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USE OF NUTRITIONAL SUPPLEMENTS IN CROSSFIT PRACTITIONERS

USO DE SUPLEMENTOS NUTRICIONAIS EM PRATICANTES DE CROSSFIT

USO DE SUPLEMENTOS NUTRICIONALES EN LOS PRACTICANTES DE CROSSFIT

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ABSTRACT

Introduction: Crossfit is an activity of physical strength and metabolic conditioning. It is known that feeding and nutritional supplementation can interfere with the physical performance of the practitioners. Objective: To quantify the use of nutritional supplements (protein, carbohydrates and micronutrients), as well as to evaluate the adequacy of the time of consumption of the most cited supplements (pre, during or post training). Materials and Methods: We invited 60 participants of the crossfit modality of three academies located in the city of São Paulo. The research instrument was a questionnaire elaborated by the researchers. The data were analyzed with descriptive statistics. Results: Among the participants (48% men and 52% women), 70% used a supplement. The most used were protein, especially whey *protein*. Only 4.8% used carbohydrate supplements, and 3.2% micronutrients. Most whey *protein users reported use* of 1 (37.1%) or 2 (34.3%) measuring spoons per day. One third (34.3%) of the users reported consuming this supplement before training, followed by 25.7% who consumed it before and after training, and 14.3% who used it only after training. Discussion: Anaerobic muscle power activities involve higher protein *turnover*, which may explain the preference for protein supplements. Conclusion: Most of the participants in the study used nutritional supplements, and *whey protein was* the most cited. The doses stipulated on the label of the products were respected by most of the interviewees, however, the time of use and the type of supplement chosen in many cases were not adequate.

KEYWORDS: Nutritional assessment. Nutritional supplements. Nutrition and sports sciences.

RESUMO

Introdução: Crossfit é uma atividade de força física e condicionamento metabólico. Sabe-se que a alimentação e a suplementação nutricional podem interferir no desempenho físico dos praticantes. Objetivo: Quantificar o uso de suplementos nutricionais (proteínas, carboidratos e micronutrientes), bem como avaliar a adequação do tempo de consumo dos suplementos mais citados (pré, durante ou pós-treinamento). Materiais e métodos: Convidamos 60 participantes da modalidade de crossfit de três academias localizadas na cidade de São Paulo. O instrumento de pesquisa foi um questionário elaborado pelos pesquisadores. Os dados foram analisados com estatísticas descritivas. Resultados: Dentre os participantes (48% homens e 52% mulheres), 70% utilizaram um suplemento. Os mais utilizados foram as proteínas, especialmente a proteína do soro de leite. Apenas 4,8% utilizaram suplementos de carboidratos e 3,2% de micronutrientes. A maioria dos usuários de proteína de soro de leite relatou o uso de 1 (37,1%) ou 2 (34,3%) colheres de medida por dia. Um terço (34,3%) dos usuários relatou consumir este suplemento antes do treinamento, seguido por 25,7% que o consumiram antes e depois do treinamento, e 14,3% que o utilizaram somente após o treinamento. Discussão: As atividades

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de potência muscular anaeróbica envolvem maior rotatividade de proteínas, o que pode explicar a preferência por suplementos proteicos. Conclusão: A maioria dos participantes do estudo utilizou suplementos nutricionais, e a proteína do soro de leite foi a mais citada. As doses estipuladas no rótulo dos produtos foram respeitadas pela maioria dos entrevistados, entretanto, o tempo de uso e o tipo de suplemento escolhido em muitos casos não foram adequados.

PALAVRAS-CHAVE: Avaliação nutricional. Suplementos nutricionais. Nutrição e ciências esportivas.

