



ISSN: 2644-2981

Global Journal of
Nutrition & Food Science

DOI: 10.33552/GJNFS.2023.04.000588

Iris Publishers

Research Article

Copyright © All rights are reserved by Geraldo Thedei

Turkesterone Containing Supplement Induces Subjective Perception of Improvement in Strength Among Gym Users in A Brazilian Community

Mateus Camilo Gomes Pinto¹, Flavia Shamne², João Paulo Silva Servato³ and Geraldo Thedei Jr^{1,3*}

¹Curso de Educacao Fisica, Universidade de Uberaba-CAMPUS AEROPORTO. Av. Nene sabino, 1801. Bairro Universitario- Uberaba/MG/Brasil; CEP. 38.055.500; Uberaba/MG/Brasil

²Curso de Medicina, Universidade de Uberaba-CAMPUS AEROPORTO- Uberaba/MG/Brasil; CEP. 38.055.500., Uberaba/MG/Brasil

³Programa de pos-Graduacao em Odontologia, Universidade de Uberaba/MG/Brasil; CEP. 38.055.500., Uberaba/MG/Brasil

***Corresponding author:** Geraldo Thedei Jr, Universidade de Uberaba - CAMPUS AEROPORTO. Av. Nenê Sabino, 1801. Bairro Universitário -Uberaba/MG/Brasil; CEP. 38.055-500, Uberaba/MG/Brasil.

Received Date: July 05, 2023

Published Date: July 17, 2023

Abstract

Aims: This study was performed to analyze the subjective perception about the *Ajuga turkestanica* extract (ATE) intake among recreational athletes and to characterize the socio-demographic profile and the training behavior of users. Methods: For that, 24 gyms from the city of Uberaba-MG were randomly selected to apply a previously tested/verified questionnaire covering sociodemographic data, habits related to physical activity, and consumption of supplements. Descriptive and inferential statistics were performed.

Results: The present study is the first to identify the use of ATE in an uncontrolled Brazilian population. Three hundred eleven individuals participated in this survey. ATE users (29; 9.3%) and nonusers (282; 91.7%), exhibited similar sociodemographic aspects. In all groups studied there is a predominance of males in the third decade of life, with monthly income between R\$ 2,001.00 and R\$ 5,000.00. ATE users showed total time of physical activity, frequency of physical activity, and use of other supplements statistically higher than the nonusers. Most ATE users reported a subjective perception of improvement in strength/disposition, and for this reason, they recommend the use of this supplement to others gym users.

Conclusion: The users of ATE are young, consumers of other supplements, and have a positive perception of ergogenic effect after consumption of this supplement.

Keywords: Population Characteristics; Fitness Centers; Dietary Supplements; Ergogenesis

Abbreviations

ATE: *Ajuga turkestanica* extract

IBGE: Brazilian National Institute of Geography and Statistics

PAPE-UNIUBE: Research support program of the University of Uberaba

Introduction

In the search for muscular development, the use of liberated and/or prohibited dietary supplements is a widespread habit among professional and recreational athletes [1]. For recreational athletes, the indication and the use of dietary supplements is mainly based on knowledge and in the subjective ergogenic perception

acquired through coaches, internet, family, and friends' experiences [2]. Although this extensive and unregulated use, it is known that these products offer health risks due to their own composition and its side-effects, the presence of contaminants or by the simple lack of the active ingredient [3, 4].



Apart of the commonly used dietary supplements, such as creatine, b-hydroxy-b-methylbutyrate, sodium bicarbonate, caffeine, antioxidants, amino acids, proteins, and others, some studies have proved the existence of a growing consumption of plant-derived supplements [5]. Among these natural supplements, the most used and commercialized are those containing plant-derived hormones such as ecdysteroids, phytoestrogens, vegetal sterols and other substances with referred hormone modulating properties and ergogenic effects [6, 7].

Ecdysteroids are a group of steroid hormones, of which the best known is Ecdysone, have a well characterized role in the process of molting in arthropods [8-11]. Ecdysteroids are also found in plants (phytoecdysteroids), although their role in these organisms is not yet clear [8, 12, 13]. Phytoecdysteroids serve in the regulation of gene expression by binding to specific receptors, leading to Protein synthesis and altered gene transcription [9-11].

