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Kick Flexibility Test Model in Taekwondo Martial Arts: BFS Flexibility Test

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Abstract

Problem. Although some of the potential benefits of taekwondo are still untapped for the safety of adolescents, there are important specific functions and physical preparations like flexibility to meet task requirements. Some of these soft skills are still missing on the ground though they enable practitioners to develop such movements in terms of technical skills. Knowing the flexibility of students' bodies during rehearsal time or competition, especially in *Kyorugi and Poomsae* is crucial. In those games, a good performer is recognised through points awarded especially if the kick hits the head of the rival. In truth, the precision, flexibility of the limbs, and perfection of motions are believed to help the accuracy of the kicks and are still missing in many Taekwondo practitioners as well as an appropriate tool. Therefore, the aim is to develop a flexibility test model known as the BFS test.

Method. This research is R&D (Research and Development) using the ADDIE model and aims to develop a flexibility test model in Taekwondo kicking. This proposed test model would enable the measurement of flexibility in the front, side, and rear kicks. Importantly, its validity and reliability were both tested by experts' judgments along with the value of Aiken's V model.

Results and Conclusions. Results showed that the new model was appraised as a suitable model, with the highest score of 0.929 against 0.74 as calculated values. We concluded that the Flexibility Test Model was completely designated and tested with the BFS Flexibility Test under $P < 0.05$. It can be said that all aspects measured were positively loaded, which implies that the Test is good and would be useful to use.

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Introduction

Physical activity commonly known as physical fitness for some is a set of sports along attributes that people have or achieve which relates mainly to the ability to deliberately execute or involve with positive health impact. As benefits, Akina *et al*. [2011] stated that normally physical fitness comprises an amalgam of health-related benefits and skill-related components that enable an individual to perform effectively. Moreover, the so-called skill-related components can help also to enjoy leisure time activities as well as capable of being acquainted with emergencies [Stebbins 2006]. For such reasons and benefits of sports particularly on human life, improvement or development is needed for the sake of maintaining the standard of being physically healthy in terms of physical well-being and other related attributes. Fundamentally, sports development is basically meant as participation, fostering opportunities and benefits for participants [Shilbury *et al*. 2008]. Take, for example, based on the need of the sport, the development of martial arts, especially taekwondo is indeed quite rapid, both in terms of *Kyorugy and Poomsae* numbers [Kang *et al*. 2021]. *Kyorugi* is simply understood as a physical exercise that applies basic movement techniques, where two people fight each other by using or practicing hands and feet attack techniques, whereas *Poomsae* is a term employed to portray a series of basic movements used against an imaginary opponent by following a certain diagram or pattern. In other words, *Kyorugy* is a number of fights in taekwondo in which the highest point is reached if the kick hits the head. Then the flexibility of the limbs becomes very indispensable. On the other hand, as *Poomsae,* the highest value of kicks can be from the perfection of motion. However, the development of taekwondo does not only mean increasing the number of communities, learning or practice centers, and participants [Albuquerque *et al.* 2021; Quintero *et al.* 2022], but more like deliberately expanding by introducing some changes in rules and regulations of the games. It can also be advanced by inspiring and encouraging coaches to always improve their interesting aspects of the throughput in the perspective of developing the world of taekwondo.

1. Background of the study

Generally speaking, noticing the dynamic development of taekwondo requires an attitude that always alerts one to the possibilities that occur. Changes that occur in any particular game make the matches held also experience a change, although not always happen. In official matches, for instance, local or international games are mostly relied on and use standard rules that eventually lead the match. As a result, controversial discussions or misunderstandings and disagreements are minimized or completely avoided. When new changes in rules are introduced especially in a certain game, it mostly has significant impacts on all concerns since all participants have to firmly adhere to it like changing strategy of performing and tactics while competing [Wasik, Pieter 2013; Ortenburger, Wasik, Gora 2016]. Then, changes are quite needed to remain updated and also to upgrade the game based on the world's evolution and needs. Conversely, when upgrading and improvement in sports games are required but not adjusted, subsequently performance, in this case, would be affected and bad achievement is predictable [Richard *et al.* 2017]. However, to our best understanding, there is a rule in taekwondo martial arts that until now has never been changed though some changes are somehow needed; that is the weight of appraisal, namely a kick to the head in the boxing matches. Kicks to the head of the opponent/adversary especially in boxing always get a higher score than in other spots areas. With respect to that, the development of the rules in taekwondo, especially the *kyorugy* number, increasingly shows that successful kicks/kicking to the head have a higher value [Moenig *et al.* 2023]. This means that kicking to the head is more profitable and worthy than kicking toward the other parts of the body. Unlikely, in the *Proomsae* practices whereby the pattern of defense-and-attack motions are primary hinges, the perfection of motion is the main thing to embed on. Then, athletes are reminded to be able to display and combine movements accurately, and good techniques in order to perform without experiencing triggers in which the height of the kick includes. Thus, the key to the success of that depends merely on the flexibility each individual bears [Vertonghen *et al.* 2012]. Therefore, taekwondo athletes must have good flexibility of the limbs for the sake of good performance and promising outcomes.

