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"Estimation of Blood Glucose Level Among Bodybuilders Consuming Supplement Protein- An Observational Study"

Dr. R. Johara Maria Cruz, Dr. Keerthi Narayan V*, Dr. K. Nitya, Dr. Vidhyadharan

Professor, Department of Prosthodontics, Crown and Bridge, Sathyabama Dental College and Hospital (Deemed University), Shollinganallur, Tamil Nadu, India.
Senior Lecturer, Department of Oral and Maxillofacial Pathology,Thai Moogambigai Dental College and Hospital
Dr MGR Educational and Research Institute, Chennai, Tamil Nadu, India.
Senior Lecturer, Department of Oral and Maxillofacial Pathology,Adhiparasakthi Dental College & Hospital, Melmaruvathur, Tamil Nadu, India.
BDS, Private practitioner, Chennai, Tamil Nadu, India.

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ABSTRACT:
Background: Bodybuilders possess firm attitudes towards muscle gaining, choice of food intake, frequency of meal, nutrition and supplementation dietary strategies to attain positive energy balance.Studies have reported that bodybuildersconsume up more protein in supplementary form which far exceeds the recommended daily allowances (RDA) that serves as a potential source for inducing systemic complications including diabetes.
Aim: The present observational study was aimed to estimate the amount of blood glucose level among bodybuilders consuming supplement protein more than the recommended daily allowance.
Results: The study sample comprises of 55 male bodybuilders with a mean age of 24.76 ± 2.04 years. For the clinical assessment, the mean weight was 85.09 ± 5.81 kg while the mean height was 176.8 ± 1.74 cm with a mean BMI (Body Mass Index) of 27.19 ± 1.65. On evaluation of protein intake the mean consumption of protein powder with BCAA was 24.9 ± 3.28gms per day and random sugar level assessment showed mean value of 138.67 ± 3.305 mg/dL. In a fully adjusted model for age, BMI, Protein intake and Blood sugar level the association remained strong (standardized OR 1.74 [95% CI 1.38, 2.89], p = <.001).
Conclusion: Consumption of Protein powder with BCAA is directly associated with an increased blood sugar level resulting in probable risk of incident diabetes.Our findings also suggest a significant association for protein supplements with that of BMI. The consumption of energy from protein, as the same percentage of energy from other macronutrients increased diabetes risk.

KEYWORDS: Blood glucose, Branched-chain amino acids, Insulin resistance, Muscle mass, Protein Powder.

I. INTRODUCTION:

Bodybuilders possess firm attitudes towards muscle gaining, choice of food intake, frequency of meal, nutrition and supplementation dietary strategies to attain positive energy balance [1]. Positive energy balance are directed towards increasing skeletal muscle mass while limiting the accumulation of adipose tissue. This is typically achieved through a decreased caloric intake, increased strength training, and intense cardiovascular exercise [2]. In determining an appropriate caloric intakeproteins forms the essential macronutrient component along with carbohydrate and fat to build large muscle mass and balance daily nutrient requirements of our body.Proteinsare the chief building blocks of muscles, tendons, organs, and skin, as well as enzymes, hormones, and neurotransmitters [3].World Health organization (WHO) in association with United States, the Office of Disease Prevention and Health Promotion (ODPHP) recommends dietary protein intake of 0.8g/kg body weight (between 10% and 35%) for women and men over the age of 18 (adults)of the total daily caloriesrequired for a balanced diet among healthy individuals [4]. The amount of protein intake depends on several factors such as age, muscle mass, physical activity, lifestyle and overall health status [5].

Branched-chain amino acids (BCAAs)supplements namely leucine, isoleucine and valine are commonly taken to boost muscle growth, enhance exercise performance and reduce

fatigue after exercise.Protein powderwith BCAAs are popular nutritional supplement among bodybuilders available as dairy-based and plant-based forms that are predominantly consumed in the same way as whole foods to reach their protein targets [6]. Bodybuilders either prefer protein powder in grams per calorie plan or intake an excess of 35% of the total calories to maintain their protein consumptionrequired to perform vigorous training. Some prefer diet typically high in carbohydrates instead of additional proteins to provide ample supplies of glucose and glycogen for training and exercises [7].American College of Sports Medicineadvised that larger protein energy intake may be more beneficial for trainee bodybuilders, while advanced bodybuilders might benefit more from conventional hyper-energetic diets (within 15%) to limit unnecessary increases in body fat [8].

Skeletal muscle protein turnover plays an important role in establishing the relationship between muscle protein synthesis and muscle protein breakdown in addition to total amount of protein consumed per day. Numerous studies have been carried out to determine the optimal amount of protein for muscle gain with various conclusions.Schoenfeld et al estimated protein needs to be a minimum of 0.7 grams per pound (1.6 grams per kg) of body weight [9]. Morton et al observed consumption of protein not more than twice the recommended daily allowance (RDA) ranging between 150 grams (for a 2,000-calorie diet) and 225 grams (for a 3,000-calorie diet) of protein per daysignificantly improve muscle size and strength in healthy adults who perform resistance exercise training [10]. A similar Study published by Jager et al suggests bodybuilder's and trainer'sprotein consumption would still be within the upper limit of the recommended dietary scale [4].