RESUMEN

Introducción: El crossfit es una actividad de fuerza física y acondicionamiento metabólico. Se sabe que la alimentación y la suplementación nutricional pueden interferir en el rendimiento físico de los practicantes. Objetivo: Cuantificar el uso de suplementos nutricionales (proteínas, carbohidratos y micronutrientes), así como evaluar la adecuación del momento de consumo de los suplementos más citados (pre, durante o post entrenamiento). Materiales y métodos: Invitamos a 60 participantes de la modalidad de crossfit de tres academias ubicadas en la ciudad de São Paulo. El instrumento de investigación fue un cuestionario elaborado por los investigadores. Los datos fueron analizados con estadística descriptiva. Resultados: Entre los participantes (48% hombres y 52% mujeres), el 70% utilizaba algún suplemento. Los más utilizados fueron las proteínas, especialmente la proteína de suero. Sólo el 4,8% utilizaba suplementos de carbohidratos, y el 3,2% micronutrientes. La mayoría de los usuarios de proteína de suero de leche declararon utilizar 1 (37,1%) o 2 (34,3%) cucharas dosificadoras al día. Un tercio (34,3%) de los usuarios declaró consumir este suplemento antes del entrenamiento, seguido de un 25,7% que lo consumía antes y después del entrenamiento, y un 14,3% que lo utilizaba sólo después del entrenamiento. Discusión: Las actividades de potencia muscular anaeróbica implican un mayor recambio de proteínas, lo que puede explicar la preferencia por los suplementos proteicos. Conclusión: La mayoría de los participantes en el estudio utilizaron suplementos nutricionales, siendo la proteína de suero de leche la más citada. Las dosis estipuladas en la etiqueta de los productos fueron respetadas por la mayoría de los entrevistados, sin embargo, el tiempo de uso y el tipo de suplemento elegido en muchos casos no fueron adecuados.

PALABRAS CLAVE: Evaluación nutricional. Suplementos nutricionales. Nutrición y ciencias del deporte.

INTRODUCTION

Crossfit is a physical strength and conditioning activity based on functional movements such as weightlifting, gymnastics and metabolic conditioning (TIBANA et al., 2017). According to Alencar et al. (2018), the modality seeks to develop strength, flexibility, cardiorespiratory and muscle resistance, agility and balance, coordination, power and speed, aiming at improving physical performance. Crossfit can promote considerable metabolic gains, as it contemplates the three ways of energy metabolism to perform muscle actions (BUENO et al., 2016; OLIVEIRA and OLIVEIRA, 2017).

It is known that food and nutritional supplementation can interfere with physical performance (OLIVEIRA and OLIVEIRA, 2017). For adequate food planning, several factors should be considered, including the energy adequacy of the diet, the distribution of macronutrients and the supply of adequate amounts of vitamins and minerals (CABRAL et al., 2006). Thus, there is a need for studies evaluating caloric intake and the use of supplements among crossfit practitioners (OLIVEIRA and OLIVEIRA, 2017).

Outlaw et al. (2014) mention that the intake of proteins and carbohydrates in the post-workout period can contribute to increase lean mass and reset glycogen reserve in trained individuals. However,

it is known that the high increase in physical exertion resulting from exercise added to dietary inadequacy can expose physical activity practitioners to organic problems (CABRAL et al., 2006).

The diets of crossfit practitioners should provide nutrients according to individual needs, frequency, intensity and duration of training (OLIVEIRA and OLIVEIRA, 2017). However, it is perceived that among amateur strength exercises, there is a certain ignorance regarding nutrition, especially in relation to the daily needs of macro and micronutrients (BUENO et al., 2016). In addition, crossfit is a relatively new modality that lacks studies with scientific rigor (OLIVEIRA and OLIVEIRA, 2017).

Given the scarcity of studies on the use of supplements by crossfit practitioners and considering that an adequate diet can contribute to a good performance in this modality, the aim of this study was to analyze the consumption of nutritional supplements by crossfit practitioners. It was also intended to quantify the use of protein supplements, carbohydrates, and micronutrients, in addition to evaluating the adequacy of the moment of consumption of the most cited supplement (pre, during or after training).

MATERIALS AND METHODS

This is an observational cross-sectional study, in which 60 crossfit practitioners from three academies located in the metropolitan region of the city of São Paulo participated.

Inclusion criteria were: crossfit for at least three months, being regularly enrolled in one of the three academies participating in the study, and age 18 to 40 years. The sample was excluded from pregnant women, individuals who suffered injuries less than three months ago, and individuals with cognitive deficits that prevented the understanding of the research procedures.

The participants of the research were approached in the academies before training, and answered a questionnaire composed of 10 questions (see appendix) about the practice of the modality, use of supplements and diet.

This research complies with resolution 466/12 of the National Health Council (BRAZIL, 2013) and the Declaration of Helsinki (WMA, 2013). The study was approved by the Research Ethics Committee of the Adventist University Center of São Paulo, opinion number 415,387. All participants signed a free and informed consent form.