Turkesterone, a phytoecdysteroid found in the *Ajuga turkestanica* extract (ATE) demonstrated possible anabolic action [10, 14, 15], without toxic and androgenic side-effects [8, 15, 16]. There is also *in vitro* and *in vivo* evidence that such kind of phytoecdysteroids exerts ergogenic actions in mammals [10, 11, 17, 18]. There is only one study that examines the impact of ecdysterones on human beings and have demonstrated that this substance has no impact on changes in fat free mass or anabolic/catabolic hormone status [19].

Based only in low quality scientific evidence, there is a large (and unregulated) internet-based market, advertising these substances as legally allowed, non-toxic, and promising huge and easy anabolic effects.

Considering this situation, the aim of the present study is to analyze the socio-demographic characteristic and the subjective ergogenic perception of ATE-based supplements among recreational athletes (gym users) in a Brazilian population.

Methods

Study design

A cross-sectional research design was adopted to determine the ATE intake among recreational athletes (gym users) in 24 different gyms in the city of Uberaba-MG, Brazil. After the approval of the Ethics Committee, the data were collected over a 3-month period. (No 2.168.233).

Population

The number of participants was defined by a sample calculation, using a 90% confidence level and 5% margin of error, based on the city population (estimated at 328,000) and the percentage of gym users (11.2% of the Brazilian population), described respectively by Brazilian National Institute of Geography and Statistics (IBGE, the Brazilian Census Bureau) (<https://cidades.ibge.gov.br/brasil/mg/uberaba/panorama>) and by de Sa et al. 2014 [20].

Based on these data, the total population practicing physical activity in the city of Uberaba was estimated to be 36,736, and the minimum number of participants calculated was 268 individuals. Initially, 320 male and female adults attending the gyms volunteered to participate in the study. Informed consent was signed before the participants completed the questionnaires. The practice of bodybuilding as a recreational activity and age above 18 years were used as inclusion criterion.

Selection of gyms

Twenty-four gym facilities from the city of Uberaba-MG, Brazil, were randomly selected from a list of all gyms registered in town. After approval of gym administrators, the users seen at these gyms, in each visit, were approached and invited to participate.

Questionnaire

A 14-item questionnaire was adapted from the available literature [20, 21]. Pilot testing of the questionnaire was performed on 20 adults who met the eligibility criteria. Minor modifications were made in the questionnaire for conceptual clarity and cultural context. The final questionnaire was divided into the following sections: gender (male, female), age, family income, training frequency, periodicity, and consumption of supplements (yes/no and type of supplement). For gym users who knew ATE, they were asked if they had used, the time of use, who indicated the use, the dosage used, the observed effect, and, finally, if the user would recommend the supplement.

Statistical analysis

The data were analyzed using the program GraphPad Prism 6.0 Software (GraphPad Software, San Diego-CA, USA). Descriptive statistics in terms of frequencies and percentages were used. Chi-squared and Fisher's exact tests were used appropriately to study the associations among dependent and independent variables. The median was defined as the "cut off" point for the analyzed ordinal variables. A Poisson regression model with robust variance estimation (IBM SPSS Statistics 21.0 Software) was used to assess association between ATE-use and the independent variables. Statistical significance was set at $p < 0.05$.

Results and Discussion

Initially, a total of 320 recreational gym users were included in the study, and from these, nine were excluded because their questionnaires were incomplete (Figure 1). Sixty-five respondents (20.9%) reported knowing ATE, and among these, 29 users and former users of this supplement (9.32%) were identified. Table 1 presents the sociodemographic characterization of the studied population. In all groups studied (Table 1), there is a predominance of males in the third decade of life, with monthly income between R\$ 2,001.00 and R\$ 5,000.00. Most of the included subjects, do their training more than 3 times per week, for less than four years, and consumed supplements, mainly proteins and amino acids.

