Anthropometric Characteristics of Elite Male Rugby Players at the Rio and Tokyo Summer Olympic Games: A Systematic Review

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Abstract: **This study reviewed the anthropometric characteristics of age, height and mass of elite male rugby players at the Rio and Tokyo summer Olympic games. A total of 149 rugby players who participated in the Rio Olympic games and 156 players who participated in the Tokyo Olympic games were profiled. Both games had 12 participating teams with each team consisting of either 12 or 13 players as per World Rugby requirements. Data was collected from team profiles that contained the ages, height and mass of all the players (Wikipedia, 2021). The means and standard deviations were subsequently calculated and Pearson's correlation used to determine the relationship between the final performances and age, height and mass respectively. Findings showed no significant correlation between performance and age, height and mass at both Rio and Tokyo except for performance and age at the Tokyo Olympics. The findings suggested that the following anthropometric characteristic were dominant: ages between 21and 29; height between 1.80m and 1.90m and mass between 91kg and 100kg.**

***Key words*: Performance, Age, Height, Mass, Profile**

I. INTRODUCTION

Rugby is a high-intensity sport, intermittent in nature, that combines a variety of physical abilities including aerobic power, speed, agility and muscular strength (Pasin, Caroli, Cas, Volpi, Galli & Passeri,2017). Rugby sevens at the Summer Olympics was played for the first time at the 2016 Summer Olympics with both men's and women's contests. Rugby sevens was added to the Olympics following the decision of the 121st IOC Session in Copenhagen in October 2009. The champions for the inaugural rugby men sevens tournament in 2016 in Rio were Fiji. The second Olympic men's rugby sevens tournament was held in Tokyo in 2021 at the Tokyo stadium. The tournament was won by the defending champions Fiji.

Anthropometric characteristics such as height and mass, have previously been advocated as key discriminators of playing level within rugby (Brazier et al. 2018). It has also been reported that there is likelihood for height and mass in rugby players to be greater with higher levels of competition (Barr et al, 2014) According to Stoop et al (2018), since 1995 when Rugby union became professional, the amount of physical contact during match play has increased. Consequently, physical demands and hence anthropometric characteristics differ between playing positions. Stoop et al (2018) further opine that there is a tendency to lean towards heavier and taller players by the coaches. Nicholas (1997) described, in his review, the differences in body height and mass, total body fat and lean body mass between first- and second-class rugby players. He further, highlighted the importance of analyzing the anthropometric and physiological performance in relation to positional physical demands.

In most sports, there is also an age "sweet spot," at which the combination of physical, technical and strategic abilities come together and this usually falls in the mid-20's to early 30's (Minson,2015). Although there have been numerous examples of Olympians competing, and sometimes winning medals over the age of 50 the vast majority of these come from sports requiring exceptional skill and less aerobic or anaerobic power, such as the shooting events, sailing, equestrian and fencing (Minsen,2015). At both Rio and Tokyo Olympics, the upper cap for the age of the competitors was 38 (Wikipedia, 2021). Training age is also an important consideration, as previous research has evidenced the relative ease in which training induced adaptations can be increased in novice participants compared with more diminishing positive gains within more advanced athletes (Till et al, 2017). Till et al (2017) further clarify that training age (i.e., 0, 1, and 2 years) is classified by an athlete's previous experience of formalized strength and conditioning training within a rugby league academy though classification of training age may be much more complex than this. There may potentially be need to account for players individual training histories to fully understand how training age may affect physical development. Within the United Kingdom, talented academy-aged rugby league players are recruited to train within the national governing bodies talent development program between 13 and 16 years and within professional clubs' academy programs between 16 and 20 years of age (Till et al, 2017)). The purpose of the academy programs at 16–20 years of age is to develop the anthropometric and physical qualities of academy rugby league players required to meet the increasing training and game demands at progressing levels. This is the stage when formalized strength and conditioning training commences (Till et al, 2017).

