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EFFECTS OF THE MYOSFASCIAL RELEASE AND THE RESISTANCE EXERCISE IN MOUNTAIN BIKERS

[1,*]Mateus de Jesus Lima, [2]Karla Cavalcante Silva de Morais, [1]João Cambuí da Silva Neto, [1]Tiago Silva Carvalho, [1]Fernando Ferreira Porto, [1]Leonardo da Silva Lima, [1]Paloma de Jesus Lima and [3]Juliana Barros Ferreira

[1]Graduate in Physiotherapy by The Northeast Independent College - Fainor
[2]Masterin Public Health by ENSP/FIOCRUZ, Professor of the Physiotherapy course by The Northeast Independent College- Fainor e UNINASSAU
[3]Master in Health Technologies by EBMSP, Professor of the Physiotherapy course by The Northeast Independent College – Fainor

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ABSTRACT

Objetives: To compare the myofascial release success and the resistance exercises oncardiorespiratory capacity and cyclists perfomance. **Materials and Methods:** It is an analytical study held in a private College in the city of Vitória da Conquista-BA. The sample was comprised by eight mountain bikers that were divided randomly into two groups. In one of the groups it was carried the myofascial release and in another group it was done the resistance exercises for four sessions. There were conducted cardiorespiratory assessments and of the performance before and after the techniques' applications. The study respected the 466/12resolutions and everyone signed the Informed Consent Term. The data were assessed in the Statistical package for social science 22.0, including the usage of the paired T-student test, and the significance level chosen was 5%. **Results:** The myofascial release group obtained association in the decrease of execution time (p = 0,019), but the maximum speed had significance with the myofascial release (p= 0,024), as well as with the exercises (p= 0,015). **Conclusion:** It is determined that the myofascial release was displayed as more effective effective than the resistance exercise in the athletes' performance and cardiorespiratory capacity.

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INTRODUCTION

The bicycle appeared in 1790 because of the requirement for a more efficient dislocation, and it was enhanced over the years, becoming faster in 1820(BIERDEMANN *et al.,* 2009).In the 1970s it was started the mountain biking (MTB), a category that increased quickly and began to be taken as a professional sport in the Atlanta Olympic Games in 1996(SMEKAL *et al.,* 2015). MTB is addressed as an adventure sport, bringing life's quality to the practitioners because it allows they to get in touch with nature, besides being a competitive modality and provide the risk and freedom feelings(BIAZOTTI *et al.,* 2016). Distinctly from the asphalt cycling, MTB competitors do not practice with high speeds, the athletes tend to make a bigger effort in upper and lower limb muscles that come from the intense and repetitive contractions therefore, there is a higher energy consumption against the gravity and resistance force. These circumstances result in athletes developing muskuloskeletal lesions, caused by intrinsic, extrinsic aspects and absence of a conservative treatment (ABREU, 2017; LUCAS *et al.,* 2010).In line with Carvalho and collaborators (2017), cyclists lesions predominance is primarily comprised by the lumbar spine and lower limb regions. To generate muscle strength in the athlete, the musculoskeletal system goes through numerous neural, physiological and metabolic aspects with the exercise (SCHIWE *et al.,* 2016). The strength shortfall provoked by the sports' practice delivers higher risks of soft tissue lesions, and to decrease it is required a balance between the musculature (Martins *et al.,* 2016). Through resistance exercises, the athlete will be benefited from basal growth, decrease of the fat percentage, muscle hypertrophy, blood pressure control and others (CARVALHO *et al.,* 2017).The practitioners of physical exercise have as main goal

Corresponding author: **Mateus de Jesus Lima,**
Graduate in Physiotherapy by The Northeast Independent College – Fainor.

