REVIEW OF LITERATURE

Sincere efforts have been made by the present researcher to locate the literature related to this study. The relevant studies in relation to fitness and skills in fencing from various sources, which the investigator came across, are summarized:

Williams and Walmsley (2000) studied Reaction time (RT), movement time (MT), total response time (RMT) and accuracy of elite and novice fencers under three levels of target choice (single-, two- and four-targets) with three variations of movement distance (short, medium and long lunge). In addition, electromyographic activity (EMG) of selected upper and lower limb muscles was used to compare the two groups. The elite subjects were faster for RT and RMT and displayed a higher level of accuracy. The hypothesis that increasing choice would cause increases in RT was not upheld. Except for some differentiation between the short and the two longer distances, the effects of movement distance were not marked. Qualitative and quantitative analysis of EMG revealed the high consistency of response patterns within subjects and highlighted the synergistic roles of selected muscles in distinguishing between elite and novice fencers. These findings confirm that differences in the technical skill of fencers can be distinguished in the laboratory through a combination of response timing measures in association with measures of muscle action. They also draw attention to practical implications for individual skill assessment and training. Analysis of pre-movement muscle activity provided moderate support for the hypothesis that it was part of a single control process and indicates that a dual process can involve both the maintenance of postural stability and the generation of movement. It is suggested that different movement contexts can lead to different levels of coordination between the system controlling posture and that controlling movement.

In a review conducted by Roi and Bianchedi (2008) analysed the data from the literature on fencing with the aim of creating a psychobiological and multi-factorial model of fencing performance. Fencing is an open-skilled combat sport that was admitted to the first modern Olympic Games in Athens (1896). It is mainly practiced indoors, with three different weapons: the foil, the sabre and the épée, each contested with different rules. A fencing international tournament may last between 9 and 11 hours. Bouts represent only 18% of total competition time, with an effective fight time of between 17 and 48 minutes. The physical demands of
fencing competitions are high, involving the aerobic and anaerobic alactic and lactic metabolisms, and are also affected by age, sex, level of training and technical and tactical models utilized in relation to the adversary. The anthropometrical characteristics of fencers show a typical asymmetry of the limbs as a result of the practice of an asymmetrical sport activity. Fencing produces typical functional asymmetries that emphasize the very high level of specific function, strength and control required in this sport. Moreover, the physical demands of fencing are closely linked to the perceptual and psychological ones, and all are subjected to a continuous succession of changes during the bouts based on the behaviour of the opponent. For this reason it is difficult to identify a significant relationship between any one physiological characteristic and performance, and performance is more likely to be influenced by perceptual and neuro-physiological characteristics. Fencers need to anticipate the opponent and to mask their true intentions with a game of feints and counter-feints, which must be supported by an adequate psycho-physical condition to prevent central and peripheral fatigue. Fencing is not particularly dangerous; however, there is a fine line between a fatal lesion and a simple wound from a broken blade. The suggestions for injury prevention fall into three primary areas: (i) actions that can be taken by participants; (ii) improvements in equipment and facilities; and (iii) administration of fencing competitions. As in every other sport, the prevention of accidents must be accomplished at various levels and above all must involve the institutions that are responsible for safety in sports.

Until now endurance in fencers has been tested by non-specific ergometer tests even though the movement patterns during fencing are considerably different. Hence Weichenberger, Liu and Steinacker (2011) evaluated a newly developed fencing-specific endurance test (FET). 2 studies were carried out: 28 fencers were tested by FET with fencing-specific footwork and incremental tests on cycle (CE) and treadmill ergometer (TM) in a random order. Afterwards fencing bouts (BOU) were conducted to determine specific physical load. Blood lactate and heart rates were measured. In a second study another group of 18 international and 20 national level fencers conducted FET to explore differences between groups. Comparison of CE, TM, FET and BOU revealed a significant correlation between FET and BOU (r=0.80, p<0.01), heart rates during CE and TM were significantly lower than in bouts (p<0.01). Performance at CE and TM hardly correlated with FET (r=0.30, p<0.05; r=0.31, p<0.05). Elite-fencers showed significantly
better performance than non-elite fencers in FET (p<0.01). FET was suitable for determining specific endurance in fencers, allows a better assessment of physical demands during bouts than conventional ergometry and can be used to distinguish between fencers of different levels.

