

Original

Prevalence of protein supplement use at gyms

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Abstract

At the present time, the abuse of all class of sport nutritional supplements (NS) has extended the people who go regularly to gymnasiums. Between these substances there are the Protein Powder Supplements (PPS). The purpose of this study is to examine the consumption of PPS in 415 individuals from Seville fitness centers.

All individuals were evaluated with anthropometric measurements and completed a questionnaire previously reviewed, evaluating the validity of the content, application, structure and presentation.

28% of the individuals were using or used PPS. Of the total, 42.7% of male individuals compared to 3.2% of the females. The use of PPS was higher than what has been reported in previous studies about supplement use in fitness center, 28% vs 10-14% aprox.

The SPP use is associated with sex, age, and time of sport practiced.

More than a 25% of the total individuals that attend a gym use PPS. The total individuals that attend a gym and use PPS far exceed the RDA of protein for general population and/or athletes, being able to cause problems of health.

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Key words: Exercise. Physical activity. Powder protein supplement. Fitness center. Questionnaire.

Abbreviations

SN: Suplementos nutricionales.
NS: Nutritional supplements.
SPP: Suplementos Proteicos en Polvo.

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ESTUDIO ESTADÍSTICO DEL CONSUMO DE SUPLEMENTOS PROTEÍCOS EN GIMNASIOS

Resumen

En la actualidad, el abuso de toda clase de suplementos nutricionales (SN) deportivos se ha extendido a las personas que acuden a gimnasios regularmente. Entre estas sustancias están los Suplementos Proteicos en Polvo (SPP). El objetivo del presente estudio es evaluar el consumo de suplementos proteicos en un grupo de 415 usuarios de gimnasios sevillanos. Los usuarios fueron valorados antropométricamente y realizaron un cuestionario que previamente fue evaluado para conocer la validez del contenido, aplicación, estructura y presentación.

El 28% de la muestra consumían o habían consumido SPP, resultando, el 42,7% del total de los hombres frente al 3,2% del total de las mujeres encuestadas. El porcentaje de consumo de SPP está por encima de los valores aportados por otros estudios que evalúan la suplementación en gimnasios, 28% vs 10-14% aprox.

El consumo de SPP está asociado con el sexo, la edad y el tiempo de práctica deportiva.

Más de una cuarta parte de las personas que acuden regularmente a un gimnasio consumen SPP. El total de los usuarios de un gimnasio que consumen SPP realizan un consumo diario de proteínas mucho mayor que el recomendado para la población normal y/o deportista, pudiendo ocasionar problemas de salud.

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Palabras clave: Ejercicio. Actividad física. Suplemento proteico en polvo. Gimnasio. Cuestionario.

PPS: Protein Powder Supplements.
CDR: Cantidad diaria recomendada.
RDA: Recommended daily allowance.
IRB: Institutional review board approval.

Introduction

The fitness center is a place where people who don't have a professional relationship with sports train. The environment created in these centers contributes to spread stereotypes and aesthetic procedures.¹

In all areas of sport and physical activity there are many products that look for better endurance, quicker recovery, fat loss and muscle building. These products

also pretend to enhance sports performance and physical appearance.²

Nowadays, the abuse of Sports Nutritional Supplements by exercising individuals that regularly attend a gym has increased. These individuals look for physical or appearance benefits without considering negative health consequences.³⁻⁵

The American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine⁶ state that only those persons who restrict their energy intake, use severe weight-loss practices, eliminate one or more food groups from their diets, or consume high-carbohydrate diets and low micronutrient density may require some dietary supplementation.⁷

Sports Nutritional Supplements include Powder Protein Supplements (PPS) which are products with a strong market position and one of the most consumed supplements among exercising individuals attending a gym.⁵ According to Applegate and Grivetti⁸ and Ciocca,⁹ protein may be the most nutritional ergogenic resource used.

