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Expert Opinion Article

Comparative Study On Dynamic Balance Among Combative Sports Male Player

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Abstract: This study aimed to compare dynamic balance abilities among male athletes from four different combat sports: boxing, karate, taekwondo, and judo. Forty national-level male athletes (10 from each sport), aged 20–25 years, were purposively selected. Participants were evaluated using key dynamic balance measures including limb length, anterior reach (left and right), posterior medial reach (left and right), and posterior lateral reach (left and right). Data were analysed using descriptive statistics and one-way ANOVA at a 0.05 level of significance. The results revealed significant differences in certain components of dynamic balance, particularly in right posterior medial reach, left posterior medial reach, and right posterior lateral reach. Judo athletes generally exhibited superior dynamic balance compared to their counterparts, likely due to the grappling and throwing techniques intrinsic to their sport. These findings highlight the influence of sport-specific training on balance performance and underscore the importance of tailored conditioning programs to enhance performance and reduce injury risk.

Keywords: Dynamic Balance, Combat Sports, Boxing, Karate, Judo, Taekwondo, ANOVA

Introduction: Balance is a critical component of athletic performance, particularly in combative sports, where athletes must maintain postural stability during dynamic and unpredictable movements. Dynamic balance, which refers to the ability to maintain equilibrium while in motion, is essential for executing techniques effectively, avoiding injuries, and improving overall performance (Paillard & Noé, 2006). Different combat sports such as boxing, taekwondo, karate, and judo place varying demands on the body, potentially influencing the development of balance in sport-specific ways. In combat sports, athletes frequently perform complex motor actions including kicking, punching, grappling, and dodging, all of which challenge the neuromuscular and proprioceptive systems. Previous research has suggested that participation in such sports may lead to superior balance abilities compared to non-athletes or athletes from non-contact sports (Bressel et al., 2007; Filipa et al., 2010). However, few studies have conducted direct comparisons of balance performance across different combat disciplines. Understanding how these sports differ in terms of dynamic balance can offer valuable insights for sport-specific training and injury prevention.

Dynamic balance, defined as the ability to maintain postural stability and orientation during movement, plays a critical role in athletic performance, particularly in combative sports such as boxing, wrestling, taekwondo, and judo. These sports require athletes to perform quick directional changes, maintain control during physical contact, and sustain body stability during offensive and defensive maneuvers (Paillard & Noé, 2006). Given the physical demands of such disciplines, it is reasonable to assume that athletes from different combative sports may exhibit varied levels of dynamic balance due to sport-specific training regimens and motor demands. Balance is a multifaceted motor skill influenced by sensory input, neuromuscular control, strength, and proprioception (Winter, 1995). In combative sports, where unpredictability and rapid responses are common, superior balance may contribute not only to performance success but also to injury prevention (Hrysomallis, 2007). Moreover, dynamic balance is particularly important in male athletes, who often compete at higher intensities, leading to increased physical load on the musculoskeletal and vestibular systems. Previous research has explored balance abilities across various athletic populations; however, there remains a gap in understanding how dynamic balance differs among athletes of distinct combative sports disciplines. Comparative studies

focusing on balance in sports like taekwondo, wrestling, and judo suggest notable differences attributable to unique movement patterns, training frequencies, and technical requirements (Matsuda et al., 2008; Zech et al., 2010). For instance, judo practitioners often develop enhanced postural control due to frequent grappling and body throws, while taekwondo athletes may rely more on lower limb coordination and single-leg stability for high kicks. Therefore, the present study aims to conduct a comparative analysis of dynamic balance among male athletes engaged in different combative sports. By identifying sport-specific balance adaptations, this research could provide insights into tailored training interventions to enhance athletic performance and reduce injury risk.

