Chapter - II

REVIEW OF RELATED LITERATURE

Research Scholar made sincere attempt to locate literature by going through the various sources. Some of the important review of literature has been cited below:

Eckert and Wendt \(^1\) conducted a study on 29 students (18 female and 11 males) in a co-educational archery class. Using a push-pull dynamometer, these subjects were measured for maximal push and pull strength in an archery draw position. A modified bow, which recorded strength in the draw position by means of a cable tensiometer was also used to measure maximal pull and comfortable pull. Full draw length of the bows selected by the students, total arm lengths, heights of the students recorded. The reliabilities of all the strength measures ranged from .919 to .981, while the

\(^1\)Helen Eckert and Dorothy Wendt, "Various Measures related to draw in Archery" The Research Quarterly 37 (1966): 145.
relationships between all the maximal strength measures and bow weights ranged from .556 to .616 with an 'r' of .445 being insignificant at the 1 percent level for the number of subjects in this study. The result reveals that the comfortable pull on the modified bow correlated .632 with the maximal pull on the same piece of equipment, it had only a .404 relationship with bow weight. The low relationship between a comfortable pull in the draw position and the bow weights the subjects were using at the time of testing would seem to indicate either misjudgement in the selection of equipment or possible lack of kinesthetic perception of the pull required to achieve the full draw position for a bow previously selected as comfortable for class use.

Olson\textsuperscript{2} conducted a study and was designed to ascertain if archery performance would be improved when the instructor used certain methods of external

motivation compared with performance when the instructor eliminated these methods. An attempt was made to determine whether certain personality traits as measured by Edwards Personality Inventory would be related to performance under experimental and control conditions (N = 44). Both groups received the same basic instruction in Archery, and in addition, the instructor utilized several common motivational techniques with the experimental group. During the last week of the experiment both groups were evaluated on archery performance by use of the AAHPER Indoor Archery Postal Tournament. The results indicated that there was no difference between the groups on archery performance under the two conditions; however, the control group was (P<.01) were motivated to succeed by the EPI index. The EPI traits, motivated to succeed, plans work efficiently and cooperativeness, emerged as being somehow related to performance both between and within groups.
Keast and Elliot\textsuperscript{3} conducted a study to examine the relationships between postural sway, aiming time, the cardiac cycle time and the placement of the first finger movement within the electrocardiadic cycle, with the quality of the arrow shot. A small group of elite male and female archers who shot either the recurve or the compound bow, freestyle or bare bow was used in this study. A total of 240 arrows were shot, classified as being of good, average or bad quality and analysed in detail. The analyses were undertaken over two occasions up to 100 days apart. The area of postural sway, as measured by the movement of the centre of pressure coordinates, varied significantly (P Less than 0.05 - 0.001) both within and between trials for all archers and for all quality of arrows shot. There was atendency for the area of postural sway to increase as the quality of the arrow shot decreased. This increase in postural sway exceeded, for arrow of bad quality, that exhibited as normal postural sway when standing

relaxed and addressing the target with the hands at the side. Aiming time was variable within the quality of arrow shot, although it was consistent for each archer. In some cases the aiming time increased as the quality of the arrow decreased, where as in the case of bare bow archery the aiming time tended to decrease as the quality of the arrow deteriorated. The cardiac cycle time increased significantly (P Less than 0.05 - 0.01) as the archers approached the loose of the good quality arrows but there was no significant increase in cardiac cycle time when arrows of average or bad quality were shot. The most consistent parameter related to the quality of the shot was the placement of the first finger movement within the ST phase or the mid-cycle phase of the electrocardiogram for arrows of good quality (P Less than 0.0001).

Hennessy and Parker\(^4\) conducted a study on electromyography of arrow release in archery. An

\(^4\)M.P. Hennessy and A.W. Parker, "Electromyography of arrow release in archery" Electromyography CL in Neurophysiology, Belgium, 30(1) (Jan 1990): 7-17.
electronic arrow movement detector was used to accurately locate the muscle activity associated with release of the arrow during shooting in archery. Digital computer analysis of the electromyograms from thirty shots for two archers facilitated an examination of the relationship between the measured activity of the muscles and their function during release. Changes present in the direct and integrated electromyograms of muscles acting at the wrist and elbow joints of the bow arm and the shoulder of the draw arm tended to anticipate the movement of arrow release. These changes would produce muscular force to reduce unwanted movement at this critical phase of the shot in the bow arm and initiate release of the bow string by the fingers. This study provides a detailed quantitative analysis of the muscular action of the technique and identifies possibilities for prevention of injury by improving the understanding of muscle action in shooting.
Robert$^5$ conducted study to construct an archery achievement test for college male freshmen. After seven weeks of instruction, 180 students shot 30 arrows at 30 yards. A sub-group of 82 subjects participated in a tournament one week prior to testing. External validity was assessed by correlating the two performance. Horizontal, vertical and radial deviations were analysed ($N = 31$) to determine their merits as alternate forms of scoring. Reliability estimated by using the Pearson 'r' with split halves and by analysis of variance, was moderately high (.67, .72, .79 and .82). Validity coefficients were also moderately high (.72 and .79). The three deviation measures showed little reliability, little inter-correlation and little power as predictors. To obtain a reliability of .90, the test should consists of 46 trials on each of four days.

