed as effectively as the often-emphasized concentric or overall dynamic strength capacity.

TeWierike SC et.al., (2014) conducted a study to find out the factors affecting repeated sprint ability (RSA) were evaluated in a mixed-longitudinal sample of 48 elite basketball players 14-19 years of age (16.1 ± 1.7 years). Players were observed on 6 occasions during the 2008-09 and 2009-10 seasons. Three following basketball-specific field tests were administered on each occasion: the shuttle sprint test for RSA, the vertical jump for lower body explosive strength (power), and the interval shuttle run test for interval endurance capacity. Height and weight were measured; body composition was estimated (percent fat, lean body mass). Multilevel modeling of RSA development curve was used with 32 players (16.0 ± 1.7 years) who had 2 or more observations. The 16 players (16.1 ± 1.8 years) measured on only 1 occasion were used as a control group to evaluate the

appropriateness of the model. Age, lower body explosive strength, and interval endurance capacity significantly contributed to RSA ($p \leq 0.05$). Repeated sprint ability improved with age from 14 to 17 years ($p \leq 0.05$) and reached a plateau at 17-19 years. Predicted RSA did not significantly differ from measured RSA in the control group ($p \geq 0.05$). The results suggest a potentially important role for the training of lower body explosive strength and interval endurance capacity in the development of RSA among youth basketball players with co-ordinative abilities. Age-specific reference values for RSA of youth players may assist basketball coaches in setting appropriate goals for individual players.

Kamandulis Set.al., (2013) conducted a research study to investigate the relationships between general co-ordination, sport-specific co-ordination, and sport-specific fitness of 8- to 17-year-old male basketball players. 312 males with training experience ranging from one year in the 8-year-old cohort up to 10 years for the 17-year-olds performed basketball-specific fitness (20 m sprint, Illinois, countermovement jump), general co-ordination (20 m run with three obstacles), semi-basketball-specific co-ordination (20 m sprint dribbling two balls, countermovement jump with arm swing) and basketball-specific co-ordination (Illinois ball dribbling) tests. There were moderate to large correlations between the results of both general and basketball-specific co-ordination with the results of most basketball-specific co-ordination tests in all age groups. Correlations between general and basketball-specific co-ordination were large in four age groups (11-14 yr., $r = .52$ to $r = .76$), moderate in five groups (8-10, 15 & 16 yr., $r = .37$ to $r = .46$), while not significant in the 17-year-olds. These results suggest that the importance of general co-ordination and orientation ability for sport-specific skills improvements during a sports-specific skill acquisition phase remains high at the skill refinement phase and decreases when sport-specific skills have been mastered to near-perfection.

2.3   **REVIEWS ON DIFFERENTIATION ABILITY**

Ziemowit Bankosz (2012) aimed to evaluate the differences between two groups of table tennis players (differing by their level of play) in terms of the kinesthetic differentiation ability of their so-called spatial component. The study was conducted using a goniometer which assessed the accuracy of performing an arm movement, specifically, the pronation and supination of the forearm at the elbow. The study analyzed the accuracy rate of performing this movement, where a smaller value indicated a higher level of kinesthetic differentiation ability. In all four tasks, the more advanced (skill-wise) group of players obtained lower arithmetic mean and median values of accuracy than the group that played at a lower skill set. This may suggest the importance of the tested variable as an important component of table tennis. However, the tested groups did not significantly differ from each other in the accuracy of performing the studied movement. Nonetheless, the variability of the accuracy rate of the lower skill level group was considerably larger than the more advanced and skilled group. It can be assumed that the more advanced group is more homogeneous in terms of accuracy production. This could be the result of specific training exercises which makes positive changes on the differentiation ability of the tennis players.

