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Development of saddle horse with electric motor drive to improve circle skills in junior male artistic gymnasts

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Abstract

This research aims to enhance performance and optimize the need for artistic gymnastics training activities on the pommel horse apparatus to become more affordable and efficient. The method used in this research employs research and development. This study's data sources consist of quantitative and qualitative data. Quantitative data were obtained from questionnaire responses from 16 samples, consisting of 4 experts in the field of sport, biomechanics, and equipment design. Artistic gymnasts 10 athletes evaluated the comfort, performance, and experience of using the apparatus. Evaluation of the effectiveness of the equipment by 2 coaches to assess the athlete's gross motor development, as well as the practicality of use and maintenance. The results of this research produce a pommel horse gymnastics equipment product using an electric motor drive that athletes, coaches, and trainers can use to achieve performance development at an affordable price. The conclusion of the development model of the pommel horse with an electric motor drive to enhance circle skills in junior male artistic gymnasts contributes further practical and scientific insights to understanding the development of key skills and developing effective training for the pommel horse in optimizing the gross motor development, grasping the idea of movement, and fixation in the circle movement of junior gymnasts.

Keywords: Saddle horse, artistic gymnastics, research and development.

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INTRODUCTION

The development of modern sports science and technology presents a new series of science and technology in fulfilling various sports facilities by integrating multifunctional spaces (Krasova, 2023; Opala-Berdzik, 2021). Sports engineering science and technology focuses on developing equipment for sports that is multifunctional, complex, and

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constant. As mentioned above, the main challenge in developing junior men's artistic gymnastics in Central Java is the limited training facilities and infrastructure. The fulfilment of multifunctional sports equipment and design innovation is an urgent need to answer this problem. On the one hand, small and underrepresented training spaces are an obstacle to optimising gross motor development, which is an important element in artistic gymnastics (Dimitriadou, 2022; Gasparyan, 2024). On the other hand, a well-designed piece of equipment can be a solution that not only increases the effectiveness of training but also makes efficient use of space.

Designing sports equipment with a multifunctional approach not only reduces space requirements but also provides a variety of exercises that support the development of technical and physical skills (Schärer, 2023). For example, designing equipment that can be adjusted in height or changed in function for some types of exercise can help athletes master certain movements without the need for any additional tools. Technologies such as computer-aided design (CAD) allow the creation of precise, ergonomic equipment tailored to the specific needs of junior male gymnasts (Sukendro, 2020).

This innovation can also help coaches develop more flexible and performance-based training programmes. Coaches can integrate technical and gross motor exercises in a more targeted way, while athletes can train with safe, effective, and specially designed tools to support their growth and development. This development discussion must also include a collaborative approach between equipment manufacturers, coaches and biomechanics experts to ensure that the equipment produced is truly optimal. In addition, support from local governments and educational institutions is also an important factor in ensuring that representative training facilities are available to maximise the potential for male artistic gymnastics achievement in Central Java.

To find out the constant sports equipment, Computer Aided Design software is needed, which is part of the multidisciplinary study of sports

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engineering and as a fulfillment of the composition requirements in the artistic gymnastics code of points (Gastélum-Cuadras, 2020; Papacharalampous, 2022). Sports engineering is a field of science that determines the conceptual design of construction by integrating high-performance and sustainable gymnastics equipment (He, 2022; Kerr, 2020). Artistic gymnastics equipment needs to have a well-designed construction, as the equipment should remain stationary while in use to ensure the gymnast's movements are stable during training or competition (Chryssanthopoulos, 2023; Melo, 2023).

The innovation of appropriate sports equipment will have an impact on users and motor learning stages consisting of the cognitive stage, associative stage, and autonomous stage (Aliriad, 2023). The growth and development stages of learning motion, according to Gentile, divide into 2 stages, namely getting the idea of the movement and fixation. Getting the idea of the movement focuses on learning motion must determine relevant and irrelevant stimuli related to skills and appropriate movement patterns to achieve effective skill goals, while fixation relates to what each type of skill requires in the patterns of motion that must be produced to achieve the target (Dallas, 2024; Mendez-Rebolledo, 2022).

