Chapter - II

Review of Related Literature
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REVIEW OF RELATED LITERATURE

An essential aspect of a research project is the review of related literature. Surveys of the literature are a crucial aspect of the planning for the study and the time spent in such a survey is a wise investment. The study of the relevant literature is a wise investment. The study of the relevant literature is an essential step to get a full picture of what has been done and said with regard to the problem under study. Such a review brings about deep insight and clear perspective of the overall field.

The review of literature has been confined to the various physical education university and internet sources. The investigator has made an attempt to bring review of research related to the present study to form the background for the present study.

Burke and Read (1987) studied carbohydrate loading techniques in a survey of 76 marathon runners. It was found that these runners practiced a variety of methods that they believed would achieve carbohydrate loading. Analysis of records of food use showed that the diets actually used by runners did not reach the level of carbohydrate specified in the high carbohydrate phase of the glycogen loading
regiments reported in the literature. It was suggested that in a free-living situation, without specific instructions or a knowledge of nutrition and food composition, runners are limited in their ability to achieve the dietary requirements of carbohydrate loading.

Burke et al., (1991) conducted dietary surveys of four groups of Australian male athletes: triathletes, marathon runners, Australian Rules football players, and Olympic weightlifters. Their training diets were assessed via a 7-day food record from which mean daily intakes of energy, macronutrients, and key micronutrients were estimated. The data were compared between groups as well as to recommendations in the literature for athlete nutrition. Results showed major differences between groups. The contribution of carbohydrate to total energy intake was greater for triathletes and marathon runners than for the other two groups. There was no difference between all four groups in the total amount of fat consumed, yet its contribution to total energy intake was significantly lower for triathletes and marathon runners. The football players and weightlifters consumed a similar fat: energy ratio as the typical Australian diet. Furthermore, the micronutrient density of the football players' diets was significantly lower than that of the other groups.
Burke et al (1993) conducted a study to find the effect of the glycemic index (GI) of postexercise carbohydrate intake on muscle glycogen storage. Five well-trained cyclists undertook an exercise trial to deplete muscle glycogen (2h at 75% of maximal O\textsubscript{2} uptake followed by four 30-s sprints) on two occasions, 1 wk apart. For 24 hr after each trial, subjects rested and consumed a diet composted exclusively of high-carbohydrate foods, with one trial providing foods with a high GI (HI GI) and the other providing foods with a low GI (LO GI). Total carbohydrate intake over the 24 h was 10g/kg of body mass, evenly drawn before exercise, immediately after exercise, immediately before each meal, and 30, 60, and 90 min post-prandially. Muscle biopsies were taken from the vastus lateralis immediately after exercise and after 24 h. When the effects of the immediate postexercise meal were excluded, the totals of the incremental glucose and insulin areas after each meals were greater (P<or = 0.05) for the HI GI meals than for the LO GI meals. The increase in muscle glycogen content after 24 h of recovery was greater (P = 0.02) with the HI GI diet (106 +/- 11.7 mmol /kg wet wt) than with the LO GI diet (71.5 +/- 6.5 mmol / kg). The results suggest that the most rapid increase in muscle glycogen content during the first 24 h of recovery is achieved by consuming foods with a high GI.
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The sports world is filled with special foods, potions, pills and powders that promise to provide the athlete with a performance edge. Advertisements and testimonials for these products claim prolonged endurance, faster recovery, increases in muscle mass and strength, losses of body fat, and resistance to fatigue, illness or infection. Such promises are attractive to athletes and coaches, especially in elite competition where very small differences separate the fame and fortune of winning from the anonymity of the rest of the field. Yet external rewards provide only part of the drive to find a ‘magic bullet’, because even non-elite and recreational athletes show considerable interest in using sports supplements.

Nicholas, (1995) examined the effects of consumption of an isotonic sports drink on endurance performance in a prolonged, intermittent, high intensity, shuttle running test which was designed to mimic activity pattern of a team sports situation like football. Nine recreational soccer players completed two exercise trials that were separated by at least seven days. In each trial subjects completed 75 minutes of exercise which was made up of five 15 minute periods of intermittent running.

Subjects consumed either an isotonic sports drink (6.9 % carbohydrate), or a non carbohydrate water placebo, immediately prior to
exercise (5 ml kg\(^{-1}\) body weight) and every 15 minutes thereafter (2 ml kg\(^{-1}\) body weight). The total volume of fluid consumed during each trial was 1167 ± 47 ml. Venous blood samples were taken at rest and at intervals during exercise in Phase 1, at the point of fatigue in Phase 2 and at intervals post exercise for biochemical analysis.

At the end of the fixed 75 minutes period of intermittent exercise, subjects who consumed the isotonic sports drink were able to continue running significantly longer during Phase 2 (p<0.05) than when the water placebo was consumed (8.9±1.5 vs.6.7±1.0 minutes).

No differences were observed between trials for blood lactate, plasma concentrations of FFA, glycerol, ammonia, serum concentrations of insulin, sodium and potassium, percent changes in plasma volume, rate of perceived exertion or heart rate. However, differences were found in post exercise values for free fatty acids at +30 (p<0.05) and +45 minutes (p<0.01); glycerol at +45 minutes (p<0.05) and insulin at +15 and +30 minutes (p<0.05). Blood glucose was higher in the sports drink trial than the placebo trial at 30 minutes and at fatigue (p<0.05) and after exercise at +15, +30 (p<0.01) and +45 minutes (<0.05).

These results demonstrate that when recreational games players drink an isotonic sports drink whilst exercising, fatigue is delayed, and
they are able to run for 33% longer than they can when consuming a water placebo.

Burke et al (1996) reported that intake of carbohydrate foods with a high glycemic index (GI) produced greater glycogen storage and greater postprandial glucose and insulin responses during 24 h of post exercise recovery than did intake of low-GI carbohydrate foods. In the present study they examined the importance of the greater incremental glucose and insulin concentrations on glycogen repletion by comparing intake of large carbohydrate meals ("gorging") with a pattern of frequent, small, carbohydrate snacks ("nibbling"), which simulates the flattened glucose and insulin responses after low-GI weighing 70.2 +/- 1.9 kg, and with a maximal triathletes [x +/- SEM: 25.6 +/- 1.5 y of age, weighing 70.2 +/- 1.9 kg, and with a maximum oxygen uptake (VO2 max) of 4.2 +/- 0.2 L/min] undertook an exercise trial (2h at 75% VO2 max followed by four 30-s sprints) to deplete muscle glycogen on two occasions, 1 wk apart for 24 h after each trial, subjects rested and consumed the same diet composed exclusively of high-GI carbohydrate foods, providing 10 g carbohydrate content eaten at 0, 4, 8 and 20h of recovery, whereas in the "nibbling" trial each of the meals was divided into four snacks and fed at hourly intervals (0-11, 20-23 h).
However, there was no significant difference in muscle glycogen storage between the two groups over the 24 h (gorging: 74.1 +/- 8.0 mmol / kg wet wt; nibbling: 94.5 +/- 14.6 mmol / kg wet wt). The results of this study suggest that there is no difference in postexercise glycogen storage over 24 h when a high-carbohydrate diet is fed as small frequent snacks or as large meals, and that a mechanism other than lowered blood glucose and insulin concentrations needs to be sought to explain the reduced rate of glycogen storage after consumption of low-GI carbohydrate foods.

Burke et al (1996) conducted a study to determine the effect of such supplementation on performance of a single-effort sprint by elite swimmers. Thirty-two elite swimmers (M = 18, F = 14, age = 17-25 years) from the Australian Institute of Sport were tested on two occasions, 1 week apart. Tests performed were 25-m, 50-m, and 100-m maximal effort sprints (electronically timed with dive start, swimmers performing their best stroke), each with approximately 10 min active recovery. A 10-s maximal leg ergometry test was also undertaken. Swimmers were divided into two groups matched for sex, stroke / event, and sprint time over 50m, and groups were randomly assigned to 5 days of Cr.H2O supplementation (4.day-1 x 5 g Cr.H2O + 2g sucrose, n = 16) or placebo (4 . day-1 x 5 g Polycose + 2 g sucrose, n=16) prior to
the second trial. Results revealed no significant differences between the
group means for sprint times or between 10-s maximal leg ergometry
power and work. This study does not support the hypothesis that creatine
supplementation enhances single-effort sprint ability of elite swimmers.

Falofield and William (1997) conducted a study to examine the
effects of consuming two different carbohydrate levels, on recovery from
prolonged running and subsequent endurance capacity.

