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Plyometric Standing Jumps and Box Drills to Improve Momtong Dollyo Chagi Kick in Junior Taekwondo Athletes

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Abstract This study aims to determine the effect of plyometric and flexibility training methods to improve the momtong dollyo chagi kick technique in taekwondo athletes. The effect of training programs that combine physical conditions specifically has no results stating that they are interrelated to improve taekwondo kick techniques. The research method used is experimental treatment by level 2 x 2. The results of this study: firstly, there are differences in the leg power of momtong dollyo chagi kicks for taekwondo athletes in the plyometric standing jump and box drill training methods with the results Fo (A) = 12,111 > F-table 4,11. Interaction Fo (AB) = 14,044 > F-table = 4,11 with the percentage effect of plyometric and flexibility exercises of 33.83%. Plyometric standing jump exercise is better for increasing leg power of momtong dollyo chagi kick than box drill exercise for athletes who have high flexibility with t_0 16,496 > $t_{table(0,05:10)}$ 1,688. Box drill exercises are better for increasing the leg power of momtong dollyo chagi kicks than standing jump plyometric exercises for athletes who have low flexibility with a value of t_0 2,455 > $t_{table(0,05:10)}$ 1,688. Thus, it can be concluded that both standing jump plyometric exercises and box drill combined with flexibility can have the effect of increasing leg power, so that the trainer can choose a power and strength training program through plyometric training to prepare for the competition.

Keywords Plyometric Standing Jump and Box Drill, Flexibility, Leg Power, Taekwondo

1. Introduction

Training is a process to improve the skills, knowledge of sports, or the athlete's physique from the training program created by the coach. The frequency of exercise that is done repeatedly will be able to improve skills or biomotor according to the programmed training load. Skill training has the potential to improve cognitive antecedents of exercise [1]. Exercise is beneficial and valuable to the promotion of physical fitness and health [2]. Sports activities made their exercise a habit to protect their health in daily life [3]. Exercise and life satisfaction levels increase the academic achievement of students [4]. That age, sex, the frequency of doing sports, and regular sporting affected exercise addiction [5]. Olympic weightlifting and plyometrics can provide similar or

greater performance adaptations [6]. Technical and physical exercises have benefits to improve physical fitness. In addition, training activities can also be used as daily activities, so that they can improve the quality and breadth of one's life in addition to providing achievements to athletes.

Participation to an exercise becomes a planned activity. Performance improvement continues to be carried out gradually, tieredly, and continuously because achievement is not obtained instantly but requires a long process. Some training programs aim not only to improve biomotor but also psychology, because of the coach's awareness of the importance of mental training of athletes. Appropriate sports/games behaviors and decreased inappropriate behaviors in a physical education setting [7]. Experiences on social and emotional learning to be included in teacher education programs in helping newly qualified teachers to handle the emotional aspects[8]. Some studies also explain that athletes or coaches need to control their emotions during matches so that pressure can be controlled. Exercises to control emotions can be done through simulation games or Classroom-management strategies to describe the situation on the field during a match. Social-Emotional Learning on regularly to foster positive learning environments, social-emotional competencies, and academic learning for all students [9]. The effects of confidence-building strategies on the students' emotional resilience concerning failure and the pedagogical skills are needed to facilitate this learning process [10].

In addition to technical and tactical training, the trainer must also implement a program to improve aspects of physical condition, for example (strength, endurance, speed, power, etc.). Use music during strength workouts to have a better strength endurance performance [11]. A learner-centered, inquiry-based approach to coaching swimming is grounded in two specific examples of theory in action [12]. Resistance-training program sets configurations to induce similar changes in bench press 1-repetition maximum, bench press throw peak velocity against 30 kg [13]. The balance and respiration training affected the respiration function capacity and muscle activity [14]. Coaches and team conditioners can program the balance and isokinetic strength training of athletes volleyball [15]. Classroom lessons, strength and conditioning sessions, and on-court lessons, to integrate a mental skills training program in high-performance youth sports environments [16]. That octacosanol supplementation reduced negative cholesterol and oxidative stress levels during taekwondo training, making it a potential therapeutic intervention to improve physiological function and prevent metabolic dysfunction in these athletes [17]. Sets and reps are key in strength training. Strength training has a characteristic that the repetitions are few but the load is maximum so that several times the strength aspect of the exercise can be increased significantly.

