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THE INFLUENCE OF LOW POWER LASER (LBP) REGARDING JUMPING PERFORMANCE IN UNDER-20 FIELD SOCCER PLAYERS

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Abstract: The jump is a resource increasingly used in sports, as it can influence the tactical and technical performance of the athlete, muscle performance in jumping is a new area of research in laser therapy. This study aims to compare the pre and post intervention effects of low power laser in the development of the jump in under-20 field soccer players, it is a randomized controlled clinical trial, in which 30 athletes were included divided into two groups, the first Laser Group (GL) performed the Jump test assessments and underwent low-power laser intervention, while the second control group (CG) performed only the Jump test assessments. Data were collected using technical variations of the vertical jump on the jumping platform: number of jumps, height reached, initial speed of each jump, jump power and graphical representation of the data. In order to measure the power of the lower limbs. The intervention protocol took place over a period of 6 weeks and finally the analysis of the collected data. In the results, we can verify significant differences in the evaluation phase of the variable v(m/s) according to the Bartlett test, and for more in the averages in the laser group both in the evaluation period and in the reevaluation period, but there were no significant differences in variables ($p>0.05$). it is concluded that the application of low power laser with the parameters used in this study were not fully effective in improving jump performance in under-20 field soccer players.
Keywords: Soccer, laser therapy, jumping.

INTRODUCTION

The jump has been an increasingly used resource in sports, as it can influence the tactical and technical performance of the athlete, both in defense and in attack, due to the fact that there are frequent jumps, changes of direction, physical contact and landings during practice. sports, evaluating the high incidence rates of muscle and joint injuries, as well as the muscle fatigue of the muscles involved in their action[1].

Low-level laser (LBP) induces cell biostimulation, which can accelerate wound healing, help in the regeneration of skeletal muscle, decrease the inflammatory response, stimulate the neoformation of blood vessels and decrease pain, very important criteria for muscle development. effective [2].

Several benefits of laser therapy are cited, the analgesic effect in acute or chronic bone, muscle and tendon injuries, vasodilation and proliferation of microvessels, with a possible increase in the amount of oxygen in the tissue[3]. Laser therapy helps in epithelial, endothelial and fibroblastic proliferation, increased collagen synthesis and phagocytic activity, which will result in the acceleration of the repair process, in addition to the release of cytokines that will reduce the inflammatory reaction, helping more easily muscle development of the body. athlete[4].

The use of low-level laser to gain muscle power has already been demonstrated in several studies, especially when associated with physical exercises, it has positive results. And it obtains expressive results using in decreasing the inflammatory response in acute orthopedic injuries, which can lead to a better response of the body to the initial inflammatory process and in turn helping a better recovery of the injured area by exercise and a better performance gain[5].

Infrared laser therapy, high-intensity pre-physical activity, can facilitate the removal of blood lactate and thereby reduce muscle damage, providing athletes with better performance during their activities[6], and significant increase in peak torque after receiving low-level laser treatment before vertical jump assessment [7]. In this perspective, the objective of the present study was to evaluate and analyze the influence of low power laser (LBP) on jumping performance in under-20 field soccer athletes.

METHODOLOGY

ETHICAL CONSIDERATIONS AND SUBJECTS

The research was carried out at the Centro Esportivo da Juventude (CEJU), in male under-20 field soccer athletes from Clube do Remo. The study was conducted respecting the norms of research involving human beings (Resolution nº 466/12 of the National Health Council), and after approval by the Research Ethics Committee of the Universidade da Amazônia – UNAMA under opinion nº 2.218.870, CAEE: 65409217100005173. It is a randomized controlled clinical trial.