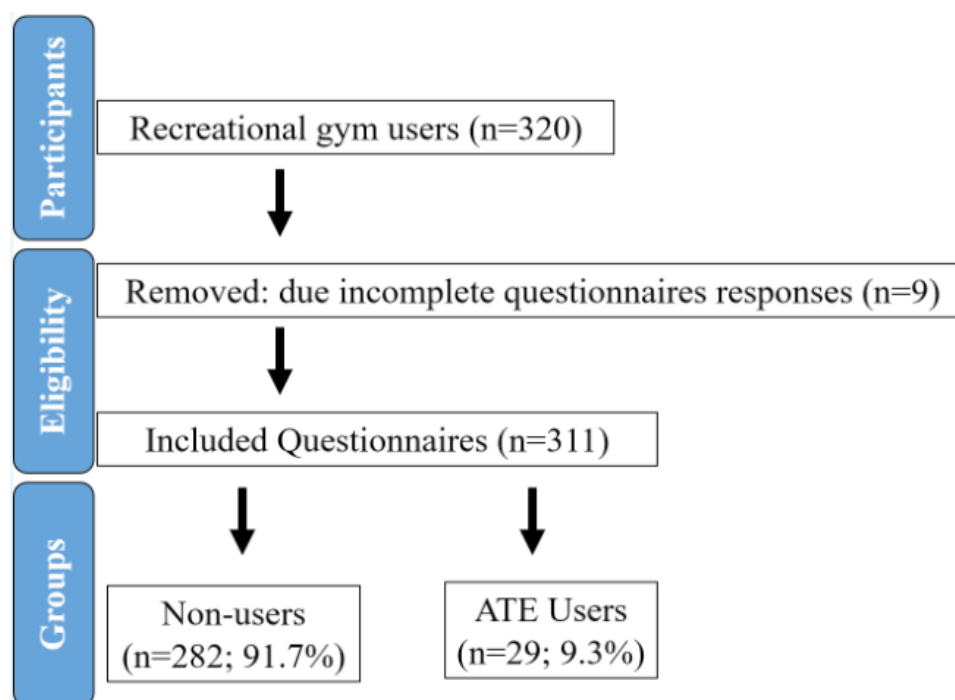


Figure 1: Organization chart with the number of volunteers enrolled in this study.

Table 1: Sociodemographic profile and training habits of the studied population.

Data	Stratum	Non-users (n=282)		ATE Users (n=29)	
		n	%	n	%
Gender	Male	155	54.96	17	58.62
	Female	127	45.04	12	41.38
Age range	18-20 years	25	8.87	2	6.9
	21-30 years	156	55.32	19	65.51
	31-40 years	62	21.99	5	17.24
	41-50 years	25	8.87	2	6.9
	> 50 years	14	4.96	1	3.45
Family income (R\$)	Less than R\$2,000.00	21	7.45	2	6.9
	R\$2,001.00-R\$5,000.00	146	51.77	15	51.72
	R\$5,001.00-20,000.00	106	37.59	10	34.48
	> R\$20,000.00	7	2.48	1	3.45
	Not answered	2	0.71	1	3.45
Time of physical activity practice (years)	Less than 1	118	41.84	6	20.69
	>1 <4	76	26.95	8	27.58
	>4 <8	38	13.48	7	24.14
	> 8	38	13.48	6	20.69
	Not answered	12	4.26	2	6.9
Training periodicity	1-2x/week	11	3.9	-	-
	3-4x/week	122	43.26	3	10.34
	5-6x/week	140	49.65	22	75.87
	7x/week	6	2.13	4	13.79
	Not answered	3	1.06	-	-

Consumption of other supplements	Yes	120	42.55	27	93.1
	No	162	57.45	2	6.9
Type of supplement	Protein	89	31.56	24	82.76
	Aminoacids	58	20.57	16	55.17
	Carbohydrates	16	5.67	7	24.14
	Creatine	33	11.7	9	31.03
	Others	27	9.57	3	10.34

Table 2 describes that gym users consumed this supplement for a short time (maximum 4 months), following recommendation by nutritionists in most cases, with a dosage ranging from 200–1.000 mg/day (Table 2). Most of the participants reported mainly increased

strength and disposition (34.48% and 27.59%, respectively), causing 65.5% of users to recommend the consumption of this supplement (Table 2), whereas almost 40% of the sample (n = 11) reported any positive effect associated with the ATE use.

Table 2: Data regarding the use and perception of the effects of the ATE supplement by its users.

