ATLANTIS PRESS

Advances in Health Sciences Research, volume 43

Conference on Interdisciplinary Approach in Sports in conjunction with the 4th Yogyakarta International Seminar on Health, Physical Education, and Sport Science (COIS-YISHPESS 2021)

The Effectiveness of Fitness Massage After Physical Activity and Sport Massage of Lower Extremities in Improving Range of Motion and Joint Function Scale of Futsal Athletes

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ABSTRACT

The study aimed at finding out the difference between sport massage (SM) and fitness massage after physical activity (FMPA) and the effectiveness of the SM and the FMPA in improving range of motion (ROM) and joint function scale of lower extremities. It used pre-experimental design of two-group pretest and posttest. Treatment was given three times, which were after 2 minutes, 15 minutes and 30 minutes. Forty samples were drawn from the population of 80 students majoring in sport science of the Faculty of Sport Science of Yogyakarta State University using purposive sampling. Additionally, it used geniometer and lower extremity functional scale (LEFS) as instruments. Data were analyzed using non-parametric statistical test with Kruskal-Wallis H (p<0.05). Pretest and posttest data were used to establish effectiveness in effectiveness test. The results of the analysis showed that the treatments of the SM and the FMPA improved the ROM and the joint function scale of the lower extremities (sig. <0.05), while the effectiveness of the SM was 0.60 (60%) and that of the FMPA was 0.63 (63%). The effectiveness of the SM in improving the joint function sale of the lower extremities was -0.30 (73%), while that of the FMPA was -0.33 (80%). Thus, it was concluded that the SM and the FMPA had significant impact on the improvement of the ROM and the joint function scale of the lower extremities, and the FMPA was more effective in improving the ROM and the joint function scale of the lower extremities than the SM.

Keywords: *massage, lower extremities, range of motion.*

1. INTRODUCTION

Sport is physical activity that involves repetitive body movement and aims at improving human fitness. The sport has been habitual every individual because physical activity that is continuously done in a good right way can improve human body fitness. Doing sport regularly was part of preventive effort in directly controlling the influencing factors of human health and represents the most functional health care (Santosa, G & Sidik, D, 2013: 24). Additionally, not only it results in physical fitness, but also it provides one with the opportunity to earn proud achievement.

Exercise is repetitive activity in a long period of time with gradual increase in exercise load. Exercise program is designed to improve athletes' physical performance by involving energy activation and repetitive muscular activity with gradual increase. A sequence of continuous and increasing exercise programs may cause athletes serious injury.

Futsal game poses a risk for injury because the game requires a lot of energy and strong physical condition. WHO's data showed that there were approximately 235 cases in 1000 games in which soccer athletes were at risk of injury because they play futsal (Sumadi, *et al.,* 2018). Meanwhile, futsal game data showed that there were 108 futsal players with minor injury in Indonesian Golden Cup Futsal Game (IGCFG 2015) and IOF (2015).

A five-season retrospective study of the etiology of injuries in the Spanish national futsal male team showed that the majority of the extrinsic injuries resulting from external trauma took place during official training. It was muscles that ranked first among the injuries (43.3%); thigh was the most frequently injured part, followed by the remaining parts of leg (12.6%), knee (10%), back (9.7%), ankle (6.15%), and foot (5.8%). More than 50% of the injuries were diagnosed as resulting from muscle overload and in the most cases (96.6%) the diagnosis was made after clinical assessment (Martinezriaza, *et al.,* 1017). Also, there were many futsal players suffering under muscle and joint stiffness that prevented the joint from widely moving and caused in turn less optimal performance.

Massage could alleviate muscle pain and tension and improve flexibility (Priyonoadi, 2011: 5). There are many kinds of massage to alleviate muscle and joint stiffness and also to improve the joint movement, such as sport massage and fitness massage after heavy physical activity (FMPA). The sport massage was a modified massaging technique for the purpose of providing athletes with health care and preparing them for competition (Graha, A. S., 2019: 11). The fitness massage after physical activity (FMPA) is human body recovering method that the body returns to its prima condition for coming physical activity. The manipulating treatment in the massage is conducted for the purpose of creating relaxing sensation, alleviating pain, recovering freshness, and reducing muscle pain.