Thirty male under-20 field soccer athletes participated in the study. The sample was randomly divided, by drawing with an opaque envelope, into two groups: Laser Group (GL) (n=15) submitted to 6 weeks of application of the LBP and Control group (CG) (n=15) without LBP low power laser. The laser group carried out an evaluation of the Jump Test (Vertical impulsion test) on the jumping platform, intervention with the low power laser and carried out a reassessment the day after the end of the applications of the LBP of the Jump Test on the jumping platform after, as the control group performed the evaluation and reevaluation of the Jump test on the jumping platform. At the beginning of the study, all participants were informed of the risks and benefits that would involve the procedures and, upon agreeing to participate, they signed an informed consent form (ICF). They were submitted to an evaluation form which contained anamnesis data and questions related to injury history.

The inclusion criteria were that all athletes who were part of Clube do Remo's under-20 field soccer, were between 15 and 20 years old, had been playing soccer for at least 6 months and were participating in weekly training sessions. frequency of three times a week. The study exclusion criteria were: having already participated in a rehabilitation program for musculoskeletal problems; present acute injury to the joints involved during the jump (coxofemoral, knee and ankle); were practicing another sport besides soccer and had a frequency below 80% of participation in training during the intervention period. Therefore, respecting the exclusion criteria, 7 participants were excluded from the study, 4 from the control group and 3 from the laser group.

EXPERIMENTAL PROCEDURES

The research was divided into three stages, the first stage consisted of application of the athletes' evaluation form and evaluation of the Jump test on the jumping platform, the second was carried out with the intervention with the use of low power laser in the period of 6 weeks. and the third and last step of reassessment of the Jump test on the jumping platform, the Jump Test Software was used to evaluate and analyze the jump in the pre and post intervention, the Jump test consists of a plate (contact platform), measured between 66 and 100cm in length and 55 and 66cm in width, sensitive to small pressures, they will be connected through a connection cable to the computer that will contain the program (software) JUMP TEST 1.1. The program allows testing to obtain data related to the vertical jump.

The evaluation form contained identification data such as: name, age, weight, height, position, dominant side, how long you have been playing soccer, and questions related to injury history, if you had lower limb injuries, if you were participating in any type of intervention, if he participated in any rehabilitation program, it was developed for sample selection respecting the inclusion and exclusion criteria.

The Jump Test aimed to measure the power of the lower limbs in the jump gesture, where the performer made a maximum effort in order to obtain the greatest possible height. The position for performing the test was standardized, using the form of jumps presented by the programs: Countermovement Jump (CMJ), in which it offers the following parameters: number of jumps, height reached, initial speed of each jump, jump power and representation data graph.

On the first day, all subjects were instructed on how the jump must be performed, of the Countermovement Jump type, the jump test consisted of performing three maximum vertical jumps, on a 50x66cm plate (contact platform), where all volunteers jumped barefoot, so that there was no influence on the result due to differences in shoes.

In CMJ, the performer must start from a standing position, with hands fixed on the waist, feet parallel and approximately muster-width apart, looking towards a fixed point at eye level and moving downwards "flexing " hip, knee and ankle joints with approximately 110º of knee flexion and then extension takes place in a continuous movement as fast and with maximum power as possible, keeping the trunk vertical and with the knees and extension in the phase of flight.

In the low-power laser application protocol, an infrared laser therapy device was used, with a wavelength of 808 nm and a useful power of the emitter of 100 mW. The volunteer remained lying in dorsal decubitus, with the quadriceps region uncovered. First, asepsis of the application site was performed and then the laser was irradiated at a 90° angle with the tissue in a punctual way with 6J (joules) at each point, being applied in six places in the knee extensors. (median, lateral and central) in both legs, totaling 36J of radiated energy for each leg, with 60 seconds of irradiation in each place (6 min of total irradiation time for each leg), the application was made in interval days, being applied three days a week.

STATISTICAL ANALYSIS

The analysis was done through the collected data, referring to the evaluations carried out before and after the intervention, by the program (software) JUMP TEST 1.1 for analysis of the following parameters: number of jumps, height reached, initial speed of each jump, power of jump and resistance. All this through a graphical representation in which the program provides, through the results obtained, the response of the laser application program was analyzed, the data were transferred to a table in which they were divided into their respective fields of analysis comparing the pre and post intervention.

