REVIEW OF RELATED LITERATURE
CHAPTER –II
REVIEW OF RELATED LITERATURE

An attempt has been made by research scholar to locate literature related to this study. The relevant studies of specific importance are cited below.

**Ubanski et.al, (1999),** carried out a study on ten physically active, untrained, college males age (26.4 ± 5.8 yrs) received creatine (CR, 5gm creatine monohydrate +3gms dextrose) and placebo (PLA, 7gms dextrose) supplementation four times per day for 5 days in a double blind, randomised, balanced, crossover design. Performance was assessed during maximal and three repeated sub maximal bouts of iso-kinetic knee extension and hand grip exercise. CR supplementation increased time to fatigue during each of the three bouts of sub maximal knee extension and handgrip exercise when compared to PLA trials. These findings suggest that CR supplementation can increase maximal strength and time to fatigue during isometric exercise. However the implements in maximal isometric strength following CR supplementation appears to be restricted to movements performed with large muscle mass.

**Prince and Fishes (1975),** studied the effects of three weight training programme on strength endurance, girth measurements, and body composition. Seventy-six female students were randomly divided in to four groups. After the treatment period, the three experimental groups experienced significant increase in strength and muscle endurance, and significant increase in three of the seven girth measures, all skin fold
measurements and percentage body fat in comparison to the controlled group.

_Sandy et al (1998)_ carried out a study on the fat metabolism in which they compared the disappearance rate of (K₂) of an intravenous fat emulsion (10% travamulsion, icc/Kg) in thirteen endurance athlete (Mean ± SD, age 33 ± 5.6 years) and twelve sedentary men (33 ± 5.6 years) and examined the relationships between fat clearance serum lipoprotein concentrations and postheparin plasma Lipolytic activities (75 lcc/Kg). The athletes have lower triglyceride (TG).

_Utter et al (1998)_ measured the influence of diet, exercise or both on body composition and cardio respiratory fitness in obese women. Ninety-one obese subjects were randomised in to one of the four groups: diet (D) (4.19-5.44 MJ or 1200-1300 kcal/day), exercise (E) (five 45 min. session at 78.5 ± 0.5% maximum heart rate), exercise and diet (ED) and control (C). Maximal aerobic power and body composition was measured in all subjects before and after a 12 week diet intervention period. Subjects in D and ED lost 7.8 ± 0.7 and 8.1 ± 0.6Kg body mass, with no significant change for E relative to C. losses of percent body fat and fat mass were significantly greater in D and ED but not in E relative to C. The change in VO₂ max was greater in ED and E but not D when compared to C. Results indicate that moderate aerobic exercise training during a 12 week period has no discernible effects on body composition but does improve cardio-respiratory fitness in dieting obese women.
Richard et.al (1997), examined the effects of ingesting nutritional supplements designed to promote lean tissue accretion on body composition alterations during resistance training. Twenty eight resistance trained males blindly supplemented their diets with Maltodextrin(M), Gainers fuel 1000 (GF) or Phosphagain (P). No significant difference was observed in absolute or relative total body water among groups. Energy intake and body weight significantly increased in all groups combined throughout the study with no group or interaction differences observed. Dual energy x-ray absorptiometry-determined body mass significantly increased in each group throughout the study with significantly greater gains observed in GF and P groups’ Lean tissue mass (excluding bones) gain was significantly greater in P groups. While fat mass and percent body fat were significantly increased in the GF group. Results indicate that total body weight significantly increased in each group and that P supplementation resulted in significantly greater gains in Lean body mass during resistance training.

Segarson (1981), conducted a study to determine the effect three dietary treatments upon energy substrate indicators during a thirty min. treadmill run. Highly trained distance runners served as subjects. Protocols were a 12 hrs. fast. A high carbohydrate meal and oral administration of fructose. After each of the diet, each subject runs on the treadmill for 30 mins. at an intensity corresponding 60-98% of their maximum aerobic capacity. Blood samples were taken at rest, after a 8 mins. warm-up and following 11.25 and 30 mins. of the treadmill exercise. The blood samples were analysed for concentration of glucose, lactate, Insulin and tri glyceride. Expired air samples were taken at 10
mins. and 29 mins. of the treadmill exercise for determining VO₂ and CO₂ producers. Results of data analysis suggests that although glucose and lactate varied with duration of time from subject to subjects, there were no significance differences in parameters analysed on the results of existing in pre-exercise diets. It might be assumed that any of the dietary protocols studied would be equally useful.