Nine men and eight women performed two endurance treadmill
runs of 90 minutes duration at 70% VO\textsubscript{2} max (Phase 1). After four hours
recovery they ran again at 70% VO\textsubscript{2} max to exhaustion (Phase 2).
Subjects consumed water freely during Phase I, and during the four hour
recovery period drank either an isotonic sports drink (6.9% carbohydrate,
1.0g carbohydrate/kg body weight) or a concentrated carbohydrate drink
(19.3% carbohydrate; 3.0 g CHO/Kg). This was consumed at the start of
recovery and two hours later.

Run time after recovery showed no differences for either drink or
between male and female subjects. Blood glucose concentrations were
more stable during the recovery period, in the sports drink trial. It was
concluded that increasing post-exercise carbohydrate intake from 1.0g to
3.0g kg\(^{-1}\) body weight during recovery does not improve endurance capacity 1 hour later.

The results of this study indicate that drinking an isotonic sports drink in the recovery phase after exercise ensures adequate hydration and restores endurance running capacity. There is no additional performance benefit obtained by increasing the amount of carbohydrate given.

Nicholas et al (1997) designed a study to examine the influence of increased carbohydrate intake on recovery, after exhaustive intermittent running.

Six subjects completed two running tests separated by 22-hours recovery period. Each trail consisted of a 70 minute exercise, protocol a combination of running sprinting and walking speeds, designed to mimic the activity pattern typically observed in a game of football, followed by a shuttle run at mixed speeds to fatigue. Different recovery period diets were given to the runners at the end of each test.

At the end of the first trial subjects were given an isotonic sports drinks (6.9% carbohydrate) and breakfast. The energy content of the breakfast was similar for both conditions. During the 22 hour recovery either the subjects carbohydrate intake was increased or they consumed
an isocaloric diet by supplementing their normal diet with extra protein and fat.

The results of this study indicate that when a normal diet is supplemented with carbohydrate (around 10g kg\(^{-1}\) body weight), improved endurance capacity during intermittent running is seen after a 22 hr recovery period, but an isocaloric diet without the additional carbohydrate did not bring about the same improvements.

Influence of fluid intake pattern on short-term recovery from prolonged, submaximal running and subsequent exercise capacity.

Wong et. al (1998) conducted a study which was designed to establish if the pattern of consumption of an isotonic sports drink during 4 hour recovery from prolonged, submaximal running, would influence the subsequent endurance capacity.

Seven, well-trained athletes performed 2 treadmill endurance runs (seven to ten days apart) at 70% VO\(_2\) max for 90 minutes (phase 1) or until volitional fatigue. After a four hour recovery period ran at the same speed for as long as possible (Phase 2) to assess endurance capacity. During the 4th recovery period, the runners either consumed an isotonic sports drink (6.9% carbohydrate) ad libitum, or the volume of the drink
was prescribed from calculations of the body mass loss during Phase 1 (2.6% of pre-exercise body mass).

Phase 1 was completed by all subjects. In Phase 2, the exercise time to exhaustion during the prescribed intake trial was 16% longer (P<0.05) than during the ad libitum trial (69.9 + 9.1 vs 60.2 + 10.2 minutes). No significant difference in the total volume ingested was observed between treatments (1499 + 155 vs 1405 + 215 ml) but the volume consumed in the fourth hour of the recovery period was greater in the prescribed intake trial (258 + 52 vs 78 + 34 ml; P<0.05). The amount of glucose ingested in this period was therefore greater (17.8 + 3.6 vs 5.4 + 2.4 g; P<0.05). There were no differences in blood glucose, plasma insulin, free fatty acid concentration or urine volume between trials. There was a higher blood lactate concentration or urine volume between trials. There was a higher blood lactate concentration at the start of Phase 2 in the prescribed intake trial compared with the ad libitum trial (1.12 + 0.2 vs 0.94 + 0.09 mmol l-1; P<0.05).

The results of this study demonstrate that drinking a prescribed volume of an isotonic sports drink, calculated to replace body fluid losses, after prolonged exercise, restores endurance capacity to a greater extent in the prescribed intake trial (258 + 52 vs 78 + 34 ml; P < 0.05). The amount of glucose ingested in this period was also therefore greater (17.8...
There were no differences in blood glucose, plasma insulin, free fatty acid concentrations or urine Phase 2 in the prescribed intake trial compared with the ad libitum trial (1.12 + 0.2 vs 0.94 + 0.09 mmol l⁻¹; P<0.05).

The results of this study demonstrate that drinking a prescribed volume of an isotonic sports drink, calculated to replace body fluid losses, after prolonged exercise, restores endurance capacity to a greater extent than drinking ad libitum during 4 hour recovery, even though the total volumes ingested were the same between trials.

Burke et al (1998) studied the effects of the glycemic index (GI) of preexercise meals on metabolism and performance when carbohydrate (CHO) was ingested throughout exercise. Six well-trained cyclists performed three counterbalanced trails of 2-h cycling at approximately 70% of maximal oxygen uptake, followed by a performance ride of 300 kJ. Meals consumed 2 h before exercise consisted of 2 g CHO/kg body mass of either high-GI potato (HGI trial) or low-GI pasta (LGI trial), or of a low-energy jelly (Con trial). Immediately before and throughout exercise, subjects ingested a 10g/100ml. [U-14C] glucose solution for a total of 25 ml/kg body mass. Despite differences in preexercise glucose, insulin, and free fatty acids concentrations among trials, both total CHO oxidation for HGI, LGI, and
Con trials, respectively, during steady-state exercise [403 +/- 16, 376 +/- 29, and 373 +/- 24 (SE) g/2 h] and oxidation of the ingested CHO (65 +/- 6, 57 +/- 6, and 63 +/- 5 g/2 h) were similar. There was no difference in time to complete the subsequent performance ride (946 +/- 23, 954 +/- 35, and 970 +/- 26 s for HGI, LGI and Con trials, respectively). When CHO is ingested during exercise in amounts presently recommended by sports nutrition guidelines, preexercise CHO intake has little effect on metabolism or on subsequent performance during prolonged cycling (approximately 2.5 h).

Felder et al (1998) assessed the dietary practices of 10 elite female surfers. Four- and five-day food diaries completed over competition and training periods demonstrated energy intakes (mean +/- SD) of 9,468 kJ (+/- 2,007) and 8,397 kJ (+/- 1,831), respectively. This level of energy intake was less than that estimated for the requirements of surfing. Female surfers' carbohydrate intakes failed to meet the recommendations, and suboptimal zinc intake was observed with 90% of subjects not meeting the Australian RDI. Comparisons between competition and training demonstrated that carbohydrate (g and g/kg body weight) and confectionary (g) intakes were significantly higher (p < .05) and protein intake was significantly lower (p<.05) during competition. These results
show that although body fat stores were not compromised (mean 22%),
self-reported energy, carbohydrate, and nutrient intakes were marginal in
elite female surfers. Questionnaires revealed that 90% of surfers did not
have good nutritional habits while traveling, which was compounded by a
lack of knowledge of nutritional practices.

Palmer et al (1998) examined the effects of carbohydrate ingestion
on 20 km cycle time-trial (TT) performance in 14 well-trained cyclists
(11 males, 3 females, peak oxygen uptake \([\text{VO}_2 \text{ peak}]\) 4.52 +/- 0.60
1/min; values are mean +/- SD). All subjects performed two experimental
trials on their own bicycles mounted on an air-braked ergometry system
(Kingcycle). Subjects were instructed to maintain the same training and
dietary regimens before trials, which were conducted in a random order,
3-7 days apart, and at the same time of day for each subject. On the
day of a trial, subjects reported to the laboratory and ingested an
8 ml/kg body mass bolus of either a 6.8g/100ml commercial
carbohydrate-electrolyte (CHO) beverage (39 +/- g of CHO), or a
coloured, flavoured placebo. Ten minutes after finishing the drink,
subject commenced a five minute warm up at 150W before commencing
the 20 km TT. The average power output (312 +/- 40 vs 311 +/- 38 W)
and heart-rate (171 +/- 5 beats / min for CHO and placebo, respectively)
during the two rides did not differ between treatments. Accordingly, the
performance times for the two TT's were the same (27:41 +/- 1:398 min : sec, for both CHO and placebo). We conclude that the ingestion of approximately 40 g of carbohydrate does not improve maximal cycling performance lasting approximately 30 min, and that carbohydrate availability, in the form of circulating blood glucose, does not limit high-intensity exercise of this duration.

