

Court Tennis Referee Decision Making: How does Mastery of Game Rules, Stress Management, and Concentration Affect it?

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Received April 28, 2023; Revised July 19, 2023; Accepted August 15, 2023

Cite This Paper in the Following Citation Styles

(a): [1] Damrah, Zikri Muthahari, Pitnawati, Deby Tri Mario, Yuni Astuti, Zulbahri, Ilham, "Court Tennis Referee Decision Making: How does Mastery of Game Rules, Stress Management, and Concentration Affect it?," *International Journal of Human Movement and Sports Sciences*, Vol. 11, No. 5, pp. 1020 - 1027, 2023. DOI: 10.13189/saj.2023.110510.

(b): Damrah, Zikri Muthahari, Pitnawati, Deby Tri Mario, Yuni Astuti, Zulbahri, Ilham (2023). *Court Tennis Referee Decision Making: How does Mastery of Game Rules, Stress Management, and Concentration Affect it?* *International Journal of Human Movement and Sports Sciences*, 11(5), 1020 - 1027. DOI: 10.13189/saj.2023.110510.

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Abstract Various previous studies have examined the important role of referees in leading sports matches. However, there are very limited studies examining how mastery of game rules, stress management, and concentration affect the decision making of court tennis referees. Therefore, the purpose of this study is to analyze and evaluate mastery of game rules, stress management, and concentration on court tennis referee decision making. A total of 40 court tennis referees in West Sumatra, Indonesia participated in this study. Participants are referees who are registered as members of the Indonesian Lawn Tennis Association in West Sumatra, consisting of males ($n=33$) and females ($n=7$). Data were collected through questionnaires and concentration exercise grid tests for concentration. Then the data were analyzed with correlation and regression. The results showed that mastery of game rules, stress management, and concentration had a significant relationship with tennis referee decision making ($P<0.05$), either partially or simultaneously. The partial influence was 64.80%, 52.40%, and 63.90%, while simultaneously was 78.30%. Of these three factors, mastery of game rules is an important factor influencing the decision making of tennis referees (64.80%), without neglecting concentration (63.90%), and stress management (52.40%). In conclusion, mastery of game rules, stress management, and concentration are important factors that

need to be possessed by referees in leading matches. This research is expected to be useful for tennis referees as an evaluation of the importance of these factors in leading a match, so that the decisions taken are truly appropriate and do not harm any of the competing parties. Future research is needed for a larger sample size, and to include other factors that influence court tennis referee decision making.

Keywords Court Tennis, Referee Decisions, Game Rules, Stress Management, Concentration, Competition

1. Introduction

Referees are an important part of competitive sports, because they are tasked with maintaining and carrying out the rules of the game [1]. This is also due to their impact on the behavior of the players and the results of the game, so they have responsibility for their performance in accordance with the applicable rules [2]. Referee decision-making in leading a match is not an easy thing. This is a challenge for the referee that involves the use of context [3]. Refereeing decision-making is also a complex one, taking into account the effects of context and given the uncertainty of their decisions in a variety of dubious situations [4, 5].

This decision includes technical, offensive, and defensive fouls [6, 7].

Their decision-making must be at a high level [8]. A referee may apply special rules during a sports match, so they must have the physical fitness to follow the dynamics of the match [9]. This is very important for someone to perform optimally [10-13], especially for the referee who led the match. The important role of the referee in sports, the referee needs to have several competencies in leading the game (match), such as personality and game management, physical fitness, knowledge and application of rules, contextual assessment, and psychological [8].

Several previous studies have examined refereeing in sports, such as individual differences in the selection of referees [14], physical abilities [15-17] and psychological [17-20], a challenge for referees in decision making [3], cardiac fitness and body composition of referees [21], communication and interaction [22], psychological and physiological aspects related to referee decision making [23], and the introduction of technology to become a sports referee [24-26]. To our knowledge, there are very limited studies examining mastery of game rules, stress management, and concentration on court tennis referee decision making.

Therefore, the purpose of this study is to analyze and evaluate mastery of game rules, stress management, and concentration on court tennis referee decision making. This research is very important because the study of sports referees has always received less attention than athletes and coaches, apart from their impact on determining decisions on athletes and the outcome of competitions [8].

2. Materials and Methods

2.1. Study Design

This research is an associative quantitative study that aims to prove the relationship between mastery of game rules (X_1), stress management (X_2), and concentration (X_3) as independent variables, and tennis referee decision making (Y) as the dependent variable.