Physical adaptation is needed to produce a good performance in sports. To achieve maximum performance, the physical and physiological adaptation of an athlete in training will increase over time. In strength training, some training models can also be applied to certain sports such as martial arts. Strength and anaerobic power characteristics of taekwondo and karate athletes were compared, a difference was found between the two branches by different competition times, training programs, training methods, and physical requirements of the branches [18] [19]. In black-belt taekwondoists, specific taekwondo movements and simulated fights twice a week for 6 weeks provide tiny additional gains on key performance parameters [20]. The international-level Taekwondo competition elicited near-maximal cardiovascular responses, high blood lactate concentrations, and increases in competitors' rating of perceived exertion across combat [21]. Respiratory muscle training increased the aerobic and anaerobic strength capacity in adolescent taekwondo athletes [22]. Long-term whole-body vibration training has positive strength, flexibility and agility applied for 10-week in taekwondo athletes [23]. That a 12-week taekwondo training given to the children in the 7-10 age group has increased the body coordination and strength-agility levels of the girls and boys [24]. Taekwondo kicks are performed with high power, athletes can use ballistic, plyometric, and training-based in velocity to improve performance [25]. The exercise program in the studies conducted generally examines the effects of exercise methods to improve cardiovascular or anaerobic performance. However, the effect of training methods by combining physical conditions specifically has no results that state that they are interrelated to improve kicking techniques in taekwondo sports. Therefore, the purpose of this study was to determine the differences in plyometric exercises applied in improving kick techniques in taekwondo

2. Method

The experimental method is defined by the manipulation of independent variables and the measurement of dependent variables, extraneous variables are either controlled or allowed to vary randomly [26]. The method used in this study is an experimental method with a factorial threat by level design. In a factorial design the influences of all experimental variables, factors, and interaction effects on the response or responses are investigated [27]. The variables in this study are one dependent variable and two independent variables. As the dependent variable, the leg power of momtong dollyo chagi kicks (Y) and the two independent variables (independent variables) are plyometric training as an experimental variable (A) and flexibility (B) as an attribute variable. The plyometric exercise treatment variable (A)

was divided into two, namely standing jumps (A1) and box drills (A2). Attribute variables (B) are divided into two types, namely high flexibility (B1) and low flexibility (B2). The groups for each variable are A1B1 and A2B1 for high flexibility and A1B2 and A2B2 for low flexibility. The plyometric exercise treatment applied to each group was carried out for 8 weeks with 2 sessions per week.

Participants who became the experimental sample amounted to 42 junior taekwondo athletes and were divided into two groups based on flexibility. Of the 42 samples whose flexibility was measured, they were then divided into 2 groups (21 high flexibility and 21 low flexibility). The high flexibility group was divided into 2 groups using the standing jump and box drill training methods, while the low flexibility group was also divided into 2 groups with the same exercise method. Thus, four groups were consisting of two taekwondo groups with high flexibility (A1B1 and A2B1) and two taekwondo groups having low flexibility (A1B2 and A2B2). The experiment was carried out for 12 meetings (twice in one week). The data of this study were obtained based on the splits test to determine the athlete's flexibility. Splits exercise to assess flexibility in the athlete muscles of the hip joint. Leg power is measured by the athlete kicking on a punching pad that has a sensor installed. If the punching Pad has been kicked, the display will display the power, force, and speed values of the kick. Sit and Reach test cut-off scores for 6–12 years old are 8 and 9 inches for boys and girls, the Double-Leg Sit-and-Reach in that it is a test of hamstring flexibility [28] [29]. The experimental sample grouping matrix can be seen in the table below. Leg power data retrieval is recorded with a device called kicking power. Next, analyze the 2-way ANOVA data using SPSS version 21.

