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Assessing the Knowledge Level of Karate Coaches Regarding Physical Training Modalities

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Abstract

Having a certain level of knowledge is always important in doing any task correctly. However, when it comes to being a sports coach, a person needs to have a deep understanding of the sport's rules, the technical aspects involved, and the various physical training modalities. This study aims to identify the knowledge level of karate coaches regarding physical training modalities, on the basics of physical training according to sex, academic qualification, belt degree, classification degree and years of experience. Fifty senior coaches of both sexes were deliberately selected after showing interest in participating into the current study. The study was based on the previously developed and validated questionnaire (Martial Arts Coaches Knowledge Level Questionnaire). The questionnaire is composed of several axes with multiple choice questions to measure the cognitive results of karate coaches in the areas of physical training concerning human exercise physiology, functional sports anatomy, sports nutrition, sports injuries and first aid. The results showed a weak level of knowledge among karate coaches and the correct answers (total level) in all areas scored 45.7%, and coaches over 5 Dan have scored higher levels compared 3 Dan (p=0.033, 0.010; respectively). Based on these findings, we conclude that karate coaches in Jordan have a significant knowledge gap in the field of physical training methods. This gap may impact the effectiveness of training programs and athlete performance, emphasizing the need for targeted educational interventions and continuous professional development programs to enhance coaches' understanding and application of physical training modalities. Such improvements could ultimately lead to better athlete outcomes and a higher level of performance in the sport.

Keywords: *martial arts, performance, injuries, exercise, comprehensive coaching*

Introduction

Sports coaching is an interactive practice that occurs in a dynamic environment which requires the continual development of specific knowledge and skills to guide athletes in an effective way (Cushion et al., 2003; Nash & Collins, 2006; Tan & O'Connor, 2023). Denton and Hasbrouck give a more philosophical definition to the concept of coaching as "different things for different people" (Denton & Hasbrouck, 2009). Coaches must use their expertise to uncover strengths and weaknesses, while also offering support and encouragement and performing a countless number of tasks to drive athletes towards their peak performance (Jones et al., 2004).

Effective athletic trainers and coaches possess key attributes, including a strong level of knowledge, good commu-

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nication skills, effective training techniques, confidence, self-reflection, and risk management (Jones et al., 2010; Kania et al., 2009; Mazerolle et al., 2015; Pitney, 2006). Additionally, a coach may be an administrator, master teacher, curriculum designer, outside expert, classroom teacher, or other professional (Erchul, 2023). However, failure to recognize an athlete's need for improvement can result in ongoing injuries and setbacks (Hegarty et al., 2018; Talpey & Siesmaa, 2017). Therefore, coaches must continually develop their knowledge in their sport to implement a successful coaching process, regardless of the coaching context they belong to.

In karate, there are a wide range of exercises, techniques and training methodologies designed to improve physical abilities such as strength, power, speed, agility, flexibility, endurance and others (García-Hermoso, 2023). The training programs must be designed and modified to meet the unique demands of the practiced type of karate (Pinto et al., 2023). In Kata, which means "form" athletes move in several directions in space applying a series of exhibition movements, while Kumite athletes perform ritualistic rather than actual fights. Although these competitions involve noncontact fighting and symbolic techniques, the athletes must demonstrate the potential force of their movements and execute them as if they were real (Doria et al., 2009). Therefore, it is imperative that karate coaches have a solid understanding of the different physical training modalities to develop training programs that effectively meet the needs of their athletes (Kabadayı et al., 2022).