Erkmen N, et.al., (2012) studied to determine the effects of exercise continued until the anaerobic threshold on balance performance in basketball players. Twelve male basketball players (age = 20.92 ± 2.81 years, body height = 192.72 ± 7.61 cm, body mass = 88.09 ± 8.41 kg, training experience = 7.17 ± 3.10 years) volunteered to participate in this study. A Kinesthetic Ability Trainer (KAT 2000 stabilometer) was used to measure the balance performance. Balance tests consisted of static tests on dominant, non-dominant and double leg stance. The Bruce Protocol was performed by means of a treadmill. The exercise protocol was

terminated when the subject passed the anaerobic threshold. After the exercise protocol, balance measurements were immediately repeated. Statistical differences between pre and post-exercise for dominant, nondominant and double leg stance were determined by the paired samples t-test according to the results of the test of normality. The post-exercise balance score on the dominant leg was significantly higher than pre-exercise (t = -2.758, p < 0.05). No differences existed between pre- and post-exercise in the balance scores of the nondominant leg after the exercise protocol (t = 0.428, p > 0.05). A significant difference was found between pre and post-exercise balance scores in the double leg stance (t = -2.354, p < 0.05). The main finding of this study was that an incremental exercise continued until the anaerobic threshold decreased balance performance on the dominant leg in basketball players, but did not alter it in the nondominant leg.

Marina Tsetseli, et.al., (2010) conducted a study to define which co-ordination abilities are the most important in tennis and to evaluate whether a co-ordination training program will improve the service technique. The study was conducted on48 children (age 11 ± 2 years). The participants were randomly divided into a control group (C) and an intervention group (A) that performed a specific co-ordination program 3times/wk. Both groups (C and A) followed a tennis training program 3times/wk. The service technique was evaluated in all subjects in the beginning of the protocol (T0), after the completion of the 5-week specific co-ordination program (T5)and one week after the intervention program was completed(T6). The present study, suggests that the most important co-ordination abilities for tennis players are kinaesthetic differentiation and reaction time. Furthermore, two-way repeated measurements ANOVA revealed that there was significant increase (p 0.05) on the service technique between groups (C and A) and among the different phases (T0, T5and T6).

Ghosh (2002) conducted a study on selected co-ordinative abilities on 15 male sprinters and 15 male jumpers of L.N.I.P.E. with the purpose to find out the of co-ordinate ability between the all of track events and abilities & fields events. The variables selected for the study were orientation ability, Differentiation ability, Reaction ability, Balance ability and Rhythm ability. T- Ratio on all the variables for males and females was applied on the basis of the results following conclusion were drawn that In case of Orientation ability and reaction ability there was a significant difference between the sprinters and jumpers. On the other hand in case of differentiation ability, Balance ability and Rhythm ability there was no significant difference between the sprinter and jumper. It was observed from the findings of the study that the co-ordinative abilities of sprinters and jumpers did not differ completely.

Mahesh Sawata Khetmalis (2012) conducted a study that sport is being influenced and does influence all of our social institutions including education, economics, arts, politics, law, mass communication and international diplomacy – its scope is awesome. Today sport has become mass participation; it is being adopted as fashion by some. It attracts the mass either for recreation or physical fitness, or as a profession. Ninety female subjects age ranged from 15 to 17 years were selected from three international schools of Pune in India. To compare the selected co-ordinative abilities and motor abilities of female athletes of international schools, the mean, standard deviation and Analysis of variance was applied. Significant difference was found in case of orientation ability, differentiation ability, explosive strength and 12 min. run/walk. No significant difference was found in case of rhythmic ability, reaction ability, speed and agility.

JinsyMol N.G.(2001) conducted a study on co-ordinative abilities on twenty male Hockey players of L.N.I.P .E. with the purpose to find out the

relationship of selected co-ordinative abilities to shooting performance in Hockey. The variables selected for the study were Orientation ability. Differentiation ability, Reaction ability, Balance ability and Shooting ability. Product moment correlation was applied to find out the relationship of co-ordinative abilities performance. It was concluded that no significant relationship of co-ordinative abilities to shooting performance in Hockey was found. And, this study also showed that shooting ability did not only depend uponco-ordination but many other factors may affect it.