2.2. Participant

Table 1. Characteristics of participants

Characteristics	Males ($n=33$)	Females ($n=7$)
Age	28.58 \pm 9.14	24.86 \pm 4.53
Weight	65.82 \pm 4.25	65.29 \pm 4.61
Height	169.82 \pm 3.40	167.00 \pm 2.16
BMI	22.81 \pm 1.15	23.41 \pm 1.55

A total of 40 court tennis referees participated in this study (Table 1). Participants are referees who are registered as members of the "Indonesian Lawn Tennis Association" in West Sumatra, and served in the National University of

Padang Chancellor's Cup Tournament Championship and Managing Director of Bank Nagari on 2-8 April 2021. This research was conducted after obtaining approval from the Faculty of Sports Science, Universitas Negeri Padang, Indonesia (No. 3002/UN35.3/LT/2021).

2.3. Procedures and Instruments

2.3.1. Mastery of Game Rules

The ability of the referee to master the rules of the game was obtained from a questionnaire based on the International Tennis Federation [27], which was developed and discussed with experts. The questionnaire items used were 20 valid statements out of 23 statements, with a reliability level of 0.994 (very high). Alternative answers include: very mastered (score 5), mastered (score 4), moderately mastered (score 3), less mastered (score 2), and not mastered (score 1). These instruments are presented in Table 2, and their classification is presented in Table 3.

2.3.2. Stress Management

Stress management was obtained from a questionnaire based on the stress management competency indicator tool [28], which was developed and discussed with experts. The questionnaire items used were 34 valid statements out of 39 statements, with a reliability level of 0.968 (very high). Alternative answers include: very often (score 5), often (score 4), sometimes (score 3), rarely (score 2), and never (score 1). These instruments are presented in Table 2, and their classification is presented in Table 3.

2.3.3. Concentration

The concentration was obtained from the grid concentration exercise test from Harris & Harris [29]. This instrument consists of numbers arranged randomly from 00 to 99 (Figure 1). The implementation of this test is: (a) participants are asked to connect these numbers with a line sequentially, (b) starting from number 00 then 01, 02, 03, 04, and so on, (c) participants are given one minute, (d) participant's score is the total number that can be linked sequentially, (e) participants with a high level of concentration are indicated by their ability to mark or connect numbers as much as 20 to 30 and above. The classification for this assessment is presented in Table 3.

18	70	49	86	80	77	39	65	96	32
24	09	50	83	64	08	38	30	36	45
33	52	04	60	92	61	31	57	28	29
34	48	62	82	42	89	47	35	17	10
40	20	66	41	15	26	75	99	68	06
53	79	05	22	74	07	58	14	02	91
56	69	94	72	84	43	93	11	67	44
63	03	12	73	19	25	21	23	37	16
81	88	46	01	95	98	71	87	00	76
54	27	51	97	78	13	90	85	55	59

Figure 1. Sheet for concentration test

2.3.4. Court Tennis Referee Decision Making

Table 2. Instrument for questionnaires

Variable	Dimensions	Indicator	Items*
Mastery of game rules	Fixture	Racket	1-2
	Service	Servers and receivers	3-4
		Faulty service	5-6
		Service order	7-9
	Coaching	Instruction	10-11
	Match official	Match regulations	12-13
	Hindrance	Disturbance	14-16
	Ball	Ball in play	17-18
	The let	Replayed game	19-20
Stress management	Integrity	Respect and responsibility	1-4
		Manage emotions	5-7
		Problem solving	8-10
	Participation	Communication	11-13
		Proactive	15-17
	Manage yourself in a team	Personal	18-20
		Social	21-23
		Empathy	24-27
Manage difficult situations	Conflict	28-30	
	Readiness	31-34	
Tennis referee decision making	Experience	Maturity	1-2
		Skill	3-5
	Crowd	Viewer	6-7
		Sound and crowd	8-9
	Decision accuracy	Be careful	10-11
		Thorough	12-13
	Environment	Match atmosphere	14-15
		Official	16-17
	Professionalism	Competent	18-19
		Honest	20-21
		Fair	22-23
	Self control	Discipline	24-25
Relax		26-27	
Afraid		28-29	

*The total items for variable mastery of game rules was 20 statements, stress management was 34 statements, and tennis referee decision making was 29 statements.

