Jurnal Pendidikan Jasmani (JPJ)
Vol. 4, No.2, Desember 2023
ISSN: 2723-2816 (Online)

Identification of Taekwondo Athlete Talent by Using Analytic Hierarchy Process (AHP) Softwear

Rini Andriani[1], Agus Rusdiana[2]

[1,2]Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Street Dr. Setiabudi No. 229 Bandung 40154, West Java, Indonesia

ABSTRACT
AHP is designed to solve complex problems in hierarchies, unclear structures, uncertain opinions of a decision, many decision makers, and inaccuracies in existing data. This study aims to determine the criteria and sub-criteria in identifying the talent of taekwondo athletes aged 12 to 14 years. The data collected and analyzed using the Analytic Hierarchy Process (AHP) with the expert choice application. The method used in this research is a combination method (mixed-methods research) by conducting a literature review and providing questionnaires to 30 taekwondo experts in West Java. Of the thirteen sub-criteria, ten sub-criteria were the highest with data analysis using AHP. The ten sub criteria include mesomorph, endomorph, height, ectomorph, V02Max, Body Mass Index, weight, agility, speed and leg length.

Keywords: *AHP; Athlete; Identification; Taekwondo*
Correspondence author: Rini Andriani, Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Indonesia
Email: andriani150602@upi.edu

INTRODUCTION

In Korean, "tae" means kick, "kwon" means fist, and "do" means art. This is how taekwondo is practised. Taekwondo, then, is a martial art that emphasises the use of the hands and feet for self-defense. (Merangin, 2018). There are two different classes in Taekwondo martial arts competition: poomsae and kyorugi. Kyorugi, which means to compete, and poomsae, which means art. Taekwondo sports require a number of fundamental biomotor skills, such as strength, endurance, power, speed, coordination, flexibility, and balance. When it comes to implementing taekwondo physical exams, these biomotor components are essential. (Setiyawan & Sukadiyanto, 2015). due to the need to determine the extent of the athlete's physical condition. Furthermore, this study may eventually lead to a quantitative and qualitative characteriszation of the typical physiological traits of Indonesian junior athletes. Taekwondo as a sport with national and international competition.

The athlete selection process is usually seen from the number of flight hours available. But flight hours cannot be a benchmark in identifying athlete talent. It is still often found that

in identifying talent the coaches still do it manually. This is still not effective (Harianto et al., 2022) In this process, there are many frauds that occur. One of the frauds that often occurs is fraud in data processing. Talent identification programs are created to select young athletes who are competent. (Vaeyens et al., 2009). Selection of athletes using the Sport talent identification (STI) program (Breitbach et al., 2014).STI plays an important role in stabilizing the continuity of athletes in the world of sports (Zheng & Chen, 2016). Taekwondo requires the application of a decision system to determine the best taekwondo athlete. There are several ways to solve these problems in determining the criteria for athletes, one of which is a system called the AHP (Kurniawan & Gusrianty, 2019).

AHP expressed by Thomas L. Saaty in the 1970s has the meaning of a decision support system in a systematic way so that it can be widely applied in important decision making. (Dari & Taroreh, 2022). AHP is designed to solve complex problems in hierarchies, unclear structures, uncertain opinions of a decision, many decision makers, and inaccuracies in existing data. (Harianto et al., 2022). An approach called the AHP has been implemented in the sport of volleyball to measure anthropometry, strength, biomechanics, agility, psychological and physiological factors (Nurjaya et al., 2020)

The application of AHP has previously been applied to the sport of volleyball to measure several parameters of volleyball athletes as criteria. This model analyzes data comparing variables, elite athlete norms, and prospective athletes. This identification model can be relied upon as an STI model in volleyball (Noori & Sadeghi, 2019). In the research has applied AHP software in rowing sports (Nurjaya et al., 2020). However, in this study the authors want to apply AHP software to taekwondo athletes because very few researchers discuss systematic criteria, procedures and make decisions using AHP.