Optimization of the idea of movement and fixation requires innovation in sports techniques that produce products with technical and tactical functions, such as different times, different spaces, and different positions according to the needs of sports (Kahya, 2024; Yu, 2024). These needs include the development of sports facilities and infrastructure among all sports gymnasium innovations and the need for energy sources for gymnasts in the artistic gymnastics training process (Morozova, 2023).

The use of artistic gymnastics equipment in Central Java, which still relies on the school gym as a training facility, poses a number of serious challenges. Less representative equipment that is not adapted to the needs of the gymnast's gross motor development has an impact on the learning of movements and inhibits fixation, especially in the mastery of turning skills on the saddle horse apparatus. This condition makes the

training programme ineffective and prevents the achievement of optimal results. In motor learning theory, as proposed by Aliriad (2023), the development of skills requires an environment that favours the adaptation of movements. Less suitable equipment can limit the learning process, which should include the mastery of complex techniques.

The principle of biomechanics also confirms the importance of harmony between sports equipment and body movement. Abahnini (2023) mentions that well-designed equipment can improve energy efficiency, reduce the risk of injury, and help gymnasts perform movements with greater precision. In situations where training space is often limited, the theory of training efficiency shows that multifunctional tools designed using modern technology, such as computer-aided design (CAD), are an ideal solution (Suchomel, 2021; Trucharte, 2021). This tool can provide a variety of exercises that support the acquisition of skills without requiring a large amount of space.

Furthermore, Goulart's (2022) and Opala-Berdzik's (2021) theory of child and adolescent physical development emphasizes the importance of tools that are appropriate for the developmental stage of young gymnasts. Ergonomic tools designed to support gross motor skills can significantly improve an athlete's confidence and physical ability. Therefore, the innovative development of gymnastic equipment, such as multifunctional saddle horses, that meet the specific needs of junior male artistic gymnasts is very important. It is important to develop innovative sports equipment to meet the special needs of athletes (Galih Dwi et al., 2024). This tool addresses the challenges of limited training space and increases training effectiveness and efficiency, helping athletes achieve optimal performance at national and international levels.

To overcome these problems, researchers need to conduct research on the innovation of saddle horse artistic gymnastics equipment as optimization of gross motor growth and development, getting the idea of the movement and fixation in accordance with the anthropometric needs of junior male artistic gymnasts on saddle horse tools designed using electric

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motor drives as a means of mastering gymnast movement skills to meet the composition of artistic gymnastics code of points using CAD (Computer-Aided Design) is a computer program used for drawing products or parts of products. The items to be depicted can be represented by lines or symbols with specific meanings. CAD can generate both 2-dimensional and 3-dimensional images (Sitasi).

The use of computer-aided design (CAD) in sports, particularly artistic gymnastics, has had a significant impact on optimizing the design of sports equipment. CAD makes it possible to design equipment with a high degree of precision, which is essential for creating equipment that meets athletes' physical and technical needs (Sánchez, 2023; Spangler, 2024). In artistic gymnastics, equipment such as saddle horses and parallel bars must be carefully designed, taking into account aspects of biomechanics, comfort, safety, and effectiveness of the exercise. CAD allows designers to create multifunctional sports equipment that can be adapted to a variety of training needs, saving space and production costs (Hales, 2020). CAD allows biomechanics to be simulated so that the interaction between the athlete and the tool can be analysed before the tool is manufactured, reducing the risk of injury and ensuring that the tool optimally supports the athlete's movements (Satria, 2024; Yu, 2024).