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Clarys and et.al.,\textsuperscript{6} conducted study on quadruple approach in the little refers to four different studies over a period of 3 years. The common factor in these studies is the methodology of the (Brussels) Electromyographic signal processing and analysis system (ESPAS), a hardware and software EMG data acquisition system that has constantly been improved. Therefore, the ESPAS methodology is described extensively (i.e. the electrodes, amplifier, tape-recorder and processing hardware). Experimental investigated muscular behaviour in target shooting, both indoors (18 and 25 m) and outdoors (50,70 and 80 m). It was found (via iEMG) that a significant increase in activity only exists between 25 and 50 m, and that there is no linear increase of activity with increased distance. No differences in muscular pattern (IDANCO system: Clarys and Cabri, 1988) or activity between the indoor distances and between the outdoor distances were

found. Experiment.2 investigated the muscular economy of four string grips: the three finger grip, two finger grip, thumb grip and reversed grip. The largest variations in activity were found for the two most unfamiliar grips, i.e., the thumb and reversed grips; however, low iEMG and the rapid precision improvement (over a limited number of shots) suggest that the thumb grip, if practised long enough, might be the most economical technique. Experiment 3 attempted to differentiate muscular activity and a number of performance variables in three different populations of archers- Olympic athletes, National Competitors and beginners- in order to obtain feedback regarding improved performance. Apparently, overall muscle pattern, intensities and arrow speed were not discriminatory. The differences found between the groups (or level of skill) were affected by the ability to reproduce identical patterns and arrow velocities in consecutive shots and by the constancy of neuro-muscular control of the M.Trapezius, M.biceps brachii and M.extensor digitorium. Finally, Experiment.4
investigated the muscular activity of elite archers shooting at distances of 70 and 90 m with and without stabilizers. Differences in iEMG were not supported by differences in precision. Overtime, the low iEMG in shooting without stabilizers increases precisions and delays fatigue.

Pekalshi\textsuperscript{7} conducted a study to introduce certain methods and research techniques and to present the results of experiments on parameters of archery equipment to optimize the interaction of the archer-bow-arrow system's elements. In order to achieve the research requirements, the following were devised: 1. A mathematical model of an arrow's movement during its interaction with a bow. 2. A mathematical model of an archer-bow-arrow system, which constitutes a device for mechanical loosing of an arrow from the bow strings (DMLA). 3. Three series of high-speed filming. The

mathematical model and computer stimulation were used to describe the arrows movement for various initial conditions and various parameters of the equipment, based on which a nomogram was constructed of the optimum arrow parameters for bows of various draw forces. The device for the mechanical loosing of arrows from a bow was used to study the influence of selected parameters of the archer - bow - arrow system on the accuracy of shots. The film analysis was used to verify the mathematical and mechanical models constructed.

Long and Haywood\textsuperscript{8} conducted a study on technical advancements in target archery have been extended to widespread use of "Scopes" which magnify the target. In fact, these optical devices are simple converging lenses used at an arm's length from the eye. They produce a magnified image, but it is an image that suffers from significant dioptic blur, diminished

somewhat by use of a peep sight in the bowstring which functions as an aperture stop. Visual acuities were taken with these scopes and, as might be expected, it was found that subjects saw no better with them. With the highest power scopes, acuity actually decreased. Experienced archers did slightly better with these aids than those with no archery experience.

Fukuda and Neer⁹ conducted a study on two right handed archers presented with posterior instability of the shoulder. A 19-year-old Japanese and a 26-year-old white male archer developed pain and instability of the shoulder of 6 months duration. Both had engaged in archery for several years. Both exhibited a positive apprehension test and recurrent posterior subluxation and dislocation by flexing the arm to 80 degrees with internal rotation. Both could reduce the instability with a snap by extending the arm. For the subluxation,

Neer's inferior capsular shift procedure via a posterior approach was performed. For the dislocation, a posterior bone block was added to the inferior capsular shift. The posterior capsular redundancy was marked in both cases. At 5 and 9 years follow up respectively, both were doing archery and full activities without pain. These cases are thought to be examples of how a repetitive force can cause shoulder instability.