The purpose of this review was thus to relate the anthropometric parameters of age, height and mass to the overall performance of the teams both at the Rio and Tokyo Olympics respectively by formulating the following null hypotheses:

1. $H0_1$: There is no significant relationship between Performance and Mean Age of Rugby players at both the Rio and Tokyo Olympics.
2. $H0_2$: There is no significant relationship between Performance and Mean Height of Rugby players at both the Rio and Tokyo Olympics.
3. $H0_3$: There is no significant relationship between Performance and Mean Mass of Rugby players at both the Rio and Tokyo Olympics.

Theoretical Framework

Sports performance is a multifactorial trait resulting from the interplay of individual, environmental, and task characteristics. Due to its complex, dynamic, and multidimensional nature, understanding the performance variability among athletes requires the adoption of a holistic perspective that considers the integration of the levels, interacting at different scales during the performance (Natacha, Mabliny & Sara, 2020). Glazier (2017) also states that sports performance is generally considered to be governed by a range of interacting physiological, biomechanical, and psychological variables, amongst others. Despite sports performance being multi-factorial, however, the majority of performance-oriented sports science research has predominantly been mono disciplinary in nature, presumably due, at least in part, to the lack of a unifying theoretical framework required to integrate the various sub disciplines of sports science.

The review therefore did not find a suitable theoretical framework to form a basis though anthropometric measures of age, height and mass are still considered a contributory factor in performance in rugby. This view is supported by Brazier et al. (2018) who states that differences in anthropometric characteristics according to playing position, as well as the trend that athletes are becoming taller and heavier, could have a significant impact on how the game is played. Increases in mass will potentially increase impact forces in the tackle and scrum, which could have implications on the severity and incidence of injury. This increased incidence and severity of injury could reduce athlete availability for selection across a season and increase demand for larger squads of athletes. The need for this review and more research in this area is therefore justified.

II. LITERATURE REVIEW

Brazier et al. (2018) reviewed the anthropometric and physiological characteristics required for elite rugby performance within both Rugby Union (RU) and Rugby League (RL). They suggested that as competitive standard rises, athletes are heavier with lower skinfold thicknesses and % body fat, they have more fat-free mass and are stronger, faster and more powerful. They however recommended a cautious interpretation of some data reviewed in their article, due to limited data regarding certain parameters, some inconsistencies in methods between studies and slightly dated research in a sport that practitioners anecdotally describe as ever-changing. Indeed, it is likely that present day elite rugby athletes have lower % body fat, higher maximal aerobic power and are faster, stronger and more powerful than presented within their article. Nevertheless, well-developed speed, agility, lower-body power and strength characteristics appear vital for performance at the elite level of rugby competition. The article confirmed the importance of specific anthropometric and physiological characteristics in distinguishing between competitive playing standards in both RU and RL. There was also emerging evidence to suggest that elite rugby athletes have differing genetic characteristics compared to non-athletes, which enables them to achieve career success and specialize in particular playing positions. They concluded that understanding the underlying biological characteristics of elite rugby athletes will allow strength and conditioning programmes to be further developed to meet the requirements of specific positions and codes within elite rugby.

Stoop et al (2018) did a systematic review to relate anthropometric properties with physical performance parameters in Rugby union backs and forwards across different playing levels of Tier 1 nations. All experimental study types in English and German were assessed for eligibility. Inclusion criteria were 15-a-side senior male backs and forwards, with anthropometric and/or physical performance data. They concluded that anthropometric parameters adapt to physical performance. In strength and endurance test situations heavier players may be underestimated postulating careful interpretation of those results to avoid misleading conclusion.

Dobbin et al (2019) investigated the factors affecting the anthropometric and physical characteristics of elite academy rugby league players. One hundred ninety-seven elite academy rugby league players (age = 17.3 [1.0] y) from 5 Super League clubs completed measures of anthropometric and physical characteristics during a competitive season. The interaction between and influence of contextual factors on characteristics was assessed using linear mixed modeling. The findings indicated that all physical characteristics improved during preseason and continued to improve until midseason, They concluded that the findings are likely to offer practitioners who design training programs for academy rugby league players insight into the relationships between anthropometric and physical characteristics and how they are influenced by playing year, league ranking, position, and season phase.

