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ORIGINAL ARTICLE

# Health aspects of active bodybuilders: monitoring by multidisciplinary team

## Aspectos de salud de los culturistas activos: seguimiento por un equipo multidisciplinario

## Aspectos de saúde de fisiculturistas ativos: acompanhamento por equipe multidisciplinar

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**Keywords:**
Weight training;
Bodybuilders;
Health aspect;
Multidisciplinary.

**ABSTRACT**
Preparation in bodybuilding involves high-intensity workouts and drastic feeding strategies. Little is known about health risks. Athletes (n=510, 59.8% male) were evaluated about health aspects, anthropometry, and blood pressure (BP). Chronic diseases were reported by 6,6%, but 88.9% of them did not treat; 1.9% reported hypertension, with 15.7% having high BP; and 52.5% reported the use of prohibited drugs in the last 6 months. Body mass index was 26.2±2.5 for man and 22.3±2.2 Kg/m$^2$ for woman. Men had lower monitoring than women by physical education professionals, nutritionists, and physicians (p<0.01). Athletes are exposed to health risks factors such as lack of knowledge about diseases, high use of prohibited substances and less monitoring by professionals among men.

**Palavras-chave:**
Treinamento com pesos;
Fisiculturistas;
Aspecto de saúde;
Multidisciplinar.

**Resumo**
A preparação para o fisiculturismo inclui exercícios de alta intensidade e estratégias alimentares drásticas. Pouco se sabe sobre os riscos à saúde. Atletas (n=510, 59,8% homens) foram avaliados quanto à saúde, antropometria e pressão arterial (PA). Doenças crônicas foram relatadas por 6,6% (88,9% não tratadas); 1,9% relataram hipertensão, mas 15,7% tinham PA elevada; e 52,5% relataram uso de drogas proibidas nos últimos 6 meses. O índice de massa corporal foi 26,2±2,5 para homens e 22,3±2,2 kg/m2 para mulheres. Os homens tiveram menor acompanhamento por profissionais de educação física, nutricionistas e médicos (p <0,01). Os atletas estão expostos a riscos à saúde, como desconhecimento de doenças, alto uso de substâncias proibidas e menor monitorização profissional dos homens.

**Palabras-clave:**
Entrenamiento con pesas;
Fisicoculturistas;
Aspecto de salud;
Multidisciplinario.

**RESUMEN**
La preparación en el culturismo incluye ejercicios de alta intensidad y estrategias de alimentación drásticas. Se sabe poco sobre los riesgos para la salud. Los deportistas (n=510, 59,8% hombres) fueron evaluados cuanto a la salud, antropometría y presión arterial (PA). Las enfermedades crónicas fueron reportadas por 6,6% (88,9% no tratavam); 1,9% informó hipertensión, pero 15,7% tenía PA alta; y 52,5% informó el uso de drogas prohibidas en 6 meses. El índice de masa fue 26,2±2,5 para el hombre y 22,3±2,2 kg/m2 para la mujer. Los hombres tuvieron menor seguimiento por profesionales de educación física, nutricionistas y médicos (p<0,01). Los deportistas están expuestos a riesgos para la salud como el desconocimiento de las enfermidades y el alto uso de sustancias prohibidas.

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## INTRODUCTION

Bodybuilding, initially, was exclusively for men (Men's Bodybuilding), and it was adapted to suit women (Women's Bodybuilding) and, later, those who wish to show off their physique, but with less muscle volume. Other modalities emerged and currently exist eleven (in the International Federation of Bodybuilding and Fitness), being six for men and five for women. The categories are divided by body weight (BW) or height (HT) or by the HT / BW ratio (IFBB, 2021b; Coraucci, 2018)

Unlike most other sports, in bodybuilding, athletes perform poses on stage and are classified by their aesthetic excellence based on muscle mass, physical harmony, line, symmetry, proportion, definition, tone and/or muscle volume, developed mainly by through resistance training, nutritional strategies and supplementation (Escalante et al., 2021; Alves et al., 2020; Sánchez-Oliver et al., 2019; Chappell et al., 2018; Hackett et al., 2013; Cyrino et al., 2002). These strategies are adopted by athletes from other sports and by people who seek quality of life and health through strength training (Santonja et al., 2016)

In general, preparation for a competition involves drastically reducing body fat and increasing and/or maintaining muscle mass with symmetry and proportion, with minimal fluid retention (Helms et al., 2014; Cyrino et al., 2002). However, the strategies depend on the athlete's competition modality that have specific rules and proposals and, therefore, can influence the athletes' preparation routine (Alves, et al., 2020).