Mann and Littke\textsuperscript{10} conducted a study on twenty-one elite-caliber archers (M=12, F=9) were investigated concerning all part and present archery-related shoulder injuries. Using a questionnaire and physical examination. The questionnaire revealed that of 11 of 21 archers had complained of significant shoulder injuries either currently or during their careers. While 9/12 men never had shoulder problems during an average of 13.5 years, only 4/9 women escaped injury

during a mean 10.9 year competitive career. Deficits in training programs were noted, including lack of training and non-specific exercises, clinical examination demonstrated shoulder asymmetry and decreased flexibility in the drawing arm (DA) shoulder. Functional testing revealed a positive impingement sign in 6/21 DA shoulders. Suprasinatus testing showed abnormalities in 4/21 DA shoulders. Pain was referred posteriorly with the impingement maneuver in 5/21 DA shoulders and abnormal external rotation testing was observed in B/21 DA shoulders. Generally, the females had proportionately more signs and symptoms of shoulder injury than the men, especially involving the DA shoulder. Testing implicated supraspinatus impingement/tendonitis and infraspinatus/teres minor traction tendonitis. These clinical findings correlated with cadaver prosection observations.

Puhl et.al.,\textsuperscript{11} conducted a study on eight U.S.

Men's National and 14 Women's University world games volleyball teams at the U.S. olympic centre. The purpose of the study was to examine the absolute and relative physical and physiological characteristics of elite man and women volleyball players. The parameters measured included percent body fat, maximal oxygen uptake (VO$_2$ max) using trademill runs, post-exercise blood lactic acid, measurers of vertical jumping ability, and peak isokinetic torque (Cybex II) for knee flexion and extension, shoulder extension and planter flexion at 30, 180, 240 and 300 degrees/second. As would be expected, the men were taller, behaviour and a higher body density and lean body weight, and lower body fat. For gross measures of jumping ability the men achieved greater absolute height for the jump and reach (317.1 Vs 277.3 cm) and greater jump distance above the standing reach (67.0 m for men and 2.24 m for women measured from centre court). The absolute jump and reach values were 130% and 124% of the respective net heights. The men also had a greater VO$_2$ max value expressed in absolute (1 min$^{-1}$) and relative terms
(ml. Kg\(^{-1}\) min\(^{-1}\)) LBW min\(^{-1}\). Maximal exercise heart rates and post-exercise blood lactic acid values were similar between groups.

Hartung and Squires\(^{12}\) investigated two groups of marathon runners volunteers. All runners had completed an official 42.3 Km marathon race. Group N was comprised of 25 young, novice runners (\(\bar{X}\) age = 49.9 years). Following measurements were made. Resting heart rate, resting systolic and diastolic blood pressure, maximal heart rate, maximal oxygen uptake, age, weight, \% fat, height and total plasma cholesterol. The results of a stepwise regression analysis using marathon time as the dependent variable yielded an \(R = 0.83\) for group N and \(R = 0.68\) for group E. An analysis of the 4 variable model verses the full model yielded a non-significant F for each group. The single best independent prediction of marathon time was VO\(_2\) max.

which accounted for 25% of the variance in marathon time (R = 0.50) in both groups.

Bults\textsuperscript{13} tested 127 high school female cross country runners percentage body fat, ratings of perceived exertion and maximal oxygen consumption during a continuous running treadmill test. These young runners ($\bar{X} = 15.6$ years) were running approximately 25 miles per week at the time of testing. They had an average VO$_2$ max of 50.8 ml. min$^{-1}$ and an HR max of 198 bpm. The mean percent body fat, as determined from hydrostatic weighing, was 15.4%. The onset of metabolic acidosis was estimated to occur at 78% of VO$_2$ max. A stepwise multiple regression with the 3000 meters run as the dependent variable indicated that max entered the equation in that order, yielding an R of 0.67. Both HR and RPE increased with work intensity, but not at equal rates. These high school female runners had

higher \( \text{VO}_2 \text{ max} \) than previously reported for this age group; however, they were considerable below these values reported for national caliber distance runners.

