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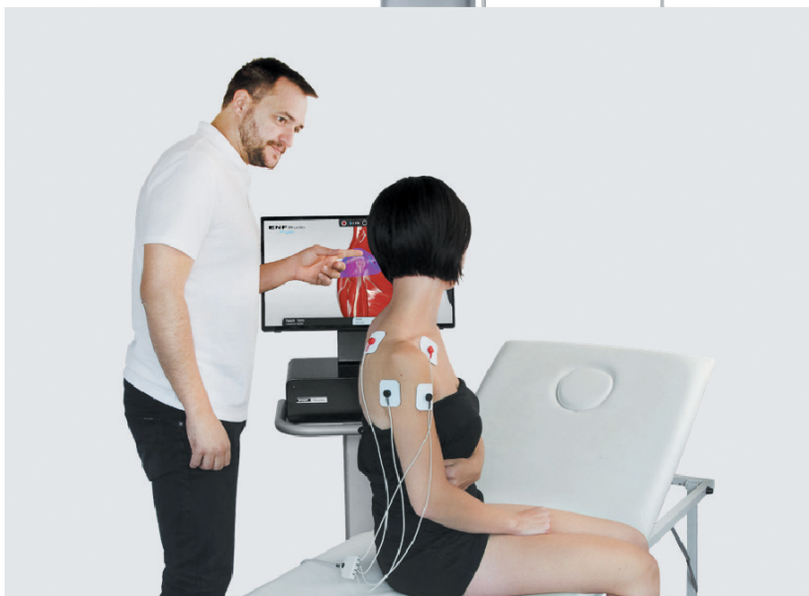

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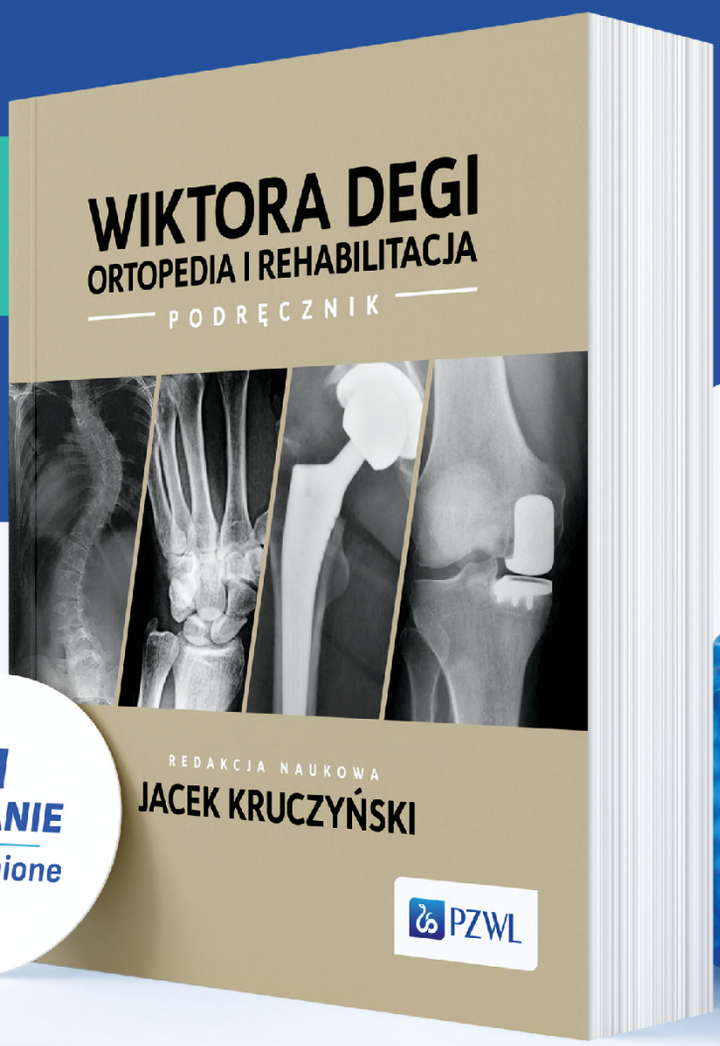