Therefore, the purpose of this article is to review talent identification especially in taekwondo athletes. Many researchers have applied AHP to solve a problem, especially in the field of sports.

METHOD

Mixed Methods Research (MMR), as it is commonly known, is a research approach that integrates quantitative and qualitative methods (Nurjaya et al., 2020). MMR was discovered in the 1950s, and in the realm of sports, this research method was heavily utilised

in 2005 (Abeza et al., 2015). One crucial component of mixed methods research is the integration of qualitative and quantitative components (Goel, 2018). In sport-related research approaches, MMR seeks to address the shortcomings of both qualitative and quantitative methodologies. Furthermore, MMR endeavours to integrate both quantitative and qualitative methodologies, thereby rendering a noteworthy contribution to the field of sport research (Jones, 1997). Because MMR involves researchers to find answers to research questions, it is a practical approach (Bressan et al., 2017).

Google Form was used to distribute questionnaires online in order to collect data. Respondents were asked to rank criteria according to three factors: somatotype, biomotor, and anthopometry. In order to identify talented taekwondo athletes, these criteria were carefully chosen while taking into account different viewpoints. Thirteen sub-criteria were identified as necessary for the process of determining the talent of taekwondo athletes at different ages based on the author's review of the literature from a variety of reference sources.

Integrating quantitative and qualitative data can take three different forms: merging, connecting, and inserting data (Palinkas et al., 2019).The study employed MMR as a technique to determine taekwondo athletes' talent. There are two methods: the first is talking with taekwondo coaches, and the second is using talent identification software created using the AHP.

The purpose of the conversation is to learn more about the standards used to determine the talent of taekwondo athletes at the provincial level. With the intention of reaching a wider audience and saving time, the discussion system is conducted online using a Google Form. The priority criteria for the responses were based on anthropometric, biomotor, and somatotype aspects. By considering various viewpoints, the selection criteria were made in a positive manner in order to obtain taekwondo athletes through STI.

Table 1. Criteria and sub-criteria selected for the evaluation of Taekwondo athletes

Criteria	Sub-Criteria	Code	Reference
Anthropometry	Height	ANT1	(All et al., 2011; Jlid et al., 2016; Kavvoura et al., 2018; J. W. Kim & Nam, 2021; Nikolaidis et al., 2016; Roh et al., 2020; Sarshin et al., 2021; M.-W. Seo et al., 2015; Taati et al., 2022; Tayech et al., 2022; Tsai et al., 2011; Wazir et al., 2019)
	Body weight	ANT2	(Wazir et al., 2019), (Nikolaidis et al., 2016), (M.-W. Seo et al., 2015), (All et al., 2011), (Taati et al., 2022), (J. W. Kim & Nam, 2021), (Taati et al., 2022), (Roh et al., 2020), (Sung et al., 2021)
	BMI	ANT3	(Choi et al., 2021; Jlid et al., 2016; Kavvoura et al., 2018; J. W. Kim & Nam, 2021; Monks et al., 2017; Nikolaidis et al., 2016; Roh et al., 2020; Sarshin et al., 2021; M.-W. Seo et al., 2015; Taati et al., 2022; Tayech et al., 2022; Tsai et al., 2011; Vasconcelos et al., 2020; Wazir et al., 2019)
	Leg length	ANT4	(All et al., 2011; Jlid et al., 2016)
	Body fat	ANT5	(Jlid et al., 2016; Kavvoura et al., 2018; J. W. Kim & Nam, 2021; Monks et al., 2017; Nikolaidis et al., 2016; M.-W. Seo et al., 2015; Sung et al., 2021; Taati et al., 2022; Tayech et al., 2022; Tsai et al., 2011; Vasconcelos et al., 2020; Wazir et al., 2019)
Biomotor	Agility	BIO1	(All et al., 2011; Nam & Lim, 2019; Nikolaidis et al., 2016; Taati et al., 2022), (Choi et al., 2021)
	Strenght	BIO2	(All et al., 2011; Jlid et al., 2016; Kavvoura et al., 2018; J. W. Kim & Nam, 2021; Monks et al., 2017; Nam & Lim, 2019; Nikolaidis et al., 2016; Roh et al., 2020; M.-W. Seo et al., 2015; Sung et al., 2021; Tayech et al., 2022; Wazir et al., 2019)
	VO2Max	BIO3	(H.-B. Kim et al., 2015; Wazir et al., 2019), (All et al., 2011; J. W. Kim & Nam, 2021; Monks et al., 2017; Rocha et al., 2016; Roh et al., 2020; M. W. Seo et al., 2019)
	Flexibility	BIO4	(H.-B. Kim et al., 2015; J. W. Kim & Nam, 2021; Monks et al., 2017; Nam & Lim, 2019; Sung et al., 2021; Tayech et al., 2022; Wazir et al., 2019)
	Speed	BIO5	(Choi et al., 2021; Jlid et al., 2016; J. W. Kim & Nam, 2021; Nam & Lim, 2019; Wazir et al., 2019)
Somatotype	Endomorph	SOM1	(ARAZI et al., 2016; Bridge et al., 2014)
	Mesomorph	SOM2	(ARAZI et al., 2016; Bridge et al., 2014)
	Ectomorph	SOM3	(ARAZI et al., 2016; Bridge et al., 2014)