Method: For the purpose of the study forty (40) National level combative sports male player from taekwondo, karate, boxing, and judo were selected. The age of the athletes was ranged from 20 to 25 years. And to assess the dynamic balance abilities in the participation of Limb Length, L- Anterior Reach, R- Anterior Reach, L- Posterior Medial Reach, R- Posterior Medial Reach, L- Posterior lateral Reach, and R- Posterior lateral Reach. Descriptive statistics and Analysis of Variance (ANOVA) were employed to analyse the data at a 0.05 level of significance.

Results:

Table 1: Descriptive Statistics of Dynamic Balance of Combat Sports

		N	Mean	Std. Deviation
LL	Boxing	10	78.6	4.53
	Karate	10	78.8	8.52
	Judo	10	83.8	4.69
	Taekwondo	10	81	7.48
	Total	40	80.55	6.63
LAR	Boxing	10	76.1	5.74
	Karate	10	74	9.68
	Judo	10	80.3	7.33
	Taekwondo	10	76	6.91
	Total	40	76.6	7.62
RAR	Boxing	10	71.1	4.79
	Karate	10	73.9	9.55
	Judo	10	80.4	9.18
	Taekwondo	10	76.6	7.93
	Total	40	75.5	8.51
LPMR	Boxing	10	71.6	7.23
	Karate	10	78.1	9.69
	Judo	10	82	7.94
	Taekwondo	10	76.3	7.47
	Total	40	77	8.69
RPMR	Boxing	10	71.5	4.03
	Karate	10	80.3	12.28
	Judo	10	82	6.62
	Taekwondo	10	79.4	7.88
	Total	40	78.3	8.93
LPLR	Boxing	10	72.1	5.11
	Karate	10	78.1	9.52
	Judo	10	79.6	9.49
	Taekwondo	10	76.9	7.2
	Total	40	76.68	8.23
RPLR	Boxing	10	71	5.6
	Karate	10	76.8	9.8
	Judo	10	79.4	6.52
	Taekwondo	10	77.5	8.42
	Total	40	76.18	8.1

(Note: LL (Limb Length), LAR (and L- Anterior Reach), RAR (R- Anterior Reach), LPMR (L- Posterior Medial Reach), RPMR (R- Posterior Medial Reach), LPLR (L- Posterior lateral Reach), LPLR (R- Posterior lateral Reach).

Table-1 displays that the means and standard deviations of Limb Length (in cm) with Boxing are 78.60±4.53, Karate 78.80±8.52, Judo 83.80±4.69, Taekwondo 81.00±7.48 respectively and L- Anterior Reach (in cm) with Boxing are 76.10±5.74, Karate 74.00±9.68, Judo 80.30±7.33, Taekwondo 76.00±6.91, respectively and R- Anterior Reach (in cm) with Boxing are 71.10±4.79, Karate 73.90±9.55, judo 80.40±9.18, Taekwondo 76.60±7.93, respectively and L- Posterior Medial Reach (in cm) with Boxing are 71.60±7.23, Karate 78.10±9.69, judo 82.00±7.94, Taekwondo 76.30±7.47, respectively and R- Posterior Medial Reach (in cm) with Boxing are 71.50±4.03, Karate 80.30±12.28, Judo 82.00±6.62, Taekwondo 79.40±7.88, respectively and L- Posterior lateral Reach (in cm) with Boxing are 72.10±5.11, Karate 78.10±9.52, Judo 79.60±9.49, Taekwondo 76.90±7.20, respectively. and R- Posterior lateral Reach (in cm) with Boxing are 71.00±5.60, Karate 76.80±9.80, Judo 79.40±6.52, Taekwondo 77.50±8.42, respectively.