2. METHOD

2.1 Participants

The study used pre-experimental design of two-group pretest and posttest because there was not any control group. Its subjects were assigned to two groups. Group I consisted of the subjects with sport massage (SM) treatment and Group II consisted of those with fitness massage after physical activity (FMPA) treatment. Pretest and posttest were carried out to find out the difference in gain score. The treatment was given three times, which were after 2 minutes, 15 minutes and 30 minutes after physical activity.

Assessment was conducted before and after the treatments. The population of the study included 80 students majoring in sport science of the Faculty of Sport Science of Yogyakarta State University who were the members of the futsal team of the students of sport science of the academic year of 2019 and 2020. Forty samples of the students were drawn using purposive sampling with certain criteria. Subsequently, they were assigned to two groups of 20 students using ordinal pairing method that the two groups were relatively similar.

2.2 Procedure

The study was conducted in February 26th, 2021 to July 26th, 2021 in the Faculty of Sport Science of Yogyakarta State University. It used geniometer, sport massage operational standard, the operational standard of fitness massage after physical activity, the operational standard of the measurement of range of movement and lower extremity functional scale (LEFS) as instruments.

2.3 Data Collection

Data were collected using measurement and test. The study was conducted in two meetings. The measurement and the test of the group with the SM treatment were carried out in the first meeting, while the measurement and the test of the group with the FMPA treatment were carried out in the second meeting. Once the subjects have done physical activity, the measurement of the ROM was carried out to hip joint for its flexion and extension, knee for its flexion and ankle for its dorsoflexion and plantar flexion and then the SM and FMPA treatments were given. The measurement was conducted three times, which were after 2 minutes, 15 minutes and 30 minutes.

2.4 Data Analysis

Non-parametric statistic test was used and if the results of normality text were not normally distributed, Kruskal-Wallis H discrimination test was carried out to establish the significance of the variable of break times of 2 minutes, 15 minutes and 30 minutes after physical activity and then sport massage (SM) and fitness massage after physical activity (FMPA) were given. Subsequently, the variables of the ROM of hip (flexion and extension), knee (flexion) and ankle (dorsoflexion and plantar flexion) were observed to establish the effectiveness of the treatments with the break times of 2 minutes, 15 minutes and 30 minutes after physical activity. Kruskal-Wallis H test is one of non-parametric methods to compare the mean of two samples or more, which were related or not paired.

TABLE 1. THE RESULTS OF THE STATISTICAL TEST OF THE SM GROUP

	Hip Flexion	Hip Extension	Knee Flexion	Dorsoflexion of Each Leg	Plantar Flexion of Each Leg
Kruskal-Wallis H	47.403	52.730	45.289	47.752	50.429
df	2	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000

The results of the statistical test summarized in table 1 show that the significance of the hip joint in the flexion ROM is 0.000 (sig. <0.05), that in the extension ROM is 0.000 (sig. <0.05), the knee joint in the flexion ROM is 0.000 (sig. 0.05), the ankle joint in the dorsoflexion ROM is 0.000 (sig. <0.05), that in the plantar flexion ROM is 0.000 (sig. <0.05).

TABLE 2. THE RESULTS OF THE STATISTICAL TEST OF THE FMPA GROUP

	Hip Flexion	Hip Extension	Knee Flexion	Dorsoflexion of Each Leg	Plantar Flexion of Each Leg
Kruskal-Wallis H	51.581	53.698	52.891	48.078	53.512
df	2	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000

The results of the statistical test summarized in table 2 show that the significance of the hip joint in the flexion ROM is 0.000 (sig. <0.05), that in the extension ROM is 0.000 (sig. <0.05), the knee joint in the flexion ROM is 0.000 (sig. <0.05), the ankle joint in the dorsoflexion ROM is 0.000 (sig. <0.05), the ankle joint in the plantar flexion ROM is 0.000 (sig. <0.05).

TABLE 3. REULTS OF THE PAIRED T-TEST OF THE SM AND FMPA GROUPS

	PostMKPAF-PreMKPAF	PostSM - PreSM
Z	Post-FMPA- Pre-FMPA	Post-SM-Pre-SM
Asymp. Sig. (2-tailed)	-3.929[b]	-3.930[b]

The results of the statistical test summarized in table 3 show that the 2-tailed significance resulting from the paired t-test of the FMPA is 0.000 (sig. <0.05) and that of the SM is 0.000 (sig. <0.05).

