



Aerobic-Anaerobic Fitness Levels and the Consistency of Roundhouse Kick Performance During Multi-Round Taekwondo Matches Among Taekwondo Athletes

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Abstract: This study examined the relationship between self-assessed aerobic-anaerobic fitness levels and roundhouse kick performance consistency during multi-round taekwondo matches among athletes at Jiaozuo University, China. A descriptive-comparative-correlational design was employed, with data collected via a validated self-assessment questionnaire administered to 100 taekwondo athletes. Results indicated moderate overall fitness levels (composite mean = 2.18, SD = 0.78), with power output under fatigue perceived as the strongest component (mean = 2.24, SD = 0.82) and speed recovery between exchanges as the weakest (mean = 2.14, SD = 0.79). No statistically significant differences were found across demographic factors (age, sex, years of experience), though trends suggested higher self-perceptions among mid-adolescent athletes and those with 3–5 years of training experience. The findings highlight the need for integrated conditioning programs that target recovery capacity, endurance sustainability, and sport-specific neuromuscular adaptation to maintain kick consistency under fatigue.

Keywords: Taekwondo, aerobic-anaerobic fitness, roundhouse kick, self-assessment, perceived fitness

I. Introduction

Taekwondo has evolved from a traditional martial art into a dynamic Olympic combat sport characterized by high-intensity intermittent efforts, where success increasingly depends on an athlete's ability to maintain technical precision under accumulating physiological strain ^[1]. Modern competitive matches consist of multiple rounds, each demanding rapid sequences of explosive actions, predominantly kicks, interspersed with brief, often incomplete recovery periods. This activity profile places significant demands on both aerobic and anaerobic energy systems, with the roundhouse kick (dollyo chagi) standing as one of the most frequently used and scoring-effective techniques ^[2]. However, the consistency of its execution across successive rounds remains a critical and often variable factor in competitive outcomes, particularly at elite levels where scoring margins are minimal ^[3].

The physiological underpinnings of sustained technical performance in Taekwondo are complex and multifactorial. Match play induces substantial metabolic stress, with athletes repeatedly transitioning between periods of maximal intensity effort and passive or active recovery ^[4]. Such activity patterns challenge the phosphagen and glycolytic pathways for immediate energy production, while the aerobic system plays a vital role in facilitating recovery between bouts and delaying the onset of fatigue ^[5]. Recent studies highlight that a well-developed aerobic capacity supports faster heart rate recovery between exchanges, which in turn helps preserve cognitive motor function, kinesthetic awareness, and movement accuracy under fatigue ^[6]. Conversely, limitations in anaerobic power and capacity have been linked to a decline in kick velocity, impact force, and inter-segmental coordination as matches progress into later rounds ^[7].

From a biomechanical perspective, the roundhouse kick is a whole-body movement requiring proximal-to-distal sequencing, core stability, and precise neuromuscular control. Effective execution depends on the coordinated timing of hip flexion, knee extension, and stable plantar flexion upon contact ^[8]. Electromyographic analyses reveal that under fatigue, even subtle alterations in muscle activation patterns, such as delayed hamstring engagement or reduced gluteal stabilization, can compromise technique, leading to "missed" kicks or non-scoring impacts ^[9]. These degradations are often exacerbated by metabolic acidosis, reduced glycogen availability, and impaired motor unit recruitment, collectively contributing to a decline in performance consistency across rounds ^[10].

The relationship between athletes' fitness levels and the ability to maintain skilled performance under fatigue is thus a central concern in contemporary Taekwondo training. While general conditioning has long been emphasized, there is growing recognition of the need for energy system development that is specific to the kinematic and metabolic demands of repeated high-quality kicking ^[11]. Emerging evidence supports the integration of sport-specific high-intensity interval training (HIIT), paced aerobic drills, and technique-focused conditioning sessions designed to mimic the work-to-rest ratios of actual competition ^[12]. Such approaches aim not only to improve physiological markers such as VO_2max and anaerobic threshold but also to reinforce neuromuscular pathways under conditions of



metabolic stress [13].