Milo of Croton was a 6th century B.C. famous wrestler, and winner of five gold medals in the Olympic Games in the Ancient Greece. He trained doing laps in the stadium and carrying a calf on his shoulders that he used to eat after training being his meat consumption about 20 lbs.^{2,8} per day. Protein sources started to become significantly associated with improved strength and/or muscle mass.^{10,11} Since then, the association between protein intake and body mass has been a requirement¹² that has not been scientifically proven.^{13,14} Although amino acids and proteins are essential for the synthesis of several body structures and are involved in many metabolic mechanisms, their intake without a well-conducted exercise regimen is not enough to increase body mass and strength. It has been suggested that athletes need extra protein in their diet as food or as supplements,^{9,15-17} but individuals who regularly exercise in gyms do not need this extra protein. Therefore, protein requirements may range from the normal $1.0 \text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ up to $2.0 \text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ in special situations.^{6,12,13,15,18}

Protein and amino acids abuse, as food or supplements, seems to be associated with side effects such as ketosis, increased body fat, gout, kidney overload, dehydration, urinary excretion of calcium, and loss of bone mass.^{12,17,19,20}

Numerous studies have focused on the use of protein supplements in normal or pathological situations²¹⁻²³ and by athletes of different performance levels.^{10,14,15,18,24,25}

There are a few studies on NS use by individuals that regularly attend a gym.²⁶⁻³² The purpose of this study is to examine the use of protein supplements in a group of 415 individuals that regularly attend gyms in Seville, Spain and contribute to the existing literature about this population.

Material and methods

415 individuals (260 men and 155 women) that regularly attend 4 gyms in Seville were evaluated with

anthropometric measurements (size and weight) using a GPM anthropometer ($\pm 1 \text{ mm}$ precision) and a Tefal brand scale ($\pm 100 \text{ g}$ precision).

Individuals completed a questionnaire previously reviewed and tested in a pilot study conducted in a little group (35 users) and a final version was developed. It was reviewed content (to observe the ability of the questionnaire to measure the use of protein supplements), application (to analyze advantages and disadvantages and to review questionnaire instructions), format (to review the formulation of questions, proposed sequence and response scale); and presentation (to identify the best format and appearance for the questionnaire).

The questionnaire had four parts: 1) personal and anthropometric data, 2) diet and physical activity, 3) use of protein supplements, 4) legal consumption of supplements and negative health consequences.

For a 95% confidence (with a margin of error of 5%), a minimum of 385 questionnaires were required.³³ We selected a random sample, by giving a questionnaire to every third person who came in the door, to represent exercising individuals' diversity. Participants completed anonymous questionnaires in the gym entry. Data were collected from 8 am to 2 pm, and from 4 pm to 9 pm Monday through Friday, and from 9 am to 1 pm Saturdays and Sundays. Data collection was simultaneously conducted in just one phase and by three pollsters during a week in three different fitness centres. It was our intention to cover all the business hours in order to include all the "user profiles".

Informed consent was obtained from each participant. The study was exempt from institutional review board approval (IRB) due to prior IRB approval for doctoral thesis. Data analysis was carried out using SPSS 12 (SPSS Inc. Chicago, IL, USA). First, descriptive statistics were performed utilizing frequency tables and percentages for categorical variables, and descriptive measures were calculated for quantitative variables. Then, inferential statistics were performed using *Pearson Chi-square* statistic test and/or *Fisher exact test* for categorical variables. Previous Shapiro-Wilk or Kolmogorov-Smirnov Normality tests, *T-tests* and ANOVA were used to compare two or more means of quantitative normal variables. Open-ended questions were tabulated using multiple choice options.³⁴

A multivariate logistic regression analysis was used to determine the variables that influence PPS consumption and consumer's profile. The percentage of right classification, coefficients of corresponding exponentials and a 95% confidence interval were obtained.

Results

Subjects' characteristics, anthropometrics' characteristics and gym practice are shown in table I and II.

Forty-eight percent of the participants indicated that the main reason to attend the gym is to be in good

		Frequency	%
Sex	Male	260	62.7
	Female	155	37.3
Profession	Student	115	27.7
	Worker	251	60.5
	Student and worker	41	9.9
	N/A	8	1.9
Number of School years	Primary school	63	15.2
	High school	129	31.1
	College	127	30.6
	University	96	23.1

shape. The second reason is to exercise (19%), and the third reason is for health benefits (11.1%) (participants could also choose more than one option). Regarding gender, male participants indicated that reasons in decreasing order of importance are: to be in good shape, exercising and to feel better. Female participants indicated these reasons for attending the gym: to be in good shape, health benefits, and exercising.

