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DIETARY INTAKE AND NITROGEN BALANCE OF BODYBUILDERS IN CUITÉ, PARAÍBA, BRAZIL

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ABSTRACT

Background: Sports nutrition has grown substantially. Considering that as compared to sedentary or moderately active individuals, athletes have distinct nutritional requirements, it is important to reflect on the adequacy of food intake as compared to the established recommendations. Thus, the present study evaluated food consumption and nitrogen balance in bodybuilders' from Cuité-Paraíba, aiming to learn their food and nutritional profiles. Methods: Data were collected using structured questionnaires and 24-hour dietary recalls. Anthropometric evaluations were performed. The analyses were performed on Avanutri®. For both urea determination and nitrogen balance calculations, twenty-four (24) hour urine processing was also performed. Results: The sample consisted of 6 amateur bodybuilders, with a mean age of 22.83 ± 4.53 (standard deviation), weight 72.37 ± 14.34 kg, height 1.68 ± 0.10 meters, and fat percentage of 11.81 ± 2.84%. The majority (5 athletes) was in the hypertrophy period (off-session), and 1 athlete was in definition (pre-contest). The food consumption results indicated that according to established recommendations for the sports modality, the athletes (with high intake of protein, and low carbohydrate consumption) were practicing inadequate eating habits. Testing showed that zinc, and vitamins D, B1, B2, and B6 intake was adequate. It was also observed that 66.67% (n = 4) used dietary supplements. The mean nitrogen balance was 19.15 ± 22.09. Conclusion: The bodybuilders' diets were hyper-proteic, normo-lipid and hypo-glycemic; being inadequate in magnesium, iron, sodium and vitamins A, B3, C and E. The positive nitrogen balance found for the athletes correlated to their high protein intakes.

Key words: Food intake. Sports performance. Anthropometry.

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RESUMO

Consumo alimentar e balanço de nitrogênio de fisiculturistas em Cuité, Paraíba, Brasil

Objetivos: avaliar o consumo alimentar e o balanço nitrogenado de fisiculturistas da cidade de Cuité-Paraíba, visando conhecer o perfil alimentar e nutricional. Métodos: Para coleta dos dados foram aplicados questionários estruturados, recordatórios alimentares de 24 horas e realizada avaliação antropométrica. As análises foram feitas no Avanutri®. O processamento da urina de 24 horas para determinação da ureia e cálculo do balanço nitrogenado também foi realizado. Resultados: A amostra foi composta por 6 atletas amadores do fisiculturismo, com médias de idade de 22,83 ± 4,53 anos (desvio-padrão), peso de 72,37 ± 14,34 Kg, altura de 1,68 ± 0,10 metros e percentual de gordura de 11,81 ± 2,84 %. A maioria (5 atletas) encontrava-se em período de hipertrofia (*off-session*) e 1 em período de definição (*pré-contest*). Os resultados do consumo alimentar indicaram que os hábitos alimentares dos atletas encontram-se inadequados frente às recomendações estabelecidas para a modalidade esportiva, com ingestão elevada de proteína com baixo consumo de carboidratos. Quanto aos micronutrientes, contatou-se que o zinco e as vitaminas D, B1, B2, B6, encontravam-se adequadas. Observou-se ainda que 66,67% (n=4) dos entrevistados fazem uso de suplementos alimentares. O balanço nitrogenado foi de 19,15 ± 22,09. Conclusão: A dieta dos fisiculturistas estava hiperprotéica, normolipídica e hipoglicídica, com inadequação de magnésio, ferro, sódio e das vitaminas A, B3, C e E. O balanço nitrogenado positivo dos atletas acompanhou o alto consumo de proteínas.

Palavras-chave: Consumo alimentar. Desempenho esportivo. Antropometria.

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BACKGROUND

Bodybuilding, being among the most practiced sports in Brazil, with the goal of achieving improvements in health status or aesthetics has gained both great preference and prominence. However, certain individuals practice weight training for competition to receive titles in body sculpture and/or bodybuilding (Paschoal and Naves, 2015; Silva and Biesek, 2010).

