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Effects of Hypnotic Induction on Muscular Strength in Men with Experience in Resistance Training

Mauro Lúcio Mazini Filho[1,2,3], Rafael Pedroza Savoia[4], Juliana Brandão Pinto de Castro[5], Osvaldo Costa Moreira[6], Gabriela Rezende de Oliveira Venturini[5], Victor Magalhães Curty[7], Maria Elisa Caputo Ferreira[1]

[1]Postgraduate Program in Exercise and Sport, Federal University of Juiz de Fora, Minas Gerais, Brazil; [2]Postgraduate Program in Sport, Trás-os-Montes e Alto Douro University, Vila Real, Portugal; [3]Postgraduate Program in Physical Education, Sudamérica Faculties, Cataguases, Minas Gerais, Brazil; [4]Paranaense Society of Education and Informatics, Brazilian Institute of Applied Hypnosis, Brazil; [5]Postgraduate Program in Exercise and Sport Sciences, Rio de Janeiro State University, Rio de Janeiro, Brazil; [6]Ciencias de la Actividad Física y el Deporte, Universidad de León, Espanha; [7]Postgraduate Program in Physiological Sciences, Federal University of Espírito Santo, Espírito Santo, Brazil

ABSTRACT

Mazini Filho ML, Savoia RP, Castro JBP, Moreira OC, Venturini GRO, Curty VM, Ferreira MEC. Effects of Hypnotic Induction on Muscular Strength in Men with Experience in Resistance Training. **JEPonline** 2018;21(1):52-61. The purpose of this study was to investigate the effects of hypnotic induction (HI) on the absolute strength of men trained in resistance training through the one-repetition maximum (1RM) test, and verify the number of repetitions maximum (NRM) with the 1RM load collected in the test without HI. Twelve men were submitted to three tests: (a) 1RM test without HI; (b) 1RM test with HI; and (c) NRM test with HI using the load of the first test. The performance in the 1RM test with HI was significantly higher than the performance in this test without HI. There was a statistically significant difference between the post-hypnosis NRM test with the same load of the 1RM test without HI when compared to the NRM test without hypnosis intervention. This study showed that the HI can be an important tool in increasing muscle strength in the 1RM test and the NRM test in trained men.

Key Words: Hypnosis, Muscle Strength, Resistance Training

INTRODUCTION

Resistance training is related to several benefits, such as increased strength and muscle mass (4), reduction of body fat percentage (16), and greater functional autonomy and mobility (20,23). Maximizing muscle strength is fundamental to improving performance in various sports and physical fitness that is often measured by the one-repetition maximum test (1RM) (18). This test consists of moving the highest possible load with correct execution through a specific range of motion once (12). The 1RM test is used as the gold standard in determining the maximum dynamic strength. Percentage values of 1RM are used to determine the training zones (9). However, there are also other methods of evaluating muscle strength, such as the number of repetitions maximum (NRM) (13).

The maximum muscular strength that an individual can perform is deeply linked to the psychophysical state, and can be produced in advanced stages of training with excellent neuromuscular coordination (31) or with the use of some ergogenic resource (2). According to the United States Anti-Doping Agency (33), among the several ergogenic resources, there are those that stimulate or inhibit the psychological aspects of the practitioner. These are designed to improve psychological processes during sports performance that allow for an increase in mental strength. Hypnosis, through post-hypnotic suggestion, can help remove barriers that limit the physiological performance ability (25-28,35).

Hypnosis uses the trance induction technique, which is an altered state of consciousness (5,29). Thus, it can be observed that the trance is induced in a gradual way with the following specific steps: rapport, relaxation, induction, deepening, use, and waking. The hypnotist triggers the trance through sensory fatigue, using the voice in a serene, monotonous, rhythmic, and persistent way (24).

Once the trance is installed, the subject's auditory perception is increased. This allows for the acceptance of the therapist's commands that lead the subject to several changes in sensorimotor perception, mental faculties, attention, and hyperamnesia. Thus, once the hypnoidal period is established, which is a type of situation that simulates sleep. The subject is expected to experience the lethargic, cataleptic, and somnambulic phases (10). In a simplified way, this technique is associated with a number of physiological correlations in the normal state of consciousness and, in the absence of suggestions, maintenance of the subject's sensory contact with the environment (22).