Due to the particularities of an athlete's preparation, which involves many interrelated variables, there is no clear scientific evidence on guidelines, safety and effectiveness of the nutritional strategies used (Escalante et al., 2021; Iraki et al., 2019; Halliday at al., 2016). Using a parallel with athletes from other sports and/or non-athlete individuals may be inappropriate (Mitchell et al., 2017). In addition, individual specific recommendations may be needed for athletes in each sport, which have their own specificities.

As for physical training regimens, bodybuilders use advanced techniques with overloads that have not yet been scientifically validated (Hackett et al., 2013) and it is established in the literature that the practice of intense exercise can increase the risk of heart problems (Mert et al., 2018; Dijkstra et al., 2014)

Athletes in high-performance competitions are exposed to major biological and psychological stresses and the monitoring of a multidisciplinary team is essential for the athletes' health (Dijkstra et al., 2014; Speed, 2013; Vianna and Mezzaroba, 2013; Kleiner et al., 1990).

Considering the amateur level of sport, where athletes have considerable expenses for their preparation and do not have a direct financial return from the sport, it is important to know how some aspects of their health are cared and if they have multidisciplinary professional monitoring

## MATERIAL AND METHODS

### PARTICIPANTS

All participants were amateur bodybuilders competing according to the standards of the International Federation of Bodybuilding and Fitness (IFBB), active and affiliated with the Brazilian Confederation of Bodybuiding and Fitness (CBMFF – IFBB Brazil).

Athletes of both genders (n=510) from all regions of Brazil were evaluated. They were participating in the Men´s Bodybuilding, Men´s Classic Bodybuilding, Men´s Physique, Men´s Fitness, Women´s Bodyfitness, Women´s Bikini Fitness, Women´s Physique, Women´s Fitness and Women´s Wellness Fitness modalities.

The study was approved by the Research Ethics Committee of the Health Center School (Nº 37388214.9.0000.5414), observing the Declaration of Helsinki.

### MEASURES

Data were collected using a questionnaire about health aspects, personal and professional profile data, state of residence, competition time, training time, and category.

Regarding the athlete's health aspects, the questions covered points about the use of a multidisciplinary team for monitoring, habits regarding medical examinations, and use of self-medication and of prohibited substances for enhanced performance that pose health risks.

Body weight (BW) was determined with the "Filizola Personal 180" electronic scale to the nearest 0.1 kg following official protocol of the federation: subjects barefoot and wearing swimsuits (except Men's Physique athletes who wore surfer shorts). Height (HT) was measured with a SECA 213 mobile stadiometer to the nearest 0.1 cm with subjects in barefoot following official protocol of the federation. Blood pressure (BP) and heart rate were measured on the right arm/forearm with oscillometric device (OMRON: HME-431) and cuffs (OMRON: HEM-CR24 and HEM-CL24) with 22 to 32 cm and 32 to 42 cm in diameter, with three measurements at 5-minute intervals, with the individuals seated, using the average of the three measurements obtained. Abdominal and right arm circumference were measured with a 150 cm anthropometric tape. For abdominal measurement, the tape was placed in the horizontal plane over the umbilical scar with the individual in the standing position. Still in this body position and with the right arm positioned at the side of the body, for the right arm measure, the tape was positioned in the horizontal plane over the middle third between the acromial process of the scapula and the olecranon process.

## DESIGN AND PROCEDURES

After authorization by the Brazilian Confederation of Bodybuilding and Fitness, data were collected during the registration and official weighing of athletes at events organized by the confederation. A team of professionals collected the data according to a pre-established standard. The questionnaire was completed without the athlete's personal identification, so that he would feel more comfortable answering the questions freely. The athletes were informed about the confidentiality of personal information.

Upon arriving at the official competition registration and weighing room, the athlete was accommodated in a seated position. At this time, the athlete was invited to participate in the research, and, in case of acceptance, the free and informed consent form was read and signed.

Afterwards, a person from the researcher's team explained how to fill out the questionnaire and followed the procedure to clarify doubts, if necessary. After verifying the completion of the questionnaire, the athlete was sent to another sector within the weighing room. With the athlete seated and with the forearm resting on the table, blood pressure and heart rate measurements were taken. At the end of the previous step, the athlete was asked to stand up to take the measurements of waist and arm circumference.

Then, the athlete, accompanied by a member of the researcher´s team, was referred for measurements of body weight and height. To respect the rules and criteria of the sport, such measurements were carried out by the members of the entity responsible for the championship.

