



INTERNATIONAL GRADUATE COLLOQUIUM

i-SPEAK 2025

SPORTS AND PHYSICAL EXERCISE ASSEMBLY OF KNOWLEDGE SHARING

COLLOQUIUM PROCEEDINGS

EXTENDED
ABSTRACT

Comparative Analysis of Punching and Blocking Techniques in Boxing Across Eight Weight Divisions

Muhamad Akasyah Mohd Zamri¹, Aliah Sahira Yusof¹, Muhamad Noor Mohamed^{1*}, Muhamad Safiq Saiful Annur¹, Mohd Azzat Adnan¹, Mardiana Mazaulan¹, & Noor Azila Azreen Md Radzi¹

¹Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Negeri Sembilan Branch, Seremban Campus, Negeri Sembilan, MALAYSIA

*Corresponding author: muhamad_noor@uitm.edu.my

Keywords: Boxing techniques, Weight class comparison, Defensive strategies, Punch frequency analysis, Premier boxing championship

I. INTRODUCTION

Boxing performance is intrinsically linked to an athlete's weight class, with variations in strength, speed, and endurance shaping both offensive and defensive capabilities. However, there remains a lack of research comparing the application of specific techniques, such as jabs, hooks, uppercuts, and defensive arm blocks, across different weight divisions. This study addresses that gap by analyzing how boxers deploy these techniques to influence match outcomes and adapt biomechanically and strategically based on body size. Previous biomechanical research has demonstrated that punch dynamics vary significantly by technique. For example, uppercuts and hooks produce greater shoulder, elbow, and wrist acceleration compared to jabs, highlighting the mechanical complexity of each punch type [1].

II. METHODS

This study analyzed the technical performance of sixteen professional boxers across eight distinct weight classes, selected based on their participation in official bouts within the Premier Boxing Championship (PBC). A total of one representative bout per boxer was included to ensure consistent comparative conditions. Data collection was conducted through hand-notational video analysis, using manual coding to record offensive and defensive techniques. Specifically, the frequency of three primary punching techniques, jab, hook, and uppercut, was recorded, along with defensive arm blocks in response to each punch type. For defensive actions, each instance of arm-based punch blocking (left or right) was registered based on the punch type it countered. Each technique was quantified per weight class to identify usage trends and frequency variations across different weight categories. To ensure accuracy and consistency, a test-retest reliability procedure was conducted, with intra-rater agreement maintained at $r > 0.80$. The percentage of coding errors was controlled and kept below 10%, following established standards in sports performance analysis.

III. RESULTS AND DISCUSSION

A. Describing Techniques Across Weight Classes

The analysis revealed distinctive technique usage patterns across weight classes. The frequency of block jab varied most significantly, ranging from just 3.0 occurrences in Featherweight bouts to 25.7 in Light Heavyweight, indicating

that larger boxers rely more heavily on this defensive tactic. Meanwhile, jabs were employed consistently across all divisions, reflecting their universal strategic importance in distance control and engagement setup [2]. Lighter weight classes, particularly lightweight and featherweight, favored offensive diversity, with higher usage rates of hooks, whereas heavyweight divisions saw few uppercuts, aligning with biomechanical analyses that show straight punches (jab and cross) deliver higher effective mass and thus greater force transfer efficiency [3]. These trends suggest that lighter boxers capitalize on agility for rapid combinations, while heavier fighters emphasize defensive organization and distance control, using straighter punches like jabs to manage space more effectively—a finding consistent with observed biomechanical differences in elite-level punch execution [4].

Figure 1 illustrates the average (mean) frequency of six selected technical actions of three offensive (jab, hook, uppercut) and three defensives (block jab, block hook, block uppercut) across eight professional boxing weight classes.

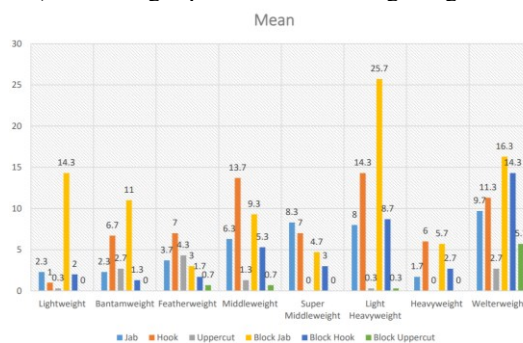


Fig. 1 Mean values of technical actions (Jab, Hook, Uppercut, Block Jab, Block Hook, and Block Uppercut) across eight boxing weight classes.