Bodybuilding is a competitive sport in which athletes dedicate time in their daily routine for preparation training. Such athletes are looking for better performance (aesthetics and physical appearance) through a combination of highly selective diets and strength training. In this sport, body composition is the primary training focus (Estevão, 2005; Helms, Aragon and Fitschen, 2014; Paschoal and Naves, 2015; Panza and contributors, 2007; Silva, Trindade and Rose, 2003).

In recent years, research on the relationship between nutrition and exercise has grown substantially. In the literature, there have been several studies suggesting that nutritional intervention, when associated with exercise, can optimize increases in muscle mass and strength, enhancing athlete performance (Arent and contributors, 2010; Candow and contributors, 2012; Ferreira and contributors, 2014; Robinson and contributors, 2015; Schoenfeld and contributors, 2014; Silva and Biesek, 2010;).

Yet energy intake recommendations for athletes must differ, because energy needs are influenced by several factors, especially exercise, which should be measured with maximum precision (Da Silva and contributors, 2012; Gomes, Rogero and Tirapegui, 2013; Hawley and contributors, 2014).

Within this context, it is believed that a high-protein diet provides subsidies to increase strength. In fact, protein is essential in a diet having this goal, but it is not a unique to muscle mass gain (Kleiner and Greenwood-Robinson, 2009; Kim, Lee and Choue, 2011; Phillips, 2012; Phillips and Van Loon, 2011).

Along this line of reasoning, amateur athletes often follow their own diets, and thus are vulnerable to unreliable information and alimentary practices that falsely promise to improve their sporting performance (Contesini and contributors, 2013; Della Guardia, Cavallaro and Cena, 2015; Nascimento and Alencar, 2007).

It is important to note that to develop muscle mass, where additional amino acids are used to synthesize new tissues, it is necessary to maintain a positive nitrogen balance, i.e., the quantity ingested of proteic nitrogen must be greater than the amount excreted (Kleiner and Greenwood-Robinson, 2009).

Considering the scarcity of studies on bodybuilder protein consumption and the lack of consensus among nutritional recommendations, this study was designed to evaluate the food consumption and nitrogen balance of amateur bodybuilders in the city of Cuité, a small city, located in the Curimataú region of Paraíba (Brazil).

MATERIALS AND METHODS

Research Design

The study was conducted with amateur adult bodybuilders of both sexes, gym regulars, located in the municipality of Cuité, Paraíba. Amateur bodybuilders who were practicing strength training for competitive purposes were considered. Those individuals who refused to sign the informed consent form or were not contemplated in the inclusion criteria were excluded from the study. Data collection was carried out after approval of the project by the Human Research Ethics Committee at the Center for Training of Teachers at Campina Grande Federal University, in opinion # 44868315.8.0000.5575.

A structured (adapted) questionnaire completed by the researchers was used as the data collection instrument (Espínola, Costa and Navarro, 2008; Hirschbruch, Fisberg and Mochizuki, 2008).

The questionnaire was structured as follows: PART I: Personal information; Part II: Information concerning the practiced sport; Part III: Information concerning consumption of dietary supplements; Part IV: Information concerning food preferences and gastrointestinal problems.

Anthropometric and dietary intake evaluation

Anthropometric information was obtained through measurements of body

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weight, height, and skinfolds (7D), in accordance with Pollock and Jackson (1984), and Siri (1961).

Each skin fold thickness measurement was taken three times to obtain a mathematically averaged result (Fontanive, Tatiana and Wilza, 2007).

Information on food intake was obtained using a 24-hour dietary recall system (R24) (Hammond, 2012).

The R24 was applied on three alternate days from the same week, including the weekend. The quantitative caloric intake (macro- and micro-nutrients) information was analyzed through the AvaNutri® program, at the Nutritional Assessment Laboratory of the Education and Health Center of Campina Grande Federal University (UFCG).

The results were compared to recommendations suggested: calories (Gomes, Rogero and Tirapegui, 2013; Kleiner and Greenwood-Robinson, 2009), carbohydrates, proteins (Helms and contributors, 2014), lipids (Helms, Aragon and Fitschen, 2014), vitamins and minerals, nutritional recommendations proposed by the *Institute of Medicine* (IOM) known *Dietary Reference Intakes* (DRI's) (Arens, 2004; Atkinson, Abrasms and Allen, 1997; IOM, 1998, 2001; Krinsky and contributors, 2000; Otten, Hellwing and Meyers, 2006; Sawka, 2005).