Technological advances have further enabled more granular monitoring of these interactions. Wearable sensors, electromyography, and motion capture systems allow researchers and coaches to track kinematic and physiological variables in real time, offering insights into how fatigue manifests in technical performance [14]. These tools provide actionable feedback for tailoring training loads, recovery strategies, and technical interventions to individual athlete profiles [15].

Despite these advances, a clear understanding of how aerobic and anaerobic fitness collectively contribute to the maintenance of roundhouse kick performance over the course of a multi-round match remains incomplete, particularly among Chinese athlete populations, who are underrepresented in the international literature [16]. While objective physiological and biomechanical metrics are crucial, the athlete's own perception of their capabilities under fatigue represents a critical, yet understudied, layer of this complex relationship. Self-assessment of fitness and performance may mediate the link between physiological capacity and technical execution, influencing pacing decisions, effort perception, and confidence during competition. Therefore, this study seeks to explore the relationship between athletes' self-assessed aerobic-anaerobic fitness levels and their perceived kinematic consistency of the roundhouse kick across successive rounds. By examining these perceptual variables, this research aims to provide initial insights into the role of self-awareness in performance sustainability, offering a complementary perspective to guide training program design and athlete monitoring in Taekwondo.

Research Questions:

1. What is the demographic profile of the athletes in terms of:
 - 1.1. Sex
 - 1.2. Age
 - 1.3. Years of taekwondo experience?
2. How do athletes self-assess their aerobic-anaerobic fitness levels during multi-round matches regarding:
 - 2.1. Endurance across rounds
 - 2.2. Recovery speed between exchanges
 - 2.3. Power output under fatigue
 - 2.4. Breathing control
 - 2.5. Kick consistency and accuracy?
3. Are there significant differences in athletes' self-assessed fitness levels when grouped by demographic profile?

II. Literature Review

2.1. High-Intensity Interval Training for Combat Sports

Systematic reviews of Olympic combat sport conditioning recommend high-intensity interval training (HIIT) tailored to sport-specific actions, such as kicking drills, to enhance both anaerobic capacity and aerobic recovery [17]. Such training can enable athletes to repeat intense roundhouse combinations without significant loss in precision, aligning conditioning with tactical consistency. Research indicates that HIIT formats, including repeated sprint training, are effective in concurrently improving maximal aerobic speed (MAS) and maximal sprinting speed (MSS), thereby expanding the anaerobic speed reserve (ASR) critical for sustaining high-intensity actions [18]. This expansion mitigates the physiological strain per effort, reducing the degradation of technique across successive rounds of competition.

2.2. Biomechanical and Neuromuscular Determinants of Kick Performance

The execution of an effective roundhouse kick is a complex whole-body movement reliant on proximal-to-distal sequencing and neuromuscular control. Biomechanical analyses show that roundhouse kick velocity depends on coordinated hip and knee segment motion [8]. Fatigue-induced breakdown in this inter-segmental coordination can reduce peak velocity and alter impact timing, directly impacting scoring potential. Furthermore, electromyographic (EMG) studies reveal that fatigue alters muscle activation patterns; for instance, advanced athletes exhibit higher co-contraction indices for knee-stabilizing muscles during repeated kicks compared to novices, suggesting a mechanism for technique preservation under metabolic strain [9]. This enhanced stabilization likely underpins the ability to maintain kick accuracy and force production as matches progress.

2.3. Physiological Profiling and Technical Endurance

The relationship between physiological capacity and the maintenance of skilled performance is well-established. Physiological profiling in athletes demonstrates that superior aerobic performance, indicated by metrics such as $\dot{V}O_{2max}$, aligns with sustained high-intensity output in later match phases [19]. Such profiles serve as predictors of technical endurance, including stable roundhouse kick execution. The ability to maintain technique is further supported by fatigue-resistant muscle activation patterns. Recent EMG analysis noted reduced tibialis anterior activation over consecutive kicks in well-conditioned athletes, potentially indicating energy-saving neuromuscular adaptations that help preserve inter-segmental coordination during later rounds [9].

