HONOURS RESEARCH PROPOSAL

THESIS TITLE:
Physiological responses and movement analysis of sport karate.

Student:

Supervisor/s:

BRIEF DESCRIPTION:
Karate is a form of Martial arts training that dates back hundreds of years and is rich in discipline, skill and tradition (Nunan, 2006). However, little research exists in terms of the physiological responses and movement patterns to Karate training, and, even less exists to these responses during actual karate competition (Nunan, 2006). Staley (1999) states that, “traditionally, martial arts emphasise the process of training over the end result” (p. 1); and “…although people may have varied reasons for studying martial arts, ultimately they are learning a physical skill” (p. 1) .

Traditional technical karate has been practiced for centuries. However, it was only in the 1950’s that traditional karate was introduced internationally (www.karateworld.org). Traditional karate consists of basic technical training, or kihon, and detailed choreographed movements known as kata.. Like most physical sports, karate governing bodies highlighted the need for competitive tournaments to be held to ensure the continual progression of their art. It was proposed that karate experts would compete against each other in sparring matches, known as kumite, using techniques learnt during kihon and kata training. In 1966, the first major competition (European Championships) were held in Paris. For the first time, karate experts were able to compete against other elite level karate athletes under set refereeing rules. Athletes competed in both team and individual kumite bouts.

Since then competition, now known as sport karate, tournaments operate under round robin conditions with participants competing in multiple bouts during a tournament. Bouts last between 2 and 4 minutes depending upon gender, age and significance of bout (i.e. medal bouts/ finals) and are scored on a points system. Rest time between bouts can vary depending upon the number of participants entered and the length of tournament.

To date, data collection and research into sport karate has been limited to training scenarios and/ or simulated karate sparring (Imamura et al., 1999; Iide et al., 2008), with little to no research available with direct links to actual karate sparring during tournament conditions (Nunan, 2006). Iide et al. (2008) highlights the fact that karate tournaments consists of sparring competitions, among others, and thus due to competition being the major diving force behind athletic training it is important to understand how the human body specifically responds to the demands placed upon it by tournament fighting conditions. Therefore, the aim of this study will investigate the physiological and movement responses of sport karate.

STATEMENT OF GENERAL AIMS AND SPECIFIC OBJECTIVES:

The aim of the proposed study is to measure neuromuscular, cardiovascular and movement patterns of sport karate competitors during state and national tournament events (see Methods section). The results collected will be used to produce training programs that are specific to age (chronological and training), competition level and physical characteristics of individuals that will optimise the training stimulus and enhance athletic progression. In addition to this, the study aims to better understand sport karate so that injury prevention strategies can be established and rates of overtraining for athletes can be reduced. The information and protocols obtained and used during this study will hopefully form the basis for future research into the field of sport karate.

Specifically, the following research questions will be addressed:

1. What is the effect of multiple bout matches on physiological responses in elite sport karate?
2. Do sport karate athletes experience neuromuscular fatigue over multiple bouts during competition?
3. Do motor time on task and movement characteristics differ following successive competitive bouts?

METHODS:

Participants:

It is proposed that a convenience sample of 12 elite athletes who will be participating in Victorian and National Sport Karate Competitions will be recruited for the study.

Physiological Characteristics to be measured:

The study will aim to measure a number of physiological responses. These include:

Heart rate (HR) Analysis: Athletes will be fitted with Heart Rate Monitors (Polar) wearing them during sparring bouts. This data will then be uploaded to a computer and stored for future analysis. Intensity of the bouts will be analysed using the "HRmax" zone method (Deutsch et al., 1998), describing exercise intensity as "low" (<75% of partipants HR max as measured in-bout), "moderate" (75-84% HRmax), "high" (85-95% Hmax) and "max" (>95% HRmax).

Blood Lactate (BLa) Analysis: Pre and post bout BLa levels will be measured via a finger prick, with their blood to be placed on a test strip for analysis through the use of a Lactate Pro Portable Lactate Analyser.

Core Temperature (Ctemp) Analysis: Individual Ctemp responses will be measured via the ingestion of a one use core temperature pill and wireless telemetry (HQ Inc). Ctemp will be measured prior to, and immediately after each sparring bout.

Hydration Analysis: Hydration status will be determined via body weight change and refractometry analysis. Prior to and post each competitive bout, athletes will be weighed, in minimal clothing for change in body weight. In addition to this, prior to the first bout, and at the completion of two or three competitive bouts, athletes will provide a small urine sample (10 mls), which will be analysed using and hand-held light refractometer (Atago Inc).

