A PERFORMANCE OF THE MALAYSIA RUGBY SEVENS TEAM BASED ON SELECTED PERFORMANCE INDICATORS ON A VARIOUS ASIA-LEVEL RUGBY SEVENS TOURNAMENT FROM 2018 - 2020.

Norasrudin bin Sulaiman.
Hasbullah bin Ismail
Hosni bin Hasan
Raja Mohamad Firhad bin Raja Azidin

*Faculty of Sport Science and Recreation, University Technologi Mara (UiTM)
40450, Shah Alam, Selangor, Malaysia.*

Corresponding Author

Norasrudin bin Sulaiman
Email: Norasrudinsulaiman@gmail.com
*Faculty of Sports Science and Recreation,
Universiti Teknologi MARA,
Shah Alam Selangor.*

PENERBIT PRESS
UNIVERSITI TEKNOLOGI MARA

A PERFORMANCE OF THE MALAYSIA RUGBY SEVENS TEAM BASED ON SELECTED PERFORMANCE INDICATORS ON A VARIOUS ASIA-LEVEL RUGBY SEVENS TOURNAMENT FROM 2018 - 2020.

Norasrudin bin Sulaiman, Hasbullah bin Ismail, Hosni bin Hasan, & Raja Mohamad Firhad bin Raja Azidin

Faculty of Sport Science and Recreation, University Technologi Mara (UiTM)
40450, Shah Alam, Selangor, Malaysia.

ABSTRACT

Identification of performance indicators related to the status of the game (winning and losing) is needed for a tactical approach especially in improving the Malaysia Men's Rugby Seven team. This study aims to characterize team performance indicators based on the game status of Malaysia men's rugby sevens teams. A total of 16 matches (winning, n=8, losing, n=8) for the national team from various Asia-level tournaments from years 2018 to 2020 were collected using Sportscode performance analysis software and a notational analysis form. The performance indicators variables are extracted from the excel spreadsheet using the visual basic application of Microsoft excel before being exported to SPSS version 26 with the significant value is set at p<0.05. Based on the analysis, there is no significant difference in the winning performance and losing performance of the Malaysia Men's Rugby Sevens Team. The finding from this research can be utilized by the coaches and practitioners in improving the rugby sevens team performance.

Keywords: Performance Analysis, Performance Indicators, Notational Analysis, Men's rugby sevens.

INTRODUCTION

Rugby is a team sport that mainly involves passing and running when attacking and tackling the opponent from moving forward or converting a try. Using an oval shape of a ball, a rugby player can run with the ball to the passed over the opponent and perform a try (grounding the ball in the opponent's try area) to score points. In addition, rugby players can kick the ball up and under or ground the ball to gain more distance during the game.

In general, rugby is divided into two types: rugby union and rugby league. Rugby union is accepted almost in all the playing rugby countries. Rugby league starts to become popular, and more countries played this type of game. The main difference between rugby union and rugby league is the rules and regulations of the play. However, their game attributes are still the same such as tackles, mauls, and rucks against opponents. Both types of rugby games have their world cup tournament.

Contact team sports like rugby require tactical deliberation (Hughes and Jomes, 2005, Deutsch, Kearney, and Rehrer, 2007, Duthie, Fyne and Hooper, 2005) at competitive levels. Previous studies have focused specifically on tactical parameters (Higham et al, 2014) physiological parameters (Higham et al, 2014), physiological parameters (Coutts, Reaburn and Abt, 2003, Higham, Pyne Anson and Eddy, 2013), or combination components between tactical and physiological parameters (Duthie, Pyne and Hooper, 2003, Duthie, Pyne and Hooper, 2003, Higham, Pyne, Ansonand Eddy, 2013). This study focuses on the winning and losing performance of the Malaysia Rugby Sevens team based on the selected performance indicators.

METHOD

The observational research used notational analysis for data collection. This study will focus on the selected performance indicators of team performance at winning and losing performance in different major tournaments.

Performance indicators

This research focuses on 15 performance indicators adapted from Higham et. al. (2014). The performance indicators described how the team used the ball when in possession. All performance indicators were analyzed as absolute values such as values per min of possession time or per try scored as presented in table 1, pg 173.

Table 1: Performance indicators are based on the phase of play.