The aim of the study conducted by Wojcik et al., (2011) was to find weak link or links of musculoskeletal system (locutor system) occurred in fencers' body diagnosed by Performance Matrix Tests. The particular aim of this research was to estimate: if some weak links occur in a fencers' group, if all fencers in a group have the same weak links, if there is a correlation between weak links and training period length and if there is a connection between weak links and fencers' age. This study covered 14 female and 14 male fencers from the Fencing Section at the Warta Club from Poznań. An average age of fencers was 13.81 +/- 2.84.Performance Matrix Test was used as a research tool, due to which the presence of musculoskeletal system's weak links was measured. The obtained results showed that weak links of musculoskeletal system occur in a fencers' group, but it can not be given the exact answer if all fencers suffer from the same weak links. The research has not shown any evidences that there is a correlation between training period length and a number of weak links. Fencers' examination has not confirmed any correlations between fencers' age and the number of weak links. The tests have indicated that the most weak links appeared in a group of 12 years old fencers. Performance Matrix Tests are an easy and cheap tool for diagnosis of musculoskeletal system's weak link appearance. The early diagnosis of weak link/links can protect the fencer from musculoskeletal system's injuries. A lot of weak links found in fencers point out the need for undertaking work on local and global stabilization within a trunk and distal joints.

Hagemann et al., (2010) examined whether results of athletes' eye movements while they observe fencing attacks reflect their actual information pickup by comparing these results with others gained with temporal and spatial occlusion and cuing techniques. Fifteen top-ranking expert fencers, 15 advanced fencers, and 32 sport students predicted the target region of 405 fencing attacks on a computer monitor. Results of eye movement recordings showed a stronger foveal fixation on the opponent's trunk and weapon in the two fencer groups. Top-ranking expert fencers fixated particularly on the upper trunk. This matched their performance decrements in the spatial occlusion condition. However, when the upper trunk was occluded, participants also
shifted eye movements to neighboring body regions. Adding cues to the video material had no positive effects on prediction performance. We conclude that gaze behavior does not necessarily represent information pickup, but that studies applying the spatial occlusion paradigm should also register eye movements to avoid underestimating the information contributed by occluded regions.

Sterkowicz and Przybycien (2009) determined body composition and somatotype of the male fencers who were grouped by different fencing weapons. Thirty contestants were examined during the Polish Fencing Championships in 2004. They took part in épée (n = 10), foil (n = 10) and sabre (n = 10). They were aged 23.3 +/- 2.9; their length of training was 12.6 +/- 2.5 years, with the frequency of training 15.9 +/- 3.1 hours per week. In each weapon style there were champions and vice-champions of Poland from the year 2004. Twelve of them were classified among the first fifty contestants according to the D'Escrime International Federation (FIE) ranking. An experienced evaluator performed 10 measurements necessary to designate somatotypes by means of Heath-Carter method and to estimate the percentage of body fat and composition. Sabre fencers (weight = 84.4 kg, somatotype = 3.4-5.4-1.8) were heavier than both épée fencers (77.9 kg, 3.6-4.9-2.5) and foil fencers (74.9 kg, 2.9-4.2-2.8). Sabre specialists had higher mesomorphy than foil fencers (ANOVA and Bonferroni's multi comparison test). Sabre fencers were characterized by higher fat free mass and a higher BMI and fat free mass index than fencers of the other two weapons. Discriminant analysis result was significant (p < 0.01) with a relative percentage with a 72.4 and a canonical correlation coefficient 0.692, and Wilks' lambda = 0.385. Amongst the 30 observations used to fit the model, 22 (73.3%) were correctly classified. Against the background of non-training men, fencers were distinguished by a higher body weight (79.0 vs. 72.1 kg, t = 3.97, p < 0.001) and a higher height-weight ratio (43.21 vs. 42.46, t = 2.24, p < 0.05). Fencers' somatotypes differed from the somatotypes of the untrained (3.3-4.8-2.3 vs. 3.7-4.3-3.1). They were characterized by their higher mesomorphy (t = 2.10, p < 0.05) and lower ectomorphy (t = 3.48, p < 0.01), as well as greater adiposity (16.8 vs. 15.7%, t = 2.03, p < 0.05).