The referee's decisions were obtained from a questionnaire that was developed and discussed with the experts. The questionnaire items used were 29 valid

statements out of 33 statements, with a reliability level of 0.928 (very high). Alternative answers include: very often (score 5), often (score 4), sometimes (score 3), rarely (score 2), and never (score 1). These instruments are presented in Table 2, and their classification is presented in Table 3.

Table 3. Concentration classification and questionnaire

Concentration*		Questionnaire*	
Score	Classification	Percentage	Classification
21-up	Very good	81-100	Very good
16-20	Good	61-80	Good
11-15	Enough	41-60	Enough
6-10	Less	21-40	Less
5-down	Very less	0-20	Very less

*Concentration- the value of participants in connecting numbers sequentially within 1 minute; Questionnaire- the percentage obtained from the achievement score/ideal score*100.

2.4. Data Analysis

Descriptive analysis is used to see the characteristics of the data for each variable (Table 3). Normality and linearity tests were analyzed using the Kolmogorov-Smirnov test and the regression significance test. Then, correlation and regression analysis were used to prove the relationship (independent and dependent variables). All of these stages were analyzed using the IBM SPSS statistical program.

3. Results

The results of the descriptive analysis of each variable obtained an average of 81.35 for mastery of game rules (very good), 77.97 for stress management (good), 13.90 for concentration (enough), and 83.12 for tennis referee decision making (very good). These results are presented in Table 4 and Figure 2.

Testing the requirements analysis as presented in Table 5, shows that the data for each variable is normally distributed and homogeneous ($P>0.05$), and Table 6 shows that the variables of mastery of game rules, stress management, and concentration have a significant relationship to decision making tennis referee ($P<0.05$). The correlation between mastery of game rules with tennis referee decision making was 0.805 and influence was 64.80%, stress management with tennis referee decision making was 0.724 and influence was 52.40%, concentration with tennis referee decision making was 0.799 and influence was 63.90%, and the overall correlation was 0.885 and the influence was 78.30%. Then, the partial variable regression model was $Y = 9.749 + 0.805X_1$, $Y = 13.80 + 0.724X_2$, $Y = 10.03 + 0.799X_3$, and simultaneous was $Y = 0.017 + 0.421X_1 + 0.245X_2 + 0.334X_3$ (Figure 3).

Table 4. Descriptive statistics

Mastery of game rules	Frequency	Percentage	Classification
81-100	22	55.00	Very good
61-80	18	45.00	Good
41-60	0	0.00	Enough
21-40	0	0.00	Less
0-20	0	0.00	Very less
Max	88,00		
Min	75,00		
M \pm SD	81.35 \pm 3.32 (very good)		
Stress management	Frequency	Percentage	Classification
81-100	13	32.50	Very good
61-80	27	67.50	Good
41-60	0	0.00	Enough
21-40	0	0.00	Less
0-20	0	0.00	Very less
Max	85.29		
Min	70.59		
M \pm SD	77.97 \pm 4.24 (good)		
Concentration	Frequency	Percentage	Classification
21-up	0	0.00	Very good
16-20	14	35.00	Good
11-15	19	47.50	Enough
6-10	7	17.50	Less
5-down	0	0.00	Very less
Max	20.00		
Min	8.00		
M \pm SD	13.90 \pm 3.04 (enough)		
Tennis referee decision making	Frequency	Percentage	Classification
81-100	26	65.00	Very good
61-80	14	35.00	Good
41-60	0	0.00	Enough
21-40	0	0.00	Less
0-20	0	0.00	Very less
Max	92.41		
Min	75.86		
M \pm SD	83.12 \pm 4.69 (very good)		

Table 5. Testing requirements analysis

Data	Normality (P*)	Linearity (P*)
Y-X ₁	0.197	0.771
Y-X ₂	0.178	0.205
Y-X ₃	0.112	0.098

*Data is normally distributed and linear ($P > 0.05$).

