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Original Article

# Use of Ergogenic Substances amongst Bodybuilding Athletes Around Polokwane Municipality, Limpopo Province, South Africa

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## Abstract

**Background:** Although there is a lack of scientific evidence supporting the use of some ergogenic substances, it remains a common practice among bodybuilding athletes. Nevertheless, the use of ergogenics among bodybuilding athletes around Polokwane Municipality (PM) in Limpopo Province remains unknown.

**Aim:** To determine the use of ergogenic substances amongst bodybuilding athletes around Polokwane municipality in Limpopo Province.

**Methods:** A descriptive study with a purposive sampling technique was used to obtain 51 amateur bodybuilding athletes in gyms around PM. Ethical approval and permission were obtained from the MEDUNSA Research and Ethics Committee (MREC) and coaches respectively. Sampled athletes signed written informed consent forms. Data collection was done using self-designed questionnaires covering the demography, training information, and the use of ergogenic agents. Data were loaded onto the SPSS (v.23) and analyzed. Descriptive tests were used to describe ergogenic use through ranges, percentages, means, and standard deviations (±SD).

**Results:** The majority (94.1%) were males, of which 66.7% participated as bodybuilders for ≤2 years. Almost all athletes (86.3%) trained three to four days a week for 1–3 hr (94.1%) on weekdays. Only 37.3% relied on coaches for nutrition information followed by those who used social media (29.4%), teammates (29.3%), and nutrition experts (4.0%). A few athletes (15.7%) used ergogenics, of them, 13.7% used creatine and 2.0% vitamin capsules.

**Conclusion:** Overall, Polokwane bodybuilders were not using ergogenic agents during their bodybuilding sports careers.

**Keywords:** bodybuilding, ergogenic agents, supplements and athletes

## 1. Introduction

Bodybuilding athletes habitually use ergogenic substances for support during training sessions and muscle growth [1]. These ergogenic substances may refer to training techniques, nutritional ingredients, practices, or any other substance used by athletes during sports to improve their capacity for exercise or performance [2]. Common ergogenic substances used by bodybuilding athletes include creatine, caffeine, and specific amino

acids [3]. Some of these substances or practices may often promote the excessive intake of a certain nutrient(s) at the expense of others. Similar practice(s) of using the ergogenic substances were alleged for bodybuilder training in gyms around Polokwane municipality (PM). The PM is situated within the Limpopo province, Capricorn district, serving as the economic center of the province. The current researchers observed an increase in popularity toward the bodybuilding sport among the Black African individuals around the PM. Athletes in this municipality seem to habitually practice the utilization of different ergogenic agents during their training and exercise sessions. Continuous unguided use of ergogenics in sports may at times bear undesired health consequences [4]. To our knowledge, there is a lack of a solid governing body to regulate or control the use of ergogenics or supplements in South Africa. The legality and safety of the product should be based on sound scientific evidence [2]. Some of the ergogenic substances/products used by the athletes may contain banned substances or there is a chance that some ingredients in the product may be inaccurately labeled. The International Society of Sports Nutrition (ISSN) has highlighted the importance of involving sports nutrition experts in interpreting scientific claims [2]. Additionally, the International Olympic Committee (IOC) recommends nutrition-specific strategies that incorporate adequate food and snacks to support athletes during intense training [5]. Some products that claim to improve body structure and endurance need to be used cautiously or under medical supervision [6]. Although the use of ergogenic substances among young athletes is not encouraged, there seems to remain an increased use of these substances by athletes [5]. The dietary intake of bodybuilding athletes around the PM has been reported [7]. However, practices related to the use of ergogenic substances have not been comprehensively covered. Therefore, this research aims at investigating the use of ergogenic agents among athletes participating in bodybuilding sport to encourage good nutrition practices during sports engagement. Many ergogenic substances may be used by bodybuilding athletes; however, this article is limited to a few of the commonly used substances.

