NUTRITIONAL STATUS AND SUPPLEMENTARY PROTEIN INTAKE AND ITS RELATIONSHIP TO BLOOD PROTEIN OF MALE BODYBUILDERS IN THE STATE OF KUWAIT

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INTRODUCTION

Athletes and noathletes are aware of the important role diet plays to improve strength and enhances physical appearance. In Canada, Melia et al. (15) used a questionnaire to determine the number of students using nutritional supplementation. He reported a 27% from 16.119 students were using nutritional supplementation.

In order to develop proper diet for bodybuilders, researchers have examined the macronutreints, micronutreints, vitamins and minerals consumption of bodybuilders' diet. Those who work out need to supply their bodies with enough protein to maintain the bodies regular day to day functions along with recovering from daily workouts.

Diet consumption of bodybuilders was studies by Kleiner et al. (9) who reported percentage of calories from protein, fat, and carbohydrate as the following; 40%, 11%, and 49%, respectively. It was also suggested that bodybuilders' diets were repetitive and monotonous. Bazzarre et al. (1) reported protein, fat, and carbohydrate provided about 40% , 12%, and 48% of total energy intake, respectively. Lemon et al. (12, 13, 14) suggests changing these recommendation values to a measurement of weight (gram) consumed rather than percentages. The researcher believes that most people are not aware of these percentages, thus recommends 6 grams or higher (depending on the training intensity) of carbohydrates per kilogram of body weight and between 200-250% of the current recommended dietary allowances (RDA).

Bodybuilders usually consume a high protein diet in order to achieve maximal skeletal muscle hypertrophy. Athletes especially weightlifters and bodybuilders depend on supplementation of amino acids to enhance muscle size and strength. One of the major function of protein is to increase muscle fiber size. Amino acids are commonly ingested as ergogenic aids in belief that they enhance protein synthesis and stimulate growth hormone release, Lumbert et al. (11). Skeletal muscle has the ability to adapt tremendously to strength training. The strength gain may be due to the gradual increase in the load, yet the nervous system is considered to be the principal factor for muscle strength. Increased strength is influenced by variety of neurophysiological process Enoka (5). A study conducted by Tesch and Larsson (17), demonstrated that fiber type composition (e.g. Fast twitch fiber and fiber type) were the same for non-strength training individuals, physical education students and bodybuilders. The results suggested that nervous system plays an important role in muscle hypertrophy.

Lemon et al. (14) studied protein requirement during the early stages of training for bodybuilders and whether supplemental protein enhanced muscle mass and strength. The researchers concluded an increase in protein intake and supplements did not increase muscle mass and strength. It was also reported a longer training session may have different effects. Brill and Keane (2) noted the supplement use varied according with the training phase and competition schedule. Protein powder was used in the beginning of the training program and protein and fat burners used prior to competitions.

Creatine is the metabolic breakdown of protein from diet and muscle. Creatine a phosphate containing high energy provides fuel for intensive exercise, and is very limited in the body and it takes 10 seconds to be depleted completely. Creatine is found in animal tissue, particularly in red meat. The human body can make creatine from amino acids found in both plant and animal sources. Researchers believe that creatine supplementation is important for building muscles, optimizing muscle metabolism, facilitating anabolic process and providing significant

improvement in training (20). High levels in the blood is an indication of renal failure (creatinine and blood urea nitrogen (BUN) are metabolic breakdown of protein from diet and muscle.

Urea is a waste product of amino acid metabolism that is formed by the liver and then secreted in the blood.

Albumin, globulin and fibrinogen are the types of plasma proteins. Albumin accounts for (60%-80%) of plasma protein. The above proteins are produce in the liver and serve to provide the osmotic pressure needed to draw water from the surrounding tissue fluid into capillaries (6, 18).

Sandoval and Heyward (16) investigated the food selection pattern of bodybuilders during noncompetitive and precompetition. It was suggested that during the off-season the bodybuilders depend heavily on foods from the meat and meat alternative group and bread group. The choices of food from meat and meat alternative groups were low-fat or lean. The overall food consumption was less in precompetition. There are various types of amino acid supplements such as arginine, ornithine, lysine or a combination which are called " basic amino acids". Lemon (13) suggested a potential risk associated with large quantities of individual amino acids intake and much more information is still required. Also a benefit for physically active individuals was reported.

The combination of increased protein intake from regular diet and high supplementary amino acids intake may have a negative effects on health. Therefore, the purpose of the present study is to Analyze the nutritional intake in relation to protein supplementary consumption in male bodybuilders.