Gabbet (2002) conducted a study to determine whether the physiological characteristics of players influence selection in a semi-professional first grade rugby league team. Sixty-six semi-professional rugby league players aged 24 - 4 years (mean - s) were monitored over two competitive seasons. The players underwent measurements of body mass, muscular power (vertical jump), speed (10, 20, 30 and 40 m sprint), agility (Illinois agility run) and estimated maximal aerobic power (multi-stage fitness test) 1 week before their first competition match. The results suggested that the physiological capacities of players do not influence selection in a semi-professional first grade rugby league team. Rather, player selection appears to be based on body mass, playing experience and skill.

Till et al (2016) evaluated the influence of annual-age category, relative age, playing position, anthropometry and fitness on the career attainment outcomes of junior rugby league players originally selected for a talent identification and development (TID) programme. Junior rugby league players (*N* = 580) were grouped retrospectively according to their career attainment level (i.e., amateur, academy and professional). Anthropometric (height, sitting height, body mass, sum of four skinfolds), maturational (age at peak height velocity; PHV) and fitness (power, speed, change of direction speed, estimated $\dot{V}O_{2max}$) characteristics were assessed at the Under 13s, 14s and 15s annual-age categories. The findings suggested that relative age, playing position, anthropometry and fitness can influence the career attainment of junior rugby league players. They concluded that talent identification programmes within rugby league, and other related team sports, should be aware and acknowledge the factors influencing long-term career attainment, and not delimit development opportunities during early adolescence.

Longo et al (2016) conducted comparative research among disciplines to investigate the age of peak performance in Olympics. The ages (in decimal years) of athletes with the best performances at the 2012 Summer Olympics were considered (n = 3548). A total of forty sport disciplines were included; the athletics events were classified in six disciplines: Sprint, Middle-distance, Long-distance, Combined, Jumping and Throwing. The ages ranged from 14.0 to 52.8 years. The 72% of the athletes aged between 20 and 30 years, and the 99% aged below 40 years. The mean ages for men and women were 27.0 and 26.2 years, respectively. They however concluded that there are multiple factors that have influence on the athletic performance. The physical, technical, tactical and psychological factors are conventionally recognized as core components of sport training. So apart from the consideration of age, optimal performance involves an integration of each of these components

In a study by Till et al (2017), sixty-one academy players undertook a fitness testing assessment, including anthropometric (height, body mass, sum of 4 skinfolds) and physical (10 and 20 m sprint, 10m momentum, vertical jump, Yo-Yo intermittent recovery test level 1, one-repetition maximum [1RM] squat, bench press and prone row) measures at the start of preseason on 2 consecutive annual occasions. The purpose of the study was to present and compare the annual changes in physical qualities of academy rugby league players according to training age. The findings demonstrated that changes in body mass, , vertical jump, and all absolute and relative strength measures were apparent across all 3 training age groups suggesting that these characteristics improve annually regardless of training age. When training age groups were compared, greater improvements in strength were evident for 0 vs. 1 year training age as expected due to greater adaptations associated with novice athletes. However, the 2 years training age group demonstrated enhanced improvements in strength characteristics compared with the 1-year training age group. They concluded that training age is an important consideration for the strength and conditioning coach that may impact on adaptations to training. They however stated that, it is more likely that a combination of chronological age, biological maturity, training age, and experience will impact on physical adaptations alongside the interindividual differences and dynamic nature of player development.