The data were tabulated and analyzed with descriptive statistics in the Statistical Package SPSS v.24 for Windows.

RESULTS

The study participants 60 individuals, 29 (48%) men and 31 (52%) women. Participants had an average of 32.3 (±6.5) years and had crossfit for 22.5 (±14.8) months (minimum of 3 and maximum of 84 months). Among them, 70% (n=42) used some nutritional supplement.

Table 1 shows the supplements mentioned. The most used by the interviewees were protein supplements, including *whey protein*. Only 4.8% of the interviewees used carbohydrate supplements,

and 3.2% used micronutrient supplements. The use of stimulant substances was reported by 11.5% of the research participants.

Table 1 - Supplements used by crossfit practitioners (n=42).

		n	%
Proteins	*Whey protein*	35	58,3
	BCAA	18	30
	Creatine	16	26,6
	Glutamine	14	23,3
	Pre-workout	4	6,6
	Casein	3	5
	Amino acids	2	3,3
	Beta Alanine	2	3,3
	Albumin	1	1,6
	HMB	1	1,6
Carbohydrates	Dextrose	1	1,6
	Waxy maize	1	1,6
	Palatinose	1	1,6
Micronutrients	Polivitamínico	1	1,6
	ZMA	1	1,6
Stimulants	Thermogenic	3	5
	Caffeine	2	3,3
	Teacrine	1	1,6
	Ephedrine	1	1,6
Other	Manipulated formula	2	3,3
	Citrux cell	1	1,6
	L-Carnitine	1	1,6
	Ashwaguandha	1	1,6

Among the 42 participants who used some nutritional supplement, the majority used 3 different supplements (n=14, 33.3%), while 21.4% (n=9) used only 1 supplement, the same amount of individuals used 2 supplements (n=8, 19.1%), 6 people (14.3%) used 4 different supplements, 3 (7.1%) used 5, 1 person only (2.4%) used 6 supplements and also 1 person (2.4%) used 7 different products.

The majority of respondents who used nutritional supplements reported having been guided by a nutritionist (n=20, 47.6%), however, a significant number of people (n=17, 40.4%) had not received professional guidance (Table 2).

Table 2 - Origin of the orientation of supplement use (n=42).

		n	%
Professional	Nutritionist	20	47,6
	Doctor	7	16,6
	Physical education professional	1	2,4
	Another professional	2	4,7
Non-professional	The practitioner himself	14	33,3
	Friends of the practitioner	3	7,1

JOURNAL HEALTH AND TECHNOLOGY - JHT
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When considering the most cited *supplement, whey protein*, most participants reported the use of 1 (n=13, 37.1%) or 2 (n=12, 34.3%) *measured spoons (scoops*). Five individuals (14.3%) stated to use the dosage indicated on the product label or recommended by a nutritionist, without mentioning details. Only one person claimed to consume 4 scoops (2.8%), and 4 users of this supplement (11.4%) did not answer this question.

Regarding the use of creatine supplementation, 5 (31.3%) individuals reported using 5g of the product, 1 (6.2%) reported daily consumption of 10g and 4 (25%) people did not specify the dosage, only reported following the recommendations of the label or the professional who indicated the supplement. Six participants (37.5%) who used creatine did not answer this question.

Among the consumers of the 3 carbohydrate supplements mentioned (n=2), only 1 reported the dose used, 10g of dextrose.

In relation to the time of consumption of the supplement, most users of protein supplements (*whey protein*, BCAA, glutamine, pre-workout, casein, amino acids, beta-alanine and HMB) (n=35) reported consuming this supplement before training (n=12, 34.3%), followed by 9 people (25.7%) who consumed it before and after training, 5 (14.3%) who consumed it only after training, 1 individual (2.8%) reported consuming before, during and after training, and 5 people (14.3%) did not specify the time of consumption, only stated that they had daily consumption of this type of supplement. Three individuals (8.6%) did not answer this question.

Most users of the creatine supplement (n=16) reported daily use of the product, without specifying the timing (n=6, 37.5%). However, 3 participants (18.7%) reported creatine consumption before training, another 3 (18.7%) before and after training and 1 individual (6.25%) consumed the supplement after training. Six participants (37.5%) did not answer this question.

Participants who used a carbohydrate supplement (n=2) reported daily consumption (n=1.50%) or before and after training (n=1.50%).