Cozen\(^{14}\) conducted a study of stature in relation of physical performance and indicated in his findings that height and weight apparently are influencing factor to some extent in the matter of physical performance although correlation obtained were not significant.

In a relationship study Bookwalter\(^{15}\) showed that the relationship of physique and shape to physical performance. The Indian Motor Fitness Test was administered and study concluded that:


(a) The very obese body are the poorest physical performance.

(b) Size and shape seems to have an influence on physical performance.

(c) Maximum size and shape do not produce performance fitness.

(d) The large and fat boys were poorer in physical performance than the normal and thin body.

Campbell\textsuperscript{16} conducted a study on heart rate of male college students during a basketball season. He selected seven subjects for that season and concluded that a season of basketball does not produce significant change in resting heart rate. He also concluded that it does not produce a significant reduction in the time required for the heart rate to return to 90 beats/minute. A recovery significant reduction was observed in mean recovery intervals.

\textsuperscript{16}Donald E. Campbell, "Heart rates of selected male college freshman during season of Basketball, "Research Quarterly 39, (December 1968): 880.
Hemsley, East and Stillwell\textsuperscript{17} conducted a study to investigate the relationship between selected physical performance tests and body fatness in preadolescent boys and girls. Measures of age, height, weight, skinfold thickness at two sites and performance scores on the vertical jump, standing broad jump, modified pull-up, 40-yard dash, and 400-yard run were obtained on 563 prepubescent elementary school children (289 boys and 274 girls). The results of a one way ANOVA indicated that there was a significant difference between boys and girls on all the physical performance tests. Although the boys were slightly taller, heavier and scored better than the girls on the performance tests, there was no significant difference between the sexes in the sum to two skinfolds. Separate regression equation for the sum of two skinfolds by performance on each test indicated that, with the exception of the modified pull up test, body fatness was only marginally related to performance. These findings indicated that, although inversely related to the ability to move the

\textsuperscript{17}Larry D. Hensley; Whitfield B. East and Jim L. Stillwell, "Body fatness and motor performance during preadolescence," \textit{Research Quarterly for Exercise and Sport}, 53 (June 1982): 133.
total body weight, body fatness was of minimal importance in explaining performance differences between young boys and girls.

Conger\textsuperscript{18} conducted a study of physical performance of body form as related to physical activity of college women. Thirty five college women ranging in age from 18 to 22 years were divided into more and less active group on the basis of their activity history strength, flexibility, specific gravity, skinfold fat, widths, girth, height and weight were measured and some selected indices computed. Mean difference between groups were tested for significance with $F$ and $t$ ratio. The study concluded that more active grip was heavier and had greater lean body mass. Specific gravity, arm, shoulder and trunk strength and all body forms measures were highly significant, maximum difference were found between percentage of fat, ponderal index, hip, leg and total strength.

\textsuperscript{18} Conger, Patricia, "Physical Performance of Body form as related to physical activity of college women" Completed Research in Health Physical Education and Recreation, 7 (1965): 67.
George and Nequin\textsuperscript{19} studied two ultramarathon world record holders, Barney Kleckar and Ben Chick Mostow, were studied immediately after a 50 mile, race and in a laboratory under controlled conditions. Blood samples were obtained before and after running and were analysed for lactate, glucose glycerol and free fatty acids. Muscle biopsies were also performed and analysed for glycogen, enzyme activity and fiber type. Results showed that although these runners are fit, their physiological data are not extreme or unique and are similar to data obtained from marathoners.

Gentry\textsuperscript{20} selected fifteen male college students, ranging in age from from 18 to 22 years, to study the effects of jogging programme on selected cardio-vascular functions. Resting pulse rate was selected as one of the cardio-vascular functions. The training programme consisted of jogging or walking a


specified distance (one to two miles) five times per week, for nine weeks, once training programme commenced, each subject progressed at his own rate dependent upon his level of fitness and rate of adaptation. Analysis of data showed no significant change in resting pulse rate of the subjects.

Alteri\textsuperscript{21} selected 63 college females between seventeen and twenty two years of age to study the effects of endurance and interval running on selected physiological parameters. Resting pulse rate was one of the physiological parameters selected. Analysis of data revealed that both treatments significantly lowered resting pulse rate.

Peter and et.al.,\textsuperscript{22} examined the body composition of US elite and junior elite archers and found that with only one exception, elite male archers


present fat values were normal for non endurance and non weight type sports. Most of the women archers, however, were considerably fatter than athletic population and even non athletic sedentary adults. They concluded that the excess body fat should be reduced by proper training and diet, both in case of U.S. and Canadian archers respectively.