



## Research Article

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**Performance Analysis of Winners and Losers in Boxing: A Critical Analysis on Selected Kpis in Aiba Youth Men's World Championship 2024 Finals**Vikho Avoinii Pao<sup>1</sup>, Rahul Kumar<sup>2</sup>, Akshay Tyagi<sup>3</sup>, Raushan Kumar<sup>3</sup>, Mayanglambam Surchand Singh<sup>3</sup><sup>1</sup>Indira Gandhi Institute of Physical Education and Sports science, Shaheed Rajguru Marg, A-Block, Vikaspuri, New Delhi.<sup>2</sup>Netaji Subhas National Institute of Sports Patiala Punjab India.<sup>3</sup>Assistant Professor, Department of Physical Education, National Sports University.**Article History**

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**Abstract:** The study aims to analyse and differentiate winning and losing performances in AIBA youth men's world championship 2024 finals by examining key performance indicators (KPIs). A total of 13 AIBA (International Boxing Association) youth men's world championship 2024 finals match were taken, across 13 weight categories. Where Punch Accuracy, Punch Outcome, target area, Attack and counter attack were considered as key Performance indicator (KPIs). The match video clips were extracted from secondary source (AIBA YouTube Channel), matches were tagged and analysed frame by frame using Dartfish Pro S 2024 Switzerland, Microsoft Excel (Version 2021) for data Processing, data visualization, and Jamovi 2.6.23 for statistical analysis. The results of the study indicate that there was a significant difference in punch accuracy and successful punches. Where winners demonstrated higher punch accuracy ( $57.25 \pm 7.68$ ) when compared to losing boxers ( $46.47 \pm 6.45$ ) and high significant difference ( $p=0.001$ ). The results also show that winners had more successful punches ( $41.31 \pm 11.21$ ) when compared to loser's ( $27.25 \pm 8.24$ ) with significant difference ( $p = 0.002$ ) and a large effect size, indicating winner had a better precision. Additionally, winners had a higher attack frequency ( $72.77 \pm 16.39$ ) more than loser ( $58.58 \pm 22.62$ ), although not statistically significant was found ( $p = 0.05$ ), indicating that more offensive strategy may influence the outcome of the match. Punch accuracy, successful punches outcome and attack frequency were the key performance indicator influencing the winner's performance. The findings of the study show that winning boxers display more offensive strategy and higher punch accuracy along with consistence target selection, focusing on the head for scoring whereas losing boxers were more defensive. The study further the underpin the role of performance analysis in enhancing overall competitive performance, training programmes and performance evaluation in Boxing. AIBA (Association Internationale de Boxe Amateur), Boxing, performance analysis, Target area, Punch accuracy, Attack, counter attack, Dartfish Pro S.

**Keywords:** Winners and Losers, Boxing, A Critical Analysis, Kpis, Aiba, Youth Men's World Championship 2024 Finals

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**INTRODUCTION**

Boxing is a very competitive contact sports with a rich history dating back to approximately 300 B.C. The objective of boxing is to successfully hit an opponent as many times possible using both hands, targeting the anterior part of the head and body at the same time avoiding opponent punches. The first boxing competition is known to have taken place in 1867 under the Marquess of Queensberry rules (Encyclopaedia Britannica). International Boxing Association (IBA) is the highest governing body of amateur boxing (previously known as AIBA) founded in 1946 London. The most prestigious events of IBA are Olympic boxing, and AIBA World championship competed by both male and female. Currently, male amateur boxers fight 3 rounds of 3 minutes and 1 minute rest between rounds whereas female boxers fight 3 rounds of 2-minute and 1 minute's rest between rounds (AIBA Technical and competition rules 2021).