As acknowledged as an important component of physical aptitude, flexibility is one of the essential qualities for acquiring and developing human physical conditioning for the American College of Sports Medicine [Pollock *et al.* 1998]. Dantas asserted that improved/improving flexibility brings certain benefits, such as lowering the risk of injuries; enhancing athletic performance, and increasing chances of winning the match [Dantas *et al.* 2011]. For these aforementioned facts along with other reasons, flexibility learning and reinforcement become increasingly immersed in physical activity prescription programs in some settings or schools. However, so far, the tests related to both physical fitness and joint flexibility are still general and seem complex for some, and unfortunately, sometimes their results generate ambiguity and biased information or even credibility gaps from the athlete's performance when demonstrating and performing certain techniques. To that, inadequate flexibility levels in different joints are readily seen, which eventually contributes to reducing the performance quality, especially activities that get involved in daily life and

then increase hazardous injury and risk. Equally, poor flexibility in the back and hip joints for example may contribute to the development of lower back pain. It is reported that this lower back pain is one of the costliest medical conditions for many adults and adolescents in American hospitals [American College of Sports Medicine 2014; Plowman *et al.* 2013]. Therefore, the avoidance and prevention of it is for good reason and is all about training athletes with proper and accurate means in the wake of developing flexibility and adequate motions.

As mentioned in the preceding paragraph, there is a need for a specific test model that can be used to measure flexibility motions and movement in taekwondo practices or after a certain training session. Suffice it to emphasize here that, training or continuous exercising/learning is something that should be constantly tailored by both athletes and coaches [Jung *et al.* 2019]. That should be done from the perspective of strengthening movements and flexibility that requires evaluation in order to trace or estimate the level of improvement. Evaluating whether there is a significant increment or reduction in skills, especially after undertaking training sessions for vital benefits. So, from here, one may wonder, what reliable tool or a test can be utilized to help measure kick flexibility in taekwondo martial arts with tangible credibility? Since there is a lack of such an instrument so far, this research was designed to help develop an instrument model accordingly named BFS. The BFS stands for Bigger Faster Stronger, as the premier performance program for high school and college sports. In a broad sense, BFS regards stretching as a separate exercise regimen, like plyometrics and weight training where stretching is not part of a warm-up or cool-down for physical activity that athletes need to do only occasionally. The BFS Stretching Program is as easy as 1-2-3-4, named so because it consists of 11 stretches, divided into four groups namely the first group of exercises which is performed on a bench, the second standing, the third against a wall, and the fourth on the floor. Then, this new model is briefly defined as the test that can be used to measure or determine accurately the actual condition of kicking flexibility of athletes in taekwondo games. In the same vein, this test model in terms of kick flexibility is an attempt to determine the actual condition of the athletes' legs used when kicking. Prospectively, to make this kick flexibility test model would intervene to distinguish personal skills as physical development processes from general comprehension to a specific one and also to determine the flexibility performance of the kick movement forms.

2. Material and Methods

2.1. Research Type and Subjects of Interest

To begin with, this research is R&D otherwise Research and Development. Based on the purpose of the study, this research chooses the ADDIE model as one of the types of R&D research. ADDIE model is an abbreviation that stands for or is composed of Analysis, Design, and Development. Implementation, and Evaluation following selective and specific procedures to produce a Flexibility Test Model in taekwondo sport. The extent of the test model accuracy was appraised based on a Likert scale of 4 points ranging from (1) not very agree; (2) not agree, (3) agree; (4) very agree. Apart from the Likert scale, Aiken's testing model was also assigned. While using Aiken's testing, fifteen (15) items were constructed, judged, and applied. Just for a record, experts' judgment helped to assess the data harvested which were then quantitatively analyzed with Aiken's formula $V = S / [n (c-1)]$; where V is the value of the validity coefficient of Aiken, S is the value of the rating scale minus 1, n is the number of assessors or experts used in the validation, and c is the highest score in the rating scale.

