

**CROSSFIT® PRACTITIONERS PROFILE WITH REGARD TO THE PREVALENCE OF USE OF DIETARY SUPPLEMENTS AND ANABOLIC ANDROGENIC STEROIDS AS ERGOGENIC RESOURCES**

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**ABSTRACT**

**Introduction:** The use of supplements is widespread in various sports as ergogenic aids but in many cases without proper prescription. **Objective:** The aim of this study is to investigate the prevalence of dietary supplements and anabolic androgenic steroids use among CrossFit practitioners and whether these were prescribed by professionals. **Methods:** A cross-sectional study was carried out in CrossFit practitioners (n=217), who answered a anonymous standardized and pre-coded online questionnaire. **Results:** Overall, 50.7% of subjects were male, and the sample had an average age of 33.7 ±5.2 years. The prevalence of dietary supplements use was 60.8% and anabolic androgenic steroids was 5.5%. Use of dietary supplements was associated with anabolic androgenic steroids usage (p<0,05). Demographic and socioeconomic variables were not associated with increased use of dietary supplements (p>0.05). Weekly training frequency; physical activity experience before CrossFit; number of years practicing CrossFit and health professional follow-up, were all associated with a higher consumption of supplements (p<0,05). **Conclusion:** The prevalence of use of anabolic androgenic steroids usage in CrossFit practitioners (5.5%). Also the subjects had a high consumption of dietary supplements (60.8%) and in addition, there was a strong correlation between dietary supplements consumption and use of anabolic androgenic steroids.

**Key words:** Anabolic Agents. Dietary Supplements. Exercise. Ergogenic Aids. Health Education.

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**RESUMO**

**Perfil dos praticantes de crossfit® em relação à prevalência de uso de suplementos alimentares e esteróides anabólicos androgênicos como recursos ergogênicos**

**Introdução:** O uso de suplementos é bastante difundido em diversas modalidades esportivas como auxiliares ergogênicos, mas em muitos casos sem a devida prescrição. **Objetivo:** O objetivo deste estudo é investigar a prevalência do uso de suplementos alimentares e esteroides androgênicos anabolizantes entre praticantes de CrossFit e se estes foram prescritos por profissionais. **Métodos:** Foi realizado um estudo transversal com praticantes de CrossFit (n=217), que responderam a um questionário on-line anônimo padronizado e pré-codificado. **Resultados:** No geral, 50,7% dos indivíduos eram do sexo masculino e a amostra tinha idade média de 33,7 ±5,2 anos. A prevalência do uso de suplementos dietéticos foi de 60,8% e de esteroides androgênicos anabolizantes foi de 5,5%. O uso de suplementos dietéticos foi associado ao uso de esteroides androgênicos anabolizantes (p<0,05). Variáveis demográficas e socioeconômicas não estiveram associadas ao aumento do uso de suplementos alimentares (p>0,05). Frequência semanal de treinamento; experiência de atividade física antes do CrossFit; número de anos de prática de CrossFit e acompanhamento profissional de saúde, estiveram associados ao maior consumo de suplementos (p<0,05). **Conclusão:** A prevalência do uso de esteroides androgênicos anabolizantes em praticantes de CrossFit (5,5%). Além disso, os indivíduos apresentavam um elevado consumo de suplementos dietéticos (60,8%) e, além disso, houve uma forte correlação entre o consumo de suplementos dietéticos e o uso de esteróides androgênicos anabolizantes.

**Palavras-chave:** Agentes Anabólicos. Suplementos Dietéticos. Exercício. Auxiliares Ergogênicos. Educação saudável.

## INTRODUCTION

Physical activity, which is all types of movement produced by muscles, that generate energy expenditure above the level we would have at rest, as well as the practice of physical exercise, which is done in order to improve performance, when combined with a balanced diet, are both considered indicators of a healthy lifestyle (Elliot, Hamlin, 2018; Jia et al., 2022).

Data from the World Health Organization (WHO, 2020) show that 60% of the world population is physically inactive or insufficiently active, which is a serious public health problem, since it is a risk factor for chronic non-communicable diseases (NCDs), such as cardiovascular diseases, cancers and diabetes mellitus.

Currently, the search for specific sports has grown, among which the CrossFit stands out (Minghelli, Vicente, 2019).

It was developed for military training, but it gradually spread among the civilian population.