Unfortunately, the World Karate Federation does not require any level of experience or knowledge for individuals to become coaches (World Karate Federation - WKF, n.d.). Even though, the Jordanian Karate Federation requires at least 3 Dan and being over 25 years old to be able to coach and start a karate academy (Jordan Karate Federation, n.d.). The recent decades have shown a growing interest in exploring the education of coaches (Fullagar et al., 2019; Stoszkowski & Collins, 2016). Studies have analyzed the structure and content of specific coach education programs, highlighting the importance of coaches continually developing their skills to facilitate sports development (Tan & O'Connor, 2023). Olympic committees advise coaches to focus on learning new training methods and to deepening their understanding of the science behind physical training to achieve optimal results (Bompa et al., 2019). The Jordan Olympic Committee has shown considerable interest in developing Jordanian karate, particularly since the 2021 Olympic Games in Tokyo, Japan; by creating the Olympic Preparation Center that focuses on preparing athletes in a scientific and planned way by providing a group of scientists to help Olympic coaches improving their work and supervise the process of the training programs. However, Mesquita et al. (2010) highlight the potential of the academic environment to be considered as a formal coach training agency. Mujika et al. (2018) declared that coaches who have a strong knowledge base of physical training modalities can implement periodized training plans, systematically advance athletes' physical attributes over time, and improve their overall performance. Therefore, coaches must study the science related to physical training more in depth, avoiding the superficial level of information generalities, to be able to achieve the best results (Bompa et al., 2019).

Recent studies have emphasized the importance of structured coach education across various sports. Cushion et al. (2003) found that well-designed coach education programs significantly impact coaching effectiveness and professional development. Similarly, Lyle (2002) demonstrated that coaches with formal education in physical training and coaching methodologies tend to develop more effective training programs, thanks to a deeper understanding of training modalities. This research highlights a gap in formalized coach education in certain sports, such as karate, where federations may not universally require comprehensive training programs, underscoring the need for further research in this area.

The current study aims to fill the gap by investigating the knowledge level of karate coaches regarding physical training modalities, particularly in Jordan, where the Jordan Karate Federation has basic requirements for coaching but lacks a formalized, scientific education structure. While studies specifically focused on karate coaches are limited, research on coaches in martial arts offers valuable insights. For example, Kilic and Ince (2015) explored coaches' access to sport science knowledge in martial arts and highlighted factors such as experience, sex, education level, coaching certification, and remuneration as influencing their access to this knowledge. Understanding these factors is crucial for developing more effective coaching education programs. Additionally, previous research has indicated that martial arts training may enhance certain fitness elements, while neglecting others, such as strength and hand-eye coordination (Hammad et al., 2024). By analyzing Jordanian karate coaches' understanding of training methods and their ability to apply them in practice, this research seeks to contribute to the broader discussion on coach education and the need for more rigorous training standards. The findings of this study can inform sports federations and Olympic committees in enhancing their coach education initiatives.

Materials and Methods

Participants

50 Jordanian karate coaches (46 men, 4 women) working in karate centers across Jordan voluntarily participated in the current study. The number of participants represent (83.33%) of the entire national coaches community, taking into account that they are trainers accredited from the Jordanian Karate Federation and they all own their academies. Participants have different demographic information (table 1). Study procedures followed international ethical guidelines and participants were informed of the confidentiality of the information collected and they provided written consent. To be included in the study the individual must be recognized from the Jordanian Karate Federation as a working coach. The Institutional Review Board (Faculty of Educational Sciences at Al-Ahliyya Amman University) approved this study under protocol (No. FES-18G-274).

Knowledge assessment questionnaire

In this study, the questionnaire that we validated in a previous study on the level of knowledge of martial arts coaches (Questionnaire on the level of knowledge of taekwondo coaches regarding physical training methods) was adopted, as well as a cross-sectional methodology similar to our previous survey to assess the level of knowledge of (martial arts) coaches (Hammad et al., 2022). The questionnaire consisted of two main sections, the first section gathered demographic information and included variables such as the participants' level of education and belt qualification. This section aimed to establish a baseline of the coaches' backgrounds. The second

Table 1. Demographic information.