Methodology:

Subjects

Twenty amateur bodybuilders from different private health clubs participated in the present study. A comprehensive questionnaire to determine the protein supplementary intake, type, and frequency of usage and questions relating to training regimen was distributed to the subjects.

To determine the diet composition, subjects were asked to report food and beverage intake for three consecutive days.

Instrumentation and techniques

Body composition was assessed by using body mass index (BMI) from height, body mass and percent body fat. Percent body fat (%BF) were determined from skinfolds measurements (Skyndex™ Caldwell, Justiss and Co, Inc., Fayettevlle, AR) using the Jackson-Pollock formula at seven different sites (triceps, chest, subcapular, abdomen, supraspinale, thigh and medial calf); and then applying the Siri equation to determine percent body fat (8). In addition, total body mass and %BF were used to partition body mass into it's fat mass and fat-free components. Fat mass was the product of body mass and %BF. Fat-free mass was the difference between body mass and fat mass.

Body height and mass (shorts, no shoes) for each subject was measured using the medical scale (Detecto). The height was measured to the nearest 0.1cm and the body mass measurement was recorded to the nearest 0.1kg. Body Mass Index was calculated as mass in kilogram divided by height meter squared (3). The Skinfolds measurements were taken on the right side of the body by the investigator who had previously demonstrated a test-retest reliability coefficient of $R > 0.90$ for each side. Two independent measurements were taken and if they differed by 0.5 mm, a third measurement was subsequently taken using the average in calculation. Girth measurements included the upper arm, thigh and calf. The diameter of humers and femur bones were measured.

Blood Sampling

Subjects were requested to report at the Al-Subah Hospital Biochemistry laboratories in the State of Kuwait. Fasting venous blood samples were collected from anterior cubital fossa while the subjects were in resting seated position. Then, the serum was analyzed for serum proteins and amino acids.

Diet Analysis

Each subjects was requested to complete a three day dietary record to obtain an average estimates of daily nutritional intake. Also, a health and activity questionnaire was designed to study the health habits, level of activity, type of resistive training, and the intake of supplementary amino acids.

The food intake was recorded daily over a period of three consecutive days, whereby the third day is a weekend (resting day). The athletes were asked to record all food intake on a sheet provided with exact amounts and a description of all foods consumed. Careful written and verbal instructions of proper recording was administered, and an open telephone line was dedicated to answer any questions or inquiries that athletes may have encountered. Instructions for recording food and beverage intakes were given by the researcher using food models to illustrate portion size. At the beginning, all subjects were asked to submit records for only the first day. This method allowed the researcher to check for proper recording procedures. Subjects with unclear records were contacted to clarify the uncertainties. The rest of the recording was submitted after the third day. Information regarding dietary supplementation was also obtained.

Food intakes for the three days was subjected to statistical analysis to provide mean intake data. The mean energy expenditure and all the macronutreints (carbohydrates, fats (saturated, polyunsaturated, monounsaturated, cholesterol, plant fat and animal fat), and proteins as well as micronutrients (mineral and vitamins) were calculated using

the computer software (Dine Healthy, Ahmerst, New York; Dine System, Inc. 1994) in conjunction with Macintosh Performa 580CD. The Dine Healthy software program includes a database for more than 8000 foods derived from the United States Department of Agriculture and other sources. After coding and data entry, a printout was delivered for all the nutrients.

Statistical analysis

All the statistical computations were performed using the Statistical Package for the Social Sciences (SPSSX Inc. Chicago, IL). Descriptive statistics are presented as means ± standard deviations for all measurements. Independent *T*-tests (two-tailed) were used to analyze the subjects body height, mass, BMI, %BF, fat-free mass and fat mass (Table 1). Also, several *T*-tests were used to determine the blood serum protein profiles (Table 2). In addition, the percentages of diet composition and mean macronutrients intake (Table 3) and composition of diet and mean micronutrients intake (Table 4) were analyzed. An alpha level of 0.05 was used for all significance testing.