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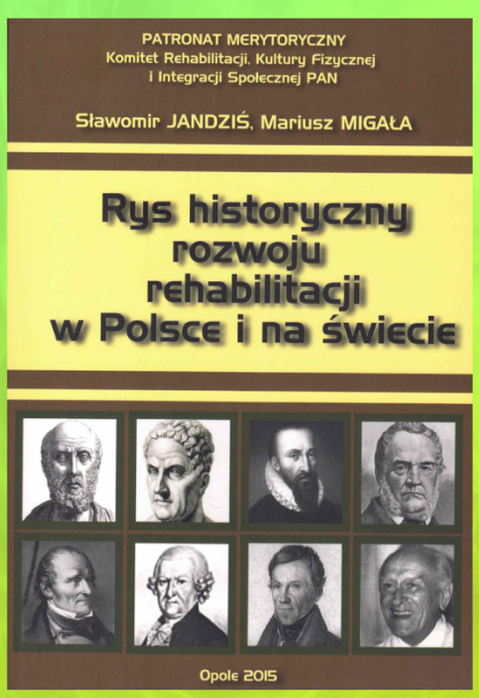

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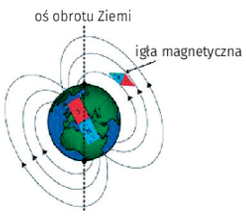

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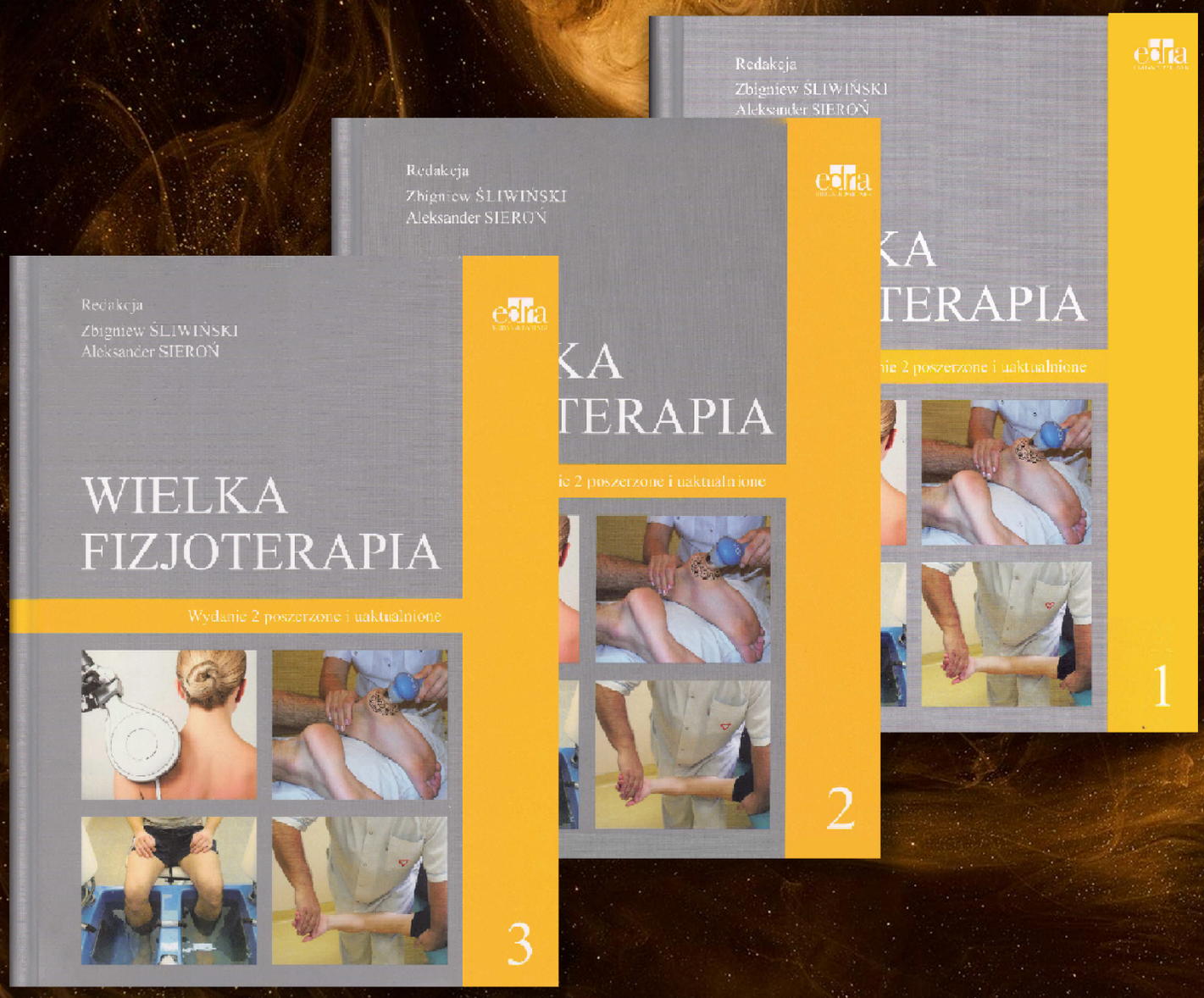