Table 1. Experimental Research Design Treatment By Level 2 x 2

Plyometric (A) / Flexibility (B)	Standing Jumps (A1)	Box Driils (A2)
High Flexibility (B1)	10	10
Low Flexibility (B2)	11	11
Total	21	21

3. Results

The data that will be displayed in the results of this study will answer the hypothesis according to the research design above. The results of the study will discuss the athlete's flexibility as an attribute variable to determine the high and low groups. Furthermore, the results of the study will answer the hypothesis, namely: there is an effect of the exercise method on the leg power ability of momtong dollyo chagi kicks for taekwondo athletes, there is an interaction between training methods, flexibility, and momtong dollyo chagi kicks. There are differences in the plyometric standing jump and box drill exercises on the ability to kick momtong dollyo chagi for athletes who have high flexibility. There are differences in plyometric standing jump and box drill exercises on the ability of momtong dollyo chagi kicks for athletes who have low flexibility. Table 2 will describe the athlete's flexibility data.

Table 2. Description of Athlete Characteristics and Flexibility

Variable	Athlete (n = 42)	
	M	SD
Age (years)	13,76	0,62
Height (cm)	157,74	8,14
Weight (kg)	49,84	13,87
Flexibility	20,18	0,77
Power (watt)	29,41	0,93

As a result of the research in **table 2**, the average age of the athletes is 13.76 years old. In the second observation, the average athlete's height is 157.74 cm and has an average weight of 49.84 kg. In addition, the average flexibility of athletes is 20.18 and power is 29.29 watts in both experimental groups. Flexibility data will determine the division of groups on the plyometric standing jump and box drill training methods. **Table 3** will explain the data analysis based on this research variable.

Table 3. Description of Statistics Anova 2 Ways

Source	JK	db	RJK	Fo	Ftable
Inter-A	7,5693	1	7,5693	12,111	4,08
Inter-B	2,8912	1	2,8912	4,626	4,08
Interaction AB	14,044	1	14,044	22,470	4,08
Inside	26,25	42	0,625		1,79
Total	37,262	41			

a. Effect A (Standing Jump and Box Drill)

The first hypothesis answers that there is a difference in the leg power of momtong dollyo chagi kicks for taekwondo athletes in the plyometric standing jump and box drill training methods with the results Fo (A) = 12,111 > F-table 4,08. Thus the one-sided test $\sqrt{12,111}$ = 3,480 > t_{table} 1,688. The effect of the exercise method based on calculations can affect 20.92% of the leg power of momtong dollyo chagi kicks.

b. Interaction of Plyometric and Flexibility (AB)

Based on statistical analysis of the interaction value of Fo (AB) = 14,044 > F-table = 4,11. The data shows that there is an interaction between the training method and flexibility on the leg power of the momtong dollyo chagi kick. The effect of AB interaction based on the results of the analysis can affect 33,83%. Figure 1. Below shows a diagram of the interaction between the variables AB.

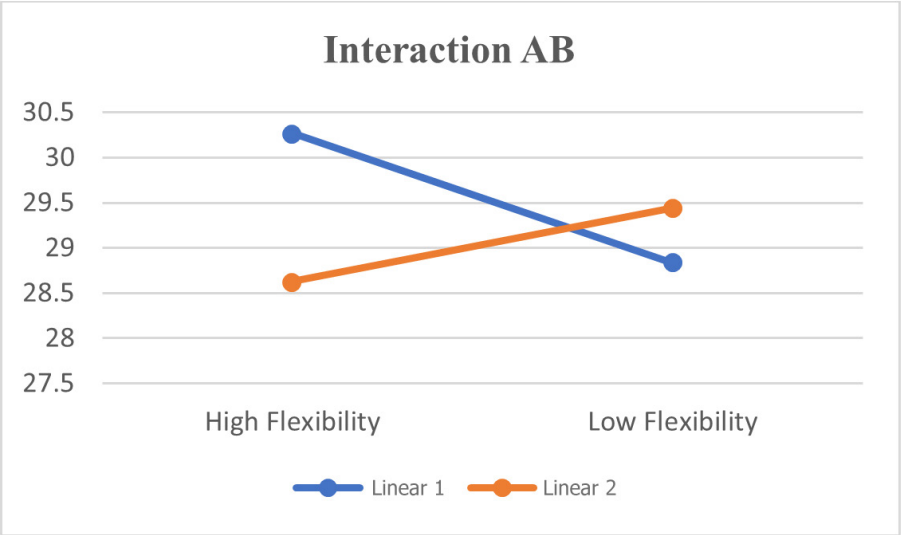

Figure 1. Diagram Interaction AB

c. Differences Y in the experimental groups (A1B1 and A2B1) and (A1B2 and A2B2)

Based on the summary of the results of the statistical calculation of the analysis of variance, the data **is** obtained in Table 4. The calculation is through hypothesis testing with t-Dunnet to compare the high and low flexibility groups with the exercise method applied. The summary data of the research results in the table below for the high flexibility group, the average value of A1B1 is 30,703 and A2B1 is 28,641. While for the low flexibility group, the average A1B2 is 28,977 and A2B2 is 29.256. The t-Dunnet statistical test is shown in **Table 4** and **Table 5** below.