Recently, Virta et al. (34) reported a significant influence on reaction time in a task soon after the hypnotic intervention. However, when it comes to the influence of hypnosis on muscle strength, the literature is very restricted. To our knowledge, no study to date has examined any aspect of hypnosis on muscle strength levels. Thus, studies designed to better understand the effects of hypnotic induction on muscle strength may aid in the improvement of sport performance and physical fitness.

The purpose of this study was twofold: (a) to verify the effect of hypnosis by trance induction on the absolute strength of men with resistance training experience through the 1RM test; and (b) to evaluate the NMR with the 1RM load collected in this test without hypnotic induction.

METHODS

Subjects

Twelve men with experience in resistance training (≥6 months of training, ≥3 times·wk^{-1}) participated in this study (age: 31.00 ± 2.6 yrs; height: 177.9 ± 5.2 cm; body mass: 85.25 ± 10.0 kg; body mass index: 26.93 ± 2.9 kg·m^{-2}). All subjects reported that they did not have any osteomioarticular problems that could compromise participation in the tests. Subjects did not consume any type of supplements or stimulant drinks (caffeine or alcohol) during the testing period, and they responded negatively to all questions in the Physical Activity Readiness Questionnaire (PAR-Q) (1).

This study was approved by the local research ethics committee (number: 2.184.952), and it met the ethical and legal criteria in research involving human beings according to Resolution 466/2012 of the National Health Council. All subjects were informed of the benefits and risks before signing a written informed consent term.

Maximum Load Test

The maximal dynamic strength of the upper limbs was evaluated through the 1RM test (3,8). All subjects performed a specific warm-up on the test equipment itself. The specific warm-up consisted of two sets: (a) 5 reps were performed with a 50% load estimated for 1RM; and (b), 3 reps were performed with 70% of the estimated 1RM load. Among the warm-up sets, there was an interval of 2 min. At the end of the specific warm-up and the beginning of the test, there was a rest period of 3 min. The load was progressively increased until the maximum load for 1RM was reached with no more than 5 attempts with 3- min intervals between them. Throughout the test, the subjects were given verbal encouragement. This procedure was repeated after an interval of 72 hrs between the test sessions, but with the subject initiating the 1RM test with the maximum load found on his 1RM on the second day. To measure the maximum load, a horizontal bench press (Paramount) was used along with a bar of 9 kg of 160 cm, washers that comprised one to 20 kg, checked on a scale (Filizola, Brazil) previously calibrated, and a metronome (Zoom, model GFX-707) to control the rhythm of movement.

Hypnosis Intervention

For the hypnotic trance, the Bernheim (7) technique was used. The level of deepening of induction was measured by the Lecron and Bordeaux scale (19), ranging from 0 to 50. Hypnotic induction followed the following steps (7):

1. It was suggested to the subject that when listening to the voice of the hypnotist, his eyes would become heavy and calm and his breathing would deepen and become very relaxed.
2. Next, it was suggested that the muscles responsible for the functioning of the eyelids simply would remain motionless, disconnected, leaving the eyes completely glued. “As on that day, that you woke up early without needing it, and preferred to lie with your eyes closed instead of opening and waking.”
3. After checking the immobility of the subject’s eyelids, it was requested that when the hypnotist made a friction between the fingers, the subject would try to open his eyes and then close them again. At that point, it was suggested that the eyelids were becoming more and more disconnected, and every attempt to open and close the eyes would make the subject feel much calmer and relaxed.

4. Afterwards, the subject was told that all his muscles would be equally relaxed, as well as the muscles of his eyes.
5. Thus, in order for the subject to be empty-minded, he was asked to say aloud the number one hundred. After saying this number, it was suggested that he begin to forget that the numbers existed.
6. From that moment, it was directly ordered that there would be an increase of the strength.
7. After the test, the subject was awakened from the Charcot' Touches.

Procedures

The tests were performed in three steps: (a) the 1RM test itself; (b) the 1RM test with the hypnotic induction; and (c) the NRM test also with hypnotic induction with the 1RM load performed in the first step.

The evaluations were performed individually and the maximum load was considered the last one in which the individual performed a movement with the appropriate patterns of execution without a performance of a second movement (3). If the maximum load was not found in three attempts, a new test could be performed after 72 hrs on the previous test, which did not happen in the present experiment. For the second and third phase of the experiment, with hypnotic induction, only one attempt was made for the 1RM test and the NRM test to verify potential differences in muscular strength.

The execution of the movement was adapted according to the Berger protocol (6) and the test routine was consistent with the ACSM protocol (3). The subject measured the distance between the hands on the bar with the arms parallel to the ground and the elbow joint at an angle of 90°. Only 1 rep was validated when the subject performed the full elbow extension (12).