Barr et al (2014) examined the importance of height and mass on performance in international rugby by analyzing final pool rankings at the 2007 and 2011 Rugby World Cups (RWC). The 2007 and 2011 RWCs both had four pools of five teams. Each team would play four games in the pool stages and points were given for wins, ties, scoring four or more tries and losing by less than seven points. The points accumulated from this system were used to examine the influence of height and mass on performance. Teams were subdivided into groups (1st, 2nd, 3rd, 4th or 5th) depending on final rankings in the pool stages. An ANOVA and Pearson's correlation were used to compare the influence of height, mass and Body Mass Index on final pool rankings and points accumulated in each of the two tournaments. The study concluded that of all of the anthropometric measurements considered, the height and mass of forwards seem to be the best indicators of team performance.

III. METHODOLOGY

Descriptive statistics are numbers that summarize the data with the purpose of describing what occurred in the sample and also help researchers detect sample characteristics that may influence their conclusions (Thomson 2009). Descriptive analysis was subsequently found suitable for this review. A total of 149 rugby players (n=149) who participated in the Rio Olympic Games and 156 rugby players (n=156) who participated in the Tokyo Olympic Games were profiled. Both games had 12 participating teams with each team consisting of either 12 or 13 players as per World Rugby requirements. Data was collected from team profiles that contained the ages, height and mass of all the players (Wikipedia, 2021). The means and standard deviations were subsequently calculated and Pearson's correlation used to determine the relationship between the final performance and age, height and mass respectively

IV. RESULTS

Table 1 shows the Distribution of Tokyo and Rio Rugby Olympics players by Age in years

Table 1: Distribution of Tokyo and Rio Rugby Olympics players by Age

Age Group (years)	Tokyo Olympics Frequency	Percentage	Rio Olympics Frequency	Percentage
18-20	1	.6	3	2.0
21-23	25	16.0	41	27.5
24-26	43	27.6	40	26.8
27-29	43	27.6	38	25.5
30-32	28	17.9	20	13.4
33-35	11	7.1	7	4.7
36-39	5	3.2	0	
Total	156	100.0	149	100.0

From Table 1 the 27.5% of Rugby players at the Rio Olympics were between the age group of 21-23 while 26.8% were between the age group of 24-26 and 25.5% were between the age group of 27-29 (Mean=26, Std=1.208). The majority of the players (67.7%) were therefore between age 21 and 29

Table 1 also shows 27.6% of Rugby players at the Tokyo Olympics were between the age group of 24-26 and 27-29 respectively while 17.9% were between 30-32 (Mean=27, Std=1.302). The majority of the players (89.1%) therefore fell in the age category between 21 and 29.

Table 2 shows the Distribution of Tokyo and Rio Rugby players by mass in Kilograms

Table 2: Distribution of Tokyo and Rio Rugby players by Mass

Mass Group (Kgs)	Tokyo Olympics Frequency	Percentage	Rio Olympics Frequency	Percentage
50-60	0	0.0	1	.7
61-70	4	2.6	2	1.3
71-80	26	16.7	18	12.1
81-90	58	37.2	53	35.6
91-100	51	32.7	50	33.6
101-110	16	10.3	22	14.8
111-120	0	0.0	3	2.0
121-130	1	.6	0	0.0
Total	156	100.0	149	100.0

Table 2 illustrates that 35.6% of Rugby players at the Rio Olympics were of the mass group of between 81-90 Kgs while 33.6% were of the Mass group of between 91-100 Kgs and 14.8% were of the Mass group of between 101-110 respectively with a mean of (Mean=90.23Kgs, Std=1.037). This demonstrates that the majority of the players (84%) weighed between 81Kgs and 110 Kgs

Table 2 also indicates that 37.2% of Rugby players at the Tokyo Olympics were between the mass group of 81-90 Kgs while 32.7% were between the mass group of 91-100Kgs and 16.7% were between 71-80 (Mean=88.4 Kgs, Std=1.00). The majority of the players (86.6%) were found to lie between 71Kgs and 100Kgs

Table 3 shows the Distribution of Tokyo and Rio Rugby players by Height in meters