### 1.1. Creatine

Creatine is produced by the liver and stored in the muscles [8]. Within the skeletal muscles, creatine is stored as phosphocreatine and free creatine [9]. Its role and use in improving sports performance are supported scientifically [10, 11]. Creatine is linked to decreasing protein breakdown during sports, thus promoting muscle hypertrophy [12]. Furthermore, this amino acid supports the utilization of energy by transporting the

intracellular energy to subcellular sites [13]. Additionally, this nonessential amino acid may serve as a buffer that minimizes the accumulation of lactic acid. Good sources of creatine include red meat, poultry, and fish or a supplement [13]. Creatine amounts of 0.3 gr/kg for five to seven days [9, 13] or 5–7 gr doses × 4/day (20–25 gr) were suggested for endurance sports such as bodybuilding [14]. Moreover, due to its minimal adverse effects [9], its use is considered safe during shorter or longer period practices [14]. However, athletes diagnosed with kidney diseases or any chronic disease should be cautious while consuming creatine as it may predispose one to kidney diseases [8].

## 1.2. Caffeine

Generally, caffeine is a stimulant that increases alertness and concentration [14]. During sports, caffeine minimizes fatigue and improves muscle strength [15]. These, according to Stecker *et al.* are accomplished through the mobilization or utilization of free fatty acids [16]. Additionally, Buzdağli and colleagues reviewed the biochemical benefits of caffeine in both athletic groups and general individuals. Their review highlighted the role of casein in controlling sleep hormones and the $Na^+/K^+$ pump regulation for muscular functioning [17]. Caffeine has an insignificant or no nutritive value [18], yet, the product appears in many foods and drinks such as cola, coffee, tea [14], and other sports drinks [18]. For athletes, caffeine is mostly presented in caffeinated bars, gels, energy drinks, and mouth aerosol sprays [17]. The ergogenic effects of caffeine in sports are, however, dependent, among other things, on the dose and timing of consumption [18]. While caffeine consumption of 1–3 mg/kg [14] still warrants further research [18], an amount of 3–6 mg/kg is considered safe enough to exert adequate ergogenic benefits [17]. Tachycardia, anxiety, insomnia [14], gastrointestinal upsets, and diarrhea [19] are common symptoms that may appear if consumed above the given dose. Pre-exercise ingestion is recommended an hour before the event. Caffeine is a potent diuretic [14]. However, this potent effect is dose (≤5 mg/kg)- and tolerance (frequency)-dependent [17].

## 1.3. Branch chain amino acids

Branch chain amino acids (BCAA), such as leucine, isoleucine, and valine are three of the nine essential amino acids [20]hypothesized to minimize muscle degradation [20]. These amino acids are involved in muscle protein resynthesis [21]. Data suggest that leucine plays a major role in regulating the intracellular signaling pathways for protein

synthesis [20]. The benefits obtained from BCAA are further supported in a meta-analysis by Khemtong *et al.* [22]. These authors have reported data supporting that BCAA are the only amino acids metabolized directly in the muscles, inferring that protein resynthesis is highly plausible. Still, the use of BCAA in alleviating muscle soreness and repair among athletes remains warranting [21]. However, the consumption and function of BCAA should be accompanied by other essential amino acids (EAA) to support these processes of muscle resynthesis [20].

## 1.4. Some vitamins and minerals

Bodybuilding athletes are highly predisposed to oxidative stress [23]. Therefore, some antioxidant vitamins such as vitamin C can minimize inflammation [2] through scavenging reactive oxygen species (ROS) [24]. To obtain this effect, intakes <250 mg are recommended [25]. Owing to the diuretic effect of vitamin C, bodybuilders often utilize this vitamin during the "peak week" to induce loss of body fluids [26]. However, due to the known undesired effects of vitamin C to induce osmotic diarrhea [27] and develop renal stones [26], athletes are encouraged to consume this vitamin optimally [28].

Other vitamins of importance in bodybuilding sport are the water-soluble B-vitamins. Thiamine and riboflavin are beneficial during the body's chemical reaction for the energy systems [29]. Vitamin $B_{12}$ and folate are also beneficial in repairing damaged tissues during sports [30]. Furthermore, bodybuilding athletes may benefit from vitamin $B_{12}$ during the formation of red blood cells and creatine synthesis [31]. Requirements for these vitamins usually increase with the increase in energy requirements [25]. Therefore, adequate intakes of 1.1–1.2 mg for thiamine and 1.1–1.3 mg for riboflavin are recommended [28].