Thirty taekwondo experts in Indonesia, including athletes and coaches with over ten years of experience, were surveyed to gather their opinions. Their varied life experiences have given them a variety of perspectives and ideas. They provided significant influences on their coaching and training experiences as well as their greatest accomplishments, which proved to have an effect on their opinions and responses, even though this sample was not statistically analysed.

The fundamental ideas behind applying the AHP method are as follows: a. Decomposition, which divides the issue into its component parts and creates a hierarchical structure for the decision-making process. b. Comparative judgement, which evaluates the relative significance of two components at a particular degree. c. Synthesis of Priority: relative weights for the decision-making elements are obtained by applying the Eigen Vector Method. d. crucial aspect of AHP is logical consistency. Logical Consistency is a crucial aspect of AHP.

According to (Kurniawan & Gusrianty, 2019) the procedural AHP. AHP is skilled in resolving multi-objective issues and criteria that rely on contrasting an idea from every component. The AHP approach looks like this: 1. Identify a problem and work out a solution. 2. Creating a hierarchical structure with the goal at the top and criteria and options below. 3. Using a basic matrix, compare elements side by side in pairs based on pre-existing criteria to identify the primary elements. 4. The numbers in the pairwise comparison matrix indicate what each other element needs in order to create a scale from 1 to 9 that compares each level.

Table 2. AHP Comparison Scale

Comparison Intensity	Definition	Description
1	Equally important	Equally important
3	Slightly more important	One element is slightly more important than the other
5	More important	One element is more important than the other
7	Very important	One element is more important than the other
9	Absolutely more important	One element is absolutely more important than the other
2,4,6,8	Middle value	Values between two adjacent consideration values
Opposite	If activity i gets 1 number compared to activity j, then j has the opposite value compared to j.	

In this research, the research process is divided into four stages, namely, the first stage of defining objectives and determining objectives, the second stage of organizing problems into a hierarchy addressed in Figure 1, the third stage of making comparisons and determining the first element, and the last stage is conducting consistency testing of comparisons between elements.