Micronutrients used *estimated average requirement* (EAR) values associated with values such as maximum limit of intake *Tolerable Upper Intake Level* - (UL). For those in which EAR data did not exist, we used *Adequate Intake* (AI values) as a reference, and UL values for the recommended maximum tolerable (Marchioni, Slater and Fisberg, 2004).

Qualitative analysis of food consumption was performed using averages from the number of times that foods were cited in the three R24s. This, in accordance with the processing level: whether *natural, minimally processed, processed,* or *ultra-processed* for oils, fats, salt and sugar. The results were then compared to the recommendations presented in the Dietary Guidelines for the Brazilian Population (Ministério da Saúde, 2014).

Nitrogen balance

To obtain the nitrogen balance calculation, collections were performed over 24 hours, on the same day that food intake assessment occurred. The urine was collected and kept under cooling during the collection period and analysis was performed immediately (Maesta and contributors, 2008).

For each volunteer's urine sampling, three samples were taken for measurements of urea. Afterwards, the arithmetic mean was calculated for each volunteer. The urea determinations were performed in the Biochemistry Laboratory (Academic Health Unit - UAS/ESC/UFCG), using a spectrophotometer (UV-VIS 5100®) and specific enzyme products (urea EC, Ref 27-Labtest®, Brazil).

Nitrogen balance (NB) is defined as the difference between the amount of nitrogen ingested (NI) and that excreted (NE) by the body (Daniel and Neiva, 2009). NI represents the amount of nitrogen supplied through ingested protein, where 16% of the protein weight corresponds to nitrogen. The value of ingested protein (g.protein) was provided by the R24 equivalent on the day of 24 hour urine collection. Thus, NI is estimated using the formula:

$$NI = (g.proteína \times 16)/100$$

NE represents nitrogen excreted in urine, feces and in digestive liquids. Urinary nitrogen (N) can be estimated from the urea determination (24h urine), and fecal nitrogen is estimated from the number of evacuations, according to the equation below:

$$NE = \text{urinary urea} \times 0.47 \times 1.2 + 4 \text{ (normal evacuation); 3 (constipation); 5 (diarrhea); 8 (fistula).}$$

In this case, 0.47 = 28 (weight mol N)/60 (weight mol urea). Urinary urea x 0.47 = uric N, to which is added a further 20% (x 1.2) corresponding to non-uric N.

Statistical Analysis

The results of the anthropometry, dietary intake, and NB were expressed in arithmetic average, standard deviation (SD), and amplitude, whereas the total volunteer sample was (n=6). Statistical evaluation of the

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data was performed using the Kruskal-Wallis test to verify differences between energy and macronutrients for each volunteer. Fisher's exact test to analyze the relationship between protein consumption and nitrogen balance was also applied. The results were considered significant when p<0.05.

RESULTS

In this sampling 1 female and 5 male volunteers participated, from an age of 19 to a maximum of 31 years, the average being 22.83 ± 4.52 years. In the periodization (training phase), 83% (n=5) were in a period of hypertrophy (*off-session*), and 17% (n=1) in a period of definition (*pre-contest*).

The energy intake per day ranged between 2,710.00 kcal and 8,441,86kcal (Table 1). In relation to the intake of macronutrients we observed variance for proteins, carbohydrates and lipids, respectively of from 2.32 to 5.80 g/kg body weight; 38.75 to 53.85%; and 15.56 to 31.58% (Table 1).

Analyzing the average energy intake of macronutrients for each volunteer we observed that there was no statistical difference between them (p>0.05) for energy (kcal), carbohydrates (g), or lipids (g). This indicated that in relation to these variables the sample was homogeneous.

However, in relation to protein (g), there was statistical difference (p<0.05) among the volunteers ingesting distinct quantities of proteins.

