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THE SOUTH PACIFIC ISLANDS RESIST DIABETES WITH INTERSE TRAINING (SPIRIT) STUDY

Impact of Progressive Resistance Training and Aerobic Training on Glycaemic Control in Māori and Pacific Islands People with Type 2 Diabetes and Grade III Obesity



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

The purpose of the South Pacific Islands Resist diabetes with Intense Training (SPIRIT) study was to evaluate and compare the effectiveness of two conventional training modalities for improving glycosylated haemoglobin (HbA_{1c}) and related physiological and psychological outcomes in Polynesian adults diagnosed with type 2 diabetes and visceral obesity. Twenty-six adults of self-identified Māori or Pacific Islands descent (20 women, 6 men; 47 ± 8 years; 116.3 ± 27.5 kg; waist circumference 124.0 ± 17.8 cm) were randomised to progressive resistance training (PRT) or aerobic training (AER), 3x/week, for 16 weeks. Nine subjects per exercise group ($n = 18$) completed the study and were included in per protocol analyses. Within-group ANOVAs revealed that HbA_{1c} remained elevated in PRT and AER after 16 weeks of training (10.7 ± 2.1 to $10.6 \pm 2.4\%$, $P > 0.05$; 8.9 ± 1.9 to $8.8 \pm 2.1\%$, $P > 0.05$, respectively). AER resulted in significant reductions in systolic ($P = 0.006$) and diastolic blood pressure ($P = 0.02$), an increase in skeletal muscle GLUT4 ($P = 0.02$), capillary density ($P = 0.05$), and power output (watts) ($P < 0.001$), while PRT resulted in a significant increase in upper ($P = 0.001$) and lower body strength ($P < 0.001$) and a reduction in hip circumference ($P = 0.05$). Eight (5 AER, 3 PRT) of 18 subjects completed $\geq 75\%$ of available training sessions. Post-hoc analysis on these eight patients revealed a significant reduction in waist circumference ($P < 0.001$). Despite low attendance, many SF-36 QOL domains scores and the Physical Component Summary scores significantly improved in both groups ($P \leq 0.002$). The findings of this doctoral research project suggest that improvement of metabolic outcomes may be delayed or overwhelmed by a combination of low attendance and class III morbid obesity ($\text{BMI} \geq 40 \text{ kg/m}^2$). The improvements observed in QOL and muscle outcomes suggest that psychological and myocellular changes may precede

changes in systemic metabolic outcomes. Additional research is required to investigate these hypotheses and overcome barriers to exercise adoption in Māori and Pacific Islands people with morbid obesity and type 2 diabetes.

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In loving memory of Nikotemo Lopa (24 September 1964 – 27 May 2009), an inspiring man of great humility who represented the spirit of the SPIRIT study and touched the lives of all with whom he came into contact.

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LIST OF ACRONYMS

1RM	1 Repetition Maximum
ACSM	American College of Sports Medicine
AER	Aerobic exercise
AHA	American Heart Association
ANOVA	Analysis of Variance
β-blocker	beta blocker
BMI	Body Mass Index
BSA	Bovine Serum Albumin
CONSORT	Consolidated Standards of Reporting Trials
CRP	C-Reactive Protein
CV	Coefficient of Variation
DBP	Diastolic Blood Pressure
DEXA	Dual Energy X-ray Absorptiometry
FFA	Free Fatty Acids
GLUT4	Glucose Transporter 4 th isoform
GOX	Glucose Oxidation
HbA _{1c}	Haemoglobin A _{1c} (glycated haemoglobin)
HDL	High Density Lipoprotein
HOMA-β	Homeostasis Model Assessment beta cell function
HOMA2-IR	Homeostasis Model Assessment Insulin Resistance (v.2)
HRR	Heart Rate Reserve
LDL	Low Density Lipoprotein
MET	Metabolic Equivalent
NOX	Non-oxidative glucose metabolism
OCT	Optimal Cutting Temperature embedding medium
PBS	Phosphate Buffered Saline
PRT	Progressive Resistance Training
QOL	Quality of Life
RMANOVA	Repeated Measures Anova
RPE	Rating of Perceived Exertion
SBP	Systolic Blood Pressure
SF36	Medical Outcomes Trust Short-Form 36 questionnaire
SPARC	Sport and Recreation New Zealand
SPIRIT	South Pacific Islands Resist diabetes with Intense Training
VLDL	Very Low Density Lipoprotein
VO ₂	Volume Oxygen consumed
WRS	William R. Sukala