Variables	Categories	Participants n (%)
sex	Male	(92) 46
	Female	(8) 4
Level of Education	Secondary and below	(20) 10
	Diploma	(16) 8
	Bachelor's	(58) 29
	Postgraduate Studies	(6) 3
Belt degree	3 Dan	(30) 15
	4 Dan	(20) 10
	5 Dan	(32) 16
	6 Dan and above	(18) 9
The degree of classification as a Karate Coach	National	(78) 39
	International	(22) 11
Experience as a Karate Coach	<5 years	12 (24)
	5 – 10 years	(46) 23
	>10 years	(30) 15

section focused on evaluating coaches' knowledge in various areas of the basics of physical training. This section was divided into five distinct areas: physical training, exercise physiology, sports career anatomy, sports nutrition, and sports injuries and first aid.

Within the five areas, a set of 49 multiple-choice questions was developed. Each question offered four options of the answer, with only one option being correct. The participants' responses were used to calculate a score, reflecting their knowledge in each area.

To assess the level of knowledge, we employed a three-category framework. Scores of 75% and above were categorized as demonstrating adequate knowledge. Scores ranging from 50% to 74% were considered indicative of moderate knowledge. Scores below 50% were categorized as reflecting insufficient knowledge (Hammad et al., 2022).

Data Collection

After the study was approved by the Jordanian Karate Federation and a list of recognized coaches' names was obtained, data collection took place during local competitions in the summer of 2023. Each volunteer was given a questionnaire and was monitored while completing it without the use of the internet or mobile phones. On average, it took respondents around 15 minutes to complete the questionnaire. To ensure the reliability of the research tool, the application and re-application method was used. This approach facilitated the extraction of the coefficient of difficulty and discrimination. The obtained values for the discrimination coefficients were deemed acceptable, ranging from 0.30 to 0.90, as confirmed by the Kuder-Richardson method. The tool was also applied to physical education students in their 3rd and 4th years of study, who were able to achieve an adequate level (above 75%) of correct answers.

Data Analysis

The collected data were analyzed using the chefé test and one-way ANOVA, employing SPSS software (version 26, IBM, USA). The statistical analysis was conducted using a significance level of $p \leq 0.05$. Additionally, the effect of guessing was calculated by the equation: FS=R-W/C-1 (FS-corrected score; R-right answers; W-wrong answers; C-number of alternatives). The threshold for statistical significance was set at $p \leq 0.05$ and $F \leq 0.05$.

Results

The results for the cognitive outcome domains of karate coaches are presented in Table2. The scores for each domain indicate the coaches' level of knowledge, calculated as the average number of correct answers. To provide a better understanding, we have also included the corresponding percentage values based on the total number of questions in each area.

According to the findings, the domains, sports injuries and first aid, had the highest average of correct score of 5.63, representing a value of 50.7% (Table 2). This suggests a relatively stronger understanding in this area than other selected ones. In contrast, anatomy of sports area had the lowest average score of 3.96, which represents a percentage of 39.6%. This indicates a lower level of knowledge in this area among coaches. However, physical training comes second, with an average score of 4.82, or in percentage of 48.2%. Sports nutrition follows closely with an average score of 4.80, a percentage of 48%. Following all exercise physiology ranked fourth, with an average score of 4.18, representing a percentage of 41.8% (Table 2). These results indicate a weak level of knowledge in these respective areas.

The average total score for the knowledge of karate coaches in all areas was 23.39, which corresponds to a percentage of 45.7% (Table 2). This overall score suggests a weak level of coach knowledge. It is noteworthy that the values obtained from the percentage values of the cognitive outcome domains indicate that the coaches' knowledge of karate is below the adequate level.

To categorize the knowledge levels of the participants, a grading scale was established. Participants' scores were classified as "weak" if they achieved less than 50% correct answers in each knowledge field. This threshold was determined based on the principle that less than half of the correct responses indicate a lack of sufficient understanding in that area. The average score for each participant was calculated by dividing the total number of correct answers by the total sample size. The

Table 2. The actual correct grades of all participants.