RESULTS

The *Two Way* ANOVA test was used to verify the influence of the laser treatment on the response variables h(cm) and v(m/s) in the evaluation and reevaluation conditions, and for the multiple comparisons between the conditions, the *Tukey* test. In all statistical tests, a significance level of 5% was adopted. Thus, the data collected were tabulated, interpreted, processed and analyzed using descriptive and inferential statistics.

For data analysis, computing resources were used, through processing in the system *Microsoft Excel*, *Statistic Package for Social Sciences* (SPSS) version 24.0, all in environment Windows 7. Data were described in tables and graphs with mean and standard deviation parameters.

First, the assumptions for carrying out the analysis of variance test (ANOVA) must be verified. It is necessary to verify if the sample data come from a normal population by performing the normality test (fig. 1), where it is verified that the sample data follow a normal distribution ($p>0.05$).

It can be seen in figure 1 that the variables h(cm) and v(m/s) in the athletes' evaluation have a distribution considered normal ($p>0.05$), except in the case of the variable v(m/s) in the control group.

In figure 2, the variables h(cm) and v(m/s) in the athletes' reassessment have a distribution considered normal ($p>0.05$), both in the control group and in the laser group.

Table 1 shows that, in the evaluation, the group treated with laser showed a higher mean for h (cm) ($\mu = 35.5$) than the control group ($\mu = 34.6$) (figure 3), but this difference is not significant ($p>0.05$), the same occurred in the reassessment, where the laser-treated group had higher h (cm) ($\mu = 38.3$) than the control group ($\mu = 35.2$) (figure 4), however there was also no significant difference ($p>0.05$).

Table 2 shows that, in the evaluation, the group treated with laser showed a higher mean for v (m/s) ($\mu = 3.5$) than the control group ($\mu = 3.6$) (figure 5), this difference being significant ($p<0.05$), while in the reassessment, where the laser-treated group had higher v (m/s) ($\mu = 3.6$) than the control group ($\mu = 3.7$) (figure 6), however, there was no significant difference ($p>0.05$).

To verify if the variance of the groups is constant, the test of homogeneity (equality) of variances, the test of *Levene* ou *Bartlett* (figures 7 and 8).

If we reject the normality hypothesis ($p<0.05$) it is better to use the test proposed by *Levene*, however, if the normality hypothesis is not violated ($p>0.05$) (fig. 1), the test proposed by *Bartlett* has a better behavior than the test proposed by *Levene*.

For the variable h (cm), considering that H0 corresponds to the hypothesis of equality of variances, it is observed that as the p-value of the test (table 1) is above 5% (0.05), we accept the hypothesis H0, that is, the variances are equal. However, the test *Bartlett* is more sensitive in relation to the hypothesis of normality of the data.

Thus, for the variable h (cm) the result of the Bartlett's test is accepted, which indicates that there is no significant difference between the sample variances, that is, the variances are equal ($p>0.05$) as shown in Figure 7, where the groups do not differ significantly regarding the variable h (cm), however in the case of the variable v (m/s), the differences in variance are significant ($p<0.05$).