Table 2: Comparative table of combat sports by applying ANOVA

Variables		Sum of Squares	df	Mean Square	F	Sig.
LL	Between Groups	176.3	3	58.77	1.37	0.266
	Within Groups	1539.6	36	42.77		
	Total	1715.9	39			
LAR	Between Groups	210.6	3	70.2	1.23	0.313
	Within Groups	2055	36	57.08		
	Total	2265.6	39			
RAR	Between Groups	471.4	3	157.13	2.4	0.083
	Within Groups	2352.6	36	65.35		
	Total	2824	39			
LPMR	Between Groups	558.6	3	186.2	2.81	0.053
	Within Groups	2385.4	36	66.26		
	Total	2944	39			
RPMR	Between Groups	651.4	3	217.13	3.18	0.035
	Within Groups	2457	36	68.25		
	Total	3108.4	39			
LPLR	Between Groups	315.68	3	105.23	1.63	0.200
	Within Groups	2327.1	36	64.64		
	Total	2642.78	39			
RPLR	Between Groups	393.28	3	131.09	2.18	0.107
	Within Groups	2166.5	36	60.18		
	Total	2559.78	39			

Table-2 displays that the F-value for comparing the adjusted means of the dynamic balance ability among Combat Sports players on between group and within group. Since the p-value of the F-statistic of Limb Length (0.266), L- Anterior Reach (0.313), R- Anterior Reach (0.083), L- Posterior Medial Reach (0.053), L- Posterior lateral Reach (0.200) and R- Posterior lateral Reach (.107) which is more than .05, it is insignificant. so, it is failed accepted at .05 level of significance and the dynamic balance of Combat Sports players on between group and within group. Since the p-value of the F-statistic of R- Posterior Medial Reach (0.035), which are less than .05, it is significant. so, it is failed to rejected at .05 level of significance.

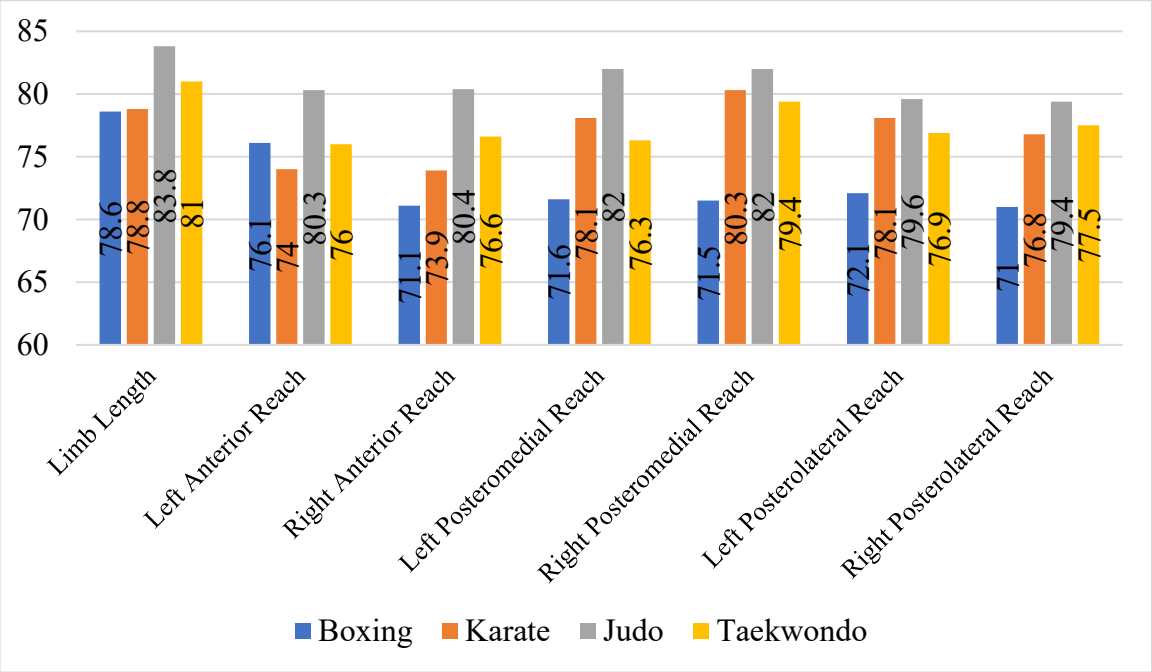
Table 3: Pairwise comparison by applying LSD (Least Significance Difference)

