
ABSTRACT: The objective of present study had verify the influence of mixed warm-up, composed for aerobic run, stretching and 30 meters sprint, on explosive force of active adolescents in 100 meters race. Participated in study 13 male volunteers with age between 15 and 17 years. All volunteers had been submitted 100 meters race on maximum speed, in two situations: a) without warm-up; and b) with warm-up. In agreement with results there was significant difference among temperature before 100 meters race (p<0.05) with or without warm-up. The time in 100 meters after warm-up was not significantly different (p>0.05) of time without warm-up. The mixed warm-up exercise elevates corporal temperature; however, it doesn’t result in improvement time’s race of 100 meters.

Keywords: warm-up, muscle stretching exercises, corporal temperature.
INTRODUCTION

The warm-up, better known as “warming”, aims to prepare the competitor, both physical and mentally, taking their muscles to the point where the work occurs more efficiently. Moreover, the preliminary exercise helps in getting the state to appropriate mental and physical exercise for preparing and coordinating the kinetic osteoarticular system and prevent injuries. To Highest & Ferreira, heating leads to increased redistribution of blood and muscle irrigation, which ensures the supply of O₂ to the muscles.

Evidence shows that the increase in corporal temperature, favored by the preliminary exercise, is beneficial to the performance. Moreover, the corporal temperature is one of the mechanisms of fatigue known, and may lead to lower tolerance to the effort.

In addition to corporal temperature, there are controversies about the fatigue and intensity of the preliminary exercise. Muscular fatigue is the result of several factors; each of them related to the specific requirements of the exercise that produces. Many athletes do not go to the competitions without doing the preliminary exercise; avoid arguing with this injury and believing that their performance will improve with the completion of even.

In agreement with Dantas for sports fast performance, as the race of 100 meters, the preliminary exercise is of fundamental importance, will need to intense heat, with due care not to cause fatigue in the athlete or deplete their energy reserves before the proof.

The implementation of exercises for flexibility as part of preliminary exercise before the exercise of force is controversial. Thompsen et al. observed that the exercise enhances the driving dynamic of women in relation to static stretching. Already Stewart et al. observed that the exercise of flexibility affect the ability of performance in sprints of 40 meters. According Sherlock & Prentice, the exercise of flexibility, coupled with preliminary exercise, can reduce the chances of joint damage or muscular.

Furthermore, a review by Hart showed that there were no evidences that support the theory that the flexibility to avoid injury.

In agreement with Simon et al., the forms warm-up in ways that require power, still need further scientific research, as are the few investigations on the types of exercises that should be incorporated before the training, or even before of tests they deem the force. Moreover, studies that correlate amount of force, warm-up and flexibility are limited, generating questions about how individuals should be prepared for the sessions of training. Thus, the objective of study had verify the influence of mixed warm-up, consisting of aerobic run, stretching and 30 meters sprint, on explosive force of active adolescents in 100 meters race.

MATERIALS AND METHODS

Ethical Care

The anonymity was preserved. Participation was voluntary in nature. All were previously informed about the procedures employed in the study. For the participation of volunteers, their responsible signed a Statement Consent of Free and Informed. All care has been taken to ensure the integrity of volunteers on the participation in the experiment.

Sample and protocol

The sample was composed of 14 adolescent males, aged between 15 and 17 years. All volunteers had been submitted 100 meters race on maximum speed, in two situations: a) without warm-up; and b) with warm-up.

Technical Procedures

To achieve the stimuli of 100 meters has taken up some procedures. Three assessors were responsible for the measure: one of
them, as a judge in the line of departure; timer one and a scorer. The race was held on alternate days in track athletics official. The time of the race was recorded by manual timing, triggered after shooting the gun by the judge of departure. The chronometer was stopped after the athlete beyond the finishing line. The evaluators were the same in all tests, thus reducing the measurement error.

The warm-up was composed by 6 laps in mild pace in track athletics, thus totaling 2,400 meters. Then, were conducted 9 exercises for flexibility. In each year, the volunteers remained in the greater range of motion, for 30 or 40 seconds (Figure 1). Soon after, were carried out preparatory exercises specific to the evidence of 100 meters. Each one was conducted over 30 meters, by 3 times (Figure 2). The exercises specific findings are described below:

**Skipping:** exercises carried bringing up, alternately, the knees, until the thigh at an angle of 90 degrees with the trunk. The arms, flexed to 90 degrees, should imitate the movement of the race in perfect coordination with the knees. The position of the trunk should be perpendicular to the ground or with slight tilt forward.

