

## 91 - PROFILE OF THE BRAZILIAN RESEARCHES ON CAFFEINE AND PHYSICAL EXERCISE

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### INTRODUCTION

In recent years, Paluska (2003) states that the intake of caffeine has been used as ergogenic strategy in the sport prior to the performance of physical exercise as shown by Graham (2001) and Altimari (2006), and anaerobic exercises in order to delay fatigue and thus improve physical performance. In this sense, the findings so far suggest the dosage of caffeine as an ergogenic effective agent in different types of exercise, identify the dosage of caffeine as a determining factor in the improvement of physical performance due to the triggering of physiological and metabolic responses that seem to be linked to the amount ingested (Paluska, 2003; Astorino, 2010). Studies show that the performance in various physical exercises can be enhanced with doses of 3 to 10mg. Kg-1 of caffeine by weight; the suggested dosage is 3 to 6mg. Kg-1 of pure caffeine, an optimal range (Graham, 2001; Altimari, 2006). Faria Junior (1992) states that the search for explanations of the paths taken by the research allows us to highlight their achievements, indicate its shortcomings and at the same time calling attention to new alternatives for investigations. The aim of this study was based on identifying the profile of researches developed in Brazil on the relationship between caffeine and exercise in the main databases on health, allowing you to see what approaches are being researched in this field, in which journals are published and how often, which can direct researchers on new researches on the subject.

### METHODOLOGIC PROCEDURES

The research was a literature of critical-epistemological research with a quantitative and qualitative analysis of the data.

The method of literature consisted of research articles contained in the following databases: LILACS, SCIELO (Scientific Electronic Library Online). The word caffeine, ergogenic performance were used as keywords for search, according to the descriptors in Health Sciences (DECS), which were sought in three languages: Portuguese, English and Spanish. They were part of the analysis articles produced by authors or Brazilian research centers that linked caffeine to physical exercise.

The articles selected for the study were published between 1985 to 2010.

### RESULTS AND DISCUSSION

#### Search results from LILACS database

The LILACS database is a bibliographic index of literature on health sciences, published in the countries of Latin America and Caribbean since 1982. It is a cooperative product of the BVS Network. In 2009, LILACS reached 500 000 bibliographic records of articles published in about 1,500 journals in health science, of which approximately 800 are currently indexed. LILACS can be accessed for literature search on the Global Gateway of BVS and records are also indexed in Google.

When the search was formed according to predetermined methodological procedures there were found 31 papers where the main objective permeated the ergogenic effect of caffeine according to several approaches.

The first article that made reference to caffeine and exercise, indexed in LILACS, was titled "Effect of caffeine on different levels of exercise," published in the Brazilian Journal of Sports Science in January 1985, led by Ulysses Paula Oswaldo Filho and Luiz Rodrigues. This study investigated the effects of caffeine on exercise time of a group of volunteers on ergometer cycle. We established three levels of effort trying to delineate a methodology that encompassed different energy substrates. Thus, it was observed that the levels of 50% and 75% of V02 max were an increase in exercise time on the bike in 24.7% ( $p < 0.01$ ) and 28.0% ( $p < 0.10$ ) respectively. The 85% of V02 max was change of time; however, it was not statistically significant. The respiratory quotient decreased from the beginning to the end of the year at 50% of V02 max with the use of caffeine and was lower at the end of the level of 50% and 75 % of V02 max in relation to the final level of 85% of V02 max without the use of caffeine. Individuals stopped always stopped the effort by muscle fatigue in the lower limb.. Thus the authors concluded that caffeine increased the physical ability to work in the less intense levels, probably due to its stimulant effects on the central nervous system and on metabolism of muscle tissue, possibly by its action on the use of lipids as energy substrate during exercise.

A few months after the first article indexed in the database in question, the survey entitled "Caffeine content in urine samples of athletes," was presented at the Venezuelan and Latin-American Congress of Analytical and Experimental Toxicology in Caracas in November 1984. The main objective of this study was to quantify caffeine in urine of athletes subjected to doping control using a tiny portion of the sample, taking the Brazilian authors like Rosemary Custódio Pedroso and Esther Fonseca de Camargo Moraes.