The control of the rhythm of execution was done in the concentric and eccentric phases in 4 sec, which was established by a metronome (Zoom, model GFX-707) that signaled to 60 beats·min^{-1}. As soon as the subject finished the eccentric phase of the movement, he was prompted to start the concentric part at the highest possible speed. This procedure was performed twice with each subject in order to familiarize him with the 1RM test protocol. It was also used to increase the chances of achieving high reliability scores, and the second 1RM result was titrated to insert in the data treatment (21,30).

All subjects participated in two sessions of the 1RM test after familiarization, the conventional test, and the hypnotic trance test. After both tests results were collected, a 5-min interval was taken to begin collecting the NRM test data. In this test, in the trance state, subjects were instructed to perform as many repetitions as possible with the load found in the 1RM test without induction.

The subjects were submitted to the hypnotic trance using the Bernheim induction method (7). It was explained to the subjects that there would be no harm to them and that they could benefit from the methodology proposed in the present study. Soon, the induction was started. The subjects were induced at medium to deep trance levels following the Lecron and Bordeaux perception scale (19). Thus, they were inducted to Level 3, on the 20 scale for deepening perception. This scale contains 5 phases: Phase 1 (preliminary phase): the patient

goes from number 1 to 8; Phase 2 (light trance): number 9 to 19; Phase 3, which was the stage that the volunteers of the present study were submitted: 20 to 29; Phase 4 (deep trance or somnambulic): 30 to 43; and Phase 5 (full trance): 44 to 50.

Statistical Analysis

Data normality was assessed using the Shapiro-Wilk Test. Comparison of the 1RM and the NRM tests with and without hypnosis was performed using the Wilcoxon test. The Figures were developed using the Prism software version number 5 (Prism software 5, GraphPad Software, Inc., San Diego, CA, USA). All statistical analyses were performed using SPSS version 20.0, and were conducted at a significance level of $P<0.05$.

RESULTS

Figure 1 presents the results of the subjects' performance in the 1RM test under two conditions, without hypnotic induction and after hypnotic induction. It can be observed that the performance in the 1RM test performed after hypnotic induction (67.42 ± 7.0 kg) was significantly higher than the test performed without hypnotic induction (58.75 ± 6.4 kg) (P=0.0001).

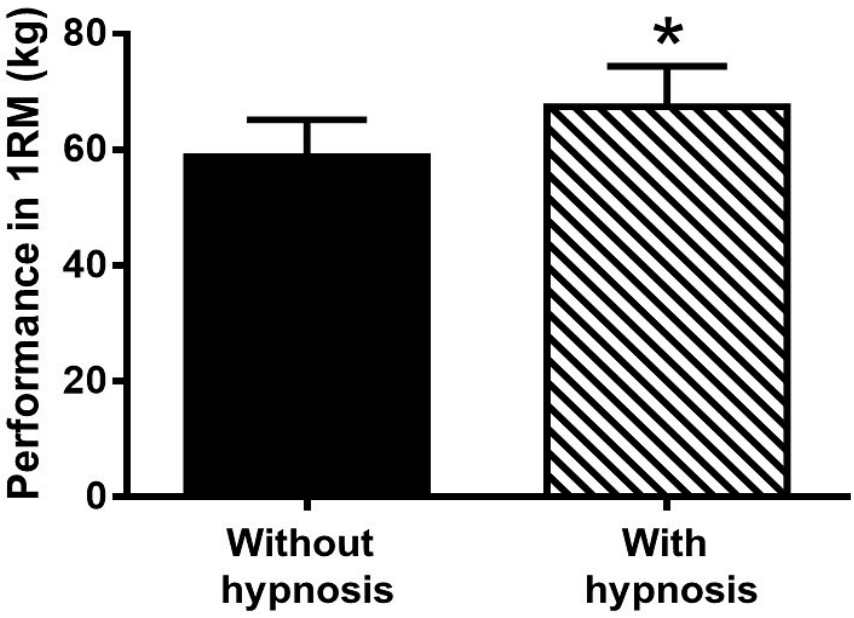

Figure 1. Comparison of the 1RM Test With and Without Hypnotic Induction.
Significant difference (P=0.0001) between the post-hypnosis group (67.42 ± 7.0 kg) and the non-hypnosis intervention group (58.75 ± 6.4 kg).