DISCUSSION

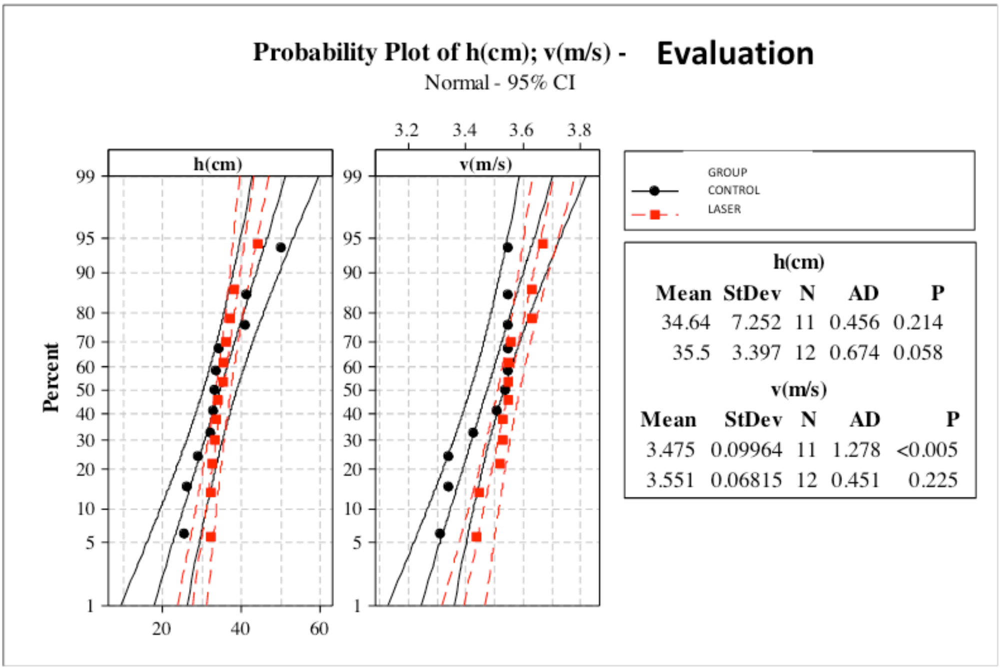
Low-power laser (LBP) is increasingly becoming a very useful technique in the field of physical therapy, whether to treat, combat fatigue or prevent injury, in recent years it has been the subject of several researches. In the current study, the main objective was to evaluate and analyze the influence of low power laser on muscle performance in jumping.

Low power laser has been frequently used in studies that infer improved performance when used before physical activity and effects on muscle recovery after activity, the best parameters for the use of laser and your objectives.

In long-duration activities, important physiological characteristics are required in the vertical jump, as it involves high-intensity actions and short distance and time[8].

In the present study, it was carried out with a group of 30 under-20 field soccer athletes, part of them submitted to intervention with LBP plus initial and final evaluation, the other group, however, was only evaluated at the beginning and end, but all following the initial participation criteria.

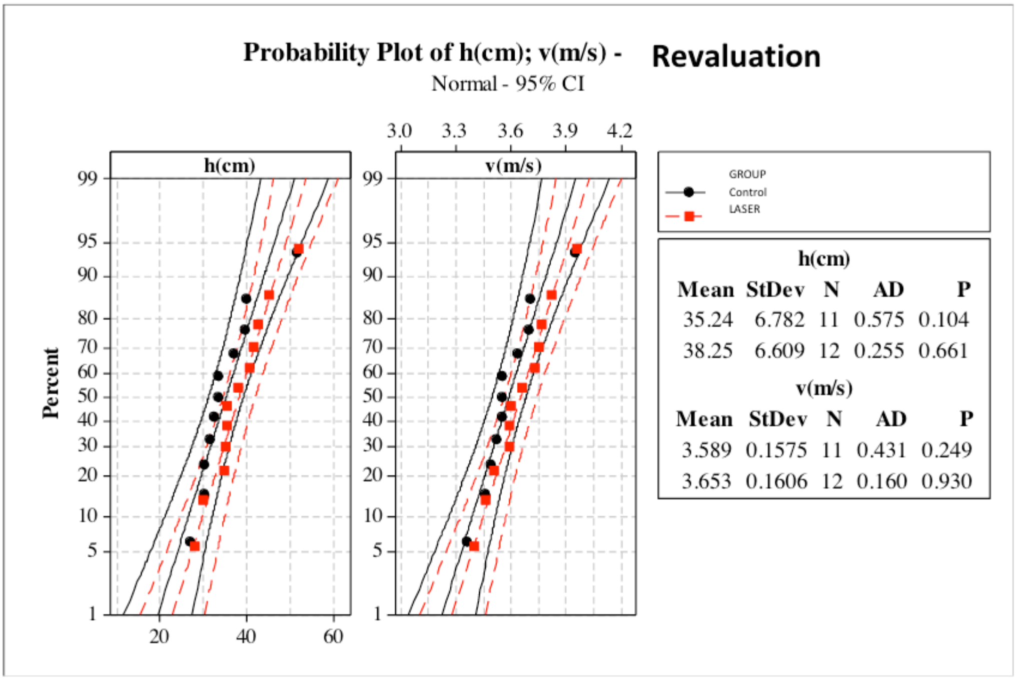
The study obtained positive results in relation to the means and standard deviation, but there was no significant difference in the analysis of variance ($p>0.05$), even showing an improvement in the tests when reassessed by the Jump Test method on the jumping