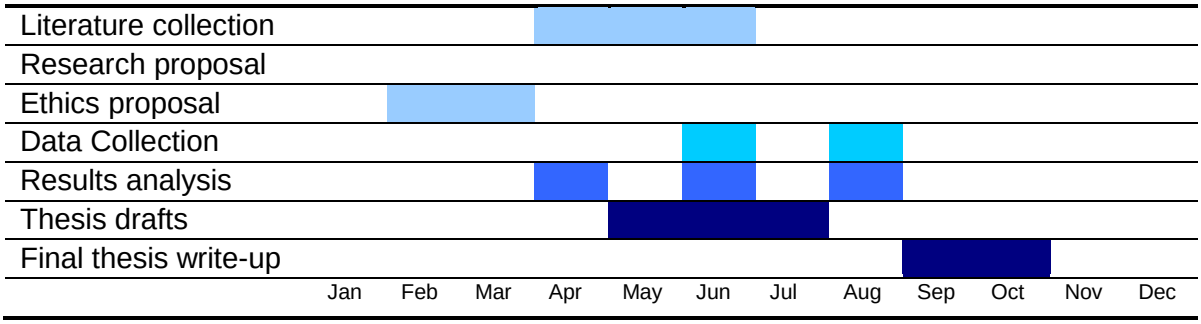
Each of the abovementioned analyses methods are well-established and have been published in elite junior (Pearce et al, 2007) and senior athletes (Pearce, 2008).

Reactive Strength Index: Neuromuscular responses will be assessed via the Reactive Strength Index (RSI). Taken from a vertical jump, the reactive strength index is a composite measure of an athlete's ground contact time with flight time (time in the air). It is envisaged that the RSI will provide a measure of neuromuscular fatigue following competitive bouts (Cormack, 2008)

Movement patterns to be analysed:

Data of motor time on and off task and motor skill characteristics during each competitive bout will be collected using video and analysed using time-motion analysis for work: rest ratios. Specific technical skills such as punching, kicking, blocking and striking will be recorded and expressed in descriptive terms.

SPECIFIC MILESTONES AND PROPOSED TIME LINE



RESOURCES REQUIRED

Blood lactate strips	2 packets @ $86 per packet + GST and delivery	$200.20	
Core temperature pills	10 pills @ $77 per pill + GST and delivery	$869.00	
Honours budget allowance			$500.00
Remaining budget covered by Alan Pearce activity account			$569.20
	TOTAL	**$1069.20**	**$1069.20**

SIGNIFICANCE OF RESEARCH

As highlighted by Nunan (2006), little research has been conducted in sport karate, with the limited research using simulated training. This study will be the first to embark on measurements taken during full competition.

This novel study will provide data for interpretation by coaching and fitness professionals when prescribing appropriate and specific training activities in preparing competitive sport karate athletes.

REFERENCES:

Cormack, S. Neuromuscular fatigue and endocrine responses in elite Australian Rules football players. PhD thesis, Edith Cowan University.

Deutsch, M. U., Maw, G.J., Jenkins, D. and Reaburn, P. Heart rate, blood lactate and kinematic data of elite colts (under-19) rugby union players during competition, Journal of Sports Sciences 16, 561-570, 1998.

Lide K, Imamura H, Yoshimura Y, Yamashita A, Miyahara K, Miyamoto N and Moriwaki C. Physiological Responses of Simulated Karate Sparring Matches in Young Men and Boys. Jouirnal of Strength and Conditioning Research. 22: 3; 2008.

Nunan D. Development of a sports specific aerobic capacity test for karate- a pilot study: Journal of Sport Science and Medicine. 5: 47-53, 2006.

Pearce AJ. Core Temperature and Hydration Status in Professional Tennis Players Under Live Tournament Conditions In: A. Lees, D. Carbello and G Torres. (Eds.) Science and Racket Sports IV. Chapter 2: 14-21. ISBN10:0-41543556-0. 2008.

Pearce AJ, Veale JP, and Carlson JS. Physiological responses of elite junior Australian Rules footballers under match situations. Journal of Sports Science and Medicine 6: Suppl. 10: 57; 2007.

Staley CI. The Science of Martial Arts Training. ISBN: 1-892515-01-6. 1999.

World Karate Federation. http://www.karateworld.org/index.php?option=com_content&task=view&id=47&Itemid=3215/2/09WKFHISTORY. Accessed 15/2/09

World Karate Federation. Kata and kumite competition rules. http://www.karateworld.org/images/stories/Downloads/WKF%20Competition%20rules%20eng_January%202009.pdf. Accessed 15/2/09

Signature of Student Date:

Signature of Supervisor Date:

Victoria University
Faculty of Arts, Education & Human Development

Bachelor of Applied Science (Human Movement)

HONOURS PROPOSAL

Thesis Title:
The effect of time constraints on the coordination patterns of preferred and non-preferred foot kicking in Australian Football.

Brief Description:
Australian Rules Football (ARF) is a popular Australian sport which requires its players to develop the ability to kick with their preferred and non-preferred foot. In the game of ARF the drop punt kick is the most frequently used kicking technique due to its accuracy for the kicker and ease of marking for the receiver (Ball, 2008). The ability for an ARF player to execute an accurate kick is vital for the success of a game. Ball (2003) found 20% of kicks in Australian Rules Football (AFL) games were performed with the non-preferred foot and this percentage was as high as 45% for some individual players. For this reason, learning how to kick accurately with the non-preferred leg is a very important skill as kicking with the preferred leg.

