The Journal of Eurasia Sport Sciences & Medicine

ISSN: 2687-265X

J Eurasia Sports Sci Med
http://dergipark.gov.tr/jessm

Volume 3, Issue 1
April 2021, 41-49.

ORIGINAL RESEARCH

The Effect of Different Passive Rest Periods on Submaximal Running Performance

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Received: 23.04.2021

Accepted: 29.04.2021

Abstract

The aim of this study was to examine the effects of different passive rest periods after the dynamic warm-up protocol on submaximal running performance. A total of 16 male volunteers who are physical activity for recreational purposes 2-3 days a week participated. The average age of the participants was 21.17 ± 2.21 years, their average height was 174.27 ± 3.41 cm, and their average body weight was 72.15 ± 4.78 kg. The participates were randomly divided into three groups (IAWarm-up n=5, 10min n=5, 20min=n=6). Submaximal heart rates of the participants were determined using the Karvonen formula. Two-way analysis of variance was used for repeated measurements in the analysis of the data. When comparisons between groups could not be achieved, analysis was made with Greenhouse-Geisser outputs. When differences were detected between groups, Bonferroni post-hoc test was used for multiple comparisons. As a result, different passive rest periods after the dynamic warm-up protocol affect the submaximal running performance. It is seen that submaximal running performance worsens as the passive rest period gets longer. Immediately after exercise and when the passive waiting time was up to 10 minutes, there was no significant difference in submaximal running performance, while significant decreases were found in performance when it was 20 minutes.

Keyword: Passive cooldown, submaximal performance, warm-up, rest interval

To cite this article Keskin K., Birinci Y. Z., Topçu H., & Pancar, S. (2021). The effect of different passive rest periods on submaximal running performance. *The Journal of Eurasia Sport Sciences and Medicine, 3*(1), 41-49.

INTRODUCTION

Warm-up practices are commonly used before exercise, mainly aiming to increase body temperature, cardiovascular system activity (Camargo et al., 2020) and accelerate metabolism (Pagaduan et al., 2012). Warm-up increases muscle flexibility (Faigenbaum et al., 2006; O'Sullivan et al., 2009), balance (Erkut et al., 2016), sprint (Zmijewski et al., 2020; Marinho et al., 2017), agility (Fradkin et al., 2010), endurance (Zourdos et al., 2012; Barnes et al., 2015; Wei et al., 2020) and strength performance (Park et al., 2018; McCrary et al., 2015) and prevents sports injuries (Bizzini et al., 2013; Adelsberger et al., 2014; Amako et al., 2003; Soligard et al., 2008).

When the literature on warm-up practices is examined, it is seen that the focus is mainly on comparing different warm-up protocols (static and dynamic) (Chaouachi et al., 2010; Incoming 2010; Zmijewski et al., 2020; Kendall, 2017; Pagaduan et al., 2012; McMillian. et al., 2006; Merino-Marban et al., 2021; Samson et al., 2012). However, it is known that the effects of warm-up on performance are not only dependent on the warm-up protocol. It should be kept in mind that it is influenced by variables such as the amount of increase in body temperature, the duration and the intensity of warm-up, the time between warm-up and exercise performance, and the type of exercise (Bishop, 2002; Bishop, 2003; Zochowski et al., 2007). The passive rest period between warm-up and performance may vary depending on the intensity and kinematics of the exercise. While the effects of passive waiting time on performance after warm-up up are not clearly understood, passive rest periods given after warm-up are concentrated in the range of 5-10 minutes in studies (Stewart et al., 1998; Gregson et al., 2002; Gregson et al., 2005; Yanaoka et al., 2018). However the extension of the waiting period may adversely affect the physical performance. The passive rest period given for exercises that require short duration, high intensity and high power output is especially important for the renewal of creatine phosphate stores (Bishop, 2003). However, although a period of up to 20 minutes is needed to fully regenerate creatine phosphate stores (McMahon et al., 2002), it has been reported that the intramuscular temperature decreases significantly during the 15-20 minute passive rest period (Saltin et al., 1968; Mohr. et al., 2004). The passive rest period given before exercises at the submaximal level should be planned that prevents the return of oxygen consumption (VO2) to a resting state, since it does not adversely affect performance (Özyener et al., 2001). Passive rest for 5 minutes after general warm-up did not adversely affect maximal running performance (90% VO2 max.) (Yamaguchi et al., 2019), passive rest applied for 12 minutes after general warm-up negatively affected flexibility performance, but at 40 m. It does not have a negative effect on sprint performance (Favero et al., 2009), 3 minutes passive rest period after warm-up does not affect the performance of squat and bench press (80% 1 MT) (Ribeiro et al., 2020), passive applied in 5 and 15 minutes It is reported that resting periods do not significantly affect anaerobic performance (Poprzecki et al., 2007). Considering that environment and body temperature affect performance (No et al., 2016; Wiecha et al., 2010; Zhao et al., 2013; Racinais et al., 2005), failure to monitor environmental and body temperature is an important deficiency in terms of studies. However, in the studies examined, it is seen that the variables of environment and body temperature, which may directly affect the study findings, were not monitoried. Therefore, monitoring the environment and body temperature in our study are the strengths of this study.