Knowledge fields	Questions Number	Actual Grades Correct answers	Average	Percentage %	Knowledge Levels
Physical Training	10	241	4.82	48.2	Weak
Exercise Physiology	10	209	4.18	41.8	Weak
Sports Career Anatomy	10	198	3.96	39.6	Weak
Sports Nutrition	10	240	4.8	48.0	Weak
Sports Injuries and First Aid	9	228	5.63	50.7	Weak
Total	49	1116	23.39	45.7	Weak

Note. Average - the total number of right answers/the total sample number, Weak - under 50% of the right answers.

overall knowledge level was then assessed based on whether the average percentage of correct answers was above or below 50%, with scores below 50% categorized as "weak."

Table 3. presents the results indicating the presence of statistical differences in the physical training field based on belt degree. The results reveal that the calculated Indication level of P-value for the physical training field reached 0.049, suggesting a statistically significant difference that indicates significant variations in the average scores among different belt degrees within the physical training field. However, in the other fields (exercise physiology, anatomy of sports, sports nutrition, and sports injuries and first aid), no significant differences were observed. This implies that the average scores in these fields did not vary significantly based on belt degree. These findings highlight the importance of belt degree in relation to the knowledge level specifically in the physical training field. It suggests that coaches with different belt degrees may exhibit varying levels of expertise and understanding in this domain.

Table 3. A Variance Analysis of the Average Knowledge Outcomes of Karate Coaches in Different Training Methods Regarding their Belt Degrees.

Fields	The source of the variance	Sum of Squares	Degree of freedom	Mean Square	Probability value (P-value)
Physical training	Between groups	19.983	3	6.661	.049*
	Within groups	108.438	46	2.357	
	Total	128.420	49		
Exercise physiology	Between groups	2.417	3	.806	.798
	Within groups	109.583	46	2.382	
	Total	112.000	49		
Sports functional anatomy	Between groups	.631	3	.210	.921
	Within groups	59.689	46	1.298	
	Total	60.320	49		
Sports nutrition	Between groups	6.230	3	2.077	.221
	Within groups	62.650	46	1.362	
	Total	68.880	49		
Sports injuries and first aids	Between groups	2.507	3	.836	.481
	Within groups	45.993	46	1.000	
	Total	48.500	49		
Overall cognitive achievement	Between groups	41.714	3	13.905	.346
	Within groups	565.406	46	12.291	
	Total	607.120	49		

Note. This calculation determines the ratio of explained variance to unexplained variance. * Significance at $\alpha \leq 0.05$.

Concerning the data analyzes according to the degree of classification as a karate coach, the results show statistical differences (Table 4). The results reveal that in the physical training dimension, a significant difference ($p \leq 0.05$) was observed with a calculated indication level of α value reaching $p \leq 0.002$. This indicates that the average scores in the physical training dimension varied considerably depending on the degree of classification as a karate trainer. Specifically, the average difference was found to be higher for international karate coaches, with an average value of 4.73, compared to the average value of 3.10 for local karate coaches. This suggests that international karate trainers display higher levels of knowledge in the dimension of physical training compared to their local counterparts. However, for the other dimensions, no significant difference was observed. This means that there were no statistically significant variations in mean scores at different degrees of classification as a karate trainer in these dimensions.

Table 4. Mean Differences in Outcome Areas of Karate Coaches' Training Methods Based on Degree of Classification as a Karate Coach (t-test Results)

Fields	Degree of classification	n	Mean ± sd	t	sig
Physical Training	local	39	3.10 ± 1.52	3.20	0.002*
	international	11	4.73 ± 1.35		
Exercise Physiology	local	39	4.46 ± 1.64	0.53	0.593
	international	11	4.18 ± 0.98		
Sports functional anatomy	local	39	1.51 ± 1.02	0.56	0.577
	international	11	1.73 ± 1.42		
Sports Nutrition	local	39	2.18 ± 1.17	1.60	0.115
	international	11	2.82 ± 1.17		
Sports Injuries and First Aid	local	39	1.51 ± 1.10	0.17	0.866
	international	11	1.45 ± 0.52		
Overall cognitive achievement	local	39	12.77 ± 3.65	1.82	0.075
	international	11	14.91 ± 2.51		

Note. * Significance at α≤0.05.