Results

Anthropometric characteristics and body composition:

Table 1

Anthropometric characteristics of bodybuilders (mean ±SD)

Variable	Bodybuilders
Age (yrs)	26.2 ±2.7
Height (cm)	177.1 ±1.1
Body mass (kg)	82.4 ±1.0
BMI (kg/m^2)	29.2 ±3.1
Body Surface Area	
Percent Body Fat (%)	9.3 ±0.9
Fat-Free Mass (kg)	74.6 ±1.9
Fat Mass (kg)	7.7 ±0.7
FFM/FM ratio	9.7 ±0.5
Skinfold thickness (MM)	
Triceps	5.6 ±0.5
Subscapular	10.8 ±0.6
Chest	5.5 ±3.1
Abdomen	10.4 ±1.0
Supraspinale	8.6 ±1.1
Thigh	7.7 ±1.6
Medial calf	10.1 ±2.4
Breadth	
Biepicondylar Humeurs	8.1 ±.7
Biepicondylar Femur	9.9 ±.6
Girths	
Upper Arm Flexed and Tensed	40.2 ±1.2
Thigh	57.5 ±1.0
Standing Calf	37.5 ±1.2

Table (1) illustrates the anthropometric characteristics of bodybuilders. The BMI (29.2 ±3.1) is higher than the value of bodybuilders in a study (24.9 ±1.9) reported by Giada et al. However, due to the high standard deviation for BMI (±19), the BMI of the current study is almost similar. Percent body fat is (9.3 0.9) which is low in comparison to (12.8 ±2.0) reported in Giada et al. study (7) and (11.2±3.1) reported in Cohen et al. study (4). The girth and breadth data suggest that the current subjects were lean and muscular.

Table 2

Serum blood chemistry of bodybuilders (mean ± SD)

Variable	Bodybuilders	Normal Range Values
Urea (mmol/L)	7.5 *	2.5-6.6 mmol/L
Creatinine (Umol)	121*	45-105 Umol/L
Albumin (g/L)	54*	37-47 g/L
Urate (Umol/L)	414	150-400 Umol/L

* ($P \leq 0.05$) significant differences between bodybuilders blood serum and daily RDA values.

Table (2) shows the serum blood chemistry of bodybuilders. Serum levels in bodybuilders (urea, creatinine and albumin) were significantly different ($P \leq 0.05$) than the normal values for non amino acid users.

Diet composition:

Table 3

Mean caloric intake and the percentages of carbohydrates, fat, and protein of bodybuilders (mean ±SD)

Variable	Bodybuilders	Normal Values
Calory (kcal-day^{-1})	4799 ±628*	2700-3000
Carbohydarate (%)	40 ±3.7*	55%
Fat (%)	29.8 ±2.2	30%
Protein (%)	29.7 ±3.2*	15%

* ($P \leq 0.05$) significant differences between bodybuilders protein supplement users and daily RDA values.

The average daily caloric intake for bodybuilders protein supplement users are shown in (Table 3). According to RDA recommendations, the caloric intake should be between 2700-3000 kcal-day^{-1}. Bodybuilders protein supplement users had significantly greater ($P \leq 0.05$) calories per day (4799 ±628). The bodybuilders protein supplement users had significantly higher ($P \leq 0.05$) percentage dietary intake for CHO (40%) and protein (29.7%) than the daily RDA value. No differences were observed for fat percentages (29.8%).

Table 4

Composition of diet and mean daily macronutrients intake by weight and percentages of bodybuilders (mean ±SD)

Variables	Bodybuilders	Normal Values
Carbohydarate (g)	557.7 ±75.3*	626.8g
fat (g)	174.5 ±24.5	168.8g
Saturated Fat (%)	14.1 ±.7*	10%
Monounsaturated (%)	6.2 ±.6*	10%
Polyunsaturated (%)	9.5 ±.4	10%
Protein (g)	285.6 ±31.7*	65.9g
Animal protein (g)	143.3 ±19.9*	32.9g
Plant protein (g)	49.4 ±8.2	32.9g
Cholesterol (mg)	578 ±88.4*	300mg
Dietary Fiber (g)	20.9 ±6.5*	30g

* ($P \leq 0.05$) significant differences between bodybuilders protein supplement users and daily RDA values.

The bodybuilders protein supplement users had significantly higher ($P \leq 0.05$) fat (174.5g) and protein (285.6g), intake in comparison to the normal value of (168.8g) for fat and (65.9g) for protein recommended by RDA (2g/kg body mass/day) and (.8g/kg body mass/day), respectively. Also, the bodybuilders protein supplement users had a significantly greater ($P \leq 0.05$) percent saturated fat (14.1%), monounsaturated (6.2%), and cholesterol consumption (578mg) than the value of (10%) and (300mg) recommended by American RDA, respectively. The mean intake for dietary fiber was significantly lower than the RDA value (20.9g).