Performance Indicator	Definition
Minute of possession	Duration and measure of how long the analyzed team holds the ball in a match which is recorded in minutes.
Try scored	A try scored can be defined as when the ball is grounded or put over the opponent's goal line in the in-goal area.
Passes	A pass is an action that to transferring a ball to a teammate by throwing it backward and not forward.

Passes per min of possession	The total passes analyzed during a match are divided by the min of possession recorded during the game.
Pass per try scored	The total passes analyzed during a match are divided by the total try scored by the respective team.
Ruck	Ruck can occur if the ball seems to be on the ground and players are near one or more players from each side who are on their feet. In the ruck, players do not control the ball and must use their feet to push the ball or drive over it to move away from the nearside foot of the team, at which stage it can be collected.
Ruck per try scored	The total ruck analyzed during a match is divided by the total try scored by the respective team.
Mauls	Mauls can occur when a player carries a ball and contact the opponent and while both players are on their feet, another player came and joins the contact.
Ruck and mauls per in of possession	The total of ruck and mauls analyzed during a match is divided by the min of possession recorded during the game.
Kick	A kick can occur when a player uses his foot to make a contact and push the ball forward for his teammate to catch.
Kick per min of possession	The total of kicks analyzed during a match is divided by the min of possession recorded during the game.
Kick per pass	The total of kicks analyzed during a match is divided by the total passes recorded during the game by the respective team.
Ruck and mauls per kick	The total of rucks and mauls analyzed during a match is divided by the total of kicks analyzed during the match by the respective team.
Turnover conceded	A turnover conceded can be occurred when a team loses possession of the ball to their opponent.
Turnover conceded per min of possession	The total of turnover conceded analyzed during a match is divided by the min of possession recorded during the game.

Adapted from: Higham, et al. (2014).

Matches

The matches (n=16) for the Malaysia Rugby Sevens team from the various tournament namely Asia Series, and Southeast Asia Games (SEA Games) from 2018-2020 were downloaded from the Asia Rugby web page and Sea Games broadcast match. The game is further divided between winning performance and losing performances by Malaysia Rugby Sevens Team (winning; n=8, Losing; n=8).

MJSSR
MALAYSIAN JOURNAL OF SPORT SCIENCE AND RECREATION

DATA ANALYSIS

Descriptive

The researcher focuses on the analysis data between the winning and losing of the Malaysia Rugby sevens team. The demographic data is based on mean and standard deviation and: minimum and maximum. The detail is as table 2 below:

Table 2: Demographic data between winning and losing of the Malaysia Rugby sevens team.

Performance Indicator	Winning (n=8)		Losing (n=8)	
	Mean (SD)	Min - max	Mean (SD)	Min - max
Possession time (min)	3.34 (0.71)	2.27-4.24	3.14 (.78)	2.29- 4.12
Try scored	4.00 (1.51)	2.00 - 7.00	1.14 (1.07)	0.00-3.00
Passes	32.88 (13.25)	12.00- 48.00	23.57 (9.13)	15.00- 36.00
Passes per minute possession	9.63 (3.37)	5.13- 13.81	7.42 (1.76)	5.13- 13.81
Passes per try score	8.31 (2.73)	5.75- 13.00	13.29 (12.67)	0.00 – 35.00
Ruck	8.25 (3.66)	2.00 – 13.00	11.29 (3.73)	6.00- 16.00
Ruck per try score	2.21 (1.17)	1.00 – 4.00	6.00 (5.86)	0.00-16.00
Maul	0.00 (0.00)	0.00	0.00 (0.00)	0.00
Maul and ruck per minute possession	2.33 (0.98)	0.86- 3.70	3.63 (1.01)	1.92- 5.06
Kick	1.00 (1.30)	0.00- 3.00	0.71 (.49)	0.0- 1.00
Kick per minute possession	0.36 (0.56)	0.00-1.28	0.25 (0.17)	0.00-0.44
Kick per pass	0.05 (0.07)	0.00-0.17	0.39 (0.03)	0.00-0.07
Ruck and maul per kick	3.46 (5.63)	0.00- 13.00	7.71 (6.29)	0.00- 16.00
Turnover conceded	0.25 (0.71)	0.00- 2.00	1.00 (1.53)	0.00-4.00
Turnover conceded per Minute possession	0.11 (0.30)	0.00-0.84	0.38 (0.61)	0.00-1.56

There is no difference in possession time between the winning and losing performance of the Malaysia Men's Rugby Sevens national team. Malaysia possesses more time when they win the game (3.34±0.71) with a maximum possession time of 4.24 minutes compared to when they lost (3.14±0.78) with 4.12 minutes of possession.