The main reason for the use of supplements among the interviewees was the improvement of performance or post-training recovery (n=22, 52.4%), followed by increased muscle mass (n=8.19%) (table 3).

Table 3 - Reason for use of the supplement (n=42).

	n	%
Improve performance or recovery	22	52,4
Increase muscle mass	8	19
Medical advice	4	9,5
Nutritionist guidance	3	7,1
Complement feeding	3	7,1
Reduce	2	4,7
Increase mood	2	4,7
Get aesthetic improvement	1	2,4

JOURNAL HEALTH AND TECHNOLOGY - JHT
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The most cited benefit according to the participants' perception was the increase in lean mass (n=14, 33.3%), followed by better muscle recovery (n=9, 21.4%) and increased disposition (n=9, 21.4%). Nevertheless, 4.7% of the interviewees did not perceive any benefit with the use of nutritional supplements, as shown in Table 4.

Table 4 - Perceived benefits with the use of the supplement (n=42).

	n	%
Increased lean mass	14	33,3
Better muscle recovery	9	21,4
Increased mood	9	21,4
Increased strength	7	16,6
Increased endurance	3	7,1
Slimming	3	7,1
Improved aerobic capacity	1	2,4
Improved aesthetics	1	2,4
Increased motivation	1	2,4
Convenience of meal replacement	1	2,4
They didn't notice improvement.	2	4,7

Among the 60 crossfit practitioners who participated in this research, only 13 (21.6%) considered their diet inadequate, and the reasons cited for this were: excess fast food (n=5, 38.4%), lack of professional guidance (n=3, 23.1%), not following a balanced diet (n=3, 23.1%), lack of awareness (n=1, 7.7%) and tiredness (n=1, 7.7%).

DISCUSSION

The aim of this study was to analyze the consumption of nutritional supplements by crossfit practitioners, in addition to quantifying the use of protein supplements, carbohydrates and micronutrients, and to evaluate the adequacy of the moment of consumption of the most used supplement (pre, during or post training). Most of the participants in this study (70%) used some type of supplement, the most used were protein, followed by a small percentage of practitioners who used carbohydrate supplements (4.8%) and micronutrients (3.2%). Most consumers of protein supplements (34.3%) reported consumption before training. Creatine users, in general, did not specify the time of consumption, while participants who used a carbohydrate supplement reported daily consumption (50%) or before and after training (50%).

Crossfit is a modality that predominantly involves intermittent exercises of anaerobic muscle power and cardiorespiratory activities of high intensity and short duration (ESCOBAR et al., 2016). Sessions can range from 5 minutes or less to 45 minutes or more (ESCOBAR et al., 2016). In this situation, there is a predominance of ATP-CP and lactic anaerobic metabolisms, which depend mainly on the stock of ATP, creatine phosphate and glucose (MCARDLE et al., 2011).

Physical activities involving anaerobic muscle power, such as crossfit, are recommended to produce increased muscle mass, especially in fast-tinted muscle fibers (MCARDLE et al., 2011). This

process involves a *higher protein turnover* in active individuals in relation to sedentary individuals, since proteins participate in muscle recovery (MCCARTNEY et al., 2018), which may explain the preference of participants in this study for protein supplements.

The supplement most cited by the participants of this research *was whey protein* (cited by 58% of the sample), corroborating the study by Vargas and collaborators. (2015) The authors interviewed 31 individuals practicing in various modalities, and also observed that the most used supplements were protein supplements (51.6% of the participants), among whom *whey protein was* the most cited (VARGAS et al., 2015). Another study on *whey protein intake*, in which 133 university students from the city of Porto Alegre - RS participated, found that there was a significant difference between the vegetarian population and the reason for consumption (Saudade and collaborators, 2017). Vegetarians (n=14) consumed the supplement to prevent nutritional deficiencies and non-vegetarians (n=119) used *whey protein* to gain muscle mass. In relation to physical activity, 97% of the participants were practitioners of some modality and, of these, almost half (47.7%) performed anaerobic physical activity, and bodybuilding was the predominant activity (SAUDADE AND COLLABORATORS, 2017).