Inclusion criteria were consented to participate in the study, signing the Informed Consent Form and be registered in the CBMFF/IFBB BRASIL competitions. As an exclusion criterion, the elimination of athlete with incomplete questionnaires was adopted.

## STATISTICAL ANALYSIS

An exploratory analysis of the data was first performed. The sample characteristics are reported as means and standard deviation and the Student t-test was performed to compare means, since the Shapiro-Wilk normality test evidenced parametric variables. Quantitative parameters were assessed using the Chi-square test ($p < 0.05$). All analyses were carried out using the IBM SPSS Statistics software - version 23.

## RESULTS

A total of 510 male and female athletes participated in the study. However, the answers of four participants were discarded due to an error in completing the questionnaire. There was no difference between male and female groups regarding mean age, BMI, arm circumference or lifetime weight training. However, there was a difference in HT, BW, waist circumference and lifetime competition. The age of the participants was 29,5±6,8 and 29,1±6,5 years (p=0,69) for male and female, respectively. The general and anthropometric characteristics of the participants are presented in Table 1.

Athletes from all regions of the country participated: 27.6% of them from the south, 22.1% from the southeast, 11.4% from the northeast. 9.3% from the central region, and 3.4% from the northern region.

The competition modalities evaluated were Men´s Bodybuilding (45.5%), Men´s Classic Bodybuilding (34.7%), Men´s Physique (19.3%) and Men´s Fitness (0.3%) for males, and Women´s Wellness Fitness (38.3%), Women´s Fitness (16.4%), Women´s Bikini Fitness (14.9%), Women´s Bodyfitness (13.9%), and Women´s Physique (11.9%) for females.

Health data are presented in Table 2.

Regarding self-knowledge about chronic diseases, 55.5% of the athletes said they had none, 22.3% had no knowledge, and only 6.6% said they had at least one. Of these, 88.9% said they did not use medication regularly.

High BP was detected in 15.7% of the 502 athletes who performed the measurements, 19.3% and 10.1% of male and female athletes, respectively. Systolic blood

**Table 1.** General and anthropometric characteristics of male and female athletes active in different bodybuilding modalities and affiliated with CBMFF/IFBB Brazil.

| FEATURES | MALE (n=305) | FEMALE (n=201) | |
|---|---|---|---|
| **Anthropometric characteristic** | | | |
| Height (meter) | 1.74 ± 0.74 | 1.63 ± 0.63 | p<0.001 |
| BMI (Kg/m$^2$) | 26.2 ± 2.5 | 22.3 ± 2.2 | p=0.25 |
| Right arm circumference (cm) | 36.7 ± 5.2 | 27.8 ± 10.2 | p=0.36 |
| Abdominal circumference (cm) | 78.4 ± 5.9 | 66.5 ± 3.9 | p<0.001 |
| **General characteristics** | | | |
| Lifetime Weight Training (years) | 10.7 ± 6.8 | 9.1 ± 6.1 | p=0.11 |
| Lifetime Competition (years) | 4.7 ± 5.9 | 2.7 ± 3.2 | p<0.001 |

BMI: body mass index.

pressure (SBP) was higher in men than in women (p <0.016) (Figure 1). Diastolic blood pressure (DBP) was similar for both genders (Figure 2). Despite adequate mean values, some subjects had extremely high BP, with maximum values of 186 mm Hg for males and 167 mm Hg for females.

Subjects with high BP had less professional physical education monitoring than subjects with normal BP (25.0%; 14.79%; p <0.03).

Table 3 presents data on the use of pharmacological substances prohibited in sport (PSPS) during the last 6 months before data collection. The use of 2 or more of these PSPS was reported by 27.1% of the athletes, while 15.1% reported the concomitant use of 3 or more of these substances. Only about one third of athletes denied the use of PSPS. The use of PSPS showed a different distribution between genders, with a greater use of anabolic steroids by males and of diuretics by females.