**Telford et al (1992),** studied the effect of vitamins and mineral supplementation; Over 7 to 8 month training and competition in 82 athletes from four sports, basketball, gymnastics, rowing and swimming. Matched sub-groups were formed and a double blind design used, with subgroups being given either the supplementation or a placebo. The only significant effect of supplementation was observed in the female basketballers, in which the supplementation was associated with increased body weight, skin fold sums, and jumping ability. A significant increase in the skin fold sum was also demonstrated over the whole group as a result of supplementation.

**Wiles et.al. (1991),** investigated the effect of pre exercise protein ingestion upon the Oxygen consumption (VO₂), respiratory exchange ratio (R) and perceived exertion (PE) of the athletes during treadmill running at the intensities of approximately 60, 80, 90 and 100% of their VO₂ max. Seventeen female athletes between 17 to 22 years participated in the study. Subject completed six assessment session each being proceeded by one of the following dietary regimen; a protein ingested 3 hours before assessment (P₃), a protein solution ingested 1 hour before (P₁), and the ingestion of water 1-3 hours before assessment (B). The
subject’s VO₂, R and PE were measured at all exercise intensities using standardised procedures. The result shows that P₁ produced is significantly higher values for VO₂ (P < 0.05) at all exercise intensities and was associated with an increased PE (P < .01). The findings could have implications for athletes when considering the consumption of their pre-exercise meals, especially if performing in activities, which required the participants to exercise close to, or at their VO₂ max.

**J.B.Walker (1986)**, concluded in his study at Creighton University, that Creatine Monohydrate plus carbs (specifically Phosphogen) does indeed seem to work better than regular creatine. In fact, in a recent study, athletes who used phosphagen gained more lean mass, ran faster, jumped higher and gained more strength than athletes who used regular creatine plus carbs (phosphagen) boosted their anaerobic performance 30% more than athletes who used regular creatine.

**Paul Greenhalf (1997)**, conducted a study on a group of men and women, 32-70 years of age, and found that creatine loading at 20 gms per day for five days, followed by a 10-gm/day maintenance doze for 51 days, produced no adverse effects. However, this regimen did produce some very important benefits other than performance enhancement. There was a 22% decrease in very low density lipoprotein in VLDL cholesterol and a 23% decrease in blood triglycerides. The very low density Lipoprotein (VLDL) cholesterol and triglycerides are complementary risk factor in heart disease and adults onset diabetes. The men in the study also found a decrease in the concentration of blood
sugar after an overnight fast suggesting that creatine may improve insulin action. Earlier studies point to creatine reducing blood sugar in diabetic patients.

Mitchell et al. (1997), observed the effects of high Vs low pre-exercise carbohydrate (CHO) diet on performance during multiple sets of resistance exercise. Eleven resistance trained males performed cycle ergometry to deplete quadriceps muscle glycogen stores, followed by a 48 hour of a high (HICHO) or a low (LOCHO) CHO diet. Subject then performed five sets of each of squats, leg press and extensions (resistance = 15 RM) to failure. Blood Sample was taken before and during exercise for determination of glucose and lactate (LA). No difference in performance (repetition x weight lifted) were observed (HICHO = 15975 ± 1381 and LOCHO = 15723 ± 1231 Kg.). Blood glucose was significantly higher after exercise for HICHO compared to LOCHO (HICHO = 4.8 ±0.2 Vs LOCHO = 3.9 ± 0.2 MM. L \(^{-1}\)). No difference in lactic acid accumulation were observed. The data indicated that pre-exercise CHO status did not effects resistance exercise performance. Further, the difference in blood glucose and similarity in LA responses suggest that glycolysis was maintained in the LOCHO condition, and there may have been increased reliance on blood glucose when pre-exercise CHO status was low.