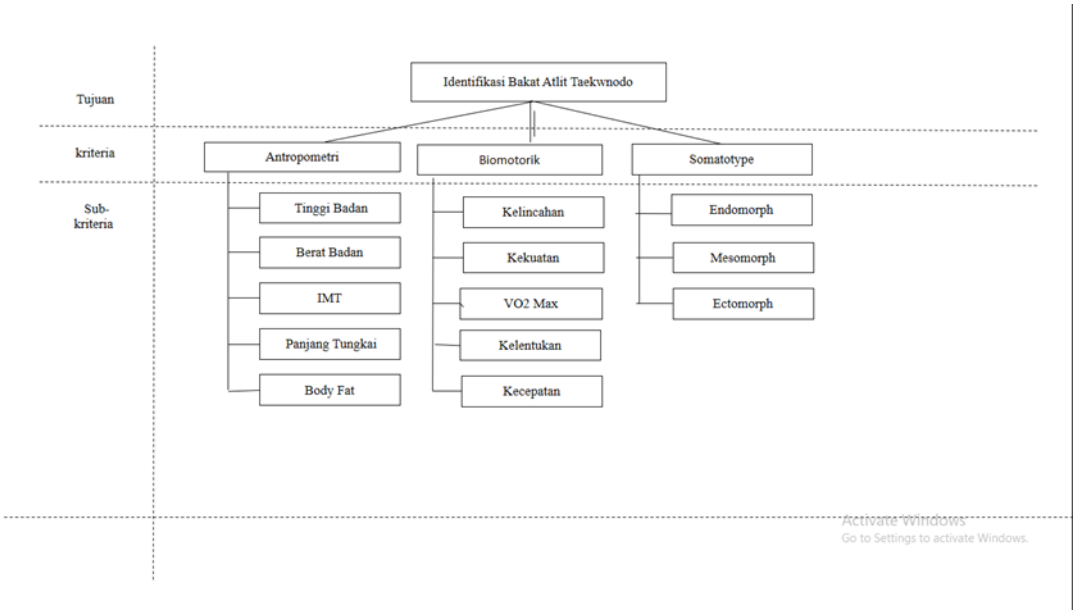

Figure 1. Taekwondo Athlete Candidate Evaluation

RESULTS AND DISCUSSION

Table 3 shows an example of an AHP questionnaire. As shown in Table 1, height has a value of three (3) compared to weight, indicating that height is slightly more important than weight. Otherwise, height has a value of one-third (0.333) of weight.

Table 3. Criteria importance questionnaire scores

	Height	Height	Height	Height	Height
Height	1	1	0,33	3	0,3
Body Weight	1	1	1	3	1
BMI	3	1	1	3	3
Limb Length	0,33	0,33	0,33	1	5
Body Fat	3	1	0,33	0,2	1

	Agility	Strenght	VO2Max	Flexibility	Speed
Agility	1	1	1	1	1
Strength	1	1	1	1	1
VO2Max	1	1	1	1	1
Flexibility	1	1	1	1	1
Speed	1	1	1	1	1

Tabel 4. shows the results of data analysis from the expert opinion questionnaire using expert choice software.

	Endomorph	Mesomorph	Ectomorph
Endomorph	1	0,14	0,14
Mesomorph	7	1	7
Ectomorph	7	0,14	1

Figure 2. Determination of main criteria and consideration of criteria with AHP method

Based on expert opinion, a pairwise comparison of the sub-criteria on each criterion was carried out in order to gain a better understanding of the priorities displayed in Figure 2. The five sub-criteria that make up the anthropometric criterion (ANT) in Figure 2 are: body mass index (ANT3), limb length (ANT4), body fat (ANT5), weight (ANT2), and height (ANT1). Height (ANT1) is demonstrated to play the most significant role among the other criteria based on the comparison results. The priority scores are as follows: ANT1 = 0.265; ANT2 = 0.219; ANT3 = 0.221; ANT4 = 0.207 and ANT5 = 0.008. There are five sub-criteria that make up the Biomotor criteria: speed (BIO5), flexibility (BIO4), VO2 Max (BIO3),

strength (BIO2), and agility (BIO1). After comparing the results, it was determined that VO2 Max (BIO3) played the most significant role among the other criteria. The priority scores are as follows: BIO1 = 0.209, BIO2 = 0.199, BIO3 = 0.223, BIO4 = 0.161, and BIO5 = 0.209. Three sub-criteria make up the Somatotype criterion: endomorph (SOM1), mesomorph (SOM2), and ectomorph (SOM3). Mesomorph (SOM2) was found to play the most significant role among the other criteria based on the comparison results. The priority scores are as follows: SOM1 = 0.0295, SOM2 = 0.455, and SOM3 = 0.250. Further analysis on each sub-criteria is shown in Figure 3.