SardarBiswajit, SardarSanjit and VermaKavita (2011) conducted a study to find out the differences of Psychomotor and Co-ordinative Abilities of Different levels of hockey players i.e. National, State and District levels. The subjects selected for the study were 90 male hockey players of different levels from Gwalior, Jabalpur, Indore and Bhopal. The subjects were selected randomly with the age ranging from 20-25 years. The tests were administered in different play grounds, with all the required equipments. The data was analyzed by using of LSD for mean comparison on Kinesthetic perception, Speed of movement, Response time, Balance ability, Differentiation ability, Orientation ability, Reaction ability and Rhythmic ability among District, state, and National level hockey players. The level of significance chosen for testing the hypothesis was set at 0.05 level of significance. On the basis of results Kinesthetic perception, speed of movement, Response time, Balance ability, Differentiation ability, Orientation ability, Reaction ability and Rhythmic ability has significant differences at various level of hockey players. National and State level hockey players were found to be superior as compared to District level hockey players in Kinesthetic perception, Response time, Speed of movement, Balance ability, Differentiation ability, and Orientation ability. Whereas, reaction ability and rhythmic ability have not found any differences among different level hockey players.

Praveen kumar Mishra, et.al., (2011) conducted a research study was to characterize elite Gujarat table-tennis players to standard human performance measures by their selected co-ordinative abilities. The purpose of the study was to compare sub junior, junior and senior players of table-tennis by their selected co-ordinative abilities. The subjects were tested on selected co-ordinative abilities i.e. Reaction ability, Orientation ability, Differentiation ability, Balance ability and Rhythm ability. To characterize elite state table-tennis players to their standard human performance measures by selected co-ordinative abilities, mean and standard deviation were used. To compare the selected co-ordinative abilities among sportsman belonging to three levels (Sub-Juniors, Juniors and Senior), one way Analysis Of Variance (ANOVA) and post hoc (Least significant difference) test was used and the levels of significance was set at 0.05 levels. The analysis of variance showed that there was significant difference between sub juniors, juniors and seniors in relation to Reaction ability, Orientation ability, Balance ability and Rhythmic ability as "F" Values were found to be significant (99.65, 9.60, 9.39 and 176.44) where these were required to be 3.92 at 0.05 level of confidence. In relation to differentiation ability there was not any significant difference between sub juniors, juniors and seniors as 'F' value was not found to be significant (0.021), where this was required to be 3.92 at 0.05 level of confidence. After applying the post-hoc (least significant difference) test it was observed that in relation to Reaction ability mean differences of sub juniors and juniors; sub juniors and seniors; juniors and seniors was found to be significant at 0.05 level of significance. In relation to orientation ability mean differences of sub juniors and junior; sub juniors and seniors; juniors and seniors was found to be significant at 0.05 level of significance. In relation to Balance ability mean differences of sub juniors and juniors; sub juniors and seniors; juniors and seniors was found to be significant at 0.05 level of significance. In relation to Rhythmic ability mean differences of sub juniors and

juniors; sub juniors and seniors; was found to be significant at 0.05 level of significance. Mean difference of juniors and seniors was found to be insignificant.

Lech Grzegorz, et.al., (2011) focused to identify coordinated motor abilities that affect fighting methods and performance in junior judokas. Subjects were selected for the study in consideration of their age, competition experience, body mass and prior sports level. Subjects' competition history was taken into consideration when analysing the effectiveness of current fight actions, and individual sports level was determined with consideration to rank in the analysed competitions. The study sought to determine the level of coordinated motor abilities of competitors. The scope of this analysis covered the following aspects: kinaesthetic differentiation, movement frequency, simple and selective reaction time (evoked by a visual or auditory stimulus), spatial orientation, visual-motor co-ordination, rhythmization, speed, accuracy and precision of movements and the ability to adapt movements and balance. A set of computer tests was employed for the analysis of all of the co-ordination abilities, while balance examinations were based on the Flamingo Balance Test. Finally, all relationships were determined based on the Spearman's rank correlation coefficient. It was observed that the activity of the contestants during the fight correlated with the ability to differentiate movements and speed, accuracy and precision of movement, whereas the achievement level during competition was connected with reaction time.