The analyses of vitamins and minerals consumption (Tables 2 and 3) compared to the DRI's (Arens, 2004; Atkinson, Abrasms and Allen, 1997; IOM, 1998, 2001; Krinsky and contributors, 2000; Otten, Hellwing and Meyers, 2006; Sawka, 2005) indicated, when interpreted as recommended by Galisa and Guimarães (2008), that intake of zinc and vitamins D, B1, B2, B6, was likely appropriate.

However, it was found that intake of magnesium, iron, sodium and vitamins A, B3, C and E, for certain athletes, was possibly inadequate (<EAR) or harmful (>UL). As to adequacy of calcium and potassium intake, it is not possible to interpret and classify the consumption, since some athletes had consumptions lower than the AI.

Table 1 - Characteristic calorie and macronutrient intake for bodybuilders (n=6) from Cuité-PB.

Athlete	Energy (Kcal)	Protein (G/kg of body weight)	Protein (%)	Carbohydrates (%)	Lipid (%)
1	8,441.86	5.80	20.63	49.80	29.57
2	2,710.20	2.32	36.06	38.75	25.19
3	3,921.51	4.40	30.79	53.85	15.36
4	2,753.74	3.63	25.84	44.17	29.99
5	6,496.03	4.76	24.27	52.10	23.64
6	3,898.19	3.34	25.91	42.50	31.58

Table 2 - Characteristic mineral intake for bodybuilders (n=6) of Cuité-PB.

Variables	Recommendation	Athlete					
		1	2	3	4*	5	6
Calcium (mg)**	M: 1,000-2,500 W:1,000-2,500	2,015.47	453.90	1,537.40	1,093.13	1,379.27	1,149.17
Magnesium (Mg)	M: 330-400 W:255-310	660.00	224.07	266.13	205.10	586.47	373.90
Iron (mg)	M: 6-45 W: 8,1-45	64.57	350.33	41.27	21.03	51.90	25.83
Zinc (mg)	M: 9,4-40 W: 6,8-40	35.73	16.77	10.70	13.00	29.17	12.83
Potassium (mg)**	M: 4,700-NA W: 4,700-NA	5,188.10	2,167.60	1,873.50	2,082.97	5,871.63	3,289.83
Sodium (mg)**	M: 1,500-2,300 W: 1,500- 2,300	5,642.17	2,353.60	3,732.90	3,646.20	5,615.80	4,852.20

Legends: Recommendations: Nutritional recommendations proposed by the Institute of Medicine of the United States, known as the Dietary Reference Intakes (DRI's). M: male. W: Female. NA: value is not established. *Athlete of the female sex. ** No athletic RDA value established for vitamin D, AI recommendation used.

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Table 3 - Characteristic vitamin intake for bodybuilders (n=6) of Cuité-PB.

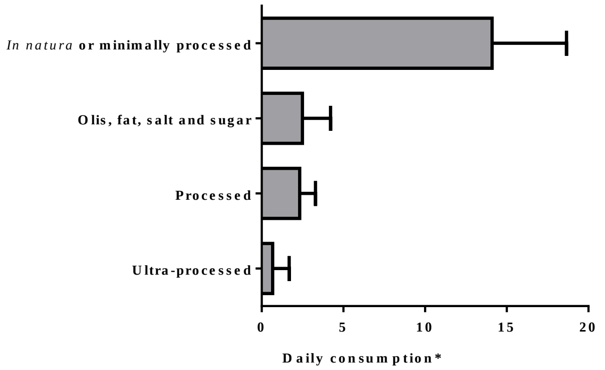
Variables	Recommendations	Athlete					
		1	2	3	4*	5	6
Vitamin A (mcg)	M: 625-3,000 W: 500-3,000	1,399.80	624.37	2,920.67	917.13	2,567.33	2,284.27
Vitamin D (mcg)**	M: 5-50 W:5-50	5.47	4.00	3.37	1.77	6.83	10.80
Vitamin B1 (mg)	M: 1-NA W:0.9-NA	3.88	1.73	2.99	2.21	4.55	1.93
Vitamin B2 (mg)	M:1.1-NA W:0.9-NA	4.44	2.11	2.31	1.50	4.35	4.35
Vitamin B3 (mg)	M: 12-35 W:11-35	69.98	48.68	95.02	46.49	158.82	64.45
Vitamin B6 (mg)	M: 1,1-100 W: 1,1-100	3.73	2.80	3.98	2.13	4.18	3.27
Vitamin B12 (mg)	M: 2.0-NA W: 2.0-NA	8.12	7.07	3.22	3.94	10.16	7.57
Vitamin C (mg)	M: 75-2,000 W: 60-2,000	1,467.30	138.33	11.77	266.60	81.70	9.70
Vitamin E (mg)	M: 12-1,000 W: 12-1,000	54.80	13.00	6.57	5.07	14.80	66.50