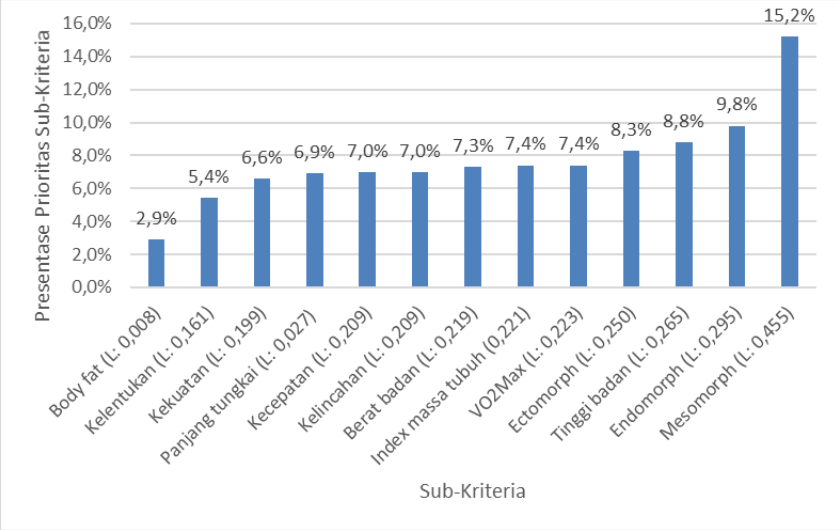

Figure 3. Prioritization of criteria using AHP method

The top ten sub-criteria, which include weight (7.3%), agility (7.0%), speed (7.0%), leg length (6.9%), mesomorph (15.2%), endomorph (9.8%), height (8.8%), ectomorph (8.3%), V02Max (7.4%), Body Mass Index (7.4%), and combination of both can be categorised based on Figure 3. Mesomorph is found to be the most significant sub-criteria in identifying the talent of taekwondo athletes when compared to other criteria based on this figure.

Based on this analysis, the highest percentage is found in height anthropometry. One of the most crucial factors in spotting talent and choosing athletes is height measurement. Achieving optimal body weight and posture is crucial for attaining high sporting achievements, particularly in taekwondo (Rudiyanto. et al., 2012).

V02Max has the largest percentage when it comes to the biomotor aspect. To compete in a long-lasting match in taekwondo, one must have strong endurance (Wahyuni & Donie,

2020)A taekwondo athlete's endurance will have an impact on how well they compete (Aldiansyah, 2020).

In contrast, an athlete's body type plays a significant role in identifying their talent in the somatotype aspect. Tall, round-framed people are typically less agile. On the other hand, those who are medium or slightly shorter but possess powerful muscles are typically more nimble. The endomorph-mesomorph body type possesses the stability of an athlete's power and horses (Suryadi & Fauziah, 2022)**.**

CONCLUSION

This study contributes to the understanding of potential taekwondo athletes' talent priority scale. Anthropometry, somatotype, and biomotor criteria are the results of a literature review that is used to select criteria and sub-criteria for identifying athlete talent. Ten of the thirteen sub-criteria have the greatest percentage based on the outcomes of the AHP analysis. Mesomorph, endomorph, height, ectomorph, V02Max, body mass index, body weight, agility, speed, and leg length are among the ten sub-criteria.

ACKNOWLEDGMENT

Thank God, the author is able to complete this article. The writer expresses gratitude to his parents and relatives for their ongoing prayers and support. Remember the study programme head and the supervising lecturer as well, who allowed me the chance to write this article and see it through to publication. Also, the author would like to express gratitude to him with the initials R for supporting her during this difficult time. Remember that the author also extends gratitude to everyone who contributed to the writing of this article from beginning to end. May Allah SWT reward you for your assistance.