Success in boxing is defined by a perfect blend of Physical, technical, tactical and mental intelligence. As the competitiveness of boxing increases understanding the key factors contributing to boxers'

winning and losing performance has become a critical component. In recent years, performance analysis has gained recognition. Performance analysis is concern with classifying and quantifying the essential aspects of sports performance and potentially can provide detailed feedback to competitors and coaches for the purpose of improving future performance (Hughes & Bartlett, 2002; Hughes & Frank, 2004). Boxing has transformed significantly international in over the years and performance analysis has contributed to the change of the sports immensely. Performance analysis have made a lot easier for coach and athletes to analysed Post match video focusing on specific area of improvement and analysing opponent boxing match to fine potential weakness for potential future match-up which has help coach and athletes to make inform decision making, optimize training and enhance boxers' performance. International boxing Association (AIBA) youth men's world championship is an international boxing platform which gives opportunity to study and analysed the performance of the elite performance of winners and losers as well as young emerging talent. Most of the existing literature focus on Physiological parameters and performance analysis based on manual notational analysis. However, there is very little research done on

data-driven analysis on the selected key performance indicator (Punch Accuracy, Punch Outcome, target area, Attack and counter attack) of youth boxers and factors effecting the performance of winners and losers using reliable performance analysis software (Dartfish Pro S Software 2024). Which this study will be covering.

## METHODOLOGY

### Need Analysis

To Analyse and understand key factors effecting winning and losing performances in AIBA youth men’s world championship 2024 finals (13 match) across 13 weight categories, systematically analysing the selected KPIs (Punch Accuracy, Punch Outcome, target area, Attack and counter attack) using Dartfish Pro s 2024 version. For the purpose of the study the

quantitative data has been collected form primary source using the following steps in respective order:

### Capture Process

To analyse the selected key performance Indicator, selected video was downloaded from AIBA YouTube Channel ([AIBA YouTube Channel](#)). Downloaded videos were transfer to Dartfish software Version 2024 Pro S for tagging. To complete the need analysis total 13 match across 13 weight categories of AIBA youth men’s world championship 2024 finals were selected by team of analyst. Total 2,710 events were tagged. Further, it was critically evaluated and analyzed Frame by Frame where needed and discussed with the, subject experts in some contradictory events. After the video is tag, the tag data were transfer to Excel for data analysis and visualization.