TABLE I
ONE-WAY ANOVA RESULTS COMPARING MEAN VALUES OF SIX
PERFORMANCE INDICATORS ACROSS EIGHT BOXING WEIGHT CLASSES

	F	df1	df2	p
Jab	3.78	7	16	< 0.01
Hook	3.71	7	16	0.059
Uppercut	3.74	7	16	0.029
Block Jab	3.83	7	16	< 0.01
Block Hook	3.77	7	16	< 0.01
Block Uppercut	3.77	7	16	< 0.01

One-way ANOVA results testing differences in six performance indicators across eight weight classes. The post-hoc Tukey analyses revealed statistically significant differences in technique usage across weight classes, underscoring how tactical preferences and physiological attributes influence boxing performance. Notably, block-jab and block-uppercut frequencies differed markedly between lighter and heavier classes, with comparisons such as Bantamweight vs. Welterweight ($p < 0.001$) demonstrating heavier divisions' reliance on defensive blocking. This aligns with biomechanical evidence suggesting that heavier boxers, due to greater punching force and slower mobility, emphasize defensive organization [2][5]. Similarly, jab usage varied significantly between classes (e.g., Lightweight vs. Welterweight, $p = 0.003$), reinforcing the jab's role as a distance-controlling and foundational offensive tool. Biomechanically, jabs and crosses generate higher effective mass transfer, making them efficient choices for maintaining range [5]. Differences in hook usage and block-hook frequency was significant between middleweight and heavier categories highlight lighter fighters' preference for hooks, leveraging their agility and speed, while heavier fighters favor straighter, more controlled tactics. This remarkable shift in punch deployment reflects weight-related strategic adaptations where lighter boxers utilize dynamic combinations and heavier boxers prioritize controlled distance and defense. These findings mirror broader combat sport research that links physiological profiles to tactical execution [2], suggesting coaches tailor training to optimize technique selection by weight class. Lighter boxers should sharpen offensive drills featuring hooks and combinations, while heavier fighters may benefit from defensive block training and refined jab usage to capitalize on their biomechanical strengths.

IV. CONCLUSIONS

Technique usage in boxing is influenced by weight class, though not uniformly across all techniques. While the jab remained a consistent tool across divisions, significant differences were observed, particularly in block-related actions such as block-jab, block-hook, and block-uppercut,

between lighter and heavier classes. These findings suggest that defensive behaviors tend to increase with weight, likely due to differences in agility, force output, and tactical preference. Offensively, lighter boxers demonstrated a broader use of techniques like hooks and uppercuts, reflecting their reliance on speed and combination work. Overall, while some variations were statistically significant, others were more subtle, indicating that both physical and strategic factors play a role in shaping technique selection across weight categories.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to all those who contributed to the completion of this study. Special thanks go to the organizing committee and data management team of the Premier Boxing Championship for granting access to match footage and fighter statistics, which were essential for the notational analysis. The authors also extend their appreciation to Universiti Teknologi MARA for providing academic guidance, institutional support, and research facilities throughout the project. We are deeply thankful to our colleagues, mentors, and those whose insights and assistance enhanced the quality and reliability of this study. Finally, heartfelt appreciation is extended to our families and friends for their unwavering support, encouragement, and understanding during the course of this research.

REFERENCES

- [1] Düz, S., & Serkan, D. (2010). Three-dimensional kinematic analysis of three different punches in amateur boxing. *Ergonomics and Human Factors Journal*, 52(6), 78–90.
- [2] Mosler, A., Kacprzak, J., & Zając, T. (2024). Tactical analysis of punch selection and frequency across boxing weight categories.
- [3] Kacprzak, J., Mosler, D., Tsos, A., & Wąsik, J. (2025). Biomechanics of punching—The impact of effective mass and force transfer on strike performance. *Applied Sciences*, 15(7), 4008. <https://doi.org/10.3390/app15074008>
- [4] Dinu, D., & Louis, R. (2020). An examination of the biomechanics of the cross, hook, and uppercut between two elite boxing groups. Retrieved from <https://www.researchgate.net/publication/342170311>.
- [5] Kacprzak, J., Mosler, D., & Wąsik, J. (2024). The influence of effective mass on the striking force of lead jab and rear cross punches of boxers. *Applied Sciences*, 14(17), 7785. <https://doi.org/10.3390/app14177785>.