2.4. Integrated Monitoring and Training Application

The integration of technology for real-time monitoring provides actionable insights for training individualization. Research emphasizes the utility of technique-performance feedback systems integrated with physiological

monitoring to improve training responsiveness [14]. Measuring real-time changes in roundhouse kick kinematics under fatigue, alongside cardiorespiratory data, enables the development of personalized programming aimed at enhancing consistency. This approach aligns with the Anaerobic Speed Reserve (ASR) framework, which posits that the stability of high-intensity skill execution is a function of the reserve between an athlete's aerobic and anaerobic capacities [18]. Training interventions designed to expand this reserve, such as sport-specific HIIT, are therefore crucial for preparing athletes for the demands of multi-round competition.

III. Methodology

3.1 Research Design

This study employed a descriptive-comparative-correlational research design to comprehensively investigate the relationship between aerobic-anaerobic fitness levels and roundhouse kick performance consistency. The descriptive component enabled the systematic documentation of athletes' self-assessments and demographic characteristics, providing a detailed profile of the study population. The comparative aspect allowed for examination of differences in fitness levels and kick performance across various demographic groupings, while the correlational approach facilitated analysis of relationships between key variables. This integrated design supported a multifaceted understanding of how physiological capacities influence technical performance sustainability in competitive taekwondo settings.

3.2 Participants and Sampling

The study was conducted at Jiaozuo University in China, utilizing a purposive sampling method to select 100 taekwondo athletes who met specific inclusion criteria: current enrollment at the university, active participation in the taekwondo program, and competitive experience representing the institution. The sample size determination followed power analysis recommendations to ensure adequate statistical power for the planned analyses. Purposive sampling ensured that participants possessed relevant experience in multi-round taekwondo matches, thereby providing meaningful insights into the research questions.

3.3 Research Instrument

The study utilized a researcher-developed questionnaire comprising three main sections. Section A collected demographic information including sex, age, and years of taekwondo experience. Section B assessed aerobic-anaerobic fitness levels through 15 items measuring endurance across rounds, speed recovery between exchanges, power output under fatigue, breathing control, and kick consistency/accuracy. Section C evaluated roundhouse kick performance consistency through 15 items examining accuracy of target strikes, power maintenance across rounds, timing of execution, balance during delivery, and speed consistency. The instrument employed a 4-point Likert scale and underwent rigorous validation including content validation by five taekwondo and sports science experts, face validation, and pilot testing (n=20) which demonstrated excellent reliability (Cronbach's $\alpha = 0.997$).

3.4 Data Collection Procedure

The data collection process followed a standardized protocol beginning with securing ethical approval from university authorities and obtaining informed consent from participants. The researcher administered questionnaires through scheduled face-to-face sessions, providing standardized instructions and ensuring confidentiality. Participants completed the questionnaires in a controlled environment with the researcher available to address queries. Each session lasted approximately 30-45 minutes, after which completed questionnaires were immediately collected and securely stored.

3.5 Data Analysis

Data analysis employed both descriptive and inferential statistics using SPSS version 26.0. Descriptive statistics (frequencies, percentages, means, standard deviations) characterized demographic profiles and self-assessment scores. Inferential analyses included independent samples t-test and one-way ANOVA with Scheffé post-hoc testing to examine differences in fitness levels and kick performance across demographic groups. Pearson's correlation analysis assessed relationships between aerobic-anaerobic fitness indicators and roundhouse kick performance consistency. The significance level was set at $p < 0.05$ for all statistical tests.

3.6 Ethical Considerations

The study adhered to ethical principles including voluntary participation, informed consent, confidentiality protection, and right to withdraw. All data were anonymized and securely stored, with access restricted to the research team. The study protocol received approval from the institutional ethics committee before implementation.