Calcium and vitamin D are other minerals required for constructing bone structure [32]. Vitamin D is activated from the cholesterol in the body through sunlight; however, dietary sources such as fatty fish, egg yolk, and fortified cereals would offer optimal amounts for this vitamin whenever consumed adequately [28]. Deficiencies of calcium and vitamin D may impose the risk of stress-related osteomalacia, osteopenia, and later osteoporosis [30]. The recommended dietary intake (RDI) for calcium and vitamin D in all gender groups is 1000 mg/day and 1000–2000 IU respectively, which can be achieved through a balanced diet alone [28].

## 2. Methods

The researchers adopted a quantitative descriptive study design and a purposive sampling technique to recruit 51 out of the 65 bodybuilding athletes in various gyms around the PM. A purposive sampling technique was used for this research due to a limited number of athletes who participated in bodybuilding sports. These athletes were affiliated and registered members of the International Federation of Bodybuilding South Africa (IFBBSA) and gyms in Limpopo respectively. Ethical clearance for this study was obtained from the MEDUNSA Research committee (MREC) (MREC/HS/251/2014:PG). Approval from the Polokwane bodybuilding gyms was further obtained through the coaches before conducting the study. Athletes signed written consent forms before participation. Data were collected on different days in the gyms during the evening before the athletes could commence their training sessions. A self-designed questionnaire covering the demographic information such as age, gender, and marital status; training information, for instance, number of years in bodybuilding sport, duration spent during training and frequency of training per week; and practice of ergogenics as well as the sources of information for nutrition. Athletes filled in the questionnaire themselves. Data were loaded onto the Statistical Package for Social Sciences (SPSS) version 23 and analyzed. Descriptive variables were expressed as percentages, ranges, mean values, and standard deviations (±SD).

## 3. Results

Results of the 51 bodybuilding athletes are reported in Figures 1–3 and Tables 1–2.

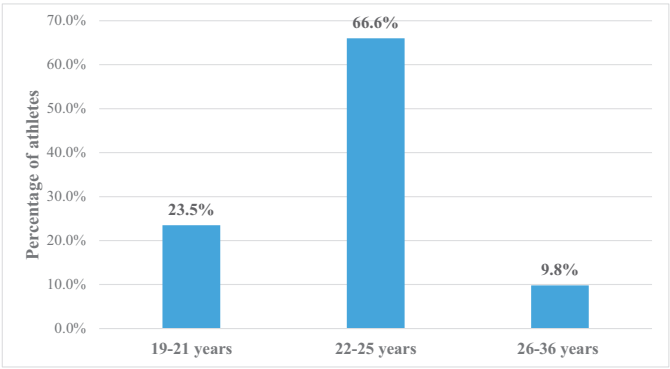


**Figure** 1: The age of the athletes ranged between 19 and 36 years. A majority (66.6%) of athletes were aged between 22–25 years, followed by those (23.5%) aged 19–21 years. Mean age = 23.6 (±3.2).

Figure 2 presents the number of years athletes participated in bodybuilding sport.

TABLE 1: Males predominated (94.1%) females (5.9%).

| Gender | Frequency (n = 51) |
|---|---|
| Male | 48 (94.1%) |
| Female | 3 (5.9%) |
| Total | 51 (100%) |

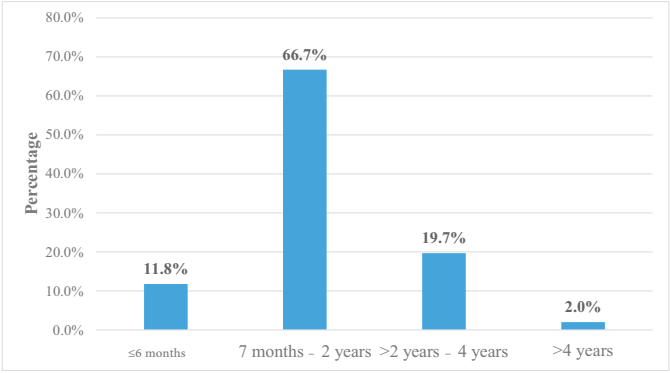


**Figure** 2: A few athletes (11.8%) participated in bodybuilding for ≤6 months, while most (66.7%) engaged from seven months to two years. Only 2.0% participated between two and four years.