Less than 5% of the interviewees used carbohydrate supplements. It is known that, in modalities involving strength, carbohydrates play an important role. In the study by Cribb et al. (2007) conducted with 31 people, three groups were compared for 10 weeks, the first group used a supplement containing only protein, the second group used protein and carbohydrate and the third group a solution containing monohydrate creatine, protein and carbohydrate. It was found that the participants of the protein group associated with carbohydrate and creatine had higher body mass and muscle strength gain compared to the other groups.

Most supplement users reported having been guided by a nutritionist (47.6%), but many (40.4%) had not received any professional guidance. Fernandes and Machado (2016) conducted a study with 108 adult individuals practicing various physical activities in the municipality of Passo Fundo - RS. Seventy percent of the interviewees had not received adequate professional follow-up, above what was observed in the present study. Despite the expressive number of people without guidance, the authors pointed out that, still, the interviewees reported that the nutritionist was the most able professional to guide them (FERNANDES and MACHADO, 2016). Also on this study, 8% of the interviewees erroneously mentioned that the physical education professional could also divest from this act.

Regarding this theme, Aragão and Fernandes (2014) studied a group of 78 bodybuilding practitioners in the city of Goiânia - GO with the objective of investigating the consumption of foods and nutritional supplements in the pre- and post-training periods. The authors observed that the physical education professional (or *personal trainer*) was the professional who most indicated supplements to the participants (28.5%). The indication of supplements by the nutritionist was reported by 23% of the participants and about 17% of the individuals consumed supplement by self-prescription.

The Federal Council of Nutritionists has considered the competence of the professional nutritionist for the prescription of nutritional supplements (CFN, 2006). This is a complementary activity

of the nutritionist in the areas of Clinical Nutrition, Collective Health and Nutrition in Sports (CFN, 2006; CFN, 2005). When the Physical Education professional prescribes the use of supplements, he is violating the code of ethics of his own profession (CONFEF, 2015), which does not cite as this professional's attribution to the prescription of nutritional supplements.

Most of the protein supplement consumers interviewed in this study reported consuming this supplement before training. Cribb and Hayes (2006) studied the consumption of supplements at times close to training compared to the consumption of supplements at other times. Seventeen young men practicing bodybuilding were selected for the study and trained for 10 weeks. The individuals were divided into two groups. The pre- and post-workout group used protein, creatine and glucose before and after training. The morning and evening group used the same supplements in the morning and evening, regardless of the training schedule. The results showed that the pre- and post-training group showed a higher increase in lean mass and strength, as well as a greater increase in creatine and muscle glycogen content compared to the morning and night group.

Lima et al. (2013) that most of the 114 study participants (bodybuilding practitioners) did not use pre-training supplements (82%). The 18% who reported using nutritional supplements mentioned the use of branched chain amino acids (BCAA), proteins, carbohydrates, creatine, vitamins, and minerals.

In the present study, the majority of users of the creatine supplement reported daily use of the product, without specifying the time of consumption. Creatine supplementation is recognized as an ergogenic resource, that is, a resource that produces improvement in sports performance and that in the long term can be efficient to improve performance in high intensity exercises, increasing strength and decreasing fatigue (PANTA e SILVA FILHO, 2015). Less than 20% reported creatine consumption before training. According to Sousa e Azevedo (2008), creatine supplementation should be used by athletes who aim to improve performance in strength modalities, for assisting in the gain of lean mass.

Creatine consumption can be done at any time: its peak is about 1h after consumption and *the washout period* is about 1 month after discontinuation of use (GUALANO, 2014). The usual recommended consumption is 5g per day (GUALANO, 2014), as reported by 31.3% of the consumers of this supplement participating in the present study. Creatine supplementation exerts ergogenic effects of increased lean mass and strength in high intensity, short-duration, and particularly intermittent activities, which depend on the ATP-CP system (GUALANO, 2014).

The most cited benefit in relation to the general use of supplements among the participants of this study was the increase in lean mass 33.3%, followed by better muscle recovery 21.4% and the increase in disposition 21.4%. *Whey protein*, the most cited supplement, can offer crossfit practitioners a number of benefits, such as aid in recovery, strengthening immunity and direct improvement in performance (SGARBIERI, 2004). Its association with adequate training can promote increased muscle mass because it is a good source of proteins of high biological value (HA and ZEMEL, 2003).