ATE Users (n=29)	Stratum	n	%
Turkesterone Consumption (in months)	< 1	6	20.69
	1 a 2	10	34.48
	3 a 4	6	20.69
	> 4	2	6.9
	In use	5	17.24
Who indicated the TK consumption	Others practitioners/ Colleague	6	20.69
	Nutritionist	14	48.28
	Trainer/ Instructor	3	10.34
	Other	6	20.69
Dosage utilized (mg/day)	< 200	5	17.24
	200 - 400	7	24.14
	500 - 1000	11	37.93
	Don't know	6	20.69
Observed effects (increase of):	Musculature	6	20.69
	Force	10	34.48
	Resistance	3	10.34
	Disposition	8	27.59
	No effects	11	37.93
The user would recommend the supplement?	Yes	19	65.51
	No	8	27.59
	Not answered	2	6.9

It can be noted that the Chi-square analysis suggested that ATE users statistically present a higher frequency and total time of physical activity than nonusers (Table 3). Similarly, ATE users also consume more types of supplements than the nonusers (Table 3). Poisson regression model with robust variance estimation revealed a statistical association between ATE use with high frequency of physical activity and another supplement consumption (Table 3). There was also a significant association between positive subjective perception and ATE doses above 500 mg/day (Table 4). Finally, ATE-users would recommend its usage more frequently than non-

users (Table 4).

This study shows, for the first time, the prevalence of ATE use among recreational athletes and their perception about the effects of the ATE supplementation. The social demographic data gathered were very similar to those described in the literature for Brazilian gym users [20-26]. A slight male prevalence was evidenced among the survey participants, similar to other surveys on bodybuilding practice (60% to 80% were male) [20-26]. About the age of gym users, the predominant age group was 21-30 years, and this did not differ from other studies [21-27].

Regarding the use of ATE, 60% of the sample used it for a time less than 2 months (Table 2) and, utilize other supplements in a much higher percentage than in the nonusers (93.1% versus 42.5%; Table 1), suggesting that these gym users are willing to employ many ergogenic alternatives, even without solid scientific evidence as previously showed [1-3, 5, 19]. ATE users also practice bodybuilding longer and more often than nonusers (Table 3).

When put together, these data suggest that after reaching the limit of physical development and the consequent reduction in progress in muscle mass acquisition, many of the gym goers will use unconventional ergogenic methods, such as ATE, to improve muscular development [23]. A similar fact was observed among

the users of anabolic steroids, where the most frequent use among those who practiced physical activity for a longer time and with a weekly frequency higher than the nonusers was detected [23].

When looking for factors associated with the consumption of supplements by gym users, Lacerda et al. [27] observed that the consumption of dietary supplements is more frequent among men, who exercise longer and more often per week. Other authors [28] found a similar situation, as well seen in this study (Table 3). Also, training more than five times a week was associated with the use of supplements in a study conducted in Belo Horizonte-MG [29], suggesting that gym users may be using ergogenic drugs to improve the effect of exercise per se.

Table 3: Contingency table demonstrating the associations between the use of ATE and sociodemographic data.

ATE Users	Gender		p*	p†
	Male	Female		
Yes	17	12	0.706	0,424
No	155	127		
ATE Users	Age (years)		p*	p†
	>30	≤30		
Yes	8	21	0.376	0,925
No	101	181		
ATE Users	Family income (R\$)		p*	p†
	>R\$ 2,000.00	≤R\$ 2,000.00		
Yes	11	17	1	0,121
No	113	167		
ATE Users	Time of physical activity practice (months)		p*	p†
	>50	≤50		
Yes	13	14	0.014	0,266
No	195	75		
ATE Users	Training periodicity		p†	p†
	>4x	≤4x		
Yes	26	3	< 0,0001	0,028
No	146	133		
ATE Users	Consumption of other supplements		p†	p†
	Yes	No		
Yes	27	2	< 0,0001	0,004
No	120	162		

*Chi-square test; † Fisher's exact test; ‡: Poisson regression model with robust variance estimation.

Lacerda et al. 2015 [27] also observed that the most frequent sources of indication for supplements were colleagues, gym teachers, and self-prescription, whereas nutritionists were scarcely mentioned as indicators of the use of these compounds. In the case of the ATE, the orientation by nutritionists was the most frequent source, and this is probably due to the ATE commercial propaganda [5].