Decision: Accept the null hypothesis (H0) if p-value>0.05.

H_0: The distribution of variables h (cm) and v (m/s) is normal.

Figure 1: Normality test of the variable h (cm) and v (m/s) in the evaluation of athletes in the control and laser groups.



Decision: Accept the null hypothesis (H0) if p-value>0.05.

H_0: The distribution of variables h (cm) and v (m/s) is normal.

Figure 2: Normality test of the variable h (cm) and v (m/s) in the revaluation of athletes in the control and laser groups.

Groups	n	Evaluation		P-Valor	Revaluation		P-Value
		Average	DP		Average	DP	
CONTROL	11	34,6	7,3	0.714ns	35,2	6,8	0.293ns
LASER	12	35,5	3,4		38,3	6,6	

(1) Test ANOVA (p-value <0.05).

** Highly significant values; *Significant Values; NS Not Significant Values.

H_1: There is a significant difference between the means (p<0.05).

Table 1: Analysis of variance of the means of the variable h (cm) in the evaluation and reevaluation of the athletes in the control and laser groups.

Source: Data resulting from the survey (2017).

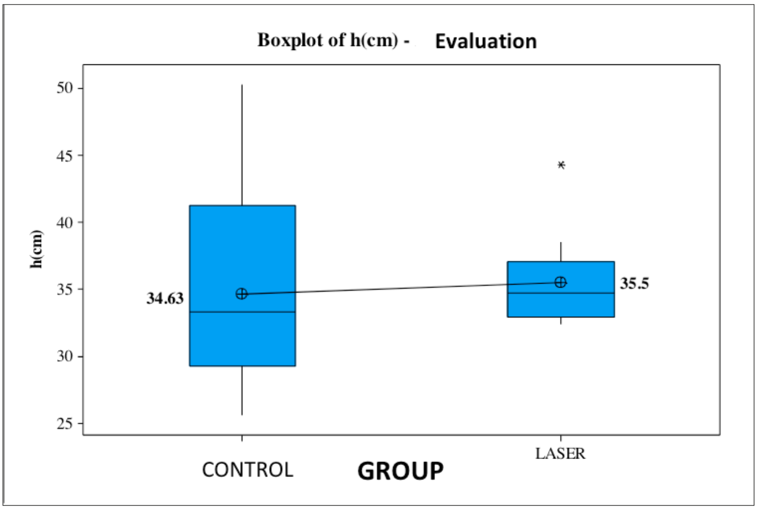


Figure 3: *Boxplot* to compare the means of the variable h (cm) in the evaluation of athletes in the control and laser groups.