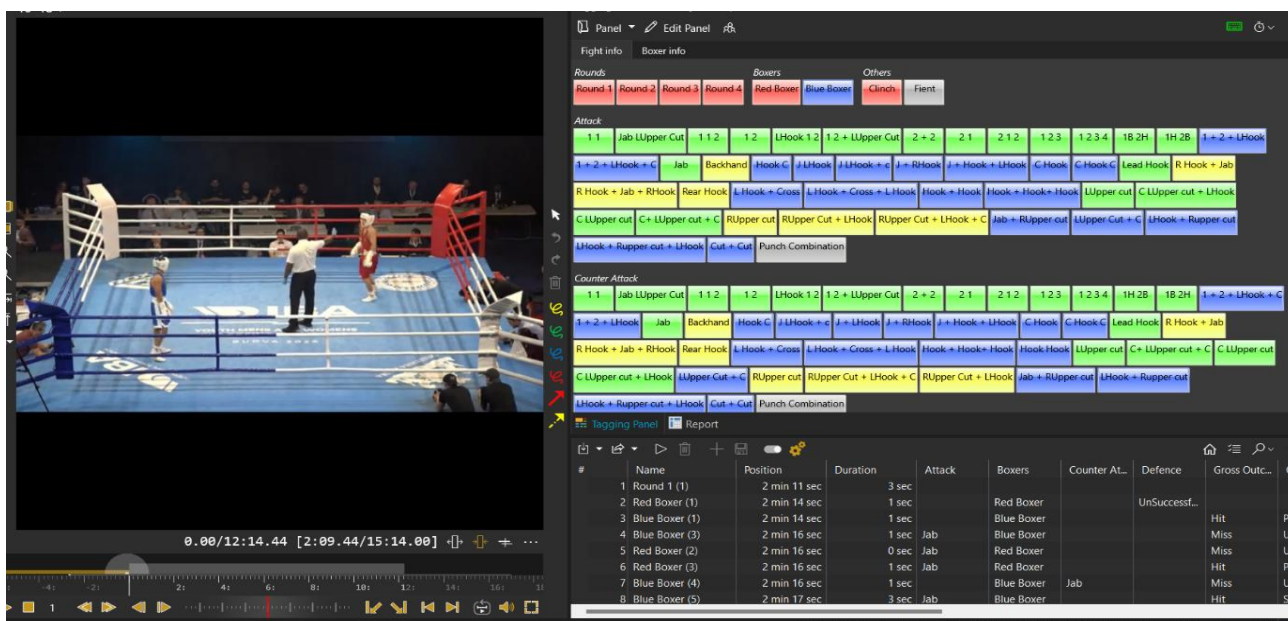


Figure 1 Dartfish Tagging Panel

### Selection of Key Performance Indicator (KPIs)

The team of analyst had selected the following KPI's as it is the most influential Key performance indicators and have direct relation with winning and

Losing outcomes of a boxing match. Punch Accuracy, Punch Outcome, target area, Attack and counter attack were considered as key Performance indicator (KPIs), for objective data analysis and presentation.

Table 1: Key Performance Indicator & Operational Definition

SL No.	Key Performance Indicator	Operational definition
1	<b>Punch Accuracy</b>	<p>Punch accuracy is the amount of punch thrown by a boxer which successfully land on the opponent targeted area (Anterior part of the head or body) from the total number of punches thrown by the boxer during a boxing match.</p> $\text{Punch Accuracy} = \frac{(\text{Total Punch Successful} + \text{Partial successful}) \times 100}{(\text{Total Punch})}$
2	<b>Punch Outcome</b>	<p>Punch Outcome is the result of the punch thrown by a boxer on the opponent, in act of defence or attack during a boxing match.</p> <p><b>Note:</b> Only Successful, Partially Successful and Un-successful was consider for Punch Outcome.</p>
	Successful Punch	<p>A punch is labelled successful when it visibly lands on the opponent’s target area. The punch must land directly with the knuckle part of a closed glove on</p>

		any part of the front or sides of the head or body above the belt line of the opponent.
	Partially Successful Punch	A punch is labelled to have partially successful when it is partially blocked or deflected yet still lands on the opponent’s target area making a visible impact. That is, the punch landed is not a clean punch. For example, a punch may partially land on the arm of an opponent yet still make some form of contact with the opponent’s target area.
	Unsuccessful Punch	A punch is labelled unsuccessful when it visibly fails to land on the opponent’s target area. For example, the punch may land clearly on the arms of the opponent or completely miss the opponent. For an attack to be labelled as such no punches must be labelled as successful or partially successful
3	<b>Target Area</b>	Target area is the legal area target by a boxer to lend punches on the opponent’s body (Anterior part of the head or body) during a boxing match.
4	<b>Attack</b>	An Attack is any types punch or any types of combination of punches initiated by a boxer in acts of Offensive move to score points or to dominate their opponent in a boxing match. For an attack to be labelled as successful, at least one punch must be deemed successful
5	<b>Counter Attack</b>	A counter attack is an act of defensive-offensive move initiated by a boxer in order to responds the attack of the opponent with their own punch or combination of punch in a boxing match.

