

***Influence of Recovery Modalities on Team Sport Performance,
Perceptions and Physiological Variables***

Laura E. Juliff

2011

**This thesis is submitted as partial fulfilment of the requirements for
the degree of Bachelor of Sports Science (Honours) at Murdoch
University, Perth, Western Australia.**

**I declare that this thesis is my own account of my research
and contains as its main content work which has not
previously been submitted for a degree at any tertiary
education institution.**

(Miss Laura Juliff)

COPYRIGHT ACKNOWLEDGEMENT

I acknowledge that a copy of this thesis will be held at the Murdoch University Library.

I understand that, under the provisions of s51.2 of the Copyright Act 1968, all or part of this thesis may be copied without infringement of copyright where such a reproduction is for the purposes of study and research.

This statement does not signal any transfer of copyright away from the author.

Signed:

Full Name of Degree: Bachelors of Sports Science with Honours

Thesis Title: Influence of Recovery Modalities on Team Sport Performance, Perceptions and Physiological Variables

Author: Miss Laura E. Juliff

Year: 2011

ACKNOWLEDGEMENTS

The completion of this thesis could not have occurred without the invaluable support, encouragement and guidance from a number of people. My upmost thanks go out to the following individuals:

To my supervisors, Dr Shona Halson and Dr Jeremiah Peiffer, I could not have asked for better supervisors. Your support, encouragement and sound advice was second to none. I cannot thank you both enough for all your patience and efforts throughout the year.

To Dr Darrell Bonetti I would like to say many thanks for your assistance throughout the method design and testing period.

I would also like to acknowledge the support of the Australian Institute of Sport (AIS) Recovery staff, in particular, Matt Driller and Nathan Versey for your assistance and support which was greatly appreciated. To the Physiology Occupational Trainees, Lachlan, Andrew, Sean and Jason, your time and assistance during the testing sessions made this an enjoyable experience. Special thanks go out to the AIS Performance Research Centre for your patience and support with me as I juggled work and writing over this time.

A study like this could not occur without the cooperation and support of such willing coaches, athletes and support staff. Sue Gaudion and Kylee Sampson, thank you for all your assistance and enthusiasm in allowing me access to your wonderful group of athletes. To the athletes, girls you have made this year a joy it really was a pleasure working with you, thank you for all your efforts and positive attitudes.

Last but not least to my loving, supportive family. Mum, Dad and Hannah thank you for all your encouragement and support throughout this time. You are always there for me in whatever I choose to pursue, for this I sincerely thank you. To my grandma in England you are my inspiration and with your support I feel as though I can conquer the world. To Julian Piromalli thank you for your support and guidance this year and keeping me on track and sane.

It's amazing how two words can mean so much... THANK YOU!

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
ABSTRACT	9
DEFINITION OF TERMS	11
ABBREVIATIONS	12
CHAPTER ONE: INTRODUCTION.....	13
1.1 BACKGROUND TO THE STUDY.....	13
1.2 PURPOSE STATEMENT/SIGNIFICANCE OF RESEARCH.....	17
1.3 RESEARCH QUESTION/S	18
1.4 HYPOTHESES.....	18
1.5 LIMITATIONS/DELIMITATIONS	18
CHAPTER TWO: CRITICAL REVIEW OF LITERATURE	20
2.1 OVERVIEW	20
2.2 PHYSICAL DEMANDS OF NETBALL.....	21
2.3 RECOVERY MODALITIES	23
2.3.1 Water Immersion/Hydrotherapy.....	23
2.3.2 Cold Water Immersion	25
2.3.3 Hot Water Immersion.....	28
2.3.4 Contrast Water Therapy	29
2.3.5 Contrast Showers.....	37
2.4 CONTRAST RECOVERY RESEARCH IN ELITE ATHLETES	39
2.5 PERFORMANCE AND RECOVERY IN FEMALE ATHLETES	40
2.5.1 Female Menstrual Cycle and Performance	40
2.6 SUMMARY.....	41
CHAPTER THREE: METHODS.....	43
3.2 STUDY DESIGN	43

3.3	SAMPLING METHODOLOGY	44
3.4	PROCEDURES.....	44
3.6	RECOVERY INTERVENTIONS	49
3.7	PHYSIOLOGICAL MEASURES.....	51
3.8	RECOVERY ASSESSMENT.....	52
3.8.1	Performance Measures.....	52
3.8.2	Psychometric Measures	53
3.9	STATISTICAL ANALYSIS.....	54
CHAPTER FOUR: RESULTS.....		55
4.1	CIRCUIT MEASURES	55
4.2	AGILITY PERFORMANCE.....	56
4.3	JUMP PERFORMANCE.....	57
4.4	TEMPERATURE.....	59
4.5	SUBJECTIVE MEASURES.....	61
CHAPTER FIVE: DISCUSSION		63
CHAPTER SIX: CONCLUSION		70
REFERENCES		71
APPENDIX 1: ETHICS APPROVAL LETTERS.		77
APPENDIX 2: FOOD DIARY		79
APPENDIX 3: WARM UP.....		82
APPENDIX 4: ILLUSTRATION OF THE NETBALL CIRCUIT.....		83
APPENDIX 5: PLANNED AGILITY TEST LAYOUT.....		84
APPENDIX 6: PERFORMANCE RECOVERY QUESTIONNAIRES		85
APPENDIX 7: MENSTRUAL CYCLE QUESTIONNAIRE.....		86
APPENDIX 8: RECOVERY SCALES		87