the muscle hypertrophy, fat reduction were observed that the typical training to improve the maximum strength and the muscle potentiality were not priorities. (MENON *et al.,* 2012).Muscle power is imperative in almost all sports, and the athlete's capacity to boost the maximum strength relies on two main aspects, the first one is related to the muscles' cross-section, and the second aspect is connected to the co contraction reduction and the recruitment's gainof motor unit amount grouped during muscle contraction, a phenomenon recognized as neuromuscular adequacy (GROSPRETRE *et al.,* 2018). The musculoskeletal system is intricated by a connective tissue named fascia, which may display tensions and tighten during the time, losing this ways its plastic ability and producing alterations in its length (SOUZA *et al.,* 2017).This stiffness reduces flexibility, functional movements, and stimulatealgic situations and muscle weakness (LEDO *et al.,* 2018). The treatment for fascia alterationsis physiotherapeutic, focused on the myofascial release (MCKENNEY *et al.,* 2013). This release results in arise of the inflammatory process, increasing the blood input, favoring the recovery of heart rate variation and of the diastolic blood pressure, after the intense activity practice(BORGES; BORTOLAZZO; NETO, 2018). Besides bringing higher flexibility gain, to have further results (ARRUDA *et al.,* 2010). Regarded as amanual therapy treatment, the myofascial technique preciselyencompasses biomechanical strength of low and long duration to release mechanoreceptors in the muscles, tendons and fascia (FAIRALL *et al.,* 2017). With the movements completed, it will occur a recovery of connective tissue and pain's instant relief (AJIMSHA, 2014). A literatura mostra que a técnica de LMF traz contribuições no ganho de capacidades musculares em homens e mulheres que praticam atividade física (JUNIOR *et al.,* 2017). Outro resultado satisfatório da aplicação desta técnica em tenistas, porém, nestes atletas, é realizado a automobilização(GAL *et al.,* 2017). Por fim o presente estudo tem o objetivo de verificar os efeito e comparar qual se mostrou mais eficaz no aprimoramento do desempenho esportivo e da capacidade cardiorrespiratória de ciclistas praticantes de mountain bike.

MATERIALS AND METHODS

It is an analytical study, ramdomized which was reffered to and approved by the ethics and research committee (CEP / FAINOR) under CAAE approval protocol: 91181418.8. 0000.5578 opinion: 2,769,934. The research was performed in a physiotherapy laboratory of a higher education institution (IES) situated in the city of Vitória da Conquista – BA that is located in the southwestern Bahia. The sample was firstly comprised by 28 athletes of which, due to withdrawal, time impossibility and health problems at the end, it was possible to get a final sample comprised by eight active mountain bikers with ages from 23 to 36 years, with a minimum frequency of three times a week**.** There were removed athletes who had physiotherapeutic monitoring, or who displayed hypersensitivity to the techniques' applicability**,** or displayed any contraindications to techniques like hypertension, diabetes and others. The sample was comprised of eight participants randomly dispersed in two groups using as tool the website www.random.org.All participants were briefed about the research procedures and intervention protocol, and after agreeing to participate, they signed the Informed Consent Form, and then the data were explored, the participants were divided into two groups. For the data collection had been used a sociodemographic questionnaire, a digital electronic scale, a measuring tape, an aneroid sphygmomanometer and stethoscope of the premium brand, a fingertip oximeter, a digital watch from the Atrio brand, STRAVA cellphone app, a stretcher, an ergometric treadmill, two Dong Yang cupping tools number two and fous**,** a body oil, a low resistance Theraband, a hollow bar of 1.20 m, two weights offive kilos**,** two low-resistance shin guards, besides defining a fixed pathway that has 35.92 km of distance in a land terrain with an elevation difference 289 m. Before starting any procedure there were carried the hemodynamic assessments with measurements of blood pressure (BP), heart rate (HR), respiratory rate (RF),peripheral oxygen saturation (SPO2), **t**emperature (T), athletes cardio respiratory capacity in accordance with the validity of the VO 2 equation proposed by Cureton *et al.,* (1995), through the protocol of 1600m VO2peak (ml.kg-1.min-1) = -8.41 (MRW) + 0.34 (MRW) 2 + 0.21 (age x sex) -0.84 (BMI) + 108.94, including in the equation the age references of the participant, the numerical reference for sex where 0 was added when the person was a woman and 1 when was a man, body mass index (BMI),MRW time (min) and the assessment of the athletes' performance during the pre-established pathway by Strava, recording execution time, maximum speed and calorie consumption. Before the techniques performance it was assigned the VO2 max protocol. where the athlete would perform using the treadmill a 1,600 m pathway, in each minute was carried with a gradual speed increase (km/h) until they got to the pathways' end, the time they took to hit was the one used for the protocol. As for the trail, it was detected by the STRAVA application, where it was put on the cyclist's bike and with it the pathway was marked, in performance time, calories and maximum speed.