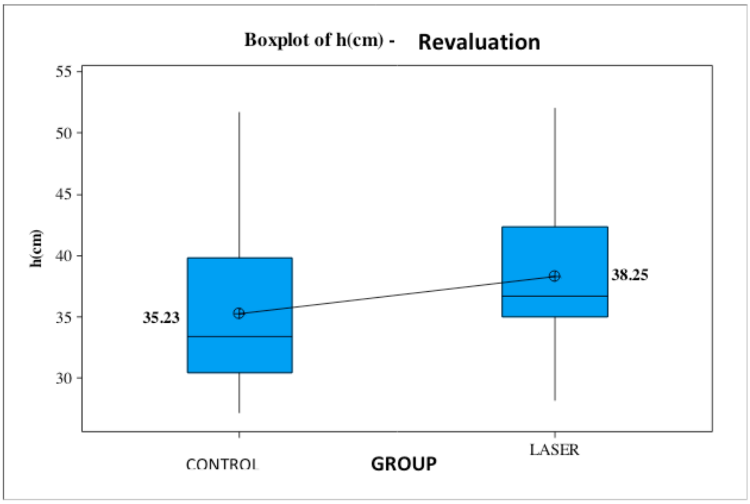


Figura 4: *Boxplot* to compare the means of the variable h (cm) in the reassessment of athletes in the control and laser groups.

Groups	n	Evaluation		P-Value	Revaluation		P-Value
		Average	DP		Average	DP	
CONTROL	11	3,5	0,1	0.043*	3,6	0,2	0.344ns
LASER	12	3,6	0,1		3,7	0,2	

(1) ANOVA test (p-value <0.05).

** Highly significant values; *Significant Values; NS Not Significant Values.

H_1: There is a significant difference between the means (p<0.05).

Table 2: Analysis of variance of the means of the variable v (m/s) in the evaluation and reevaluation of the athletes in the control and laser groups.

Source: Data resulting from the survey (2017).

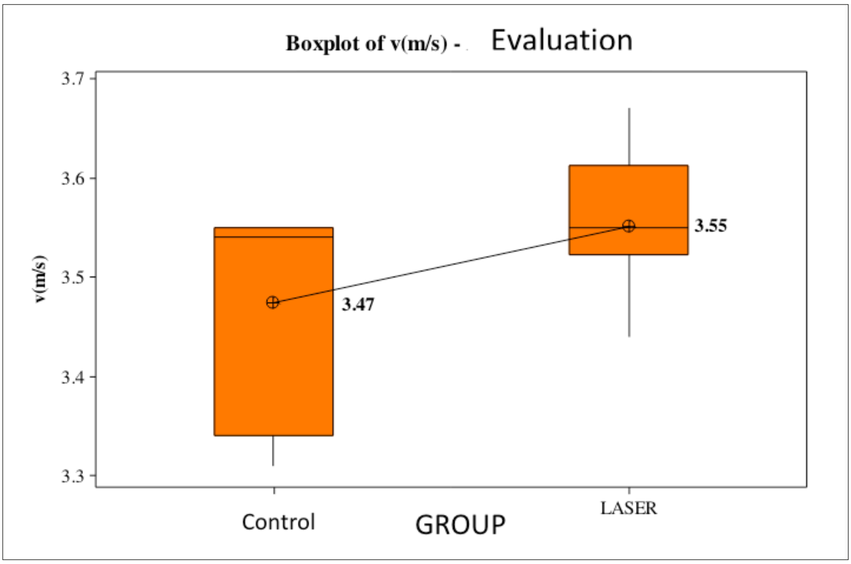


Figura 5: *Boxplot* to compare the means of the variable v (m/s) in the evaluation of athletes in the control and laser groups.