TABLE 4. THE EFFECTIVENESS SCALE OF JOINT MOVING FUNCTION

Variabel	Σ(pre-treatment)	Σ(post-treatment)	Joint Movement	Percentage
MKPAF	0.42	0.75	-0.33	80%
MO	0.42	0.72	-0.30	73%

The increase in the joint moving function scale resulting from the FMPA treatment is -0.33 (80%) and that resulting from the SM treatment is -0.30 (73%).

The results of the comparison of the effectiveness of the SM and FMPA treatments are summarized in table 5 below:

TABLE 5. THE EFFECTIVENESS OF THE SM AND THE FMPA IN 2 MINUTES

Variabel	ROM	SM	MPKAF
Hip	Flexion	0.2	0.25
	Extension	0.29	0.37
Knee	Flexion	0.19	0.46
Ankle	Dorsoflexion	0.72	0.51
	Plantar Flexion	0.09	0.26
Difference	Mean	0.29	0.37

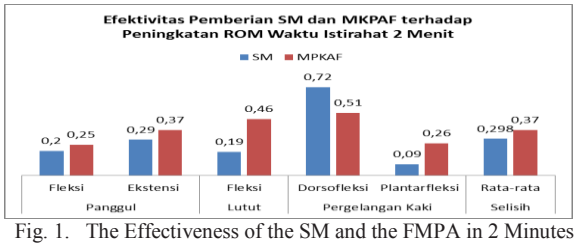

Fig. 1. The Effectiveness of the SM and the FMPA in 2 Minutes

TABLE 6. THE EFFECTIVENESS OF THE SM AND THE FMPA IN 15 MINUTES

Variabel	ROM	SM	MPKAF
Hip	Flexion	0.17	0.32
	Extension	0.33	0.35
Knee	Flexion	0.16	0.16
Ankle	Dorsoflexion	0.81	0.16
	Plantar Flexion	0.07	0.33
Difference	Mean	0.30	0.26

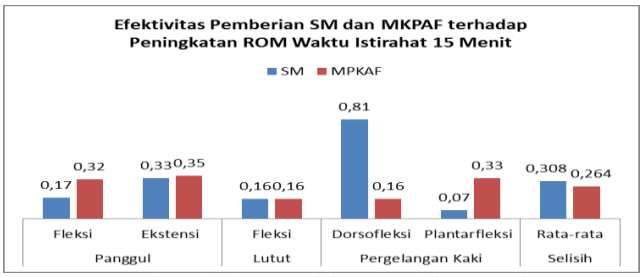

Figure 2. The Effectiveness of the SM and the FMPA in 15 Minutes

TABLE 7. THE EFFECTIVENESS OF THE SM AND THE FMPA IN 30 MINUTES

Variabel	ROM	SM	MPKAF
Hip	Flexion	0.37	0.56
	Extension	0.62	0.72
Knee	Flexion	0.35	0.62
Ankle	Dorsoflexion	1.52	0.67
	Plantar Flexion	0.16	0.59
Difference	Mean	0.60	0.63

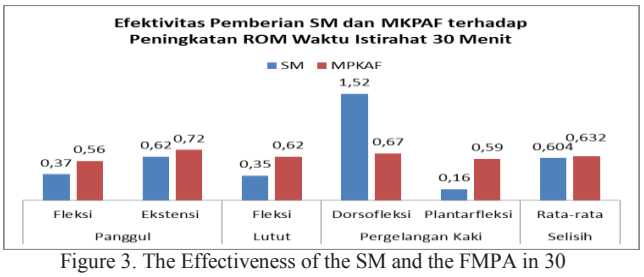

Figure 3. The Effectiveness of the SM and the FMPA in 30 Minutes

The mean percentages of the ROM effectiveness in the SM and FMPA treatments summarized in table 7 show that 1) the percentage of the increase in the SM in the second minute is 0.29% and that in the FMPA is 0.37%, 2) the percentage of the increase in the SM in the 15th minute is 0.30 and that in the FMPA is 0.26%, and 3) the percentage of the increase in the SM in the 30th minute is 0.60% and that in the FMPA is 0.63%.

3. DISCUSSION

If someone does physical exercise, the physical exercise may result in fatigue and even injury. The fatigue may be observed in panting, excessive sweating, difficulty to move body and contracting muscle. Excessive physical exercise can also result in muscle injury and damage. Additionally, uncontrolled physical exercise can cause muscle damage, inflammation, pain, and decrease in range of motion (ROM).

