
TABLE OF CONTENTS

INTRODUCTION.....	1
CURRENT KNOWLEDGE.....	3
MUSCLE STRENGTH DEVELOPMENT.....	3
I. Muscle function.....	3
I.1 Muscle structure	3
I.2 Muscle contraction and force generation.....	6
I.3 Muscle mechanical behaviour during contraction.....	6
I.4 Muscle properties	11
II. Neural adaptations.....	16
II.1 Neural mechanisms.....	16
II.2 Spinal and supraspinal adaptations	18
II.3 Intermuscular coordination	22
III. Muscle adaptations.....	25
III.1 Muscle hypertrophy	25
RESISTANCE TRAINING METHODOLOGIES.....	31
I. Muscle contraction type	31
I.1 Exercise-induced muscle damage	31
I.2 Indirect markers of muscle damage.....	34
II. Loading and volume	36
PROTEIN METABOLISM.....	37
I. Catabolic reactions and oxidation.....	37
I.1 Protein oxidation and energy substrate consumption	37
I.2 Amino acid catabolism	38
I.3 BCAA oxidation.....	41
I.4 Nutrition and amino acid catabolism	42
I.5 Exercise and amino acid catabolism	43
II. Technical approaches to human protein turnover in vivo.....	44
II.1 Invasive isotopic tracer methods	44
II.2 Non-invasive techniques	47
III. Regulation of muscle protein turnover by acute exercise	50

III.1	Threshold and mode dependent anabolic response	50
IV.	Regulation of muscle protein turnover by chronic training.....	51
V.	Regulation of muscle protein turnover by nutrition.....	53
V.1	Effect of the type and composition of dietary proteins on protein turnover.....	54
VI.	Regulation of protein turnover by a combination of exercise and nutrition.....	58
VI.1	Dose-dependent anabolic response of dietary proteins.....	59
VI.2	Optimal timing and distribution of supplementation	60
VII.	Protein requirements.....	61
	OBJECTIVES OF THE THESIS.....	65
	EXPERIMENTAL PART	67
	METHODOLOGY	67
I.	Materials and methods	67
I.1	Subjects	67
I.2	Nutritional supplementation.....	67
I.3	Experimental methods and data recordings.....	68
II.	Measurements and data analysis	73
II.1	Electromyographic and mechanical recordings	73
II.2	Muscle architecture	75
II.3	Anthropometric characteristics	75
II.4	Strength evaluation.....	76
II.5	Dietary intakes	76
III.	Statistical analysis	77
	STUDY 1- Effects of a combined essential amino acid-carbohydrate supplementation on neural and muscle adaptations following heavy-load training.....	78
I.	Subjects	78
II.	Sub-study A - Effects of a combined essential amino acid-carbohydrate supplementation on muscle mass, architecture, and maximal strength following heavy-load training.....	78
II.1	Introduction	78
II.2	Methods	80
II.3	Results	80
II.4	Discussion.....	83
II.5	Conclusion	87
III.	Sub-study B - Effects of an essential amino acid supplementation on neural and peripheral muscle adaptations following heavy-load training.....	87
III.1	Introduction	87

III.2	Methods	88
III.3	Results	88
III.4	Discussion	93
III.5	Conclusion	96
STUDY 2- Effects of a leucine-enriched essential amino acid supplementation on neural and muscle adaptations following heavy-load training		
I.	Subjects	97
II.	Sub-study A - Effects of a leucine-enriched essential amino acid supplementation on muscle mass, architecture and maximal strength following heavy-load training	97
II.1	Introduction	97
II.2	Methods	98
II.3	Results	98
II.4	Discussion	102
II.5	Conclusion	104
III.	Sub-study B - Effects of a leucine-enriched essential amino acid supplementation on neural and peripheral muscle adaptations following heavy-load resistance training.....	105
III.1	Introduction	105
III.2	Methods	105
III.3	Results	106
III.4	Discussion	109
III.5	Conclusion	112
STUDY 3- Potential effects of an essential amino acid supplementation on muscle damage following a heavy-load eccentric training session		
I.	Introduction	113
II.	Methods.....	114
III.	Results	115
IV.	Discussion.....	118
V.	Conclusion.....	121
GENERAL DISCUSSION.....		
EFFECTS OF AN ESSENTIAL AMINO ACID/PROTEIN SUPPLEMENTATION		
IMPACT OF INITIAL PROTEIN DIET		
IMPACT OF TRAINING STATUS.....		
SELECTIVE MUSCLE HYPERTROPHY		
IMPACT OF COMPOSITION AND TIMED INGESTION OF THE SUPPLEMENT		
CONCLUSION.....		

BIBLIOGRAPHY	132
APPENDIX	159
Appendix 1	159
Appendix 2	170