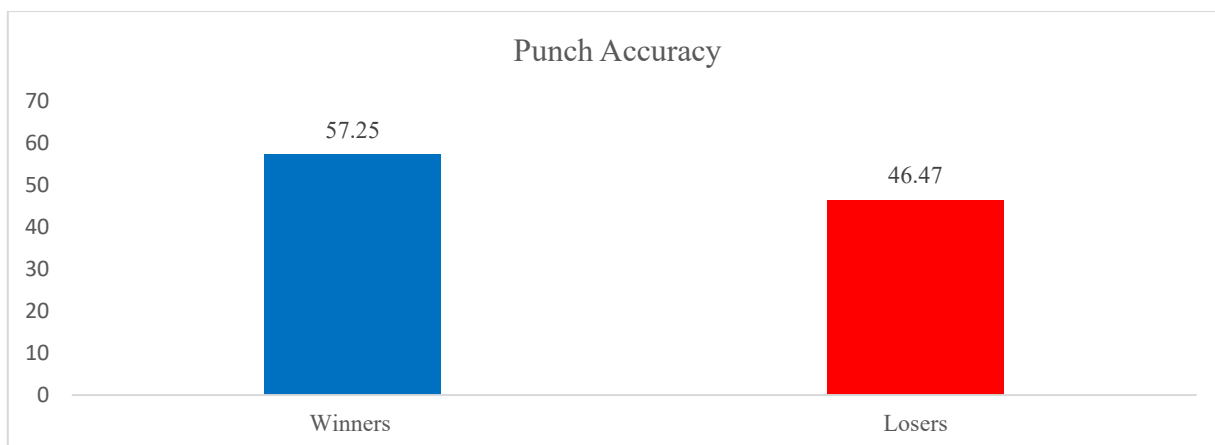
## FINDINGS & DISCUSSION

**Table 2: Descriptive Statistic of Punch Accuracy, Punch Outcome, Attack, Counter Attack and Target Area of Winners & Losers**

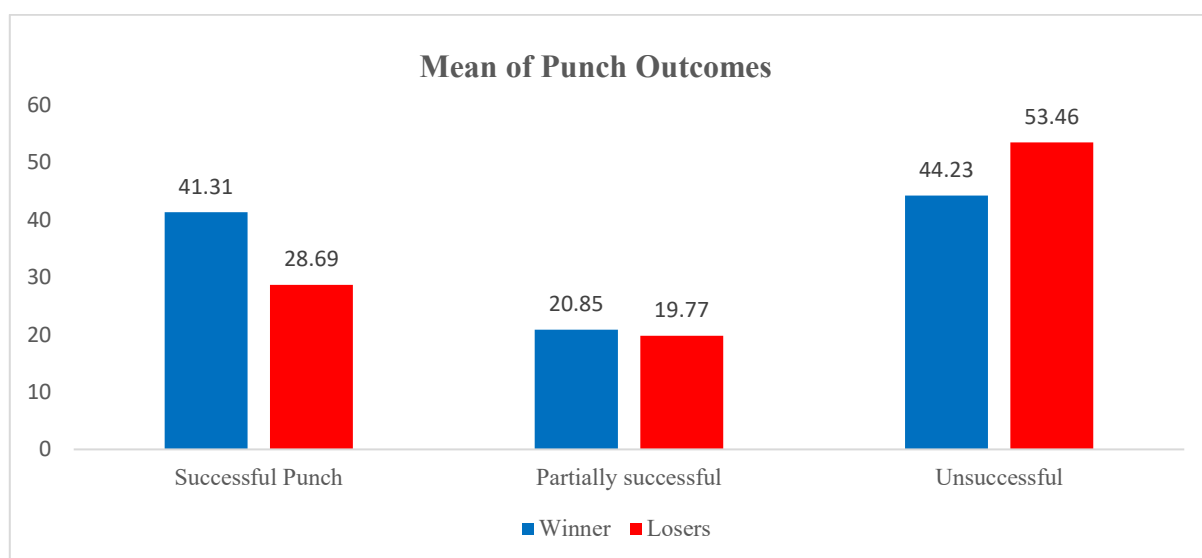
KPIs		Winners/Losers	N	Mean	SE	SD	Range
Punch Accuracy		Winners	13	57.25	2.13	7.68	30.2
		Losers		46.47	1.86	6.45	28.4
Punch Outcome	Successful Punch	Winners		41.31	3.11	11.21	41
		Losers		27.25	2.38	8.24	32
	Partially successful	Winners		20.85	2.11	7.6	27
		Losers		19.77	1.74	5.99	20
	Unsuccessful	Winners		44.23	3.27	11.79	38
		Losers		54.58	4.37	15.75	60
Attack		Winners		72.77	4.55	16.39	50
		Losers		58.58	6.19	22.32	92
Counter Attack		Winners		35.08	3.62	13.07	53
		Losers		41.17	4.23	14.2	40
Target area	Head	Winners		91.31	4.45	16.05	58
		Losers	81.38	4.36	15.73	52	
	Body	Winners	10.46	1.42	5.13	14	
		Losers	12.91	2.14	7.71	28	
	Head and Body	Winners	6.42	1.69	6.09	22	
		Losers	6.67	1.64	5.91	18	