Hargreaves et al (1999) conducted a study to examine the influence of beverage sodium content on glucose bioavailability during exercise, six trained men were studied during 30 min of cycle ergometer exercise at 65 percent VO₂ max. Immediately prior to exercise, subjects ingested 400 ml of a 10 percent glucose solution containing 100 μCi of D-(3-3H)-glucose, with a sodium concentration of either 0,25 or 50 mmol.l-1. Trials were conducted in the morning after an overnight fast and in randomised order at least 1 wk apart. Blood samples were obtained from a forearm vein before and during exercise and subsequently analysed for plasma glucose and 3H-glucose activity and blood lactate. No differences in oxygen uptake, heart rate, or blood lactate were observed between trials. Resting plasma glucose levels were not different between trials. The increases in plasma glucose and the plasma accumulation of 3H-glucose were similar in the three trials. These results indicate that alterations in beverage sodium content, from 0-50 mmol.l-1,
have no effect on glucose bioavailability, as measured by increases in plasma glucose and 3H-glucose activity during moderate intensity exercise.

Hawley et al (2000) determined the effect of altering substrate availability on metabolism and performance during intense cycling. Seven highly trained men ingested a random order of three isoenergetic meals 90 min before cycling at 80% maximal oxygen uptake (VO2max) for 20 min (about 310 W), followed by a 600 kJ time trial lasting about 30 min. Meals consisted of either 1.2 g saturated fat/kg body mass (BM) with 3500 U heparin intravenously (HIFAT) to elevate circulating plasma free fatty acid (FA) concentration, 2.5 g carbohydrate/kg BM (CHO) to elevate plasma glucose and insulin concentrations or 2.5 g carbohydrate +20 mg nicotinic acid/kg BM (NA) to suppress lipolysis and reduce free FA concentration. HIFAT elevated free FA concentration (HIFAT 1.3 (sem 0.2), CHO 0.2 (sem 0.1), NA 0.1 (sem 0.1) mm; P < 0.001) lowered the RER (HIFAT 0.94 (sem 0.01), CHO 0.97 (sem 0.01), NA 0.98 (sem 0.01); P < 0.01) and increased the rate of fat oxidation (HIFAT 24 (sem 3), CHO 12 (sem 2), NA 8 (sem 3) micromol/kg per min; P < 0.01) during the 20 min ride. Marked differences in fat availability and fuel utilisation, however, had little effect on performance in the subsequent
time trial (HIFAT 320 (sem 16), CHO 324 (sem 15), NA 315 (sem 13) W). They concluded (1) increased fat availability during intense cycling increases the rate of fat oxidation; but (2) the reduction in the rate of carbohydrate oxidation in the presence of high circulating plasma free FA is unlikely to enhance intense exercise performance lasting about 1 h; (3) substrate selection during intense (about 80% VO2max) exercise is dominated by carbohydrate oxidation.

Burke et al (2000) conducted a study in which, eight well-trained cyclists consumed a random order of a high-carbohydrate (CHO) diet (9.6 g. kg(-1). day(-1) CHO, 0.7 g. kg(-1). day(-1) fat; HCHO) or an isoenergetic high-fat diet (2.4 g. kg(-1). day(-1) CHO, 4 g. kg(-1). day(-1) fat; Fat-adapt) while undertaking supervised training. On day 6, subjects ingested high CHO and rested before performance testing on day 7 [2 h cycling at 70% maximal O(2) consumption (SS) + 7 kJ/kg time trial (TT)]. With Fat-adapt, 5 days of high-fat diet reduced respiratory exchange ratio (RER) during cycling at 70% maximal O(2) consumption; this was partially restored by 1 day of high CHO [0.90 +/- 0.01 vs. 0.82 +/- 0.01 (P < 0.05) vs. 0.87 +/- 0.01 (P < 0.05), for day 1, day 6, and day 7, respectively]. Corresponding RER values on HCHO trial were [0. 91
During SS, estimated fat oxidation increased [94 +/- 6 vs. 61 +/- 5 g (P < 0.05)], whereas CHO oxidation decreased [271 +/- 16 vs. 342 +/- 14 g (P < 0.05)] for Fat-adapt compared with HCHO. Tracer-derived estimates of plasma glucose uptake revealed no differences between treatments, suggesting muscle glycogen sparing accounted for reduced CHO oxidation. Direct assessment of muscle glycogen utilization showed a similar order of sparing (260 +/- 26 vs. 360 +/- 43 mmol/kg dry wt; P = 0.06). TT performance was 30.73 +/- 1.12 vs. 34.17 +/- 2.48 min for Fat-adapt and HCHO (P = 0.21). These data show significant metabolic adaptations with a brief period of high-fat intake, which persist even after restoration of CHO availability. However, there was no evidence of a clear benefit of fat adaptation to cycling performance.


Forty-three competitive endurance cyclists (2 female, 41 male) performed two simulated 40-km time trials on an air-braked ergometer. In the first trial they ingested water to establish baseline performance (mean power 265 +/- 46 W for 58 +/- 4 min, mean +/- SD). For the second trial 6-8 d later they were randomized to two groups: one group ingested 16
mL x kg(-1) of a drink containing 7.6 g x 100 mL(-1) carbohydrate; the other ingested an indistinguishable noncaloric placebo drink. Cyclists in each group were further randomized to three subgroups according to whether they were told the drink contained carbohydrate, placebo, or either (not told).

Changes in mean power in the second trial were: told carbohydrate, 4.3 +/- 4.8%; told placebo, 0.5 +/- 5.8%; and not told, -1.1 +/- 8.5%. The difference between the told-carbohydrate and told-placebo groups was 3.8% (95% likely range 7.9 to -0.2%). The change in performance in the not-told group was more variable than that of the told groups by a factor of 1.6 (2.6 to 1.0). The real effect of carbohydrate was a slight reduction in power of 0.3% (4.4 to -3.8%).

(a) The placebo effect of a potentially ergogenic treatment during unblinded laboratory time trials lasting approximately 1 h is probably a small but worthwhile increase in endurance power. (b) Blinding subjects to the treatment increases individual differences in endurance effort, which may reduce precision of performance outcomes in controlled trials.

Burke et. al (2000) evaluated the effect of carbohydrate (CHO) loading on cycling performance that was designed to be similar to the demands of competitive road racing. Seven well-trained cyclists
performed two 100-km time trials (TTs) on separate occasions, 3 days after either a CHO-loading (9 g CHO. Kg body mass (-1) day (-1)). A CHO breakfast (2g CHO/kg body 1). h(-1) was consumed during the TTs to optimize CHO availability. The 100-km TT was interspersed with four 4-km and five 1-km sprints. CHO loading significantly increased muscle glycogen concentrations (572 +/- 107 vs. 485 +/- 128 mmol/kg dry wt did not differ between trials, nor did time to complete the TTs (147.5 +/- 10.0 and 149.1 +/- 11.0 min; P = 0.4) or the mean power output during the TTs (259 +/- 40 and 253 +/- 40 W, P = 0.4). This placebo-controlled study shows that CHO loading did not improve performance of a 100-km cycling TT during which CHO was consumed. By preventing detrimental effects on performance of lower preexistence muscle and liver glycogen concentrations. Alternatively, part of the reported benefit of CHO loading on subsequent athletic performance could have resulted from a placebo effect.

Kreider et al (2000) conducted a study to examine the effects of creatine supplementation on the incidence of injury observed during 3-years of NCAA Division IA college football training and competition. In an open label manner, athletes participating in the 1998–2000 football seasons elected to take creatine or non-creatine containing supplements
following workouts/practices. Subjects who decided to take creatine were administered 15.75 g of creatine for 5 days followed by ingesting an average of 5 g/day thereafter administered in 5–10 g doses. Creatine intake was monitored and recorded by research assistants throughout the study and ranged between 34–56% of players during the course of the study. Subjects practiced or played in environmental conditions ranging from 8–40°C (mean 24.7 ± 9°C) and 19–98% relative humidity (49.3 ± 17%). Injuries treated by the athletic training staff were recorded and categorized as cramping, heat/dehydration, muscle tightness, muscle strains/pulls, non-contact joint injuries, contact injuries, and illness. The number of missed practices due to injury/illness was also recorded. Data are presented as the total number of treated injuries for creatine users/total injuries observed and percentage occurrence rate of injuries for creative users for all seasons. The incidence of cramping (37/96, 39%), heat/dehydration (8/28, 36%), muscle tightness (18/42, 43%), muscle pulls/strains (25/51, 49%), non-contact joint injuries (44/132, 33%), contact injuries (39/104, 44%), illness (12/27, 44%), number of missed practices due to injury (19/41, 46%), players lost for the season (3/8, 38%), and total injuries/missed practices (205/529, 39%) were generally lower or proportional to the creatine use rate among players. Creatine
supplementation does not appear to increase the incidence of injury or cramping in Division IA college football players.

