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ORIGINAL ARTICLE

EFFECTS OF PROPHYLACTIC ANTI-INFLAMMATORY NON-STEROIDAL IBUPROFEN ON PERFORMANCE IN A SESSION OF STRENGTH TRAINING

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ABSTRACT

Introduction: Non-steroidal anti-inflammatory drugs, such as ibuprofen, have been used by athletes of several sports modalities in order to increase athletic performance. Objective: To verify the effect of the prophylactic use of ibuprofen on performance in a strength training session. Methods: A crossover, randomized, double-blind and placebo-controlled clinical trial was developed with twelve regular strength training male practitioners, which performed a strength training session after ibuprofen (1,2 g) ingestion and another session after placebo ingestion. Six series of bench press and squat exercises were performed in each training session with a constant load corresponding to 65% of the 1RM in each exercise. The training performance was measured through the number of repetitions that volunteers have accomplished in each exercise series of each strength training session. Results: It was verified no significant performance differences in strength training with previous administration of placebo or ibuprofen ($p < 0.05$). Conclusion: Ibuprofen administration at the same parameters adopted by the present study do not promote any change on tolerance to exercise in a single strength training session, which contraries this substance indication to ergogenic purposes in strength training.

Keywords: non-steroidal anti-inflammatories, strength training, performance.

INTRODUCTION

The powerful analgesic and anti-inflammatory effects of the non-steroidal anti-inflammatory drugs (NSAIDs) place these pharmaceuticals on a special status for the treatment of osteomyoarticular injuries consequent of training routines and competitions of athletes from many sport modalities[1,2]. Since these are substances allowed by the World Anti-Doping Agency (WADA), the NSAIDs end up being used in high frequency, or even in a chronic way, for a considerable number of athletes[3,4]. Moreover, the index of athletes who adopt prophylactic use of s NSAIDs with the purpose to prevent pain and inflammation prior their onset due to exercise has increased[4,5].

The scientific community has been concerned about the prophylactic effect of NSAI use over sports performance for over three decades[6]. However, this kind of issue is still limited in the literature áand, despite the belief from the part of athletes and coaches that some medication has ergogenic action; the scientific evidence so far reported is contradictory. While clinical assays have already demonstrated that the analgesic drug known as aspirin does not alter performance in incremental exercises[7], exercises with predominately aerobic characteristic (ultra-marathon)[8] or anaerobic (strength training)[9], evidence suggests that the analgesic paracetamol is able to reduce the time of cyclists in ten-mile events[10]. Concerning the NSAI, a limited number of evidence in humans suggests absence of benefits related to the pharmacological therapy in endurance exercises[11]. However, no study was found in the researched databases (PubMed and SciELO) concerning the NSAI effect on performance in predominantly anaerobic exercises.

The correlation between NSAI and strength training (also called resistance training) has already been approached by investigations which focused on the effects of the prophylactic[12,13] or therapeutic use[12,14-16] of these pharmaceuticals in the treatment of the symptoms of muscular damage induced by eccentric exercise, especially delayed muscular pain. Moreover, the chronic effect of NSAI use on the hypertrophic response and the strength increase after a period of strength training has been studied[17,18]. However, it is still unknown the effect the administration of NSAI plays on performance of strength training practitioners in an isolated training session.

Since the mechanical overload suffered by the musculature during training is directly related with the neural[19] and morphological[20] adaptations which promote strength increase in practitioners of resistance exercise[21], positive or negative interference of the NSAI on the training volume tolerated by the individuals would have direct implication on the results obtained with a period of strength training. Thus, the aim of the present study was to verify the effect of the NSAI ibuprofen administration prior to a strength training session on performance of practitioners of this modality of physical exercise.

METHODS

Experimental design

The present study was approved by the Ethics in Research Committee of the Federal University of Rio Grande do Sul and is characterized as a crossover, randomized, double-blind and placebo-controlled clinical trial. Each participant was submitted to two strength training sessions, preceded by oral administration of placebo or ibuprofen, with the aim to verify the effect of the drug on the performance of the participant in the training session.

Sample

Twelve male individuals were selected to participate in the present study. All of them had at least one year of regular practice of strength training and were able to perform the 1RM test with load equal or higher than their own total body mass in the bench press and squat exercises[22]. The subjects agreed on participating as volunteers in the study through the signature of a free and clarified consent form. Table 1 presents the physical charcteristics of the volunteer group.

Table 1. Physical characteristics of the participants of the study (n = 12).