IV. Results and Discussion

The demographic profile of the athlete respondents from Table 1 indicates a predominantly older and male cohort with relatively limited experience in the sport: the majority (71.3%, n=107) were over 18 years old, suggesting a sample of physically mature athletes; most (80%, n=120) were male, reflecting a male-dominated participation; and nearly three-quarters (74.7%, n=112) had been practicing taekwondo for less than three years, indicating a population largely composed of developing athletes in the early stages of their training.

Table 1
Frequency Distribution of the Athlete Respondents' Profile

Profile	Frequency	Percentage
Age		
Less than 15 years old	3	2%
17 years old	4	2.7%
18 years old	36	24%
More than 18 years old	107	71.3%
Total	150	100%
Sex		
Male	120	80%
Female	30	20%
Total	150	100%
Number of Years as a Taekwondo Athlete		
Less than 3 years old	112	74.7%
3-5 years	11	7.3%
More than 5 years	27	18%
Total	150	100%

Table 2 presents the athletes' self-assessment of their endurance across rounds during multi-round taekwondo matches. The composite mean of 2.16 (SD = 0.81) falls within the "Slightly True of Me" range, indicating that respondents perceive their ability to sustain energy throughout a match as only moderately developed. The highest-rated indicator was the ability to maintain a consistent pace from start to finish (Mean = 2.25), while confidence in lasting through multiple rounds was the lowest (Mean = 2.04), suggesting that while athletes can manage their effort, their belief in their overall stamina requires improvement.

Table 2
Self-Assessment of the Athlete Respondents of their Aerobic-Anaerobic Fitness Levels during Multi-Round Taekwondo Matches on Endurance across Rounds

Endurance across Rounds	Mean	SD	QD	INT	Rank
1. I can maintain my energy levels consistently across all rounds	2.11	.89	Slightly True of Me	Slightly Effective	8
2. I rarely feel completely exhausted before the final round	2.18	.90	Slightly True of Me	Slightly Effective	5
3. I am able to perform well even in the later stages of the match	2.22	.87	Slightly True of Me	Slightly Effective	2
4. I can keep up with the intensity of my opponent throughout the rounds	2.19	.88	Slightly True of Me	Slightly Effective	4
5. I do not experience a significant drop in performance after the first round	2.13	.87	Slightly True of Me	Slightly Effective	7
6. I am capable of sustaining my kicking and defensive movements until the last round	2.16	.87	Slightly True of Me	Slightly Effective	6
7. My body resists fatigue during extended matches	2.20	.91	Slightly True of Me	Slightly Effective	3
8. I feel confident in my ability to last through multiple rounds	2.04	.86	Slightly True of Me	Slightly Effective	9
9. I maintain nearly the same pace from the start to the end of the match	2.25	.92	Slightly True of Me	Slightly Effective	1
Composite Mean	2.16	.81	Slightly True of Me	Slightly Effective	

Table 3 summarizes the self-rated speed recovery between exchanges. With a composite mean of 2.14 (SD = 0.79), also interpreted as "Slightly True of Me," the results show a basic but limited capacity for rapid recovery. The ability to recover after high-intensity kicking exchanges was perceived most strongly (Mean = 2.20), whereas recovering focus and sharpness during breaks was the weakest area (Mean = 2.06), highlighting a potential gap between physical and mental recuperation.

Table 3^μ
**Self-Assessment of the Athlete Respondents of their Aerobic -
 Anaerobic Fitness Levels during Multi-Round Taekwondo
 Matches on Speed Recovery^μ between Exchanges^μ**