30.1% of the participants in the sample (125 individuals, 53 males and 72 women) were on a diet that involved food and nutritional control. A total of 85 respondents were on a low fat diet, the most common diet among participants.

28.0% of the total, 42.7% men and 3.2% women were using or used protein supplements. There are individuals that have consumed up to 20 different PPS commercial brands. Table III shows the most widely consumed commercial brands of protein supplements by the participants. The survey included the average proportion of protein in the PPS consumed by the participants, 78.90%. These commercial brands recommend a daily average protein intake of 57.33 g.

We studied participant's preferred places to buy protein supplements. They frequently chose gyms, sports and nutrition supplements stores and shopping malls to buy PPS. A total of 68.1% of the consumers

occasionally bought PPS in a gym, 51.7% occasionally bought PPS in sports and nutrition supplements stores and 14.6% in a shopping mall. Seventy-six individuals (66.1% of the total) were motivated by friends to buy PPS, 59.7% of the total was motivated by gym's instructors and 16.4% by trainers, although 100% of the gyms reported having a nutritionist.

We studied the time of day in which participants used PPS. A total of 25 participants (21.7%) consumed proteins before training, 24 participants (20.9%) consumed them after training and 22 participants (19.1%) consumed proteins before and after training. A total of 22 participants (19.1%) consumed proteins in the morning and in the evening regardless the time of training. Therefore, a 52.68% of the sample used PPS once a day, and 47.31% twice a day. A total of 89 individuals (77.4%) using PPS reported positive results, 22 individuals (19.1%) reported negative results, and 5 individuals (3.7%) were undecided or did not answer.

Three-hundred-seventy-one participants (89.4%; 228 men and 143 women) were in favor of legal use of nutritional supplements. Only 16 male individuals (3.9%) from 415 total participants used or would use nutritional supplements to improve performance even if they cause health damages. Twenty-two male individuals (5.3%) used or would use illegal or prohibited supplements.

Logistic regression analysis (table IV) showed that PPS use is more common among men ($P = 0.0001$; $\hat{O} = 151.845$) (the odds ratio of PPS users vs. non users is 151.845 higher in our sample as shown in table IV). Men who used PPS in our sample:

- were below 30 years of age (the participants of the study were divided into two groups: 30 years and below and above 30 years of age) ($P = 0.007$; $\hat{O} = 2.499$)
- were training in a gym for a long period of time ($P = 0.0001$; $\hat{O} = 1.250$)
- attended the gym a few hours a week ($P = 0.0001$; $\hat{O} = 1.291$) (men who spent more time in the gym were more likely to use PPS)
- were on any kind of diet ($P = 0.0001$; $\hat{O} = 4.482$)

	Total	Male	Female
Age (years) ^a	31.63 ± 11.15 (17;68)	29.95 ± 10.22 (18;68)	34.43 ± 12.06 (17;65)
Height (m) ^a	1.72 ± 0.08 (1.50;1.96)	1.77 ± 0.06 (1.58;1.96)	1.64 ± 0.06 (1.50;1.78)
Weight (kg) ^a	73.38 ± 11.26 (46;112)	79.15 ± 7.41 (60;112)	63.69 ± 9.90 (46;110)
Years attending the gym ^a	3.01 ± 2.89 (0.08;16)	3.13 ± 2.82 (0.1;16)	2.82 ± 3.01 (0.8;16)
Days of the week attending the gym ^a	3.64 ± 1.02 (1;6)	3.78 ± 1.02 (1;16)	3.41 ± 0.97 (2;6)
Time attending the gym per day (min) ^b	87.41 ± 27.14 (30;240)	92.17 ± 25.02 (45;210)	79.42 ± 28.71 (17;240)

Average ± SD (min;max).
^aHighly significant ($P < 0.001$).
^bNot significant.
 Student's t test for independent samples was used to compare means

Table III
Commercial brands of the most frequently consumed protein supplements by the participants