The results of the physical training domain based on the belt level (Table 5) showed significant differences (p≤0.05). The results indicate that there are significant differences in the average scores between different belt degrees within the physical training field. Specifically, 6th Dan and above scored higher levels compared to 5th Dan, and there was also a significant difference favoring 6th Dan and above compared to 3rd Dan. These findings suggest that coaches with higher belt degrees, particularly those at the 5th Dan and above level, exhibited greater knowledge and proficiency in the physical training field compared to those with lower belt degrees. The differences observed highlight the importance of advancing to higher belt degrees as a reflection of increased expertise and understanding in this specific domain.

Table 5. Chefé test of the Belt degree in karate coaches.

Fields	Arithmetic mean	Belt degree	4 Dan	5 Dans	6 Dans and above
Physical training	2.60	3 Dan	0.208	0.033*	0.010*
	3.40	4 Dan		0.508	0.192
	3.81	5 Dan			0.420
	4.33	6 Dan and above			

Note. * Significance at α≤0.05.

Discussion

This study attempted to investigate the knowledge level of karate trainers regarding physical training modalities. The cognitive knowledge assessment of karate coaches in Jordan came within the weak level with an overall percentage of 45.7%, similar data was obtained from the taekwondo coaches (S. Hammad et al., 2022). This finding emphasizes the need for targeted interventions and educational programs to enhance coaches' knowledge which will consequently improve their effectiveness in training athletes. The discrepancy in knowledge levels across the different fields highlights specific areas that require coaches to give attention and develop themselves in (Attardi et al., 2018; Bhadana et al., 2015; Bompa et al., 2019; García-Isidoro et al., 2020; Pope et al., 2015).

Among the different areas assessed, sports injuries and first aid achieved the highest percentage of correct answers. Non-surprisingly the results of Jorge et al., also indicates a relatively higher level of knowledge in first aid area compare to others (Jorge et al., 2009). Conversely, anatomy of sports career recorded the lowest average, those results meets the finding of some previous studies (Attardi et al., 2018; Bhadana et al., 2015; Bompa et al., 2019; García-Isidoro et al., 2020; Pope et al., 2015). This deficiency in knowledge among karate coaches may impede athlete development and increase the risk of injuries and health complications (Bhadana et al., 2015). The study also uncovered findings that are consistent with previous studies and suggest a consistent pattern of insufficient knowledge among karate coaches, which can hinder athlete development and increase the risk of injuries and health complications (Bhadana et al., 2015). One contributing factor to this knowledge gap may be the inadequacy of the training courses offered by the Jordan Karate Federation. The limited duration of the courses, coupled with a lack of practical components, restricts the depth of knowledge that coaches can acquire. The current approach of providing theoretical materials for a short period, typically twice a year, is insufficient in effectively improving coaches' cognitive outcomes and knowledge acquisition. Previous studies have shown that academic training plays an important role in the development of coaches' knowledge, conditioned by the knowledge related to their professional background (Kilic & Ince, 2015; Mesquita et al., 2010). Additionally, the lack of theoretical promotion examinations, except for higher belt degrees such as 6th Dan and above, raises concerns about the quality and standardization of training within the sport (Fullagar et al., 2019; Stoszkowski & Collins, 2016).

To address these challenges, it is crucial to enhance the training programs provided by the Jordan Karate Federation. Increasing the duration and frequency of the courses, incorporating practical elements, and emphasizing evidence-based practices can significantly enhance coaches' understanding and application of physical training fundamentals (S. Hammad et al., 2022; Heath et al., 2012), By providing coaches with comprehensive and up-to-date knowledge, they can better guide athletes in their training, resulting in improved performance and reduced injury rates.