In group 1 (G1), it was conducted a manual myofascial release combined with the dynamic cupping sets two times in each muscle grouping for two weeks, in the first weeks' session the quadriceps muscles of tensor fascia latae and tibialis anterior, in the second weeks' session ischiocruraland gastrocnemius muscles with a 24-hour interval in every session and according to the same logic in the second week. For the technique execution, it was used bodily oil to help and in a dynamic manner from distal to proximal with the cupping number 02, with 3.8 cm of diameter and number 04, with 3,0 cm of diameter of Dong Yang brand. To start the myofascial release techniques, it was demanded the hair removal from segments to be worked and it followed the subsequent steps:

The therapist started the myofascial realease technique bilaterally in the quadriceps and TA in dorsal decubitus**,** TFL in lateral decubitus and in ischiocrural and gastrocnemius in ventral decubitus. The technique began with the oil application on the muscles with the therapist asking for the muscle contraction movement to position the cupping set and afterwards requesting the muscle relaxionand conducted two suctions starting the dynamic movement that was carried from distal to proximal, promoting the contraction of muscle fibers. Finished with the cupping set, the patient will make a new muscular contraction, and the therapist will do the manual MFR with the fingers to the muscle through dynamic movements from distal to proximal until the regions' hyperemia.

In group 02 (G2), there will be a protocol of resistance exercises with focus on muscles that act on all knee and hip motion plans and after it was executed an elastic stretching

with each muscle worked on the intervention' day. Resistance exercises were conducted for 50 minutes, twice a week during two weeks, with four series of 30 repetitions, with a load of 30% of 1MR (one maximum repetition) with intervalsof30 seconds between series and one minute between one exercise and the other. There were held two groups which are listed below in A and B.

GROUP A

A. Plank with 90º of elbow flexion for 1,5 min;
B. Bridge exercise with hip elevation, 04 series de 30 repetitions;
C. Leg extension chair 0 °to 90 °, 04 series of 30 repetitions;
D. Hip lateral rotation, 04 series of 30 repetitions;
E. Stiff, 04 series with 30 repetitions;
F. Squat of 0 ° to 90 °, 04 series of 30 repetitions;
G. Thera- Band Hip abduction (stood up), 04 series of 30 repetições;

GROUP B

H. Squat with knee flexion in bilateral 90°, 04 series of 30 repetitions;
I. Calf Plantar Flexion, 04 series of 30 repetitions;
J. Ankle Dorsiflexion, 04 series of 30 repetitions;
K. Hip Abduction with weights (lateral deviation), 04 series de 30 repetitions;
L. Abduction and extension in 4 supports, 04 series de 30 repetitions;
M. Hip abduction and extension and knee flexion in 90° with tera-band (OYSTER), 04 series de 30 repetitions;
N. Prone knee flexion, 04 series of 30 repetitions;

After the collection there were reassessed the VO² and each athlete's performance with the aim of checking the possible evolutions comparing the before and after. The project obeyed the Resolution 466/12 of the National Health Council for Human Study. All participants were properly clarified about the procedures and accepted to participate in a voluntary way by signing the Informed Consent Form. Assessments were held before and after the interventions. All data were tabulated and calculated the means and the relative and absolute frequencies after this they were examined in the IBM SPSS Statistics for Windows (IBM SPSS, 22.0, 2012, Armonk, NY: IBM Corp.), using the paired T-student test to check pre and post-intervention averages. In all assessments, the level of significance chosen will be 5% ($\alpha = 0.05$).

RESULTS

There were assessed 8 male individuals evenly dispersed between the myosfascial release groups - MFR and ER exercises resistance groups. The participants' profile, displayed in table 1, shows that cyclists are aged between 24 and 35 years 5 (62.5%), with incomplete higher education 4 (50.0%), the ones married are 5 (62, 5%), employed 7 (87.5%) and family income between two and three minimum salaries 4 (50.0%). With the variables outcomes connected to the cyclists performance as displayed in table 2, it is determined that although there is a rise of the VO2 and calories variable for both groups, it was not seen statistically significant difference for the variance. The reduction for the test's performance time even after happening for both groups, is only linked to the myofascial release group ($p = 0.019$).

The maximum speed kept by the cyclist on the trail had a positive variation for both groups and was statistically confirmed for the MFR and RE group ($p = 0.024$ and 0.015, respectively). When assessing the sample's evolution with percentage parameters, it was noticed that myofascial release provides better outcomes in all variables.

Table 1. Sample'sSociodemographiccharacteristics.Vitória da Conquista – BA, 2018.

