DOI: https://doi.org/10.53350/pjmhs22162384

ORIGINAL ARTICLE

Effects of Time-of-Day on Repeated Sprint Performance of Aromatherapy Massage Applied Young Futsal Players

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ABSTRACT

Background: Different protocols are applied in order to increase the performance of athletes in sports that include high-intensity activities such as futsal. Massage protocols applied before or after exercise are frequently used for performance improvement. The differences in oils used in the massage and the time of day may vary performance levels of the futsal players.

Aim: This study was planned to determine the effects of time-of-day on repeated sprint performance of aromatherapy massage applied young futsal players.

Methods: Twelve male athletes between the age of 18-25, who exercised regularly for five days a week and played futsal for at least 4 years, participated in the study (age, 20.50± 1.78 years; height, 171.92± 2.23 cm; 67.92 ± 2.42 kg; BMI 23.06±.77). The research protocols consisted of three different protocols as single group, non-massage protocol (NM), Swedish massage applied protocol (SM), and aromatherapy massage applied protocol (ATM). In addition, three measurements were taken for each protocol and measurements were made at different times of the day (09.00 in the morning; 13.00 in the afternoon; 17.00 in the evening). After each measurement, the Repetitive Sprint Test (RST) (6x20m) measurements of the athletes were taken. While evaluating RST results, the fastest sprint time (FS), total sprint time and percent change (PC) from the first sprint to the last sprint were calculated.

Results: It was determined that there was a statistical difference between RST values observed at different times of the day after NM, SM and ATM protocols. In addition, among all protocols, ATM protocol was found to be more effective.

Conclusion: It was determined that ATM had a positive effect on RST performance compared to NM and SM protocols and the ATM protocol applied in the evening was more effective than the ATM protocol applied in the morning and afternoon.

Keywords: Futsal, Diurnal Variation, Aromatherapy Massage, Repetitive Sprint.

INTRODUCTION

Futsal is called indoor football, which started as an indoor version of football in South America in the 1930s and is played on a 40x20 m field in five-on-five teams, based on the principle of continuous offense and defense[1,2]. The popularity of futsal has increased in recent years and the rules of the sport are administered by FIFA and implemented by more than 130 countries[3]. Although a futsal match consists of two 20-minute halves, the ball goes out of bounds, foul etc. Due to the circumstances, the playing time is stopped and due to this situation, the duration of a futsal match takes between 40 and 85 minutes[4]. In each half, teams are entitled to a time-out and the half-time break is set at 10 minutes[4,5]. As in other sports, futsal players need different physical, psychological, technical and tactical characteristics[6]. Since futsal requires actions such as speed, change of direction, acceleration and deceleration, it requires energy source from aerobic and anaerobic ways. Characterized as an intermittent modality, they do high-intensity exercise for approximately 3-6 minutes before switching players during a match, sprinting 13.7% of their total distance at high-intensity (speed ≥15 km·h -1) and 8.9% sprinting. (speed ≥25 km·h -1)[7–9]. In competitive sports, differences in daily variations in maximum performance are quite significant[10]. This circadian rhythm can be affected by variety of factors, including exposure to hot and humid environmental conditions, which can affect sports performance[11,12]. Nutrition at different times of the day, sleep, individual chronotype differences, rest and body temperature are among the factors that can affect daily variation[13]. It has been stated that diurnal variation is effective in many variables in sports performance, and different results have been observed on diurnal variation[14,15]. When the effect of daily variation on maximum short-term performance was examined, it was determined that it reached the lowest values in the morning and the highest values in the afternoon[11,16,17]. It also confirms the existence of diurnal variation in performance changes during repeated short-term high-intensity activities[11,18–20].