Pradhan and Nagendra (2010) investigated the effect of two yoga-based relaxation techniques, namely, cyclic meditation (CM) and supine rest (SR), using the six letter cancellation task (SLCT). The subjects consisted of 208 school students, (132 boys, 76 girls) in the age range of 13 - 16 years. The subjects were assessed on SLCT before and immediately after both yoga-
based relaxation techniques. After both practices, the total and net scores were significantly increased, although the magnitude of change was more after CM than after SR in the net scores (14.5 versus 11.31%). The net score change in the CM session was significantly larger than the change in the SR, whereas, there was no significant change in the wrong cancellation score. After either practice, the total and net scores were significantly increased, irrespective of gender and age. Both CM and SR led to improvement in performance, as assessed by SLCT, but the change caused by CM was larger than SR.

Shenbagavalli (2005) designed a study to analyze the effect of the selected yogic exercises on the Cardio Vascular Endurance and body fat percentage of the individual. To achieve this purpose, the subjects were selected randomly from the Chidambaram Chettiar Girl’s Higher Secondary School, Kottaiyur. Total of 60 students were selected randomly and they were divided into two groups of 30 each. Group I was treated as experimental and group II was considered as control group. The initial reading was taken for both the groups by measuring their height, weight, skin fold measurement and cardio vascular efficiency. The Cardio vascular endurance was measured by using the Harvard step test. For Body fat percentage skin fold measurements were taken at the biceps, triceps, sub scapular and supra-iliac sites. The experimental group was progressively introduced to the selected yogic exercises given in the National Fitness Corps syllabus published by government of India in 1965. The practice session was conducted for 30 minutes on all days except Sundays for a period of six weeks. After six weeks the post test measurements were taken. The difference in the percentage of subjects improving in the experimental group and the corresponding control group was tested for significance of difference by computing the ‘t’ ratio. It was concluded that the practice of the selected yogic exercises helped to increase the physical efficiency index derived from the Harvard step test score which was the indication of the improved cardiovascular efficiency. There was no change in the height, and weight after the experimental treatment. Body fat percentage did not show any significant reduction and changes in body density were also not found to be statistically significant.

Sixty-six college women enrolled in either of 2 beginning fencing classes or 2 health classes in the required PE program were tested by Fiburzi (1970) for muscular endurance of the legs and for agility, using selected tests. The Edgren Side Step Test and the Scott and French
Shuttle Run were used as measurements of agility, and the successive number of leg lifts and the successive number of squat thrusts that could be performed until exhaustion, using a designated cadence, were used as measurements of muscular endurance of the legs. Testing was conducted at the beginning and completion of a 5 week programme of fencing, for the experimental group, or health, for the control group. The control group did not participate in any planned activity program. The groups did not statistically differ from each other either initially or at the end of the experiment. Within-group differences showed significant (p<.05) gains in scores of all tests for the control group, and in the endurance items for the experimental group.

Lolage and Bera (2002) randomly assigned forty (n = 40) male college level Kho-Kho players, age ranged from 20 to 30 years, from Pravara College of Physical Education (Maharashtra) into equal number of subjects in experimental and control groups. Their cardiovascular efficiency was assessed by administering three tests viz., Harvard step test (r = 0.63, p < 0.01), 8 - minute Run Test (r = 0.73, p < 0.01) and 1600 M Run Test (r = 0.60, p < 0.01). The experimental group underwent training of Pranayama (viz., anuloma-viloma, Ujjayi, suryabhedana and bhasrika) in two sessions of 45 minutes each day (morning and evening), 6 days week
1 for a total period of 3 months. The subjects of control group did not participate in the above programme and were kept busy with interesting activities, separately, during experimental period. The result of ANCOVA revealed -1) treatment effects of Pranayama on three tests of cardiovascular efficiency were not identical, 2) Harvard step Test could measure CV efficiency with insufficient reliability (r = 0.30, p > 0.05) whereas the other two tests i.e., 8-Minute Run Test and 1600 M Run test could measure this variables with acceptable reliability (r = 0.82, p < 0.01; r = 0.80, p < 0.01), 3) selected Pranayama were found useful in improving CV endurance of Kho-Kho players.

The brief literature as presented above revealed that different training interventions helped to improve not only the performance of fencers but also performance of other sports. Some of the reports presented here also indicate that relaxation type of training interventions could improve performance. It was, therefore, thought that yoga brings relaxation and hence may be useful to improve health related fitness and skill of fencers. Thus, this study seems to be logical and justified.