Speed Recovery between Exchanges ^μ	Mean ^μ	SD	QD	INT ^μ	Rank
1. I recover quickly after high-intensity kicking exchanges.	2.20 ^μ	.93	Slightly True of Me	Slightly Effective	1 ⁺
2. I regain my breathing rhythm fast between actions.	2.14 ^μ	.86	Slightly True of Me	Slightly Effective	6 ^μ
3. My legs recover quickly for the next set of attacks or defenses.	2.17 ^μ	.87	Slightly True of Me	Slightly Effective	3.4 ^μ 5 ^μ
4. I can restore my energy quickly during short pauses or referee breaks.	2.09 ^μ	.82	Slightly True of Me	Slightly Effective	7 ^μ
5. My body responds well to fast recovery demands in a match.	2.18 ^μ	.81	Slightly True of Me	Slightly Effective	2 ^μ
6. I can launch another attack shortly after a demanding movement.	2.16 ^μ	.86	Slightly True of Me	Slightly Effective	5 ^μ
7. My heart rate stabilizes quickly after each exchange.	2.17 ^μ	.88	Slightly True of Me	Slightly Effective	3.4 ^μ 5 ^μ
8. I recover my focus and sharpness quickly during breaks.	2.06 ^μ	.84	Slightly True of Me	Slightly Effective	9 ^μ
9. I feel ready for another exchange after just a brief pause.	2.07 ^μ	.85	Slightly True of Me	Slightly Effective	8 ^μ
Composite Mean^μ	2.14^μ	.79^μ	Slightly True of Me^μ	Slightly Effective^μ	

Legend: 3.51-4.00 Very True of Me/ Very Effective; 2.51-3.50 True of Me/ Effective; 1.51-2.50 Slightly True of Me/ Slightly Effective; 1.00-1.50 Not True of Me/ Not Effective^μ

Table 4 displays the athletes' perception of their power output under fatigue. This dimension received the highest composite mean of 2.24 (SD = 0.82) among the fitness components, though it remains in the "Slightly True of Me" category. The ability to deliver strong kicks while tired was the highest-ranked indicator (Mean = 2.30), while sustaining high-impact techniques and overall forcefulness as fatigue accumulated were the most challenging aspects (Mean = 2.20), pointing to a need for improved fatigue resistance.

Table 4^μ
**Self-Assessment of the Athlete Respondents of their Aerobic -
 Anaerobic Fitness Levels during Multi-Round Taekwondo^μ
 Matches on Power Output under Fatigue^μ**

Power Output under Fatigue	Mean	SD	QD	INT ^μ	Rank
1. I can still deliver strong kicks even when I feel tired.	2.30	.89	Slightly True of Me	Slightly Effective	1 ^μ
2. My power in techniques is consistent even in the later rounds.	2.28	.93	Slightly True of Me	Slightly Effective	2.5 ^μ
3. I can generate explosive movements despite fatigue.	2.28	.91	Slightly True of Me	Slightly Effective	2.5 ^μ
4. My kicking force does not decrease significantly after repeated actions.	2.24	.90	Slightly True of Me	Slightly Effective	4 ^μ
5. I am able to execute decisive strikes even under physical strain.	2.22	.86	Slightly True of Me	Slightly Effective	6 ^μ
6. I can maintain punching and kicking strength when exhausted.	2.22	.90	Slightly True of Me	Slightly Effective	6 ^μ
7. I sustain powerful movements throughout the match.	2.22	.87	Slightly True of Me	Slightly Effective	6 ^μ
8. My performance remains forceful despite fatigue accumulation.	2.20	.86	Slightly True of Me	Slightly Effective	8.5 ^μ
9. I can overcome tiredness and still deliver high-impact techniques.	2.20	.90	Slightly True of Me	Slightly Effective	8.5 ^μ
Composite Mean^μ	2.24^μ	.82^μ	Slightly True of Me^μ	Slightly Effective^μ	

Legend: 3.51-4.00 Very True of Me/ Very Effective; 2.51-3.50 True of Me/ Effective; 1.51-2.50 Slightly True of Me/ Slightly Effective; 1.00-1.50 Not True of Me/ Not Effective^μ

Table 5 outlines the self-assessment of breathing control during matches. The composite mean of 2.15 (SD = 0.80) suggests respondents have a foundational but not yet optimal ability to manage their breathing. Maintaining steady breathing throughout rounds and avoiding breathlessness in crucial moments were the strongest perceived skills (Mean = 2.22), while consciously regulating breathing between techniques was the weakest (Mean = 2.10), indicating a need for more integrated breath-control training.