Massage is widely used by athletes to improve exercise performance and contribute to increased performance[21–23]. However, there are varieties of massage used such as thai, reflexology, Swedish, sports and aromatherapy. Aromatherapy massage is one of the non-invasive, inexpensive and easy-to-use complementary therapies in which essential oils and essential oil-bearing plants (aromatic plants) are used for treatment[24,25]. It includes various manipulation methods such as rubbing, squeezing, stroking, surface massage, deep massage and vibration movements on the body. However, there is no consensus on how aromatherapy will be more effective when applied. However, it has been reported that aromatherapy through massage may be more effective because it stimulates both the sense of smell and touch, and this may prolong the therapeutic effect[26]. Lavender oil is also among the essential oils commonly used in aromatherapy massage[24]. It is known that lavender oil,

which is applied through massage, is rapidly absorbed starting from the epidermis layer of the skin and participates in the circulation, and it is thought that it provides relaxation and changes the perception of pain by increasing the parasympathetic activity with the effect of active ingredients and stimulating the sense of touch[27,28]. In the literature, it has been reported that the group that was massaged with lavender gel after exercise reduced muscle pain more[28]. It has also been reported that lavender oil has anti-inflammatory and analgesic effects[29–31].

Futsal competitions include high-intensity activities, and the competitions are held at different time intervals such as morning, afternoon or evening hours. Because of this situation, it is important to investigate the studies that contribute to the daily performance changes of the athletes. Massage, which is thought to contribute to the increase in performance, is widely used by the athletes, but it can be thought that the oils used during the optimal massage protocol that can contribute to the performance individually will change the effect of the massage. Accordingly, it is seen that there is no study in the literature regarding the level of contribution of aromatherapy oils to performance development during massage performed at different times of the day. This study was planned to determine the acute effect of aromatherapy massage applied to young futsal players at different times of the day on repeated sprint performance. The hypotheses of the study were determined to affect the repetitive sprint performance of ATM.

MATERIAL AND METHODS

Participants: Twelve male athletes between the ages of 18-25, who exercised regularly for five days a week and played futsal for at least 4 years, participated in the study (age, 20.50± 1.78 years; height, 171.92± 2.23 cm; 67.92 ± 2.42 kg; BMI 23.06±.77). The power analysis program G*Power (version 3.1.9.3, Germany) was used to determine the study group. As a result of the power analysis (confidence interval=.95, alpha value=.05 and beta value=.80, and effect size value=.60), it was determined that the number of athletes to be included in the study should be at least 12 athletes (Foul, Erdfelder, Lang, & Buchner, 2007). Inclusion criteria of futsal players in the research (a) have been playing futsal for at least 4 years; (b) not have any history of disability that would affect the result of the study; (c) ensure regular participation in the study; (d) obey the investigators' commands throughout the study; (e) no known skin allergy. All players were given the necessary information about the requirements and risks related to the study, and an informed consent form was signed that they voluntarily participated in the study. During the study, the players were instructed to maintain their usual physical activity, but during this time they were instructed to avoid strenuous activities for the 24 hours before the study. In addition, athletes participating in the study were instructed not to take any drugs (anabolic steroids, other hormones, metabolic modulators, diuretics, non-steroidal anti-inflammatory drugs NSAIDs, etc.) or any medical treatment (blood transfusion, blood donation) during the study period. Before starting the study, necessary approval was obtained from the Malatya Turgut Özal University Non-interventional Clinical Research Ethics Committee (Ethics Committee Protocol Number: 2021/33).

Experimental Design of the Study: The players included in the study were formed on a single group. Measurements were carried out in three different protocols and each protocol was applied 72 hours apart [32]. In addition, three measurements were taken for each protocol and measurements were carried out at different times of the day (09.00 in the morning; 13.00 in the afternoon; 17.00 in the evening). Repeated Sprint Test (RST) (6x20m) measurements of the athletes were taken after each measurement taken at different times of the day. Protocols consist of accordingly;

A No massage protocol (NM); RST measurements after 15 minutes of low tempo jogging (40% HR),

B Swedish massage protocol (SM); RST measurements after 5 minutes of jogging (40% HR) + 10 minutes of SM,

C Aromatherapy massage protocol (ATM); RST measurements after 5 minutes of jogging (40% HR) + 10 minutes of ATM were determined as protocols.