Comprehensive review concludes that high protein diets don’t cause kidney damage by Dr. Paul Cribb Ph.D. CSCS. AST Director of Research. In recent years, the general public and the medical community have taken a leaf out of the bodybuilder’s hand book. High-protein diets have been extremely popular among many health-conscious groups. This is due to an increasing amount of research that suggests high-protein diets provide a number of health benefits such as stabilized blood sugar levels, improved cholesterol profiles, reduced appetite, preservation of lean tissue and more effective fat loss. However, some physicians are still concerned about the safety of a high protein intake over the long term.

One of these concerns is the effects of a high protein diet on kidney function. The kidneys are responsible for eliminating the waste products of protein metabolism. However, a recent, conclusive review of the scientific literature on this topic has shown that high-protein diets have little or no effect on kidney function.

There is no research that is able to link increased protein intake to kidney damage or disease. Obviously, people with a pre-existing kidney
condition need to take caution with their dietary protein intake. However, a high protein intake does not damage a healthy kidney.

Cribb (2001) The research team here at AST has known for some time that the quality of protein athletes consume has a tremendous impact on exercise performance and ability to build muscle. This research study demonstrated that the type of protein you consume can affect the anabolic (muscle building) hormone profile your body produces.

This study sought to evaluate the effects of meat protein in the diet or a soybean protein. Performed by researchers at Deakin University in Melbourne Australia, a randomized crossover dietary intervention design was utilized where 42 healthy adult males aged 35-62 years followed the same isoenergetic diet (equal amount of calories) but consumed either 150g lean meat or 290g tofu daily for 4 weeks. The diets provided an equivalent amount of macronutrients with only the source of protein differing between the two diets. After a 2-week interval the men were switched to the diet containing the other protein that they had not consumed previously. Fasting blood samples were taken from all the subjects and concentrations of testosterone, dihydrotestosterone, androstanediol glucuronide, oestradiol and sex hormone-binding globulin (SHBG) were assayed.
After the men had completed a 4 week stint of each type of protein, the data revealed that blood concentrations of the sex hormones did not differ after the two diets, but the mean testosterone:oestradiol value was 10% higher after the meat diet. SHBG levels were found to be 8.8% higher and the testosterone:oestradiol ratio to be significantly lower on the tofu diet. From these results it appears that replacement of a meat containing diet with a soybean protein, actually decreases the amount of circulating biologically-active anabolic hormones. Decreasing the level of biologically-active anabolic hormones within the body won't do your muscle building/fat loss attempts any good.

Glycemic Load, Weight loss and cardiovascular disease risk Jennie C. Brand – Noyer, conducted a study to improve changes in body composition and cardio-vascular risk factors. The study compares a conventional reduced fat, high carbohydrate diet with 3 means of reducing glycemic load.

More recently there has been interest in low glycemic index and high protein diets with some evidence that these produce better fat loss and improvement in cardiovascular risk factors. This trial aims to evaluate these different approaches and compare the outcomes over 12 weeks. Major outcomes are weight loss, body composition change, blood
lipids change, measures of glucose homeostasis, insulin resistance, leptin and CRP.

Staudacher et al, (2001) determined the effect of a high-fat diet and carbohydrate (CHO) restoration on substrate oxidation and glucose tolerance in 7 competitive ultra-endurance athletes (peak oxygen uptake [VO (2 peak)] 68 +/- 1 ml x kg(-1) x min(-1); mean +/- SEM). For 6 days, subjects consumed a random order of a high-fat (69% fat; FAT-adapt) or a high-CHO (70% CHO; HCHO) diet, each followed by 1 day of a high-CHO diet. Treatments were separated by an 18-day wash out. Substrate oxidation was determined during submaximal cycling (20 min at 65% VO (2 peak)) prior to and following the 6 day dietary interventions. Fat oxidation at baseline was not different between treatments (17.4 +/- 2.1 vs. 16.1 +/- 1.3 g x 20 min(-1) for FAT-adapt and HCHO, respectively) but increased 34% after 6 days of FAT-adapt (to 23.3 +/- 0.9 g x 20 min(-1), p < .05) and decreased 30% after HCHO (to 11.3 +/- 1.4 g x 20 min(-1), p < .05). Glucose tolerance, determined by the area under the plasma [glucose] versus time curve during an oral glucose tolerance (OGTT) test, was similar at baseline (545 +/- 21 vs. 520 +/- 28 mmol x L(-1) x 90 min(-1)), after 5-d of dietary intervention (563 +/- 26 vs. 520 +/- 18 mmol x L(-1) x 90 min(-1)) and after 1 d of high-CHO (491 +/- 28 vs. 489 +/- 22 mmol x L(-1) x 90 min(-1) for FAT-
adapt and HCHO, respectively). An index of whole-body insulin sensitivity (S(1), 10000/divided by fasting [glucose] x fasting [insulin] x mean [glucose] during OGTT x mean [insulin] during OGTT) was similar at baseline (15 +/- 2 vs. 17 +/- 5 arbitrary units), after 5-d of dietary intervention (15 +/- 2 vs. 15 +/- 2) and after 24 h of CHO loading (17 +/- 3 vs. 18 +/- 2 for FAT-adapt and HCHO, respectively). We conclude that despite marked changes in the pattern of substrate oxidation during submaximal exercise, short-term adaptation to a high-fat diet does not alter whole-body glucose tolerance or an index of insulin sensitivity in highly-trained individuals.

Carey and Staudacher, (2001) determined the effect of fat adaptation on metabolism and performance during 5 h of cycling in seven competitive athletes who consumed a standard carbohydrate (CHO) diet for 1 day and then either a high-CHO diet (11 g. kg(-1)x day(-1) CHO, 1 g x kg(-1) x day(-1) fat; HCHO) or an isoenergetic high-fat diet (2.6 g x kg(-1) x day(-1) CHO, 4.6 g x kg(-1) x day(-1) fat; fat-adapt) for 6 days. On day 8, subjects consumed a high-CHO diet and rested. On day 9, subjects consumed a preexercise meal and then cycled for 4 h at 65% peak O(2) uptake, followed by a 1-h time trial (TT). Compared with baseline, 6 days of fat-adapt reduced respiratory exchange ratio (RER) with cycling at 65% peak O(2) uptake [0.78 +/- 0.01 (SE) vs. 0.85 +/-
However, RER was restored by 1 day of high-CHO diet, preexercise meal, and CHO ingestion (0.88 +/- 0.01; P < 0.05). RER was higher after HCHO than fat-adapt (0.85 +/- 0.01, 0.89 +/- 0.01, and 0.93 +/- 0.01 for days 2, 8, and 9, respectively; P < 0.05). Fat oxidation during the 4-h ride was greater (171 +/- 32 vs. 119 +/- 38 g; P < 0.05) and CHO oxidation lower (597 +/- 41 vs. 719 +/- 46 g; P < 0.05) after fat-adapt. Power output was 11% higher during the TT after fat-adapt than after HCHO (312 +/- 15 vs. 279 +/- 20 W; P = 0.11). In conclusion, compared with a high-CHO diet, fat oxidation during exercise increased after fat-adapt and remained elevated above baseline even after 1 day of a high-CHO diet and increased CHO availability. However, this study failed to detect a significant benefit of fat adaptation to performance of a 1-h TT undertaken after 4 h of cycling.

Burke and Hawley (2002) conducted a study to find out the effects of short-term fat adaptation on metabolism and performance of prolonged exercise.

The concept of manipulating an individuals habitual diet before an exercise bout in an attempt to modify patterns of fuel substrate utilization and enhance subsequent exercise capacity is not new. Modern studies have focused on nutritional and training strategies aimed to optimize endogenous carbohydrate (CHO) stores while simultaneously maximizing
the capacity for fat oxidation during continuous, submaximal (60-70% of maximal \(O_2\) uptake \([VO_{2\text{max}}]\)) exercise. Such "nutritional periodization" typically encompasses 5-6 d of a high-fat diet (60-70% E) followed by 1-2 d of high-CHO intake (70-80% E; CHO restoration). Despite the brevity of the adaptation period, ingestion of a high-fat diet by endurance-trained athletes results in substantially higher rates of fat oxidation and concomitant muscle glycogen sparing during submaximal exercise compared with an isoenergetic high-CHO diet. Higher rates of fat oxidation during exercise persist even under conditions in which CHO availability is increased, either by having athletes consume a high-CHO meal before exercise and/or ingest glucose solutions during exercise. Yet, despite marked changes in the patterns of fuel utilization that favor fat oxidation, fat-adaptation/CHO restoration strategies do not provide clear benefits to the performance of prolonged endurance exercise.