Despite the relative higher ATE-use frequency, few scientific studies have tested the efficacy of ATE, many of which were performed on animals or a cell culture, with a partially purified extract or the structural analogues of Turkesterone [8, 10, 11, 17, 18], whereas only one study have been conducted on humans [19]. In this respect, there is a need for further studies on the efficacy of this commercial extract, since almost 40% of ATE users reported no ergogenic effects. Interestingly, those who noticed any positive

effect used ATE in the dosage above 500 mg/day and would recommend the extract to their colleagues (Table 4). This can lead to greater dissemination of the product's use without proper scientific proof [3, 5, 7].

Table 4: Contingency table showing the associations between the dose of ATK used and indication, subjective perception of effects and recommendation.

Dosage utilized	Who indicated		p†
	Colleague/ Instructor	Nutritionist	
>500 mg/day	9	2	0.6404
≤500 mg/day	8	4	
Dosage utilized	Subjective perception		p†
	Positive	Negative	
>500 mg/day	10	0	0,0396
≤500 mg/day	7	5	
Dosage utilized	Recommendation to other Colleague		p†
	Yes	No	
>500 mg/day	10	0	0,0396
≤500 mg/day	7	5	

N.S.: Statistically not significant; *Chi-square test; † Fisher's exact test.

Despite the main limitations of this study, represented by sample size, and the possibility of underreporting of the use of ATE and other substances, (due to social and legal constraints related to anabolic hormones and other performance-enhancing drugs) there is no other study concerning the use of ATE containing supplement. With the presented data in mind, education about plant-derived supplements utilization, prescription, indications and side-effects, should be implemented among recreational athletes, in reason to avoid uncontrolled and disseminated ATE and others phytoecdysteroids usage.

Conclusions

The present study is the first to notice the use and perception of the ergogenic effect of ATE in an uncontrolled Brazilian population. The users of this supplement were mainly young adult males. The ATE users have a positive perception of the ergogenic effect after consumption of this supplement. Most of them, are consumers of other supplements and spread among colleagues the supposed positive effects of the supplement.

Acknowledgment

Research support program of the University of Uberaba (PAPE-UNIUBE).

Conflict of Interest

The authors declare that there is no conflict of interest involved in the work.

References

- Leifman H, Rehnman C, Sjöblom E, Holgersson S (2011) Anabolic androgenic steroids--use and correlates among gym users--an assessment study using questionnaires and observations at gyms in the Stockholm region. *Int J Environ Res Public Health* 8(7): 2656-2674.
- Attlee A, Haider A, Hassan A, Alzamil N, Hashim M, et al. (2018) Dietary Supplement Intake and Associated Factors Among Gym Users in a University Community. *J Diet Suppl* 15(1): 88-97.
- Wiens K, Erdman KA, Stadnyk M, Parnell JA (2014) Dietary supplement usage, motivation, and education in young, Canadian athletes. *Int J Sport Nutr Exerc Metab* 24(6): 613-622.
- Mathews NM (2018) Prohibited Contaminants in Dietary Supplements. *Sports Health* 10(1):19-30.
- Borrione P, Rizzo M, Quaranta F, Ciminelli E, Fagnani F, et al. (2012) Consumption and biochemical impact of commercially available plant-derived nutritional supplements. An observational pilot-study on recreational athletes. *J Int Soc Sports Nutr* 9(1): 28.
- Ambrosio G, Wirth D, Joseph JF, Mazzarino M, de la Torre X, et al. (2020) How reliable is dietary supplement labelling?-Experiences from the analysis of ecdysterone supplements. *J Pharm Biomed Ana* 5(177): 112877.
- Santesteban MV, Ibáñez SJ (2017) Ergogenic aids in sport. *Nutr Hosp* 34(1): 204-215.
- Báthori M, Tóth N, Hunyadi A, Márki A, Zádor E (2008) Phytoecdysteroids and anabolic-androgenic steroids--structure and effects on humans. *Curr Med Chem* 15(1): 75-91.
- Spindler KD, Hönl C, Tremmel Ch, Braun S, Ruff H, Spindler-Barth M. (2009) Ecdysteroid hormone action. *Cell Mol Life Sci*. 66(24): 3837-3850.
- Gorelick-Feldman J, Maclean D, Ilic N, Poulev A, Lila MA, Cheng D, et al. (2008) Phytoecdysteroids increase protein synthesis in skeletal muscle cells. *J Agric Food Chem*. 56(10):3532-7.
- Parr MK, Botrè F, Naß A, Hengevoss J, Diel P, Wolber G (2015) Ecdysteroids: A novel class of anabolic agents? *Biol Sport* 32(2): 169-173.
- Báthori M, Pongrácz Z (2005) Phytoecdysteroids--from isolation to their effects on humans. *Curr Med Chem* 12(2): 153-172.
- Báthori M (2002) Phytoecdysteroids effects on mammals, isolation and analysis. *Mini Rev Med Chem* 2(3): 285-293.
- Arthur ST, Zwetsloot KA, Lawrence MM, Nieman DC, Lila MA, et al. (2014) Ajuga turkestanica increases Notch and Wnt signaling in aged skeletal muscle. *Eur Rev Med Pharmacol Sci* 18(17): 2584-2592.
- Zubeldia J, Hernández-Santana A, Jiménez-del-Río M, Pérez-López V, Pérez-Machín R, et al. (2012) In Vitro Characterization of the Efficacy and Safety Profile of a Proprietary Ajuga Turkestanica Extract. *Chin Med* 3(4): 215-222.