2.4   REVIEWS ON BALANCE ABILITY

Hrysomallis C (2011) found the relationship between balance ability and sport injury risk has been established in many cases, but the relationship between balance ability and athletic performance is less clear. This review compares the balance ability of athletes from different sports, determines if there is a difference in

balance ability of athletes at different levels of competition within the same sport, determines the relationship of balance ability with performance measures and examines the influence of balance training on sport performance or motor skills. Based on the available data from cross-sectional studies, gymnasts tended to have the best balance ability, followed by soccer players, swimmers, active control subjects and then basketball players. Surprisingly, no studies were found that compared the balance ability of rifle shooters with other athletes. There were some sports, such as rifle shooting, soccer and golf, where elite athletes were found to have superior balance ability compared with their less proficient counterparts, but this was not found to be the case for alpine skiing, surfing and judo. Balance ability was shown to be significantly related to rifle shooting accuracy, archery shooting accuracy, ice hockey maximum skating speed and simulated luge start speed, but not for baseball pitching accuracy or snowboarding ranking points. Prospective studies have shown that the addition of a balance training component to the activities of recreationally active subjects or physical education students has resulted in improvements in vertical jump, agility, shuttle run and downhill slalom skiing. A proposed mechanism for the enhancement in motor skills from balance training is an increase in the rate of force development. There are limited data on the influence of balance training on motor skills of elite athletes. When the effectiveness of balance training was compared with resistance training, it was found that resistance training produced superior performance results for jump height and sprint time. Balance ability was related to competition level for some sports, with the more proficient athletes displaying greater balance ability. There were significant relationships between balance ability and a number of performance measures. Evidence from prospective studies supports the notion that balance training can be a worthwhile adjunct to the usual training of non-elite athletes to enhance certain motor skills, but not in place of other conditioning such as resistance training. More research is

required to determine the influence of balance training on the motor skills of elite athletes.

Sekulic D, et.al., (2013) determined the gender-specific influence of speed, power, and balance on different agility tests. A total of 32 college-aged male athletes and 31 college-aged female athletes (age 20.02 ± 1.89 years) participated in this study. The subjects were mostly involved in team sports (soccer, team handball, basketball, and volleyball; 80% of men, and 75% of women), martial arts, gymnastics, and dance. Anthropometric variables consisted of body height, body weight, and the body mass index. Five agility tests were used: a t-test (T-TEST), zig-zag test, 20-yard shuttle test, agility test with a 180-degree turn, and forward-backward running agility test (FWDBWD). Other tests included 1 jumping ability power test (squat jump, SQJ), 2 balance tests to determine the overall stability index and an overall limit of stability score (both measured by Biodex Balance System), and 2 running speed tests using a straight sprint for 10 and 20 m (S10 and S20, respectively). A reliability analysis showed that all the agility tests were reliable. Multiple regression and correlation analysis found speed and power (among women), and balance (among men), as most significant predictors of agility. The highest Pearson's correlation in both genders is found between the results of the FWDBWD and S10M tests (0.77 and 0.81 for men and women, respectively; $p < 0.05$). Power, measured using the SQJ, is significantly ($p < 0.05$) related to FWDBWD and T-TEST results but only for women (-0.44; -0.41). The balance measures were significantly related to the agility performance for men but not for women. In addition to demonstrating a known relationship between speed and agility in both genders, and a small but statistically significant relationship between power and agility in women, these results indicate that balance should be considered as a potential predictor of agility in trained adult men.

Hota (2001) conducted a study on selected co-ordinative abilities on twenty male football players studying at L.N.l.P.E. with the purpose to find out the relationship of co-ordinative abilities to playing ability in Soccer. The variables selected for the study were Orientation ability. Differentiationability, Reaction ability, Balance ability, Rhythm ability and Playing ability. To find out the relationship of co-ordinative ability to Soccer playing ability. The collected data were subjected to person's product moment correlation. It was concluded that co-ordinative abilities namely Orientation ability, Reaction ability and Rhythm ability are significantly related to playing ability. And, differentiation ability and Balance ability are not significantly related to playing ability performance. And, co-ordinative ability plays very crucial role in football performance.