Age (years)	22.83 ± 3.24
Stature (m)	1.77 ± 0.08
Body mass (kg)	78.72 ± 10.48
Adipose mass (%)	8.69 ± 1.86
Lean mass (%)	91.31 ± 1.86
1RM Bench press (kg)	96.67 ± 17.71
1RM Squat (kg)	112.33 ± 25.55

Procedures

1RM test: The 1RM test is characterized as the highest load that can be tolerated by the individual in one repetition of a given exercise. For the present study, 1RM tests were performed for the bench press and squat exercises on the week previous to the first training session. The bench press exercise was performed at dorsal decubitus using free weights, where the volunteer started from initial position of total elbow extension (180º) for a final position of 90º of elbow flexion. The squat was performed with free weights as well, initial position was knee total extension (180º) and final position of 90º of knee flexion. For both exercises, one repetition comprehends the movement performed at initial position to final position (eccentric phase) and return to initial position (concentric phase). Velocity control of movements of the volunteers was performed with a metronomer with emission of sound signals in the 1 Hz frequency, and the participants had to perform the concentric and eccentric phases with duration of two seconds each[23]. The volunteers were told not to practice any kind of physical exercise in the 48 hours prior to the tests[24], which were performed with the same equipment used in the subsequent strength training. The method used in the test was trial and error, and the 1RM value in a maximum of five interval attempts for a minimum period of five minutes of recovery between each one should be reached[22].

Placebo or ibuprofen administration: The drug was administered exactly one hour before the strength training session of each participant. The volunteers ingested one ibuprofen tablet (1.2 g) or a placebo tablet (microcrystalline cellulose) with the same shape, color, weight, odor and taste of the ibuprofen[15]. A single researcher was responsible for the randomization and distribution of the tablets to the participants. Neither the volunteers not the researchers in charge by the conduction of the training session had access to the content of the tablets administered before each session.

Strength training sessions: The strength training sessions, intervalled by a period of seven days, were initiated with a period of five minutes of warm-up in a cycle ergometer, followed by a standard set of stretching exercises for upper and lower limbs. Subsequently, the two strength exercises part of the training protocol were performed: bench press and squat. Six sets of each of the exercises were performed and a 45-second interval between sets was respected. Individualized load corresponding to 65% of the 1RM test load was applied in the exercises of both training sessions The participants were told and verbally encouraged during the training to reach the highest number of repetitions as possible in each set, which was interrupted by exhaustion (concentric fail) or by inability of the individual to perform the movement according to the metronome signal.

Data analysis

Since the load used in the exercises performance was the same in the two sessions, the performance of the volunteers in each training was evaluated through the number of repetitions performed in each set of the bench press and squat exercises. Additionally, the total training volume was calculated from the sum of the bench press training (number of sets x number of repetitions x used load) and squat training volume (number of sets x number of repetitions x used load).

Descriptive statistics was used (mean, standard deviation and confidence interval) for results presentation. Data normality distribution was proved through the Shapiro-Wilk test, and the comparisons between the sessions preceded by placebo and ibuprofen were performed through a Student's t test for paired samples. The significance level adopted by the present study was of $p < 0.05$.

RESULTS

No performance differences have been verified in strength training with administration of placebo or ibuprofen. As illustrated in table 2, the number of maximum repetitions performed

Table 2. Number of repetitions performed in each set of the bench press and squat exercises in the sessions preceded by placebo and ibuprofen administration.

	Placebo		ibuprofen	
Set	Bench press	Squat	Bench press	Squat
1	13.0 ± 3.1 [10.4 - 13.8]	18.5 ± 5.2 [15.1 - 23.4]	12.1 ± 2.7 [10.9 - 15.1]	19.2 ± 6.4 [15.1 - 21.8]
2	8.5 ± 2.6 [7.3 - 10.6]	13.4 ± 3.7 [10.9 - 14.5]	8.9 ± 2.5 [6.9 - 10.3]	12.7 ± 2.8 [11.1 - 15.7]
3	6.5 ± 1.9 [5.1 - 7.9]	11.3 ± 2.6 [9.1 - 11.7]	6.5 ± 2.2 [5.3 - 7.8]	10.4 ± 2.1 [9.7 - 13.1]
4	5.1 ± 1.6 [4.5 - 6.9]	9.8 ± 2.5 [8.5 - 10.8]	5.7 ± 1.8 [4.1 - 6.2]	9.7 ± 1.8 [8.2 - 11.4]
5	4.7 ± 1.6 [3.4 - 5.7]	8.9 ± 2.5 [7.5 - 10.3]	4.5 ± 1.8 [3.7 - 5.7]	8.9 ± 2.1 [7.3 - 10.6]
6	4.0 ± 1.5 [3.0 - 5.2]	8.4 ± 2.3 [6.8 - 9.6]	4.2 ± 1.7 [3.1 - 4.9]	8.2 ± 2.1 [6.9 - 9.9]

by set was not altered by the ingestion of placebo or ibuprofen ($p > 0.05$), both for the bench press and squat exercises. In the same way, the substance administered before the training did not interfere in the total training time tolerated by the participants, as presented in figure 1.