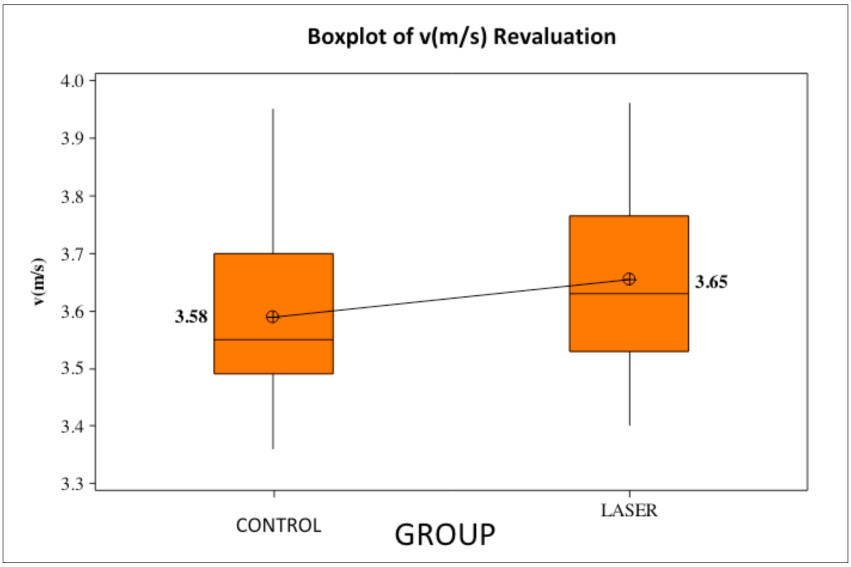


Figure 6: *Boxplot* to compare the means of the variable v (m/s) in the reassessment of the athletes in the control and laser groups.

		Test of Homogeneity of Variances (1)		
Variable	Levene's Test	P- Value 2	Bartlett's Test	P-Value3
h (cm)	0,99	0,409ns	6,10	0.107ns
v (m/s)	1,83	0,156ns	9,01	0,029*

(1) Test of Homogeneity of Variances (p-value>0.05).

H_0: There is no significant difference between the sample variances, that is, the variances are equal (p>0.05).

H_1: There is a significant difference between the sample variances, that is, the variances are not equal (p<0.05).

** Highly significant values; *Significant Values; NS Not Significant Values.

(2) Decision:Accept the null hypothesis (H0) if p-value>0.05.

(3) Decision: Reject the null hypothesis (H0) and accept the alternative hypothesis (H1) if p-value<0.05.

Table 1: Test of Homogeneity of the variable h (cm) and v (m/s) in the evaluation and reevaluation of the athletes of the control and laser groups.

Source: Data resulting from the survey (2017).

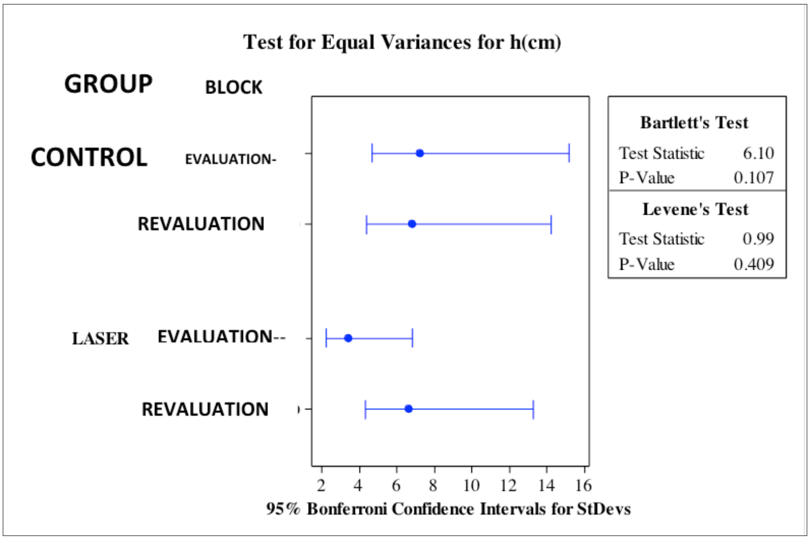


Figure 7: Test of Homogeneity of the variable h (cm) in the evaluation and reevaluation of the athletes of the control and laser groups.