The sport consists of a set of complex exercises that, in a short time, recruits practically all muscle groups. It includes running, weightlifting, Olympic gymnastics and ballistic movements (Nicolay et al., 2022).

Coaches set up workouts by combining high-intensity training routines that are performed quickly and repetitively with little or no recovery intervals between sets so the physiological and biochemical demands of this sport are extremely complex, requiring practitioners to develop muscle agility and strength (Szeles et al., 2020; Machado, Sanches, Cornacini, 2021).

Thus, the use of specific food, nutritional supplements and possibly even drugs, such as anabolic androgenic steroids, have been explored in order to generate greater gains for this athletes (Sadowska-Krępa et al., 2019; Fogaça et al., 2020; Maroufi et al., 2020).

The scientific literature refers to ergogenic resources as being the substances, processes or phenomena that have the ability to improve an athlete's performance, being its term derived from two Greek words: "ergon" which means work and "gennan" which means to produce (Ekmekci, 2016; Kerksick et al., 2018).

It is noted that, in most cases, the use of these resources is done in an unconscious way and without criteria, due to the amount of easily accessible products on the market

without need for a medical or nutritional prescription (Ekmekci, 2016; Freitas et al., 2020).

However, without proper prescription, these resources may not only fail to generate the expected sporting effect, but also cause harmful effects to health, which may be of small magnitude and reversible, such as cramps and muscle fatigue, as well as extremely serious, from kidney failure, failure of the liver and cardiac changes, to death in severe cases (Peeling et al., 2018; ANVISA, 2020).

Thus, considering that the use of ergogenic resources can cause deleterious effects, the aim of this study is to investigate the prevalence of dietary supplements and anabolic androgenic steroids use among CrossFit practitioners and whether these were prescribed by professionals or not.

## MATERIALS AND METHODS

A cross-sectional study was carried out with physical active people who are CrossFit practitioners properly enrolled in a CrossFit Box in a city in southern Brazil (n=217) of both sexes, over 18 and under the age of 60. The sample was defined by convenience, and all athletes who answered the standardized and pre-coded online questionnaire during the month of October 2020, and who were not pregnant, were included in the study.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Serra Gaúcha University Center Research Ethics Committee, approved under the number 3.912.822. Written informed consent was obtained from all subjects and the inclusion of participants only occurred after signing.

In addition to the collection of socioeconomic variables, the assessment questionnaire consisted of: physical exercise (types of activities, time of practice, frequency and duration) and use of supplements and anabolic androgenic steroids (types, periodicity and whether or not there was a prescription by a health professional) and health issues (such as NCD conditions).

The questionnaire was designed according to a questionnaire validated in the scientific literature by Sprey et al., (2016), using the data collection tool Google® Form.

For statistical analysis the data were tested using SPSS software version 25.0 and

their normality was verified by the Shapiro-Wilk test. In order to verify possible associations between the outcomes and the independent variables, the Chi-Square test was applied, the categorical variables were described by absolute (n) and relative (n%) frequency, the results being expressed in percentage, average and standard deviation or absolute and relative frequency and adopted the level of statistical significance when value  $p < 0.05$ .

## RESULTS

Of 217 assessed individuals, 50.7% of the sample was male and the average age was  $33.7 \pm 5.2$  years.

The prevalence of supplement use in the analyzed population was 60.8%. The distribution of demographic and socioeconomic variables in relation to the use of supplements is shown in Table 1.

**Table 1** - Description of demographic and socioeconomic variables in relation to the use of supplements among CrossFit® practitioners (n=217).

Variables	Total		Use of supplements		p-value*
	n	n%	n	n%	
Gender					0.070
Female	107	49.3	59	55.1	
Male	110	50.7	73	66.4	
Age					0.063
≥ 30 years	117	53.9	64	54.7	
< 30 years	100	46.1	68	68.0	
Civil status					0.164
Single	138	63.6	91	65.9	
Married	71	32.7	38	53.5	
Divorced	6	2.8	2	33.3	
Widower	2	0.9	1	50.0	
Education					0.258
Elementary school	1	0.5	1	100.0	
High school	12	5.5	8	66.7	
Incomplete college	56	25.8	39	69.6	
Complete college	87	40.1	54	62.1	
Specialization	49	22.6	25	51.0	
Master's or doctorate degree	12	5.5	5	41.7	
Occupation					0.287
Administration	71	32.7	42	59.2	
Marketing	22	10.1	11	50.0	
Law	13	6.0	6	46.2	
Education	15	6.9	13	86.7	
Engineering	25	11.5	13	52.0	
Technology	20	9.2	13	65.0	
Health	44	20.3	30	68.2	
Others	7	3.2	4	57.1	
Income in reais (R \$)					0.170
Until 1,000.00	14	6.5	11	78.6	
Between 2,000.00 and 3,000.00	33	15.2	22	66.7	
Between 3,000.00 and 4,000.00	38	17.5	27	71.1	
Between 4,000.00 and 5,000.00	35	16.1	20	57.1	
Between 5,000.00 and 6,000.00	28	12.9	20	71.4	
Between 6,000.00 and 10,000.00	44	20.3	21	47.7	
More than 10,000.00	25	11.5	11	44.0	