Minehan et al (2002) conducted a study to find out whether a palatable flavour enhance fluid intake during exercise; however, a fear of excessive kilojoule intake may deter female athletes from consuming a sports drink during training sessions. In order to examine this issue, they monitored fluid balance during 9 separate training sessions undertaken by junior elite female netball players \((n = 9)\), female basketball players \((n = 7)\), and male basketball players \((n = 8)\).
The beverages tested were water, a regular carbohydrate-electrolyte beverage (6.8% CHO, 18.7 mmol/L Na, 3.0 mmol/L K, 1130kJ/L), and an identical tasting, low kilojoule electrolyte beverage (1% CHO, 18.7 mmol/L Na, 3.0 mmol/L K, 170 kJ/L). Each subject received each of the 3 drinks at 3 separate training sessions, in a randomized, balanced order. Subjects were aware of the beverage provided. Change in body mass over the training session was used to estimate body fluid change, while voluntary fluid intake was determined from the change in weight of drink bottles used in each session. The overall fluid balance on drinks classified as regular, low kilojoule and water was -11.3 ml/h (95%CI -99.6 to 77.0), -29.5 ml/h (95%CI -101.4 to 42.5) and -156.4 ml/h (95%CI - 215.1 to -97.6), respectively. The results indicate that, overall, better fluid balance was achieved using either of the flavoured drinks compared to water. These data confirm that flavoured drinks enhance fluid balance in a field situation, and suggest that the energy content of the drink is relatively unimportant in determining voluntary fluid intake.

Cox et al (2002) investigated the effects of acute creatine (Cr) supplementation on the performance of elite female soccer players undertaking an exercise protocol simulating match play. On two occasions, 7 days apart, 12 players performed 5 x 11 – min exercise testing blocks interspersed with 1 min of rest. Each block consisted of 11
all-out 20-m running sprints, 2 agility runs, and 1 precision ball-kicking drill, separated by recovery 20-m walks, jogs, and runs. After the initial testing session, subjects were assigned to either a CREATINE (5g of Cr, 4 times per day for 6 days) or a PLACEBO group (same dosage of a glucose polymer) using a double-blind research design. Body mass (BM) increased (61.7 ± 8.9 to 62.5 ± 8.9 kg, p<0.01) in the CREATINE group; however, no change was observed in the PLACEBO group (63.4 ± 2.9 kg to 63.7 ± 2.5 kg). No CREATINE group achieved faster post-supplementation times in sprints 11, 13, 14, 16, shooting was unaffected in both groups. In conclusion, acute Cr supplementation improved performance of some repeated sprint and agility tasks simulating soccer match play, despite an increase in BM.

Cribb (2002). Conducted a study and examined the effects of two supplements whey isolate and casein protein on strength, body composition and plasma glutamine levels during a 10-week intense resistance training program.

In a randomized, double-blind protocol thirteen resistance-trained males (mean ± SD age:25.5 ± 6.68yr; height:179.67 ± 7.94cm; weight:83.97 ± 4.98kg,) supplemented their normal diet with either a 100% whey isolate or casein protein supplement (1.5gms/kg body
wt/day) for 12 weeks. To ensure normal eating patterns were maintained, written three-day food recordings were completed by the bodybuilders throughout the study. Compliance to the supplement intake and nutrition recordings was 100%. Strength was assessed by 1-RM in the barbell bench press, squat and lat-pull down. Body composition was assessed by DEXA QDR 4500. Plasma glutamine levels were determined by the enzymatic method with spectroscopic detection. All assessments occurred in the week before (week 1) and the week after training (week 12).

The whey isolate group achieved a significantly greater gain (P < 0.01) in lean mass than the casein group (4.99 ± 0.25 vs. 0.81 ± 0.43 kg for whey and casein groups, respectively). While both groups significantly increased (P < 0.05) strength in the three exercises assessed, the whey isolate group made greater strength increases (P < 0.05) in all three exercises compared to the group supplementing with casein. The whey isolate group also showed a significantly greater (P < 0.05) change in fat mass (-1.46 ± 0.52) than the casein group (+0.19 ± 0.27 kg). Plasma glutamine levels, pre- and post-training, did not change in either group.

Braakhuis et al (2003). A routine activity for a sports dietitian is to estimate energy and nutrient intake from an athlete's self-reported food intake. Decisions made by the dietitian when coding a food record are a source of variability in the data. The aim of the present study was to
determine the variability in estimation of the daily energy and key nutrient intakes of elite athletes, when experienced coders analysed the same food record using the same database and software package. Seven-day food records from a dietary survey of athletes in the 1996 Australian Olympic team were randomly selected to provide 13 sets of records, each set representing the self-reported food intake of an endurance, team, weight restricted, and sprint/power athlete. Each set was coded by 3-5 members of Sports Dietitians Australia, making a total of 52 athletes, 53 dietitians, and 1456 athlete-days of data. They estimated within- and between-athlete and dietitian variances for each dietary nutrient using mixed modeling, and we combined the variances to express variability as a coefficient of variation (typical variation as a percent of the mean). Variability in the mean of 7-day estimates of a nutrient was 2- to 3-fold less than that of a single day. The variability contributed by the coder was less than the true athlete variability for a 1-day record but was of similar magnitude for a 7-day record. The most variable nutrients (e.g. vitamin C, vitamin A, cholesterol) had ~3-fold more variability than least variable nutrients (e.g. energy, carbohydrate, magnesium). These athlete and coder variabilities need to be taken into account in dietary assessment of athletes for counselling and research.
Cribb (2004) a study has showed that healthy adults who followed a calorie-restricted diet and included 3-4 servings of dairy foods each day, lost more body fat than those who consumed a low intake of dairy foods.

Those that consumed more dairy protein rich foods lost an average of 24 pounds, significantly more than those who consumed few or no dairy protein-rich foods. Dairy proteins are shown to enhance fat metabolism from the abdominal region. The mix of essential nutrients in dairy proteins, including calcium and a high dose of essential amino acids appears to speed up metabolism and improve the body’s ability to burn fat.

Lead researcher Michael Zemel, Professor of Nutrition at the University of Tennessee suggests that the practical significance of this research is simple; fat loss is quicker on diets that include at least three servings of dairy proteins every day. VP2 Whey Isolate and Ny-Tro PRO-40 contain the finest quality dairy proteins so be sure to make them a staple of your bodybuilding diet.

Paddon Jones, et. al (2005) examined the effects of ingesting a carbohydrate (30 g) and amino acid supplement (15 g of essential amino acids) (CAA) or a meal on protein synthesis. Thirteen men aged 28 to 48 years age were randomly divided in two treatment groups: 1) CAA = 36:1::10 yrs and 2) Control = 38:1::8 yr. The CAA and meal were
designed to be similar in amino acid content and were administered periodically throughout an 18 hour period. Throughout the day blood and muscle tissue/samples were collected in order to assess anabolism. The inclusion of a CAA supplement into a normal diet resulted in a great anabolic stimulus than the meal treatment as indicated by the 25% increase in protein synthesis rate. Additionally, the consumption of only meals throughout the 16 hour study period resulted in a negative net protein balance, while adding frequent CAA supplements resulted in a positive balance. The researchers suggested that the CAA supplement was more effective in maximizing protein synthesis rates as a result of the speed with which the supplement is digested and taken up into the system. Based upon these findings it may be recommended that athletes consume some sort of CAA supplement throughout the day in order to maximize the muscular adaptations to their training regimes and maintain a positive protein balance.

Mero et al (2005) conducted a study to determine the effects of two weeks of bovine colostrums (the nutrient–rich, pre-milk fluid that is secreted by female mammals to nourish their young) supplementation on muscle proteins, serum amino acids, and strength performance. Twelve male subjects with a mean age of 27-1:5 yrs participated in this study. The study was performed in a double blind placebo
controlled method with subjects either receiving 20 mg of a placebo or bovine colostrums consumed in four equal dosages spaced throughout the day. The bovine colostrums contained 62 mg of free amino acids of which 25 mg were essential. Over the course of the two week study, subjects were required to eat from their standard diet and maintain their current level of exercise. When comparing the weeks of bovine colostrums supplementation and placebo supplementation, there were no differences in the caloric intake and carbohydrate, fat, or protein content of the subject's diets. Results indicated that the addition of bovine colostrums in the diet did result in greater levels of circulating amino acids in the blood. However, no difference was noted in the net protein balance of the bovine colostrums group, even though protein synthesis and breakdown were increased when compared to the placebo group. Based upon these results the authors concluded that the addition of bovine colostrum had no effect on strength performance or net protein balance in young men.