With the ability to personalize the design based on individual needs, CAD also allows the creation of tools that are suitable for the size and strength of each athlete, increasing the comfort and effectiveness of the exercises. In addition, CAD speeds up the production process by allowing design improvements to be made to digital models without the need for repeated physical prototyping (Yan, 2024). Continuous innovation in the design of more sophisticated sports equipment, in line with the evolving needs of athletes. Overall, using CAD in the design of artistic gymnastics equipment improves the quality of training and competition, minimizes the risk of injury, and opens up opportunities for further development in the sport (Martinus, 2024). The technology is also pushing for higher

standards in the sport, better-equipping athletes to compete internationally and developing the sport professionally.

The research aims to create an innovative tool that is effective and efficient and meets the specific needs of junior male artistic gymnasts. Criteria-based approaches, such as originality, innovation, economy, safety, and comfort, are used to guarantee that this tool makes a significant contribution to artistic gymnastics training.

METHOD

The method used in this study is research and development, and the data sources included quantitative and qualitative data. Quantitative data is obtained from the results of filling out questionnaires from experts, athletes, and coaches, and analysis of artistic gymnastics equipment innovations in limited space as an optimization of gross motor growth and development of junior male artistic gymnasts using computer-aided design technology (sitasi).

The questionnaire assessors in this study consisted of three main groups: experts, athletes, and coaches. Experts (4 people) from the fields of sports, biomechanics, and sports equipment design provide technical and scientific assessments related to equipment design, potential risk of injury, and effectiveness in supporting gymnasts ' gross motor development. Athletes (10 people) are junior men's artistic gymnasts with varying abilities who provide an assessment based on first-hand experience in using tools, comfort, and the impact on performance and gymnastic skills. Meanwhile, coaches (2 people) experienced training junior gymnasts assessed the effectiveness of the apparatus in training, the ease of adaptation of the apparatus, and its Effect on the development of athletes' gross motor and technical skills.

The product assessment process in this study was carried out through the filling of questionnaires by three groups of assessors: experts, athletes, and coaches. Prepared questionnaires with various assessment items were distributed to the assessors, who then filled out questionnaires based on their knowledge, experience, and observations of the developed

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artistic gymnastics apparatus. After the questionnaire is collected, the data obtained will be analyzed to assess the effectiveness and suitability of the tool. Each group provides input on different aspects, resulting in an overall picture of the quality of the tool. The results of this analysis are then used to evaluate the design and effectiveness of the tool and identify areas that require improvement or further development.

Table 1. Assessment items of assessment groups

Assessment Group	Rating Items
Members	1. Compliance of the design with the principles of biomechanics. 2. A potential tool to reduce the risk of injury. 3. The effectiveness of the tool in supporting gross motor development. 4. Material quality and durability of the tool. 5. Innovations in the design of gymnastic apparatus.
Athletes	1. Convenience when using the tool. 2. The effectiveness of the tool in improving exercise performance. 3. Ease in mastering gymnastic skills with this tool. 4. The impact of tools on the development of technical skills. 5. Flexibility of the tool in different types of exercises.
Coach	1. The effectiveness of the tool in supporting training routines. 2. Ease of adaptation of the tool in various exercises. 3. The influence of the apparatus on the gross motor development of athletes. 4. Practicality in the use and care of the tool. 5. A potential tool to improve the quality of workouts.

To find out the results of gross motor growth and development data on aspects of getting the idea of movement and fixation, researchers used experimental methods by measuring the ability of the physical condition component and the ability of junior male artistic gymnasts' movement skills on each tool both before the pre-test and post-test with quasi-experiments (Achen, 2023; Hu, 2020).

The results were obtained from research reports prepared after analysis of data obtained from questionnaires distributed to experts, athletes, and coaches. The results of the study can be published in scientific journals on the innovation of sports equipment, especially in the field of artistic gymnastics. In addition, the study's results can be used as a reference for the development of gymnastic tools that are better and more in line with the needs of junior and junior athletes men.

Qualitative data, in the form of interview results, field surveys, and input from expert validators of athletes and coaches, were used to test all data results with the data triangulation method. In this study, researchers developed artistic gymnastics equipment on a saddle horse using an

electric motor drive to optimize the gross motor growth of junior male artistic gymnasts (sites).