## DISCUSSION

### GENERAL CHARACTERISTICS OF THE SAMPLE

To obtain a panoramic and current view of bodybuilding in Brazil and considering the large territorial

**Table 2.** Health aspects of athletes active in different bodybuilding modalities and affiliated with CBMFF/IFBB Brazil.

| HEALTH ASPECTS | MALES (n=305) | FEMALES (n=201) | |
|---|---|---|---|
| **Monitoring by a Physical Education Professional** | | | |
| Yes | 232 (76.1%) | 176 (87.6%) | |
| No | 98 (32.1%) | 18 (9.0%) | p<0.001 |
| No answer | 6 (2.0%) | 7 (3.5%) | |
| **Monitoring by a Nutritionist** | | | |
| Yes | 201 (65.9%) | 164 (81.6%) | |
| No | 98 (32.1%) | 31 (15.4%) | |
| No answer | 6 (2.0%) | 6 (3.0%) | p<0.001 |
| **Medical consultation within the last 12 months** | | | |
| Yes | 241 (79.0%) | 175 (87.1%) | |
| No | 58 (19.0%) | 20 (10.0%) | |
| No answer | 6 (2.0%) | 6 (3.0%) | p<0.01 |
| **Medical consultation before starting to compete** | | | |
| Yes | 207 (67.9%) | 157 (78.1%) | |
| No | 96 (31.5%) | 39 (19.4%) | p-0.02 |
| No answer | 2 (0.7%) | 5 (2.5%) | |
| **Frequency of routine medical examinations** | | | |
| Monthly | 20 (6.6%) | 11 (5.5%) | |
| Quartely | 62 (20.3%) | 64 (31.8%) | |
| Semiannual | 101 (33.1%) | 76 (37.8%) | |
| Anual | 101 (33.1%) | 40 (19.9%) | P=0.08 |
| Other | 8 (2.6%) | 2 (1.0%) | |
| None | 10 (3.3%) | 4 (2.0%) | |
| No answer | 3 (1.0%) | 4 (2.0%) | |

**Table 3.** Reported data on the use of pharmacological substances by active athletes of different bodybuilding modalities and affiliated with CBMFF/IFBB Brazil.

| PHARMACOLOGICAL SUBSTANCES PROHIBITED IN SPORT | MALES (n=305) | FEMALES (n=201) | |
|---|---|---|---|
| Androgenic anabolic steroids | 131 (43.0%) | 41 (20.4%) | |
| Peptide hormones and growth factors | 11 (3.6%) | 18 (9.0%) | |
| Insulin | 4 (1.3%) | - | |
| Diuretics | 38 (12.5%) | 47 (23.4%) | |
| Masking agents* | - | 1 (0.5%) | p<0.001 |
| Hormonal and metabolic modulators | 7 (2.3%) | 5 (2.5%) | |
| Beta 2-agonists | 1 (0.3%) | 1 (0.5%) | |
| None | 92 (30.2%) | 69 (34.3%) | |
| No answer | 21 (6.9%) | 19 (9.5%) | |

*Masking agents are substances or methods used to mask the use of prohibited substances in sport.

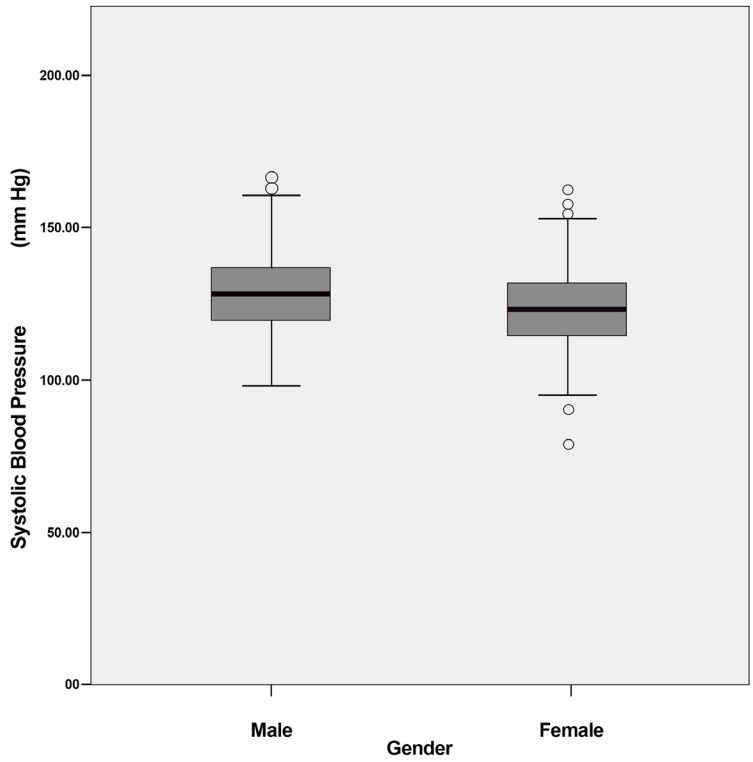


**Figure 1.** Boxplot of systolic blood pressure values of male and female athletes active in different bodybuilding modalities.