According to a review study conducted by Melo and Bordonal (2009) on *the use of whey protein* associated or not with the practice of physical activity, most reported benefits in relation to the

consumption of this supplement, such as increased muscle density, bone mineral density, better appetite control, increased hepatic glycogen and better digestibility.

Saudade and collaborators (2017) observed that, among the changes perceived after *whey protein consumption,* 74.4% of the interviewees reported increased strength and gain in muscle mass and 22.6% of the respondents *used whey protein* to have greater disposition.

Among the participants of this research, only 21.6% considered their diet inadequate, having attributed this mainly to excess fast food, lack of professional guidance, and difficulty in following a balanced diet. In the study by Moreira and Rodrigues (2014) with 60 regulars of a gym in the city of Pelotas - RS, similar results were found. The authors used a 24-hour recall and observed that most exercise is who used some type of supplement maintained hypoglycidic diets 89.47%, hyperprotein 100% and hyperlipidic 52.63%. Nevertheless, the studied sample presented moderate knowledge about nutrition, despite the difficulty in establishing the relationship between food and its source.

One limitation of this study is the fact that an objective instrument for assessing the adequacy of feeding was not used. In addition, the results obtained here relate to a sample of crossfit practitioners and cannot be generalized to practitioners of other physical activities.

CONCLUSION

Most crossfit practitioners make use of nutritional supplements, and among them protein supplements predominate. Less than 5% of participants used carbohydrate supplements, which also play an important role in strength modalities. The time of use and the type of supplement chosen in many cases were not adequate, which reflects the lack of adequate professional guidance.

REFERENCES

ALENCAR, L.; SODRÉ, R.S.; ROSA, G. Acute effect of a Crossfit session on hemodynamic variables and the perception of exertion of trained adults. **Physical Education Journal**. Vol. 1. Num. 81. 2018. p. 271-278.

ANDERSEN, L.L. TUFEKOVIC G., ZEBIS M.K., CRAMERI R.M., VERLAAN G., KJAER M., SUETTA C., MAGNUSSON P., AAGAARD P. The effect of resistance training combined with timed ingestion of protein on muscle fiber size and muscle strength**. Metabolism**. Vol. 54. Num. 2. 2005. p.151-156.

ARAGON, A.R.; FERNANDES, D.C. Food and supplementintake in the pre and post-training in men practicing bodybuilding in Goiânia, Goiás. **Life and Health Studies.** Vol. 41. Num. special .2014. p. 15-29.

BUENO, B.A.; RIBAS. M.R.; BASSAN, J.C. Determination of micro and macro nutrient intake in the diet of crossfit practitioners. **Brazilian Journal of Sports Nutrition**. Vol. 10th Num. 59. 2016. p. 579-586.

BRAZIL, National Health Council (2013). Resolution 466/12. Available in: <http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf Accessed: October> 3, 2019.

CABRAL, C.A.; ROSADO, G.P.; SILVA, C.H.O.; MARINS, J.C.B. Diagnosis of the nutritional status of athletes of the Permanent Olympic Weightlifting Team of the Brazilian Olympic Committee (COB). **Brazilian Journal of Sports Medicine.** Vol. 12th Num. 6. 2006. p.345-350.

CRIBB, P.J.; HAYES, A. Effects of supplement timing and resistance exercise on skeletal muscle hypertrophy. **Medicine & Science in Sports & Exercise**. Vol. 38. Num.11. 2006. p. 1918-1925.

CRIBB, P.J.; WILLIAMS, A.D.; HAYES, A. Creatine-protein-carbohydrate supplement enhances responses to resistance training. **Medicine & Science in Sports & Exercise**. Vol.39. Num. 11. 2007. p. 1960-1968.

FEDERAL COUNCIL OF PHYSICAL EDUCATION (CONFEF). **Resolution 307** of 2015. Available in: <https://www.confef.org.br/confef/resolucoes/381> Access on May 20, 2019.

FEDERAL COUNCIL OF NUTRITIONISTS (CRF). **Resolution 390** of 2006. Available in: <http://www.cfn.org.br/novosite/pdf/res/2006/res390.pdf> Access on May 20, 2019.

FEDERAL COUNCIL OF NUTRITIONISTS (CRF). **Resolution 380** of 2005. Available in: http://www.cfn.org.br/novosite/pdf/res/2005/res380.pdf Access on May 20, 2019.