The study involved 16 assessors, consisting of 4 Experts, 10 athletes, and 2 coaches. The diverse number of assessors provides a balanced perspective from various parties who have a direct relationship with the evaluated artistic gymnastics apparatus. The background of product reviewers is very diverse; they include professionals in the field of sports and gymnastics, as well as practitioners directly involved in the development and training of athletes. Experts are individuals with in-depth knowledge in the areas of biomechanics, sports equipment design, and sports theory who are instrumental in assessing the technical and scientific aspects of the tools developed. Athletes, as the primary users of the device, provide feedback based on first-hand experience using it, providing important insights into the comfort and effectiveness of the device in improving their performance. The coach, with a background in training athletes, assesses how the tool supports the training process as well as the development of the athlete in the long term.

Data reduction in this study selects the main points of research results carefully and in detail from the analysis of product design, experts, coaches, and athletes on aspects of physical condition, anthropometric analysis, and gross motor development in the realm of getting the idea of movement and fixation (Atikovic, 2020; Macías, 2024). Data reduction takes place during the data collection process; at this stage, activities will also be summarized, and parts will be made according to the research flow vv.

Presentation of data by researchers in the form of brief descriptions, charts, or relationships between categories in qualitative research is usually presented in a narrative supported by the results of analysis and evaluation by experts, athletes, and coaches (Gantcheva, 2021; Trucharte, 2021). Drawing conclusions and verification, researchers summarize the problems in the field and then make notes to draw

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preliminary conclusions, which are still temporary and may change during the research process as a result of the research.

RESULT

The data collection process in this study was carried out systematically to ensure that the data obtained was accurate and relevant to the purpose of the study. The first step is to conduct a literature review that includes previous research, artistic gymnastics equipment standards, mechanical principles, and electric motor technology. The aim is to understand the technical needs of equipment and concepts relevant to the hoop skills of junior gymnasts. Field observations were then carried out at the artistic gymnastics training center in order to identify the actual conditions, the needs of the athletes, and the barriers to practicing vault skills. In addition, in-depth interviews were conducted with gymnastics coaches, junior gymnasts, and mechanical engineering experts to explore the specific needs related to the development of Saddle Horse tools with electric motor drives.

The next stage is the prototype development trial, where a prototype saddle horse is tested in advance to evaluate its functionality. The data collected includes motor speed, tool stability, and safety level of use, which is then used to improve the tool. A trial was then carried out with junior male gymnasts. Data was collected through live observation, video analysis of movements and questionnaires completed by athletes and coaches to assess the tool's effectiveness in improving hoop skills. The data obtained was analysed using quantitative and qualitative approaches. Quantitative data included comparisons of hoop skill performance before and after using the tool, while qualitative data included subjective ratings from coaches and athletes regarding the comfort and effectiveness of the tool. The final step will be expert validation to ensure that the tools developed meet international artistic gymnastics standards, followed by revisions based on the input received before the tools are implemented more widely.

Gymnastics Expert Assessment

Assessment is carried out through in-depth testing and analysis based on criteria of originality, innovation, usability, economy, safety, comfort, and completeness of supporting data. Each indicator is assigned a percentage that reflects the level of achievement of the tool against these criteria. Data is collected through direct observation, interviews, surveys, and technical analysis, the results of which are used to refine and validate the tool prior to implementation.

Criteria and indicators of saddle horses with electric motor drives are derived from product development and technology evaluation. The originality aspect measures the extent to which the tool offers innovation compared to existing technologies. Innovation excellence assesses the level of sophistication in the design and functionality of the tool. Usability assesses the ease with which gymnasts use tools, while the economic aspect includes consideration of cost and market potential. Safety measures the extent to which the tool is safe to use, and comfort considers ergonomic factors for the gymnast. Finally, the completeness of the supporting data ensures that all relevant data is collected to support the conclusions and claims of the study. These aspects come from product development methodologies and evaluation standards used in sports research and technology.