Try scores shows a greater difference on the Malaysia team compared to winning and losing. Malaysia makes an average of 4.0±1.51 tries per winning match with a minimum try is 2 and a maximum try is seven times. Malaysia makes only 1.14 (0.78) tries when they lost with a minimum of no try per match and a maximum of three tries.

Passes have shown a greater difference between winning and losing matches. Malaysia National rugby sevens team completed 32.88 (13.25) time of passing with a maximum of 48 passes. While in losing matches, 23.57 (9.13) passing per losing match with a minimum of 15 passing and a maximum of 36 passing.

In winning the game, Malaysia made more passing with 9.63±3.37 times passing per minute of possession with a minimum of 5.13 times and a maximum of 13.81 passes. While in the losing match, 7.42±1.76 passing per minute of possession has been made. In terms of passes per try score, the Malaysia team makes less passing per try scored in the winning game

173

PENERBIT PRESS
UNIVERSITI TEKNOLOGI MARA

compared to the losing game.

Malaysia has made fewer passes per try scored in the winning game compared to the losing game where 8.31±2.73 passes per try scored in the winning game and 13.29±12.67) passes for a try scored in the losing game. The range of minimum is 5.75 passes and a maximum of 13 passes per try scored for a winning game. Whereby for losing match the range of passes per try is between 0 to 35 times.

Malaysia performs 8.25 (3.66) times in ruck for winning games compared to 11.29 (3.73) times for losing games. The minimum of two and maximum of 13 times of ruck in the winning game. Whereby, the range of minimum and maximum for a losing game is between six to 16 times of ruck.

The Malaysia national team performs fewer rucks per try scored in the winning game (2.21±1.17) compared to the losing game (6.0 ± 5.86). The range of minimum is one and maximum four times of rucking for the winning game. Whereby, a minimum of zero and a maximum of 16 times of ruck per try scored has been made in a losing match. No maul has been made by Malaysia in all studied matches either winning or losing.

Malaysia performs fewer rucks per minute of possession in the winning game by 2.33 (0.98) times per minute of possession with the maximum ruck formation being 3.70 times. Whereby, 3.63 (1.01) rucks perform in one minute of possession in the losing match with the range of a minimum of 1.92 to 5.06 times.

The Malaysia national team performs more kicks in winning games (1.00±1.30) with a maximum of three kicks per winning game. Whereby 0.71±0.49 kicks on average for a losing game with a maximum of one kick per losing game with a maximum of 1.28 kicks. On the other hand, 0.25±00.17 kick has been made per minute possession in a losing game with a maximum of 0.44 kick. A comparison of kicks per pass shows a higher value of kicking has been made in the losing game (0.39±0.0). whereby 0.05±0.07 kick has been made in the winning game.

The Malaysia national sevens team performs more ruck per kick in losing matches compared to winning matches. A mean of 7.71±6.29 ruck per kick has been made in losing matches with a maximum of 16 ruck per kick. Whereby, 3.46±5.63 ruck per kick has been made in winning matches with a maximum ruck per kick is 13.

Turnover conceded is more in the losing match, where the national team lost the position by 1.0±1.53) in the losing match with a maximum of four times. Malaysia lost their ball position fewer in winning matches with a mean of 0.25 (0.71) with the actual two times lost position per winning match. Turnover conceded per minute possession, winning matches shows lower value in winning (0.11±0.30) compared to losing match (0.38±0.61).