Despite several clinical studies and protein recommendation guidelines given by National Institutes of Health's Dietary Supplement Fact Sheet for Health Professionals(NIH's) Dietary Reference Intake (DRI), sports nutrition authorities, and USDA Dietary Guidelines for Americans, many bodybuilding and weight-training coaches still believes more protein intake have a direct role in body muscle mass build-up that lacks scientific evidence to support this quantity based dietary approach. Studies have also reported that bodybuildersconsume up to 4.3 g/kg of protein per day among males, and 2.8 g/kg among females which far exceeds these recommendations [2, 3, 4]. Thus excessive protein/ High-protein diet intake causes increase in coronary heart disease, risk of atherosclerosis, myocardial infarction, stroke and impairment of renal functions associated with proteinuria due to increased water intake required to filter excess protein-assimilation process and vitamin B6 required for protein breakdown [11]. Among several complications, Wang et al first reported additional protein consumption is associated with type 2 diabetes risk in south Asian Indians [5]. Over the years, very few studies were carried among professional bodybuilder and athleteto find association between energy attuned additional protein in diet and diabetes.Hence, the present observational study was aimed to estimate the amount of blood glucose level among bodybuilders consuming supplement protein more than the recommended daily allowance.

II. METHODOLOGY:

Study design and selection of participants:

The present observational cross sectional study consisted of 55 professional male bodybuilders randomly selected across Chennai city, Tamil Nadu, India. The study was conducted following the Helsinki declaration as revised in 2013.All the participants were briefed about the purpose of the study, aims and methods followed by obtaining a written informed consent with assured that their participation was purely voluntary.Male Bodybuilders between 22 to 30years of age, not diagnosed with any systemic diseases including diabetes, hypertension, and other cardiovascular ailments and with known history of protein powder supplement intake with BCAA (Branched chain Amino Acid)for more than 1 year, were only included in the study.

Questionnaire data:

After the approval of the Ethics and Research Committee, all the 55 participants completed questionnaire on demographic data with basic activity profile that included age, gender, past medical history, daily activities, quantity and frequency of protein powder consumption, type of bodybuilding practices, duration of training, frequency of training, consumption of alcohol or tobacco, and smoking.The data were collected through the questionnaire, and later organized into a database.Participants were then invited to complete the clinical assessments as described below.

Clinical assessment:

Bodybuilder's weight (nearest 0.1 kg) was measured on a digital clinical scale (Acme Scale Co., San Leandro, CA) and height (nearest 0.1 cm) was measured with a calibratedstadiometer tool (Acme Scale Co., San Leandro, CA). Body mass index (BMI) (kg/m^2) was calculated as weight (kg)

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divided by height squared (m^2). Random blood sugar level was obtained from each participant before the beginning of their routine training by using AccuChek Instant Glucometerautomated blood sample analyzer (Roche Diabetes Care, Inc.,Indiana, USA) as per manufacturer's instruction under aseptic protocol.

Statistical analysis:

All the responses were recorded and data analysis among the selected population group was performed using statistical analysis package IBM SPSS software Version 22.0. Associations of baseline characteristics with random blood sugar leveland average protein powder consumption were assessed using the Kruskal-Wallis test for continuous variables and the χ^2 (Chi-Square) test for categorical variables.Characteristics of populations were described by proportions for categorical variables, means and standard deviation for normal distribution, and medians and interquartile ranges for skewed distribution of continuous variables.To determine association of protein with blood sugar level multivariable logistic regression models were used at 95% CI intervals were shown, being considered statistically significant differences when $P \leq 0.05$.The model was initially adjusted for age and BMI and then further adjusted for protein intake and blood sugar level.

III. RESULTS:

On descriptive analysis, the study sample comprises of 55 male bodybuilders with a mean age of 24.76 ± 2.04 years. For the clinical assessment, the mean weight was 85.09 ± 5.81 kg while the mean height was 176.8 ± 1.74 cm with a mean BMI (Body Mass Index) of 27.19 ± 1.65. On evaluation of protein intake the mean consumption of protein powder with BCAA was 24.9 ± 3.28gms per day and random sugar level assessment showed mean value of 138.67 ± 3.305 mg/dL.Associations of baseline characteristics (Age, BMI) with random blood sugar leveland average protein powder consumption were assessed using the Kruskal-Wallis test for continuous variables and the χ^2 (Chi-Square) test for categorical variables (Table1). Age, Body Mass Index, mean consumption of protein powder with BCAA showed significant correlation with random blood sugar level (Table 2).