Characteristics, *n (%)*	n	%
Age group, *years*		
≥ 23	2	25
24-35	5	62,5
≤ 36	1	12,5
Schooling		
Complete High School	3	37,5
IncompleteHighereducation	4	50
Complete HigherEducation	1	12,5
Marital Status		
Single (a)	3	37,5
Married (a)	5	62,5
WorkSituation		
Employed	7	87,5
Other	1	12,5
Family income, *minimumsalaries*		
Onlyone	1,0	12,5
Betweentwoandthree	4,0	50,0
Betweenthreeand four	2,0	25,0
Above 5	1,0	12,5

Source: Research Data.

Table 2. Assessment and reassessment after interventions Vitória da Conquista - BA. 2018

Variables	Mean[1] ± SD[2] (n = 4)	Mean[3] ± SD[2] (n = 4)	*p**
Myofascial Release	29,75 ± 11,44	35,75 ± 3,5	0,345
Exercises	31,0 ± 34,75	34,75 ± 1,25	0,797
Time, *hours*			
Myofascial Release	1,71 ± 0,30	1,29 ± 0,41	0,019
Exercices	1,60 ± 0,05	1,59 ± 0,12	0,268
Maximumspeed, *km/h*			
Myofascial Release	62,07 ± 13,81	62,92 ± 17,26	0,024
Exercises	73,20 ± 0,23	73,70 ± 0,93	0,015
Calories			
Myofascial Release	1110,5 ± 408,4	1335,75 ± 242,5	0,253
Exercises	1148,7 ± 270,0	1303,0 ± 309,9	0,112

[1]Meanbefore; [2] Standard Deviation; [3]Mean after; * t-Student paired test.
Source: Research data.

Table 3. Samples' Evolution percentage. Vitória da Conquista - BA. 2018

Variable	Averagedifference	% ingains
Vo2		
Myofascial Release	6	20,1
Exercises	3,75	12,09
Time, *hours*		
Myofascial Release	-0,42	24,56
Exercises	-0,01	0,62
Maximumspeed, *km/h*		
Myofascial Release	0,85	1,36
Exercises	0,5	0,68
Calories		
Myofascial Release	225,25	20,28
Exercises	154,3	13,43

Source: Research data.

DISCUSSION

The present paper held a comparison between the myofascial release technique and the muscle resistance exercises and assessed which technique is displayed as more effective to work on the performance improvement and the cardiovascular capacity in cycling athletes, and the final sample was comprised of eight mountain bikers. The observed variables were the means before and after the maximum speed, test's performance time, calories and max. VO2 in compliance with the protocol of 1,600 meters with validity of the equation drafted by Cureton and collaborators (1995). In relation to the cyclists'sociodemographic characteristics, most of them were young, married, employed and with family income above two minimum salaries. Literature displays coinciding data related to age, education, marital status and work situation (CARVALHO *et al.,* 2017). A study held in Paraíba has revealed that most cyclists are male, married and with higher education degree (ARAÚJO and TOMAS, 2013)**.** Yet a research with young athletes carries data that are different from the current study concerning age and schooling degree (HEALEY, 2014).

The cycling athletes, as in any aerobic sport, have more demands for oxygen, and for that it is essential to recruit muscle structures, which are the so-called type I fibers, also known as red or slow. These are resistant to fatigue, and able to remain longer in mechanical stress. The American College of Sports Medicine (ACMS) brings out that the suitable prescription to stimulate these fibers are with exercises that use between 20 and 40% of a maximum repetition (1MR) (ACMS, 1998). Nunes *et al.* (2016) highlighted that that the myofascial release done in athletes promotes the appearance of benefits regarding sports practice, because this technique revealed decrease in the execution time and a rise on maximum speed. Besides that**,** the mentioned authors highlight that the techniques' physiology increases the blood input level in the muscle structure what optimizes the levels of energy substrate during an aerobic exercise, and rises the gains upkeep in capacity and performance. A randomized clinical trial was held with 48 participants**,** the major part of them being physically active women who carried out exercises 4 times a week for 30 minutes, it exposed that themyofascial release technique application done in the quadriceps amplified the mean during vertical jump and the peak power (MACDONALD *et al.,* 2016). It is supposed that the myofascial release positive outcome in the current paper is due to the fact that the technique was done in two ways: manually and with the assistance of the cupping set. This way, it offers and empowers, in a mutual way, the growth of the physiological effects, muscle capacities and of the sports practice performance. Donahue and collaborators (2008) directed a study with physically active university students, and found that the myofascial release done with instruments in the quadriceps area, increased the production ability of muscle strength substantiated by the dynamometry**.** These statements supports the current study, with the perspective of making the athletes' performance to grow, which was shown by the decrease of the execution time and increase of the maximum speed. It is implied that the growth in resistance strength capacity that was improved in these athletes happened because of the MR technique, as cyclists could keep for a longer period of time, a physical demand in this sports practice. Concerning RE, it was noticed benefits in the cycling athlete performance, to increase the maximum speed scores during the execution of a pre-established pathway. Likewise, Araújo *et al.* (2013) say that these exercise modalities intensifies the potential of fibers resistant to tiredness. This way, there is an enhancement in sports performance, because it expands the ability to maintain speed values over the mean for a longer period. In the current study, it was used 20% of 1MR more load, as also a protocol that has as goal to stimulate resistance fibers**.** These data agree with what Coelho and collaborators (2017) exhibited in a study using moderate intensity exercise prescription, 50% of 1MR, where it was used a protocol that had as goal to prompt the resistance fibers for a comparison between men and women in power strength and resistance increase. The outcomes express that there was improvement in both groups, though the highest power scores were seen in men, and the resistance ones in women**.** It is alleged that the muscular benefits that stimulate the sports enhancement given by exercises with loads of low to moderate intensity boosts the resistance fibers and influences on the sports improvement. In the study of Askow *et al.* (2018), we looked for the variables speed and power in men and women trained in resistance during the squats execution, with several loads varying from 30 to 90% of 1MR. The outcomes stated that both offered good levels of strength and speed of execution. It is important to note the importance of muscle resistance training for strength production and recruitment of fibers during exercise of different intensities.