As the sample size is concerned, this study provides treatment in the form of flexibility exercises for eight (8) meetings. The sampling technique used in this study was the purposive sampling technique, which is a technique with which sample selection is determined based on some inclusion criteria. In other words, individuals who have the appropriate qualifications desired by researchers and are related to research objectives [Paramitha *et al.* 2020]. Therefore, ten (10) individuals opted as the sample size with criteria, namely the fighting category (kyorugi) whereby six (6) were males and the rest four (4) were female.

2.2. Product Design through ADDIE Model

Snyder, [2019] stated that research and development methods are methods employed to produce certain products and test their effectiveness. The ADDIE development model was developed by [Branch *et al.* 2015] and aims mainly for Instructional Design (learning design). In this present work, the development procedure for the "Development of a Kick Flexibility Test Model in Taekwondo" is schematized based on the following terms:

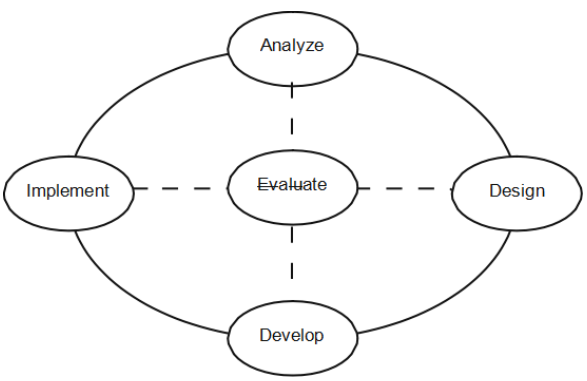

Figure 1. ADDIE model development flow used in the kick flexibility test model [Branch *et al.* 2015]

As previously stated, this research has two main objectives, namely product development and testing its effectiveness through experts' judgments and inputs. According to Borg & Gall [1983], the R&D with ADDIE model is framed under or on five steps organized and briefly comprehended in the following order;

a. Analysis
Need analysis and information gatherings: it is briefly explained as a stage of identifying the problem of interest and obtaining sufficient information related to the subject to be developed. Selecting inclusive literature related to existing problems like limb flexibility and the form of techniques used in the taekwondo game guided our search. Besides, a field survey was conducted to obtain data on real conditions, especially on the process of testing the flexibility of self-defense in taekwondo. In the wake of seeking the need for the product in sports fields, the data collection was performed into two schemas; namely by conducting unstructured interviews along with carrying out the field observation.

b. Design
Design is the second stage in the ADDIE model. In this present study, this stage includes the design of the three positions; that is taekwondo martial arts and flexibility test kit; the preparation of needful components such as the meter, black cloth, cork, wood/aluminum slats, and chalk. However, it is advised that during the practicing process, the shape and size of the tool, the cost of manufacture, and the processing time of the tool should be taken into account to help the feasibility of the research and the accuracy of the data.

c. Product Development
Product development is the third stage in which a product will be produced in the form of a test model for the limbs of taekwondo martial arts athletes based on the design proposed in the previous stage. After passing through all the stages above, this flexibility test model was then judged and evaluated for validation. In such an activity, different experts with different expertise were invited, namely, material experts appointed based on some inclusive criteria like bearing intuition and understanding of the movement's performance in the game of taekwondo; test and measurement experts with qualifications as experts in the field of the test, measurement, and evaluation. Physicists were called to assess the feasibility of the flexibility test method. By having the expertise to understand and analyze the physical needs of taekwondo games, the validation test aimed at determining the validity standard of the new tool. Prompt the corrections and inputs adjustment, the improvements, and then implementation was made.

d. Implementation
Implementation is the fourth stage in the ADDIE model used in this research during data collection. This stage was carried out by testing the new product which has previously been passed through experts' judgments. The trial was carried out only as a tool to find out whether the new method developed for measuring flexibility could be approved and easy to employ.

e. Evaluation
Evaluation becomes the last stage assigned in this research. At this step, the researcher assessed the form of three flexibility tests developed that have been produced after passing through the implementation stage in the form of data obtained from the respondent's assessment questionnaire. Judging from the potential problems above, the next step was to find out information from field observation. Based on the observations made, the flexibility test model has not yet been specifically developed. For that, the data was taken from experts' opinions and trainers during product trials.

