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WEIGHT TRAINING PROGRAMME TO IMPROVE THE BIOMOTOR POWER COMPONENT IN FUTSAL ATHLETES: VALIDITY AND RELIABILITY APPROACHES OF CONSTRUCTED CONTENTS

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ABSTRACT

Background: Different training stimuli can cause different responses and adaptations in the muscles and body. These stimuli can reach their peak in a certain scheme and make the body's adaptation response more optimal. **Purpose:** To develop a weight training programme to adapt to the development of power training, especially for futsal athletes. **Design/methodology/approach:** This research applied the research and development method supported by the quantitative approach and involved five physical conditioning experts and two futsal coaches. The data analysis on the construct validity of the weight training programme was conducted using content validity with the Delphi technique. A questionnaire with a scale of 1 to 5 (very relevant, relevant, quite relevant, less relevant, and irrelevant) was also used as the research instrument. The collected data were analysed using Aiken's V formula to test the content validity, while the ICC formula was used to test the agreement between raters. **Results:** The results showed that the weight training programme for futsal athletes showed high content validity (≥ 0.75), with strong agreement between raters (0.887) and good consistency values for each rater (0.530). **Conclusion:** The developed training programme was feasible to increase futsal athletes' biomotor power component. Even so, this training programme still needs further research to determine its effectiveness using experimental methods.

Keywords: weight training, futsal, power, validity, reliability

INTRODUCTION

The best performance in futsal is highly determined by physical, technical, tactical, and mental aspects (Ribeiro et al., 2020). Those aspects are closely related, with each formation having its developments. Physical aspects are needed to obtain better technical skills, which are prepared to acquire tactical abilities to achieve the skills of competitive maturity. Out of these various factors, the physical factor is the most important

factor for futsal (Nikolaidis et al., 2019; Ramos-Campo et al., 2016). Therefore, every futsal athlete must maintain and develop their physical abilities to always be in prime and maximum condition.

According to Naser et al. (2017), futsal athletes must have a high intermittent endurance capacity, repeated sprint ability, leg power, agility, and coordination to achieve higher performances. To upstage their opponents, they are not only required to have a good ability in handling balls and great aerobic and anaerobic endurance, but they also must have a big explosive power (such as speed in kicking and running)(Sekulic et al., 2021). Leg muscle power is one of the most important factors in achieving the highest level of performance (Permana et al., 2022) because good control of power can help young athletes compete at the senior level. Muscle power is crucial in futsal, especially in shooting, passing and heading techniques. Without good leg muscle power, an optimal kick or header technique will not be created (Palucci Vieira et al., 2021). However, young futsal athletes' leg muscle power abilities are generally not optimal (Parmadi et al., 2022) (Afrizal & Soniawan, 2021). In addition, chronic hip, knee and ankle (part of the leg muscles) injuries, which are very common problems worldwide, can hinder development in several sectors, including athletes' training and performances. Judging from the importance of leg muscle power in futsal athletes, but not balanced with the existing reality, this can cause many athletes to have insufficient leg muscle power that is mature at their age, and cause them to get injured and not be able to reach their highest performances.

One method that can be used to train athletes' power is the weight training method, an effective intervention to increase muscle adaptation (Kang et al., 2012). Optimising this adaptation requires manipulating the weight training variable (Suchomel et al., 2018). The changes in the weight, or the amount of weight lifted in one set, are widely considered a very important variable (Marques et al., 2019). Evidence shows that changes in weight training can affect acute metabolic, hormonal, nervous, and cardiovascular responses to exercise (Hoeger et al., 2018).

According to Bompa & Buzzichelli (2019), good intensity of power training is using 40%-60% of the maximum weight (1RM). According to Torres-Torrelo et al. (2017), the good intensity of power training is 2–3 sets and 4–6 repetitions at 45–60% of 1RM. Schoenfeld et al. (2021) divide the dose of weight training into three. The first is a low repetition intensity scheme with a heavy weight (1 to 5 repetitions per set at 80% to 100% of a maximum of 1 repetition (1RM). The second is a moderate-intensity repetition scheme with a moderate weight (from 8 to 12 repetitions per set at 60% to 80% of 1RM). The last one is a high repetition intensity scheme with light weight (15+ repetitions per set with a weight below 60% of 1RM).