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Rhythmic physical activity to improve the motor abilities of junior students-athlete in gymnastics: randomized control trial

Rytmiczna aktywność fizyczna w celu poprawy zdolności motorycznych młodszych uczniów-sportowców w gimnastyce: randomizowane badanie kontrolowane

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Abstract

This study aims to investigate the effect of Rhythmic Physical Activity (RPA) on enhancing the motor abilities of junior athlete-students enrolled in gymnastics courses at the university level.

Materials and Methods. This study employed a randomized control trial method conducted over an 11-week period. A total of 29 junior athlete-students from Singaperbangsa State University Karawang (Indonesia) in their first year were involved. They were divided into the CON (n = 14) and RPA (n = 15) groups. Instruments to measure motor abilities included the standing long jump, handgrip strength, seated straddle stretch, foot tapping, and an obstacle course taken in reverse. Paired sample t-tests were employed to examine the differences in motor abilities scores at both the baseline and post-intervention stages for the CON and RPA groups.

Results. The primary findings indicated that RPA significantly impacted motor ability components. These components were the standing long jump ($p \leq 0.05$, $d = -1.97$), handgrip strength ($p \leq 0.05$, $d = -2.30$), seated straddle stretch ($p \leq 0.05$, $d = -1.02$), foot tapping ($p \leq 0.05$, $d = -2.00$), and the reverse obstacle course ($p \leq 0.05$, $d = -1.26$). For the CON group, the results related to the standing long jump ($p \geq 0.05$, $d = -0.26$), handgrip strength ($p \geq 0.05$, $d = -0.13$), seated straddle stretch ($p \leq 0.05$, $d = -0.66$), foot tapping ($p \geq 0.05$, $d = 0.12$), and reverse obstacle course ($p \geq 0.05$, $d = -0.21$).

Conclusions. The results underscore the significance of employing RPA to bolster the motor abilities of junior student-athletes in their first year at the university level.

Keywords:

rhythmic physical activity, motor abilities, gymnastics

Streszczenie

To badanie ma na celu zbadanie wpływu rytmicznej aktywności fizycznej (RPA) na poprawę zdolności motorycznych młodszych studentów-sportowców uczęszczających na kursy gimnastyki na poziomie uniwersyteckim.

Materiały i metody. Badanie to wykorzystało metodę randomizowanej próby kontrolnej przeprowadzonej przez okres 11 tygodni. W sumie wzięło w nim udział 29 młodszych studentów-sportowców z Państwowego Uniwersytetu Singaperbangsa w Karawang (Indonezja), którzy byli na pierwszym roku studiów. Zostali podzieleni na grupy kontrolną CON (n = 14) i badaną RPA (n = 15). Narzędzia do pomiaru zdolności motorycznych obejmowały skok w dal z miejsca, siłę chwytu ręki, rozciąganie w siedzeniu na rozkroku, tupanie oraz tor przeszkód pokonany w odwrotnej kolejności. Testy t dla par próbek zostały użyte do zbadania różnic w wynikach zdolności motorycznych zarówno na etapie początkowym, jak i po interwencji dla grup CON i RPA.