After going through all the steps, the data yielded were technically analyzed as an appropriate way to find out the results of the research. Then, Aiken's techniques were the basis of analysis to reveal its feasibility and reliability. Aiken's technique is broadly understood as a type of quantitative assessment focusing on using numbers during calculation as percentages indeed. In other words, the analysis of the expert's test data was performed through the Aiken formula while the feasibility of them was dealt with by using a qualitative approach.

2.3. The Material Used and how the Measurements were Carried out

Despite studying the need for kick performance during a match, the author was also keen on making a flexibility test method for three kick positions stated in the preceding section. Besides that, the researcher bears personal experience of being a taekwondo coach and had ever partaken in international championship events whereby opportunities were set to observe and probe the real need for flexibility when using in matches, especially during the competition where kicking techniques are the core. During the process of testing the new model, some materials/or tools were indispensable; namely measuring tools, wooden or aluminum slats covered with a dark cloth, writing sets (pen, felt-tip marker, chalk, etc.), and flat walls before proceeding to the measurement itself. The measurements were also taken in different steps by following some instructions presented in the suite below:

Table 1. Profile of Steps and Instructions of the Measurements Performed

a. **First of all, measuring the athlete's inner leg length;**
b. **After knowing the length of the limb, the measurement process begins;**
c. **Back or facing the wall:** 1) One leg straight, toe tips and body against the wall; 2) Swing the other leg straight back as high as possible; 3) After the maximum is reached by the data taker and affixed to the prepared bar so that there are tang and color in the bar; 4) After that, compare the length of the leg and the measurement results by lifting the leg forward and backward
d. **Front or facing forward:** 1) Stand straight and the back of the body against the wall, both legs and feet, back and head against the wall; 2) Swing one leg forward as high as possible, and stay still or don't let the leg fall off from the wall; 3) After the maximum is held and the height is measured, then a comparative analysis between the length of the leg and the result of the height from the swing of the leg is.
e. **Side or facing sideways:** 1) Stand straight sideways; 2) Legs and arms against the wall; 3) Swing your leg out to the side as high as possible and hold it; 4) After that, it is marked and measured with a bar so that it leaves the mark; 5) Then, look for the difference between the length of the leg and the height of the kick.

3. Results of the Research

The accuracy of the material developed/flexibility test model in kicking was tested and deemed by three experts (see more info in the preceding paragraphs) through the experts' validation stage. Thus, this new model was developed to be used in the latent search for prospective athletes and coaches, especially in taekwondo martial arts. During the process of the data treatment, Aiken's formula was employed, thereby the profile of its validity test outputs is depicted in the table 2.

N.B: Abbreviations used and their comprehension

- As: assessors and their codes that are;
  - A = assessor number 1, B = assessor number 2, C = assessor number 3, D = assessor number 4, E = assessor number 5, F = assessor number 6, G = assessor number 7, H = assessor number 8, I = assessor number 9.
- Aiken formula V = S / [n (c-1)].
  - V is the value of the validity coefficient of Aiken,
  - S is the value of the rating scale minus 1,
  - n is the number of assessors or experts used in the validation,
  - c or r is the highest score on the rating scale.
- Itm = item,
- **Skr** or Sk were the codes orbitally assigned to **score.**

Based on data portrayed in Table 2, aspect 1 shows Aiken's V coefficient value of 0.893, while aspect 2 shows Aiken's V coefficient value of 0.929. To simplify the results, the highest value of Aiken's found was equal to 0.929 with 0.786 as the lowest value. From here, we can estimate and draw the average score of Aiken's V among all 15 items used which is virtually equal to 0.857 as the Aiken's V coefficient value ranges from 0 to 1. Because the minimum standard of Aiken's V coefficient value for this study is 0.74, while using a significance level of $P < 0.05$, It can be said that all aspects are valid. In other words, all the experts agreed that the BFS (bigger faster, and stronger) Flexibility Test product is good and ready to be utilized.

3.1 Reliability of Internal Items

Cronbach's Alpha was used to view the extent of reliability that assesses the observational instruments summarized in the following table:

Table 3. Results Test Reliability Inter-Rater observational instrument ratings to assess flexibility test model in taekwondo kicking performance

Reliability Statistics
Cronbach's Alpha
0.870

With an aggregate value of Cronbach's alpha equal to 0.870 resulting from 15-item instruments, that means, the instrument ratings have sufficient inter-rater reliability.