Even so, there are still many mistakes regarding determining intensity in power training. Frequent power exercises still use excessive weights and are not in accordance with the rules (seemingly perfunctory). The rules state that athletes must have good muscle strength before being given power training (Afrizal & Soniawan, 2021; Mcguigan, 2017; Swinnen, 2016). Understanding how weight can interfere with the development of adaptations in the human body, coaches and weight training practitioners need to be able to design more effective and efficient training programmes.

Therefore, the researchers aimed to develop a construction related to the development adaptation of power training for athletes, especially in futsal sports, by testing the validity of the weight training programme according to the dosage and needs of the futsal sport.

MATERIALS AND METHODS

This study applied the research and development method, supported by a quantitative approach (Edmonds & Kennedy, 2016; Hong et al., 2019; Petrovic et al., 2017). It involved five physical conditioning experts and two futsal coaches. The data analysis on the construct validity of the weight training programme was conducted using content validity. This research was carried out in four steps to validate the content. First, the authors collected relevant research sources and conducted a participatory observational study as a preliminary of the development. The second step was the product assessment stage, carried out using the Delphi technique by ten experts. The results of a questionnaire with a rating scale of 1 to 5 show consensus from experts (Doolan-Noble et al., 2019; Hong et al., 2019). The third step was analysing the quantitative data from the seven experts' assessments using Aiken's V formula. The fourth step was testing the agreement among raters using the Intraclass Correlation Coefficients (ICC) formula (Portney & Watkins, 2009) and with the help of the SPSS application Version 25.

The conclusions from Aiken's V calculation results, according to the V table based on ten raters using the 1 to 5 scale and a 5% confidence level would be declared as 'valid' if the V count is greater than the V table, in which the V table is 0.75 (Aiken, 1985). Meanwhile, the value of agreement among the raters (ICC) is described as adopting property (Portney & Watkins, 2009):

Table 1. ICC Value Category

ICC Value	Interpretation
0.00 - 0.50	Poor Reliability
0.51 - 0.75	Moderate Reliability
0.76 – 0.90	Good Reliability
0.91 – 1.00	Excellent Reliability

RESULTS AND DISCUSSION

Results

The literature reviews through various documents, such as relevant scientific articles and textbooks, found that weight training programmes increase the power component, especially leg muscle power in futsal athletes, as seen in Table 2.

The training programmes compiled by the researchers not only focus on the leg muscles (lower body), but also the whole body because playing futsal requires the upper body. Thus, the muscles of the whole body are trained even though they are still centred on the leg muscles. This exercise programme can be done in a fitness centre (gym) because it adopts the Maximum Repetition Continuum theory. In addition, this training programme is recommended to be carried out at the special preparation stage, where athletes must have received maximum strength training in general preparation.

Furthermore, Table 3 presents Aiken's V coefficient values of all items. The first item shows the Aikens V coefficient value of 1.00, the second item shows the Aiken V coefficient value of 0.89, and the third item shows the Aiken V coefficient value of 0.82. Furthermore, the fourth item shows the Aiken V coefficient value of 0.79, the fifth item shows the Aiken V coefficient value of 0.82, the sixth item shows the Aiken V coefficient value of 0.75, the seventh item shows the Aikens V coefficient value of 0.96, the eighth and ninth items show the calculated Aiken V coefficient value of 0.75, respectively, and the last shows the calculated Aiken V coefficient value of 1.00. Thus, the weight training programme in this study was declared valid for power training because the calculated Aiken V coefficient value was greater than the V table, where the V table value was 0.75.

Table 2. Weight Training Programme to Improve Power

Week	Training Item	Training Dose
1-2	1. Romanian Deadlift 2. Calf Raises 3. Rear Delt Raise 4. Leg Extension 5. Total Abdominal 6. Side Lunges 7. Cable Row 8. Multi-Hip Abductor 9. Cable core Rotation 10. Arm Curl	Frequency: 2-3/week Intensity: 60%-65% 1RM Set: 2-3 Repetition: 8-12 Rhythm: High Velocity Rest: 2-3 minutes Method: Set System
3-4	1. Power Back Squad 2. Russian Twist 3. Shoulder Press 4. Side Bend 5. Pull Down 6. Side Squat with Plate 7. Butterfly 8. Single Leg Deadlift 9. Triceps Pushdown	Frequency: 2-3/week Intensity: 65%-70% 1RM Set: 3 Repetition: 8-10 Rhythm: High Velocity Rest: 2-4 minutes Method: Set System
5-6	1. Squad Jump 2. Leg Curl 3. Upright Row 4. Bulgarian Squat 5. Chest Press 6. Plate Wood Chop 7. Hip Thrust 8. Cable Crunches 9. Close Grip Reverse Pull Down 10. Triceps Extension	Frequency: 2-3/week Intensity: 75%-80% 1RM Set: 3 Repetition: 8 Rhythm: High Velocity Rest: 2-5 minutes Method: Set System