There were no differences in mean dietary intake for polyunsaturated fats (9.5%).

In addition, there were significant differences ($P \leq 0.05$) for animal protein consumption (143.3 ±19.9g) for the current subjects in comparison to the normal value of (32.9g). This recommendation is based on the consumption of 50% animal protein from total protein intake. No significant differences was observed for plant protein intake.

Table 5

Amino acids consumption and training characteristics of bodybuilders (mean ±SD)

Variable	Bodybuilders
Amino Acids Type	Mega mass 2000 and Creatine
Years Taken	2.3
Amount per day	4 times
Training (yrs)	3.1
Training (h-day)	3.5
Training (h-wk)	17.5
Training (d-wk)	5
Smpkers	42%
Second Hand Smoke	84%

Data for type of amino acid supplementations, years taken, and the amount taken per day were given in Table 5. The major nutrition supplement is amino acid powder and tablets. The Megga 2000 and Creatine brands were most favorable by current subjects.

The daily and weekly training time is higher than those who train for endurance aerobic conditioning. It is important to train more hours in order to increase the load on the working muscle. However, there is a high number of smokers (42%) and second hand smokers (84%).

Discussion

The purpose of the present investigation was to determine the body composition and to analyze the dietary intake among bodybuilders. In addition, fasting blood serum was obtained and analyzed to compare the daily dietary intake with protein supplement.

Body composition

The bodybuilders protein supplement users showed low value in BMI, percent body fat, fat mass and free fat mass than other values reported in several studies. This is mostly due to the fact that all measurements were taken prior to national competition (19).

Blood serum chemistry profile

The abnormal blood serum chemistry profile can be observed in the high levels of urea, creatine, and albumin. Also, dietary protein intake was statistically significant in bodybuilders protein supplement users. The bodybuilders protein supplement users should increase their dietary fiber intake to match the RDA values, this is important since the saturated fat consumption is high.

Diet composition

Daily caloric intake was significantly higher in bodybuilders protein supplement users when compared with American Recommended Dietary Allowances (RDA). The increase is mostly due to high fat and protein consumption. The fat and protein intake should be primarily from plant sources rather than the animal sources, due to the fact that animal fat has more saturated fat and cholesterol values than the plant foods.

Gastelu and Hatfield (6) suggested dietary guidelines to match the energy demands of bodybuilding during the preseason, season and off-season. The preseason and season the percentage of carbohydrates, fat and protein should be 55%, 15%, and 30%, respectively. The target macronutrients should change to 55% CHO, 20% fat, and 25% protein in

the off-season. The percentages for bodybuilders in the current study were 40%, 29% and 29% for carbohydrate, fat, and protein, respectively. The recommended RDA for protein in sedentary individuals is 0.08g/kg body mass/day, yet bodybuilders should consume higher amounts of protein than the current recommendations. Lemon (23) suggested an increase in daily protein intake to 1.7 - 1.8g/kg body mass/ day (212% - 225% of current RDA). In the present study, bodybuilders protein supplement users consumed 2.33g protein /kg body mass/ day (270% of current RDA). This amount is considered to be high in comparison with recommendations reported from other studies. This may confirm the idea that bodybuilders do not need protein supplementation especially, the current study subjects. Therefore, the high amount of the end product of amino acid metabolism in the subjects' blood is due to high protein consumption. Lemon et al. (14) also suggested that bodybuilders need to increase protein intake to 100% of current RDA value to 1.6g/kg body mass/ day. They also suggested that values from 1.3 to 2.6g protein /kg body mass/ day do not enhance muscle mass or strength gain .

Training Characteristics

Table 5 illustrates that bodybuilders protein supplement users had an average training year, training hours per day, training hours per week and training days per week. This may explain that there could be a usage of Anabolic Androgenic Steroids (AAS), which considered as a doping substance, by the current subjects (9, 19). There was high percentages of second hand smokers (84%) and smokers (42%). Smokers is well established that it is very hazardous to health (10).

In conclusion, the present study indicates that the bodybuilders protein supplement users consume 3.5g protein/kg body mass.day more than the recommended daily allowances for protein 0.8g protein/kg body mass.day. The bodybuilders must reduce their amino acid intake since there is no benefit recorded for higher intake than 2.62g protein/kg body mass.day.

The optimal value for bodybuilders is ranged from 1.3g to 1.6g (12, 13, 14).

It is important that bodybuilders should be supervised so that coaching staff work and educate the bodybuilders about health and performance associated with training and nutritional ergogenic aids.

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