In other study carried by Aasa *et al.* (2015), it was shown that the effect of low intensity exercises enhanced physical performance when compared to high intensity exercises**.** Furthermore, low intensity exercises were effective as well on the improvement of lower back pain, because this is a limiting factor in athletes which has impacts concerning the performance. This way, the MR group had greater evolution percentages when compared to the RE group, related to the improvement of the execution time. The ER group had benefits together with the MR group only in the increase of the maximum speed, in addition to providing benefits like the improvement of the cardio respiratory capacity, and in the VO². means. The literature promotes the calories consumption which was also a marker seen in the current paper and that had evolution even without the VO² and calories variables and they did not met the significance values (SHATE, BUTE, DESHMUKH, 2014; CURETON *et al.,* 1995). The study indicated that athletes had a growth in the VO² mean, and calorie consumption. It is an important tracer for the weight loss training and the muscle mass growth, therefore increasing the athlete's performance. Shete; Bute; Deshmukh (2014), detected that the evolution of cardiovascular capacity levels, checked by the maximum VO² test, was substantial for the decrease of body fat percentages. In the study by Tibanaand collaborators (2017),it was noticed an inversely proportional relation between maximum VO2 and fat levels, in other words the authors evidenced that the higher the maximum VO2, smaller the adipose tissue. At the same time, they asserted that the higher the VO2 the greater the muscle strength. This way, it stimulates and enhances the requests stipulated by the sport practice and consequently brings tothe athletes improved performance. In face of the observed results, it may be noticed that the group that performed the myofascial release, showed better evolutions compared to the resistance exercises group regarding the improvement of the execution time. In the maximum speed assessment, the two techniques presented themselves as expressively relevant, not being possible to specify whether one is more successful than the other. The current research provides support because it handles the

relevance of the MR and ER techniques, and states them as successful for getting higher speed scores. Besides showing that the myofascial release was successful for the enhancement of the execution time, and exhibited that it is essential for the upkeep of these maximum speed gains evolution, since it decreases the pedaling execution time. As the studies'shortcomingsit is highlighted the absence of one control group and another group for the application of the associated techniques, with the aim of comparing the variables, aside from the dynamometry to assess the muscle strength and some withdrawals that caused a decrease inthe samples' size but, these shortcomings did not affect the outcomes acquisitions.

Conclusion

Based on the above considerations, it is possible to settle that with a premature manner the myofascial release was displayed as a more successful method than the RE in the reduction of the pathways' execution time, in addition to present beneficial effects with the protocols in enhancing the maximum speed, improving this way the sports' performance. There were cardio respiratory capacity and calorie consumption evolution in both groups. Even though MR arose as the most effective method, it is noticed the significance of the present study for the scientific community and professionals working with Sports Physical Therapy that always look for upgrading the therapeutic conducts with the goal of improving the athlete's performance. It is suggested the use of myofascial release in therapeutic actions directed to enhancing cyclists cardiovascular capacity and performance. It is worth mentioning the importance of performing studies with bigger samples and combining techniques to expand the techniques effects and the comprehension regarding this topic.

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