Table 3. Content Validity Test Results

Jury	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8		Item 9		Item 10	
	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S
A	5	4	4	3	4	3	4	3	4	3	4	3	5	4	4	3	4	3	5	4
B	5	4	4	3	4	3	3	2	4	3	4	3	4	3	4	3	4	3	5	4
C	5	4	4	3	4	3	4	3	4	3	4	3	5	4	4	3	4	3	5	4
D	5	4	5	4	4	3	4	3	4	3	4	3	5	4	4	3	4	3	5	4
E	5	4	5	4	4	3	4	3	4	3	4	3	5	4	4	3	4	3	5	4
F	5	4	5	4	5	4	5	4	5	4	4	3	5	4	4	3	4	3	5	4
G	5	4	5	4	5	4	5	4	5	4	4	3	5	4	4	3	4	3	5	4
∑s	28		25		23		22		23		21		27		21		21		28	
V	1		0.89		0.82		0.79		0.82		0.75		0.96		0.75		0.75		1	

Then, the agreement results among the raters are presented in Table 4 below.

Table 4. Intraclass Correlation Coefficient Analysis Result

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.530	.284	.808	11.889	9	54	.000
Average Measures	.887	.735	.967	11.889	9	54	.000

Based on Table 4 above, each rater has a consistency of 0.530. Meanwhile, the average inter-rater agreement is 0.887. This result is included in the category of good reliability, and it can be concluded that the agreement among the raters is strong and that each rater has a good consistency.

DISCUSSION

Futsal is a sport that has the characteristics of speed with maximum power (Miftachurochmah et al., 2023; Naser et al., 2017). According to Spyrou et al. (2020), who studied the physiological characteristics of futsal games, 17% of futsal matches used moderate intensity with 65-85% MHR, while the other 83% use high intensity with more than 85% MHR. As seen from the intensity of the match, futsal is a sport that predominantly uses an anaerobic threshold energy system. This anaerobic threshold zone has an intensity range of 85-90% MHR (Gaidos & dos Santos, 2015). The biomotor power component is important for futsal athletes because it supports the performance and skills of playing futsal, such as shooting, passing, heading, explosive movements, etc.

One of many ways to increase power is by applying the weight training method. It is widely accepted that training volume (weight × repetitions × sets) plays an important role in weight training (Kubo et al., 2021). This study aimed to develop a weight training programme to increase the power abilities of futsal athletes. The results of the content validity test for the developed training programme stated that the training programme was valid in all aspects

assessed, with strong agreement between raters.

Independent test validity is a very important part of the development process. This validity test can describe the extent to which the design of the weight training programme can increase the power abilities of futsal athletes.

In this study, the designed exercise dose adopts the Maximum Repetition Continuum theory, which uses a moderate repetition intensity exercise dose scheme with moderate weight (from 8 to 12 repetitions per set with 60%-80% of 1RM) and aims to achieve hypertrophy training adaptation (Schoenfeld et al., 2021). According to Schoenfeld, the dose of exercise in the hypertrophy training zone scheme can also be used as a power training zone. However, the focus of the implementation is that it must be done at maximum speed (fast rhythm). In line with the results of this study, Pareja-Blanco et al. (2017) proved that by intervention using a dose of weight training of three sets x 8 repetitions at 75% 1RM with maximum speed. The results of half squats, leg presses and hamstring curls significantly increase the ability of power jumps, sprints and repeated sprints in professional futsal players.

Research conducted by (Lopez et al., 2021) states that using a low repetition volume and high weight or intensity (< 8RM) can enhance the strength and hypertrophy biomotor components, compared to using a high repetition volume and low weight or intensity. In line with this, research according to French & Ronda (2021) states that a more optimal increase in strength is found at higher intensities.