Wyniki. Główne ustalenia wskazują, że RPA miało znaczący wpływ na składowe zdolności motorycznych. Te składowe to skok w dal z miejsca ($p \leq 0,05$, $d = -1,97$), siła chwytu ręki ($p \leq 0,05$, $d = -2,30$), rozciąganie w siedzeniu na rozkroku ($p \leq 0,05$, $d = -1,02$), tupanie ($p \leq 0,05$, $d = -2,00$) oraz tor przeszkód w odwrotnej kolejności ($p \leq 0,05$, $d = -1,26$). Dla grupy CON wyniki dotyczyły skoku w dal z miejsca ($p \geq 0,05$, $d = -0,26$), siły chwytu ręki ($p \geq 0,05$, $d = -0,13$), rozciągania w siedzeniu na rozkroku ($p \leq 0,05$, $d = -0,66$), tupania ($p \geq 0,05$, $d = 0,12$) oraz toru przeszkód w odwrotnej kolejności ($p \geq 0,05$, $d = -0,21$).

Wnioski. Wyniki podkreślają znaczenie stosowania RPA w celu wzmocnienia zdolności motorycznych młodszych studentów-sportowców na pierwszym roku studiów uniwersyteckich.

Słowa kluczowe:

rytmiczna aktywność fizyczna, rytmiczna aktywność fizyczna, gimnastyka

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Introduction

Basically, students-athletes have a dual role at the University level as students and professional athletes who have achievement in every type of sport [1], including gymnastics. Gymnastics is a sport that has energetic movements such as jumping, spinning, maintaining body balance [2, 3]. Therefore supporting factors are needed in order to display performance good at gymnastics. Data from previous studies showed that in order to gain success in gymnastics or competitive sports, it was needed guidance and improvement concerning psychological, technical, tactical or motor skills [4]. Among these criteria, motor abilities is considered the most important quality to determine students-athlete's competitive ability.

Motor abilities is an important element for junior students-athletes to support their performance in competitive sports [5, 6]. Motor abilities is currently a global issue and get attention from coaches and junior students-athletes in the worldwide [7, 8]. Basically, motor abilities can be interpreted as a biomotor skills such as strength, endurance, speed [9], balance and flexibility [10, 11, 12]. Possessing high motor abilities could support student-athletes perform movements such as running quickly [13], and being agile, jumping higher [8], good flexibility, balance and endurance. Data from previous studies reported that high motor abilities can help junior students-athletes to perform well [14, [15], and have the opportunity to win a competition [6]. Conversely, student athletes with low motor abilities are related to poor performance and minimal achievement [16]. Considering the important role of motor abilities for junior students-athletes in competitive sports including gymnastics, it is needed to conduct physical activities that could develop motor abilities among junior students-athletes.

Rhythmic physical activity (RPA) is a strategy that has an impact on the development of human movement, especially students-athletes. RPA can be interpreted as a physical activity accompanied by music [17, 18]. Basically, a physical activity using the rhythm of music will trigger the training process much more fun and encourage the enthusiasm of students-athletes.

According to Vazou, Klesel, Lakes & Smiley [19], that physical activity with rhythm or music is an important component in a training process, because it has several positive impacts, including stimulate cognitive and motor development. In addition, recent data has documented the benefits of using RPA, such as being able to develop motor skills and creativity so that it is proven to have an impact on increasing components of physical fitness [20]. Likewise with the report from Solomons, Kraak, Kidd & Africa [10], in his research that using RPA on 54 rugby players showed that their biomotors increased significantly. Another study revealed that rhythmic physical activity can be an effective way to improve fundamental movement skills [17], and strength [21].

There had been extensive international research on RPA. However, there was still a lack of evidence on the effect of RPA on improving motor abilities among gymnastics junior students-athletes in university-level courses. Due to this gap, we presented a novelty in terms of analyzing the effects of RPA through an 11-week randomized controlled trial. Thus, the purpose of our study was to analyze the effect of the RPA on increasing motor abilities among junior athlete-students in gymnastics courses at university-level.