Table 3; Distribution of Tokyo and Rio Rugby players by Height

Height Group (meters))	Tokyo Olympics Frequency	Percentage	Rio Olympics Frequency	Percentage
1.70-1.75	27	17.3	30	20.1
1.76-1.80	34	21.8	23	15.4
1.81-1.85	38	24.4	35	23.5
1.86-1.90	42	26.9	38	25.5
1.91-1.95	13	8.3	19	12.8
1.96-2.00	2	1.3	4	2.7
Total	156	100.0	149	100.0

Table 3 shows that 25.5% of Rugby players at the Rio Olympics were between the Height group of 1.86-1.90m while 23.5% were of the Height group of between 1.81-1.85m and 15.4% were of the Height group of between 1.76-1.80m (Mean=1.83m, Std=1.407). The majority (64.4%) were found to be between 1.76m and 1.90m

Table 3 also indicates that 26.9% of Rugby players at the Tokyo Olympics were of the Height group of between 1.86-1.90m while 24.4% were between the Height group of 1.81-1.85m and 21.8% were between the Height group of 1.76-1.80m (Mean=1.83m, Std=1.276). This demonstrates that the height of the majority of the players (73.1%) was between 1.76m and 1.90

H01: There is no significant relationship between Performance and Mean Age of Rugby players at both the Rio and Tokyo Olympics.

In order to test the relationship between Performance and Mean Age of Rugby players at the Rio Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Mean Age of Rugby players at the Rio Olympics.

Table 4 shows Correlation matrix between Performance and Mean Age of Rugby players at the Rio Olympics.

Table 4; Correlation matrix between Performance and Mean Age of Rugby players at the Rio Olympics

		Performance	Mean Age (years)
Performance	Pearson Correlation	1	.303
	Sig. (2-tailed)		.339
	N	12	12
Mean Age	Pearson Correlation	.303	1
	Sig. (2-tailed)	.339	
	N	12	12

The correlation result in Table 4 indicates a positive and no significant coefficient between Performance and Mean Age of Rugby players at Rio Olympics where (r=.303, p-value>0.05). The null hypothesis was subsequently accepted leading to the conclusion that there was no significant relationship between Performance and Mean Age of Rugby Players at the Rio Olympics.

In order to test the relationship between Performance and Age of Rugby players at the Tokyo Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Age of Rugby players at the Tokyo Olympics.

Table 5 shows correlation matrix between Performance and Mean Age of Rugby players at the Tokyo Olympics.

Table 5; Correlation matrix between Performance and Mean Age of Rugby players at the Tokyo Olympics

		Performance	Mean Age
Performance	Pearson Correlation	1	.972
	Sig. (2-tailed)		.000
	N	12	12
Mean Age	Pearson Correlation	.972	1
	Sig. (2-tailed)	.000	
	N	12	12

The correlation result in Table 5 shows a positive and strong significant coefficient between Performance and Mean Age of Rugby players at Tokyo Olympics where (r=.927, p-value<0.05). The null hypothesis was therefore rejected leading to the conclusion that there was a significant relationship between Performance and Mean Age of Rugby Players at the Tokyo Olympics.

H02: There is no significant relationship between Performance and Mean Height of Rugby players at both the Rio and Tokyo Olympics.

In order to test the relationship between Performance and Mean Height of Rugby players at the Rio Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Mean Height of Rugby players at the Rio Olympics.

Table 6 shows correlation matrix between Performance and Mean Height of Rugby players at the Rio Olympics.

Table 6: Correlation matrix between Performance and Mean Height of Rugby players at the Rio Olympics

		Performance	Mean Height
Performance	Pearson Correlation	1	-.202
	Sig. (2-tailed)		.529
	N	12	12
Mean Height	Pearson Correlation	-.202	1
	Sig. (2-tailed)	.529	
	N	12	12

The correlation result in Table 6 demonstrates a negative and weak coefficient between Performance and Mean Height of Rugby players at Rio Olympics where (r=-.202, p-value>0.05). The null hypothesis was hence accepted leading to the conclusion that there was no significant relationship between Performance and Mean Height of Rugby at the Rio Olympics.