Koopman et al (2005) examined effects of (CHO), carbohydrate + protein (CHO + Pro) and carbohydrate + protein + leucine (CHO + Pro + Leu) on post exercise protein synthesis with eight untrained men (22.3-1:.0.9 yr). After the completion of a 45 minute resistance training bout, eight men consumed one of the three supplement drinks. Insulin
levels increased in response to all three treatments (CHO < CHO + Pro < CHO + Pro + Leu). The CHO + Pro + Leu supplement resulted in the highest protein synthesis rate and whole body protein balance during a six hour post exercise period. The results of this study suggested that a combination of carbohydrate, protein, and leucine maximize post-resistance training protein synthesis in college aged men. While not investigated in the present study the supplement stimulated increases in protein synthesis could ultimately either improve athletic performance or result in magnified hypertrophy.

Burke et al. (2005) conducted a study to find out the effect of carbohydrate intake on half-marathon performance of well-trained athletes.

Eighteen highly-trained runners ran two half marathons in mild environmental conditions, 3 wk apart, consuming either 426 ± 227 mL of a flavored placebo drink (PLACEBO) or an equivalent volume of water (386 ± 185 mL) and a commercial gel (GEL) supplying 1.1 ± 0.2 g/kg body mass (BM) carbohydrate (CHO). Voluntary consumption of this fluid was associated with a mean BM change of ~ 2.4%. Runners performed better in their second race by 0.9% or 40 s (P = 0.03). Three
runners complained of gastrointestinal discomfort in GEL trial, which produced a clear impairment of half-marathon performance by 2.4% or 105 s (P = 0.03). The effect of GEL on performance was trivial: time was improved by 0.3% or 14 s compared with PLACEBO (P = 0.52). Consuming the gel was associated with a 2.4% slower time through the 2 x 200 m feed zone; adding a trivial ~ 2 s to race time. Although benefits to half marathon performance were not detected, the theoretical improvement during 1-h exercise with CHO intake merits further investigation.


The results of an interesting study presented recently at the European College of Sports Science’s Annual meeting have shown that the addition to protein to a carbohydrate drink provided more efficient rehydration after exercise.

In this study, dehydration was induced in a group of cyclists during exercise and rehydration commenced with either a carbohydrate solution (8%), the addition of a small amount of protein (6 grams) to this solution or water alone. Results showed that the protein-carb combo ensured better rehydration than the carb drink or water alone. This finding has
important implications for all athletes. A small dose of easily absorbed protein such as VP2 whey isolate to a standard carbohydrate sports drink will not only promote rehydration, it will also stimulate better recovery. The small dose of protein used in this study has been shown in previous research to stimulate muscle protein synthesis. Simulating a high rate of protein synthesis after exercise is the key to better recovery.

Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden (2005) conducted a study to examine the effect of dietary protein supplements on high blood pressure (BP)

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Genetics home reference related topics: Heart Diseases Vascular Diseases

Medline Plus Related topics: Heart diseases, High Blood Pressure, Vascular Diseases, Proteins, soy

Official Title : Clinical Trial of Dietary Protein on Blood Pressure
- Difference in systolic and diastolic BP between each supplement phase (measured at week 30) and measures

- Differences in fasting plasma insulin levels

- Glucose levels

- Leptin levels

- Homocysteine levels

- Serum lipid levels and

- Waist and hip circumstances (measured at week 30)

The results from this study may provide justification for recommending protein supplements for the prevention and treatment of high BP in the general population.

Systolic BP of 120-159 mm Hg and diastolic BP of 80-5 mm Hg. Participants received either 40 grams of soy protein, 40 grams of milk protein, or 40 grams of complex carbohydrates (control) daily for eight weeks. Following those eight weeks, participants will not receive any supplements for three weeks. Participants will then repeat the process with the other two supplements. The primary outcome will be difference in BP during the soy protein supplementation, milk protein
supplementation, and placebo control phases. In addition, changes in serum lipids; waist and hip circumstances; and fasting plasma insulin, glucose, leptin, and homocysteine will be monitored and examined in terms of impact on BP level.

Cribb (2005) suggest that adding whey protein to the end of meal may result in better blood glucose control during the day.

Blood glucose fluctuations cause people to get irritated, hungry and crave foods they usually wouldn’t/shouldn’t eat. Fluctuating blood glucose levels not only make sticking to a calorie-controlled diet a tough task, it promotes muscle breakdown and fat storage. These are two things a person must avoid if they’re after a better looking physique. Conversely, maintaining steady blood glucose levels reduce hunger, preserve muscle and promote better fat metabolism.

This research showed that adding a dose of high quality whey protein to breakfast and lunch, resulted in steadier blood glucose control. Scientists aren’t sure why this benefit occurs but it’s probably due to a high concentration of amino acids that evoke an insulin response and their effect on hormones that control blood glucose regulation. Either way, there is increasing evidence that suggests adding one serving of VP2
Whey Isolate to several meals throughout the day will promote better fat loss.

Cribb (2005) demonstrated the benefits of protein supplementation to speed recovery and enhance the effects of exercise training are beginning to filter down to the United States armed forces. A study completed by Iowa State University on U.S Marine Corps has demonstrated the power of protein supplementation after intense exercise.

Soldiers given a protein drink after each day’s fitness training resulted in 37% fewer medical visits for illnesses, muscle and joint problems and 30% fewer visits for heat-stress related effects. Post-exercise protein shakes are a must for bodybuilders who are concerned with maximum muscle gains. However, this research also suggests that a post-workout protein shake will speed recovery and maintain general health after partaking in a variety of vigorous sports of activities. VP2 whey isolate is state-of-the-art in protein supplementation, it is shown in research to enhance fat loss and muscle gains during intense exercise.

The effect of VP2 whey isolate and resistance training on strength, body composition and plasma glutamine (2005) athletes from a variety of sports desire an increase in muscle mass, and strength. This study
examined the effects of VP2 whey isolate and micronized creatine supplementation on force production and fatigue in whole muscle fibers.

Female Sprague-Dawley rats were randomly separated into 3 groups: 1) control (n = 10), 2) creatine supplemented (n = 8), and 3) VP2 supplemented (n = 8). The rats were fed normal or supplemented chow for a period of 6 weeks. After the supplementation period, the animals were anaesthetized and both the fast-twitch muscle – the extensor digitorum longus (EDL) and the slow-twitch muscle – the soileus were removed and tested.

Muscle taken from rats supplemented with micronized creatine and VP2 whey isolate generated highly significant absolute and specific forces (P<0.001). The improvements in force production caused by supplementation were witnessed in both the EDL (fast-twitch) and soleus (slow-twitch) muscles. Furthermore, animals treated with micronized creatine exhibited a 17% improvement in fatigue recovery in the EDL muscle. Supplementation with micronized creatine also increased the percentage of type-2a fibers in the soleus muscle compared to controls (P<0.05). Fast-twitch muscles are utilized predominantly during endurance exercise. The major finding of this investigation was that supplementation with either VP2 whey isolate or micronized creatine significantly increased muscle force output in fast-twitch and slow-twitch
muscle. Micronized creatine supplementation also improved the influence of exercise training.

Supplementation with VP2 whey isolate and micronized creatine appears to enhance force production in both muscle fiber types. Therefore, these nutritional supplements show the potential to enhance work capacity in short term exercise requiring strength and explosive power, as well as longer duration exercise.

The major finding of this study was that a 100% whey isolate protein supplement was more effective at increasing muscle mass and strength and decreasing fat mass than a casein protein supplement in resistance trained athletes. Both types of protein appear to prevent a decline in plasma glutamine levels that have previously been reported with intense exercise training. Supported by AST Sports Science.

Cribb (2006) have reported that supplementation with whey protein had a direct effect on fat metabolism, unlike other protein sources like casein and soy. The rodents fed whey protein showed a decrease in fatty acid synthesis in the liver and increased fat utilization in muscle. Most interestingly, these results were similar to that observed in rodents placed on an exercise program.
Aside from whey protein’s unique capacity to stimulate muscle protein synthesis, the researchers suggested that whey protein may also improve fat metabolism that may result in a reduction in body fat during exercise. This theory is in line with the research we’ve completed on VP2 Whey Isolate with bodybuilders undergoing intense resistance training.

In one of the clinical trials completed on VP2 Whey Isolate, he compared supplementation with VP2 (1.5g/kg/day) alongside a standard (but high quality) protein. The bodybuilders provided with VP2 not only gained significantly more muscle mass they also demonstrated a significant decrease in body fat.

This beneficial effect on body composition from VP2 was not detected in the group given the protein placebo, and was achieved without modification of a healthy, bodybuilding diet.

Growth factors play crucial roles in the synthesis of muscle tissue. One growth factor in particular, insulin-like growth factor-1 (IGF-1), is of great importance to bodybuilders as it is involved in the expression of a complete spectrum of muscle-specific proteins. Scientists have known for a while that IGF-1 production is directly correlated to nitrogen balance. However, the production of this growth factor is also thought to be
closely related to the quality and quantity of an individual's protein intake. Now, the results of a recent study have confirmed this.