Virgil Tudora, et.al., (2014) found that nowadays the volume of activities performed under varying and unexpected conditions has significantly increased. This requires the individual manifestation of sharpness, cleverness, ingenuity, reaction speed, concentration and ability to transfer attention, movement precision (spatial, temporal, dynamic), balance ability and their biomechanical rationalization. The present paper shows that influencing the educational process by using appropriate methods and means for developing co-ordination abilities can stimulate the students' interest and positive attitude towards physical exercise in general, and towards physical education classes in particular.

Verbina V. Vet.al., (2013) found that pathology of hearing causes a disturbance of the function of the vestibular apparatus. In children with hearing impairment significantly disturbed co-ordination, balance, reduced ability to the maximal manifestation of motor skills, spatial orientation. Inclusion in athletic training fitball gymnastics and acrobatics contributes to the development of co-ordination abilities.

Sterkowicz Stanislaw (2012) conducted a study on the co-ordination motor abilities of judo contestants at different age. Judo is generally considered as a sport which combines strength and endurance. In this sport, with predominance of open movement habits, an important role is played by co-ordination abilities. The main aim of the present study is to carry out a comparative analysis of the indices of co-ordination motor abilities (CMA) among judo contestants at different age. The study group was comprised of 25 judo contestants during the competitive season (7 seniors, 10 juniors and 8 cadets). A series of computer tests were carried out in order to evaluate kinaesthetic differentiation of movements, simple reaction time, complex reaction time, spatial orientation, visual-motor co-ordination, rhythmization, speed, accuracy and precision of movements, ability to adapt movements, eye-hand co-ordination. The study also tested global movement co-ordination (Starosta's test) and balance (Flamingo test). Significance of differences was assessed by means of one-way ANOVA ($p<0.05$). In intergroup comparisons, the levels obtained in seniors were adopted as reference values. The factor of experience (age category and sport experience) has an overwhelming effect on the sense of balance, which is the highest in seniors, medium in juniors and the lowest in cadets. The category of juniors exhibits the most of beneficial differences in terms of global motor co-ordination compared to cadets, minimal complex reaction time compared to seniors, spatial orientation and indexes of reaction to moving objects. Seniors are characterized by longer minimal complex reaction time compared to juniors and stagnant results in the test of global motor co-ordination, spatial orientation and reaction to moving objects. The tests which differentiate between age categories should be taken into consideration in monitoring of the preparation of judo contestants.

VasilikiZisi, et.al., (2009) examined differences in selected cognitive, perceptual, motor abilities and psychological characteristics among elite rhythmic

gymnasts aged 11 to 12years (M=11.76 + 0.62) of different performance levels. The contribution of gymnasts' experience years (M=5.22 + 0.85) on these differences was also examined. The 33 gymnasts - the top scorers at the Hellenic national championship - were classified in three levels of performance (high, medium, low)according to their mean competitive performance score on the 2001 Hellenic National Championship semifinals and finals. They participated in a series of laboratory tests assessing memory (retention and grouping), analytic ability, simple visual and choice reaction time, selective attention, perception speed, two hand co-ordination, coincidence anticipation and wrist-finger dexterity. Intrinsic motivation was assessed using the Intrinsic Motivation Inventory (IMI). Self confidence state was assessed using a subscale of Competitive State AnxietyInventory-2 (CSAI-2) and self-confidence trait was assessed using the Vealey's (1988) questionnaire. According to the results, gymnasts at the high level of performance outperformed gymnasts at the low level of performance only on memory grouping and self-confidence. Athletic experience, used as a covariate, significantly accounted for these differences. Differences on choice reaction time and co-ordination referred from previous studies were not found most probably due to the high level of gymnasts and to the recent changes in rhythmic gymnastics' code of points. Modest scores on intrinsic motivation were attributed to the fact that the study was conducted about three months before competitions. More research is needed to define the determinants of elite performance in rhythmic gymnastics. These findings however, can provide useful information for designing training schemes and new competitive combinations for rhythmic gymnasts.