**Legenda:** n - absolute frequency; n% - relative frequency. Categorical variables were described by absolute and relative frequency. \*Association Chi-Square Test. Bold values are statistically significant ( $p \leq 0,05$ ).

There were no differences in the analyzed variables for the total number of participants or in relation to the use of supplements ( $p>0.05$ ).

Table 2 shows data on the CrossFit practice and other physical activities, resistance training was the most mentioned practice (57.6%), followed by court sports (12.9%) and only 3.7 % of the sample did not perform any type of physical activity before starting CrossFit.

Regarding the reasons for starting CrossFit training, 30.9% of people answered that they were looking for physical conditioning, followed by life quality (25.3%) and aesthetic issues and weight loss (12.4%).

In this same table, we see that 52.2% of the sample reported having a follow-up with a nutritionist and 7.8% with a doctor, while 35.5% of subjects reported not having any follow-up with health professionals ( $p<0.0001$ ).

**Table 2** - Description of the physical activity variables in relation to the use of supplements among CrossFit® practitioners (n=217).

Variables	Total		Use of supplements		p-value*
	n	n%	n	n%	
Physical activity at work					0.204
Sedentary	111	51.2	63	56.8	
Slightly active	75	34.6	49	65.3	
Moderately active	27	12.4	19	70.4	
Vigorously active	4	1.8	1	25.0	
CrossFit® time					0.207
Up to 6 months	54	24.9	31	57.4	
Between 6 months and 1 year	24	11.1	10	41.7	
Between 1 year and 2 years	41	18.9	29	70.7	
Between 2 years and 3 years	54	24.9	34	63.0	
More than 3 years	44	20.3	29	63.6	
Weekly frequency of CrossFit® training					0.020
< 4 days a week	95	43.8	49	51.6	
≥ 4 days a week	122	56.2	83	68.0	
Days a week without physical activity					0.025
None	7	3.2	6	85.7	
1 day	54	24.9	35	64.8	
2 days	57	26.3	38	66.7	
3 days	47	21.7	21	44.7	
4 days	33	15.2	20	60.6	
5 days	12	5.5	5	41.7	
6 days	7	3.2	7	100.0	
Physical activity before starting CrossFit®					0.131
No	30	13.8	14	46.7	
Yes	187	86.2	118	63.1	
Physical activity before CrossFit®					0.023
Not practice	8	3.7	2	25.0	
Resistance training	125	57.6	81	64.8	
Swimming	20	9.2	15	75.0	
Court sports	28	12.9	14	50.0	
Combat sports	14	6.5	11	78.6	
Running/Cycling	19	8.8	7	36.8	
Other	3	1.4	2	66.7	
Physical activity experience before CrossFit®					0.003
Between 1 and 6 months	13	6.0	9	69.2	
Between 6 months a 1 year	8	3.7	2	25.0	
Between 1 and 2 years	26	12.0	15	57.7	
Between 2 and 3 years	28	12.9	24	85.7	
Between 3 and 4 years	8	3.7	5	62.5	
Between 4 and 5 years	11	5.1	8	72.7	
More than 5 years	102	47.0	63	61.8	

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Reason why you started practicing CrossFit®					0.087
Weight loss	27	12.4	20	74.1	
Physical conditioning	67	30.9	40	59.7	
Muscle mass gain	5	2.3	5	100.0	
Quality of life	55	25.3	27	49.1	
Medical recommendation	1	0.5	1	100.0	
Recommendations from other athletes	23	10.6	17	73.9	
Curiosity	39	18.0	22	56.4	
Follow up with a health professional					≤0.0001
No	77	35.5	32	41.6	
Nutritionist	113	52.1	87	77.0	
Doctor	17	7.8	9	52.9	
Physiotherapist	9	4.1	4	44.0	
Other	1	0.5	0	0.0	

**Legenda:** n - absolute frequency; n% - relative frequency. Categorical variables were described by absolute and relative frequency. \*Association Chi-Square Test. Bold values are statistically significant ( $p \leq 0,05$ ).