In the literature, there appears to be no consensus on the optimal passive rest time after warm-up for exercise performance (Bishop 2003; Zochowski et al., 2007; Poprzecki et al., 2007;

West et al., 2013). Thus, the aim of this study was to examine the effects of different passive rest periods after the dynamic warm-up protocol on submaximal running performance.

METHOD

The study was carried out by crossover design with 3 trials. Participants were randomly divided into 3 groups (IAWarm-up = 5, 10min = 5, 20min = 6). All groups applied different passive waiting times (immediately after, 10 and 20 minutes passive waiting) during each trial week. Trials were carried out with an interval of 7 days.

Participants

A total of 16 male volunteers who were studying at Gazi University, Faculty of Sport Sciences, engaged in recreational physical activity 2-3 days a week and had no health problems participated in this study. The average age of the participants was 21.17 ± 2.21 years, their average height was 174.27 ± 3.41 cm, and their average body weight was 72.15 ± 4.78 kg.

Room and Body Temperature

Participants carried out all the trials in the indoor sports hall with a temperature of 24-25 degrees. Body temperatures of the participants were measured immediately after the exercise, 10 and 20 minutes after using the NEC A15 brand non-contact thermometer.

Dynamic Warm-up Protocol

In the last 1 minute of the 10-minute jogging run, the athletes ran and skipped by turning their arms to the front and back and opening and closing them in turn. Then they were made to run sideways by spreading their legs in different directions. Then they were asked to squat (10 times) and double-leg forward leaps (10 times). Then they were asked to perform stretching movements, which lasted a total of 10 minutes. These consist of Rising Torso Twist, Squat, Walking lunge / Twist, Frankestein walk, Alternating high kicks, Alternating Toe touch, Butt Kicks (Jung, Lee and Lee, 2018).

Heart Rate

Participants were kept in the lying position for 10 minutes and their resting heart rates were recorded. Heart rate Polar brand M430 band was placed on the lower part of the sternum after moistening beforehand (Mizugaki et al., 2021).

Submaximal Running Speed

Before starting the study, the target heartbeat intervals of 80% intensity of the participants were calculated using the Karvonen method described below (She et al., 2015).

Formula: Target Heart Rate = (Maximum Heart Rate-Resting Heart Rate) x (80%) + Resting Heart Rate

Two weeks before starting the study, a test was carried out to determine the speed of the treadmill that would correspond to the heartbeat intervals determined according to the Karvonen method. During the test, Polar M430 brand band and dynamic brand treadmill were used to monitor heart rate. Participants started to run at a 1% incline, 8 km / h running speed on the treadmill. Every 3 minutes the speed was increased by 1 km / h. Participants were allowed to run until they reached the specified heart rate range. During the test, the heart rate of the participants was monitored and the treadmill speed corresponding to the target heart rate was determined.

Submaximal Running Test

Participants started the submaximal running test after warm-up on the day of the test. Their heartbeats were continuously monitored to enable them to run at a previously determined heart rate of 80% (Peltonen et al., 199). They were provided to run at the determined intensity on the treadmill. Participants were encouraged to perform high during the test, and the time to run out was determined as the total running time.