Materials and Methods

There were 33 junior level student-athletes attended gymnastics classes in their first year at Singaperbangsa State University, Karawang (Indonesia). They were selected from a total of sixty-three student-athletes based on inclusion criteria, namely: healthy or had no ankle injuries and having an interest in becoming participants. Participants who did not meet these criteria were excluded from the study. Thus, from the selection results, 30 participants were allocated to the control group (CON) (n = 15) and rhythmic physical activity (RPA) (n = 15). However, at the intervention stage, 1 woman from the CON class withdrew, so that only 29 participants completed the study with details: CON class (n = 14; male = 10; female = 4) and rhythmic physical activity (n = 15; male = 10; female = 5) (CONSORT see Fig. 1). Meanwhile, the characteristics of the participants are presented in Table 1.

Table 1. Characteristics of Participants

Characteristics	CON (n = 14)	RPA (n = 15)
Age [year]	19.07 ± 0.61	19.67 ± 0.72
High [cm]	160.86 ± 3.82	162.20 ± 3.40
Weight [kg]	55.14 ± 2.71	57.80 ± 4.16
BMI [kg/m^2]	21.37 ± 4.18	20.39 ± 3.52

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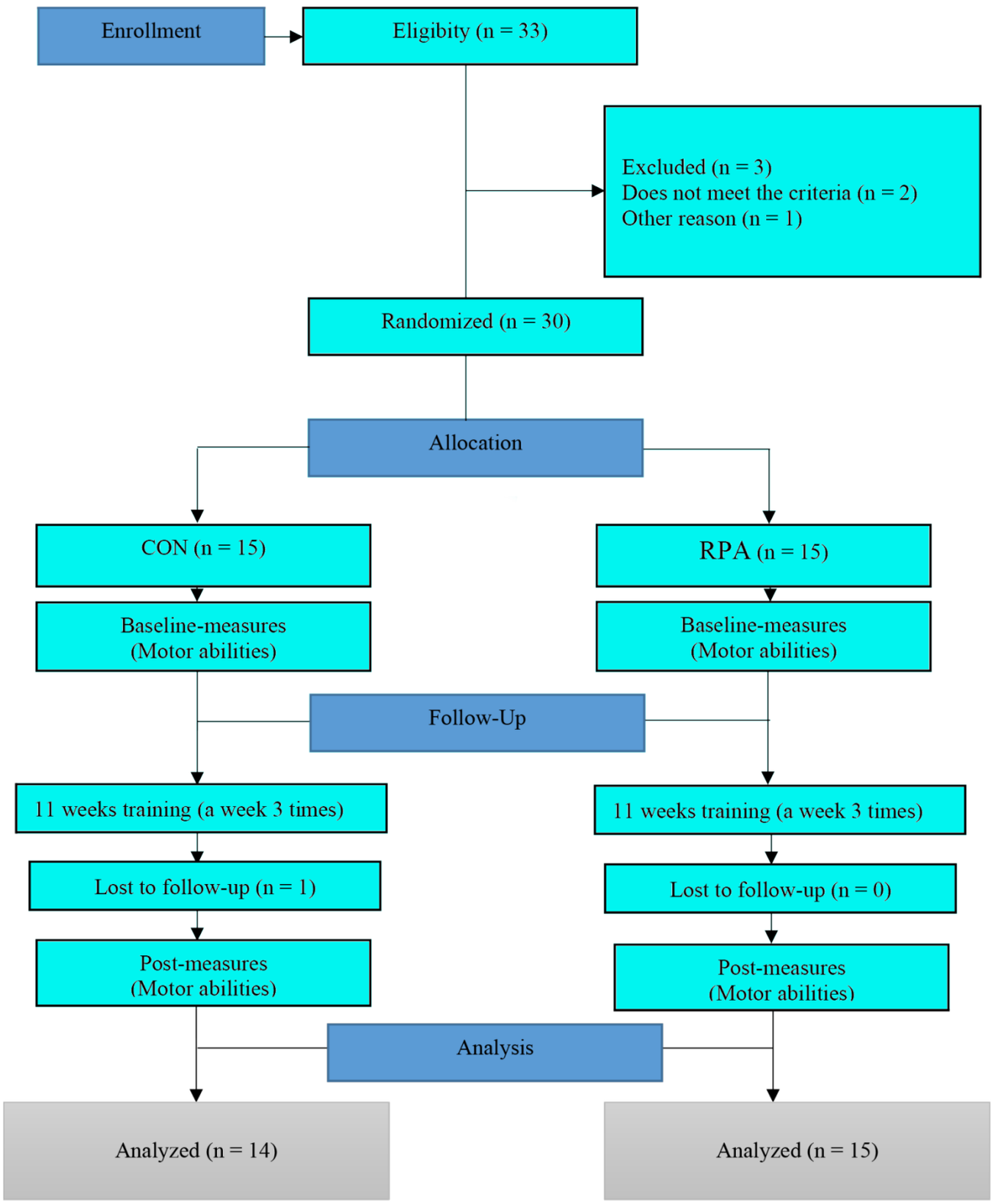