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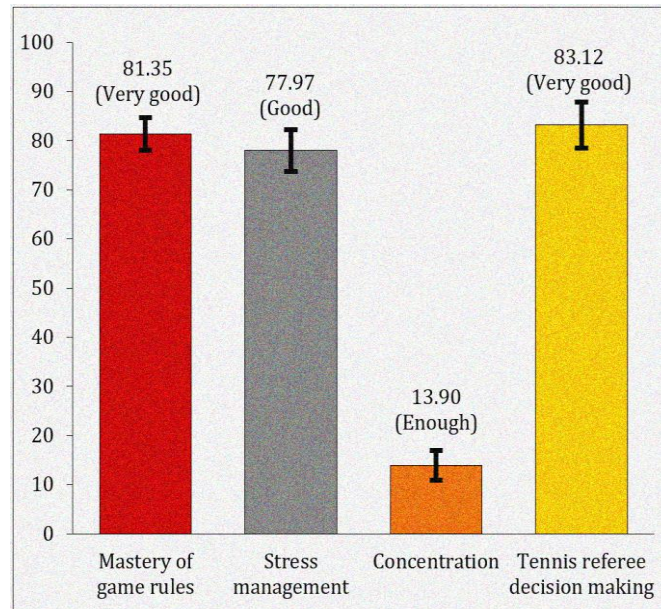
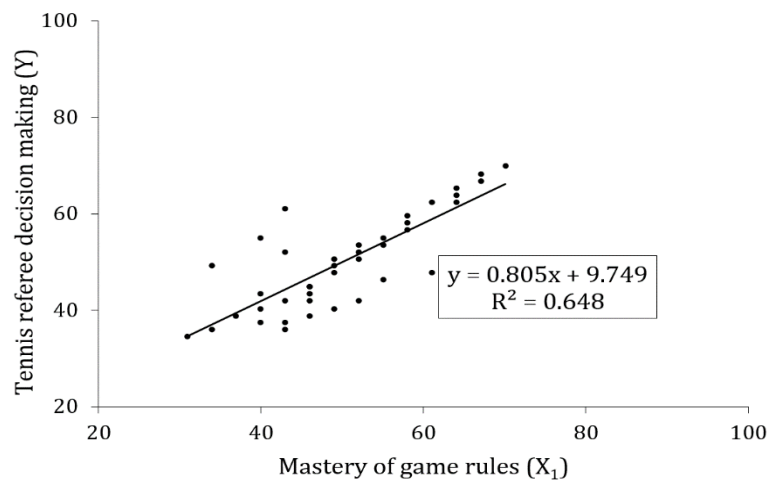


Figure 2. Classification for each variable

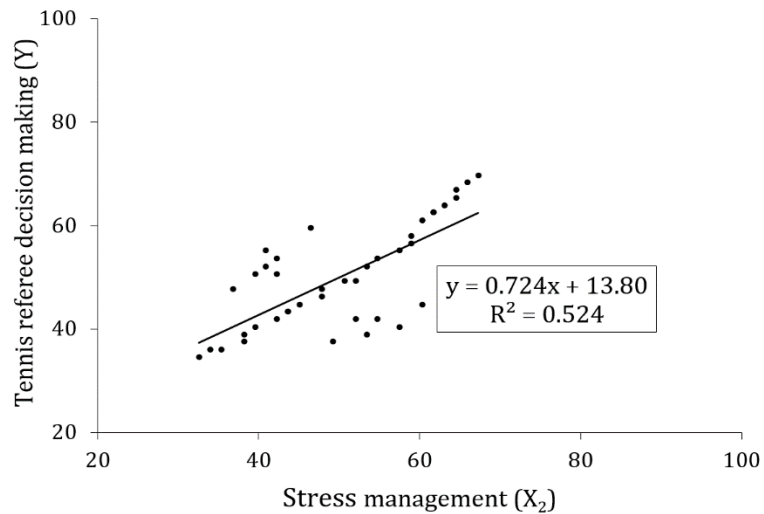
Table 6. Hypothesis test

Data	B	R	R ²	F	P*	t	P*
Y-X ₁	9.749	0.805	0.648	68.57	0.000	3.707	0.001
	0.805						
Y-X ₂	13.80	0.724	0.524	43.18	0.000	2.262	0.030
	0.724						
Y-X ₃	10.03	0.799	0.639	56.76	0.000	2.700	0.010
	0.799						
Simultaneous (X ₁ , X ₂ , X ₃ dan Y)	0.017	0.885	0.783	43.26	0.000		
	0.421						
	0.245						
	0.334						