Brand	N.° of participants	Protein ^a	Protein Source ^b
1	33	75	WPC
2	32	86	WPC
3	31	77.5	WPC
4	28	86.2	WPC
5	20	68	WPC + Calcium Caseinate
6	18	84	WPC
7	16	70.2	WPC + WPI + Partially hydrolyzed Whey Protein
8	15	85	WPC + WPI + Isolated Soy Protein
9	14	91	WPI
10	11	78	WPC
11	9	78.5	WPI + WPC + Whey Peptides
12	9	79.1	WPC + immunoglobulins
13	7	80	WPI
14	6	74.1	WPC + WPI + lactalbumin
15	5	51.7	WPC + Calcium Caseinate
16	5	87	WPC

^aData are expressed as g/100 g product.

^bProtein Source: WPC, whey protein concentrate; WPI, whey protein isolate.

The percentage of right classification was 83.6%. Table IV shows the variables (mentioned above) used for the logistic regression analysis, significance (Sig.), odds ratios (\hat{O}) and the 95% confidence interval (CI).

Discussion

There are several articles in current bibliography that evaluate SN consumption in fitness centers. Among them, there are several about PPS consumption, the object of our study. The percentage of PPS used in our study (28%) is higher than what has been

reported in previous studies (10% and 13,98%) that evaluated SN consume by fitness center's user.^{26,27} Consistent with previous reports, PPS consumption was more prevalent among men.²⁶⁻³⁰

As in our study, to be in form, to do exercise or to be healthy are some of the options most chosen to come to the gymnasium.^{26,27}

The results found in the bibliographical review regarding who informs and promotes SPP consumption are similar to our study results.²⁷ Mainly, the users reported taking supplements by suggestion from a friend,^{26,27} self-prescription^{26,27,30,35} and trainer or gym's instructor indications,^{26-29,36-38} and their supplements use

Table IV
Consumer profile variables to be considered in nutritional supplements users

Risk variables	B	Wald	Sig. (P)	OR	95% CI	
					Inferior	Superior
Sex ⁽¹⁾	5.023	51.565	0.000	151.845	38.548	598.130
Age ⁽²⁾	0.223	15.299	0.007	2.499	1.278	4.888
Time ⁽³⁾	0.255	19.760	0.000	1.250	1.118	1.398
Diet ⁽⁴⁾	1.500	14.721	0.000	4.482	2.083	9.643
Hours/week ⁽⁵⁾	0.916	7.162	0.000	1.291	1.153	1.445

⁽¹⁾Male vs Female.

⁽²⁾< 30 years vs > 30 years.

⁽³⁾Those who have attended the gym for a longer time consume more.

⁽⁴⁾Diet vs No Diet.

⁽⁵⁾Those who exercise more hours consume more.

Logistic Regression Analysis Results

is without seeking any professional guidance, although a lot of the gyms reported having a nutritionist.²⁶

The percentage of SPP consumers that obtained the desired results was higher in our study (77%) than in other reviewed studies (55%)²⁶. There is no conclusive evidence that the majority of supplements have any health or performance benefits, and any improvement related to performance is typically mediated by placebo effects.^{8,39} According to the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine when athletes believe that certain foods, diets or supplements improve performance, these substances or technologies can provide psychological benefits, more than physiological ones.⁶ Short (1994) and Trissler (1999) have verified in their studies that some consumers buy SN just in case they are useful.^{12,40}

Many checked studies, included ours, associated supplement use with a sex, age, and time of sport practiced. Thus, young men, who go to fitness center regularly (3 times at the week) since 1 year ago at least, is the profile of the consumer of SN.^{26,27,31,32} The fact that the majority of SPP consumers have been exercising regularly for more than a year shows that there is a tendency to look for supplements in order to improve results. Time devoted to exercise and attending the fitness center affects supplement use as individuals are more exposed to a consumption environment.

The participants preferred gyms, sports and nutrition supplements stores, and shopping malls to buy PPS. There is only another study that reports athletes' preferences to buy PPS:⁴¹ supermarkets, sports and nutrition supplements stores, and pharmacies. We observe that sports and nutrition supplements stores are the only places in common preferred by users in both studies.