As for the supplementation types, participants reported making greater use of protein supplement, followed by vitamins and minerals and collagen.

These data, the frequency of use and the prescription or not by a health professional are shown in Table 3.

**Table 3** - Description of variables related to supplementation among CrossFit® practitioners (n=217).

Variables	Total	
	n	n%
Use of supplements		
No	85	39.2
Yes	132	60.8
Whey protein		
No	103	47.5
Yes	114	52.5
BCAA		
No	203	93.5
Yes	14	6.5
Creatine		
No	150	69.1
Yes	67	30.9
Vitamins and minerals		
No	171	78.8
Yes	46	21.2
Collagen		
No	199	91.7
Yes	18	8.3
Frequency		
Don't use	80	36.9
Once a day	111	51.1
Twice a day	20	9.2
3 times a day	5	2.3
> 3 times a day	1	0.5
Prescription		
Don't use	80	36.9
Doctor	5	2.3
Nutritionist	96	44.2
Self prescription	34	15.7
Coach	2	0.9

**Legenda:** BCAA - branched-chain amino acids. n - absolute frequency; n% - relative frequency. Categorical variables were described by absolute and relative frequency.

Table 4 shows the variables related to the use of anabolic androgenic steroids. Thus, it was found that 5.5% of CrossFit practitioners asserted that use these synthetic hormones. In addition, 18.0% reported having already used

anabolic steroids and only 34.1% reported having knowledge about the risks of dietary supplementation and the use of ergogenic resources.

**Table 4** - Description of variables for the use of anabolic androgenic steroids in relation to the use of supplements among CrossFit® practitioners (n=217).

Variables	Total		Use of supplements		p-value*
	n	n%	n	n%	
Use of anabolic androgenic steroids					0.011
No	205	94.5	120	58.5	
Yes	12	5.5	12	100.0	
Have you ever used anabolic androgenic steroids?					0.005
No	178	82.0	100	56.2	
Yes	39	18.0	32	82.1	
Knowledge about the risks of dietary supplementation or anabolic androgenic steroids					≤0.0001
No	143	65,9	72	50,3	
Yes	74	34,1	60	81,1	

**Legenda:** n - absolute frequency; n% - relative frequency. Categorical variables were described by absolute and relative frequency. \*Association Chi-Square Test. Bold values are statistically significant ( $p \leq 0,05$ ).

## DISCUSSION

In the assessed sample, it was observed that most of the participants were male, young adults, and that used nutritional supplements, mainly proteins. Although many of them follow up with health professionals, mainly nutritionists, self-supplementation was also widely mentioned.

To prevent injuries and improve physical performance, the use of dietary supplements by physical activity practitioners is common (Rawson, Miles, Larson-Meyer, 2018).

The present study findings, showing that men use more supplements than women, is similar to recent studies in the sports field that show male individuals as the largest consumers of supplements (Baltazar-Martins et al., 2019; Ruano, Teixeira, 2020; Aguilar-Navarro et al., 2021).

This differentiation by sex may occur due to the fact that men tend to ingest food supplements on a more regular basis, as a way of maintaining goals, while women use them more occasionally, as they seek immediacy in their goals with exercise practice and they are more concerned with health than men, therefore they are more cautious with the products they eat (Wahlgemuth et al., 2021).

Younger individuals also tend to make greater use of dietary supplements when compared to older individuals, as they are more vulnerable to the influence of the appeals of these products, since at this age the desire for

quick results is greater, in addition to having a desire for physical appearance and perfect bodies (Garthe, Maughan, 2018; Jovanov et al., 2019).

As for the variables of physical activity in relation to the use of supplements, a statistically significant association was observed with the weekly frequency of CrossFit training, number of days per week with no practice of physical activity, type of physical activity practiced before CrossFit and physical activity experience before starting CrossFit.

Thus, a higher prevalence of supplements use was identified among participants with a higher weekly frequency of CrossFit training, that is, those who trained 4 days or more per week (68.0%), when compared to those who trained less than 4 days a week (51.6%), a similar result to other national and international studies (Jawadi et al., 2017; Higino, Freitas, 2021).