MaricKristijan, et.al., (2013) conducted a research study to find the relations between Basic and Specific Motor Abilities and Player Quality of Young Basketball Players. Subjects from 5 first league clubs from Herzegovina were tested

with the purpose of determining the relations of basic and specific motor abilities, as well as the effect of specific abilities on player efficiency in young basketball players (cadets). A battery of 12 tests assessing basic motor abilities and 5 specific tests assessing basketball efficiency were used on a sample of 83 basketball players. Two significant canonical correlations, i.e. linear combinations explained the relation between the set of twelve variables of basic motor space and five variables of situational motor abilities. Underlying the first canonical linear combination is the positive effect of the general motor factor, predominantly defined by jumping explosive power, movement speed of the arms, static strength of the arms and co-ordination, on specific basketball abilities: movement efficiency, the power of the overarm throw, shooting and passing precision, and the skill of handling the ball. The impact of basic motor abilities of precision and balance on specific abilities of passing and shooting precision and ball handling is underlying the second linear combination. The results of regression correlation analysis between the variable set of specific motor abilities, co-ordinative abilities and game efficiency have shown that the ability of ball handling has the largest impact on player quality in basketball cadets, followed by shooting precision and passing precision, and the power of the overarm throw.

Zurek Piotr (2012) conducted a study to determine the ability of water polo players from the Polish junior national team to maintain static body balance. The ability to maintain one's balance depends on a variety of co-ordination skills and is necessary both for performing sports and everyday activities. Water polo players during supervised training are characterized by a high ability to maintain postural balance. The body mass of junior athletes significantly influences their ability to maintain static body balance. A group of water polo players performed three tasks: a) standard - with their eyes open; b) with their eyes closed; c) with feedback. Using

visual control allowed water polo players to achieve optimal characteristics in their ability to maintain postural balance. Significant differences were observed between the center of pressure distribution area [COPA, mmÂ²]; results of trials with open and closed eyes, as well as between the closed eyes trial and feedback trial. A significant relationship between the ability to maintain postural balance and body mass was noted during the open eyes trial. Players with a greater body mass achieved less favorable COPA characteristics during this trial.

2.5   REVIEWS ON RHYTHM ABILITY

Sisodia (2000) conducted a study on selected co-ordinative abilities on sixty Judokas studying at various standards at L.N.I.P.E. and Jiwaji University, Gwalior with the purpose to find out the effects of Transcendental Meditation on selected physiological variables and co-ordinative abilities in Judo. The variables selected for the study were reaction ability orientation, Different balance and Rhythm ability and physiological variables An aerobic power, vital capacity, resting respiratory rate, resting heart rate, body composition, t- test on all the subjects was applied. It was concluded that aerobic power performance, transcendental meditation did not improve performance significantly in comparison to the non-meditations. In case of vital capacity transcendental meditation had not shown significant improvement among experimental groups as compared to the control group. And, Incase of total body fat percentage, transcendental meditation had shown insignificant change in comparison to non-meditations.

Joseph Singh (2014) investigated the relationship of Kho-Kho performance with selected co-ordinative ability. Eighteen female Kho-Kho players who had participated in Inter- collegiate Kho- Kho competition held at Dehradun were randomly selected for this study. Their age ranged from 18-25 years. Findings

reveals that co-ordinative abilities - Reaction ability and Rhythm ability were found significantly related to the kho-kho performance as their calculated Correlation Coefficient (r) were 0.66 and 0.54 respectively. Orientation ability, Differentiation ability and Balance ability were not found significantly related to the Kho-Kho performance as their calculated Correlation Coefficient (r) were -0.05, -0.01 and -0.34 respectively. The calculated Correlation Coefficient (r) are lower than the required value of (r) 0.507 to be significant at 0.05 level of significance.