Legends: Recommendations: Nutritional recommendations proposed by the Institute of Medicine of the United States, known as the Dietary Reference Intakes (DRI's). M: male. W: female. NA: value not established. *Athlete of the female sex. **No athletic RDA value established for vitamin D, AI recommendation used.

The bodybuilders' dietary intake, according to food production processing levels (Figure 1) showed that the athletes consumed daily on average 12.67 ± 4.55 servings of *In natura* or *minimally processed* food, 2.33 ± 1.72 servings of oils, fats, salt, and/or sugar, 2 ± 0.97 servings of processed foods, and 0.33 ± 1.01 servings of food ultra-processed foods.

In relation to the use of a dietary supplements, it was found that 66.67% (n=4) of athletes were using some type of dietary supplementation.

Of these, 50% (n=2) used isolated proteins (*whey protein*), 25% (n=1) branched chain amino acids (BCAA), and 50% (n=2) the hyper-calorics based in maltodextrin. In addition, there was a report of phytotherapeutic and thermogenic use of which individually corresponded to 25% (n=1).



Legends: *Number of citations in the 24 of 24h as mean ± SD (standard deviation). *In natura* or minimally processed: fruits, vegetables, herbs, roots, tubers, eggs, meat, beans, rice, fruit juices, nuts, peanuts, milk, etc.; oils, fats, salt and sugar, vegetable oils, butter, sugar, salt or refined, etc. Processed: Vegetables preserved in brine or salt and vinegar, extract or tomato concentrates, fruits in syrup, candied fruits, dried meat, bacon, sardines and tuna canned foods, cheeses, breads made from wheat flour, etc.; Ultra-processed: cookies, Ice Cream, candies, sweets in general, sugary cereals, cereal bars, soups, noodles and instantaneous foods, frozen and ready for heating food products such as: pasta dishes, pizzas, burgers, breaded chicken, bakery products, etc.

Figure 1 - Levels of food processing listed in the diet of bodybuilders (n=6) of Cuité-PB.

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Table 4 - Amateur bodybuilders' nitrogen balance of (n=6) of Cuité-PB.

Variables	Mean ± SD	Amplitude
Nitrogen ingested (g/24h)	49.96 ± 26.14	21.33 - 88.93
Nitrogen excreted (g/24h)	29.81 ± 9.14	15.42 - 41.60
Nitrogen balance	19.15 ± 22.09	-7,33 - 51.09

Legends: SD: standard deviation.

Consumption of food supplements was reported by three (75%) male athletes and one (25%) female, only one individual had received indications from a professional nutritionist, one had received indications by a supplements salesperson, and two acted on their own initiatives.

When asked if their objectives were being achieved with the use of supplementation, the five (100%) athletes reported positive results. As to the frequency of product consumption, two (50%) subjects reported consuming the product every day and two (50%) only on days of training.

In Table 4, the results for NB of the investigated amateur bodybuilders are summarized. We applied Fisher's exact test to analyze the relationship between adequate protein intake and nitrogen balance; with no observed association ($p>0.05$).

In other words, positive NB being is not associated with a higher than normal protein intake. This is evident when we note for NB amplitude that one volunteer even when consuming proteins above the recommended amounts presented negative NB. Thus, high protein consumption may not be the only factor in obtaining a positive NB. The NB average was positive, as accompanied by high protein consumption for the sample.

DISCUSSION

Periodic strength training is crucial to modulate testosterone and cortisol hormonal levels, and consequently, potentiation of muscle strength. In this study, the majority of the athletes were in the hypertrophy period and, consequently, displayed body compositions within the suggested values for adults (Tirapegui and Ribeiro, 2013).