Figure 2 shows the performance of the subjects in the NRM test performed with and without the hypnotic induction with the same load used for 1RM without hypnotic induction. It was observed that the NRM performed after hypnotic induction (3.58 ± 1.1) was significantly higher to the NRM performed in the 1RM test without the hypnotic induction (P=0.0001).

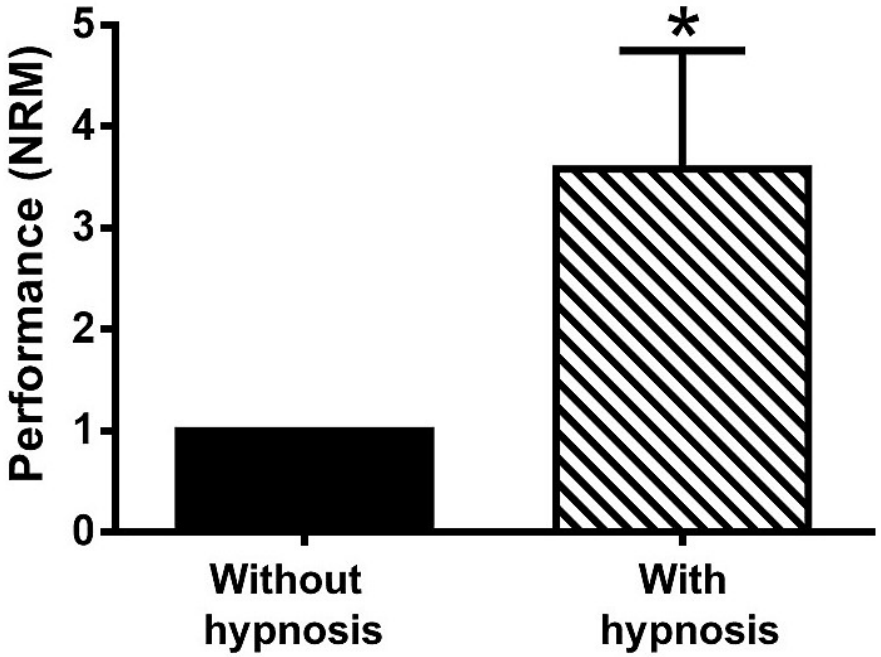

Figure 2. Comparison of the Number of Repetitions Maximum (NRM) With and Without Hypnotic Induction. Significant difference (P=0.0001) between the post-hypnosis group (3.58 ± 1.1) and the group without hypnosis intervention.

DISCUSSION

To our knowledge, this is the first study that analyzed the effects of hypnosis on muscular strength levels. The findings indicate that: (a) the hypnotic induction had a positive influence on the subjects' maximal strength improvement; and (b) the hypnotic induction was able to promote a higher NRM with the same load.

A possible physiological explanation that justifies the increase in muscular strength induced by hypnosis is related to the recruitment of motor units and components of neural control in the muscle fiber (17). Supposedly, hypnosis can increase the recruitment of motor units in the agonist musculature and inhibit the co-activation of the antagonist musculature, thereby increasing the production of muscular strength (15). This mechanism of an increase in strength by hypnotic induction would work similar to the mechanism of strength gain induced by improvement of the neural components (14).

In this sense, the increase of the contractile strength in the skeletal muscle by the neural adaptation can result in an improvement in the synchrony of motor unit recruitment and the recruitment of additional motor units that is caused by the blockage or reduction of inhibitory impulses. This increase in strength may also come from the reduction of autogenic inhibition, which allows for the decrease in the influence of inhibitory mechanisms of the neuromuscular system, such as the Golgi tendon organs (14,15).

Szenészi (32) evaluated the perception of the visualization characteristics in the Ironman and its psychophysiological components during the hypnotic trance in 7 male triathlon athletes in

6 hypnosis sessions. After each session, a semi-structured interview was conducted with the application of a specific questionnaire. Heart rate (HR) was monitored during the hypnotic trance in all sessions. The results indicated that relaxation and concentration as the main characteristics of the hypnotic trance with triathletes, who reported the feeling of corporal relaxation throughout the trance. This was confirmed by the HR behavior, which decreased significantly during the trance. With these results, Szenészi (32) concluded that the hypnosis applied in triathlon athletes during the Ironman showed characteristic behaviors of concentration, relaxation, anesthesia, and hypermnesia. Hence, it is reasonable that this method can be used to improve performance in the training of triathlon athletes or athletes of other sports.

