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# **The Physiological Effects of Nutritional Thiol Supplementation**

A thesis presented in partial fulfilment  
of the requirements for the degree of

Doctor of Philosophy  
in  
Sport and Exercise Science

at Massey University, Manawatu  
New Zealand

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2017

## Abstract

Endogenous antioxidant defence systems are largely comprised of thiol antioxidants and antioxidant enzymes. Keratin protein, being high in cysteic acid, has potential to improve antioxidant status via generation of several thiol antioxidants. Common dietary antioxidants are often used by athletes aiming to reduce oxidative stress, which in turn can improve exercise performance. However, whilst studies into their action against oxidative stress are positive, the subsequent effect on exercise performance is less so. In addition to having little effect on acute performance, their non-specific ROS-targeting mechanisms may also blunt important adaptation signalling pathways. It has been proposed that improving endogenous defence systems may be of greater benefit to athletic performance, thus keratin may be an alternative to dietary antioxidant supplementation. The first study within this thesis found acute keratin supplementation to improve plasma total thiol content, while longer term supplementation increased lean body mass significantly more than casein protein. Study two suggested one week of keratin vs. taurine supplementation did not affect plasma total thiol content, while study three found that despite no significant effects on serum total thiol content, taurine improved muscle recovery following eccentric-induced muscle damage compared to a placebo. In summary, findings from this thesis suggest keratin may be a useful supplement for athletes wanting to maintain or gain lean body mass. This suggests implications for the use of keratin beyond athletes, potentially benefiting other population groups including the elderly and the sick. Results also suggest that supplementing with taurine following resistance exercise involving eccentric actions may improve recovery and subsequent performance. This research sets a platform for further investigation into the use of keratin and thiols for various areas of sporting performance.

## Acknowledgements

It goes without saying that undertaking a PhD is no walk in the park. The ability to stay motivated, inspired, engaged, and driven cannot be achieved by oneself; rather, it takes a committed crew to see it through from start to finish. For that, I would like to acknowledge first and foremost my supervisory team; Professor Stephen Stannard, Dr. Matthew Barnes, and Dr. Carlene Starck. I could not have asked for a more encouraging and supportive team. Your knowledge and input over the years has not only kept me on track during this doctorate, but has challenged my thinking as a researcher. Massive thanks must also be given to my co-worker Miss Emma Crum. Without you, the research side of this doctorate would not have been possible. Also to Mr. Chris Kendrick and Ms. Felicity Jackson for their analysis of blood samples, and Ms. Anne Broomfield for running our DEXA scans. And to my participants, I am so appreciative of the effort you put in to these studies, despite it not always being easy to do so. Your willingness and enthusiasm made it so easy to work with you all – so thank you. To my family, thank you for supporting me throughout not just these past three years, but over my entire eight years of university study. The completion of this is a real testament to how you have raised me to be a determined and driven woman. Your unconditional love and encouragement to pursue my dreams has instilled a strong sense of self-belief and I can never thank you enough for that. And last but not least, to my fiancée Jordan. It is hard for me to put into words how grateful I am to have had you in my life during this time. Thank you for being an absolute rock during 2.5 years of a long-distance relationship whilst I completed this. Thank you for being my number one fan. And thank you for never letting me give up.

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## List of Abbreviations

8-OHdg	8-hydroxy-deoxy-guanosine
<b>A</b>	
AA	Arachidonic acid
AMPK	Adenosine monophosphate-activated protein kinase
ATP	Adenosine triphosphate
<b>C</b>	
CA	Cysteic acid
CAT	Catalase
Ca <sub>2</sub> <sup>+</sup>	Calcium ion
CDO	Cysteine dioxygenase
Cl <sup>-</sup>	Chloride ion
CNS	Central nervous system
CSAD	Cysteine sulfinic acid decarboxylase
CSA	Cysteine sulfinic acid
<b>D</b>	
DNA	Deoxyribonucleic acid
DOMS	Delayed onset muscle soreness
<b>E</b>	
EIH	Exercise induced hypoxemia
EPO	Erythropoietin
ETC	Electron transport chain
<b>F</b>	
FADH <sub>2</sub>	Flavin adenine dinucleotide
<b>G</b>	
GCS	Gamma-glutamyl cysteine synthetase
GCl	Resting muscle chloride conductance
GLUT-4	Glucose transporter
GPx	Glutathione peroxidase
GR	Glutathione reductase
GS	Glutathione synthetase
GSC	γ-glutamylcysteine synthetase
GSH	Reduced glutathione
GSSG	Oxidised glutathione
<b>H</b>	
h	Hours
H <sup>+</sup>	Hydrogen ion
H <sub>2</sub> O <sub>2</sub>	Hydrogen peroxide
Hb	Hemoglobin
HbO <sub>2</sub>	Hemoglobin saturation
HIF	Hypoxia inducible factor



HOCl	Hypochlorous acid
<b>I</b>	
IGF-1	Insulin-like growth factor
IMP	Inosine monophosphate
IL-	Interleukin isoforms
<b>K</b>	
K <sup>+</sup>	Potassium ion
<b>L</b>	
LBM	Lean body mass
LOX	Lipoxygenase
<b>M</b>	
MAPK	Mitogen-activated protein kinase
MDA	Malondialdehyde
MPO	Myeloperoxidase
mtDNA	Mitochondrial DNA
mRNA	Messenger ribonucleic acid
<b>N</b>	
Na <sup>+</sup>	Sodium ion
NAC	N-acetyl-cysteine
NAD <sup>+</sup>	Nicotinamide adenine dinucleotide, oxidised
NADH	Nicotinamide adenine dinucleotide, reduced
NADP	Nicotinamide adenine dinucleotide phosphate
NADPH	Nicotinamide adenine dinucleotide phosphate, reduced
NF-κβ	Nuclear factor-kappaβ
NO	Nitric oxide
NOS	Nitric oxide synthase
NOX	NADPH oxidase
<b>O</b>	
O <sub>2</sub>	Molecular oxygen
O <sub>2</sub> <sup>-</sup>	Superoxide radical
OH <sup>-</sup>	Hydroxyl radical
ONOO <sup>-</sup>	Peroxynitrite
<b>P</b>	
PaO <sub>2</sub>	Partial pressure of oxygen saturation
PGC-1α	Peroxisome proliferator-activated receptor gamma coactivator 1-alpha
PLA2	Phospholipase A2
PMRS	Plasma membrane redox system
<b>R</b>	
RBC	Red blood cell
RNS	Reactive nitrogen species
ROO	Peroxyl radical
ROS	Reactive oxygen species
RPM	Revolutions per minute
<b>S</b>	

SD	Standard deviation
SE	Standard error
SOD	Superoxide dismutase
SR	Sarcoplasmic reticulum
Sub-max	Submaximal exercise
<b>T</b>	
Tau	Taurine
TauCl	Taurine chloramine
TauT	Taurine transporter
TBARS	Thiobarbituric acid reactive substances
TNF- $\alpha$	Tumour necrosis factor-alpha
tRNA	Transfer ribonucleic acid
<b>V</b>	
VEGF	Vascular endothelial growth factor
VO <sub>2max</sub>	Maximal oxygen uptake
<b>X</b>	
XDH	Xanthine dehydrogenase
XO	Xanthine oxidase

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