Within the sports world the indiscriminate use of caffeine by athletes in the early 1980s, with the goal of improving athletic performance, meant that this substance was included in the list of prohibited substances of the International Olympic Committee (IOC), which stipulated threshold value of 15 $\mu$ g/ml of caffeine in urine for positive doping cases as stated by Rogers (1985) and Delbeke (1984). However, according to Rogers (1985), Sinclair (2000) and Graham (2001), caffeine use only became evident after the Olympic Games in Los Angeles (1984), when some members of the cycling team of the United States declared publicly have used this alkaloid as a stimulant during the competitions, which led the IOC to alter the threshold value to 12 $\mu$ g/ml of caffeine in urine for a positive doping case.

The journals indexed by the LILACS database, the Journal of Sports Medicine published most articles, a total of four where three refer to the ergogenic action of caffeine and the other portrays the legality of caffeine, as shown in Table 1.

Table 1: Number of articles published on caffeine and physical exercises in journals indexed by LILACS database.0 c+30mnbo

Name of the Journal	Number of Articles
Brazilian Journal of Sports Medicine	5
Brazilian Journal of de Science and Movement	3
Journal of Pharmacology and Biochemistry. University of São Paulo	3
Brazilian Journal of Medical and Biological Research	2
Nutrire: Journal of the Brazilian Society of Food and Nutrition.	1
Another journals	17
<b>Total of articles analysed</b>	<b>31</b>

Source: Base LILACS

The main objectives of the articles in question are described in Table 2, which allows us to visualize the lines of inquiry and their approaches.

Table 2: Main objectives of the articles indexed in the LILACS database on caffeine and exercise.

Central theme of the search	Number of articles
Ergogenic effect of caffeine on endurance exercise	10
Developing techniques for measuring urinary caffeine	2
Quantify caffeine in sports drinks	2
Caffeine and doping	5
Ergogenic effect of caffeine in anaerobic exercises	5
Caffeine and mechanisms involving calcium	1
Caffeine and perceived exertion	4
Caffeine and lipolysis	1
Concentration of caffeine in ergogenic	1
<b>Total of articles analyzed</b>	<b>31</b>

Source:Base LILACS

In the context of the 31 articles reviewed, nine were based on international literature reviews and 22 had different goals. In this sense can be seen that review articles are a guide for researchers in easy recognition of cumulative aspect of scientific knowledge, that is, the need to build upon the progress already made in different conditions and methodological realities, considering the limitations of studies devoted to the theme which seeks to maximize the control of variables involved that can influence the results.

Among the difficulties in researching caffeine and exercise there are the various possibilities of dosages (GRAHAM, 2001), the effects of caffeine varied according to the sport and the physiological mechanisms involved (SINCLAIR, 2000), the difficulties of measuring caffeine in foods (Rogers, 1985); control of climatic conditions (humidity, temperature, etc..) that can influence the results VAN (2006); knowledge of the nutritional profile of study participants (Graham, 2001), the volume of ingested substance in tests, lifestyle and their consumption of caffeine (Graham, 2001).

In the study by Van (2006), we attempted to measure the concentrations of caffeine in urine from 4633 athletes for doping control at the Ghent Doping Control Laboratory in 2004, performed by a validated method in accordance with ISO 17025 (International Organization for Standardization). After finding values of caffeine in urine of athletes, there was a comparison of the sports most often tested in 2004 and has been shown that the caffeine concentration in samples was increased. A comparison was made between the results obtained in 2004 and obtained before the removal of caffeine from the doping list of WADA (World Anti-Doping Agency), indicating that the average concentrations of caffeine decreased after removal of caffeine from the list of banned substances . The overall percentage of positive samples between the two periods remained the same, although the percentage of positive samples observed in cycling increased after the removal of caffeine from the doping list.

It is noteworthy that, while not a substance banned by WADA, studies by Van (2005, 2006) and monitoring carried out after removal of caffeine from the list of banned substances did not observe a significant increase in consumption of the same in sports.

#### SEARCH RESULTS ON THE BASIS SCIELO

The database SCIELO - Scientific Electronic Library Online is an electronic library covering a selected collection of Brazilian scientific journals. SCIELO is the result of a research project sponsored by FAPESP (Foundation for Research Support of São Paulo) in partnership with BIREME (Latin American and Caribbean Center on Health Sciences) from 2002 to , had the support of CNPq (National Council for Scientific and Technological Development). The SCIELO Project aims to develop a common methodology for the preparation, storage, dissemination and evaluation of scientific literature in electronic format.