Implementing regular assessments, including theoretical promotion examinations, can ensure that coaches demonstrate an adequate level of training related to the sport. These assessments should not only evaluate theoretical knowledge but also assess coaches' practical application of training methods and their ability to adapt to the individual needs of athletes. By setting higher standards for certification, coaches will be incentivized to continually improve their knowledge and skills (Fabio & Towey, 2018; Moen et al., 2020). This rigorous evaluation process will help maintain high-quality coaching standards and ensure that coaches possess the necessary expertise to effectively train athletes.

Furthermore, collaboration and knowledge exchange platforms should be established to facilitate interaction between coaches within Jordan and international experts. Encouraging coaches to participate in workshops, conferences, and seminars can expose them to innovative training methods and the latest research findings. This exposure to diverse perspectives and best practices can inspire coaches to explore and implement new approaches in their training programs (Boniwell & Osin, 2014; Martindale et al., 2005; Romar et al., 2020).

Additionally, there were some significant differences ($P \leq 0.05$) in the knowledge outcome areas among trainers working in karate centers in Jordan based on the variable of Belt degree. This suggests that international coaches and those with higher Dan ranks have likely undergone advanced training courses, either outside the country or through the Jordanian Karate Federation. These additional training opportunities may have exposed these coaches to different methods and advancements in karate training (García-Isidoro et al., 2020). Consequently, trainers with higher belts and international classification are more likely to have acquired extra knowledge and skills in the field of physical training. This may have motivated other trainers to explore similar training methods through internet research or consulting with other coaches, potentially leading to a higher level of expertise in physical training among trainers with higher belts and international classification (S. Hammad et al., 2022).

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Conflicts of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics statement

The studies involving human participants were reviewed and approved by Committee for Scientific Work and Ethics of the Faculty of Educational Sciences at Al-Ahliyya Amman University, under protocol (No. FES-18G-274).

The recommendations outlined align with international guidelines and best practices in karate coaching, as emphasized by organizations like the World Karate Federation (WKF) (World Karate Federation, 2021). The WKF recognizes the importance of continuous education and knowledge enhancement for coaches, aiming to elevate the overall coaching standards in karate.

By implementing these strategies in Jordan, a profound transformation in the knowledge and expertise of karate coaches can be achieved, leading to significant benefits for both athletes and their performance. It is worth noting that athletic training has the potential to influence starting from the gene level to the various physiological systems within the body (R. Hammad et al., 2022). Therefore, investing the knowledge and professional levels of coaches will not only contribute to the growth of karate in Jordan but also pave the way for enhanced success in the field (S. Hammad et al., 2022).

Limitations

Despite the results being interesting and providing valuable advice and information regarding the knowledge level of the karate coaches, we only assess the current level, and we cannot predict how this knowledge might evolve or change in the future. Further research is needed to obtain a longitudinal assessment and a broader understanding about the knowledge level improvements.

Conclusion

The study revealed that karate coaches in Jordan have a significant knowledge gap in the field of physical training methods. This knowledge gap was observed across coaches of various belt degrees, indicating a widespread issue within the coaching community. To address this issue, it would be recommended to implement comprehensive educational programs that specifically focus on enhancing coaches' understanding of physical training methods.

These programs should be integrated into coaching curricula and emphasize the importance of continuous professional development for coaches. By incorporating education on the fundamentals of physical training methods, coaches can acquire the necessary knowledge and skills to effectively train athletes and reduce the risk of injuries.

Additionally, it is crucial to establish and enforce regulations that mandate coaches to engage in ongoing education and professional development activities. This will ensure that coaches remain up-to-date with the latest advancements in physical training methods and maintain a high level of competence in their coaching practice.

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