Repeated Sprint Test Protocols (RST): Repeated sprint test (RST) (6x20m) results were evaluated in three different ways: fastest time (FS) of six sprints, total time (TS) for all six sprints, percent change (PC) from the first sprint to the last sprint. RST velocity values were determined according to previously described methods[33,34]. Accordingly, FS was calculated as the fastest time out of six sprint tests, TS as the sum of six sprint times, and PC as ((total time/ideal time×100)-100). The ideal time is the time obtained by multiplying the fastest RST time by six. An example of the calculated FS, TS and PC values is presented below:

RST: 2,88 / 2,96 / 2,92 / 3,04 / 2,84 / 3,01
FS: 2,84
TS: 17,65
İdeal Time: 6 x 2,84 = 17,04

PC (%) =

$$\left(\frac{\text{Total time}}{\text{İdeal time}} \times 100\right) = \left(\frac{17,65}{17,04} \times 100\right) = 102,8\text{-}100 = 3,57\%$$

All measurements were made in the gym in order to minimize the effect of environmental factors that affect the performance of the athletes. Some researchers have reported that the optimal rest period during repetitive sprints is 30s, and interval sprints with 30s will provide the highest performance[35–37]. Because of this situation, 30 s rest interval was given after each sprint.

Massage Protocols: The futsal players participating in the study were given Swedish massage and aromatherapy massage at different times, and each massage was evaluated as a separate protocol. Swedish massage was used in the first massage protocol and aromatherapy massage was used in the second massage protocol, and 72 hours of rest was given between each protocol[32]. In addition, measurements within each protocol were carried out at different times of the day (09.00 in the morning; 13.00 in the afternoon; 17.00 in the evening). While massaging each futsal player, approximately 15 ml of oil was used, during the Swedish massage, classical baby oil was used, and in the aromatherapy massage, lavender oil was used. In a study investigating the effect of different massage times on the lower extremity muscles on acute

performance, it was reported that the most effective massage time was 5 minutes[38]. However, since the massage applications applied in the study were applied to the lower and upper extremity muscles, the massage time was determined as 10 minutes after a 5-minute warm-up run. While applying Swedish and aromatherapy massage, the massage was performed in the direction of the heart and muscle fibers by using effleurage, friction, petrissage, and pressure applications[39–42]. In order to ensure consistency between massage applied to different athletes, massage were performed by three masseurs who received the same training and carried out similar studies together.

Statistical Analysis: Since the number of volunteers participating in the study was less than 50, the normality analyzes of the data were tested with the Shapiro Wilk's test. “Repeated Measures Anova” was used to determine the effect of different protocols on measurement times. Mauchly Test was used for homogeneity of variances and Greenhouse-Geisser correction factor was used to correct for variances. All statistical analyzes were performed with the IBM Statistics (SPSS, version 25.0, Armony, NY) package program. Data were expressed as mean±standard deviation ($\bar{x}$ ±ss) and significance level was accepted as $p<0.05$.

RESULTS

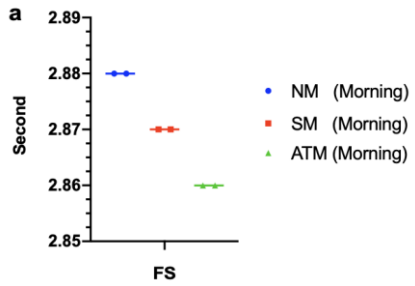

Figure 1a: FS performance times of futsal players after morning NM, SM and ATM protocols.

