

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

THE DEVELOPMENT OF A RELIABLE AND VALID NETBALL INTERMITTENT ACTIVITY TEST

A thesis presented in partial fulfilment of the requirements for
the Degree of
Master of Science
in
Sport and Exercise Science

at Massey University, Auckland,
New Zealand

HELEN JOANNE RYAN

2009

ABSTRACT

The purpose of the present investigation was to identify the exercise intensity of netball match play in order to assist in the development of a Netball Intermittent Activity Test (NIAT). A further aim was to assess the criterion validity and the test-retest reliability of the NIAT. Eleven female netball players (21.4 ± 3.1 years, 1.73 ± 0.06 m, 69.3 ± 5.3 kg and 48.4 ± 4.9 ml·kg⁻¹·min⁻¹ mean $\pm$ SD, age, height, body mass and $\dot{V}O_{2\max}$, respectively) volunteered to participate in the study. Heart rate data was recorded for all participants from at least two full 60 minute games during Premier Club competition. Individual maximum heart rate values were acquired for all subjects from the performance of the Multistage Fitness Test, and used to transform heart rate recordings into percent maximum heart rate (%HR_{max}). Patterns in %HR_{max} were used to indicate positional grouping when developing the NIAT from time motion analysis data. Subjects performed two trials of the NIAT separated by at least seven days. Physiological and performance markers were measured systematically throughout the NIAT. Exercise intensity as denoted by %HR_{max} significantly decreased from the first half of match play to the second half ($90.4 \pm 2.7\%$ v $88.3 \pm 2.8\%$; $p < 0.05$). Significant differences ($p < 0.05$) were observed between positional groups and led to the grouping of Defence (D), Centre Court (CC), and Attack (A) players for NIAT performance. Comparisons of %HR_{max} between match play and NIAT performance indicated that the NIAT had good criterion validity for D (*match Mdn* = 92.52% vs. *NIAT Mdn* = 86.27%, $p > 0.05$) and A (*match Mdn* = 86.95% vs. *NIAT Mdn* = 82.93%, $p > 0.05$) players, but that %HR_{max} during the NIAT (*Mdn* = 79.70%) was significantly lower than match play (*Mdn* = 89.70%) for CC group ($p < 0.05$). Measures of 5 m sprint performance (1.27 ± 0.06 s v 1.25 ± 0.06 s; $p > 0.05$; $r = 0.66$, $p < 0.001$), vertical jump height (29.12 ± 4.17 cm v 28.82 ± 3.60 cm; $p > 0.05$; $r = 0.91$, $p < 0.001$), circuit time (107.49 ± 3.22 s v 107.89 ± 4.27 s; $p > 0.05$; $r = 0.72$, $p > 0.001$) and %HR_{max} ($82.56 \pm 4.66\%$ v $81.03 \pm 4.13\%$; $p > 0.05$; $r = 0.82$, $p < 0.001$) for NIAT1 vs. NIAT2 indicated good test-retest reliability. These data suggest that netball players experience a reduction in exercise intensity over the duration of a game, with exercise intensity being related to on-court position. Whilst the NIAT appears to be a repeatable activity pattern, it is not a good simulation of physiological strain for all positional groups. More work is required in order to create a netball simulation that is both reliable and valid for all players.

ACKNOWLEDGEMENTS

This research project would not have been possible were it not for the time and effort contributed by the participants and local netball infrastructure. In particular I am indebted to:

Netball North Harbour

Rangitoto Netball Club

Commodores Netball Club

Shore Rovers Netball Club

For the support and guidance they have given me during this research I would like to acknowledge my supervisors:

Dr. Andrew Foskett

Dr. Alan Walmsley

Finally I would like to thank my family and numerous friends who have been patient and gone above and beyond in helping me through this process.

TABLE OF CONTENTS

		PAGE
Abstract		i
Acknowledgements		ii
Table of Contents		iii
List of Figures		vii
List of Tables		viii
 CHAPTER I	 INTRODUCTION	 1
1.1	Hypotheses	3
 CHAPTER II	 REVIEW OF LITERATURE	 4
2.1	Introduction	4
2.2	Physiological Demands of	
	Intermittent Running Exercise	4
2.2.1	Distance Covered	5
2.2.2	Speed and Intensity of	
	Player Activity	7
2.2.3	Energy Requirements	10
2.3	Physiological Demands of	
	Netball	15

	2.3.1 Positional Patterns	16
	2.3.2 Physical Characteristics	17
	2.3.3 Maximal Oxygen Uptake	18
	2.3.4 Leg Power	19
	2.3.5 Activity Patterns	20
2.4	Models for Simulating High Intensity Exercise	25
	2.4.1 Laboratory Based Models	25
	2.4.2 Shuttle Running Simulations	30
2.5	Reliability and Validity	38
2.6	Summary	39
	2.6.1 Assumptions of the Study	40
CHAPTER III	METHODOLOGY	41
3.1	Introduction	41
3.2	Subject Characteristics	41
3.3	Preliminary Measurements	42
	3.3.1 Physical Characteristics	42
	3.3.2 Maximal Oxygen Uptake and Maximum Heart Rate	42

3.4	Game Data	43
3.5	Netball Intermittent Activity	
	Test	44
	3.5.1 Familiarisation	44
	3.5.2 Main Trials	45
3.6	Facilities	48
3.7	Statistical Analysis	49
CHAPTER IV	RESULTS	52
4.1	Match Data	52
	4.1.1 Playing Quarter	52
	4.1.2 Positional Group	53
4.2	NIAT Criterion Validity	56
4.3	NIAT Reliability	57
	4.3.1 Sprint Time	57
	4.3.2 Jump Height	57
	4.3.3 Circuit Time	58
	4.3.4 Percent Heart Rate	
	Maximum	59

CHAPTER V	DISCUSSION	61
5.1	Match Data	61
	5.1.1 Playing Quarter	63
	5.1.2 Positional Group	65
5.2	Protocol Validity	70
5.3	Protocol Reliability	76
	5.3.1 Sprint Time	76
	5.3.2 Jump Height	78
	5.3.3 Circuit Time	79
	5.3.4 Percent Heart Rate Maximum	81
5.4	Conclusion	83
5.5	Limitations of the Study and Recommendations for Future Research	84
	REFERENCES	87
	APPENDICES	

LIST OF FIGURES

Figure	Title	Page
3.1	Diagrammatical Representation of the NIAT	46
3.2	Diagrammatical Representation of the Skill Circuit within the NIAT	47
3.3	Photograph of a Participant Completing Skill Circuit during NIAT	48
4.1	Mean %HR _{max} for the Four Quarters of Match Play	52
4.2	Comparison of Mean % HR _{max} between Match Halves	53
4.3	Mean %HR _{max} during Match Play for the Different Positional Groups	54
4.4	Median % time in Heart Rate Zone by Positional Group	55
4.5	Median % HR _{max} for Positional Groups in Match and NIAT	56

LIST OF TABLES

Table	Title	Page
2.1	Heart Rate Intensity Zones	24
3.1	Activity Patterns During Skill Section of the NIAT Protocol by Positional Variation	45
4.1	Median $\dot{V}O_{2\max}$ and $HR_{\max}$ values by positional group	53
4.2	Mean NIAT performance times ($\pm$ standard deviations)	58
4.3	Pearson's correlation (r), intra-class correlation coefficients (ICC), standard error of measurement (SEM), 95% confidence intervals (95% CI), and coefficient of variation (CV) for NIAT performance	60
4.4	Absolute limits of agreement (LOA) for NIAT performance	60