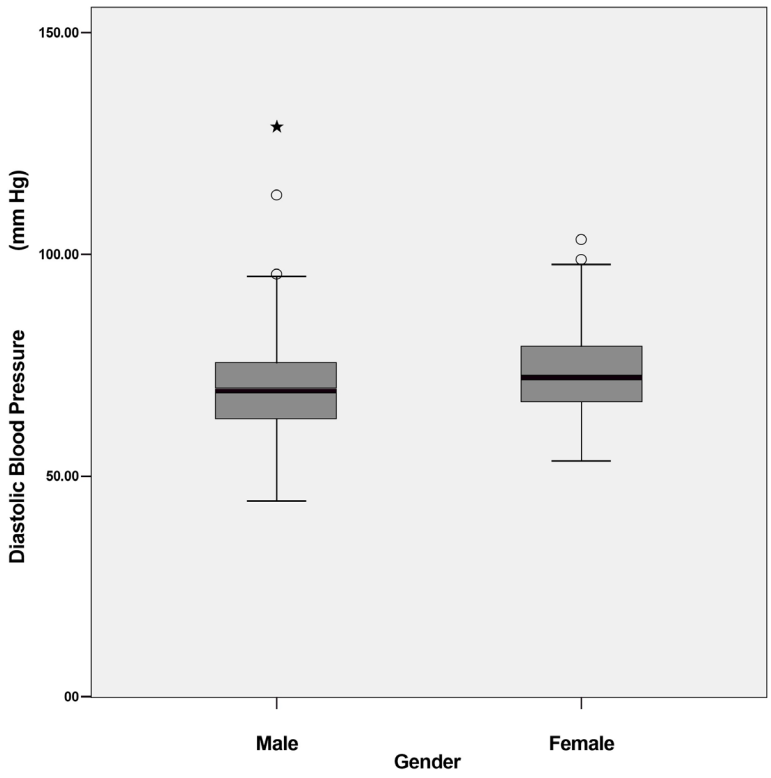


**Figure 2.** Boxplot of diastolic blood pressure values of male and female athletes active in different bodybuilding modalities.

extension of the country with its cultural differences and socioeconomic levels, the study included athletes, men and women, residing in twenty-one states that covered all the demographic regions.

Participants were aged between 16 and 61 years old, and from one to thirty years of experience with resistance training, with men having more time in competition than women.

Athletes from all modalities existing in the International Federation of Bodybuilding and Fitness (IFBB) on the date of data collection participated in the study, except for the modalities Men's Games Classic Bodybuilding and Men's Muscular Physique, which were introduced in the entity in 2016 (IFBB, 2021b), during the period of this study. Athletes were affiliated, active and enrolled in the championships where the study was conducted.

This aspect distinguishes the present study from the vast literature with bodybuilders, where athletes of one or another sport were studied (Gentil et al., 2017; Cyrino et al., 2002), and most only with male athletes (Mert et al., 2018; Kim, 2018; Mitchell et al., 2017; Hackett et al., 2013). Although most studies do not mention the athletes' modality, it is possible to deduce that they are athletes in the Men's Bodybuilding modality.

It is important to emphasize that, despite this sport having started with the modalities Men's Bodybuilding and Women's Bodybuilding, today, in the IFBB, there are six men's modalities and five women's modalities with different physical standards (Coraucci, 2018). For example, for men, the Men's Bodybuilding modality demands muscle development, low fat levels and extreme dehydration (IFBB, 2021a; Alves et al., 2020), while the Men's Physique modality prioritizes the presentation of an athletic physique with a limit to the development of muscle mass and the reduction of body fat levels. For women, the Women's Physique modality requires muscle development with more volume, with low levels of fat and dehydration (but not extremely dry). Women's Bikini Fitness athletes, on the other hand, must have a physique like the models, however, with a healthy and attractive appearance, and with muscle tone developed through weight-bearing exercises, without the need for drastic training and nutrition measures (IFBB, 2021b).

In addition, there are several entities that manage the sport, each with its own rules and guidelines. The physical standards required may vary between the various existing federations (Escalante et al., 2021).

Due to this heterogeneity between the physical standards demanded by the different modalities, it may be inappropriate to draw parallels on training and diet among athletes of different modalities.

## ANTHROPOMETRIC CHARACTERISTICS

The mean age of the sample was consistent with data previously reported (Ribeiro et al., 2016; Cyrino et al., 2002, 2008; Maestá et al., 2000). The participants' BW and its heterogeneity were like those reported (Gentil et al., 2017; Cyrino et al., 2002; van der Ploeg et al., 2001; Maestá et al., 2000). The HT of the sample resembles, on average, the values of the Brazilian population reported by the Brazilian Institute of Geography and Statistics (IBGE, 2010).