Figure 1. CONSORT flow chart

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Instruments
Instruments for measuring the level of motor abilities among junior students-athletes adopt test batteries from previous studies [22], which are presented in Table 2.

Table 2. Instruments Motor Abilities

Test name	Measuring unit	Objective
Standing long jump	cm	Explosive strength
Handgrip strength	kg	General strength
Seated straddle stretch	cm	Flexibility
Foot tapping	freq	Speed
Obstacle course backwards	0.1 s	Coordination

Procedures
This research was conducted from May to July 2023 at Singaperbangsa Karawang State University (Indonesia) with approval number: 0234/UNSIKA-05/2023. In the first meeting (03 May 2023) all participants carried out baseline-measures, namely motor abilities from 09.00 until finished. In the second meeting on May 5 2023 the participants in the CON group carried out their usual daily exercise lecture activities and the experimental group carried out RPA and this activity was carried out until the 10th week (July 15 2023). Then in week 11 (July 19 2023) all participants carried out the posttest activity, namely the motor abilities test. All activities in this research follow the Helsinki Declaration for Humans which is implemented at Singaperbangsa Karawang State University.

Intervention RPA
This study using a protocol involving RPA as an intervention in the experimental group. The activities were carried out in the morning from 08.00-09.00 in the field of Universitas Singaperbangsa Karawang (Indonesia), namely on Wednesdays, Fridays and Saturdays. Before the RPA was carried out, all participants (junior student-athletes) were given 5 minutes to warm up. Then, RPA was carried out for 50 minutes, and finally cool-down for 5 minutes. The RPA program is presented in Table 3.

Table 3. RPA program

Movement type	Song	Duration	Rest
Walking, jumping,	Danza kuduro	4 min	1 min
Standing on a single leg, turning	Be your good friend	4 min	1 min
Mountain climbers, leaping	Blinding lights	4 min	1 min
Squat raise, walking	Poker face	4 min	1 min
Walking backwards, v-step	Crazy in love	4 min	1 min
Inchworms, running	Baby one more time	4 min	1 min
Plank jack, knee up	Just dance	4 min	1 min
Walking sideways, rotating	Keep moving	4 min	1 min
Heel touch, double lunge	Shape of you	4 min	1 min
Leg curl, forward and backwards	Dance monkey	4 min	1 min

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Statistical analysis

Motor abilities data were analyzed through the statistical application IBM SPSS v.25.0. Descriptive statistic was presented in terms of mean and standard deviation. Data normality was analyzed by Shapiro-Wilk. Data normally distributed used Paired sample t-test for parametric test to analyze the differences scores in the motor abilities between CON and RPA groups at the baseline and post-intervention stages. Meanwhile, abnormal data distribution used Mann-Whitney U tests for non-parametric test. The effect size in these two groups referred to following criteria: (i) trival: 0.00-0.19, (ii) small effect: 20-49, (iii) moderate effect: 50-79, (iv) large effect: 0.80 ≥ (Hu, Jiang, Ji, Pang & Liu, 2020). The significance level was 0.05.

Results

Based on the study results, it was proven that the data for each variable were normally distributed ($p \geq 0.05$).

Table 4 shows that RPA has a significant effect on the motor skills components related to standing long jump ($p \leq 0.05$, $d = -1.97$), handgrip strength ($p \leq 0.05$, $d = -2.30$), seated straddle stretch ($p \leq 0.05$, $d = -1.02$), foot tapping ($p \leq 0.05$, $d = -2.00$), obstacle course backwards ($p \leq 0.05$, $d = -1.26$). Whereas in CON, the components of standing long jump ($p \geq 0.05$, $d = -0.26$), handgrip strength ($p \geq 0.05$, $d = -0.13$), seated straddle stretch ($p \leq 0.05$, $d = -0.66$), foot tapping ($p \geq 0.05$, $d = 0.12$) and obstacle course backwards ($p \geq 0.05$, $d = -0.21$).