FINDINGS

The selection of statistical procedures to analyze the data for the research objective is based on the normality of the data. If the data is normal, ANOVA will be used together with Bonferroni. If the data is not normal, the researcher will choose non-parametric statistics, Kruskal Wallis

and Man-Whitney for data analysis. The detailed analysis as table 3 below:

Table 3: Differences in performance between winning and losing of Malaysia Rugby 7s team

[t]t=Independent T-test; [M]M=Mann Whitney U

Performance Indicators	Winning (n=8)		Loosing (n=8)		Sig.
	Mean (SD)	95% CI	Mean (SD)	95% CI	
Possession time (min)	3.34 (0.71)	2.74-3.92	3.14 (.78)	2.42-3.86	0.47[t]
Try scored	4.00 (1.51)	2.74-5.26	1.14 (1.07)	0.15-2.13	**0.00[t]**
Passes	32.88 (13.25)	21.80-43.95	23.57 (9.13)	15.13-32.01	0.09[t]
Passes per minute possession	9.63 (3.37)	6.81-12.44	7.42 (1.76)	5.79-9.04	0.11[t]
Passes per try score	8.31 (2.73)	6.02-10.59	13.29 (12.67)	1.57-25.00	0.49[t]
ruck	8.25 (3.66)	5.19-11.31	11.29 (3.73)	7.84-14.73	0.1[t]
Ruck per try score	2.21 (1.17)	1.23-3.19	6.00 (5.86)	0.58-11.42	0.19[t]
Maul	0.00 (0.00)	0.00	0.00	0.00	NIL
Maul and ruck per minute possession	2.33 (0.98)	1.51-3.15	3.63 (1.01)	2.70-4.56	0.19
Kick	1.00 (1.30)	-0.9-2.09	0.71 (.49)	0.26-1.17	0.88[M]
Kick per minute possession	0.36 (0.56)	-0.11-0.83	0.23 (0.17)	0.07 – 0.39	0.58[M]
Kick per pass	0.05 (0.07)	-0.01-0.11	0.39 (0.03)	0.01-0.07	0.73[t]
Ruck and maul per kick	3.46 (5.63)	-1.25-8.16	7.71 (6.29)	1.90-13.53	0.12[t]
Turnover conceded	0.25 (0.71)	-0.34-0.84	1.00 (1.53)	-0.41-2.41	0.13[t]
Turnover per min possession	0.11 (0.30)	-0.14-0.35	0.38 (0.61)	-0.18-0.95	0.15[t]

This study is to investigate the difference in selected performance indicators between winning and losing in Malaysia's national rugby sevens teams' performance. Based on the analysis, there is a significant difference in selected performance indicators between winning and losing match performance by the National sevens team.

Try scores show a significant difference (p=0.00) between the winning game and the losing game. Malaysia performs more tries (4.00±1) in winning matches with the range of tries made between 2.74 to 5.26 try. Whereby, 1.14±1.07 tries have been made in a losing match

PENERBIT PRESS
UNIVERSITI TEKNOLOGI MARA

with a minimum of 0.15 tries and a maximum of 2.13 tries per losing match.

There is no significant difference in others performance indicators; position time (p=0.47, winning 3.34±0.71, losing 3.14±0.78), passes (p=0.09, winning 32.88±13.25, losing 23.57±9.13), passes per min position (p=0.11, winning 9.63±3.37, losing 7.42±1.76), passes per try score (p=0.49, winning 8.31±2.73, losing 13.29±12.67), ruck (p=0.09, winning 8.25±3.66, losing 11.29±3.73), ruck per try score (p=0.19, winning 2.21±1.17, losing 6.0±5.86), Maul and ruck per minute possession (p=0.19, winning 2.33±0.98, losing 3.63±1.01), kick (p=0.88, winning 1.0±1.3, losing 0.71±0.49), kick per minute position (p=0.58, winning 0.36±0.56, losing 0.23±0.17), kick per pass (p=0.73, winning 0.05±0.07, losing 0.39±0.03), ruck and maul per kick (p=0.12, winning 3.46±5.63, losing 7.71±6.29), turnover conceded (p=0.13, winning 0.25±0.71, losing 1.0±1.53), and turnover per minute possession (p=0.15, winning 0.11±0.30, losing 0.38±0.61).

CONCLUSION

The insight from this research can be as a guide to current national coaches in the planning of training programs. Based on the finding, there is no significant difference between the winning performance and losing performance of the Malaysia Rugby Sevens Rugby Team. The previous finding stated there must be a difference between winning performance and losing performance (Moolman et al. 2021) in terms of tactical deliberation. Thus, it is important to plan a specific tactical plan for the national rugby sevens team which is able to discriminate between winning and losing performance.