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Table 2. Percentage of gymnastics expert assessment

No	Criteria	Indicator	Percentage
1	Originality Aspect	Researcher's findings.	86,5 %
		There is a differentiating aspect to existing sports technology.	81,3 %
2	Aspects of Innovation Excellence	Excellence in innovative tool design.	84,4 %
3	Usability Aspect	Become a multifunctional tool as an artistic gymnastics achievement development in Central Java.	86,5 %
4	Economic Aspects	Have a positive impact on the application of CAD technology in designing products for the development of saddle horse tools with electric motor drive to improve circling skills in junior male artistic gymnasts.	84,4 %
		Has commercialization potential and market reach	81,3 %
5	Safety Aspects	It has a good level of safety for artistic gymnasts	84,4 %
6	Comfort Aspect	It has a good comfort level for artistic gymnastics athletes	81,3 %
7	Aspects of Completeness of Supporting Data	It describes the use of saddle horse tool development with electric motor drive to improve circling skills in junior male artistic gymnasts.	84,4 %

Source: Research Results 2023

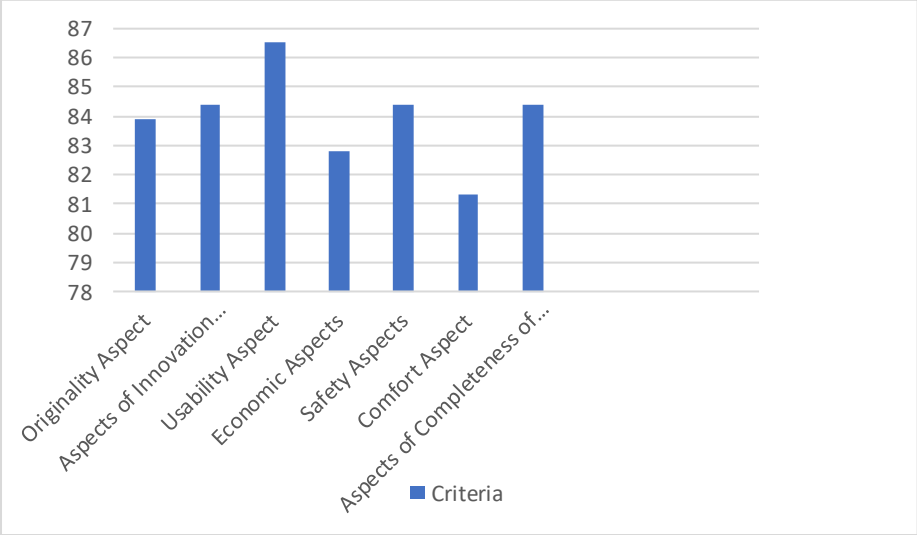

Figure 1. Percentage of Gymnastics Expert Assessment

Overall, the average results of the assessment of gymnastics experts and technical experts from the items in the measurement instrument on the development of saddle horses with electric motor drives to improve circuit skills in junior male artistic gymnasts which include 7 aspects and 9 statement items, obtained a percentage of 83.8%. The percentage results can be concluded in the “good” assessment category.

Table 2. Data for male athletes and coaches

No	Male Athlete	Question Item														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	N1	4	3	3	4	3	4	3	4	3	3	4	3	3	4	3
2	N2	4	3	3	4	3	3	4	3	4	4	3	3	3	3	3
3	N3	3	4	3	3	3	3	3	4	3	3	4	3	3	4	3
4	N4	4	3	4	3	3	4	3	3	3	3	3	4	3	3	3
5	N5	3	4	3	4	3	4	3	3	3	3	3	3	4	3	4
6	N6	3	4	3	4	3	3	4	3	3	3	3	3	3	3	4
7	N7	4	3	4	3	4	3	3	4	3	3	4	3	3	4	3
8	N8	4	4	3	4	4	3	3	3	3	3	3	3	4	3	4
9	N9	3	3	4	4	3	3	4	3	3	3	4	3	3	3	3
10	N10	3	3	3	4	3	3	3	3	4	3	3	3	3	3	4
11	N11	4	3	4	3	3	3	3	3	4	3	3	3	3	3	4
12	N12	4	3	4	3	4	3	3	4	4	3	4	3	4	3	3
Average		3,5	3,3	3,4	3,5	3,2	3,2	3,2	3,3	3,3	3,08	3,4	3,08	3,3	3,3	3,4
Percentage		89,7 %														