Figure 1a shows the difference between futsal players' FS performance times in the morning after NM, SM and ATM protocols. It was observed that the FS performance time observed after the ATM (2.86±.05) protocol was better than the FS performance times observed after the SM (2.87±.06) and NM (2.88±.05) protocols, respectively. In addition, it was determined that there was no statistically significant difference between FS performance times after NM, SM and ATM protocols [F(1,157)= 3,476 p= ,081, partial eta squared: ,640] (p>.05).

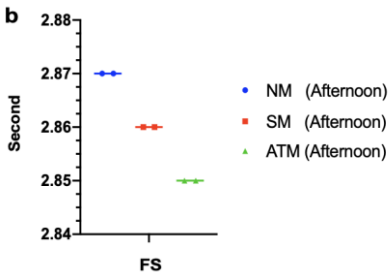

Figure 1b: FS performance times of futsal players after afternoon NM, SM and ATM protocols.

Figure 1b shows the difference between futsal players' FS performance times at noon after NM, SM and ATM protocols. It was observed that the FS performance time observed after the ATM (2.85±.05) protocol was better than the FS performance times observed after the SM (2.86±.05) and NM (2.87±.05) protocols, respectively. In addition, a statistically significant difference was found between the FS performance times after NM, SM and ATM protocols [F(1,258)= 10,572 p= ,004, partial eta square: ,490] (p<.05).

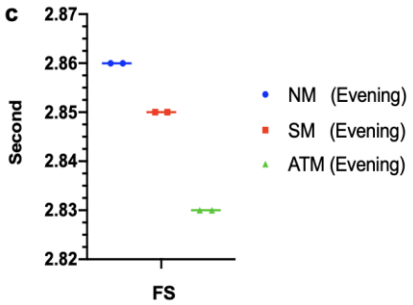

Figure 1c: FS performance times of futsal players after evening NM, SM and ATM protocols.

Figure 1c shows the difference between futsalers' FS performance times after evening NM, SM and ATM protocols. It was observed that the FS performance time observed after the ATM (2.83±.05) protocol was better than the FS performance times observed after the SM (2.85±.04) and NM (2.86±.04) protocols, respectively. In addition, it was determined that there was a statistically significant difference between FS performance times after NM, SM and ATM protocols [F(1,140)= 14,749 p= ,002, partial eta square: ,573] (p<.05).

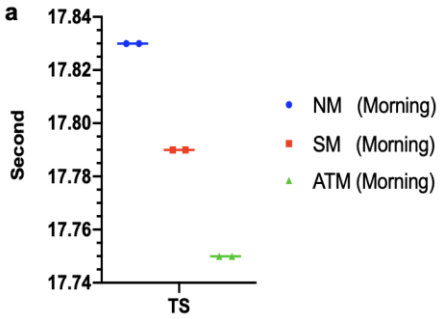

Figure 2a: TS performance times of futsal players after morning NM, SM and ATM protocols.

Figure 2a shows the difference between futsal players' TS performance times in the morning after NM, SM and ATM protocols. It was observed that the TS performance time observed after the ATM (17.75±.15) protocol was better than the TS performance times observed after the SM (17.79±.14) and NM (17.83±.15) protocols, respectively. In addition, it was determined that there was a statistically significant difference between TS performance times after NM, SM and ATM protocols [F(1,167)= 12,609 p= ,001, partial eta squared: ,534] (p<.05).

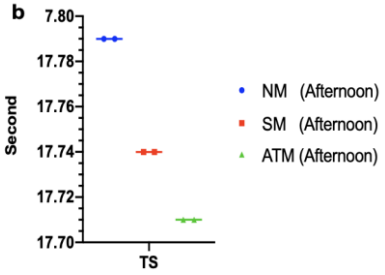

Figure 2b: TS performance times of futsal players after afternoon NM, SM and ATM protocols.