## 3.1. Nutrition information sources

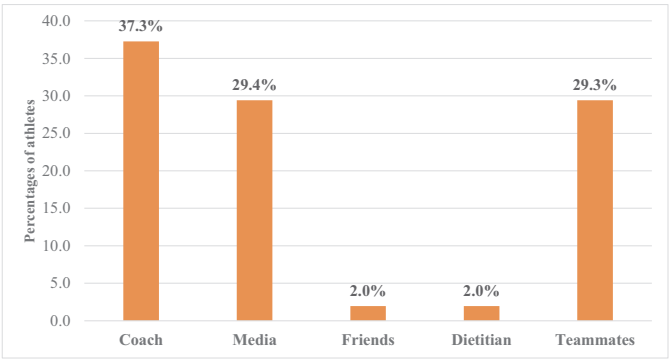


**Figure** 3: Coaches served as the main source of nutrition information for most athletes (37.3%) followed by 29.4% and 29.3% of athletes using social media and teammates respectively.

Figure 4 reports the use of ergogenic substances by bodybuilding athletes.

Most of the athletes (84.3%) were not using any ergogenic agents; only 15.7% were on ergogenic agents.

TABLE 2: The duration of training spent each day at the gym. Almost all athletes (86.3%) trained for an hour or more.

| Duration during training | Frequency (%) |
|---|---|
| 30–45 min | 1 (2.0%) |
| 45 min–1 hr | 6 (11.8%) |
| ≥ 1 hr | 44 (86.3%) |

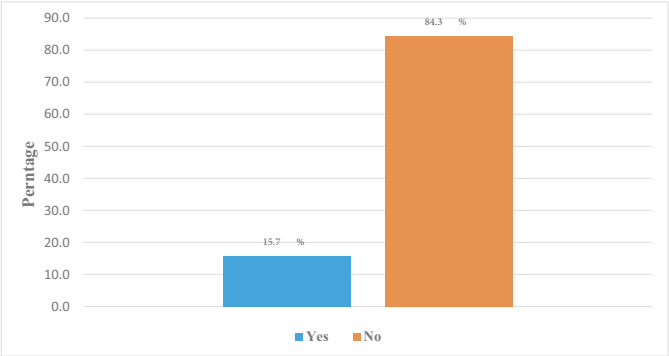


**Figure** 4: The use of ergogenic aids by the athletes.

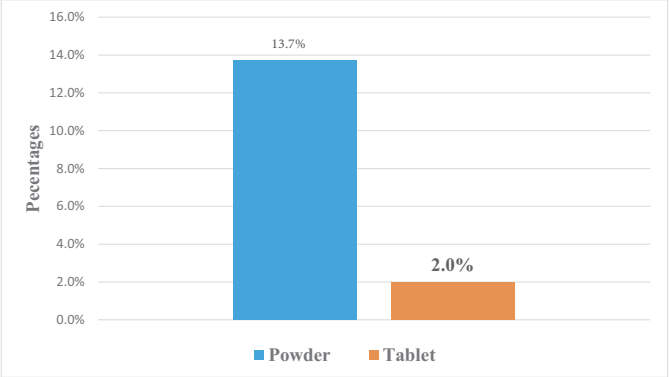


**Figure** 5: Type of ergogenics used.

Figure 5 indicates that of all those who utilized ergogenics, 13.7% of the participants used powders, while 2.0% used vitamin capsules.

# 4. Discussion

## 4.1. Demography

A total of 51 bodybuilding athletes were recruited inferring a 78% response rate. The mean age of the athletes was 23.6 (±3.2) years. These findings are comparable to those reported by Monteiro and colleagues [33]. In their study, a representative sample of 33 athletes was studied. Additionally, Gaines utilized a total sample of 37 while comparing the anthropometry of competitive bodybuilders to judge's score [34]. However, Ogita *et al.* obtained fewer (27 or fewer) participants during their investigations [35, 36]. Even lower samples ($n$ = ≤18) of athletes were used by Lenzi *et al.* and Mitchel *et al.* during the investigations of bodybuilders' body composition and anthropometry [37, 38]. Similar to these bodybuilding studies, the researcher in the current study obtained smaller samples. This could suggest that bodybuilding sport has gained insufficient popularity around PM, especially among women. Also, given that bodybuilding is an intensive