REFERENCES

Abeza, G., O'Reilly, N., Dottori, M., Séguin, B., & Nzindukiyimana, O. (2015). Mixed methods research in sport marketing. *International Journal of Multiple Research Approaches*, *9*(1), 40–56. https://doi.org/10.1080/18340806.2015.1076758

Aldiansyah. (2020). Volume 3 no I Tahun 2020. *Jurnal Halaman Olahraga Nusantara*, *3*(I), 9–20.

All, N. I. C. K. B., Olan, E. M. N., & Heeler, K. E. W. (2011). *A , p , t p p e t a 9 w o c p*.

ARAZI, H., HOSSEINZADEH, Z., & IZADI, M. (2016). Relationship between anthropometric, physiological and physical characteristics with success of female

taekwondo athletes. *Turkish Journal of Sport and Exercise*, *18*(2), 69. https://doi.org/10.15314/tjse.94871

Breitbach, S., Tug, S., & Simon, P. (2014). Conventional and Genetic Talent Identification in Sports: Will Recent Developments Trace Talent? *Sports Medicine*, *44*(11), 1489–1503. https://doi.org/10.1007/s40279-014-0221-7

Bressan, V., Bagnasco, A., Aleo, G., Timmins, F., Barisone, M., Bianchi, M., Pellegrini, R., & Sasso, L. (2017). Mixed-methods research in nursing – a critical review. *Journal of Clinical Nursing*, *26*(19–20), 2878–2890. https://doi.org/10.1111/jocn.13631

Bridge, C. A., Ferreira Da Silva Santos, J., Chaabène, H., Pieter, W., & Franchini, E. (2014). Physical and physiological profiles of Taekwondo athletes. *Sports Medicine*, *44*(6), 713–733. https://doi.org/10.1007/s40279-014-0159-9

Choi, D. S., Jung, E. N., & Park, M. H. (2021). Comparison of balance ability and physical fitness according to the growth period in taekwondo players. *Journal of Exercise Rehabilitation*, *17*(5), 354–361. https://doi.org/10.12965/JER.2142502.251

Dari, W., & Taroreh, M. (2022). Selection of sports news portal with analytical hierarchy process (AHP) method. *Journal of Information System, Informatics and Computing*, *6*(1), 11–21. https://doi.org/10.52362/jisicom.v6i1

Goel, I. (2018). Transgender identities. *Economic and Political Weekly*, *53*(36), 4–5. https://doi.org/10.4324/9781003090724

Harianto, P., Faisal, N., & Hutabarat, N. (2022). Sistem Pendukung Keputusan Menggunakan Analityc Hierarchy Process Dalam Pemilihan Atlet Kyorugi Taekwondo. *Seminal Nasional Corisindo*, 2–7.

Jlid, M. C., Maffulli, N., Souissi, N., Chelly, M. S., & Paillard, T. (2016). Pre-pubertal males practising Taekwondo exhibit favourable postural and neuromuscular performance. *BMC Sports Science, Medicine and Rehabilitation*, *8*(1), 1–7. https://doi.org/10.1186/s13102-016-0040-2

Jones, I. (1997). Mixing Qualitative and Quantitative Methods in Sports Fan Research. *The Qualitative Report*, *3*(4), 1–8. https://doi.org/10.46743/2160-3715/1997.2014

Kavvoura, A., Zaras, N., Stasinaki, A. N., Arnaoutis, G., Methenitis, S., & Terzis, G. (2018). The importance of lean body mass for the rate of force development in taekwondo athletes and track and field throwers. *Journal of Functional Morphology and Kinesiology*, *3*(3). https://doi.org/10.3390/jfmk3030043

Kim, H.-B., Jung, H.-C., Song, J.-K., Chai, J.-H., & Lee, E.-J. (2015). A follow-up study on the physique, body composition, physical fitness, and isokinetic strength of female collegiate Taekwondo athletes. *Journal of Exercise Rehabilitation*, *11*(1), 57–64. https://doi.org/10.12965/jer.150186

Kim, J. W., & Nam, S. S. (2021). Physical characteristics and physical fitness profiles of korean taekwondo athletes: A systematic review. *International Journal of Environmental Research and Public Health*, *18*(18). https://doi.org/10.3390/ijerph18189624