As quoted by De Paula and contributors (2015) and Robinson and contributors (2015), bodybuilding athletes have fat percentages below the normal population patterns, this in spite of higher lean mass, and exhibiting high degrees of muscle and symmetry.

Body composition is a determinant factor in performance bodybuilding; affecting strength, agility and especially appearance (Cyrino and contributors, 2008; De Paula and contributors, 2015; Silva and Mura, 2010; Tirapegui and Ribeiro, 2013).

To maintain torque, muscle mass, strength, and health, a good supply of energy is the most important component for training and adequate physical performance (Dipla and contributors, 2008; Dorfman, 2012). For bodybuilding, Kleiner and Greenwood-Robinson (2009) and Gomes, Rogero and Tirapegui (2013) inform that tables for energy expenditure calculation (estimated by minutes of activity practiced) establish individual energy recommendations, which vary on average between 3,000 and 5,000 kcal/day.

Thus, two athletes in our study revealed excessive energy intake while another two revealed consumption below the recommended levels. The practice of *overfeeding* is common in bodybuilders, but can bring unwanted body composition effects (Paschoal and Naves, 2015). It is important to mention that low energy consumption by athletes brings accentuated loss of lean mass with a decline in immune system activity, and increased risk of injury (Gomes, Rogero and Tirapegui, 2013).

For a strength training practitioner in the hypertrophy phase, consumption of carbohydrates at 60% to 70% of the caloric total is recommended (Dorfman, 2012; Gomes, Rogero and Tirapegui, 2013).

Thus, the percentages of carbohydrate consumption in the present study were below recommendations. Yet a diet with moderated carbohydrates at around 42% does not affect *performance* in high intensity strength training (Dipla and contributors, 2008; Paschoal and Naves, 2015).

For athletes, daily intake of lipids at around 15 to 35 % of total energy consumption is well established (Helms, Aragon and Fitschen, 2014; Manore, Barr and Butterfield, 2000), and, in this case, it was found that five of the athletes practiced adequate intake.

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Helms and contributors (2014) state that for bodybuilding practitioners, calorie reduction in lipids consumption is needed.

Force exercise generates signaling pathways that drive growth and strengthen muscle fibers. In this process, intracellular proteins increase quantitatively as a form of adaptation to exercise caused stress. The amino acids necessary for this process come mainly from dietary proteins (Hawley and contributors, 2014; Kleiner and Greenwood-Robinson, 2009; Paschoal and Naves, 2015; Phillips, 2014).

Strength training requires every day protein intake above that recommended for sedentary individuals (Della Guardia, Cavallaro and Cena, 2015; Kim, Lee and Choue, 2011; Paschoal and Naves, 2015). In bodybuilding, recommendations are commonly similar to those of strength training at about 1.2 to 2 g/kg/day (Della Guardia, Cavallaro and Cena, 2015; Gentil, 2015; Helms, Aragon and Fitschen, 2014; Kim, Lee and Choue, 2011; Kleiner and Greenwood-Robinson, 2009; Lambert, Frank and Evans, 2004; Monteiro, Pimentel and Sousa, 2012; Phillips, 2014). Some authors approve (*pre-contest*) hypo-energetic consumption for bodybuilders at 2.5 to 2.6 g/kg/day (Maestu and contributors, 2010), or 2.3 to 3.1 g/kg/day (Helms and contributors, 2014). In conformation with such recommendations, the athletes in this study showed excess protein consumption.

It is important to highlight that there is no benefit to going above recommended levels for protein consumption (Antonio and contributors, 2014).

In addition, low carbohydrates intake can compromise exercise performance, thus the suggestion is to increase carbohydrates intake and decrease protein intake (Phillips and Van Loon, 2011).

Overvaluation of protein consumption, for hypertrophy and maintenance of adequate muscle definition, has led bodybuilding athletes (in pre–competition) to diets with excessively low carbohydrates content.

This unnecessary technique can cause unpleasant side effects, such as reduced performance during practice, shivering during muscle contractions for posing during competition, and reduction of muscle volume due to decreases in glycogen deposits (Paschoal and Naves, 2015).