Table 2 shows the breakup of descriptive statistics for various key performance Indicators difference between winners and losers. Mean value, SD, Standard Error and range for all the KPIs are given in table 2 for both winners and losers, respectively. Major finding of the above table revealed that mean score of winners are slightly higher in major KPIs selected for the studies. That include Punch Accuracy (Winners= 57.25, losers = 46.47), Successful Punch (Winners = 41.31, Losers = 27.25), Partially successful (winners = 20.85,

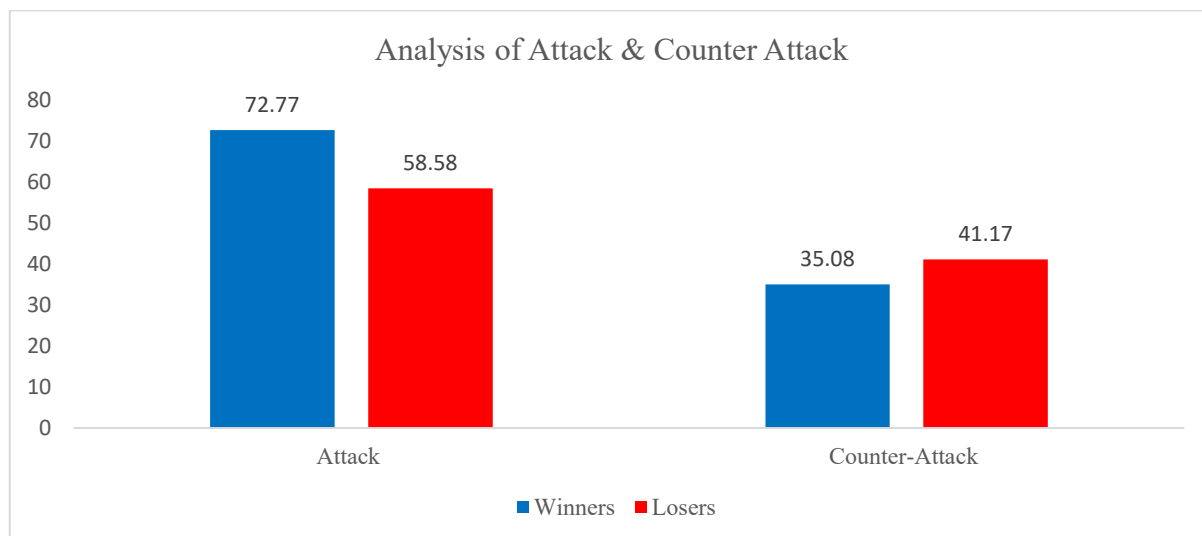
loser = 19.77), Attack (winners = 72.77, Losers = 58.58), and Head (winners = 91.31, Losers = 81.38). On the other hands, losers exhibited higher score in KPIs such as Unsuccessful (winners = 44.23, Losers = 54.58), counter attack (winners = 35.08, losers = 41.17), Body (winners = 10.46, losers = 12.91) and Head and body (winners = 6.42, losers = 6.67). the finding of the study revealed that winners demonstrate superior accuracy, strategic attack frequency and prioritize head strikes.