Costa et al. (11) used a similar approach to the present study to compare the effects of visual deprivation on performance in the 1RM and the NRM tests. Eleven male volunteers (age: 23.64 ± 2.42 yrs; body mass: 73.76 ± 9.37 kg, height: 174 ± 0.06 cm; BMI: 24.35 ± 2.63 $kg \cdot m^{-2}$) performed the 1RM test in the leg press and in the bench press exercises under two conditions: (a) with visual deprivation (VD); and (b) without visual deprivation (WVD). The authors found that the maximum strength in both exercises increased significantly from the WVD condition to the VD condition. This result indicates that in addition to the possible neural mechanisms induced by hypnosis, some psychological factors related to unawareness of the raised load may influence the production of strength.

In relation to the higher number of repetitions performed with the same load in two different situations, Costa et al. (11) found that for the 85% load of 1RM, the subjects also presented better performance in the VD condition, when compared to the WVD condition. These results reinforce the idea that some psychological factors may be related to the production of strength to a greater or lesser extent. This has been demonstrated in some conditions of acute stress, such as the risk of death or an accident with a loved one when a person may experience strength levels far above those usually achieved (36).

Limitations in this Study

There are several limitations in this study that should be taken into consideration. The most obvious limitation is the lack of opportunity to compare the results found in the present study with similar studies. Another limitation was the lack of analysis of electromyographic or electroencephalographic indicators that might help confirm the participation of the neural mechanisms in the production of force induced by hypnosis. Thirdly, there is also the lack of control of psychological factors that may have helped to induce the increase in strength independently of the hypnosis.

Nevertheless, the present study presents a practical relevance for suggesting hypnosis as an effective, fast, and inexpensive method to increase the production of muscular strength and that may help to improve the athlete's performance in sports as well as physical fitness.

CONCLUSIONS

From the results found in the present study, it is reasonable to conclude that the hypnotic induction demonstrated a positive influence on the increase of muscular strength production of men experienced in resistance training.

Address for correspondence: Juliana Brandão Pinto de Castro - Programa de Pós-Graduação em Ciências do Exercício e do Esporte, Universidade do Estado do Rio de Janeiro, Rua São Francisco Xavier, 524, Pavilhão João Lira Filho, Bloco F, 9º andar, Maracanã, Rio de Janeiro, RJ, Brasil, CEP: 20550-900, Email: julianabrandaoflp@hotmail.com

REFERENCES

1. Adams R. Revised physical activity readiness questionnaire. ***Can Fam Physician.*** 1999;45:992,995:1004-1005.

2. Altermann AA, Dias CS, Luiz MV, Navarro F. The influence of caffeine as an ergogenic resource for physical exercises: Its action and side effects. ***Braz J Sports Nutri.*** 2008;2(10):225-239.

3. American College of Sports Medicine. ***ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription***. (7th Edition). USA: Wolters Kluwer Health / Lippincott Williams & Wilkins; 2013.

4. American College of Sports Medicine. American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. ***Med Sci Sports Exerc.*** 2009;41(3):687-708.

5. Barabasz A, Barabasz M. Induction technique: Beyond simple response to suggestion. ***Am J Clin Hypn.*** 2016;59(2):204-213.

6. Berger RA. Optimum repetitions for the development of strength. ***Res Q.*** 1962;33(3): 334-338.

7. Bernheim H. ***Hypnosis and Suggestion in Psychotherapy: A Treatise on the Nature and Uses of Hypnotism***. New York, NY: University Books, 1964.

8. Brown LE, Weir JP. ASEP procedures recommendation I: Accurate assessment of muscular strength and power. ***JEPonline.*** 2001;4(3):1-21.

9. Brown LE. ***Strength Training.*** (2nd Edition). United States: Human Kinetics, 2017.

10. Carreiro AA. ***Hipnose e Psicoterapia: Etiologia e Práxis.*** São Paulo: Fiúza, 2008.

11. Costa S, Matos DG, Silva AC, Aidar F, Rodrigues BM, Klain I, Mazini Filho ML. Influence of visual deprivation in one repetition maximum test and load prediction. ***Rev Bras Ciên Saúde.*** 2013;7(40):339-346.

12. Cronin J, Sleivert G. Challenges in understanding the influence of maximal power training on improving athletic performance. ***Sports Med.*** 2005;35(3):213-234.

13. Desgorces FD, Berthelot G, Dietrich G, Testa MS. Local muscular endurance and prediction of 1 repetition maximum for bench in 4 athletic populations. ***J Strength Cond Res*.** 2010;24(2):394-400.