Table 5^μ
**Self-Assessment of the Athlete Respondents of their Aerobic -
 Anaerobic Fitness Levels during Multi-Round Taekwondo^μ
 Matches on Breathing Control^μ**

Breathing Control	Mean	SD	QD	INT ^μ	Ran ^μ k
1. I manage my breathing effectively during high-intensity moments.	2.13	.85	Slightly True of Me	Slightly Effective	5 ^μ
2. I know how to regulate my breathing between kicks and defenses.	2.10	.85	Slightly True of Me	Slightly Effective	9 ^μ
3. My breathing remains steady throughout the rounds.	2.22	.87	Slightly True of Me	Slightly Effective	1.5 ^μ
4. I recover my breath quickly after powerful movements.	2.11	.86	Slightly True of Me	Slightly Effective	7.5 ^μ
5. I rarely feel out of breath during crucial parts of the match.	2.22	.89	Slightly True of Me	Slightly Effective	1.5 ^μ
6. I use proper breathing techniques to sustain my performance.	2.11	.86	Slightly True of Me	Slightly Effective	7.5 ^μ
7. I coordinate my breathing well with my strikes and movements.	2.14	.86	Slightly True of Me	Slightly Effective	4 ^μ
8. I can prevent breathlessness from affecting my performance.	2.19	.89	Slightly True of Me	Slightly Effective	3 ^μ
9. My breathing technique supports my endurance and stamina.	2.12	.85	Slightly True of Me	Slightly Effective	6 ^μ
Composite Mean^μ	2.15^μ	.80^μ	Slightly True of Me^μ	Slightly Effective^μ	

Legend: 3.51-4.00 Very True of Me/ Very Effective; 2.51-3.50 True of Me/ Effective; 1.51-2.50 Slightly True of Me/ Slightly Effective; 1.00-1.50 Not True of Me/ Not Effective^μ

Table 6 provides the athletes' evaluation of their kick consistency and accuracy under match conditions. The composite mean of 2.23 (SD = 0.83) reflects a moderate level of technical reliability. Retaining kick timing under fatigue was the strongest aspect (Mean = 2.27), while the ability to adjust kicks for accuracy under pressure was the most challenging (Mean = 2.16), revealing a specific area for technical and tactical improvement under stressful conditions.

Table 6^μ
**Self-Assessment of the Athlete Respondents of their Aerobic -
 Anaerobic Fitness Levels during Multi-Round Taekwondo^μ
 Matches on Kick Consistency and Accuracy^μ**

Kick Consistency and Accuracy ^μ	Mean ^μ	SD ^μ	QD ^μ	IINT ^μ	Ran ^μ k ^μ
1. I can maintain the accuracy of my kicks throughout the match.	2.24 ^μ	.87 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	4.5 ^μ
2. My kicking technique remains sharp even when I am tired.	2.24 ^μ	.92 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	4.5 ^μ
3. I am consistent in hitting the target areas round after round.	2.21 ^μ	.92 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	7 ^μ
4. My kicks retain their timing regardless of fatigue.	2.27 ^μ	.93 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	1 ^μ
5. I can adjust my kicks to remain accurate under pressure.	2.16 ^μ	.89 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	9 ^μ
6. My precision does not decline as the match progresses.	2.26 ^μ	.93 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	2.5 ^μ
7. I am able to land effective kicks consistently in every round.	2.23 ^μ	.86 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	6 ^μ
8. My accuracy remains steady even in fast-paced exchanges.	2.26 ^μ	.89 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	2.5 ^μ
9. I can deliver kicks to the intended target regardless of exhaustion.	2.20 ^μ	.92 ^μ	Slightly True of Me ^μ	Slightly Effective ^μ	8 ^μ
Composite Mean^μ	2.23^μ	.83^μ	Slightly True of Me^μ	Slightly Effective^μ	