Table 2. Profile of Aiken's Validity Test Outputs

As = n	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14		Item 15
	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr	s	skr
A	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	2	3
B	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	2	3
C	3	2	4	3	4	3	4	3	3	2	4	3	4	3	4	3	3	2	3	2	3	2	2	1	4	3	3	2	3
D	4	3	4	3	3	2	2	1	3	2	4	3	4	3	4	3	4	3	2	1	3	2	4	3	4	3	4	3	4
E	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	2	3	2	4	3	4	3	4	3	4
F	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	2	3	2	4	3	4	3	4
G	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4
H	4	3	4	3	3	2	4	3	4	3	4	3	4	3	4	3	4	3	3	2	3	2	4	3	4	3	4	3	3
I	3	2	3	2	4	3	4	3	4	3	3	2	3	2	3	2	4	3	4	3	4	3	4	3	3	2	4	3	4
Σs	25		26		25		25		25		26		26		26		26		22		22		24		26		24		23
V	0.893		0.929		0.893		0.893		0.893		0.929		0.929		0.929		0.929		0.786		0.786		0.857		0.929		0.857		0.821

4. Discussion

Suffice to remind here that the main impression of this study is to develop a model that would help to tailor the flexibility movements and the perfection of technical motion in taekwondo athletes, especially when taking a kick. The reason behind this is to secure a hint in the form of a test model to assess the flexibility of motions and minimize casualties in taekwondo games. As selected and retrieved from different resources, it has been found that most authors and coaches in physical fitness (taekwondo martial arts) do not have a specific model to rely on in such games or during training or rehearsal [Santos *et al.* 2021]. For that reason, some athletes undergo unnecessary injuries because of the training they had during the preparation for the match. In tandem, the author manifested a sense of dissatisfaction with a such classic model when it says that *Kyorugi* is the number of matches and the highest points are recorded when it (the kick) comes to the head.

The research on the flexibility test hailed BFS Flexibility test is the development research, commonly known as R&D with ADDIE as the research model. This research originated from the experience and observations of researchers who have been pursuing field training and observation of taekwondo martial arts, where flexibility tests available so far were found not in accordance with reality. Please note that kicks that occur in taekwondo matches, *both Poomsae, and kyorugi,* have three main directions with many variations of kicks [Haddad 2014]. According to [Mailapalli, Benton *et al.* 2015], the three directions include front kicks, sidekicks, and back kicks as well as spinning kicks. However, the three ways of kicks require real flexibility according to their functions. Therefore, it is hoped that once real flexibility is applied the kick technique will be maximized and mistakes avoided. For that reason, it was important to develop a reliable flexibility test model able to measure movements according to the athletes' needs. So far, the flexibility test coaches using still general and cannot be used to measure the flexibility of an athlete [Sporis *et al.* 2011; Bertolla *et al.* 2007]. Meanwhile, if the BFS Flexibility Test is used, the emphasis is on the actual function of the kick technique. Then, this test was carried out in three different directions according to the kick that might occur. This test kit is still manual and according to the author, the main equipment needed is the meter, flat walls, wooden slats that are dark-colored and covered with soft cloth and cork, chalk/dyes, and writing utensils or pencils to note the test results.

Normally, before the final product designed and developed is used, it should be consulted and validated by some experts in the related discipline like the FGD, however, due to the ongoing pandemic, the Delphi method was used. From the results of the FGD, there are inputs to carry out the test not only statically but also dynamically, since it is under reality on the ground. This suggestion led the researcher to finally make the measuring instrument made of blades and coated with cork and cloth, so that when taking measurements dynamically, then, the measuring instrument does not hurt the dark color. It enables one to indicate the position of the foot's height if it touches the cloth with chalked footnotes, so that easy to measure. Based on the Delphi results processed using the Aiken formula, it shows that the BFS Flexibility Test is declared feasible and good for measuring kick flexibility with Aiken's V results ranging from 0.929 to 0.786. Based on the results of the expert's judgment and test model validation relating to the results of calculations using the Aiken method, it can be said that the flexibility test method for taekwondo is appropriate to be used as a tool to measure the flexibility of taekwondo practitioners. This model test is specifically appropriate to measure the flexibility in the athlete's limbs, both back flexibility, and front flexibility as well as side flexibility. Concerning that, it is assumed that if the flexibility of the legs both forward, sideways, and backward is good, it will increase the performance of the kick in taekwondo matches [Da Silva *et al.* 2015].