On the other hand, although recommendations regarding the ideal weighting dose for biomotor speed are still being debated, the existing literature agree that weight training can increase speed (Kristensen et al., 2006; Prieske et al., 2018). According to Fossmo & van den Tillaar (2022), the speed component can be trained through weight training with lightweight intensity, but done quickly or explosively. These compiled exercises can help activate all high-threshold motor units, firing frequency and better intramuscular coordination. In this case, Cormie et al. (2011) explain that exercises for the development of maximal speed can be achieved optimally through the application of maximal mobilisation, where the exercises are structured close to the characteristics of a specific sport (executed quickly, such as, running, jumping or throwing).

Hill's curve theory explains that maximum power execution can only be done with a slow muscle shortening speed, whereas fast muscle shortening speeds tend to generate less force. Speed training using high-intensity weight can also help adapt the development of the speed component. Meanwhile, Fossmo & van den Tillaar (2022) explained their findings that weight training, with a light weight, has a range of 30-60% of 1 RM, moderate weight covers 60-85% of 1 RM, and heavy or maximum weight includes 85-100% of 1 RM, can increase the speed. The maximum weight range impacts speed development more than training at other ranges. Furthermore, when applied to athletes with good strength, the range of light and explosive weight or combined with heavy weight training is more prioritised to develop speed.

In developing training strategies, the coach must remember that strength, power, and speed are inherently related to one another. Therefore, coaches are expected to pay attention to the component's characteristics so that the training programme matches the requirements; otherwise, the programme does not develop.

In conclusion, based on the results and discussion above, it can be summarised that increasing power ability can use weight training interventions. The researchers recommend weight training with moderate repetition intensity, moderate weight and fast rhythms.

CONCLUSION

Based on the results and discussion, it can be concluded that the weight training programme for futsal athletes shows high content validity, with strong agreement between raters and good consistency for each rater. Thus, the developed exercise programme is feasible to increase the biomotor power component in futsal athletes. However, this training programme still needs further research to determine its effectiveness using the experimental method.

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PROGRAM TRENINGA SA OPTEREĆENJEM ZA POBOLJŠANJE BIOMOTORIČKE KOMPONENTE SNAGE KOD IGRAČA FUTSALA: PRISTUPI VALJANOSTI I POUZDANOSTI KONSTRUISANOG SADRŽAJA

SAŽETAK

Kontekst: Različiti trenažni podražaji mogu prouzrokovati različite odgovore i adaptacije mišića i tijela. Ovi podražaji mogu dostići vrhunac u određenoj šemi i optimizovati odgovor tijela putem adaptacije. **Svrha:** Razviti program treninga sa opterećenjem koji će se prilagoditi razvoju treninga snage, a posebno za igrače futsala. **Dizajn/metodologija/pristup:** U istraživanju je korištena metoda istraživanja i razvoja uz pomoć kvantitativnog pristupa, a u njemu je učestvovalo 5 stručnjaka iz oblasti fizičke kondicije i 2 trenera futsala. Analiza podataka o konstruktnoj valjanosti programa treninga sa opterećenjem je provedena korištenjem valjanosti sadržaja uz Delphi tehniku. Upitnik sa skalom od 1 do 5 (iznimno važno, važno, prilično važno, manje važno i nevažno) je korišten kao instrument istraživanja. Prikupljeni podaci su analizirani uz pomoć Aikenove V formule za testiranje valjanosti sadržaja, dok je ICC formula korištena za testiranje slaganja između ocjenjivača. **Rezultati:** Rezultati su pokazali da je trening sa opterećenjem za igrače futsala pokazao visoku valjanost sadržaja (≥ 0,75) uz iznimno slaganje između ocjenjivača (0,887) i dobru konzistenciju za svakog ocjenjivača (0,530). **Zaključak:** Razvijeni program treninga je uspješan u povećanju biomotoričke komponente snage kod igrača futsala. Ipak, ovaj program treninga još uvijek zahtijeva dodatno istraživanje kako bi se utvrdila njegova efikasnost korištenjem eksperimentalnih metoda.

Ključne riječi: trening sa opterećenjem, futsal, snaga, valjanost, pouzdanost

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