Legend: 3.51-4.00 Very True of Me/ Very Effective; 2.51-3.50 True of Me/ Effective; 1.51-2.50 Slightly True of Me/ Slightly Effective; 1.00-1.50 Not True of Me/ Not Effective^μ

Table 7 summarizes the athletes' self-assessment of their aerobic-anaerobic fitness levels during multi-round taekwondo matches across five dimensions: endurance across rounds, speed recovery between exchanges, power

output under fatigue, breathing control, and kick consistency and accuracy. Among these, power output under fatigue received the highest mean score (2.24, SD = 0.82), rated as "slightly true of me," indicating that athletes perceive their ability to maintain forceful movements under exhaustion as their strongest attribute. In contrast, speed recovery between exchanges scored the lowest (mean = 2.14, SD = 0.79), suggesting that rapid physiological and mental recuperation after high-intensity efforts remains their most challenging area. The overall composite mean of 2.18 (SD = 0.78) reflects a moderate, yet still developing, level of aerobic-anaerobic fitness, highlighting the need for targeted conditioning to improve endurance, recovery efficiency, breathing control, and technical consistency under match-like fatigue.

Table 7
Summary Self-Assessment of the Athlete Respondents of their Aerobic-Anaerobic Fitness Levels during Multi-Round Taekwondo Matches

	Mean	SD	QD	INT	Rank
Endurance across Rounds	2.16	.81	Slightly True of Me	Slightly Effective	3
Speed Recovery between Exchanges	2.14	.79	Slightly True of Me	Slightly Effective	5
Power Output under Fatigue	2.24	.82	Slightly True of Me	Slightly Effective	1
Breathing Control	2.15	.80	Slightly True of Me	Slightly Effective	4
Kick Consistency and Accuracy	2.23	.83	Slightly True of Me	Slightly Effective	2
Overall	2.18	.78	Slightly True of Me	Slightly Effective	

Legend: 3.51-4.00 Very True of Me/ Very Effective; 2.51-3.50 True of Me/ Effective; 1.51-2.50 Slightly True of Me/ Slightly Effective; 1.00-1.50 Not True of Me/ Not Effective

Table 8 presents the results of the analysis examining significant differences in the self-assessment of aerobic-anaerobic fitness levels across demographic profiles, including endurance across rounds, speed recovery between exchanges, power output under fatigue, breathing control, and kick consistency and accuracy. The findings indicate that no statistically significant differences were found based on age, sex, or years of experience in any of the measured fitness categories. Despite the lack of statistical significance, observable trends in the mean scores provide practical insights into how different groups perceive their fitness capabilities during multi-round matches.

In terms of age, 17-year-old athletes consistently reported higher mean scores across all fitness dimensions, including endurance (2.81), speed recovery (2.61), power output (2.69), breathing control (2.72), and kick consistency and accuracy (2.75). This suggests that mid-adolescent athletes may perceive themselves as having superior fitness performance, possibly due to peak growth phases or structured training engagement at this stage. In contrast, athletes under 15, those aged 18, and those over 18 reported lower and relatively similar scores, indicating a slight decline in self-assessed fitness among younger and older participants. Regarding sex, female athletes showed marginally higher means than males across all categories, such as endurance (2.52 vs. 2.08) and power output (2.50 vs. 2.18), though these differences were not statistically significant. Similarly, athletes with 3–5 years of taekwondo experience reported the highest self-assessment scores, while those with more than 5 years of experience surprisingly recorded the lowest scores, particularly in endurance (1.98) and speed recovery (1.86).

These trends, though not statistically significant, suggest that self-perceptions of aerobic-anaerobic fitness may be influenced by developmental stage, training experience, and personal expectations rather than demographic factors alone. The generally higher scores among 17-year-olds and those with 3–5 years of experience point to a potential confidence peak during mid-adolescence and early-middle training phases. Conversely, the lower self-assessments

among highly experienced athletes may reflect more critical self-evaluation or accumulated fatigue. These patterns highlight the need for tailored conditioning programs that address not only physiological demands but also perceptual and psychological factors influencing fitness confidence in taekwondo athletes.