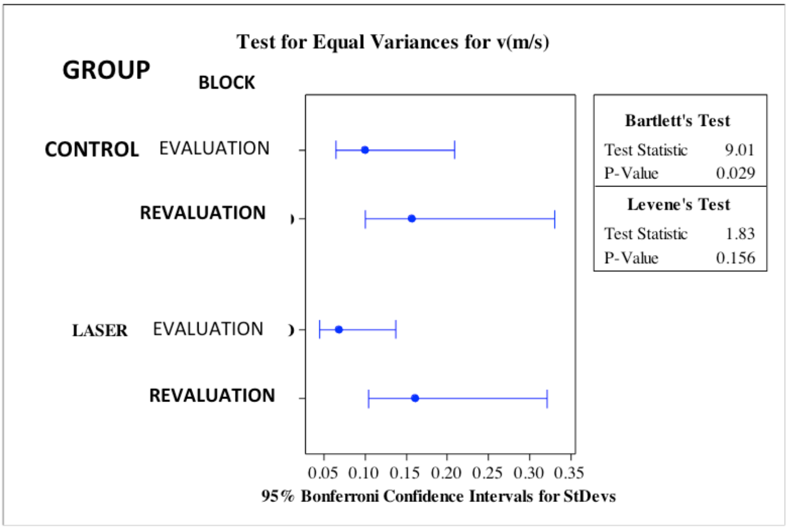


Figure 8: Test of Homogeneity of the variable v (m/s) in the evaluation and reevaluation of the athletes of the control and laser groups.

platform and compared to the group control.

With similar objectives to evaluate the effects of low-level laser therapy on exercise performance, oxidative stress and muscle status in humans, a randomized, double-blind, placebo-controlled crossover study was performed in 22 untrained male volunteers. After application of LBP in 12 points of lower limbs (six in the quadriceps, four in the hamstrings and two in the gastrocnemius), 5 minutes before a running protocol of standardized progressive intensity until exhaustion. There was an increase in exercise performance and a decrease in exercise-induced oxidative stress and muscle damage[9].

There are many studies on the use of LBP linked to studies on reduction in muscle fatigue, increase in resistance, muscle recovery, where positive results have been noticed.

Reductions in muscle injury markers were observed after the application of low-level laser therapy before eccentric exercise10. In another study, the musculature suffered a reduction in muscle fatigue after hardening training associated with the application of LLLT. The structure most vulnerable to exercise-induced muscle damage appears to be the Z line, with damage also occurring in the sarcoplasmic membrane, sarcoplasmic reticulum, T tubules, myofibrils, and the cytoskeletal system[11].

In addition to the use of LLLT low-level laser therapy, other types of laser and their effects on exercise performance have been studied. [12] compared the effects of red (660 nm) and infrared (830 nm) low-level laser therapy (LLLT) on skeletal muscle fatigue in healthy men and concluded that both are effective in delaying the development of muscle fatigue and increasing muscle performance, but without differences that might infer that one type is better than another.

In previous human studies, the use of LBP had not been used before exercise in order to assess muscle power performance, and the results could be hypothetically more significant if LBP was performed after exercise,[13] there was a significant decrease in the fatigue index of the group that performed more Laser exercises compared to the other groups.

The World Association for Laser Therapy (WALT) has standardized some dosages for humans, so that for each type of tissue to be treated, there are indicated doses and wavelengths. Therefore, based on several studies, a certain dosage was determined for application[14].

The possible use of LBP in conjunction with training, and factors such as age of the players, recovery time, have been key factors for the study in question to have shown positive results of the laser group in relation to the control group, even without a large variance. Perhaps with a longer follow-up period and LBP intervention, players could show a greater significant difference in the tests.

CONCLUSION

Based on the results obtained in the measurements, the results of the present study point to the conclusion that the application of low power laser with the parameters used in this study were not fully effective in improving jumping performance in under-20 field soccer players. Therefore, further studies are needed on the use of LBP to aid the performance of athletes, both in jumping and in other physical qualities required in sports practices.

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