Authors' Contribution:
Norasrudin Sulaiman: the main researcher contributes to the whole process of the research.
Associate Professor Dr Hashbullah Ismail: contribute to the study design, method, statistic,and discussion.
Associate Professor Dr Mohamed Firhad Raja Azidin : the idea of the research
Associate Professor Dr Hosni Hasan: the idea of the research

REFERENCE

Argus CK, Gill ND, Keogh JWL, Hopkins WG (2011) Assessing lower-body peak power in elite rugby-union players. The Journal of Strength & Conditioning Research 25:1616–1621

Ball, S., Halaki, M., & Orr, R. (2019). Movement demands of rugby sevens in men and women: a systematic review and meta-analysis. *The Journal of Strength & Conditioning Research*, *33*(12), 3475-3490.

Bangsbo, J. (1994a). Energy demands in competitive soccer. *Journal of Sports Science,* 12, S5-S12.

Bangsbo, J. (1997) The physiology of intermittent activity in football. In: *Science and Football III*. Eds: Reilly, T., Bangsbo, J. and Hughes, M. London, E & FN Spon. 43-53.

Barbero-Alvarez, J. C., Coutts A., J., Barbero-Alvarez, V.,Granda-Vera, J. and Castagna C. (2009). The validity and reliability of a global positioning satellite system deviceto assess speed and repeated sprint ability (RSA) in athletes. *Journal of Science and Medicine in Sport*. 10.1016.

Barkell, F. J., O'connor, D., & Cotton, G. W. (2016). Characteristics of winning men's and women's sevens rugby teams throughout the knockout Cup stages of international tournaments. *International Journal of Performance Analysis in Sport*, *16*(2), 633-651.

Barkell, J. F., Pope, A., O'Connor, D., & Cotton, W. G. (2017). Predictive game patterns in World Rugby Sevens Series games using Markov chain analysis. *International Journal of Performance Analysis in Sport*, *17*(4), 630-641.

Bloomfield, J., Polman, R., & O'Donoghue, P. (2007). Physical demands of different positions in FA Premier League soccer. *Journal of Sports Science and Medicine*, 6, 63-70.

Bremner, S., Robinson, G., & Williams, M. D. (2013). A retrospective evaluation of team performance indicators in rugby union. *International Journal of Performance Analysis in Sport*, *13*(2), 461-473.

Cahill N, Lamb K, Worsfold P, et al. The movement characteristics of English Premiership rugby union players. J Sport Sci. 2013;31(3):229–37.

Carreras, D., Kraak, W., Planas, A., Martín, I., & Vaz, L. (2013). Analysis of International Rugby Sevens matches during tournaments. *International Journal of Performance Analysis in Sport*, *13*(3), 833-847.

Cunniffe B., Proctor W., Baker J., S., and Davies B. (2009) An evaluation of the physiological demands of elite rugby union using global positioning system tracking software. *Journal of Strenght and Conditioning*. 23(4)/1195-1203.

Colomer, C. M., Pyne, D. B., Mooney, M., McKune, A., & Serpell, B. G. (2020). Performance analysis in rugby Union: a critical systematic review. *Sports Medicine-Open*, *6*(1), 1-15.

Couderc, A., Gabbett, T. J., Piscione, J., Robineau, J., Peeters, A., Igarza, G., & Lacome, M. (2019). Repeated high-intensity effort activity in international male rugby sevens. *J Strength Cond Res*, *22*, 22.

Duthie, G., Pyne, D., & Hooper, S, (2003). Applied physiology and game analysis of rugby union. *Sport Medicine*, 33(13), 339-342.

MJSSR
MALAYSIAN JOURNAL OF SPORT SCIENCE AND RECREATION

Elloumi, M., Makni, E., Moalla, W., Bouaziz, T., Tabka, Z., Lac, G., & Chamari, K. (2012). Monitoring training load and fatigue in rugby seven players. *Asian journal of sports medicine*, *3*(3), 175.

Grant, S., Corbett, K., Amjadt, A. M., Wilson. J. & Aitchson, T. (1995). A comparison of methods of predicting maximum oxygen uptake. *British Journal of Sports Medicine, 29*(3), 147-152.