Protein intake is essential to multiple physiological functions, but for anabolic effect, there is a quantitative limit to dietary intake. In addition to protein amounts, both the digestibility and/or availability of their amino acids are essential to obtain a positive response (Churchward-Venne, Burdd and Phillips, 2012; Dideriksen, Reitelseder and Holm, 2013).

The area of sports nutrition has advanced scientifically and discoveries are being applied in more specific ways considering macro and micronutrients, which may help to improve the *performance* and health of the athletes (Paschoal and Naves, 2015).

In this study, the micronutrients potassium, calcium, iron, alpha-tocopherol, vitamin C, Niacin, magnesium and sodium fell short of the recommendations (Arens, 2004; Atkinson, Abrasms and Allen, 1997; IOM, 1998, 2001; Krinsky and contributors, 2000; Otten, Hellwing and Meyers, 2006; Sawka, 2005).

The diet profile of the bodybuilders studied in accordance with the processing levels of the foods listed in their diets is in agreement with the recommendation set out in the Dietary Guidelines for the Brazilian Population (Ministério da Saúde, 2014).

However, studies show that bodybuilders and other athletes consume hyper-proteic diets with little variety in food groups or sources, and their diets are composed mainly of meats, milk, dairy products and eggs. This can compromise athletic performance, through nutritional inadequacies (Kleiner and Greenwood-Robinson, 2009; Menon and Santos, 2012; Robinson and contributors, 2015).

Adding to this, the prevalence of dietary supplement consumption in this study was 66.67% of the athletes interviewed; being the most consumed proteins (*whey protein* and albumin) and amino acids supplements (BCAA and glutamine).

The use of supplemental proteins has increased among athletes who aim at increasing both the quantity and biological value of alimentary protein, or at their anabolic effects (Figueiredo and Narezi, 2010; Menon and Santos, 201).

In bodybuilding, and considering the foregoing, maximum suitability of the diet is

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essential to obtain positive results in muscle gain and *performance*.

In addition, it is necessary that athletes maintain a positive NB which is dependent on the balance between intake and excretion of proteic nitrogen (Kleiner and Greenwood-Robinson, 2009).

In the well-fed state, the nitrogen excreted is coming mainly from normal turnover or excess ingested proteins (Tirapegui and Ribeiro, 2013).

Intense physical exercise increases nitrogen excretion and when protein intake and energy are insufficient the NB becomes negative, which is undesirable for athletes (Maesta and contributors, 2008).

Generally, healthy NB occurs in individuals who are increasing their body mass index and incorporating (more than degrading) the amino acids in proteins (Tirapegui and Ribeiro, 2013).

In mild to moderate NB surplus, nitrogen intake exceeds excretion, and a good part of this dietary protein is probably involved in new tissue synthesis.

However, it is also necessary that the athletes to maintain adequate levels of muscle and liver glycogen to minimize loss of performance and avoid protein catabolism (Daniel and Neiva, 2009).

CONCLUSIONS

This study results characterize for the first time in amateur bodybuilder food intake (Cuité-PB), a real scenario presenting a prototype for further studies in other small cities.

In this study, the bodybuilders' nutritional habits, being inadequate in the face of established recommendations, did not follow the principles of a balanced diet.

Their diet was characterized as hyper-protein, normo-lipid, and low-carbohydrate, with inadequacies in magnesium, iron, sodium and vitamins A, B3, C and E. The bodybuilders' positive nitrogen balance corroborated their high protein consumption.

Considering the importance of protein consumption for athletes in bodybuilding, it is important to consider other factors such as: energy supply appropriateness, quality, and time of protein intake. Together these factors can yield a state of negative nitrogen balance, and harm to the athletes.

Alimentary monotony and the indiscriminate use of food supplements mentioned in this study were associated with inadequate nutritional intake.

The importance of individualized nutritional conduct conforming to personal characteristics and the sport practiced was also confirmed.

Further, the presence of a professional nutritionist "in the gym" is paramount to assist and guide the athletes; through promotion of food and nutritional education, being against indiscriminate use of food supplements, and relating the importance of biological individuality in maintaining both performance and health.

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