**Anfersen:** exercise run closer to the heel of the back of the thigh musculature movements in rapid, coordinated with arms. The body moves forward in a slow progression. It is seeking a high frequency of movements.

**Dribbling:** activity with their feet, seeking the maximum extent of them, touching the ground with the tip of the feet, falling below the heel. Moving forward, with movements of shortness magnitude and frequency as high as possible, without harming the accuracy of the movement.

**Race of coordination:** racing in sub maximal effort, aiming to implement the principles of movement within biomechanics ideals, keeping the relaxation differential.

**Racing in continuous acceleration:** racing started in rate slowly, gradually increasing to up to a maximum intensity or sub maximum.

**Figure 1** shows the exercises for flexibility used as a warm-up to the test of 100 meters.  
**Figure 2** shows the warm-up for specific proof of 100 meters.

When the test was conducted without the warm-up, the corporal temperature was measured only once before the sprint of 100 meters (digital auricular thermometer, MedHealth®). In the warm-up to test the corporal temperature was measured before and after the warm-up.

### Statistical analysis

Initially used to descriptive statistics to characterize the sample. Then there was the test Kolmogorov-Smirnov to check the normality of variables. Then there was the Student t test for independent samples to verify significant differences between the time obtained by volunteers with or without prior exercise, and the corporal temperature of volunteers before the initial stimulus. The paired t test was used to compare the corporal temperature between the beginning and end of the prior exercise. The significance level was 5%. For the calculations was used software SPSS version 12.0.

### RESULTS

The results for analysis of the test of normality are presented in Table 1.

**Figure 2.** Specific exercises for proof of 100 meters.

<table>
<thead>
<tr>
<th>1°</th>
<th>2°</th>
<th>3°</th>
<th>4°</th>
<th>5°</th>
<th>6°</th>
<th>7°</th>
<th>8°</th>
<th>9°</th>
</tr>
</thead>
<tbody>
<tr>
<td>30s</td>
<td>30s cada lado</td>
<td>30s cada lado</td>
<td>40s</td>
<td>40s</td>
<td>30s cada lado</td>
<td>30s</td>
<td>40s cada lado</td>
<td>40s cada lado</td>
</tr>
</tbody>
</table>
The Kolmogorov-Smirnov test is recommended to see normality in small samples\textsuperscript{13}. In agreement with Table 2, all variables showed normal acceptable. Thus, the difference between averages could be achieved by a parametric test (t test). The results of proof of 100 meters are shown in Table 2.

The Kolmogorov-Smirnov test is recommended to see normality in small samples\textsuperscript{13}. In agreement with Table 2, all variables showed normal acceptable. Thus, the difference between averages could be achieved by a parametric test (t test). The results of proof of 100 meters are shown in Table 2.

The time in 100 meters after warm-up was not significantly different (\(p>0.05\)) of time without warm-up. The corporal temperature of volunteers is shown in Table 3.

In agreement with results there was significant difference among temperature before 100 meters race (\(p<0.05\)) with or without warm-up.

**DISCUSSION**

There is a lack of such work of this nature, produced in Brazil. Studies in corridors Brazil, during the training period, could help the coaches in the planning of its activities. This is the first study to observe the effect of exercise on the preliminary mixed performance of adolescents in the 100 meters low proof. The main finding of this study indicates that the exercise of flexibility static reduces the beneficial effects arising from the elevation of temperature obtained by the aerobic warm-up.

There is great controversy and debate regarding the effect of warm-up on performance in evidence explosive. Scientifically, there is nothing conclusive that the advance. Many athletes consider the important, perhaps by the belief that the “warming” before the competition will take you to improve your performance\textsuperscript{14}.

In the current study was a protocol of warm-up. However, some authors are divided on the standardization of “warming” to all athletes of the same team. According Weineck\textsuperscript{15}, the warm-up took feature individual because each person has their own way to prepare for the activity. In this sense, Mandengue et al.\textsuperscript{16} found that athletes are able to develop their own warm-up. Possibly, this single protocol for all the individuality has violated related to warm-up. Not so well, that volunteers to prepare properly for the sprint of 100 meters.