In order to test the relationship between Performance and Mean Height of Rugby players at the Tokyo Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Mean Height of Rugby players at the Tokyo Olympics.

Table 7 shows correlation matrix between Performance and Mean Height of Rugby players at the Tokyo Olympics.

Table 7; Correlation matrix between Performance and Mean Height of Rugby players at the Tokyo Olympics

		Performance	Mean Height
Performance	Pearson Correlation	1	.040
	Sig. (2-tailed)		.902
	N	12	12
Mean Height	Pearson Correlation	.040	1
	Sig. (2-tailed)	.902	
	N	12	12

The correlation result in Table 7 shows there is a positive and no significant coefficient between Performance and Mean Height of Rugby players at Tokyo Olympics where (r=.040, p-value>0.05). The null hypothesis was subsequently accepted leading to the conclusion that there was no significant relationship between Performance and Mean Height of Rugby Players at the Tokyo Olympics.

H03: There is no significant relationship between Performance and Mean Mass of Rugby players at both the Rio and Tokyo Olympics.

In order to test the relationship between Performance and Mean Mass of Rugby players at the Rio Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Mean Mass of Rugby players at the Rio Olympics.

Table 8 shows correlation matrix between Performance and Mean Mass of Rugby players at the Rio Olympics.

Table 8: Correlation matrix between Performance and Mean Mass of Rugby players at the Rio Olympics

		Performance	**Mean Mass**
Performance	Pearson Correlation	1	-.257
	Sig. (2-tailed)		.421
	N	12	12
Mean Mass	Pearson Correlation	-.257	1
	Sig. (2-tailed)	.421	
	N	12	12

The correlation result in Table 8 shows there is a negative and no significant coefficient between Performance and Mean Mass of Rugby players at Rio Olympics where (r=-.257, p-value>0.05). The null hypothesis was therefore accepted leading to the conclusion that there is no significant relationship between Performance and Mean Mass of Rugby Players at the Rio Olympics.

In order to test the relationship between Performance and Mean Mass of Rugby players at the Tokyo Olympics. Pearson correlation was used to test the hypothesis. The null hypothesis states that there is no significant relationship between Performance and Mean Mass of Rugby players at the Tokyo Olympics.

Table 9 shows correlation matrix between Performance and Mean Mass of Rugby players at the Tokyo Olympics.

Table 9: Correlation matrix between Performance and Mean Mass of Rugby players at the Tokyo Olympics

		Performance	**Mean Mass**
Performance	Pearson Correlation	1	-.257
	Sig. (2-tailed)		.421
	N	12	12
Mean Mass	Pearson Correlation	-.257	1
	Sig. (2-tailed)	.421	
	N	12	12

The correlation result in Table 9 shows there is a negative and no significant coefficient between Performance and Mean Mass of Rugby players at Tokyo Olympics where (r=-.257, p-value>0.05). The null hypothesis was accepted leading to the conclusion that there is no significant relationship between Performance and Mean Mass of Rugby Players at the Tokyo Olympics.

V. DISCUSSION

The purpose of this review was thus to relate the anthropometric parameters of age, height and mass to the overall performance of the teams both at the Rio and Tokyo Olympics respectively. The literature review has indicated that anthropometric measurement reveals correlation between body structure physical characteristics and sport capabilities. Height, weight, and other anthropometric variables play a vital role in the player's performance.