16. Syrov VN (2000) Comparative experimental investigation of the anabolic activity of phytoecdysteroids and steranebols. *Pharm Chem J* 34(4): 31-34.
17. Cheng DM, Kutzler LW, Boler DD, Drnevich J, Killefer J, et al. (2013) Continuous infusion of 20-hydroxyecdysone increased mass of triceps brachii in C57BL/6 mice. *Phytother Res* 27(1):107-111.
18. Kerksick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, et al. (2018) ISSN exercise & sports nutrition review update: research & recommendations. *J Int Soc Sports Nutr* 15(1): 38.
19. Wilborn CD, Taylor LW, Campbell BI, Kerksick C, Rasmussen CJ, Greenwood M, et al. (2006) Effects of methoxyisoflavone, ecdysterone, and sulfo-polysaccharide supplementation on training adaptations in resistance-trained males. *J Int Soc Sports Nutr* 3(1): 19-27.
20. De Sa TH, Garcia LM, Claro RM (2014) Frequency distribution and time trends of types of leisure-time physical activity in Brazil, 2006-2012. *Int J Public Health* 59(6): 975-982.
21. Nogueira FRS, Brito AF, Vieira TI, Oliveira CVC, Gouveia RLB (2015) Prevalence of the use of ergogenic resources in bodybuilders in the city of João Pessoa, Paraíba. *Rev. Bras. Ciênc Esporte* 37(1): 56-64.
22. Brunacio KH, Verly-Jr E, Cesar CLG, Fisberg RM, Marchioni DM (2013) Use of dietary supplements among residents of the city of São Paulo, Brazil. *Cad. Public health* 29(7): 1467-1472.
23. Macedo CLD, Santos RP, Pasqualotto AC, Copette FR, Pereira SM, Casagrande A, et al. (1998) Use of anabolic steroids in bodybuilders and/or bodybuilders. *Rev Bras Med Sport* 4(1): 13-7.
24. Silva LSMF, Moreau RLM. (2003) Use of anabolic androgenic steroids by bodybuilders in large gyms in the city of São Paulo. *Rev. Bras. Ciênc Farm* 39(3): 327-333.
25. Fayh APT, Silva CV, Jesus FRD, Costa GK. (2013) Consumption of nutritional supplements by gym goers in the city of Porto Alegre. *Rev. Bras. Sport Science* 35(1): 27-37.
26. Rocha LP, Pereira MVL (1998) Consumption of nutritional supplements by practitioners of physical exercises in gyms. *Rev Nutr* 11(1): 76-82.
27. Lacerda FM, Carvalho WR, Hortegal EV, Cabral NA, Veloso HJ (2015) Factors associated with dietary supplement use by people who exercise at gyms. *Rev Saude Publica* 49(1): 63.
28. Hirschbruch MD, Fisberg M, Mochizuki L. (2008) Consumption of supplements by young gym goers in São Paulo. *Rev Bras Med Sport* 14(6): 539-543.
29. Goston JL, Correia MI (2010) Intake of nutritional supplements among people exercising in gyms and influencing factors. *Nutrition* 26(6): 604-611.