Griffin, J. A., McLellan, C. P., Presland, J., Woods, C. T., & Keogh, J. W. (2017). Effect of defensive pressure on international women's rugby sevens attacking skills frequency and execution. *International Journal of Sports Science & Coaching*, *12*(6), 716-724.

Haseler LJ, Hogan MC, Richardson RS (1999) Skeletal muscle phosphocreatine recovery in exercise-trained humans is dependent on O2 availability. Journal of applied physiology 86:2013–2018.

Henderson, M. J., Fransen, J., McGrath, J. J., Harries, S. K., Poulos, N., & Coutts, A. J. (2019). Individual factors affecting rugby sevens match performance. *International journal of sports physiology and performance*, *14*(5), 620-626.

Hendricks, S., van Niekerk, T., Sin, D. W., Lambert, M., den Hollander, S., Brown, J., ... & Jones, B. (2018). Technical determinants of tackle and ruck performance in international rugby union. *Journal of Sports Sciences*, *36*(5), 522-528.

Hendricks, S., Till, K., Den Hollander, S., Savage, T. N., Roberts, S. P., Tierney, G., ... & Jones, B. (2020). Consensus on a video analysis framework of descriptors and definitions by the Rugby Union Video Analysis Consensus group. *British journal of sports medicine*, *54*(10), 566-572.

Higham, D. G., Pyne, D. B., Anson. J. M., & Eddy (2012). Movement pattern in rugby sevens: Effect of tournament level, fatigue and substitute players. *Journal of Science and Medicine in sport.* 15, 277-282.

Higham, D.G., Hopkins, W. G., Pyne, D. B. & Anson, J. M. (2014). Performance Indicators Related to Points Scoring and Winning in International Rugby Sevens. Journal of Sports Science and Medicine, 13, 358-364.

Higham, G. D., Hopkins, G. W., Pyne, B. D., & Anson, M. J. (2014). Patterns of play associated with success in international rugby sevens. *International Journal of Performance Analysis in Sport*, *14*(1), 111-122.

Higham DG, Pyne DB, Anson JM, Eddy A (2013) Physiological, anthropometric, and performance characteristics of rugby sevens players. International Journal of Sports Physiology and Performance 8: 19-27.

Hohenauer, E., Rucker, A. M. L., Clarys, P., Küng, U., Stoop, R., & Clijsen, R. (2017). Anthropometric and performance characteristics of the German rugby union 7s team. *The Journal of sports medicine and physical fitness*.

PENERBIT PRESS
UNIVERSITI TEKNOLOGI MARA

Hugget, D. L., Connelly, D. M. & Overend T.J. (2005). Maximal aerobic capacity testing of older adults: a critical review. *Journal of Gerontology. Medical Sciences*, *60A*(1), 57-66.

Hughes, M., Cooper, S.M. and Nevill, A., Analysis of Notation Data: Reliability, in: Hughes, M. and Franks, I.M., eds., Notational Analysis of Sport, 2nd edn., Routledge, London, 2004, 189-204.

Hughes MT, Hughes MD, Williams J, James N, Vučković G, Locke D (2012) Performance indicators in rugby union. Journal of Human Sport and Exercise 7:383–401.

Ismail, A. N., Azmi, S. H., & Sulaiman, N. (2016, November). The Differences in Selected Performance Indicators Among Top Four and Bottom Four Teams in MASUM Rugby Sevens Tournament. In *International Colloquium on Sport Science, Exercise, Engineering and Technology* (pp. 93-99). Springer, Singapore.

James N, Mellalieu SD, Jones NMP (2005) The development of position- specific performance indicators in professional rugby union. Journal of Sports Sciences 23:63–72

Jones, James, &. Mellalieu (2008) An objective method for depicting team performance in elite professional rugby union. Journal of Sports Sciences 26:691–700.

Kraak, W. J., & Welman, K. E. (2014). Ruck-play as performance indicator during the 2010 Six Nations Championship. *International Journal of Sports Science & Coaching*, *9*(3), 525-537.

Lacome, M., Piscione, J., Hager, J. P., & Carling, C. (2017). Fluctuations in running and skill-related performance in elite rugby union match-play. *European journal of sport science*, *17*(2), 132-143.