Aletssio et al. (1997), in their study supplemented vitamin (ascorbic acid) (1gm/day) for one day and two weeks on the same subjects. Plasma thibarbituric acid reacting substance (TBARS) and Oxygen redical absorbance capacity (ORAC) before and after 30 min.
sub-maximal exercise were measured. Different vitamin C supplementation did not affect resting TBARS or ORAC. Following 30min. exercise, values for TBARS were 12.6 and 33% above rest with one day and two weak of C supplementation, respectively compared to 46% higher with placebo, nor when subjects were given vitamin C supplements for 1 day or two week (4.9% and 5.73% respectively).

TBARS: ORAC, a ratio representing oxidative stress, increased 32% (P<0.05) with placebo compared to 5.8 and 25.8% with vitamin C supplement for 1 day or two weeks respectively. It was concluded that exercise induced oxidative stress was highest when subjects did not supplement with vitamin C compared to either 1 day or two weeks of vitamin C supplementation.

**Frentsos and Berer (1997),** evaluated dietary habits in 6 elite triathletes (4 male and 2 female). Analysis of seven days diet record showed mean daily energy and carbohydrate intake to be insufficient to support estimated requirements. Mean intakes of vitamins and most mineral exceeded the Recommended Dietary Allowances (RDA) except zinc and chromium, which did not meet 66% of recommended amounts individualised nutrition intervention using the diabetic food exchange system to support performance during training and competition was provided. To improve dietary intake, subjects consumed fortified nutrition supplements (Reliv,Inc.) before and after daily training. Follow up 7 days diet records showed that average energy intake and percentage of energy from carbohydrate increased, as did intakes of zinc and chromium. Triathletes performance in a short course triathlon was improved compared to a similar competition completed prior to nutrition
intervention. Following the interventions, triathletes were able to meet recommended daily energy, macronutrient and micro nutrient intakes and improved endurance performance.

Burke DG et. al. (1999), conducted a study to see the effect of continuos low dose creatine supplementation on force, power, and total work. They concluded that dietary supplementation (SUP) has become a significant part of athletic training. Studies indicate that creatine (Cr) can enhance short-duration, high intensity activities. This study examined the effect of 21 days of low dose Cr. SUP (approximately 7.7 g/day) and resistance training on force output, power output, duration of mean peak power output, and total work performed until fatigue. A double – blind protocol was used, when an individual, who was not part of any other aspect of the study, randomly assigned subjects to creatine and placebo groups. Forty-one male university athletes were randomly assigned to either Cr (n =20) or placebo (n =21) SUP. On the first and last day of the study, subjects were required to perform concentric bench press movements until exhaustion on an iso-kinetic dynamometer. The dynamometer was hard – wired to a personnel computer, which provided force, velocity, and duration measures. Force and power output until fatigue, were used to determine total work, force-time, and power-time relationships. ANOVA results revealed that the Cr subjects performed more total work until fatigue significantly greater improvements in peak force and peak power and maintained elevated mean peak power for a longer period of time. These results indicate that Cr. SUP can significantly improve factors associated with short-duration, high intensity activity.
Francaux M, Poortmans JR (1997), tested the effect of creatine supplement on the size of the extra- and intracellular compartments and on the increase of iso-kinetic force during a strength training-programme. Twenty-five healthy male subjects (age 22.0 +/- 2.9 years) participated in this experiment. Seven subjects formed the control group. They did not complete any training and did not have any dietary supplement. The eighteen other subjects were randomly divided into a creatine- (n = 8) and placebo- group (n = 10). They were submitted to a controlled strength- training programme for 42 days followed by detraining period of 21 days. Creatine and placebo were given over a period of 9 weeks. The size of the body water compartments was assessed by bio-impedance spectroscopy and the iso-kinetic force was determined during a single squat by means of an iso-kinetic dynamometer. These measurements were completed beforehand, at the end of the training period, and after the determining period. Both placebo and creatine group increased the iso-kinetic force by about 6% after the training period, showing that creatine ingestion does not induce a higher increase of the force measured during a single movement. No change in the body mass was observed in the control and placebo groups during the entire experiment period while the body mass of the creatine- group was increased by 2 kg (P < 0.001). This change can be attributed partially to an increase (P = 0.039) in the body water content (+1.11), and more specifically, to an increase (P < 0.001) in the volume the inter- cellular compartment (+0.61). Nevertheless, the relative volumes of the body water compartments remained constant and therefore the gain in the body mass cannot be
attributed to water retention, but probably to dry matter growth accompanied with a normal water volume.