Kurniawan, W. J., & Gusrianty, G. (2019). Sistem Pendukung Keputusan Seleksi Atlet Poomsae Taekwondo Dengan Metode Analityc Hierachy Process. *JOISIE (Journal Of Information Systems And Informatics Engineering)*, *2*(1), 26. https://doi.org/10.35145/joisie.v2i1.244

Merangin. (2018). Pengaruh Youtube Beauty Vlogger Program Strata 1 Manajemen Sekolah Tinggi Ilmu Ekonomi Indonesia. *Galang Tanjung*, *2504*, 1–9.

Monks, L., Seo, M. W., Kim, H. B., Jung, H. C., & Song, J. K. (2017). High-intensity interval training and athletic performance in Taekwondo athletes. *Journal of Sports Medicine and Physical Fitness*, *57*(10), 1252–1260. https://doi.org/10.23736/S0022-4707.17.06853-0

Nam, S.-S., & Lim, K. (2019). Effects of Taekwondo training on physical fitness factors in Korean elementary students: A systematic review and meta-analysis. *Journal of Exercise Nutrition & Biochemistry*, *23*(1), 36–47. https://doi.org/10.20463/jenb.2019.0006

Nikolaidis, P. T., Busko, K., Clemente, F. M., Tasiopoulos, I., & Knechtle, B. (2016). Age- and sex-related differences in the anthropometry and neuromuscular fitness of competitive taekwondo athletes. *Open Access Journal of Sports Medicine*, *Volume 7*, 177–186. https://doi.org/10.2147/oajsm.s120344

Noori, M., & Sadeghi, H. (2019). *designing smart pattern in soccer talent identification based on main and weighted criteria resulted from analytic hierarchy process via fuzzy logic*. *March*. https://doi.org/10.22077/jpsbs.2017.377.1147

Nurjaya, D. R., Abdullah, A. G., Ma'Mun, A., & Rusdiana, A. (2020). Rowing talent identification based on main and weighted criteria from the Analytic Hierarchy Process (AHP). *Journal of Engineering Science and Technology*, *15*(6), 3723–3740.

Palinkas, L. A., Mendon, S. J., & Hamilton, A. B. (2019). Innovations in Mixed Methods Evaluations. *Annual Review of Public Health*, *40*, 423–442. https://doi.org/10.1146/annurev-publhealth-040218-044215

Rocha, F. P. S., Louro, H., Matias, R., Brito, J., & Costa, A. M. (2016). Determination of Aerobic Power Through a Specific Test for Taekwondo - A Predictive Equation Model. *Journal of Human Kinetics*, *53*(1), 117–126. https://doi.org/10.1515/hukin-2016-0016

Roh, H. T., Cho, S. Y., & So, W. Y. (2020). Effects of regular taekwondo intervention on oxidative stress biomarkers and myokines in overweight and obese adolescents. *International Journal of Environmental Research and Public Health*, *17*(7), 1–11. https://doi.org/10.3390/ijerph17072505

Rudiyanto., Waluyo, M., & Sugiharto. (2012). Hubungan Berat Badan Tinggi Badan Dan Panjang Tungkai Dengan Kelincahan. *Journal of Sport Sciences and Fitness*, *1*(2), 26–31.

Sarshin, A., Fallahi, V., Forbes, S. C., Rahimi, A., Koozehchian, M. S., Candow, D. G., Kaviani, M., khalifeh, S. N., Abdollahi, V., & Naderi, A. (2021). Short-term co-ingestion of creatine and sodium bicarbonate improves anaerobic performance in trained taekwondo athletes. *Journal of the International Society of Sports Nutrition*, *18*(1), 1–9. https://doi.org/10.1186/s12970-021-00407-7

Seo, M.-W., Jung, H.-C., Song, J.-K., & Kim, H.-B. (2015). Effect of 8 weeks of pre-season

training on body composition, physical fitness, anaerobic capacity, and isokinetic muscle strength in male and female collegiate taekwondo athletes. *Journal of Exercise Rehabilitation*, *11*(2), 101–107. https://doi.org/10.12965/jer.150196