Figure 2b shows the difference between futsal players' TS performance times at noon after NM, SM and ATM protocols. It was observed that the TS performance time observed after the ATM (17.71±.08) protocol was better than the TS performance times observed after the SM (17.74±.09) and NM (17.79±.15) protocols, respectively. In addition, it was determined that there was a statistically significant difference between TS performance times after NM, SM and ATM protocols [F(1,445)= 6.319 p= ,015, partial eta squared: ,365] (p<.05).

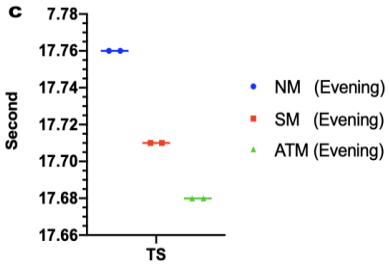

Figure 2c: TS performance times of futsal players after evening NM, SM and ATM protocols.

Figure 2c shows the difference between futsal players TS performance times after evening NM, SM and ATM protocols. It was observed that the TS performance time observed after the ATM (17.68±.05) protocol was better than the TS performance times observed after the SM (17.71±.08) and NM (17.76±.13) protocols, respectively. In addition, it was determined that there was a statistically significant difference between TS performance times after NM, SM and ATM protocols [F(1,392)= 5,700 p= ,022, partial eta square: ,341] (p<.05).

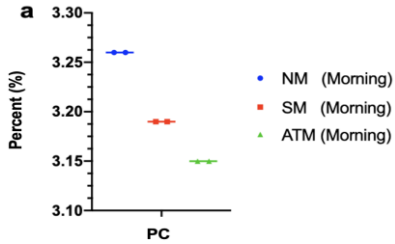

Figure 3a: PC performance percentages of futsal players after morning NM, SM and ATM protocols.

Figure 3a shows the difference in PC performance percentages of futsal players after morning NM, SM and ATM protocols. It was observed that the PC performance percentages observed after the ATM (3.15±.42) protocol were better than the PC performance percentages observed after the SM (3.19±.42) and NM (3.26±.43) protocols, respectively. In addition, it was determined that there was a statistically significant difference between PC performance percentages after NM, SM and ATM protocols [F(1,322)= 30,836 p= ,000, partial eta square: ,737] (p<.05).

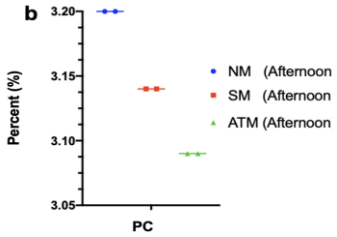

Figure 3b: PC performance percentages of futsal players after afternoon NM, SM and ATM protocols.

Figure 3b shows the difference in PC performance percentages of futsal players after noon NM, SM and ATM protocols. It was observed that the PC performance percentages observed after the ATM (3.09±.43) protocol were better than the PC performance percentages observed after the SM (3.14±.43) and NM (3.20±.44) protocols, respectively. In addition, it was determined that there was a statistically significant difference between PC performance percentages after NM, SM and ATM protocols [F(1,215)= 45,278 p= ,000, partial eta squared: ,805] (p<.05).

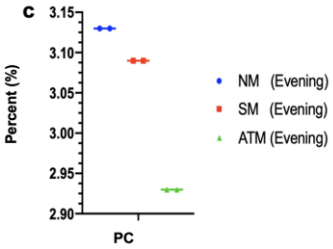

Figure 3c: PC performance percentages of futsal players after evening NM, SM and ATM protocols.

Figure 3c shows the difference in PC performance percentages of futsaler players after evening NM, SM and ATM protocols. PC performance percentages observed after ATM (2.93±.34) protocol were observed to be better than PC performance percentages observed after SM (3.09±.43) and NM (3.13±.43) protocols, respectively. In addition, it was determined that there was a statistically significant difference between PC performance percentages after NM, SM and ATM protocols [F(1,049)= 6,642 p= ,024, partial eta square: ,376] (p<.05).