**Murray J. et. al. (2001)**, conducted a study to assess the effect of creatine (Cr.) supplementation combined with resistance training on muscular performance and body composition in older men. Thirty men were randomised to receive creatine supplementation (CRE, N = 16, age = 70.4 ± 1.6 yr.) or placebo (PLA, N = 14, age = 71.1 ± 1.8 yr.), using double blind procedure. Cr. supplementation consisted of 0.3- g Cr. kg⁻¹ body weight for the first 5 d (loading phase) and 0.07- g Cr. kg⁻¹ body weight thereafter. Both groups participated in resistance training (36 sessions, 3 times per week, 3 sets of 10 repetitions, 12 exercises). Muscular strength was assessed by repetition maximum (1-RM) for leg press (LP), knee extension (KE), and bench press (BP). Muscular endurance was assessed by the maximum number of repetitions over 3 sets (separated by 1 - min rest intervals) at an intensity corresponding to 70 % baseline 1 – RM for BP and 80 % baseline 1 – RM for the KE and LP. Average power (AP) was assessed using a Biodex iso-kinetic knee extension / flexion exercise (3 sets of 10 repetitions at 60° s⁻¹ separated by 1 – min rest). Lean tissue (LTM) and fat mass were assessed using dual energy x-ray absorptiometry. **Results:** Compared with PLA, the CRE group had significantly greater increases in LTM (CRE, + 3.3 kg; PLA, + 1.3 kg), LP 1- RM (CRE, + 50.1 kg; PLA + 31.3 kg), KE 1- RM (CRE, +14.9 kg; PLA, + 10.7 kg), LP endurance (CRE, +47 reps; PLA, +32 reps), KE endurance (CRE, +21 reps; PLA +14 reps), and AP (CRE, + 26.7 W; PLA, +18 W). Changes in fat mass, fat percentage, BP 1-RM, and BP endurance were similar between groups.
**Conclusion:** Creatine supplementation, when combined with resistance training, increases lean tissue mass and improves leg strength, endurance, and average power in men of mean age 70 yr.

**Tarnopolsky, MA et al. (2001),** tested the hypothesis that a post-exercise protein-carbohydrate supplement would result in similar increases in FFM, muscle fibre area, and strength as compared with creatine monohydrate (CM), during a supervised 2-month resistance exercise training program in untrained men. Young healthy male subjects were randomised to receive either CM or glucose (N = 11; CM 10 g+ glucose 75 g [CR-CHO]) or protein and glucose (N = 8; casein 10 g+ glucose 75 g [PRO+CHO]), using double-blinded allocation. Participants performed 8 wk of whole body split – routine straight set weight training, 1 h .d$^{-1}$, 6 d wk$^{-1}$. Measurements, pre– and post training were made of fat–free mass (FFM; DEXA), total body mass, muscle fibre area, iso-kinetic knee extension strength (45 and 240$^0 \cdot s^{-1}$), and 1 repetition maximal (1 RM) strength for 16 weight training exercises. They concluded that post exercise supplementation with PRO-CHO resulted in similar increases in strength after a resistance exercise training program as compared with CR-CHO. However, the greater gains in total mass for the CR-CHO group may have implications for sport-specific performance.

**Kreider et al. (1998),** reported that 28 days of creatine supplementation (16g per day) resulted in a 1.1 kg greater gain in lean body mass in college football players undergoing off–season resistance / agility training.
Vandenberghe et al. (1997), reported that untrained females ingesting creatine (20 g per day for 4 days followed by 5 g per day for 66 days) during resistance training observed significantly greater gains in lean body mass (1.0 kg) than subjects ingesting a placebo during training. The gains in lean body mass were maintained while ingesting creatine (5 g per day) during a 10 – week period of detraining and in the four weeks after supplementation stopped.

Casey et al. (1996), investigated the ergogenic effects of short term creatine loading, and reported that work performed during sets of multiple repetition strength tests may be enhanced by creatine supplementation, typically by 5 – 15 %. In addition, one – repetition maximum strength and vertical–jump performance may also be increased with creatine supplementation, typically by 5 – 10 %. The improvement in exercise performance has been correlated with the degree in which creatine is stored in the muscle following creatine supplementation, particularly in Type II muscle fibres.