According to [Aiken 1985] who stated that the validity of any kind of instrument developed as a flexibility test model in this study, can be accepted if the critical level calculated is equal to or over 0.50 in value. However, in some cases, most of the values of the variables are found higher than the critical level of 0.70 [Charter 2003]. Hence, the content and internal, as well as the inter-rater reliability were tested. The results showed that using Aiken's V formula, the flexibility test model designed an optimal validity value of not less than 0.80. The same results also show a sufficient level of reliability, which is the value of Cronbach's Alpha of 0.851. That said the item instruments employed during data collection were proved reliable based on Cronbach's alpha value. This means that the instrument/test model can be used to help improve the flexibility of the body for athletes in taekwondo games. Overall, it can be concluded that the results yielded especially based on both the quantitative and qualitative inputs of experts' judges, the value of Aiken's and Cronbach's Alpha, reflect that the design or construction of validity and reliability of flexibility test model in kicking to assess and minimize some head injuries since their values proposed by experts are all above the acceptable range of critical level.

5. Conclusions

This study concluded that the Flexibility Test Model was completed and named the BFS Flexibility Test. Then, this flexibility test helps to measure the position of the kick straight forward, the position of the leg to kick to the side, and the position of the kick to the back. The difference between the length of the inner leg of the leg and

the result of the highest kick was taken. This means the new model proposed can be considered as a useful hint, which could be used in akin circumstances by instructors or teachers to novice athletes. As limitation reported, this product still needs more supporting data from not only experts' judgment rather than testing the product with specific athletes. If doing so, it is suggested that the sample size should be greater in number. This assertion is corroborated with the one postulated by Branch *et al.* [2011] in their book "Research Methods in Education" that *the greater the sample the better.* Yet, it could be also an additional asset if this flexibility test model developed is applied in different areas by/with individuals with distinctive characteristics, such as gender differences or age. Just for the record, this study concludes that the flexibility test model designed for kicking purposes in Taekwondo martial arts has a high value of content and internal validity from experts' judgment, apart from sufficient reliability tested by the aid of Aiken's coefficient value and Cronbach's Alpha.

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Model testu elastyczności kopnięć w sztukach walki taekwondo: test elastyczności BFS

Słowa kluczowe: kopnięcia, model testu elastyczności, taekwondo, sztuki walki

Streszczenie.
Tło. Chociaż niektóre z potencjalnych korzyści płynących z taekwondo są nadal niewykorzystane dla dobra nastolatków, ważne są określone funkcje i przygotowanie fizyczne, takie jak elastyczność do wymagań zadania. W związku z tym nadal brakuje umiejętności miękkich, chociaż umożliwiają one adeptom sztuk walki rozwijanie ruchu pod względem umiejętności technicznych. Znajomość elastyczności ciała uczniów podczas treningów lub zawodów, szczególnie w *Kyorugi i Poomsae*, jest kluczowa. W tych walkach dobry zawodnik jest doceniany punktami, zwłaszcza jeśli kopnięcie trafi w głowę rywala. W rzeczywistości uważa się, że precyzja, elastyczność kończyn i perfekcja ruchów pomagają w dokładności kopnięć i wielu trenującym taekwondo wciąż brakuje odpowiedniego narzędzia. Dlatego celem jest opracowanie modelu testu elastyczności znanego jako test BFS. Metoda. Badania autorów miały na celu opracowanie modelu testu elastyczności w kopnięciach w taekwondo. Zaproponowany model testowy umożliwiłby elastyczność pomiaru w postaci kopnięć przednich, bocznych i tylnych. Co ważne, jego trafność i rzetelność zostały przetestowane przez ekspertów wraz z wartością modelu V Aikena. Wyniki i wnioski. Wyniki pokazały, że nowy model został oceniony jako odpowiedni model, z najwyższym wynikiem 0,929 wobec 0,74 jako wartości obliczonych. Stwierdzono, że model testu elastyczności został całkowicie wyznaczony i przetestowany za pomocą testu elastyczności BFS przy $P < 0,05$. Można powiedzieć, że wszystkie mierzone aspekty były pozytywnie obciążone, co oznacza, że test jest dobry i przydatny do zastosowania.