Table 8
Differences in the Self-Assessment of the Athlete Respondents of their Aerobic-Anaerobic Fitness Levels during Multi-Round Taekwondo Matches According to Profile

	Group	Mean	SD	t- / F-value	Sig.	Decision on Ho	Interpretation
Endurance across Rounds	< 15 years old	2.1481	1.0324	.866	.461	Accepted	Not Significant
	17 years old	2.8056	.22906				
	18 years old	2.1173	.71613				
	> 18 years old	2.1620	.85049				
Speed Recovery between Exchanges	< 15 years old	2.0370	1.0020	.493	.688	Accepted	Not Significant
	17 years old	2.6111	.44905				
	18 years old	2.1420	.64876				
	> 18 years old	2.1256	.84469				
Power Output under Fatigue	< 15 years old	2.0000	1.0000	.499	.683	Accepted	Not Significant
	17 years old	2.6944	.47467				
	18 years old	2.2068	.70281				
	> 18 years old	2.2440	.87628				
Breathing Control	< 15 years old	2.0000	1.0000	.712	.546	Accepted	Not Significant
	17 years old	2.7222	.48432				
	18 years old	2.1389	.71338				
	> 18 years old	2.1391	.83999				
Kick Consistency and Accuracy	< 15 years old	2.0000	1.0000	.666	.574	Accepted	Not Significant
	17 years old	2.7500	.50000				
	18 years old	2.1667	.70897				
	> 18 years old	2.2451	.88149				
Overall	< 15 years old	2.0370	1.0020	.666	.574	Accepted	Not Significant
	17 years old	2.7167	.39809				
	18 years old	2.1543	.67328				
	> 18 years old	2.1832	.82129				
Endurance across Rounds	Male	2.0796	.80487	7.407	.311	Accepted	Not Significant
	Female	2.5222	.76210				
Speed Recovery between Exchanges	Male	2.0935	.77249	2.139	.379	Accepted	Not Significant
	Female	2.3296	.86238				
Power Output under Fatigue	Male	2.1787	.82324	3.584	.755	Accepted	Not Significant
	Female	2.4963	.81636				
Breathing Control	Male	2.0954	.78848	2.989	.695	Accepted	Not Significant
	Female	2.3778	.84700				
Kick Consistency and Accuracy	Male	2.1824	.82933	2.380	.942	Accepted	Not Significant
	Female	2.4444	.84317				
Overall	Male	2.1259	.77213	3.798	.736	Accepted	Not Significant
	Female	2.4341	.78463				
Endurance across Rounds	< 3 years old	2.2034	.81471	.972	.381	Accepted	Not Significant
	3-5 years	2.2828	.89906				
	> 5 years	1.9753	.77431				
Speed Recovery between Exchange	< 3 years old	2.2034	.80661	2.088	.128	Accepted	Not Significant
	3-5 years	2.1919	.76189				
	> 5 years	1.8601	.71518				
Power Output under Fatigue	< 3 years old	2.2550	.82741	1.616	.202	Accepted	Not Significant
	3-5 years	2.5758	.86897				
	> 5 years	2.0535	.80027				
Breathing Control	< 3 years old	2.1925	.80718	1.514	.224	Accepted	Not Significant
	3-5 years	2.3131	.85030				
	> 5 years	1.9177	.76460				
Kick Consistency and Accuracy	< 3 years old	2.2748	.82933	1.867	.158	Accepted	Not Significant
	3-5 years	2.4646	.94910				
	> 5 years	1.9753	.78889				

assessments against objective physiological measures (e.g., VO₂max, lactate thresholds) and biomechanical performance data (e.g., kick velocity and accuracy under fatigue). Establishing the correlation, or lack thereof, between athlete perception and objective reality is essential for developing more effective, holistic training models that optimize both physical capacity and the self-awareness necessary for peak performance in Taekwondo.

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