Excessive consumption of protein supplements among physical activity practitioners has been reported in literature at the same time as there is considerable debate about the amount of protein required in diet.

Initially, it was recommended that athletes do not need to ingest more than the RDA (0.8 g/kg/day) for protein, however, recent research indicates that the athlete involved in intense training and people seeking physical fitness can benefit from the higher intake (1.2-2.0 g/kg/day) (Phillips, Chevalier, Leidy, 2016; Witard et al., 2016; Jager et al., 2017).



However, it is very clear that this consumption should be entirely, and when it is not possible, mostly, through food instead of supplementation (Kerksick et al., 2018).

The variables on the use of anabolic androgenic steroids demonstrated statistical significance in relation to the use of supplements, at the time of the research 100% of the individuals who claimed to be using some type of anabolic steroids and/or androgens reported using dietary supplements. The prevalence of steroids and androgens use among the individuals participating in the research was low (18%) compared to another study with bodybuilding practitioners, which found 57.9% (Bezerra, Silva, 2020), but very close to that found in a meta-analysis of global epidemiology that found for recreational athletes the percentage of 18.4 (Sagoe et al., 2014).

The uses of supplements and anabolic androgenic steroids are the most modern aspect of sports medicine and promote the idea of greater competitive advantage.

Thus, users of dietary supplements use significantly more anabolic androgenic steroids than those who do not consume supplements, since the objectives that encourages users to take supplements seems to be the same that encourages the use of anabolic steroids: increased strength, muscle mass and performance.

Recent studies have shown that amateur athletes, especially young people, have an increasing tendency to use ergogenic aids to improve performance (Codella et al., 2019; Miskulin, Grbic, Miskulin, 2021).

Nutritional recommendations must be individualized, and prescribed preferably by a nutritionist, who also assesses the need for dietary supplements to enhance the benefits of exercise.

When it is necessary to use a differentiated nutritional support so that the practitioner is able to achieve his goals or results with greater ease, food supplementation can be used. However, it is becoming very common to use this supplementation indiscriminately and without guidance, which can lead the practitioner to health problems (Maughan et al., 2021).

In addition to this, in the present study, it was observed that, 50% of supplement consumers having no knowledge about the risks of dietary supplementation and use of anabolic androgenic steroids.

This is very important since even if it is prescribed by a professional, the consumer needs to know the possible side effects and, in the case of anabolic steroids, they are decisively prohibited by the World Anti-Doping Agency (WADA, 2021).

It is important to highlight the limitations of the present work evaluations, such as the online questionnaire application, where it was observed that there were some possible restrictions, such as the impediment of helping the participant when he did not understand any question and the impossibility of knowing the circumstances in which the questionnaire was answered.

Another important factor is the sample size, obtained by convenience. However, we believe that the description of the results of this type of physical activity practitioner is also relevant for a better understanding of the relation between dietary supplements consumption and the sports nutrition area. In addition, in relation to the use of anabolic androgenic steroids, we are not aware of any other study in literature that has investigated this aspect in CrossFit practitioners.

## CONCLUSION

The consumption of dietary supplements prevalence among CrossFit practitioners was 60.8%, and the use of anabolic steroids 5.5%.

The biggest consumers of supplements are those who are young, practice physical activities; male, and individuals who have already used anabolic androgenic steroids.

Even though supplements are prescribed by nutritionists in 44.2% of the cases, it should be noted that many users are unaware of the risks of using dietary supplements and anabolic steroids, demonstrating the importance of further studies analyzing their effects on health and the harmful effects of these products, when used incorrectly.

## REFERENCES

- 1-ANVISA. Agência Nacional de Vigilância Sanitária. Suplementos Alimentares. 6ª edição Brasília. 29 de junho de 2020.
- 2-Aguilar-Navarro, M.; Baltazar-Martins, G.; Souza, D.B.; Muñoz-Guerra, J.; Plata, M.M.; Coso, J. Gender Differences in



Prevalence and Patterns of Dietary Supplement Use in Elite Athletes. *Res Q Exerc Sport*. Vol. 92. Num. 4. 2021. p. 659-668.

3-Baltazar-Martins, G.; Souza, D.B.; Aguilar-Navarro, M.; Muñoz-Guerra, J.; Plata, M.M.; Coso, J. Prevalence and patterns of dietary supplement use in elite Spanish athletes. *J Int Soc Sports Nutr*. Vol. 16. Num. 30. 2019. p. 1-9.