**Figure 1: Punch Accuracy Analysis**



**Figure 2: Mean Score of Punch Outcome**



**Figure 3: Analysis of Attack and Counter Attack**

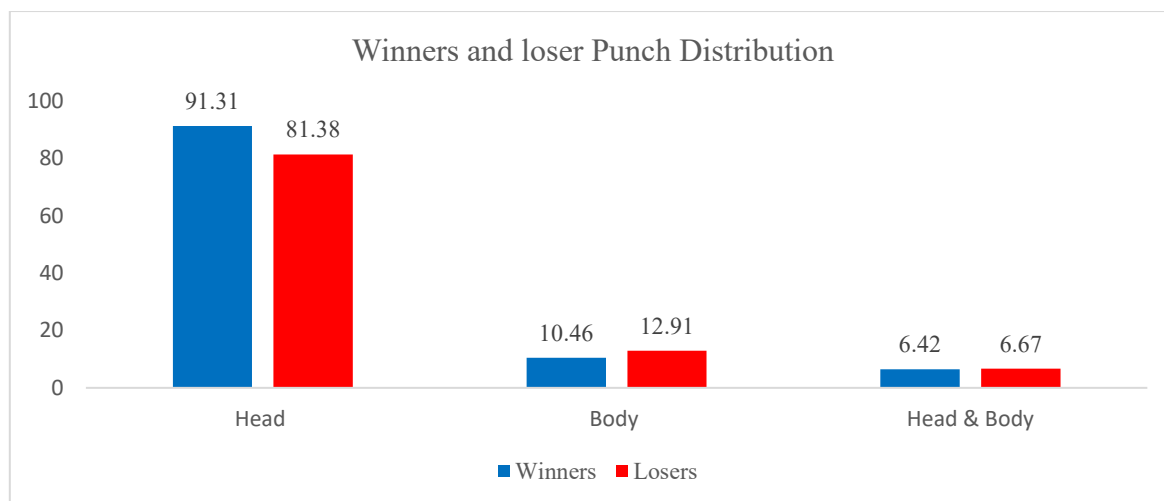


Figure 4: Winners and Losers Punch Distribution

Table 3: Independent Sample t-test

KPIs		Winners/Losers	Mean	SD	t	p	Cohen's d																																																																															
Punch Accuracy		Winners	57.25	7.68	3.78	0.001	1.215																																																																															
		Losers	46.47	6.45				Punch Outcome	Successful Punch	Winners	41.31	11.21	3.55	0.002	1.216	Losers	27.25	8.24	Partially successful	Winners	20.85	7.60	0.55	0.589	0.157	Losers	19.33	6.03	Unsuccessful	Winners	44.23	11.79	-1.86	0.076	-0.664	Losers	54.58	15.75	Attack		Winners	72.77	16.39	1.81	0.084	0.648	Losers	58.58	22.62	Counter Attack		Winners	35.08	13.07	-1.099	0.283	-0.4	Losers	41.17	14.64	Target area	Head	Winners	91.31	16.05	1.548	0.135	0.624	Losers	81.38	16.42	Body	Winners	10.46	5.13	-0.949	0.353	-0.357	Losers	12.91	7.46	Head and Body	Winners	6.42	6.09	-0.108
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An Independent t-test was conducted to examine the difference between winners and losers, on the selected KPIs. Major findings of the above table (table 2) revealed that:

The analysis of punch accuracy revealed that a statistically significant difference was observed ( $p=0.001$ ), Winners demonstrated significantly higher punch accuracy ( $57.25 \pm 6.45$ ) when compare to losers ( $46.47 \pm 6.45$ ), with a large effect size (Cohen's  $d = 1.215$ ) indicating that there was a meaningful practical difference. Which suggested that punch accuracy play a key role in determining match outcomes.

The analysis of punch outcome revealed that a statistically significant difference was observe in successful punches ( $p<0.002$ ), with a large effect size (Cohen's  $d >1$ ) with winners having more successful punch ( $41.31 \pm 11.21$ ) when compare to losers ( $28.69 \pm 9.46$ ), suggesting that winner has a better precision and control.

No statistically significant difference was observed in Partially successful Punches ( $p>0.05$ ). though not statistically significant there was difference in performance with winners ( $20.85 \pm 7.60$ ) slightly

outperforming losers ( $19.33 \pm 6.03$ ) with a small effect size was observed (Cohen's  $d < 0.2$ ). Implying both the group had a similar performance when it comes to partially successful punches and partially successful punches do not play a major role in performance outcomes.

No statistically significant difference was observed in Unsuccessful punches ( $p > 0.05$ ). Though not statistically significant was observed, losers had more unsuccessful punches ( $54.58 \pm 15.75$ ) thrown when compare to winners ( $44.23 \pm 11.79$ ) with medium effect size (Cohen's  $d > 0.664$ ).

