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Original Research

Modification of hand muscle strength training equipment: study of the development of a ball stick for handball shooting

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Authors' contribution:
A. Conception and design of the study; B. Acquisition of data; C. Analysis and interpretation of data; D. Manuscript preparation; E. Obtaining funding

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Abstract

Background and Study Aim. This study aims to modify the ball stick as a hand muscle strength training aid for shooting handball as a training aid that can be used to train hand muscle strength against shooting strength.

Material and Methods. The research method used is Research and Development (R&D) with the Borg & Gall Development Model. This research was conducted in several steps, namely: potentials and problems, data collection, product design, design validation, design revision, trial use. The development of modifications to hand muscle strength training tools for shooting handball was first validated by material experts, expert practitioners, 7 product trial respondents, and 15 product use trial respondents.

Results. The results of this study indicate that the development of modified hand muscle strength training tools for shooting handball sports can be seen from material experts (78.75% in the appropriate category) and expert practitioners (78.09% in the appropriate category), 75.82% in small-scale trials in the appropriate category, and 82.46% in large-scale trials. eligible category. Thus, it can be concluded that the development of modified hand muscle strength training tools for shooting handball sports is declared feasible to be used as an exercise aid.

Conclusions. The results of this study also provide a new reference for hand muscle strength training tools for shooting in handball sports and can be used by sports practitioners and sports coaches in providing exercise programs.

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Introduction

Handball is a sport that is also the oldest in the world at the time of Ancient Greece. Handball is a game that uses a large ball, in which this game is played in a team by putting the ball into the

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opponent's goal to win (Rahayu et al., 2020). The game of handball is more like the basic techniques of basketball (Hermansah, 2018). The basic handball techniques consist of passing, dribbling, shooting, catching, feinting, defending and attacking, and goalkeeping, which is the same as the basic basketball techniques, namely throwing, catching, dribbling techniques, shooting techniques (Suryadi, Saputra, et al., 2022). The playing field and its forms are also more like a soccer field, consisting of netted goals and areas limited by regulations that limit the opportunities for player movement including the mechanics of the game.

The basic technique of playing handball in the learning process must be taught, one of which is Passing (Hermansah, 2018), and other basic techniques consisting of dribbling catching the ball, shooting the ball. Shooting the ball is one of the most important techniques in handball because this technique determines the success or victory of a team in scoring goals. under two hands, throw throw while dropping the body. For the shooting section there are also several shooting styles, namely the standing throw shot, the jump shot, the dive shot, the fall shot, the side throw, the flying shot, and the reverse shot.

In addition, success in playing handball can be influenced by several factors, namely technique, tactics and physical condition (Al-ayyubi & Irawan, 2022), so it is important to do sports activities to stay physically fit. Sport is an activity that everyone can do (Suryadi, Gustian, et al., 2022), to maintain physical and mental health (Suryadi, Rubiyatno, et al., 2022). Various sports activities are played in order to get the ideal body (Khairunnisa Balqis et al., 2020), and physical fitness (Baek et al., 2020; Darmawan, 2017; Fikri, 2017; Prativi et al., 2013; Rubiyatno et al., 2023; Saputra, 2015; Sukendro & Triadi Santoso, 2019; Suryadi, 2022; Suryadi et al., 2021; Suryadi & Rubiyatno, 2022). Physical fitness is an activity carried out without experiencing significant fatigue (Suryadi, 2022)(Suryadi et al., 2023). So that sports activities carried out regularly can prevent obesity so that the body remains ideal and can expedite the body's metabolism, so that diseases experienced such as hypertension can decrease (Kristiawan & Adiputra, 2019).

Judging from the components of the physical condition. In this regard, handball is a sport that requires overall physical abilities and anthropometry (Ardian & Sifaq, 2018), so that they can do all the movements in handball properly, as mentioned Suryadi that a sportsman must have good physical fitness in order to be able to perform sports perfectly and achieve achievement (Suryadi, 2022). An article says that physical condition is also affected by shooting practice in handball (Al-ayyubi & Irawan, 2022). In the shooting department itself, grip strength or what is called hand muscle strength has a very important factor for shooting, passing and catching the ball. This is in line with the research results of Ardian and Sifaq which state that individual hand muscle strength has the greatest contribution to the accuracy of handball shooting, namely 63.04% (Ardian & Sifaq, 2018).