Seo, M. W., Song, J. K., Jung, H. C., Kim, S. W., Kim, J. H., & Lee, J. M. (2019). The associations of vitamin D status with athletic performance and blood-borne markers in adolescent athletes: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *16*(18), 1–13. https://doi.org/10.3390/ijerph16183422

Setiyawan, S., & Sukadiyanto, S. (2015). Pengembangan Model Tes Fisik Calon Atlet Taekwondo Usia 11-13 Tahun. *Jurnal Pedagogi Olahraga Dan Kesehatan*, *1*(2), 96–105. https://doi.org/10.21831/jpok.v1i2.58

Sung, Y. C., Yang, Y. Z., Chang, C. C., & Chou, C. C. (2021). A preliminary study of pre-season taekwondo preparation strategy: Personal isolation training effect for elite athletes. *International Journal of Environmental Research and Public Health*, *18*(20). https://doi.org/10.3390/ijerph182010570

Suryadi, D., & Fauziah, E. (2022). Identifikasi Somatotype Pada Atlet Beladiri Tarung Derajat Kategori Seni Gerak Identification of Somatotypes in Tarung Derajat Martial Athletes in Motion Art Category. *Physical Activity Journal (PAJU)*, *3*(April). https://doi.org/10.20884/1.paju.2021.3.2.5451

Taati, B., Arazi, H., Bridge, C. A., & Franchini, E. (2022). A new taekwondo-specific field test for estimating aerobic power, anaerobic fitness, and agility performance. *PLoS ONE*, *17*(3 March), 1–17. https://doi.org/10.1371/journal.pone.0264910

Tayech, A., Mejri, M. A., Makhlouf, I., Uthoff, A., Hambli, M., Behm, D. G., & Chaouachi, A. (2022). Reliability, criterion-concurrent validity, and construct-discriminant validity of a head-marking version of the taekwondo anaerobic intermittent kick test. *Biology of Sport*, *39*(4), 951–963. https://doi.org/10.5114/biolsport.2022.109459

Tsai, M. L., Ko, M. H., Chang, C. K., Chou, K. M., & Fang, S. H. (2011). Impact of intense training and rapid weight changes on salivary parameters in elite female Taekwondo athletes. *Scandinavian Journal of Medicine and Science in Sports*, *21*(6), 758–764. https://doi.org/10.1111/j.1600-0838.2010.01099.x

Vaeyens, R., Güllich, A., Warr, C. R., & Philippaerts, R. (2009). Talent identification and promotion programmes of olympic athletes. *Journal of Sports Sciences*, *27*(13), 1367–1380. https://doi.org/10.1080/02640410903110974

Vasconcelos, B. B., Protzen, G. V., Galliano, L. M., Kirk, C., & Del Vecchio, F. B. (2020). Effects of High-Intensity Interval Training in Combat Sports: A Systematic Review with Meta-Analysis. *Journal of Strength and Conditioning Research*, *34*(3), 888–900. https://doi.org/10.1519/JSC.0000000000003255

Wahyuni, S., & Donie. (2020). VO2Max, Daya Ledak Otot Tungkai, Kelincahan Dan Kelentukan Untuk Kebutuhan Kondisi Fisik Atlet Taekwondo Sovia. *Kondisi Fisik*, *2*, 1–13.

Wazir, M. R. W. N., Hiel, M. Van, Mostaert, M., Deconinck, F. J. A., Pion, J., & Lenoir, M. (2019). Identification of elite performance characteristics in a small sample of taekwondo

athletes. *PLoS ONE*, *14*(5), 1–12. https://doi.org/10.1371/journal.pone.0217358

Zheng, J., & Chen, S. (2016). Exploring China's success at the Olympic Games: a competitive advantage approach. *European Sport Management Quarterly*, *16*(2), 148–171. https://doi.org/10.1080/16184742.2016.1140797