Analysis of Attack and Counter revealed that winner ( $72.77 \pm 16.39$ ) demonstrated a higher number of attacks when compare to losers ( $58.58 \pm 22.62$ ) and a medium effect size was observed (Cohen's  $d > 0.5$ ) though there was not statistically significant ( $p > 0.05$ ). suggesting that offensive strategies contribute to match outcomes as winner were more offensive. But when it comes to Counter attack losers had slightly higher number of counter attack ( $41.17 \pm 14.64$ ) when compare to winners ( $35.08 \pm 13.07$ ) and a small effect size was observed (Cohen's  $d < 0.2$ ) though there was no statistically significant difference ( $p > 0.05$ ). implying that counter-attack do not play a major role in performance outcomes.

Analysis of target area revealed that Winners targeted the head more consistently on the head as their target ( $91.31 \pm 16.05$ ) when compare to losers ( $81.38 \pm 16.42$ ), although there was not statically significant ( $p > 0.05$ ). Medium effect size (Cohen's  $d > 0.05$ ) suggested that targeting head may be associated with winning performance, further analysis is needed.

The analysis data revealed that there was not significant difference in Body ( $p > 0.05$ ) and small effect size (Cohen's  $d < 0.2$ ) suggest that targeting body does not determine the match outcome.

The analysis of head-body combination revealed that both winners ( $6.4 \pm 6.09$ ) and losers ( $6.67 \pm 5.22$ ) have identical mean value which indicate that there was no meaningful difference between winners and losers (Cohen's  $d < 0.2$ ). The finding of the study revealed that punch accuracy, successful punches and attack frequency are the key performance indicator associated with winning performance.

## CONCLUSION

The finding of the study demonstrates the key difference in winning and losing performance in AIBA youth men's world championship 2024 finals on the selected KPIs. Both groups threw a comparable number of punches, Winners demonstrated superior performance in term of punch accuracy, successfully landing more punches as clearly shown in Figure 1 and Figure 2. This suggest that boxers should focus more on punch

precision and effectiveness rather than throwing more punches.

In terms of punch outcomes, Winners had more successful punch when compare to losers (Table 2) suggesting that winner has a better precision and control. Although not statistical difference was observed in partially successful and unsuccessful punches, winners slightly outperformed losers. Implying both the group had a similar performance when it comes to partially successful punches. Further, statistically no significant was observed, losers have more unsuccessful punches thrown when compare to winners. This suggest that, punch thrown by the losing boxers were less effective even though total number of punches thrown were similar between winners and losers. Highlighting the importance on punch accuracy and efficiency.

While attacking frequency plays a role in winning performance which revealed the difference in offensive and defensive tactics between winners and losers as shown in figure 3 and table 3. winners were more offensive but high standard deviation among losers indicates a lack of structure offensive strategies. On the other hand, counter-attack do not significantly impact the outcomes of the boxing match however, loser counter-attack more frequently than the winners suggesting the losers were more defensive. Even though the difference was not statistically significant. This finding suggests that maintaining higher level of offense, combine with precision plays a critical role in controlling the pace of the fight and influence the match outcome.

Another critical differentiation is targeting areas, both winners and losers primarily targeted head. However, winners consistently targeted head as their target as shown in figure 4 however losers distribute their punch more evenly towards the body and head-body combination.

The key finding of the study revealed that successful boxers optimized punch accuracy, strategic target, strategic attack and counterattack measures and by giving more emphasize on offense. As the result clearly shows that winner demonstrated a higher success rate, superior punch accuracy. Further, the study also revealed that losing boxers are more defensive and are more dependent on counterattack. Future research should focus on conducting studies over multiple competition identifying the trends and consistency in performance metrics adopting primary data collection methods, along with high quality video recordings with multiple camera angles to ensure visibility of all the angle and observation of all the action. More Investigation should be carried on defensive skills, footwork and ring positioning. Future training should focus on Punch Accuracy, strategic target, strategic attack and counterattack measures and giving more emphasize on offense, along with refining punch variety. Adopting these approaches could improve the overall performance and increase the changes of

victory in future boxing match. By integrating this approach, future boxers can improve their overall performance.

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