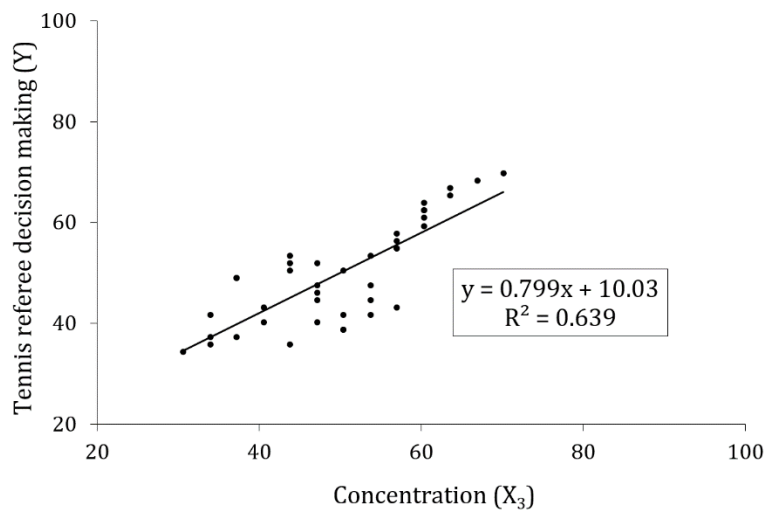
*Regression and the relationship are significant ($P < 0.05$), "B" is the regression model, "R" is the magnitude of the relationship, "R²" is the magnitude of the effect, "F" is the significance of the regression, and "t" is the significance of the relationship.



(a)



(b)



(c)

Figure 3. Linearity curves: (a) Y- X_1 (b) Y- X_2 , dan (c) Y- X_3

4. Discussion

Based on these findings, the variables of mastery of game rules, stress management, and concentration have a significant relationship to tennis referee decision making ($P < 0.05$), either partially or simultaneously. Thus, mastery of game rules, stress management, and concentration are important factors that need to be possessed by referees in leading matches. The results of this study are in accordance with the opinion of Reid and Dallaire., who reported that the referee needs to have several competencies in leading the game (match), such as mastery of game rules, having physical, and psychological conditions (eg confidence, consistency, firmness in attitude and action). The confidence of a referee in leading the game is influenced by mastery of the game, knowledge (referee education), support from other important people, physical readiness, environment, and anxiety [30]. Previous studies have

reported that referee beliefs can have an influence on referee performance, stress, athlete satisfaction, and peer referee satisfaction [17]. In addition to having knowledge of the game, the referee's performance is also influenced by physical and mental abilities [8].

Previous studies reported that psychological factors such as self-confidence, concentration and emotional control play an important role in determining the behavior of referees and their decisions [31, 32]. Another study also reported that physiological and psychological ones are factors that affect the performance of the referee [33]. The relationship between refereeing decision making and physical exertion is of particular concern [34]. Their decisions are perceptual-cognitive processes that may be disrupted through high physical stress [35]. High physical stress can lead to excessive enrichment of norepinephrine, resulting in a decrease in neural activity in the prefrontal cortex and ultimately a decrease in attention and executive

function [35, 36]. This means that physical loads can interfere with the attention control of referees, thereby impacting their decision making [35]. Technological support for sports performance can be used as an alternative to overcome this [37, 38].

Based on these findings, mastery of game rules, stress management, and concentration have a significant relationship to tennis referee decision making. However, we realize there are some limitations in this study. This research involved 40 tennis referees who were registered with the “Indonesian Lawn Tennis Association” in West Sumatra, so a larger sample size was needed to support this research. Then, the variables used are mastery of game rules, stress management, and concentration, so it is necessary to involve other variables that influence the decision making of court tennis referees.

5. Conclusions

The conclusion from the results of this study is that mastery of game rules, stress management, and concentration are important factors that need to be owned by a tennis referee in leading a match. This is evidenced by the partial effect of 64.80%, 52.40% and 63.90%, while simultaneously 78.30%. Of these three factors, mastery of game rules is an important factor influencing the decision making of tennis referees (64.80%), without neglecting concentration (63.90%), and stress management (52.40%). The results of this study are expected to be useful for tennis referees as an evaluation of the importance of these factors in leading a match, so that the decisions taken are truly appropriate and do not harm any of the competing parties. Future research is needed for a larger sample size, and to include other factors that influence court tennis referee decision making.

Acknowledgements

The authors would like to thank all those who assisted in this research, the tennis court referees in West Sumatra, Indonesia, and the lecturers at the Faculty of Sports Science, Universitas Negeri Padang.

Conflict of Interest

The authors declare no potential conflicts of interest.

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