In this study, a liquid protein supplement (providing 42 grams of protein and 24 grams of carbohydrate) was given to a group of healthy participants during an intense exercise program that consisted of cardio and weight training exercise. Those participants given the protein supplement demonstrated higher circulating IGF-1 levels after 6 months of training, whereas a similar group given an equivalent dose of carbohydrate showed a decrease in this growth factor. The results of this six month investigation suggest that protein quality and quantity have a profound influence on circulating IGF-1 levels during intense training. The protein supplement in this research contained a blend of dairy proteins. Ny-Tro PRO-40 contains a precision blend of the finest dairy protein available. This study identifies yet another important role of protein supplementation for people that want the best results from intense exercise training.

Muscle gains from soy not as good as those from dairy protein by Cribb (2006).

Many athletes use protein supplements to achieve high protein intakes. Aside from quantity, one reason is that athletes understand that
different types of protein have beneficial effects on muscle metabolism and therefore, have the capacity to improve muscle and strength gains during training. Now, a recent study has confirmed that not all protein supplements are the same in what they contribute to muscle gains during training.

In a group of young men that completed 12 weeks of resistance training (5 days a week), those given a dairy milk protein supplement after each workout showed greater gains in lean mass and larger muscle fibers compared to those given a soy protein supplement. The truly interesting part of this research was that both supplements were high quality, hydrolyzed proteins that contained the same amount of protein. However, dairy milk and soy proteins differ tremendously in their amino acid profiles. Previous studies have shown that this aspect affects the way in which the amino acids are absorbed and presented to muscles. Dairy milk proteins stimulate anabolism and promote gains in muscle protein, whereas soy protein is shown to actually encourage protein loss breakdown (increased urea production).

Ny-Tro PRO-40 contains a blend of the highest quality dairy proteins available. It's amino acid profile is biochemically tailored to stimulate better recovery and build more muscle during intense resistance
training. If you’re after quality gains from your efforts in the gym, make sure you take advantage of this latest research.

Cribb (2006) conducted a study for body builders supplemented with VP2 Whey Isolate and Creatine HSC immediately before and after every workout doubled gains in muscle mass.

After 10 weeks of training, supplementation with VP2 Whey Isolate and Creatine HSC immediately before and after every workout resulted in double the gain in muscle mass observed in a control group. The control group performed the same training program but did not follow this supplement – timing strategy.

Supplement – timing also provided significantly better strength gains and reduced body fat percentage. Supplement – timing also resulted in higher muscle creatine and glycogen concentrations.

Muscle gains were confirmed at three different levels of physiology; lean mass, muscle fiber hypertrophy and contractile protein synthesis. Also, this research utilized experienced body builders and fully supervised training.
Petroczi et al (2007) investigated the relationship between specific performance-related reasons for supplement use and the reported use of nutritional supplements.

The 'UK Sport 2005 Drug Free Survey' data (n = 874) were re-analysed using association [chi-square] and 'strength of association' tests [phi] to show the proportion of informed choices and to unveil incongruencies between self-reported supplement use and the underlying motives. Results: Participants (n = 520) reported supplement use in the pattern of: vitamin C (70.4%), creatine (36.1%), whey protein (30.6%), iron (29.8%), caffeine (23.8%), and ginseng (8.3%) for the following reasons: strength maintenance (38.1%), doctors' advice (24.2%), enhancing endurance (20.0%) ability to train longer (13.3%), and provided by the governing body (3.8%). Of thirty possible associations between the above supplements and reasons, 11 were predictable from literature precedents and only 8 were evidenced and these were not strong (phi < .7). The best associations were for the ability to train longer with creatine (reported by 73.9%, chi-square = 49.14, p < .001; phi = .307, p < .001), and maintaining strength with creatine (reported by 62.6%, chi-square = 97.08, p < .001; phi = .432, p < .001) and whey protein (reported by 56.1%, chi-square = 97.82, p < .001; phi = .434, p < .001).
This study provided a platform for assessing congruence between athletes' performance enhancing reasons for supplement use and their actual use. These results suggest that a lack of understanding in supplement use. There is an urgent need to provide accurate information which will help athletes make informed choices about the use of supplements.

Richard et al (2007) conducted a study to find out the effects of ingestion of carbohydrate (CHO) and protein (PRO) following intense exercise has been reported to increase insulin levels, optimize glycogen resynthesis, enhance PRO synthesis, and lessen the immuno-suppressive effects of intense exercise. Since different forms of CHO have varying glycemic effects, the purpose of this study was to determine whether the type of CHO ingested with PRO following resistance-exercise affects blood glucose availability and insulin levels, markers of anabolism and catabolism, and/or general immune markers.

40 resistance-trained subjects performed a standardized resistance training workout and then ingested in a double blind and randomized manner 40 g of whey PRO with 120 g of sucrose (S), honey powder (H), or maltodextrin (M). A non-supplemented control group (C) was also
evaluated. Blood samples were collected prior to and following exercise as well as 30, 60, 90, and 120 min after ingestion of the supplements. Data were analyzed by repeated measures ANOVA or ANCOVA using baseline values as a covariate if necessary.

Glucose concentration 30 min following ingestion showed the H group (7.12 +/- 0.2 mmol/L) to be greater than S (5.53 +/- 0.6 mmol/L; p < 0.03); M (6.02 +/- 0.8 mmol/L; p < 0.05), and C (5.44 +/- 0.18 mmol/L; p < 0.0002) groups. No significant differences were observed among groups in glucose area under the curve (AUC) values, although the H group showed a trend versus control (p = 0.06). Insulin response for each treatment was significant by time (p < 0.0001), treatment (p < 0.0001) and AUC (p < 0.0001). 30-min peak post-feeding insulin for S (136.2 +/- 15.6 uIU/mL), H (150.1 +/- 25.39 uIU/mL), and M (154.8 +/- 18.9 uIU/mL) were greater than C (8.7 +/- 2.9 uIU/mL) as was AUC with no significant differences observed among types of CHO. No significant group x time effects were observed among groups in testosterone, cortisol, the ratio of testosterone to cortisol, muscle and liver enzymes, or general markers of immunity.

CHO and PRO ingestion following exercise significantly influences glucose and insulin concentrations. Although some trends
were observed suggesting that H maintained blood glucose levels to a better degree, no significant differences were observed among types of CHO ingested on insulin levels. These findings suggest that each of these forms of CHO can serve as effective sources of CHO to ingest with PRO in and attempt to promote post-exercise anabolic responses.

Dan Roble et al (2007) conducted a study to determine the effects of 6-OXO, a purported nutritional aromatase inhibitor, in a dose dependent manner on body composition, serum hormone levels, and clinical safety markers in resistance trained males. Sixteen males were supplemented with either 300 mg or 600 mg of 6-OXO in a double-blind manner for eight weeks. Blood and urine samples were obtained at weeks 0, 1, 3, 8, and 11 (after a 3-week washout period). Blood samples were analyzed for total testosterone (TT), free testosterone (FT), dihydrotestosterone (DHT), estradiol, estriol, estrone, SHBG, leutinizing hormone (LH), follicle stimulating hormone (FSH), growth hormone (GH), cortisol, FT/estradiol (T/E). Blood and urine were also analyzed for clinical chemistry markers. Data were analyzed with two-way MANOVA. For all of the serum hormones, there were no significant differences between groups (p > 0.05). Compared to baseline, free testosterone underwent overall increases of 90% for 300 mg 6-OXO and 84% for 600 mg, respectively (p < 0.05). DHT underwent significant
overall increases (p < 0.05) of 192% and 265% with 300 mg and 600 mg, respectively. T/E increased 53% and 67% for 300 mg and 600 mg 6-OXO, respectively. For estrone, 300 mg produced an overall increase of 22%, whereas 600 mg caused a 52% increase (p < 0.05). Body composition did not change with supplementation (p > 0.05) and clinical safety markers were not adversely affected with ingestion of either supplement dose (p > 0.05). While neither of the 6-OXO dosages appears to have any negative effects on clinical chemistry markers, supplementation at a daily dosage of 300 mg and 600 mg for eight weeks did not completely inhibit aromatase activity, yet significantly increased FT, DHT, and T/E.

Willoughby et al (2007) examined the effects of an aromatase-inhibiting nutritional supplement on serum steroid hormones, body composition, and clinical safety markers. Sixteen eugonadal young men ingested either Novedex XT trade mark or a placebo daily for 8 wk, followed by a 3-wk washout period. Body composition was assessed and blood and urine samples obtained at weeks 0, 4, 8, and 11. Data were analyzed by 2-way repeated-measures ANOVA. Novedex XT resulted in average increases of 283%, 625%, 566%, and 438% for total testosterone (P = 0.001), free testosterone (P = 0.001), dihydrotestosterone (P = 0.001), and the testosterone: estrogen ratio (P =
0.001), respectively, whereas fat mass decreased 3.5% (P = 0.026) during supplementation. No significant differences were observed in blood and urinary clinical safety markers or for any of the other serum hormones (P > 0.05). This study indicates that Novedex XT significantly increases serum androgen levels and decreases fat mass.