Hancock (2008) found that differences between the preferred and non-preferred foot were range of motion rather than coordination based. However, subjects performed in self-paced conditions. In game situations, there will be time constraints and it is in part due to these time constraints that players might choose to kick with their non- preferred foot. Another limitation of this research was that it was limited to the knee only. Examining other joints, in particular the hips and pelvis, is an important progression for this research. The aim of this study is to compare coordination profiles of the knee, hip and pelvis during preferred and non-preferred foot ARF kicking under time constraints.

Statement of General Aims and Specific Objections:
The purpose of this study is to examine if coordination differences exist between preferred and non-preferred foot kicking when Australian Rules Football (ARF) players perform a drop punt kick. A time constraint variable will be introduced into the study to examine the extent to which a pressured environment can affect coordination whilst performing a kicking task. Time constraint was chosen as it is a realistic challenge that football players encounter during game play.

Previous research comparing coordination profiles between the preferred and non-preferred foot kicking in Australian Rules Football (ARF) indicated that differences were related to joint range of motion and joint angular velocity rather than coordination patterns. However, this work did not examine kicking under game-like conditions.

Method:

Subjects
The subjects used for this study will be ten elite and/or sub-elite ARF players.

Protocol
Elite and Sub-Elite ARF players will kick a football under two conditions with their preferred and non-preferred foot – a self paced condition and a time constraint condition. For both conditions, players will run with a ball and kick it for maximal distance. For condition one (self-paced), players will be instructed to run in and kick for maximal distance with no time constraints. Condition two (time constraint) requires the players to kick for maximal distance as soon as they can after hearing a beeper. Keeping in mind that some players might take longer to kick than others, the duration between the beeper sounding and the point at which the player kicks the ball will be timed.

During each kick, three dimensional data of the shank, thigh and pelvis will be collected using Optotrak Certus System. Markers will be place on the trunk (pelvis, upper trunk) and lower extremities (shank, thigh). Joint centres will be located and established at the hip, knee and ankle. In addition, reflective markers will be placed on each end of a Sherrin football in order to track ball movement.

The preferred and non-preferred foot kicks will be compared for coordination profiles and kinematic data identified as important in previous research. Coordination profiles will be evaluated using angle-angle diagrams (knee-hip angle, hip-pelvis angle) and phase plane diagrams (knee angle-knee angular velocity) for each condition. Kinematic data will include foot speed, thigh, shank and knee angular velocity (all identified as important in ARF kicking, Ball, 2008).

Equipment
- Optotrak Certus System
- Beeper
- Sherrin football
- Reflective markers
- Timer

Ethical Risks and Safeguards
It is possible that injury may occur to the player while performing the kicking task. To reduce this risk the subject will be given an appropriate warm-up and familiarisation period in the lab. It should be noted that this risk is small as the tasks being performed are similar to those the players will be performing as part of training and games.

Specific Milestones and Time Line:

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
LITERATURE REVIEW		■	■	■	■	■	■	■	■	■		
PROPOSAL			■									
ETHICS			■	■								
TESTING				■	■	■						
ANALYSIS						■	■					
METHOD WRITING							■					
RESULTS								■				
DISCUSSION								■	■			
FORMATTING									■	■		

Resources Required:

Facilities:

Biomechanics Laboratory – Victoria University (City Campus)

Equipment:

Optotrak Certus System – Used for kicking research projects in AFL

Cost Estimation

BUDGET	
Subject parking at City Flinders Campus (15 @ $17 each)	$255
Optotrak consumables (tape, cabling)	$100
Beeper (cabling, sound card, software)	$150
TOTAL	**$505**

All equipment with the exception of the beeper exists and is available at Victoria University Biomechanics Laboratory. Development of the beeper is currently underway and is expected to be complete in the next week. All procedures and analysis software have been developed and used in previous kicking research.

Significance of Research:

In ARF, players are constantly placed under pressured situations by their opponents. During this time, efficient ball progression is important to remain in possession of the ball. This however can become a difficult task depending on the pressure exerted by an opponent and may require the player to kick the ball with their non-preferred foot. For

this reason, the ability of players to know how to kick with their preferred and non-preferred foot is vital for the development of their skill level as a football player. Biomechanical analysis of this technique is important for future coaching of this skill as it provides detailed understanding of how complex movements and coordination patterns are performed and executed.

References:

Ball, K. (2008). Biomechanical considerations of distance kicking in Australian Rules Football. *Sports Biomechanics 7*, 10-23.

Ball, K. (2003). Profile of kicking in AFL football. *Technical report for Fremantle football club*. Perth.

Dichiera, A., Webster, K., Kuilboer, L., Morris, M., Bach, T., and Feller, J. (2006). Kinematic patterns associated with accuracy of the drop punt kick in Australian Football. *Journal of Science and Medicine in Sport*, 9, 292-298.

Endorsement by Student and Supervisor:

Signature of Supervisor*:* ……..

Supervisor Name *(please print):* ……..

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Signature of Student*:* ……...

Student Name *(please print*)*:* ……