Lim, E., Lay, B., Dawson, B., Wallman, K., & Anderson, S. (2011). Predicting try scoring in super 14 rugby union–the development of a superior attacking team scoring system. *International Journal of Performance Analysis in Sport*, *11*(3), 464-475.

Lord, F., Pyne, D. B., Welvaert, M., & Mara, J. K. (2020). Methods of performance analysis in team invasion sports: A systematic review. *Journal of Sports Sciences*, *38*(20), 2338-2349.

Loturco, I., Pereira, L. A., Moraes, J. E., Kitamura, K., Cal Abad, C. C., Kobal, R., & Nakamura, F. Y. (2017). Jump-squat and half-squat exercises: Selective influences on speed-power performance of elite rugby sevens players. *PloS one*, *12*(1), e0170627.

Lythe, J. (2006). *The physical demands of men's hockey: A summary of GPS findings*. Auckland: New Zealand Academy of Sport North Island.\

Nicholas, C. W., Frank E. Nuttall, F. E. & Williams, C. (2000). The Loughborough Intermittent Shuttle Test: A Field test that simulates the activity pattern of soccer. *Journal of Sports Sciences*, 18, 97-104.

Martens, R. (2012). Successful Coaching, 4th ed. Human Kinetics

Moolman, B. W., van den Berg, P. H., & Broodryk, R. (2021). Performance indicators that discriminate between winning and losing teams in male university rugby sevens teams. *International Journal of Performance Analysis in Sport*, *21*(2), 242-249.

Murray, A. M., & Varley, M. C. (2015). Activity Profile of International Rugby Sevens: Effect of Score Line, Opponent, and Substitutes. *International Journal of Sports Physiology & Performance*, *10*(6).

Norasrudin, S., Aizat, A., Rahmat, A. & Shariman, I. (2013). Differences in Game Statistics between winning and losing team in rugby world cup 2012. In *Humanities, Science and Engineering (CHUSER), 2013 IEEE Colloquium on* (pp. 454-457). IEEE.

Novak, Impellizzeri, Garvey & Fransen, J. (2021). Implementation of path analysis and piecewise structural equation modelling to improve the interpretation of key performance indicators in team sports: An example in professional rugby union. *Journal of sports sciences*, *39*(22), 2509-2516.

Quarrie, K. L., & Hopkins, W. G. (2015). Evaluation of goal kicking performance in international rugby union matches. *Journal of Science and Medicine in Sport*, *18*(2), 195-198.

Reilly, T. and Thomas, V. (1976) A motion analysis of work-rate indifferent positional roles in professional football match-play. *Journal of Human Movement Studies* 2**,** 87-89.

Rienzi, E., Reilly, T. & Malkin, C. (1999). Investigation of anthropometric and work-rate profiles of Rugby Sevens Players. *Journal of Sport Medicine and Physical Fitness*, 39(2), 160-164.

Ross, A., Gill, N., & Cronin, J. (2014). Match analysis and player characteristics in rugby sevens. *Sports medicine*, *44*(3), 357-367.

Ross, A., Gill, N., & Cronin, J. (2015). The match demands of international rugby sevens. *Journal of sports sciences*, *33*(10), 1035-1041.

Ross, A., Gill, N., Cronin, J., & Malcata, R. (2016). Defensive and attacking performance indicators in rugby sevens. *International Journal of Performance Analysis in Sport*, *16*(2), 569-580.

Schoeman, R., & Schall, R. (2019). Team performance indicators as predictors of final log position and team success in Aviva Premiership, Guinness Pro 14, French Top 14 and Super Rugby. *International Journal of Performance Analysis in Sport*, *19*(5), 763-777.

Schuster, J., Howells, D., Robineau, J., Couderc, A., Natera, A., Lumley, N., ... & Winkelman, N. (2018). Physical-preparation recommendations for elite rugby sevens performance. *International Journal of Sports Physiology and Performance*, *13*(3), 255-267.

Sella, F. S., McMaster, D. T., Beaven, C. M., Gill, N. D., & Hébert-Losier, K. (2019). Match demands, anthropometric characteristics, and physical qualities of female rugby sevens athletes: a systematic review. *The Journal of Strength & Conditioning Research*, *33*(12), 3463-3474.

Simon, E. & Huges, M. (2003). Patterns of play of international rugby union teams before and after the introduction of professional status. *International Journal of Performance Analysis in Sport,* 3 (2).