Table 4. Statistical Hypothesis Between Experimental Groups

Statistic	A1B1	A2B1	A1B2	A2B2	Total
n	10	10	11	11	42
$\sum Y1$	307,03	286,41	289,77	292,56	1175,77
$\sum Y1^2$	9434,08	8203,107	8397,18	8561,71	34596,09
$\sum y1^2$	38,663	40,620	0,368	2,190	81,842
$\bar{X}$	30,703	28,641	28,977	29,256	29,394

Table 5. Statistical Hypothesis t-Dunnet

Value	(Se)	t_0	t_{table}
$\bar{Y}_{11} - \bar{Y}_{21} = 2,6$	0,625	16,496	1,688
$\bar{Y}_{22} - \bar{Y}_{12} = 0,9$	0,625	2,455	1,688

Based on the statistical test of the hypothesis in table 5 groups between A1B1 and A2B1 obtained data that t_0 16,496 > $t_{table(0,05:10)}$ 1,688, This means that the hypothesis that explains the plyometric standing jump exercise method is better for increasing the leg power of momtong dollyo chagi kicks than box drill exercises for athletes who have proven high flexibility. While the A1B2 and A2B2 groups obtained data t_0 2,455 > $t_{table(0,05:10)}$ 1,688, This also means that the hypothesis that explains box drill exercises is better for increasing the leg power of momtong dollyo chagi kicks than standing jump plyometric exercises on athletes who have low flexibility has been tested. It appears that the two exercises had different increasing effects on athletes who had low or high flexibility for 6 weeks.

4. Discussion

This study examines the effect of plyometric exercises performed by athletes for 6 weeks effective in increasing the leg power of momtong dollyo chagi kicks in taekwondo. In addition, plyometric exercises that are applied can also maintain athlete performance in the short term. The plyometric exercise design made by the trainer is also adjusted so that the objectives of the exercise can be achieved. The results of previous studies also stated that plyometric training improved jump height, 20-m sprint speed, and endurance, in male adult soccer players [30]. Plyometric training elicits significant increases in sprint acceleration performance, thus highlighting the importance of movement pattern and contraction velocity specificity [31]. The implementation of strength training to improve middle- and long-distance performance, mainly through improvements in maximal power, and maximal strength [32]. Plyometric training and overwhelmingly (96.7%) reported positive athlete feedback surrounding its perceived efficacy [33].

The two plyometric exercises standing jump, box drill, and low or high flexibility also have the effect of increasing the athlete's leg power. The aim is to compare the effectiveness of the standing jump and box drill plyometric training methods including volume periodization, exercise options, and plyometric intensity applied to taekwondo athletes during 6 weeks of training. It is evident from the results of the exercise carried out that there is an effect of increasing the power leg felt by the athlete. That 6 weeks of

suspension training or plyometric training seems to be effective to improve strength- and power-related variables in healthy untrained children [34]. Plyometric training a twice-weekly short-term high-intensity contrast strength enhances many factors relevant to athletic performance (sprinting, ability to change direction, vertical jumping, strength, power and neuromuscular adaptations) [35]. Plyometric training frequency across 8 weeks has effects on the jumping ability of prepuberal male soccer players [36]. Plyometric exercise intensity and program design, for those who require significant horizontal power in sport [37].

5. Conclusions

Based on the results of this study, it was concluded that the plyometric standing jump and box drill training methods were effective for increasing leg power in junior taekwondo athletes. Coaches may want to look at the group differences reported in this study when creating the most suitable training program for their athletes. So that the plyometric training program designed by the coach will be able to determine the kick technique training program to increase the athlete's power or strength in preparation for competition.

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