In Scielo we found 214 current titles where 68 are periodicals in circulation in health sciences and 23 journals framed in the biological sciences. All titles were investigated to search for papers that related caffeine and exercise, with a total of eight articles.

The first article found in this database was developed by the Faculty of Pharmaceutical Sciences, University of São Paulo, entitled "Caffeine and performance in anaerobic exercises (Altimari, 2006). This study consisted of a literature review on the ergogenic action of caffeine in predominantly anaerobic activities

The Brazilian Journal of Sports Medicine, indexed by both databases studied, presented itself as the journal that publishes more on this subject, where we found half of the eight selected articles. Table 3 describes the number of published articles about caffeine and physical exercise in journals indexed by SCIELO

Table 3: Number of articles published on caffeine and exercise in journals indexed by SCIELO

Name of the Journal	Name of the articles
Brazilian Journal Sport Medicine	4
Brazilian Journal of Pharmaceutical Sciences (*)	2
Brazilian Journal of Pharmaceutical Sciences (*)	1
Pediatrics Journal	1

Source:Base Scielo

Caffeine has been used often acutely, prior to physical exercises in order to stave off fatigue and, consequently, improve physical performance, especially in activities of medium and long duration as highlighted lourini (2003) and Molt (2003). The use of caffeine according Thuyne (2006), has become very common in recent years, particularly for well-trained cyclists and runners for middle and long distance, due to its alleged ergogenic action in long-term sports that currently directs research in this area. Table 4 shows the main lines of research of the articles analyzed on base SCIELO.

Tabela 4: Main search criteria of the articles analyzed on the basis SCIELO

Central theme of the search	Number of articles
Ergogenic effect of the caffeine in aerobic exercises	2
Ergogenic effect of the caffeine in anaerobic exercises	2
Caffeine and perceived exertion	2
Cafeína e doping	1
Caffeine and lipolysis	1
<b>Total of articles analyzed</b>	<b>8</b>

Source: SCIELO

According to the statement by Yeo (2005), although we have in the international literature a significant number of studies evaluating the ergogenic effects of caffeine on aerobic performance, there is no consensus among authors, and the Brazilian researches are still insufficient. Factors such as intensity of exercise, the amount of caffeine offered and the time of supply of the product before exercise may influence its action on performance, as well as the absence of a placebo group in studies, which difficults the speculation about the results in relation to effects of caffeine.

The published literature on caffeine intake and exercise performance, in general, are held with adults, young and healthy. Some studies, like those made by Yeo (2005), Pedersen et al. (2008), Beaven et al. (2008) and Jenkins et.al. (2008), are carried out with athletes and other physically active individuals. However, the groups generally are not homogeneous and there are several variables that are not controlled and can interfere inthe results of the study (Malek et al, 2006; GLIOTTINI, 2008 and Silveira, 2004).

Another aspect observed in studies related to the little use of treadmill walking to the experiments for analysis of caffeine in aerobic activities. One possible explanation for this is due to the fact the facility that offers a cycle ergometer in relation to the mat for the monitoring of metabolic and biochemical variable (Yeo, 2005).

Most of the available studies provide caffeine one hour before exercise, and caffeine administration in advance of 30 minutes may have a better influence on the result. Then It is suggested that allowing the substance to be held in this time interval, before exercise, due to fact that the peak of concentration of caffeine in the bloodstream occurs in about 20 minutes after its ingestion (SINCLAIR 2000).

The addition of carbohydrate to the caffeinated drink has been introduced by some authors in the LILACS database, the methodology of studies, where the decrease of the use of levels of muscle glycogen levels and increased production of hepatic glycogen seems to be the mechanisms involved in the use of carbohydrate as an ergogenic aid. None of the studies included in the database SCIELO took into account the association of caffeine with carbohydrates (Ahrens, 2007; PEDERSEN, 2008; Jacobson, 2006; KOVACS, 1998).

None of the studies included in the database SCIELO took into account the association of caffeine with carbohydrates (Ahrens, 2007; PEDERSEN, 2008; Jacobson, 2006; KOVACS, 1998).