According to scientific literature,^{42,43} the recommended daily intake of protein varies from 1.2 to 1.4 g/kg for resistance athletes, and from 1.7 to 1.8 g/kg for strength athletes—it is 160% and 220% of the recommended intake for general population (0.8 g/kg/day).⁴⁴

The indirect assessment of total energy expenditure of PPS users (considering basal metabolic rate, diet-induced thermogenesis and the energy cost of physical activity^{45,46} report a mean energy expenditure of 3251 kcal/day for men (we have chosen male participants because they are more representative). The recommended protein intake is 15% of total energy intake (488 kcal), it is 122 g/kg/day for men. Participants in our study add one or two intakes of 57.33 g of PPS with a protein purity of 78.9% (45.23g in one or two intakes). This results in the consumption of 167 g to 212 g/kg/day of protein by male participants in one or two intakes. Considering that the average weight of male PPS users is 76.52 kg, we have found that they consume from 2.2 g to 2.8 g/kg/day of protein, approximately 309% of the daily recommended allowance for general population,⁴⁴ 190% for resistance athletes and 141% of the recommended protein allowance for

strength athletes. Obviously, this high intake of protein far exceeds the daily recommended allowance for the three groups. Very rarely, those individuals who exercise regularly should take dietary supplements.^{7,47-51}

The abuse of protein supplements increases the risk of dehydration if the right amount of liquid is not consumed because 50 ml of water are needed to excrete a gram of urea.⁴³ The exceed consumption of proteins can catalyze deamination and transamination processes and the transformation of hydrocarbonated residues in fat, as there are not amino acids reserves in the body.² Furthermore, the high intake rate of protein by the participants might indicate inappropriate and dangerous consumption. The amino acid carbon skeleton may be deviated by energy production (Krebs cycle intermediary compound synthesis) or excreted, because the human being does not have a protein reserve compartment.

89.4% of the participants in the sample were in favor of legal use of nutritional supplements. Only 3.9% of the participants would use supplements even if they cause health damages, and 5.3% would use illegal or prohibited supplements. Numerous studies have shown that supplement users are not conscious of the products they consume and sometimes they use supplements that are harmful and/or contain illegal or prohibited substances.^{4,11,52-59} The majority of these studies have found that many users do not receive professional information about nutritional supplements. The media play an important role in the decision to use supplements.^{60,61} The population is increasingly exposed to more information from the media than from the scientific community.⁶²⁻⁶⁴

PPS have been bought for many years by strength athletes above all. PPS protein content is derived from cow's milk, eggs and soy and does not add any advantage to natural sources when equivalent amount of proteins are compared. Furthermore, PPS are more expensive than natural sources of protein. This is based on the mistaken idea that protein supplements have special muscle-building power or, which is even worse, that unlimited muscle mass and strength are associated with a higher consumption of proteins.⁴³ It must be highlighted that even if these supplements are useful to provide additional protein sources, they must be a complement to a well-balanced healthy diet not a substitute. Conclusive results show that the average Western diet provides enough protein for athletes.⁶⁵ More education is needed about NS and PPS risks and effective use and, more importantly, how to maximize nutrient intake from food to minimize or avoid the use of nutritional supplements.⁶⁶

According to the American Dietetic Association⁶ any recommendation for athletes and sportsmen/women should be given based on current scientific data and individual needs.

Supplements should be used cautiously and only after checking that they are legal. The existing literature about the ingredients on the product label should be reviewed. Supplements should not be recommended

without evaluating the individual's health, diet, nutritional and energetic needs, and current use of supplements and drugs.

Conclusions

In conclusion, a considerable number of people who regularly exercise at gyms consume PPS, mostly without specialized guidance and possibly without real need of them. Men who attend a gym consume more PPS than women. Men who are below 30 years of age and on any kind of diet consume more PPS.

The total number of individuals attending a gym that use PPS exceed the recommended intake of proteins for general population and/or athletes. Overuse of PPS to be associated with health risk.^{12,17,19,20}

One can conclude that the use of supplements was associated with people who perhaps needed them less.

Supplements use in fitness centres is sufficiently relevant and important to receive attention in future detailed studies.

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