and demanding sport, it is suspected that there could be less interest in participation by individuals around the PM. In the current study, almost all (94.1%) of the athletes were males. Again, these results are different from those reported by Monteiro and colleagues [33]. In their study, there was a fair gender distribution of 54.5% and 45.5% between men and women bodybuilders respectively [12]. However, in a study by Gaines [34], majority were males (78.3%) [8]. It is, therefore, not uncommon for bodybuilding sport to be predominated by males around the PM. A two-thirds majority of the athletes (66.8%) in the current study participated in bodybuilding sport for up to two years; training for an hour or more. Increased training duration improves muscle gain and strength. Furthermore, time spent in training influences the oxidation of fatty acids and carbohydrates [39]. Barakat *et al.* emphasized that the extent of muscle gain and fat loss among individuals may be influenced by several things, including the training status, exercise interventions, and body composition of the athlete [40].

## 4.2. Nutrition information sources

Coaches and the internet were the most commonly used source of nutrition information by athletes. This possibly made athletes count on them for dietary and ergogenic practices guide. Athletes continue relying on fellow athletes, coaches, and magazines [3]. In Ahwaz (Iran), almost half (47%) of the trainers/coaches prescribed diet programs for the athletes [41]. In another bodybuilding athletes study, investigating the nutrition strategies during different competitive cycles, >60% of the athletes used the self-management approach, coaches, and websites as their strategies for obtaining nutrition information [38].The majority of coaches (65.6%) studied by Jazayeri and Amani recognized protein and CHO as the most essential nutrients for bodybuilding [41]. Additionally, the internet was among the reported nutrition information source used by athletes [38]. Nutritional information sources such as coaches and/or media may at times offer inconsistent or deviating evidence-based practices [37] posing a threat to the health outcomes of athletes. For instance, in a study by Masoga *et al.*, macronutrients intake by bodybuilding athletes around PM was reported suboptimal [7]. It is possible that the type of nutrition information source used by the majority of bodybuilders in the latter study guided them toward intakes that deviate from sports nutrition science.

### 4.3. The practice of ergogenic substances

The current study found that fewer athletes used ergogenic substances. On the list of those who used ergogenic substances, creatine and vitamin supplements were the only two substances appearing. Although athletes in our study reported not using ergogenic substances, the use of these substances was common among athletes [8]. For instance, Frączek *et al.* found that almost half (48.2%) of the athletes in their study used isotonic sports and creatine as ergogenic substances [42]. In another study by Rezaei, almost half of the bodybuilding athletes (43%) used ergogenic substances [43]. Again, creatine and anabolic steroids were the most used substances by athletes (77.2%). We noted that creatine seems to be a commonly used substance by bodybuilders worldwide [8]. Additional to creatine is the prevalent use of dietary supplements among bodybuilders [44]. However, in our study, comparatively few athletes used the product. Unusually, most of the athletes in our research were not using ergogenics. We, therefore, postulate that athletes may have under-reported the use of these substances due to fear or uncertainty that researchers could be linked to substances regulating/monitoring the body. We further noted that the majority of the athletes in our research were in their early years of career development or still at higher institutions of learning. This may imply that these athletes may still be in their financial development stages. Therefore, less priority is given to substances needed for bodybuilding given that they participated in this sport on a part-time basis.

## 5. Conclusion and Recommendations

This research aimed at determining the use of ergogenic substances by the bodybuilders within PM in Limpopo province, South Africa. These athletes were, in general, not using the ergogenic substances during their bodybuilding routine practices. However, there is still a need for the involvement of dedicated nutrition practitioners, for instance, dietitians to guide athletes toward good sports nutrition practices; including the need for use and safety of ergogenic substances.

## Acknowledgments

The researchers would like to acknowledge all bodybuilding athletes within the Polokwane Municipality for participating in the study.

## Ethics Approval and Consent to Participate

Ethical approval was obtained from the MEDUNSA Research committee (MREC) (MREC/HS/251/2014:PG). Consent to participate was obtained from the bodybuilding athletes in writing after the aim of the study was explained to them.

## Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Competing Interests

There is no competing interest for this study

## Funding

None.

## Authors' Contributions

Mr. S. Masoga conducted the study and analyzed the data. Mr. S Masoga, Mr. NW Mboweni, and Mr. KM Ramokolo prepared the manuscript.

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