Another methodological aspect that was not observed in LILACS and SciELO was the use of the placebo group, where volunteers would undergo a week of withdrawal of caffeine, in order to make them non-habitual consumers of foods containing this substance (with consumption less than 100 mg daily) and according to the classification suggested by Griffiths (1990), it may affect the results.

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## PROFILE OF THE BRAZILIAN RESEARCHES ON CAFFEINE AND PHYSICAL EXERCISE

### ABSTRACT

**Introduction:** The knowledge of the direction of scientific production of an area is fundamental to improving the quality of research for the advancement of science and especially for diagnosing the impact of this production in our society. The search for explanations of the paths taken by research on caffeine highlights their achievements, gaps and calls attention to new alternatives for investigations. **Objective:** To identify the profile of research in Brazil on caffeine and physical exercise. **Methodology:** This study was conducted through literature search, critical-epistemological in nature, with quantitative and qualitative analysis, where it searched the articles produced in Brazil linking caffeine to physical exercise, indexed in LILACS and SCIELO. **Results:** 31 articles were found in the LILACS database and eight on database SCIELO that studied the effect of caffeine on aerobic exercises (11 articles) and anaerobic exercises (6 articles), and caffeine doping (6 articles), caffeine and perceived exertion (5 articles), concentration of caffeine in ergogenic beverages (3 articles) and other goals (8 articles), which identified the Brazilian journal of sports medicine as the journal that publishes more this subject (9 articles). The removal of caffeine from the doping list of World Anti-Doping Agency has increased the amount of researches in the area. The main control variables of the studies analyzed were the intensity of exercise, caffeine dosage and duration of supply of the product before exercise. **Conclusion:** the quantity of Brazilian researches on caffeine and exercise are insufficient, performed with small and restricted samples where the variables need greater control, as the temperature of ingested substances, environmental aspects and the homogeneity of the sample.

**KEY - WORDS:** Caffeine. Ergogenic. Performance. Doping.

## PROFIL DE LA BRÉSILIEN DE RECHERCHES SUR L'EXERCICE PHYSIQUE ET CAFÉINE

### RÉSUMÉ

**Introduction:** la connaissance de la direction de la production scientifique d'un secteur est fondamentale pour améliorer la qualité de la recherche pour l'avancement de la science et en particulier pour le diagnostic de l'impact de cette production dans notre société. la recherche des explications sur les voies empruntées par les recherches sur la caféine met en lumière leurs réalisations, les lacunes et appelle l'attention sur de nouvelles alternatives pour les enquêtes. **Objectif:** identifier le profil de la recherche au Brésil à l'exercice de caféine et physique. **Méthodologie:** Cette étude a été réalisée grâce à la recherche de la littérature, critique épistémologique dans la nature, avec une analyse quantitative et qualitative, où il recherche les objets fabriqués au Brésil reliant la caféine à l'exercice physique, indexées dans LILACS et SCIELO. **Résultats:** 31 articles ont été trouvés dans la base de données LILACS et huit sur la base de données SCIELO qui a étudié l'effet de la caféine sur des exercices aérobiques (11 articles) et des exercices anaérobies (6 articles), et le dopage de caféine (6 articles), la caféine et l'effort perçu (5 articles), la concentration de caféine dans les boissons ergogéniques (3 articles) et d'autres objectifs (8 articles), qui a identifié la revue brésilienne de médecine du sport comme le journal qui publie plus de ce sujet (9 articles). L'élimination de la caféine de la liste des produits dopants de World Anti-Doping Agency a augmenté la quantité de recherches dans le domaine. Les variables de contrôle principal des études analysées ont été l'intensité de l'exercice, la dose de caféine et de la durée de fourniture du produit avant l'exercice. **Conclusion:** la quantité de recherches brésiliennes sur la caféine et l'exercice sont insuffisantes, effectués avec des échantillons de petites et restreintes où les variables ont besoin de plus de contrôle.