Factors that affect shooting are hand muscle strength, arm muscles, shoulder muscles, leg muscles, and abdominal muscle strength (Al-ayyubi & Irawan, 2022). Based on a survey on the field, the current training process is provided with a training program and makeshift facilities in the form of: futsal field, ball, skun, and stopwatch. Then, based on the results of interviews conducted with the Pontianak City Handball Club coach, he said that there were no specific training aids for shooting strength training for Pontianak city athletes. Based on the importance of training hand muscle strength in shooting for handball athletes, the researcher modified the tool to provide solutions and create new models of training equipment for athletes during shooting practice, the researchers made innovations by modifying the tool, namely the ball stick.

Based on this opinion, researchers are also in line with the theory of motion learning, where a movement learning occurs through muscular responses expressed in movements of body parts in part or in whole according to the principle of learning motion from easy to difficult or from simple to more. Because the throwing motion used is in the form of the muscles in the upper and lower arms, the muscles around the back and also the muscles in the legs. Related to the theory of motion in handball, special training is needed to improve movement skills in the handball shooting section so that it requires supporting tools for increasing hand muscle strength. In addition, research on the

development of training tools in handball is very rarely carried out, so this is one of the gaps that can be developed as well as the reason why this study is important.

Materials and Methods

Participants.

The small-scale product trial phase was carried out in a limited group by 7 students of handball sports coaching education, then the trial use used more subjects than product trials, totaling 15 Pontianak city handball athletes.

Research Design.

The method used in this research is the Borg & Gall development research (RnD) model according to (Sa'adah & Wahyu, 2021; Sugiyono, 2016). The research method provides an overview of how the research design includes; procedures or steps that must be fulfilled, time of research, data sources, and with what steps the data was obtained and then processed and then analyzed. Research development procedures include analysis of potential problems, data collection, product design, design validation, design revisions, trials, product revisions, re-trials, product revisions, mass production (Sa'adah & Wahyu, 2021; Sugiyono, 2016).

Statistical analysis.

Data collection in this development research uses closed and open questionnaires, which are accompanied by a suggestion column on the next page. The questionnaire was given to material experts, practitioner experts and tested on students of Sports Science FKIP Untan. The data that has been collected will be analyzed to determine the quality of the resulting product development. Product validation will use a feasibility formula based on (Sugiyono, 2016). Data analysis techniques were assisted by using Microsoft Excel 2016 software.

Table 1. Score Interpretation Criteria

Percentage	Category
86 - 100 %	Very worth it
71 - 85 %	Worthy
56 - 70 %	Pretty decent
41 - 55 %	Not worth it
< 41 %	Not feasible

Results

Product Development Modification of Hand Muscle Strength Training Tools for Shooting Handball Sports before conducting trials needs expert validation first. To test the product, it is carried out by material experts and practitioner experts.

Table 2. Mathematician calculation

No	Aspects Assessed	Score Obtained	Maximum Score	Percentage (%)	Category
1	Physical	23	30	76'66%	Worthy
2	Design	19	25	76%	Worthy
3	User	21	25	84%	Worthy
	Total score	63	80	78,75%	Worthy

Based on the results of the material experts on the product development of the development of modified hand muscle strength training tools for shooting handball sports regarding the assessment of the physical aspect of 76'66% which is categorized as Feasible while for the design of 76% which is categorized as Very feasible and for aspects of the user of 84% categorized as Feasible. From the total results of the research test according to the material expert of 78.75%, it is categorized as "Feasible" to be used as a training aid and tested in the next stage.

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Table 3. Practitioner expert calculation results

No	Assessed Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
1	Material	15	20	75%	Worthy
2	Physical	19	25	76%	Worthy
3	Design	24	30	80%	Worthy
4	User	24	30	80%	Worthy
	Total score	82	105	78.09%	Worthy

Table 3 shows the assessment of expert practitioners regarding the assessment of the material aspect 75% which is categorized as "Feasible", for the physical aspect 76% which is categorized as "Feasible Enough" while for the design aspect 80% which is categorized as "Feasible" and for the user aspect 80% which is categorized as "Feasible". From the results of the assessment test according to the expert practitioner of 78.09%, it is categorized as "Feasible" to be used as a training aid and tested at the next stage.

Table 4. Small-scale calculation results

No	Assessed Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
1	Security	136	175	77.71%	Worthy
2	Comfort	103	140	73,57%	Worthy
3	Ease	106	140	75,71%	Worthy
	Total Score	345	455	75,82%	Worthy

Table 4 shows that for the safety aspect 77.71% is categorized as "Feasible" while for the comfort aspect 73.57% is categorized as "Feasible Enough" and for the convenience aspect 75.71% is categorized as "Feasible". For the total calculation of the feasibility of research according to the results of the calculation of the respondent test of 75.82%, it is categorized as "Feasible" to be used as a training aid to be tested at the next stage.