Skowronek Tomasz, et.al., (2013) conducted a study on the importance of rhythm and specific endurance capabilities were examined in the technical skill and performance of hurdle runners. Additionally, interaction effects among rhythm, anaerobic fitness, and body constitution were analyzed. Seven 18-year-old members of the Polish Junior National Team in 110 m hurdles and 8 age-matched controls who were non-athletes participated. Movement co-ordination tests (rhythm and differentiation tests) and an anaerobic fitness test were performed. There were no statistically significant differences between the athletes and the control group on the co-ordination or rhythm test variables. No support was found for the hypothesis that a hurdler's timing ability influences performance.

Hemraj D Patel, et.al., (2012) conducted a research study to define which co-ordination abilities are the most important in tennis and to identify whether a co-ordination training program will improve the learning process of tennis skills (backhand and forehand). 10 expert coaches in tennis completed a check list of five co-ordination abilities and suggested that the most important co-ordination abilities for tennis players are "kinesthetic differentiation" and "reaction time". Based on the results from the questionnaires, the program designed to practice the two most important co-ordination abilities. Participants were 48 novice children (age 11 ± 2 years). They were randomly divided into two groups, the experimental group

(N=24) and the control group (N=24). Both groups followed tennis training program 3 times/wk for 8 weeks. Participants of the experimental group performed a specific co-ordination program for 20 min before the skills practice and participants of control group performed he traditional practice. The tennis skill performance and learning assessed using observation technique in five basic elements of every skill. There were three measurements, pre, post and retention test, one week after post test without practice. ANOVA with repeated measures (2 group X 3 measures) revealed that there was significant interaction between groups and measures. The Bonferroni post hoc analysis revealed that experimental group performed better than the control group in the post test and in the retention test in the two skills. Results indicated that co-ordination training program help athletes to learn and perform the forehand and backhand tennis skills better with lots of rhythmic ability.

Henning Budde, et.al., (2008) found that teachers complain about growing concentration deficits and reduced attention in adolescents. Exercise has been shown to positively affect cognitive performance. Due to the neuronal connection between the cerebellum and the frontal cortex, we hypothesized that cognitive performance might be influenced by bilateral co-ordinative exercise (CE) and that its effect on cognition might be already visible after short bouts of exercise. One hundred and fifteen healthy adolescents aged 13–16 years of an elite performance school were randomly assigned to an experimental and a control group and tested using the d2-test, a test of attention and concentration. Both groups performed the d2-test after a regular school lesson (pre-test), after 10 min of co-ordinative exercise and of a normal sport lesson (NSL, control group), respectively (post-test). Exercise was controlled for heart rate (HR). CE and NSL enhanced the d2-test performance from pre- to post-test significantly. ANOVA revealed a significant group (CE, NSL) by performance interaction in the d2-test indicating a

higher improvement of CE as compared to NSL. HR was not significantly different between the groups. CE was more effective in completing the concentration and attention task. With the HR being the same in both groups we assume that the co-ordinative character of the exercise might be responsible for the significant differences. CE might lead to a pre-activation of parts of the brain which are also responsible for mediating functions like attention. Thus, our results support the request for more acute CE in schools, even in elite performance schools which will enhance the co-ordinative abilities.

Akram Esfahankalati (2013) conducted a research study to determine the relationship between co-ordinative abilities and performance in elite female Handball players.120 elite Handball players (age 18 to 25 years, height 166.76 ± 3.89cm and weight 64.45 ± 4.15kg; mean ± SD) were participated in this study. The results of this study were showed highly negative significant correlation between elite female handball players' performance and Rhythm Ability and Orientation Ability (-.280, P≤.002 and -.319, P≤.000 respectively), but there was no significant correlation between Differentiation Ability and performance in elite female Handball players (.145, P≤.115).In conclusion there was a significant correlation between Rhythm Ability and Orientation Ability and performance in elite female Handball players. Therefore co-ordinative abilities - Rhythm Ability and Orientation Ability- had effect on performance in elite female handball players.