As age cannot be influenced by training, it is uniquely an aspect of identification, selection and then building on other training capacities of the physical, technical, tactical and mental. The study findings demonstrate the while there was no significant relationship between performance and mean age in the Rio Olympics, the relationship was significant in the Tokyo Olympics. Could this be attributed to the results showing that when the age bracket of 21years to 29 years is considered, 67.7% of the players in Rio were in this category while in Tokyo 89.1% were in this category? This finding seems to be in line with the conclusion by Till et al (2017) who resolved that training age is an important consideration for the strength and conditioning coach that may impact on adaptations to training. They were however cautious and further suggested that, it is more likely that a combination of chronological age, biological maturity, training age, and experience will impact on physical adaptations alongside the interindividual differences and dynamic nature of player development. This is consistent with the results of the study by Longo et al (2016). Despite finding that the mean age of the athletes at the London summer Olympics was 27 years for men, they still concluded that an integration of physical, technical, tactical and psychological factors is conventionally required for success in performance. The age versus performance in sports is therefore an aspect that requires more investigation and it would be prudent to avoid considering causal effect between age and performance.

The findings of the review indicate that the relationship between performance and the height of the players at both Rio and Tokyo Olympics was not significant. This inconsistent with the results of the study by Stoop et al (2018) which stated that usually tall players become elite rugby athletes and since teams with the tallest forwards win a greater number of matches, this anthropometric advantage is of great importance. They further reiterated that as height cannot be influenced by training, it is uniquely a matter of directional selection

In comparison with the study by Barr et al (2014) which concluded that having tall and heavy forwards seems to be important for performance in international rugby while height and mass for backs does not seem to be as important of a discriminator, height still appears to be a relevant consideration in Rugby World Cups. In addition to competence at positional-specific rugby skills, identifying young players with adequate height for international rugby is likely important for talent development and is likely to be a key factor of success at the Rugby World Cup. Height therefore seems to be an anthropometric measure that should be considered for selection especially in relation to forward players

The review findings indicate that most of the players at both Rio and Tokyo Olympics had a mass between 80 and 100 kgs. The review also demonstrated that there was no significant relationship between performance and mass of the players at both Rio and Tokyo Olympics. This appears contrary to Gabbet (2002) findings which state that selection appears based on body mass, playing experience and skill in a semiprofessional rugby league team while Stoop et al (2018) are a bit more cautious in their conclusion by stating that anthropometric parameters adapt to physical performance. They further indicated that in strength and endurance test situations heavier players may be underestimated postulating careful interpretation of those results to avoid misleading conclusion. Barr et al (2014) seems more definite in his conclusion that of all of the anthropometric measurements considered, the height and mass of forwards seem to be the best indicators of team performance though his study was based on 15s rugby. There however seems to be a consistency with this conclusion when the distribution of players by mass is considered at both Rio and Tokyo Olympics where 16.8% and 10.6% of the players weighed between 100kg and 120kgs respectively. This alludes to a possible indicator of heavier forwards at both Olympics. So, mass as an anthropometric measure seems to be an important indicator for selection but considering a causal effect with performance should be avoided and treated with caution

VI. CONCLUSION

This review presents and compares the correlation of performances with the age, height and mass of the rugby players at both Rio and Tokyo Olympics. The findings demonstrated that there was no significant relationship between performances and age, height and mass except for the Tokyo Olympics where the relationship between performance and age was found to be significant When the distributions by age, height and mass were compared, the findings suggested that the following anthropometric characteristic were dominant: ages between 21and 29; height between 1.80m and 1.90m and mass between 91kg and 100kg. However, it is more likely a combination of chronological age, biological maturity, training age, and experience that impacts on physical adaptations alongside the interindividual differences and dynamic nature of player development as stated by Till et al (2017)

A cautious interpretation of some data reviewed in this article is recommended, due to limited data regarding other parameters that may influence performance. Indeed, it is likely that the anthropometric measures of age, height and mass are considered during team selection though well-developed speed, agility, lower-body power and strength characteristics appear vital for performance at the elite level of rugby competition. The findings however confirm the importance of specific anthropometric and physiological characteristics in distinguishing between competitive playing standards in rugby union. Understanding the underlying biological characteristics of elite rugby athletes will allow strength and conditioning programmes to be further developed to meet the requirements of specific positions and codes within elite rugby in preparation for the next Olympics scheduled to be held in France in 2024.

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