ESCOBAR, K.A.; MORALES, J., VANDUSSELDORP, T.A. The effect of a moderately low and high carbohydrate intake on crossfit performance. **International Journal of Exercise Science**. Vol. 9. Num. 3. 2016. p.460-470.

FERNANDES, W.N.; MACHADO, J.S. Use of dietary supplements by regulars of a gym in the municipality of Passo Fundo-RS. **Brazilian Journal of Sports Nutrition**. Vol. 10th Num. 55. 2016. p.59-67.

GUALANO, B. **Creatine supplementation: ergogenic, therapeutic and adverse effects**. Sao Paulo. Manole. 2014. p. 172.

HA, E.; ZEMEL, M.B. Functional properties of whey, whey components, and essenctial amino acids: mechanisms underlying health benefits for active people. **The Journal of Nutrition Biochemistry**. Vol.14. Num. 5. 2003. p. 251-258.

LIMA, D.C.; NASCIMENTO, S.P.; MACÊDO, E.M.C. Evaluation of food intake in pre-training in bodybuilding practitioners. **Brazilian Journal of Sports Nutrition**. Vol. 7. Num. 37. 2013. p. 13-18.

MCARDLE, W.D.; KATCH, F.I.; KATCH, V.L. **Exercise physiology: nutrition, energy and human performance**. 7th ed. Rio de Janeiro. Guanabara Koogan, 2011. p. 2578.

MCCARTNEY, D.; DESBROW, B.; IRWIN, C. Post-exercise ingestion of carbohydrate, protein and water: a systematic review and meta-analysis for effects on subsequent athletic performance. **Sports Medicine**. Vol. 48. Num. 2. 2018. p.379-408.

MELO, F.F.; BORDONAL, V.C. Relationship of the use of whey protein alone and as an adjunct in physical activity. **Brazilian Journal of Sports Nutrition**. Vol. 3rd Num. 17. 2009. p. 478-487.

MISS YOU, J.O.; KIRSTEN, V.R.; OLIVEIRA, V.R. Milk serum protein consumption among university students from Porto Alegre RS. **Brazilian Journal of Sports Medicine**. Vol. 23. Num. 4. 2017. p. 289-293.

MOREIRA, F.P.; RODRIGUES, K.L. Nutritional knowledge and dietary supplementation by physical exercise rs. **Brazilian Journal of Sports Medicine**. Vol. 20. Num. 5. 2014. p. 370-373.

OLIVEIRA, A.A., OLIVEIRA, A.A. Supplementation and performance in crossfit practitioners. **Brazilian Journal of Sports Nutrition**. Vol. 11. Num. 66, 2017, p.719-723.

JOURNAL HEALTH AND TECHNOLOGY - JHT
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OUTLAW, J.J., WILBORN, C.D., SMITH-RYAN, A.E.; HAYWARD, S.E.; URBINA, S.L.; TAYLOR, L.W.; FOSTER, C.A. Effects of a pre-and post-workout protein-carbohydrate supplement in trained crossfit individuals. **Springerplus**. Vol. 3. 2014. p.369.

PANTA, R.; SILVA FILHO, J.N. effects of creatine supplementation on muscle strength of bodybuilding practitioners: a systematic review. **Brazilian Journal of Sports Nutrition**, Vol. 9. Num. 54. 2015. p. 518-524.

SGARBIERI, V.C. Functional physiological properties of whey proteins. **Nutrition Magazine**. Vol. 4th Num. 17. 2004. p. 397-409.

SOUSA, M.A.Q.; AZEVEDO, C.H.G. Creatine supplementation and possible side effects. **Brazilian Journal of Sports Nutrition.** Vol. 2. Num. 9. 2008. p. 99-105.

TIBANA, R.A.; SOUSA, N.M.F.; PRESTES, J. Quantification of the load of the training session in Crossfit through subjective perception of exertion: a case study and literature review. **Brazilian Journal of Science and Movement**. Vol. 25. Num. 3. 2017. p. 5-10.

VARGAS, C.S.; FERNANDES, R.H.; LUPION, R. Prevalence of use of nutritional supplements in physical activity practitioners of different modalities. **Brazilian Journal of Sports Nutrition.** Vol. 52. Num. 9. 2015. p. 343-349.

WORLD MEDICAL ASSOCIATION (WMA). **Declaration of Helsinki** (2013). Available in: <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/> Access on October 3, 2019.