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
RPMR	Boxing	Karate	-8.8	3.69	0.023*	-16.29	-1.31
		Judo	-10.5	3.69	0.007*	-17.99	-3.01
		Taekwondo	-7.9	3.69	0.039*	-15.39	-0.41
	Karate	Judo	-1.7	3.69	0.648	-9.19	5.79
		Taekwondo	0.9	3.69	0.809	-6.59	8.39
	Judo	Taekwondo	2.6	3.69	0.486	-4.89	10.09

*. The mean difference is significant at the 0.05 level.

least significant difference of R- Posterior Medial Reach between Boxing and Krate (0.023), Boxing and Judo (0.007), Boxing and Taekwondo (0.039) group were found significant as the 'p' value is less than 0.05. least significant difference of karate and judo (0.648) and karate and Taekwondo (0.809) groups were insignificant as the 'p' value is more than 0.05, whereas karate and Boxing (0.023) was found significant as the 'p' value is less than 0.05. and judo and Karate (0.648) and between Judo and Taekwondo (0.486) groups were insignificant as the 'p' value is more than 0.05, whereas Judo and Boxing (0.007), was found significant as the 'p' value is less than 0.05. and between Taekwondo and boxing (0.039) Taekwondo and Karate (0.809), Taekwondo and judo (0.486) groups were insignificant as the 'p' value is more than 0.05.

Figure 1: Mean Comparison Graph of Combat Sports



Discussion of Findings: The purpose of this study was to compare dynamic balance among national-level male athletes participating in four different combat sports: boxing, karate, taekwondo, and judo. The dynamic balance was assessed using the Star Excursion Balance Test (SEBT), a reliable tool for evaluating postural control in athletes. The results revealed that among the tested balance components, significant differences were found in Right Posterior Medial Reach, while Left Posterior Medial Reach showed borderline significance. Post-hoc analysis showed that judo athletes exhibited significantly superior dynamic balance compared to boxing athletes in multiple reach directions, which was supports by previous study suggesting that judo training, which involves frequent grappling, throws, and falls, fosters greater neuromuscular coordination and postural control (Matsuda et al., 2008; Zech et al., 2010). Taekwondo athletes also performed better in posterior reach directions compared to boxers, though not always significantly. The kicking-oriented nature of taekwondo likely enhances single-leg stance stability, which is consistent with previous findings (Paillard & Noé, 2006). Karate athletes showed moderate performance but were generally outperformed by judo athletes, suggesting that the intensity and type of physical engagement in each combat sport plays a key role in developing balance proficiency. Boxers consistently showed lower balance scores, particularly in the posterior medial and lateral reach directions. This may be attributed to the limited lower-body dynamic movement in boxing, as it emphasizes upper-body coordination and footwork rather than sustained single-leg support which is aligned with the study of Hrysomallis (2007), who emphasized the importance of balance as a predictor of performance and injury prevention in athletes. Sports that place high demands on multidirectional movement, proprioceptive control, and reactive balance (e.g., judo and taekwondo) are more likely to improve dynamic balance through regular training.

Conclusion: This comparative study highlights that dynamic balance capabilities differ significantly across combat sports. Judo athletes demonstrated the highest dynamic balance performance, especially in posterior reach directions, followed by taekwondo,

karate, and boxing. These variations are likely due to sport-specific movement patterns and training demands. The results underscore the importance of incorporating balance training into sport-specific conditioning programs, particularly for athletes in sports with lower inherent balance demands, such as boxing. Coaches and trainers should consider integrating dynamic balance exercises into regular training, especially for sports where balance is not the primary focus, to enhance performance and reduce injury risk. Future research may expand upon these findings by including larger samples, female athletes, and other forms of dynamic stability assessment.

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