Juravle and Ileana (2013) related in this study reflects the opinion of various experts regarding the importance in developing the co-ordinative abilities level to improve selection system of elite athletes. These co-ordinative abilities can be viewed as the ability of a person that performs actions with a high degree of difficulty, adjusting the movements in time and space and taking into account new situations that occur. The main research method used in this paper is based on the

literature studies in this area of interest, i.e. articles and publications, manuals, tutorials, etc. Initially, the study began from the hypothesis that significant improvements can be observed in the selection process of the young athlete's when is take into account the development of the co-ordinative abilities. Analyzing the related work in this field, selection process is the decisive factor in creating the assumptions for achieving high performances in sport. Also, these researches provide criteria, samples and standards, features and models for initial and primary selection process, and also for the selection of the Olympic or national athletes groups. The conclusion of this study shows that one of the most important criteria for athletes' selection process is represented by their level of development of co-ordination abilities. Researches included in this paper also argue the importance of athlete's co-ordination abilities development for selection process in different types of team sport games.

G.P.Raju (2013) conducted a study to compare the co-ordinative abilities of 11 to 14 year school boys total 120 boys studying in 6th, 7th, 8th and 9th standards were selected as subjects. A sample of 30 boys from each age group from11, 12, 13, and 14 years school boys at Municipal high school, Narasaraopet, Guntur district, Andhra Pradesh were selected at random after obtaining the date of birth of the each subjects from the school records. Four co-ordinative abilities namely differentiationability of the hands, space orientation ability, dynamic balancing ability, reaction ability were selected for the purpose of the study. Four standardized tests suggested by Peter Herts were used to measure these co-ordinative abilities. One way analysis of variances was used to compare the co-ordinative abilities among 11 to 14 years school boys. The level of significant was fixed as 0.5.

Jasmel KaurHanda (2012) conducted a research study to compare the morphological characteristics and motor abilities of high performance and low

performance female gymnasts. 94 female gymnasts who participated in All India Inter University Gymnastics Championship were taken as subjects. The various body measurements, as well as, strength, flexibility and speed tests were recorded on each subject. Heath Carter method was used to record the somatotype rating. The gymnasts were divided into two groups according to their performance. The marks obtained during the competition were taken as competitive performance. The results of the investigation has shown that high performance gymnasts were lighter, significantly shorter, possessed less amount of% body fat and were more mesomorphic and significantly better on selected strength, flexibility, speed and co-ordinative abilities than the low performance gymnasts.

Mihaela Puiu (2014) found that the performance of the gymnasts on the rings has a specific character, determined by the alternation of elements in dynamic regime with elements in isometric regime and the pendulum movement of the cables to which the two circles are attached (support points). The main parameters that define the specificity of the effort in performing the exercises on the rings are: muscular, ligament and tendon strength, the velocity at which the maximum muscular contraction is produced, muscular and joint resistance, intersegmentalco-ordination, intermuscularco-ordination in the muscle chains involved and the ability of static and dynamic balance. The purpose of this study was to streamline the existing workout methodologies aimed at developing muscle strength in a short time and with low energy expenditure. To this end we proposed and tested in practice a workout programme with visual feedback in real time, whose main stimulus was aimed at consolidating the neuromotor abilities. The effects produced in the energy mobilization, found at the initial, final and post-experiment test, were significant in terms of immediate increase in the strength, co-ordinative ability parameter and its stabilization in time. Although the research was conducted as a case study, this

progress leads us to point out the existence of "reserves" important improvement of the energy component in the process control and monitoring of the neuromuscular contraction.

2.6   OVERVIEW ON THE REVIEWS

Researcher selected five types of co-ordinative abilities, reaction ability, orientation ability, differentiation ability, balance ability and rhythm ability which will help and create a strong foundation in learning any game especially Basketball. At the elite level players' need to improve their co-ordinative abilities to meet the demand of the game by increasing the ability to play the game more skillfully. The reviews of the studies showed that systematic practice of co-ordinative exercises improved all the co-ordinative abilities by making the strong foundation on both sides that is fitness and technique. This might be due the reason that district level Basketball players developed co-co-ordinative abilities by the long duration of participation and by the help of ·general and specific exercises. Additional means for improving motor sense organs, variation of exercises, variation of movement execution, variation in external conditions, combination of movement, change in information uptake, practice against time and due to practice under fatigue were discussed in the reviews by various researchers.