Smart D, Hopkins WG, Quarrie KL & Gill, N (2014). The relationship between physical fitness and game behaviours in rugby union players. European Journal of Sport Science 14:8-17.

Suarez-Arrones LJ, Nuñez FJ, Portillo J, Mendez-Villanueva A (2012) Running demands and heart rate responses in men Rugby Sevens. Journal of Strength and Conditioning Research 26:3155–3159.

Suarez-Arrones, L., Arenas, C., López, G., Requena, B., Terrill, O., & Mendez-Villanueva, A. (2014). Positional differences in match running performance and physical collisions in men rugby sevens. *International Journal of Sports Physiology and Performance*, *9*(2), 316-323.

Suarez-Arrones, L., Núñez, J., de Villareal, E. S., Gálvez, J., Suarez-Sanchez, G., & Munguía-Izquierdo, D. (2016). Repeated-high-intensity-running activity and internal training load of elite rugby seven players during international matches: A comparison between halves. *International Journal of Sports Physiology and Performance*, *11*(4), 495-499.

Tee, J. C., Lambert, M. I., & Coopoo, Y. (2017). Impact of fatigue on positional movements during professional rugby union match play. *International journal of sports physiology and performance*, *12*(4), 554-561.

Kes, D., Nicholas, C., Lamb, K. & Twist, C. (2013). An evaluation of the external validity and reliability of a rugby league match simulation protocol. *Journal of Sport Science*, 31(1), 48-57.

Stoggi, T. L & Sperlich, B. (2016). The training intensity distribution among well-trained and elite endurance athletes. Frontiers in Physiology, vol. 6, 1-14.

Takahashi I, Umeda T, Mashiko T, Chinda D, Oyama T, Sugawara K, Nakaji S. (2006) Effects of rugby seven matches on human neutrophil-related non-specific immunity. British Journal of Sports Medicine 41:13–18.

Tomlin DL, Wenger HA (2001) The relationship between aerobic fitness and recovery from high intensity intermittent exercise. Sports Medicine 31:1–11.

Watson, N., Durbach, I., Hendricks, S., & Stewart, T. (2017). On the validity of team performance indicators in rugby union. *International Journal of performance analysis in sport*, *17*(4), 609-621.

Wheeler, K. W., Askew, C. D., & Sayers, M. G. (2010). Effective attacking strategies in rugby union. *European Journal of Sport Science*, *10*(4), 237-242.

Williams, J. J. (2012). Operational definitions in performance Analysis and the needfor consensus. *International Journal of Performance Analysis in Sport*, *12*(1), 52-63.

Wright, C., Atkins, S., & Jones, B. (2012). An analysis of elite coaches' engagement with performance analysis services (match, notational analysis and technique analysis). *International Journal of Performance Analysis in Sport*, *12*(2), 436-451.

Van Rooyen MK, Lombard C, Noakes TD (2008) Playing demands of sevens rugby during the 2005 Rugby World Cup Sevens Tournament. International Journal of Performance Analysis in Sport 8:114–123.

Vaz, L., Van Rooyen, M., & Sampaio, J. (2010). Rugby game-related statistics that discriminate between winning and losing teams in IRB and Super twelve close games. *Journal of sports science & medicine*, *9*(1), 51.

Vaz, L., Carreras, D., & Kraak, W. (2012). Analysis of the effect of alternating home and away field advantage during the Six Nations Rugby Championship. *International Journal of Performance Analysis in Sport*, *12*(3), 593-607.

Vaz, L., Hendricks, S., & Kraak, W. (2019). Statistical review and match analysis of Rugby World Cups finals. *Journal of human kinetics*, *66*(1), 247-256.

Villarejo, D., Ortega, E., Gómez, M. Á., & Palao, J. M. (2014). Design, validation, and reliability of an observational instrument for ball possessions in rugby union. *International Journal of Performance Analysis in Sport*, *14*(3), 955-967.

Villarejo, D., Palao, J. M., Ortega, E., Gomez-Ruano, M. Á., & Kraak, W. (2015). Match-related statistics discriminating between playing positions during the men's 2011 Rugby World Cup. *International Journal of Performance Analysis in Sport*, *15*(1), 97-111.