Source: Research Results 2023

The assessment Proposal is designed to evaluate the effectiveness and quality of a saddle horse tool with an electric motor drive to improve hoop skills in junior male artistic gymnasts. The assessment was conducted through a Likert scale-based questionnaire with a score range of 1-4, which reflects the athlete's perception of various aspects of the tool, including the effectiveness, convenience, safety, and benefits of the tool in supporting exercise. A total of 12 male athletes (N1–N12) participated in this assessment, answering 15 items of questions covering various indicators of the apparatus. The average score for each item ranges from 3.08 to 3.5, which indicates a positive assessment of the athletes. The items with the highest average score, which is 3.5, are in Items 1 and 4, indicating an excellent perception of the originality or innovative design of the tool. Meanwhile, the item with the lowest average score, which is 3.08, is found in items 10 and 12, which indicates the existence of areas that require further improvement.

The overall average score reached 3.3, which equates to a satisfaction rate of 89.7%. This reflects the tool's success in meeting most user expectations and providing significant benefits in artistic gymnastics exercises. The assessment also shows that the tool is considered effective, safe, and convenient to use, although there are some areas that can be further improved, such as its multifunctional aspect and technical description. The variation in scores between athletes also suggests that

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the experience or comfort level of tool use can be different, depending on individual factors such as initial skill level.

The assessment results provide guidance for the further development of the tool. The results of the expert validation of the aspects with low scores should be improved, and more participants and coaches should be involved in the next evaluation. Quantitative Data from the results of the study will be combined with qualitative data to give an idea of the effectiveness of the gymnastic apparatus. This assessment ensures the tools developed to meet technical standards and support the optimal improvement of hoop skills in junior male artistic gymnasts. The overall results of the product trial using 12 samples showed the average number of scores per question item was 3.32 with a percentage of 89.7%. This shows that the saddle horse product trial is in a good category.

DISCUSSION

Modification of the use of Circle aids on saddle horses with an electric motor drive exerts a significant influence on the kinematics and kinetics of Circle movement. The suspension position of the AIDS, whether around the knees or ankles, affects the movement pattern and the moment distribution in the hip and shoulder joints. Knee suspension produces a movement pattern that is more similar to unaided movement than to ankle suspension. In addition, aids that use elastic components and rotational bearings allow vertical movement of the foot, which aids gross motor development in junior gymnasts. These findings support the use of modern technology in optimizing gymnastic skills, particularly in circular movements in saddle horses.

This finding is consistent with research stating that the position of the suspension affects the distribution of the moment and amplitude of the circular motion (Astuti et al., 2021). The observation that knee suspension results in a smaller hip joint moment compared to ankle suspension is also in line with previous findings (Hakim, 2023; Septiana et al., 2022). However, some small variations in the additional reaction force at certain phases suggest that other factors, such as the individual's comfort level or

adaptability, may also play a role. Instead, the study (Abahnini, 2023) emphasizes that the role of assistive devices should be evaluated individually to accommodate biomechanical variability between athletes, a view that highlights the importance of personalized adjustment of assistive devices.

The limitations of the first study were that testing was conducted on a small sample of junior gymnasts, so the results may not be fully generalizable to the wider population or to other age groups. Secondly, variability in the skill level of athletes probably influenced the results, especially in comparing movements without AIDS and with AIDS. In addition, the study focused more on biomechanical analysis without exploring the psychological or long-term training aspects of using assistive devices. Further research is needed to evaluate the effectiveness of this tool in improving long-term competition performance.