BMI values were 22.3 ± 2.2 kg/m$^2$ for female athletes and 26.2 ± 2.5 kg/m$^2$ for male athletes in the pre-competitive period. For the individuals in the present study, based on the standard adopted by the WHO, female athletes were classified as "normal weight" and male athletes as "overweight". When using the out-of-competition BW reported by the athlete when completing the questionnaire, BMI values changed from 22.3 to 23.9 kg/m$^2$ for female athletes and from 26.2 kg/m$^2$ to 30.2 kg/m$^2$ for male athletes. Female athletes, despite the increase in the result, remained classified as "normal weight" while the male athletes began to be classified as "obesity 1". However, we should keep in mind that the result obtained with the BMI, by itself, does not reflect the health condition of these individuals (Weir and Jan, 2021). Previous studies (Gentil et al., 2017; Cyrino et al., 2008; van der Ploeg et al., 2001) have shown that bodybuilding athletes of both sexes, even in the off-season, have a percentage of fat within acceptable levels for health.

## HEALTH ASPECTS

In high performance sport there is a constant search for improvement in the athlete's performance, but they are exposed to great biological (physical and physiological) and psychological stress during their physical preparation and competitions. Thus, monitoring by a multidisciplinary team is essential to provide high performance and to maintain the health of the athletes (Dijkstra et al., 2014; Speed, 2013; Vianna and Mezzaroba, 2013).

### MONITORING BY A NUTRITIONIST:

Bodybuilding has a particular characteristic compared to other sports because the goal of its practitioners is to achieve an aesthetically perfect physique for competition. Regarding the dietary strategies used in combination with high volume and intensity resistance training, in general, the studies (Gentil et al., 2017; Della Guardia et al., 2015; Spendlove et al., 2015; Keith et al., 1996), although contradictory in some points, are unanimous about the need for a more balanced diet in terms of macronutrient and micronutrient intake.

However, it is necessary to consider the individual responses related to the manipulations of the variables, as each individual's body responds differently to changes, and different approaches are needed for athletes in each sport, where the standards of judgment are specific (Escalante et al., 2021; Iraki et al., 2019).

For example, the thinness pattern of women's sports such as Women's Bikini Fitness often require higher levels of body fat and less muscle than Women's

Physique and therefore may not require or require fewer training manipulations. and diet. In this context, some athletes, instead of using diuretic procedures, use "water load" to hide excessive thinness (Escalante et al., 2021). Another very particular modality is Men's and Women's Fitness, in which athletes need, in addition to presenting a perfect physique, to perform a choreographic routine with elements of rhythm, strength, flexibility and power. For these athletes, the restoration of water and fuel to optimize competitiveness and minimize injuries is essential (Escalante et al., 2021)

In modalities that require a great change of strategy between the off-season and pre-contest phases to adjust the physical pattern, some individuals use more aggressive processes with a large variation in body weight (15% or more), while others have preferred a phase of off-season with greater control so that such drastic changes are not necessary, using a variation in body weight of approximately 6% (Kim, 2018)

Due to the large number of interrelated variables, research proving the safety and effectiveness of dietary strategies used by bodybuilders is scarce (Escalante et al., 2021; Iraki et al., 2019). And there are no evidence-based guidelines for athletes to adjust their physique for competition or to regain appropriate levels of body fat in a way that preserves or at least minimizes health risks (Halliday et al., 2016).

So, the dietary strategies used by bodybuilders remain poorly understood and given the unique nature of this sport it may be inappropriate to draw dietary parallels with other sports (Mitchell et al., 2017).

Attention is needed to these issues as, historically, bodybuilders use magazines, other successful competitors, and the internet as the basis of information for eating strategies – with sites and forums on bodybuilding, strength and conditioning being the primary source of education, especially for inexperienced athletes (Mitchell et al., 2017)

In the present study, about 25.0% of the participants stated that they did not follow up with a nutritionist, which is more prevalent in males.

## MONITORING BY A PHYSICAL EDUCATION PROFESSIONAL

Resistance training programs for bodybuilders prioritize strategies aimed at maximizing muscle hypertrophy, and the degree of development depends on the modality in which the athlete competes. As each modality has its proposals and rules, we can speculate that these differences influence the athletes' training routines (Alves et al., 2020).