Table 5. Results of Large-scale respondent Counting

No	Assessed Aspect	Score Earned	Maximum Score	Percentage (%)	Category
1	Security	304	375	81.33%	Worthy
2	Comfort	244	300	84%	Worthy
3	Ease	256	300	90.67%	Very worth it
	Total score	804	975	82.46%	Worthy

Based on what was obtained in table 5 on 15 respondents, which was analyzed using the score interpretation criteria, namely from the product trial, it shows that for the safety aspect 81.33% is categorized as "Feasible" while for the comfort aspect 84% is categorized as "Feasible" and for the convenience aspect 90.67% is categorized as "Very Feasible". For the total calculation of the feasibility of research according to the results of the respondent test calculation of 82.46% categorized as "Feasible" to be used as a training aid.

Discussion

Based on that obtained in table 5 for 15 respondents, who were analyzed using the score interpretation criteria, namely from product trials, it showed that for the safety aspect 81.33% were categorized as "Decent" while for the comfort aspect 84% were categorized as "Decent" and for the convenience aspect 90.67% categorized as “Very Eligible”. For the total calculation of research feasibility according to the results of the respondent's test calculation of 82.46%, it was categorized as "Easy" to be used as a training aid.

At the beginning of the development of this ball stick tool it was designed and produced into an initial product in the form of a hand muscle strength training tool for shooting handball games. An article says that hand muscle strength and shooting ability have a significant relationship (Mahyuddin

& Sudirman, 2021; Saputro, manurizal, 2020). The development process through research and development procedures. Then the product is developed with the help of someone who masters the ballstick tool, after the initial product is produced it needs to be evaluated by material experts and practitioner experts. The next research phase was carried out with product trials on a small scale and trial use on a large scale.

Products in phase I have passed the manufacturing stage and are ready to be validated by material experts and practicing experts. Then the product in stage I produces data on the assessment of material experts and practitioner experts accompanied by suggestions. In the expert's assessment of the change in the shape of the ballstick tool design and the loading inside the ball using sand and water as a load. Meanwhile, the assessment of expert practitioners giving added training models using existing tools and variations of paired exercises. Furthermore, small-scale respondent trials where the product has revisions to be changed in the hook section become not easily separated.

The results of the questionnaire test for material experts who initially gave an assessment of 62% in the category were quite feasible. After the product was revised, the material expert gave an assessment of 78.75% with a feasible category to try out, which means that research on the development of modifications to hand muscle strength training tools for shooting handball sports increased by 16.75%, where arm muscle power is an important physical component. required in handball (Ardian & Sifaq, 2018). Furthermore, the results of the questionnaire test for expert practitioners, which initially gave an assessment of 60.95%, were in a fairly decent category. After the product was revised, expert practitioners gave an assessment of 78.09% with a feasible category to be tried out, which means research for the development of modifications to hand muscle strength training tools for shooting handball sports increased by 17.14%. In previous research conducted on the sport of football, it is very feasible to use it to practice shooting skills (Perdana, 2021).

The results of research conducted by (Rihatno & Tobing, 2019) also proves the development of an arm muscle strength training model that is easy and interesting to do and effective for increasing the throwing ability of athletes in softball. Based on the results of small-scale respondent trials regarding the product Development of Modification of Hand Muscle Strength Training Tools for Shooting Handball Sports at 75.82% it was categorized as feasible with several product revisions to be tested in the next stage. After the revision of the small-scale product, the results of the large-scale trial of respondents regarding the product Development of Modification of Hand Muscle Strength Training Equipment for Shooting Handball Sports amounted to 82.46% which were categorized as feasible for use as training aids and an increase of 6.64%. Other research conducted by Kumbara, developed a smash variation training model that proved to be effective for implementing smash skill training in volleyball games (Kumbara et al., 2022).

Conclusion

The results of the research on the development of modifications to hand muscle strength training tools for handball shooting are categorized as suitable for use as hand muscle strength training aids for handball shooting. This can be seen from the results of assessments from material experts, practitioner experts, small-scale product trials and large-scale product trials. The results of this study prove that the modified training equipment is feasible to use and can be utilized by sports practitioners and sports coaches, especially handball. The weakness in this study is that the trial sample is still limited, due to time limitations, limited respondents due to conditions in the UAS state which is quite a hindrance to research. Further research recommendations can provide ballstick treatment in the sport of handball games and, of course, with a wider sample and population.

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Conflict of Interest And Funding

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