Statistical Analysis

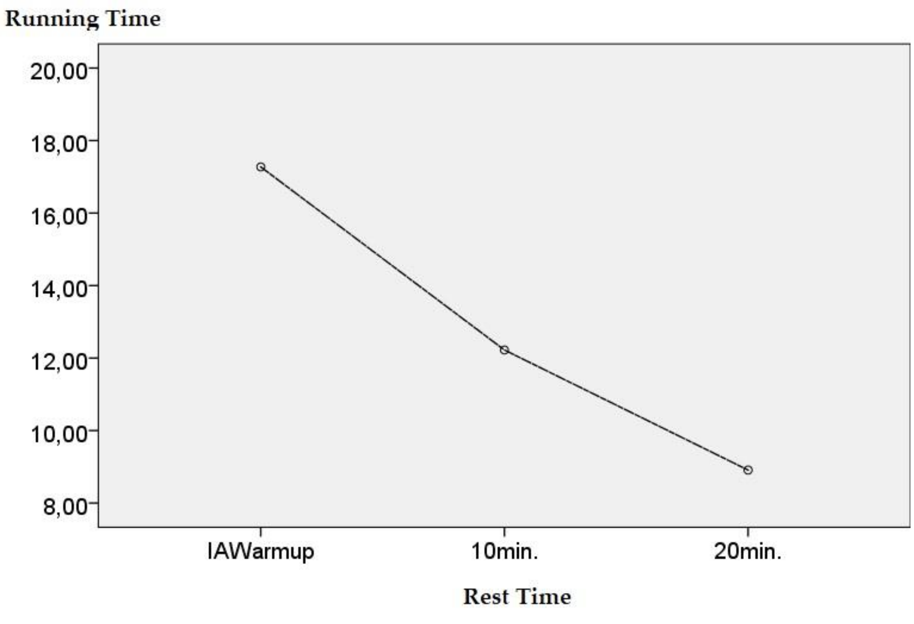
SPSS 24 package program (Windows, Chicago, Illinois, USA) was used in all statistical analyzes. Two-way analysis of variance was used for repeated measures in the analysis of the data. When sphericity could not be achieved in comparisons between groups, Greenhouse-Geisser outputs were analyzed. When differences between groups were detected, Bonferroni post-hoc test was used for multiple comparisons. Significance level was tested as 0.05.

RESULTS

Room and Body Temperature

The 3 trials applied to the participants were carried out at similar room temperature (24-25 C°). Body temperatures were measured immediately after warming, 10 minutes and 20 minutes later. In order to prevent a decrease in body temperature due to environmental temperature during the passive waiting period, they were provided with tracksuits. In the comparison, no statistically significant difference was found between the 3 trials in terms of body temperature ($p > 0.05$).

Submaskismal Running Performance



In the comparison of running times with one-way analysis of variance, there was no significant difference between the IAWarm-up group and the 10-minute passive group, while a statistically significant difference was found between the IAWarm-up group and the passive waiting group for 20 minutes and the groups waiting passive for 10 minutes to 20 minutes ($p < 0.05$).

DISCUSSION

In this study, the effects of different passive rest periods applied after the dynamic warm-up protocol on submaximal running performance were investigated. As a result of the study, it was found that there was no significant difference in submaximal running performance immediately after exercise and when the passive waiting time was up to 10 minutes, while there was a significant decrease in performance when it was 20 minutes.

Our study shows that different passive rest periods applied after general warm-up affect submaximal running performance. It has been observed that submaximal running performance is positively affected when performed immediately after warm-up. Although there was no significant difference between 10 minutes of passive waiting and immediately after warm-up, a decrease in performance was detected. In addition, when performed after 20 minutes of passive rest period, a statistically significant decrease in performance was determined.

When the literature is reviewed, there are studies reporting that warm-up practices do not affect endurance running performance positively (Zourdos et al., 2017; Zourdos et al., 2012, Wilson et al., 2010). However, Yamaguchi et al. (2007) reported that a 5-minute passive rest period after 15 minutes of general warm-up and dynamic stretching negatively affected maximal aerobic performance. Wei et al., (2020) differently reported that a 10-minute passive rest period after general warm-up plus plyometric exercise practices positively affected running economy. Burnley et al., (2005) reported that a 10-minute passive rest period after 10-12 minutes of moderate-intensity warm-up has a positive effect on performance. Bailey et al., (2009) also reported that 9-12 minutes of passive application after 6 minutes of high-intensity application. It has been reported that rest periods improve performance, but a 3-minute passive rest period negatively affects performance. Andzel et al. (1976) showed that passive rest periods applied as 30 seconds and 60 seconds after dynamic warm-up positively affect submaximal performance.

The effect of the dynamic warm-up protocol on submaximal running performance may be due to the increase in body temperature, it may also occur by reducing the oxygen deficit that occurs at the beginning of the exercise and enabling anaerobic metabolism to be active in the later stages of performance (Bishop, 2003). Although pre-exercise dynamic warm-up does not significantly alter oxygen consumption during exercise, it can lead to a higher VO_2 value at the beginning of performance than at rest. However, the prolongation of the warm-up time and the rest period and the excessive warming intensity and thus causing fatigue may adversely affect the submaximal performance. In addition, it should not be ignored that the positive effect of warming may disappear in cases where the rest period exceeds 5 minutes for medium and long-term performance.

CONCLUSION

According to the results of our study, different passive rest periods after the dynamic warm-up protocol affect the submaximal running performance. It is seen that submaximal running performance is negatively affected as the passive rest period increases. Immediately after exercise and when the passive waiting time is up to 10 minutes, there is no significant difference in submaximal running performance, while it can be said that there is a significant decrease in performance when it is 20 minutes.

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