One of the objectives of the warm-up is to raise corporal temperature. According Reilly et al.\textsuperscript{17}, the metabolic processes in the cell carried out with greater speed when the corporal temperature is higher during the exercise. The elevation of corporal temperature increases the peripheral blood flow, preparing the body for the exercise. Moreover, the corporal temperature excessive cause fatigue early\textsuperscript{2}. In the current study, raising the temperature by the warm-up did not contribute to the better performance of individuals. Possibly, the work of flexibility has cancelled the physiological effect positive acquired by raising the temperature. Nelson et al.\textsuperscript{18} found that the warm-up for the legs significantly affect the performance of athletes in sprints of 20 meters.

Studies that compared the warm-up the flexibility with the passive exercise dynamic occurred positive effect of dynamic performance and flexibility negative\textsuperscript{1,6}. Faigenbaum et al.\textsuperscript{6} found that the flexibility static affect the performance of children in a subsequent battery of tests. The negative influence of the warm-up in static explosive force is well documented\textsuperscript{1,18,21}. The flexibility affects the structures of the tendon, causing delay in the rate of contraction\textsuperscript{22} and reducing muscular stiffness\textsuperscript{19}. In agreement with Nelson et al.\textsuperscript{18}, the reduction of force by static flexibility is explained by lower nerve conduction in the muscles in activity.

It is worth mentioning that the studies cited above stimulus used to feature concentric after the static flexibility. However, proof of 100 meters dash is a type of exercise where the predominant effort is characterized by rapid transitions of concentric and eccentric contractions\textsuperscript{14}. As the current study, Young & Elliot\textsuperscript{23} evaluated the negative effect of the warm-up of flexibility in the static performance of the stimulus eccentric. In agreement with these authors, flexibility static system affects the muscle-articulate (SMA), reducing the return comes from work concentric elastic, which adversely affects the performance of the eccentric phase of muscular contraction. Fletcher & Jones\textsuperscript{14} observed in their study that flexibility pre-stimulation affects the sprint of 20 meters by reducing the capacity for recovery of elastic energy by SMA.

In the case of races that require explosive strength, especially the 100 meters dash, flexibility contributes to the speed and comprehensiveness of the last\textsuperscript{15}. However, this study has shown that the

---

**Table 1.** Indicators of normality for the variables collected in the sample evaluated.

<table>
<thead>
<tr>
<th></th>
<th>Time in 100 meters</th>
<th>Corporal temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with exercise</td>
<td>without exercise</td>
</tr>
<tr>
<td>norm</td>
<td>0.922</td>
<td>0.945</td>
</tr>
</tbody>
</table>

* = normality, exercise. = warm-up.

**Table 2.** Performance of volunteers in the race of 100 m.

<table>
<thead>
<tr>
<th>n</th>
<th>Age (years)</th>
<th>Performance at 100 meters (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Without warm-up</td>
</tr>
<tr>
<td>14</td>
<td>15.61 ± 0.76</td>
<td>13.72 ± 0.62</td>
</tr>
</tbody>
</table>

**Table 3.** Corporal temperature before warm-up and proof of 100 meters.

<table>
<thead>
<tr>
<th>Corporal temperature before the 100 meters</th>
<th>Without warm-up</th>
<th>Before warm-up</th>
<th>After warm-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>36.4 ± 0.6</td>
<td>36.8 ± 0.5</td>
<td>37.8 ± 0.4*</td>
<td></td>
</tr>
</tbody>
</table>

* = significant difference to \(p < 0.05\).
implementation of passive flexibility as warm-up adversely affects the ability of performance. For future studies it is recommended the adoption of different protocols of warm-up, such as the inclusion of dynamic flexibility. Other models may result in beneficial effects on performance of athletes in evidence calling explosive force.

One of the factors that may limit the scope of the results of this study is the number of adolescents assessed (14 in total). A larger sample of sprinter increases the range of responses, thus enriching the discussion of the work. Another factor that limits the quality of results was the timing adopted in this study. A system of electronic timing could add more precision to the data collected.

**CONCLUSION**

In comments to the objectives set and, in agreement with the findings, concluded that the preliminary joint exercise raises the corporal temperature, however does not result in improvement in time to race the 100 meters dash of active adolescents.

**REFERENCES**