TABLE OF FIGURES

FIGURE 3.1: An outline of the study experimental design.....	46
FIGURE 3.2: Outline and Description of the Netball Circuit Stations	48
FIGURE 3.3: Participants alternating through contrast showers.....	50
FIGURE 3.4: Participants immersed in cold water maintained at 15°C	50
FIGURE 4.1: Agility Performance	56
FIGURE 4.2: Jump Performance	57
FIGURE 4.3: Temperature results	59

TABLE OF TABLES

TABLE 1: Contrast Therapy Literature Review30

TABLE 2: Circuit Measures55

TABLE 3: Subjective Measures61

ABSTRACT

Purpose: In order to cope with the demands and stress of training and competition many team sports have begun to utilise contrast water therapy as their preferred recovery modality. Although popular, there may be an inability to access necessary facilities when at sporting venues or overseas therefore contrast showers may prove to be a convenient, accessible and effective alternative. Research examining the influence of contrast showers on sport performance and psychological and physiological variables is lacking. Therefore, this study sought to examine the effects of contrast showers and contrast water therapy on vertical jump and repeated agility performance, skin and core temperature and psychological measures following a netball specific circuit in elite female netball players. **Methods:** Eleven elite netball players completed three experimental sessions (randomised crossover design) followed by one of three post-exercise recovery interventions; (1) contrast water therapy (CWT, 38°C and 15°C), (2) contrast showers (CS, 38°C and 18°C) and (3) passive recovery (PAS, seated rest 20°C). For each trial, participants performed a fatiguing netball specific circuit followed by one of the recovery interventions. Repeated agility, repeated vertical jump, skin and core temperature and muscle soreness were measured before, immediately after, 5 hours post and 24 hours post-exercise. **Results:** No significant differences ($p > 0.05$) were evident between conditions for exercise performance (vertical jump, repeated agility). Post-exercise CWT and CS provided similar cooling effects through decreased skin temperature (T_{skin}) results and a delayed drop in core temperature (T_{core}) of (-1.0%) when compared to a passive condition. Perceived perceptions overall were greater in the CWT (18.95 ± 13.77) and CS (17.70 ± 12.98) conditions when compared with a passive recovery (72.80 ± 14.26). Furthermore, a significant ($P < 0.001$) change in

perception of CS recovery conditions was observed pre and post condition indicating a significant favourable change in perception. **Conclusion:** Although no improvements in performance were noted after CWT or CS, neither modality negatively influenced performance. Furthermore, both CWT and CS resulted in faster cooling responses and greater perceptions of recovery when compared with passive sitting. For this reason, it is suggested that CWT and CS are viable recovery modalities that can be used to help increase recovery in netballers after intense training or competition scenarios.

DEFINITION OF TERMS

For consistency of interpretation the preceding words are defined:

Active recovery: Low intensity exercise conducted post-exercise.

Agility: Ability to effectively and efficiently move and change direction of the body.

Contrast Water Therapy (CWT): The alternation of cold and hot water immersion.

Cold Water Immersion (CWI): The Immersion of the body in water temperatures of less than 15°C⁸¹.

Hot Water Immersion (HWI): The Immersion of the body in water temperatures greater than 37°C³⁸.

Hydrostatic Pressure: Pressure exerted on the body through the weight of fluid.

Passive Recovery: A form of post-exercise recovery that involves periods of rest (i.e. passive sitting).

Recovery: A process of restoring the body physiologically and psychologically to pre-exercise levels following exercise.

Vasoconstriction: Narrowing of the blood vessels that increase peripheral resistance.

Vasodilation: Relaxation of the smooth muscles of the blood vessels that decreases peripheral resistance.

ABBREVIATIONS

Selected abbreviations used throughout the text

AFL: Australian Football League	GK: goal keeper netball position
AIS: Australian Institute of Sport	GS: goal shooter netball position
ANOVA: analysis of variance	HWI: hot water immersion
ATP: adenosinetriphosphate	ISAK: International Society for the Advancement of Kinanthropometry
bpm: beats per minute	kg: kilogram
C: centre netball position	PAS: passive recovery
°C: temperature in degrees centigrade	PostEx: post-exercise measurement
CHO: carbohydrate	PostRec: post-recovery measurement
CMJ: counter movement jump	RPE: rate of perceived exertion
CNS: central nervous system	T_{core}: core temperature
CS: contrast showers	T_{mean}: mean body temperature
CWI: cold water immersion	T_{skin}: skin temperature
CWT: contrast water therapy	VAS: visual analogue scale
DOMS: delayed onset muscle soreness	W:R: work to rest ratio