4-Bezerra, A.S.; Silva, J.S.A. O uso de esteroides anabólicos por praticantes de musculação da cidade de Patos-PB. *Revista Brasileira de Nutrição Esportiva*. São Paulo. Vol. 16. Num. 47. 2020. p. 123-142.

5-Codella, R.; Glad, B.; Luzi, L.; La Torre, A. An Italian campaign to promote anti-doping culture in high-school students. *Front Psychol*. Vol. 10. Num. 534. 2019. p. 1-5.

6-Ekmekci, P.E. Physicians' Ethical Dilemmas in the Context of Anti-Doping Practices. *Ann Sports Med Res*. Vol. 3. Num. 7. 2016. p. 1-7.

7-Elliot, C.A.; Hamlin, M.J. Combined diet and physical activity is better than diet or physical activity alone at improving health outcomes for patients in New Zealand's primary care intervention. *BMC Public Health*. Vol. 18. Num. 1. 2018. p. 1-10.

8-Freitas, R.F.; Campos, S.G.O.; Maia, A.C.F.; Benevides, K.F.; Almeida, I.V.; Pereira, E.J. Conhecimentos dos clientes de uma loja de suplementos alimentares sobre a alimentação saudável e fatores associados. *Revista Brasileira de Nutrição Esportiva*. São Paulo. Vol. 13. Num. 82. 2020. p. 902-911.

9-Fogaça, L.J.; Santos, S.L.; Soares, R.C.; Gentil, P.; Naves, J.P.; Santos, W.D. Effect of caffeine supplementation on exercise performance, power, markers of muscle damage, and perceived exertion in trained CrossFit men: a randomized, double-blind, placebo-controlled crossover trial. *J Sports Med Phys Fitness*. Vol. 60. Num. 2. 2020. p. 181-188.

10-Garthe, I.; Maughan, R.J. Athletes and Supplements: Prevalence and Perspectives. *Int J Sport Nutr Exerc Metab*. Vol. 28. Num. 2. 2018. p. 126-138.

11-Higino, D.D.; Freitas, R.F. Prevalência e fatores associados ao uso de suplementos alimentares e esteroides anabólicos androgênicos em praticantes de CrossFit. *Revista Brasileira De Nutrição Esportiva*. São Paulo. Vol. 15. Num. 90. 2021. p. 9-23.

12-Jager, R.; Kerksick, C.M.; Campbell, B.I.; Cribb, P.J.; Wells, S.D.; Skwiat, T.M. International society of sports nutrition position stand: protein and exercise. *J Int Soc Sports Nutr*. Vol. 14. Num. 20. 2017. p. 1-25.

13-Jawadi, A.H.; Addar, A.M.; Alazzam, A.S.; Alrabieah, F.O.; Alsheikh, A.S.A.; Amer, R.R. Prevalence of Dietary Supplements Use among Gymnasium Users. *J Nutr Metab*. 2017. p. 1-8.

14-Jia, T.; Liu, Y.; Fan, Y.; Wang, L.; Jiang, E. Association of Healthy Diet and Physical Activity With Breast Cancer: Lifestyle Interventions and Oncology Education. *Front Public Health*. 2022. Vol. 10. 2022. p. 1-12.

15-Jovanov, P.; Dordic, V.; Obradović, B.; Barak, O.; Pezo, L.; Marić, A.; et al. Prevalence, knowledge and attitudes towards using sports supplements among young athletes. *J Int Soc Sports Nutr*. Vol. 16. Num. 1. 2019. p. 1-9.

16-Kerksick, C.M.; Wilborn, C.D.; Roberts, M.D.; Smith-Ryan, A.; Kleiner, S.M.; Jäger, R. ISSN exercise & sports nutrition review update: research & recommendations. *J Int Soc Sports Nutr*. Vol. 15. Num. 1. 2018. p. 1-57.

17-Machado, M.R.; Sanches, A.C.S.; Cornacini, M.C.M. Uso de maltodextrina no pré e intra treino de Crossfit para melhora da performance. *Revista Brasileira De Nutrição Esportiva*. São Paulo. Vol. 14. Num. 86. 2021. p. 268-280.