DISCUSSION

It is stated that the sprint performance of the athlete is important in sports branches that include high-intensity activities such as futsal. For this purpose, sports scientists are constantly working to improve the performance of athletes and it is tried to determine the situations in which

the athletes show the highest performance. Accordingly, it is thought that the competition time, the practices before the exercise and the environmental factors affect the performance indicators. In addition, it is thought that massage protocols applied before exercise or competition contribute to the performance development of athletes. However, the time intervals in which the applied massage protocols contribute the most to the performance development and the effect of the contribution of the different oils used in the massage on the performance development have not been determined yet. It is considered important to determine the most appropriate protocol that contributes to performance development, especially in sports branches that require high-intensity performance such as futsal, studies examining the effects of massage exercises that provide performance improvement before exercise or competition can add originality to the literature for futsal athletes. The aim of our study is to evaluate the acute effects of aromatherapy massage applied to young futsal players at different times of the day on repeated sprint performance. From our hypotheses, it was determined that ATM affects the repetitive sprint performance, especially the FS, TS and PC performance values of ATM applied in the evening are more effective than NM and SM protocols. In addition, the hypothesis that NM, SM and ATM protocols applied at different time intervals could produce different results on FS, TS and PC performance values was also confirmed.

When the literature is examined, there is no other study that tests and compares the results of 2 different massage protocols and these massage protocols at different times of the day on the same player group. Implementation of this procedure in the current study allows each massage protocol to produce different physiological and performance results. According to the findings of our study, it was determined that the ATM applied to futsal players in the evening had a positive effect on acute performance.

Although this study is the first to examine the acute effect of aromatherapy massage applied to young futsal players at different times of the day on repeated sprint performance, our findings are consistent with studies with similar characteristics examining the effects of repeated sprint performance at different times of the day. When the relevant literature is examined, intraday time differences of repetitive sprint performance have been investigated in previous studies, generally using bicycle ergometry exercise[15,18,43–45]. According to the results obtained, it was observed that the RST performance values of the athletes were lower in the morning than in the evening, and there were fluctuations in the morning and evening sprint performance values of the athletes[11,44,46]. In addition, it has been stated in other studies that the maximum short-term performances reach the lowest values in the morning and maximum values in the afternoon[47,48]. Pullinger (2014) stated that the daily change in repeated sprint performance on a non-motorized treadmill was in favor of sprint tests applied in the evening[20].

Our findings are consistent with studies with similar characteristics examining RST performance at different times of the day. However, when the relevant literature was examined, it was seen that there were no studies examining the effect of aromatherapy massage on RST performance, and our findings were compared with similar studies. Accordingly, our findings show contradictory results with studies examining the effect of massage on sprint performance. For example, it was determined that there was no significant difference between massage and warm-up combination, dynamic warm-up, massage and control groups in acceleration and sprint performance among four repetitive measurements [22]. In his study, Arabaci (2008) found that massage had negative effects on vertical jump, speed and reaction time[49]. It is argued that the massage applied to increase sprint performance does not significantly benefit sprint performance[50] and the effectiveness of pre-competition massage applications[22]. However, until scientific evidence is found that massage does not prevent speed performance, it can be psychologically beneficial for athletes[51], athletes should be aware that massage may not significantly affect their performance, but massage does not have a negative effect. Therefore, if it works for athletes, they should continue to use the massage application[52].

CONCLUSION

According to the results found in this study, it was determined that ATM affects the RST performance, especially the FS, TS and PC performance values of ATM applied in the evening are more effective than NM and SM protocols. Accordingly, the use of lavender oil, which is used among aromatherapy oils, during massage application by sports scientists, trainers and athletes can contribute to performance increase. However, more detailed studies are needed in order to obtain more precise results and to explain the contribution of ATM implementation to performance. It is thought that determining the physiological mechanism of ATM application will lead to future scientific studies.

Disclaimer: None.
Conflict of interest: None.
Source of funding: None

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