Contracting muscle results among others from the accumulation of metabolic residual substances that can not be quickly excreted or further processed into energy. Lactic acid is one of the indicators of fatigue observable in blood by drawing blood sample and examining the blood sample in laboratory to find out the lactic acid content. The lactic acid accumulating in muscles could hamper anaerobic glycolysis process (Sudargo, *et al.,* 2012: 11).

Other literature describes that muscular pain may result from the accumulation of lactic acid in blood and muscles. The increase in the lactic acid content could influence enzymatic activity in ATP producing process and it could cause fatigue (Hartono, *et al.,* 2012: 204). Lactic acid balancing mechanism in muscles and blood could be significantly influenced by lactic acid excreting mechanism from the muscles into blood, the increase in blood flow that transported the lactic acid to liver, heart and skeletal muscles (Hartono *et al.,* 2012: 204). Thus, it can be concluded that all of the processes are the condition for smooth distribution of blood to entire body. The smooth distribution of the blood to all of body organs will accelerate metabolic process so that there is abundant oxygen (O_2) supply for muscles and it will in turn accelerate lactic acid metabolism in liver through Krebs cycle into energy.

Massage is one of the treatments to decrease the lactic acid content. The results of the study by Ilmi, M. A. (2018: 1412-1433) showed that sport massage manipulating treatment after eccentric activity could decrease pain intensity. Sport massage is touching and pressing technique of body parts to influence nervous system and muscles that they become more relaxed and can work and function maximally. The sport massage enabled smooth blood circulation in muscles and body organs and could also result in smooth circulation of lymph (Roepajadi, 2015: 1). The results of the study by Juchli, L., R. M. T. (2021) showed that massage could alleviate pain and functional disorder of patients with plantar fasciitis. Kasmadi & Kafrawi, F. R. (2017) (2017: 17-24) suggested that 10 minutes sport massage manipulation had significant impact on the decrease in blood lactic acid content after anaerobic exercise (37.5%). Hindle, *et al.* (2012: 111) in an international journal described that PNF stretching was effective in maintaining and improving ROM, strengthening muscle and increasing muscle explosive power, and improving athletes' performance, especially after physical exercise. Andrew Vickers, *et al.* (2001: 202-204) suggested that strong pressure in massage manipulation could improve blood circulation or relax muscles and stiff joints, while softer massaging technique could be relaxing and calming. Massage was useful in relaxation and alleviated muscle pain and anxiety (Vickers, *et al.,* 2001: 202-204).

The results of the study by Ali in 2016 showed that *frirage* massage could improve range of motion and decrease creatine kinase content in ankle and knee. There was significant improvement of the range of motion of the ankle and the knee in therapeutic exercise treatment group. Meanwhile, the creatine kinase content of the ankle and the knee increased after the therapeutic exercise. There were significant improvement of the range of motion of the ankle and the knee and the decrease in the creatine kinase content in the combined *frifage* massage and therapeutic exercise treatment group. Hindle, *et al.* (2012: 111) described that PNF stretching was effective in maintaining and improving ROM, strengthening muscles, increasing muscle explosive power, and improving athletes' performance, especially after physical exercise. Static stretching is effective in improving ROM. The most significant improvement of the ROM took place with the static stretching for 15 and 30 seconds (McHugh, *et al.,* 1992: 1375-1382). Meanwhile, Bandy, W. D. and Irion, J. M. (1994: 845-850) suggested that 10 to 30 seconds were enough to improve flexibility. Static, dynamic and pre-contraction stretching are effective methods to improve muscle flexibility and extensibility, but the methods may be more effective in certain population. Some authors have noted individual response to stretching. Therefore, it is necessary to individually adapt stretching program. Dalrymple *et al.* (2010: 149-155) suggested that passive ROM exercise strengthened muscles of patients with stroke (Agusrianto & Rantesigi, N., 2020: 61).

ROM exercise is done to maintain or to improve joint movement in normal and complete way and to increase muscle mass and tonus. The ROM exercise is usually done for semi coma and unconscious patients, patients with mobility constraint unable to do some or all of independent movements, totally bed rest patients or patients with totally paralyzed extremity. It aimed at maintaining muscle strength, joint mobility, stimulating blood circulation and preventing malformation (Bakara, D. M. & Warsito, S., 2016: 12-18).

4. CONCLUSION

SM had significant impact on the improvement of the ROM of lower extremity. FMPA had significant impact on the improvement of the ROM of lower extremity. The FMPA was more effective in improving the ROM of the lower extremity than the SM.

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