Lemule et al (2007) conducted a study to examine the effects of a functional coffee beverage containing additional caffeine, green tea extracts, niacin and garcinia cambogia to regular coffee to determine the effects on resting energy expenditure (REE) and hemodynamic variables.

Subjects included five male (26 ± 2.1 y, 97.16 ± 10.05 kg, 183.89 ± 6.60 cm) and five female (28.8 ± 5.3 y, 142.2 ± 12.6 lbs) regular coffee drinkers. Subjects fasted for 10 hours and were assessed for 1 hour prior (PRE) and 3 hours following 1.5 cups of coffee ingestion [JavaFit™ Energy Extreme (JF) ~400 mg total caffeine; Folgers (F) ~200 mg total caffeine] in a double-blind, crossover design. REE, resting heart rate (RHR), and systolic (SBP) and diastolic (DBP) blood pressure was assessed at PRE and 1, 2, and 3-hours post coffee ingestion. Data were analyzed by three-factor repeated measures ANOVA (p < 0.05).
JF trial resulted in a significant main effect for REE (p < 0.01), SBP (p < 0.01), RER (p < 0.01), and VO2 (p < 0.01) compared to F, with no difference between trials on the RHR and DBP variables. A significant interaction for trial and time point (p < 0.05) was observed for the variable REE. The JF trial resulted in a significant overall mean increase in REE of 14.4% (males = 12.1%, females = 17.9%) over the observation period (p < 0.05), while the F trial produced an overall decrease in REE of 5.7%. SBP was significantly higher in the JF trial; however, there was no significant increase from PRE to 3-hours post.

Results from this study suggest that JavaFit™ Energy Extreme coffee is more effective than Folgers regular caffeinated coffee at increasing REE in regular coffee drinkers for up to 3 hours following ingestion without any adverse hemodynamic effects.

Richard J Bloomer, Michael J Falvo, Brian K Schilling, and Webb A Smith (2007) conducted a study to find out the effects of prior exercise and anti oxidant supplementations on oxidative stress and muscle injury.

Both acute bouts of prior exercise (preconditioning) and antioxidant nutrients have been used in an attempt to attenuate muscle injury or oxidative stress in response to resistance exercise. However, most studies have focused on untrained participants rather than on
The purpose of this work was to determine the independent and combined effects of antioxidant supplementation (vitamin C + mixed tocopherols / tocotrienols) and prior eccentric exercise in attenuating markers of skeletal muscle injury and oxidative stress in resistance trained men.

Thirty-six men were randomly assigned to: no prior exercise + placebo; no prior exercise + antioxidant; prior exercise + placebo; prior exercise + antioxidant. Markers of muscle/cell injury (muscle performance, muscle soreness, C-reactive protein, and creatine kinase activity), as well as oxidative stress (blood protein carbonyls and peroxides), were measured before and through 48 hours of exercise recovery.

No group by time interactions were noted for any variable (P > 0.05). Time main effects were noted for creatine kinase activity, muscle soreness, maximal isometric force and peak velocity (P < 0.0001). Protein carbonyls and peroxides were relatively unaffected by exercise.

There appears to be no independent or combined effect of a prior bout of eccentric exercise or antioxidant supplementation as used here on markers of muscle injury in resistance trained men. Moreover, eccentric exercise as used in the present study results in minimal blood oxidative stress.
stress in resistance trained men. Hence, antioxidant supplementation for the purpose of minimizing blood oxidative stress in relation to eccentric exercise appears unnecessary in this population.

Campbell et al (2007) recommended seven points related to the intake of protein for healthy, exercising individuals constitute the position stand of the Society. They have been approved by the Research Committee of the Society. 1) Vast research supports the contention that individuals engaged in regular exercise training require more dietary protein than sedentary individuals. 2) Protein intakes of 1.4 – 2.0 g/kg/day for physically active individuals is not only safe, but may improve the training adaptations to exercise training. 3) When part of a balanced, nutrient-dense diet, protein intakes at this level are not detrimental to kidney function or bone metabolism in healthy, active persons. 4) While it is possible for physically active individuals to obtain their daily protein requirements through a varied, regular diet, supplemental protein in various forms are a practical way of ensuring adequate and quality protein intake for athletes. 5) Different types and quality of protein can affect amino acid bioavailability following protein supplementation. The superiority of one protein type over another in terms of optimizing recovery and/or training adaptations remains to be convincingly demonstrated. 6) Appropriately timed protein intake is an
important component of an overall exercise training program, essential for proper recovery, immune function, and the growth and maintenance of lean body mass. 7) Under certain circumstances, specific amino acid supplements, such as branched-chain amino acids (BCAA's), may improve exercise performance and recovery from exercise.

Creative supplementation during college football training does not increase the incidence of cramping or injury.

Lkizler, (2007) conducted a study to determine how protein supplementation, with or without exercise, affects functional capacity, strength, body composition, and physical activity in hemodialysis patients.

- Increase in lean body mass (time frame: 12 months)
Secondary Outcome Measures

- Increase in physical functioning (time frame: 12 months)

(Designated as safety issue: No)

<table>
<thead>
<tr>
<th>Arms</th>
<th>Assigned Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Active comparator only protein supplementation</td>
<td>Drug: nutritional supplementation oral administration of 2 cans of protein supplement (lactose-free formula that contains a total of 960 Kilo calories: 132.8 kilo calories from protein, 412.8 kilo calories from carbohydrates, and 412</td>
</tr>
<tr>
<td>2. Active comparator protein supplementation plus exercise</td>
<td>Drug: nutritional supplementation oral administration of 2 cans of protein supplement (lactose-free formula that contains a total of 960 kilo calories: 132.8 kilo calories from protein, 412.8 kilo calories from carbohydrates, and 412.8 kilo calories from fat) every other day, 3 days per week, for 6 months Behavioural: exercise leg press exercise, every other day, 3 days per week, for 6 months</td>
</tr>
</tbody>
</table>

John Zhang, (2008) conducted a study (fruits and vegetable powders, whey protein and calcium) for patients with hypertension. The null hypothesis was that the supplements had no effects on participants blood pressure.
Hypertension

<table>
<thead>
<tr>
<th>Condition</th>
<th>Intervention</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dietary supplement: Nano greens</td>
<td>Phase I</td>
</tr>
<tr>
<td></td>
<td>Whey protein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and Calcium pills</td>
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</tbody>
</table>

Blood pressure and HRV (Time frame: every two weeks for three months)

<table>
<thead>
<tr>
<th>Arms</th>
<th>Assigned Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental groups fruits and vegetables</td>
<td>Dietary supplement: NanoGreens fruits and vegetables</td>
</tr>
<tr>
<td>Whey protein: Active Comparator Whey protein</td>
<td>Dietary Supplement: Whey Protein Whey</td>
</tr>
<tr>
<td>Ca: Active Comparator Calcium Pills</td>
<td>Dietary Supplement: Calcium pills CA</td>
</tr>
</tbody>
</table>

Hypertensive participants were randomly assigned into three groups. The first group of participants took the fruits and vegetables powders mixed with water. The second group took whey protein and the third group took calcium pills. Blood pressure and heart rate variably were measured every two weeks for three months.

Van Loon, (2008) studied the effect of carbohydrate and protein co-ingestion on muscle protein synthesis during endurance type exercise activities (Part A) as well as to investigate the differences in the molecular signaling response to resistance versus endurance type exercise, leading to skeletal muscle protein synthesis (Part B).
It was hypothesized that muscle protein synthesis is higher when protein is co-ingested during exercise and that the signalling pathways after endurance and resistance training are partly similar.

**Primary Outcome Measures**

- Differences in muscle protein synthesis rates between carbohydrate and carbohydrate + protein (Part A) and difference in phosphorylation of signaling proteins between resistance and endurance exercise (Part B) (Time Frame: 1 day) (Designated as safety issue: No)

**Secondary Outcome Measures**

Difference in whole-body protein synthesis and breakdown between carbohydrate and carbohydrate plus protein.

<table>
<thead>
<tr>
<th>Arms</th>
<th>Assigned Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Experimental</td>
<td>Dietary Supplement: Carbohydrate and protein</td>
</tr>
<tr>
<td></td>
<td>The intake of carbohydrate and protein during endurance type exercise</td>
</tr>
</tbody>
</table>