Table 1: Association of baseline characteristics among the study population

Characteristics	N	Mean Value	P value
Age	55	24.76 ± 2.04	**0.04***
Body mass index (kg/m^2)	55	27.19 ± 1.65	**0.003***
Protein Powder Intake	55	24.9 ± 3.28gms	**0.023***
Blood sugar level	55	138.67 ± 3.305	**0.035***

*p Values comparing the overall groups by blood sugar level, calculated by χ^2 test or Kruskal-Wallis test as appropriate, p<.05 –significant level

Table 2: Correlation analysis showing the linear relationship between variables and their association

	Age	Body mass index (kg/m^2)	Protein Powder Intake	Blood sugar level
Age	1			
Body mass index (kg/m^2)	**0.041063***	1		
Protein Powder Intake	0.3131953	**0.0036912***	1	
Blood sugar level	0.2556674	**0.0239070***	**0.035903167***	1

*p<.05 –significant level

Table 3: Sequential Models Showing the Association between protein intake and blood sugar level among the study population

	Standardized Odds Ratio	95% Confidence Interval	P value
Unadjusted model	1.48	0.87-2.63	**0.027***
Adjusted for age and	1.65	1.11-1.95	**0.04***

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BMI			
Fully adjusted for age, BMI, Protein intake and Blood sugar level	1.74	1.38-2.89	**<.001***

In an unadjusted logistic regression model, there was 48% increase in odds of blood sugar level per standard deviation in gram of protein intake/day (standardized OR 1.48 [95% CI 0.87, 2.63], p = 0.27). In a model adjusted for age and BMI, the association was significant (standardized OR 1.65 [95% CI 1.11, 1.95], p = 0.04). In a fully adjusted model for age, BMI, Protein intake and Blood sugar level the association remained strong (standardized OR 1.74 [95% CI 1.38, 2.89], p = <.001). In the total study population, protein intake demonstrated a significant positive relation with blood sugar level [OR: 1.74 (1.38, 2.89)]. (Table 3)

IV. DISCUSSION:

Diabetes Mellitus is a metabolic disease characterized by high blood glucose level caused due to lack of insulin activity with an increased prevalence in the South Asian population compared to other ethnic groups. Lack of insulin activity results in hyperglycemia, a state of increased production of glucose during higher intensity or aerobic exercise that hinders the body's ability to store and utilize nutrients properly resulting in increased protein breakdown and reduced protein synthesis which limits muscle growth [12].

In the present study population, protein intake demonstrated a significant positive relation with blood sugar level. The association between protein intake and diabetes was also assessed by Ericson et al [13], Feskens et al [14], Linn et al [15], and Sluijs et al [16] showed increased insulin resistance, reduced glucose disposal stimulated gluconeogenesis by 40% resulting in increased blood sugar level. Wang et al [5] , Tinker et al [17], Duc Son le NT et al [18], Nettleton JA et al [19], and Ghosh A [20] in their respective studies showed consuming 5 energy % from protein at the expense of 5 energy % from carbohydrate or fat increased diabetes risk by 30%.Contrasting results were reported by Ke Q et al [12], Gannon et al [21], and Rietman et al [23] owing to the difference in nature of protein intake, variance in study methodologies and duration of observation thus making it difficult to obtain a direct assessment regarding the increased odds of diabetes or blood sugar level per gram of protein as compared to other population groups and healthy individuals.

In the present study difference in blood sugar level was observed at the expense of carbohydrate or fat. This could be attributed to the fact that increased dietary protein intake and decreased carbohydrate intake mediated diabetes through several possible mechanisms including advanced glycation end products resulting in intense inflammatory response which may play a role in development of diabetes [23].It was also concluded that higher protein diet may or may not improve HbA1C (Glycated hemoglobin) but appears to improve one or more cardiovascular risk factors. In this bodybuilder's population group, there was a trend toward increased odds of blood sugar level and higher protein intake, which supports the main outcome of this study.

Insulin resistance may arise, as amino acids can inhibit glucose transport and phosphorylation, leading to impaired glucose synthesis.Ke Q et al [12], Batch et al [24], Huffman et al [25], Newgard et al [26], and Shah et al [27]observed protein supplements with BCAA distinguished metabolically healthy from unhealthy individuals with increased risk of type 2 diabetes.The exact mechanism by which excessive amino acid availability may contribute to insulin resistance has not been fully investigated. However, it has been hypothesised that mammalian target of rapamycin (mTOR) complex 1 hyperactivation in the presence of amino acid overload contributes to reduced insulin-stimulated glucose uptake because of insulin receptor substrate (IRS) degradation and reduced Akt-AS160 activity. In addition, high-protein diets shows long term effects on insulin sensitivity during severe muscular activity associated conditions. An isocaloric high protein diet and higher branched-chain amino acid intake may also increase insulin resistance, which could adversely affect metabolism.

V. CONCLUSION:

In summary, protein powder with BCAA is directly associated with an increased blood sugar level resulting in probable risk of incident diabetes. Our findings also suggest a significant association for protein supplements with that of BMI. The consumption of energy from protein, as the same percentage of energy from other macronutrients increased diabetes risk. The major limitation of the study include the small sample size, assessment of macronutrient intake without taking account of other macronutrient at the time of study. Similarly random blood sugar level was taken as reference

which needs to be further evaluated by Fasting blood sugar (FBS) as well as HbA1C (Glycated hemoglobin) levels to obtain better results.

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CONFLICT OF INTEREST: None declared

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