The practice of resistance training for health promotion and cardiovascular disease prevention is endorsed by the American Heart Association, American College of Sports Medicine (Cornelissen et al., 2011) and the American Diabets Association (Braith and Stewart, 2006). And it is well established in the literature that moderate-intensity exercise reduces the risk of cardiovascular mortality and morbidity, however, intense exercise can increase the risk of sudden cardiac death (Dijkstra et al., 2014; Mert et al., 2018). And the strategies used by bodybuilders increase stroke volume and cardiac output to a greater degree than in other athletes (Mert et al., 2018). These individuals use advanced techniques, not yet validated in scientific research, with the use of overload to increase muscle hypertrophy (Hackett et al., 2013).

Although the training program for bodybuilders must be systematized to avoid a plateau, maintain progressive overload, and manage the stress imposed on training sessions by avoiding overtraining and overreaching, it is known that many bodybuilders do not follow these recommendations (Alves et al., 2020). The support of a professional in the field contributes to supervising the quality of training and handling the many determining variables (series, repetitions, rest interval between sets and training sessions, choice of exercises, weekly frequency, load adjustment and others) for better results and lower risk of injury (; Pina et al., 2014; Gentil and Bottaro, 2010; ACSM, 2009; McClaran, 2003; Cyrino et al., 2002).

Going further, this professional helps in setting goals, greater work intensity and greater motivation. Seventeen percent of athletes, mainly male, said they did not have the support of a professional.

Monitoring by a doctor, routine checkups, and BP measurement

Medical evaluation is essential for monitoring the athlete's morphological profile regarding changes caused by intense resistance training, nutritional strategies, and the use of pharmacological substances with and without professional monitoring. Individuals of both sexes (93.9%) reported undergoing routine examinations up to one year apart. However, 26.7% reported that they had no medical consultation before starting sports, a statement more frequently made by males, as well as the absence of medical consultation in the last 12 months. Based on the data obtained, which agree with the information obtained by Brazilian Institute of Geography and Statistics (IBGE, 2015), women adopt more preventive behaviors than men and see a doctor more often.

Although most athletes mentioned frequent medical examinations, 26.8% said they did not know if they had a chronic disease. Perhaps there is some communication problem between professional and athlete that explains the divergence between the fact that 93.9% of the athletes stated that they had medical examinations and yet more than 20% of them did not know whether they had a chronic disease or not. The number of individuals reporting chronic diseases in this study is well below the index for the Brazilian population.

Regarding the use of medication in the presence of a diagnosed chronic disease, 43.8% (48.5% of them males and 36.8% females) do not use medication even when

they are aware of the disease. According to Gentil et al. (2017), bodybuilders tend to refuse treatment and /or do not follow medical recommendations, and perhaps this is due to the fear that medications will reduce their ability to reach desired goals.

BP measurements were taken the day before the competition, when athletes were in the process of dehydration and low carbohydrate intake, which may not be the ideal time to measure. The values obtained during the study may not represent the usual BP values of the athlete and it is a limitation of the study. It is also necessary to consider a) the psychological state due to the competition environment; b) anxiety, especially among athletes who need to reach a certain weight to fit the category; c) mood state due to dehydration and low carbohydrate intake; d) use of pharmacological substances such as diuretics; and others. In the present study, the number of individuals with high BP was higher in men than in women, in agreement with what is expected for young adult individuals. In this study, there was a correlation between individuals with high BP and the fact that they did not have professional physical education monitoring.

## USE OF PHARMACOLOGICAL SUBSTANCES

Using the PSPS is a reality for all high-performance sports. When interviewing elite Olympic athletes, Sports Illustrated, a US sports magazine, asked the following question: "If you were given a substance to improve your performance, didn´t get caught and win, would you take it?" Ninety-eight percent answered "Yes." So they rephrased the question harder: "If you were given a substance to improve your performance, didn't get caught, win every competition for the next 5 years and then die, would you take it?" More than 50% said "Yes" (Baron et al., 2007)

Doping is a global problem and the fight to slow its spread through educational programs, testing, and supportive medical treatments has had few results (Baron et al., 2007)

The use of anabolic steroids is widespread among amateur athletes, especially bodybuilders, and the frequent use of these substances, often in high doses, involves health risks for athletes due to side effects (Melhem et al., 2020)

Supraphysiological administration of anabolic androgenic steroids can cause irreversible organ damage, hypertension and atherosclerosis, jaundice, liver cancer and carcinomas, tendon injuries, psychiatric diseases, and behavioral disorders (El-Reshaid et al., 2018; Hackett et al., 2013;). In order to reduce these risks, athletes should be encouraged to have regular medical check-ups (Sonmez et al., 2016; Hackett et al., 2013)