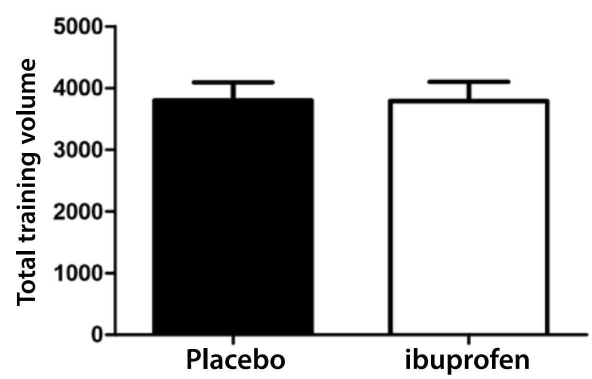

Figure 1. Total training volume of the sessions preceded by placebo and ibuprofen administration.

DISCUSSION

The present study was developed to answer a very specific questioning: does the prophylactic use of the NSAI ibuprofen alter performance in one session of strength training? Objectively, the results reported here evidence that ibuprofen administration before one session of strength training does not affect performance of healthy men; that is, it does not alter the total training volume tolerated by the practitioners.

One of the justifications for the use of NSAI as ergogenic agents in sports training and competitions relies in the capacity of this medication to substantially reduce the pain sensation. Due to the acute painful experience promoted by some types of exercise[25], there seems to be a consensus among athletes, coaches and researchers that pain limits performance in some sports modalities[26]. According to Anshel and Russel[27], the ability of an athlete to tolerate pain induced by exercise is a critical factor for successful sports performance. Moreover, there is evidence that the analgesic effect of the drugs is able to alter subjective exertion sensation in athletes[28], reducing the discomfort produced by exercise and, possibly, promoting delay of the exhaustion point caused by the muscular fatigue[29].

The action mechanism through which the NSAI alleviate pain is in the inhibition of the synthesis of prostaglandins, intermediate endogenous substances of the inflammatory process, in the presence of inactivation of two isoenzymes, the constitutive cyclo-oxygenase (COX-1) and the inducible cyclo-oxygenase (COX-2)[2]. Since the prostaglandins sensitize the nociceptors, which start to transmit painful stimuli in increased way to the CNS, it can be said that the NSAI alleviate pain through the increase of the threshold pain of the individual; that is to say, a greater amount of stimuli has to be developed to the nociceptors before significant pain is felt by the subject[10]. However, as reported in a study involving analgesic medication and strength training[9], the results of the present study suggest that the pain reduction promoted by the ibuprofen seems not to promote increase in performance in the exercise under study.

On the other hand, the inhibition of the synthesis of prostaglandins seems to have negative reflection on the protein synthesis induced by one session of strength training[30]. This can be the key-explanation for the reduction in the hypertrophic response after a period of strength training associated with continuous use of NSAI in an animal model[17], although evidence in humans demonstrates similarity in the morphological and functional adaptations of subjects treated or not with the same drug of the present study[18]. Thus, the consequences of the reduction of the protein synthesis induced by NSAI on the neuromuscular adaptations to strength training in humans still needs further investigation. However, due to the evidence about the reduction of protein synthesis[30], the absence of benefits concerning strength and muscle mass gain[17], the findings of the present study that the drug presented here does not increase tolerance to exercise and a series of contraindications to prolonged use of this kind of medication[5] not approached in the present study, the use of NSAI as ergogenic substance in strength training seems to be totally mistaken.

Considering the high number of substances classified as NSAI, the present study cannot categorically state that all and any kind of NSAI is unable to increase performance in one strength training session. In the same way, other doses and periods of drug administration have to be tested in the future.

Due to these limitations, the conclusions of this investigation should be restricted to the ingestion of 1.2 g of ibuprofen in a single dose administered one hour before the exercise performance.

CONCLUSION

The present study demonstrates that the ingestion of the NSAI ibuprofen in the administration parameters adopted does not promote nany kind of alteration in exercise tolerance in one isolate session of strength training. It is worth mentioning that this article seems to be pioneering in evaluating the effects of a drug of this nature on performance in this training modality, and the findings support the reasons for not using NSAI concomitantly to strength training with ergogenic goals.

All authors have declared there is not any potential conflict of interests concerning this article.

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