14. Enoka RM. Muscle strength and its development. New perspectives. ***Sports Med.*** 1988;6(3):146-168.

15. Enoka RM. Neural adaptations with chronic physical activity. ***J Biomech.*** 1997;30 (5):447-455.

16. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. ***Med Sci Sports Exerc.*** 2011;43(7):1334-1359.

17. Ikai M, Fukunaga T. A study on training effect on strength per unit cross-sectional area of muscle by means of ultrasonic measurement. ***Int Z Angew Physiol.*** 1970; 28(3):173-180.

18. Knutzen KM, Brilla LR, Caine D. Validity of 1RM prediction equations for older adults. ***J Strength Cond Res.*** 1999;13(3):242-246.

19. Lecron LM, Bordeaux J. ***Hypnotism Today.*** New York, NY: Grune and Stratton; 1947.

20. Mazini Filho ML, Aidar FJ, Matos DG, Moreira OC, et al. Circuit strength training improves muscle strength, functional performance and anthropometric indicators in sedentary elderly women. ***J Sports Med Phys Fitness.*** 2017.

21. Mazini Filho ML, Rodrigues BM, Reis ACRS, et al. Analysis of one repetition maximum test in bench press exercise to predict the load. ***Braz J Biomotricity.*** 2010;4(1):57-64.

22. Menzocchi M, Mecacci G, Zeppi A, Carli G, Santarcangelo EL. Hypnotizability and performance on a prism adaptation test. ***Cerebellum.*** 2015;14(6):699-706.

23. Moreira OC, Faraci LL, Matos DG, Mazini Filho ML, et al. Cardiovascular responses to unilateral, bilateral and alternating limb resistance exercise performed using different body segments. ***J Strength Cond Res.*** 2017;31 (3):644-652.

24. Otani A, Kostka MP. The dialogue technique of hypnotic induction. ***Am J Clin Hypn.*** 1992;35(1):20-28.

25. Pates J, Cummings A, Maynard I. The effects of hypnosis on flow states and three-point shooting performance in basketball players. ***Sport Psychol.*** 2002;16(1):1-15.

26. Pates J, Oliver R, Maynard I. The effects of hypnosis on flow states and golf-putting performance. ***J Appl Sport Psychol.*** 2001;13(4):341-354.

27. Pates J, Maynard I, Westbury T. An investigation into the effects of hypnosis on basketball performance. ***J Appl Sport Psychol.*** 2001;13(1):84-102.

28. Pates J, Maynard I. Effects of hypnosis on flow states and golf performance. ***Percept Mot Skills.*** 2000;91(3 Pt 2):1057-1075.

29. Rainville P, Price D. Hypnosis phenomenology and the neurobiology of consciousness. ***Int J Clin Exp Hypn.*** 2003;51(2):105-129.

30. Ramalho GHRO, Mazini Filho ML, Rodrigues BM, et al. The 1RM testing for prediction of load in hypertrophy training and its relation with maximum number of repetitions. ***Brazi J Biomotricity.*** 2011;5(3):168-174.

31. Schoenfeld BJ, Peterson MD, Ogborn D, Contreras B, Sonmez GT. Effects of low- vs. high-load resistance training on muscle strength and hypertrophy in well-trained men. ***J Strength Cond Res.*** 2015;29(10):2954-2963.

32. Szenészi DS. ***A Hipnose em Triatletas:*** percepção das características da visualização da prova de Ironman e seus componentes psicofisiológicos. Dissertação [Master in Psychology] – Universidade Federal de Santa Catarina, 2005.

33. United States Anti-Doping Agency (USADA). ***Reasoned Decision of the United States Anti-Doping Agency on Disqualification and Ineligibility.*** Claimant, v. Lance Armstrong, Respondent, 2012.

34. Virta M, Hiltunen S, Mattsson M, Kallio S. The impact of hypnotic suggestions on reaction times in continuous performance test in adults with ADHD and healthy controls. ***PLoS One.*** 2015;10(5):e0126497.

35. Williamson JW, McColl R, Mathews D, Mitchell JH, Raven PB, Morgan WP. Brain activation by central command during actual and imagined handgrip under hypnosis. ***J Appl Physiol.*** 2002;92(3):1317-1324.

36. Wise J. ***Extreme Fear: The Science of Your Mind in Danger.*** New York, NY: St. Martin's Press, 2009.