The actual quantification of the use of prohibited substances by athletes is very complex (Sánchez-Oliver et al., 2019). In amateur and "unnatural" bodybuilding, it is estimated that the use of prohibited substances in sport is greater than 70% (Sánchez-Oliver et al., 2019; Ntoumanis et al., 2014) and many athletes do overdoses (Brand et al., 2014)

Although athletes use natural dietary strategies in pursuit of their goals, self-prescribing of dangerous prohibited substances such as insulin and diuretics are widely reported (Escalante et al., 2021; Baron et al., 2007; Konrad et al., 1998). It is also common, due to improved physical adaptations (El-Reshaid et al., 2018), the abuse of substances such as stimulants and anabolics, with overdoses and concomitant use of several drugs (Sánchez-Oliver et al., 2019). Values from nine to forty-one times higher than the natural production in athletes of the Men's Physique modality and from 142 to 258 times greater than the natural production among the athletes of the Women's Wellness Fitness modality were found (Gentil et al., 2017)

In the present study, we observed a difference in the use of PSPS between men and women, with the use of androgenic anabolic steroids prevailing in men and the use of diuretics in women.

In competitive sports, the prevalence statistics for the use of prohibited substances are varied and seem to depend on the measurement technique employed (Ntoumanis, et al., 2014). Data collection relies almost exclusively on verbal self-reports, but athletes do not always report their actual attitude or behavior, responding to what they believe is socially desirable (Brand et al., 2014).

Brand et al. (2014) believe that, unlike other sports, in bodybuilding the use of prohibited substances to improve performance is not formally or socially prohibited. Thus, it is possible that these athletes have a different attitude towards doping, reporting more easily their feelings and behaviors regarding the use of prohibited substances.

In our approach, the question about the use of banned substances in the last six months prior to the event was surprisingly answered by 93.4% (n=466) of the athletes. Approximately 32% (n=161) denied use. As the IFBB is a signatory entity of the World Anti-Doping Agency (WADA) and athletes can be drawn for doping controls at events (IFBB, 2021a), to reduce the possibility of refusing to fill in the questionnaire and the specific question, the filling was anonymous. Still, this factor may have influenced the participants' responses.

The substances most used by the athletes who participated in this study were anabolic androgenic steroids followed by diuretics, and the athletes used more than one substance (Goldman and Basaria, 2018; Gentil et al., 2017; Brand et al., 2014).

## CONCLUSIONS

Bodybuilders seem to be a very specific population about nutritional and physical training strategies adopted to provide aesthetic changes that meet the demands of each modality. Furthermore, due to the different

modalities and their specific rules and standards, to study the strategies used and their impacts on performance and health, individualized approaches by competition category are necessary.

It turns out that many surveys that use the terms "bodybuilding" or "bodybuilders" do not specifically mention the category in which individuals compete, and most study male athletes. Apparently, even after the emergence of several modalities in the last two decades, the focus of research seems to be on athletes who belong to the most traditional sport modality, Men's Bodybuilding.

It is clear in the literature that there is still no consensus on guidelines, safety and effectiveness of the methods used by athletes in this sport, especially about health impacts (except for the well-documented side effects of banned substances in sport).

In the present study, we observed that despite the athletes reporting having professional monitoring and performing routine exams, many were unaware of having chronic diseases. And those who said they had knowledge of chronic diseases did not use medication regularly.

Therefore, in general, athletes who practice this sport should pay more attention to health aspects. However, women reported a higher rate of follow-up by physical education professionals, nutritionists, and physicians than men, indicating the need for greater attention to men's health.

It is important to emphasize that the athletes participating in this study compete at an amateur level and, therefore, do not live only from the sport. In other words, there is no financial income from this activity. Thus, it is necessary to reconcile personal, professional and sports routine. In addition, a considerable financial investment is required for the preparation: gym, aesthetic therapies and treatments, food, supplements, ergogenic substances, federation membership, registration in championships, tanning and painting, clothing, hair and makeup (for female athletes), travel and accommodation expenses.

Given the many investments needed to prepare, in addition to the expenses of personal life, and the lack of encouragement for the amateur athlete, having the monitoring of a multidisciplinary team that supports the performance and preservation of the athlete's health is a big challenge. In addition, in the Unified Health System, few assessments with the necessary complexity for bodybuilding athletes are available.

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## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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