This study answers the main goal, which is to develop a saddle horse aid with an electric motor drive to improve circle skills in junior male artistic gymnasts. The results show that these aids not only support more optimal movement patterns but also help reduce moment changes in the joint, especially in knee suspension conditions. Exercise aids help individuals achieve more precise movement patterns and contribute to reducing errors in joint motion to produce movement (Waluyo, 2023). It is proved that the use of innovative technologies in training aids can contribute to the improvement of the technical abilities of junior gymnasts, especially in circular movements. Research provides a solid scientific basis for the development of similar aids in the future and emphasizes the importance of personalizing aids to meet the specific needs of athletes.

This research shows that a biomechanical model of a gymnast consisting of a torso/head, arms, and legs, with frictionless shoulder and hip joints, provides deep insights into the dynamics of circular motion in saddle horses (Straker, 2022). The maximum torque in the shoulder and hip joints is measured by Angle and speed, with the movement driven by the activation of joint torsion. This activation reflects the coordinated work

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of the muscles to produce extension, flexion, adduction, or abduction, all of which contribute to the acceleration of the center of mass and an increase in mechanical energy (Krasova, 2023). The results revealed that the constraints inherent in Saddle Horse limitations of force, energy, and moment of inertia limit the performance of gymnasts by reducing the energy of the system during circular motion. These constraints provide significant biomechanical challenges and create opportunities to design more efficient assistive devices and support the development of gymnasts ' technical skills (Bağcı, 2023; Mayencourt, 2022).

The implications of the findings of this study include several important aspects in the development of gymnastic training aids. First, the study results provide a scientific basis for creating training aids that can overcome biomechanical constraints on saddle horses, focusing on optimal torque distribution, reduction of moment of inertia, and energy efficiency of athletes. The findings also emphasize the importance of personalized assistive devices based on the athlete's individual biomechanics, such as the more effective use of knee suspension versus ankle suspension, which opens up opportunities for designing devices with suspension position adjustments according to the specific needs of the gymnast. In addition, the study supports the integration of modern technologies, such as electric motors, in gymnastic training programs, allowing better control of biomechanical variables that can improve the technical skills of athletes. Finally, the results of this study could potentially be applied to gymnasts of different skill levels, from beginners to professionals, with modifications of the AIDS adapted to the age, skill level, and physiological needs of each athlete.

The limitations of this study include several aspects that need to be considered for further research. First, the sample used in the study was relatively small, limiting the ability to generalize the findings to a wider population. Using a larger and more diverse sample will increase the external validity of the study results. Second, this study focused more on biomechanical aspects and did not explore psychological factors or

athletes ' perceptions of assistive device use, whereas a holistic assessment that includes cognitive and emotional aspects can provide a more comprehensive picture. In addition, the short duration of the study limits the understanding of the long-term impact of the use of assistive devices on the development of athletes ' skills. Lastly, the study did not compare different age groups or skill levels, making it difficult to understand how these findings apply to a wider population, such as gymnasts with varying ability levels. Taking these limitations into account, further research is needed to explore the impact of assistive devices on long-term performance and evaluate their effectiveness in different groups of gymnasts. This will ensure that the research findings are not only scientifically relevant but also useful in practical applications.

CONCLUSION

The results show the potential to hold objects from a more proximal point to the center of rotation in the circling movement with the position of the foot placed on the Adjuster U base, and the gymnast will be more practical in changing the minimum torque of the hip joint moment that optimizes anatomically/physiologically involving maximum arm muscle strength on the saddle handle at a more proximal place that supports the gymnast's knee and torque on the gymnast's joints including the body/head, arms, and two legs connected by a circling rotation. The findings of this study add further practical and scientific contributions to understanding the development of key skills and developing effective training for saddle horses in optimizing gross motor development getting the idea of the movement and fixation in the circling movement of junior gymnasts.

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