18-Maroufi, K.; Razavi, R.; Gaeini, A.A.; Nourshahi, M. The effects of acute consumption of carbohydrate-protein supplement in varied ratios on CrossFit athletes' performance in two CrossFit exercises: a randomized cross-over trial. *J Sports Med Phys Fitness*. Vol. 61. Num. 10. 2020. p. 1362-1368.

19-Maughan, R.J.; Burke, L.M.; Dvorak, J.; Larson-Meyer, D.E.; Peeling, P.; Phillips,

- S.M. IOC consensus statement: dietary supplements and the high-performance athlete. *Br J Sports Med*. Vol. 52. Num. 7. 2018. p. 439-455.
- 20-Minghelli, B.; Vicente, P. Musculoskeletal injuries in Portuguese CrossFit practitioners. *J Sports Med Phys Fitness*. Vol. 59. Num. 7. 2019. p. 1213-1220.
- 21-Miskulin, I.; Grbic, D.S.; Miskulin, M. Doping Attitudes, Beliefs, and Practices among Young, Amateur Croatian Athletes. *Sports*. Vol. 9. Num. 2. 2021. p. 1-10.
- 22-Nicolay, R.W.; Moore, L.K.; DeSena, T.D.; Dines, J.S. Upper Extremity Injuries in CrossFit Athletes-a Review of the Current Literature. *Curr Rev Musculoskelet Med*. Vol. 15. Num. 5. 2022. p. 402-410.
- 23-Peeling, P.; Binnie, M.J.; Goods, P.S.R.; Sim, M.; Burke, L.M. Evidence-Based Supplements for the Enhancement of Athletic Performance. *Int J Sport Nutr Exerc Metab*. Vol. 28. Num. 2. 2018. p. 178-187.
- 24-Phillips, S.M.; Chevalier, S.; Leidy, H.J. Protein "requirements" beyond the rda: implications for optimizing health. *Appl Physiol Nutr Metab*. Vol. 41. Num. 5. 2016. p. 565-572.
- 25-Rawson, E.S.; Miles, M.P.; Larson-Meyer, D.E. Dietary Supplements for Health, Adaptation, and Recovery in Athletes. *Int J Sport Nutr Exerc Metab*. Vol. 28. Num. 2. 2018. p. 188-199.
- 26-Ruano, J.; Teixeira, V.H. Prevalence of dietary supplement use by gym members in Portugal and associated factors. *J Int Soc Sports Nutr*. Vol. 17. Num. 11. 2020. p. 1-8.
- 27-Sadowska-Krępa, E.; Domaszewski, P.; Pokora, I.; Zebrowska, A.; Gdańska, A.; Podgórski, T. Effects of medium-term green tea extract supplementation combined with CrossFit workout on blood antioxidant status and serum brain-derived neurotrophic factor in young men: a pilot study. *J Int Soc Sports Nutr*. Vol. 16. Num. 1. 2019. p. 1-9.
- 28-Sagoe, D.; Molde, H.; Andreassen, C.S.; Torsheim, T.; Pallesen, S. The global epidemiology of anabolicandrogenic steroid use: a meta-analysis and meta-regression analysis. *Annals of epidemiology*. Vol. 24. Num. 5. 2014. p. 383-398.
- 29-Szeles, P.R.Q.; Costa, T.S.; Cunha, R.A.; Hespanhol, L.; Pochini, A.C.; Ramos, L.A.; Cohen, M. CrossFit and the Epidemiology of Musculoskeletal Injuries: A Prospective 12-Week Cohort Study. *Orthopaedic Journal of Sports Medicine*. Vol. 8. Num. 3. 2020. p. 1-9.
- 30-Wahlgemuth, K.J.; Arieta, L.R.; Brewer, G.J.; Hoselton, A.L.; Gould, L.M.; Smith-Ryan, A.E. Sex differences and considerations for female specific nutritional strategies: a narrative review. *J Int Soc Sports Nutr*. Vol. 18. Num. 1. 2021. p. 1-20.
- 31-Witard, O.C.; Wardle, S.L.; Macnaughton, L.S.; Hodgson, A.B.; Tipton, K.D. Protein considerations for optimizing skeletal muscle mass in healthy young and older adults. *Nutrients*. Vol. 8. Num. 181. 2016. p. 1-25.
- 32-WADA. World Anti-Doping Agency. Standard prohibited list 2021. Montreal, Canada: World Anti-Doping Agency. 2021.
- 33-WHO. World Health Organization guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization. 2020.
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