**MOTS - CLÉS:** la caféine. Ergogéniques. Performance. Le dopage.

**PERFIL DE LA INVESTIGACIÓN EN BRASIL CAFEÍNA Y EL EJERCICIO****RESUMO**

Introducción: La búsqueda de explicaciones de las rutas tomadas por las investigaciones sobre la cafeína resaltar sus logros, deficiencias y especifique su llama la atención a nuevas alternativas para las investigaciones. Objetivo: identificar el perfil de la investigación en Brasil el consumo de cafeína y el ejercicio. Metodología: El estudio se realizó a través de búsqueda en la literatura, crítico-epistemológica en la naturaleza, con el análisis cuantitativo y cualitativo de los datos, donde se buscó los artículos producidos en el país que une la cafeína para el ejercicio, indexadas en LILACS y SCIELO. Resultados: 31 artículos fueron encontrados en la base de datos LILACS y SCIELO ocho en la base que estudió el efecto de la cafeína en el ejercicio de resistencia (11artigos) y los ejercicios anaeróbicos (6 puntos), el dopaje y la cafeína (6 puntos), la cafeína y el esfuerzo percibido (5 artículos), la concentración de cafeína en las bebidas ergogénicas (3 artículos) y otros objetivos (8 artículos), que identificó la revista brasileña de la medicina deportiva como la revista que publica más este tema (9 artículos). La eliminación de la cafeína de la lista de dopaje de la World Anti-Doping Agency ha aumentado la cantidad de investigación en el área. Las variables de control principal de los estudios analizados fueron la intensidad del ejercicio, la dosis de cafeína y la duración de la oferta del producto antes de hacer ejercicio. Conclusión: la cantidad de la investigación brasileña sobre la cafeína y el ejercicio no son suficientes, realizado con muestras pequeñas y restringidas, donde las variables de necesidad de mayor control, como la temperatura de las sustancias que ingiere. Conclusión: la cantidad de la investigación brasileña sobre la cafeína y el ejercicio no son suficientes, realizado con muestras pequeñas y restringidas, donde las variables de necesidad de mayor control.

**PALABRAS - CLAVE:** La cafeína. Ergogénicas. Rendimiento. Dopaje.

**PERFIL DAS PESQUISAS BRASILEIRAS SOBRE CAFEÍNA E EXERCÍCIO FÍSICO****RESUMO**

Introdução: O conhecimento dos rumos da produção científica de uma área é fundamental para a melhoria da qualidade da pesquisa, para os avanços da ciência e, principalmente, para o diagnóstico do impacto dessa produção no âmbito social. A busca de explicações sobre os caminhos adotados pela pesquisa sobre cafeína evidenciam suas conquistas, indica suas lacunas e chama atenção para novas alternativas de investigações. Objetivo: identificar o perfil das pesquisas desenvolvidas no Brasil sobre cafeína e exercício físico na base de dados em saúde LILACS e SCIELO. Metodologia: Este estudo é uma pesquisa bibliográfica, de caráter crítico-epistemológico e procedeu-se de uma análise quantitativo-qualitativa dos dados, onde buscou-se os artigos produzidos por autores ou centros de pesquisa brasileiros que relacionem a cafeína ao exercício físico, indexados nas bases de dados LILACS e SCIELO. Resultados: foram encontrados 31 artigos na base LILACS e oito na base SCIELO que objetivaram estudar o efeito da cafeína em exercícios aeróbios (11artigos) e exercícios anaeróbios (6 artigos), cafeína e doping (6 artigos), cafeína e a percepção subjetiva do esforço (5 artigos), concentração de cafeína em bebidas ergogênicas (3 artigos) e outros objetivos (8 artigos). A revista brasileira de medicina do esporte é o periódico brasileiro que mais publica sobre a temática (9 artigos). A retirada da cafeína da lista de doping World Anti-Doping Agency não fez seu consumo aumentar, e sim a quantidade de pesquisas na área. As principais variáveis de controle dos estudos analisados foram a intensidade do exercício, dosagem de cafeína e o tempo de oferta do produto antes do exercício. Conclusão: a quantidade de pesquisas brasileiras sobre cafeína e exercício físico são insuficientes, realizadas com amostras pequenas e restritas, onde as variáveis analisadas carecem de maior controle, como a temperatura das substâncias ingeridas, os aspectos ambientais e a homogeneidade da amostra.

**PALAVRAS - CHAVE:** Cafeína. Ergogênico. Performance. Doping.