Table 4. Differences in motor abilities scores between the two groups at the baseline and post-intervention stages

Variable	Variable	Motor skills	CON (n = 14)	RPA (n = 15)
Standing long jump [cm]	Baseline		142.00 ± 5.32	139.47
	Post-intervention		142.50 ± 5.69	157.20
	t		−0.959	−7.615
	p-value		0.355	0.000
	Cohen's (d)		−0.26	−1.97
Handgrip strength [kg]	Baseline		23.21 ± 1.96	22.87 ± 1.76
	Post-intervention		23.50 ± 3.00	39.40 ± 6.46
	t		−0.486	−8.894
	p-value		0.635	0.000
	Cohen's (d)		−0.13	−2.30
Seated straddle stretch [cm]	Baseline		44.21 ± 7.01	42.67 ± 6.16
	Post-intervention		45.07 ± 7.38	51.33 ± 7.40
	t		−2.482	−3.961
	p-value		0.028	0.001
	Cohen's (d)		−0.66	−1.02
Foot tapping [freq]	Baseline		14.64 ± 1.49	13.53 ± 0.99
	Post-intervention		14.50 ± 1.60	19.87 ± 3.39
	t		0.458	−7.720
	p-value		0.655	0.000
	Cohen's (d)		0.12	−2.00
Obstacle course backwards [0.1 s]	Baseline		145.50 ± 8.30	142.87 ± 7.93
	Post-intervention		146.14 ± 9.55	152.53 ± 9.34
	t		−0.788	−4.882
	p-value		0.445	0.000
	Cohen's (d)		−0.21	−1.26

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Discussion

Our research aims to investigate the effect of RPA on increasing motor abilities among junior students-athlete studied physical education in gymnastics class at university-level.

The main finding in this study showed that RPA had proven effective in increasing the motor abilities component. In addition, another finding from this study demonstrated that the RPA group had a larger effect size than CON group. This is because the RPA program provided a lot of movement experiences for junior student-athletes, for example the type of movement in plank jacks, knee ups can be the right way to improve motor skills components related to speed or heel touch and double lunges were used to improve strength components of lower leg muscles. This is in line with the findings of previous studies which reported that by providing motion practice (e.g., jumping, running and kicking) aimed at developing ability would certainly increase motor abilities [17]. Basically RPA provided advantages in terms of presenting a series of fun activities because it is accompanied by music [19], and challenges motor abilities, a sense of rhythm for junior students-athletes [18]. Other findings reported that by implementing RPA for 6 weeks was proven improve physical fitness (e.g., strength, endurance and flexibility) [23]. Russo et al [24], explained that in order to show good performance in gymnastics, it was needed to train and improve flexibility, leg strength, coordination and balance among junior student-athletes through RPA. Similar with Mulyaningsih, Suherman, Sukoco & Susanto [25], revealed that the combination between RPA and energetic music can trigger junior student-athletes to actively move and ultimately improve flexibility or other motor skills. In addition, RPA allows muscles, tendons and ligaments to move, so that flexibility, balance, muscle strength, coordination can increase gradually [10, 26], and in the end provide great advantages for junior student-athletes gain high achievement in gymnastics [27, 28, 29].

Finally, the uniqueness and novelty of our research was RPA has become an effective tool in gymnastics class to improve motor abilities components among junior student-athletes at the university level through an 11-week randomized control trial.

Conclusion

In conclusion, we highlight the importance of implementing RPA which has a positive impact on improving the motor abilities components of junior students-athletes. This study contributes as important information for teachers, lecturers, trainers and junior student-athletes in fostering and developing motor skills through RPA in the future. However, this study is limited by the sample size which involved a few numbers of junior students-athletes from one university in Indonesia. Further research using many junior students-athletes from several universities and comparing RPA with other kind of competitive sports is needed to conduct.

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