

**Effects of obesity and diet induced weight loss on cardiovascular
risk factors, vascular and ventricular structure and function,
prostate symptoms and sexual function in obese men.**

A thesis submitted to the University of Adelaide by

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Discipline of Medicine

University of Adelaide and Royal Adelaide Hospital

South Australia

For the degree of

Doctor of Philosophy

February 2009

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ABSTRACT

Obesity is a major epidemic and is increasing in prevalence worldwide.^{1,2} The health problems and consequences of obesity include cardiovascular disease (CVD) risk factors, such as hypertension, hyperlipidemia, glucose intolerance and diabetes mellitus.^{3, 4} Each of these abnormalities directly promotes atherosclerosis. More recently, visceral obesity has been shown to be independently associated with abnormalities of both the ventricular and vascular structure and function. The mechanisms by which they occur remain incompletely defined.

Cardiovascular magnetic resonance imaging (CMR) offers several advantages for evaluation of cardiac structure and function in the obese. The high accuracy and reproducibility of the technique allows for detection of very small changes in ventricular volumes, mass, ejection fraction, and cardiac output with a relatively small sample size, as compared with echocardiography. In this thesis we investigated whether cardiovascular magnetic resonance imaging can better characterize possible cardiac abnormalities associated with obesity, in the absence of other confounding comorbidities.

Obesity is associated with myocardial and vascular function, the extent of reversibility of these abnormalities with rapid acute weight loss remains uncertain. Therefore the first aim of the study was to (i) determine the relationship between obesity and left ventricular structure and function using magnetic resonance imaging, and (ii) the acute effects of rapid diet-induced weight loss on cardiac and vascular function in normal obese and obese diabetic men.

Erectile dysfunction is related to cardiovascular risk factors such as obesity by an impairment of endothelial function. Therefore, symptoms of erectile dysfunction are probably to precede cardiovascular disease and events. The second aim of this study was to (i) determine the relationship between obesity and erectile function (EF), sexual desire (SD), lower urinary tract symptoms (LUTS) and quality of life (QOL) measures in obese males, and (ii) determine the effects of rapid diet-induced weight loss on EF, SD, LUTS and QOL measures in normal obese and obese diabetic men. In this group of men, obesity was associated with mild/moderate erectile dysfunction, and significant LUTS, which together with sexual desire improved following rapid diet induced weight loss, but was not directly related to the amount of weight loss or changes in measured metabolic state.

Pericardial adipose tissue (PAT) covers 80% of the heart and constitutes 20% of its weight. PAT mass is related to the amount of abdominal fat and the risk of coronary atherosclerosis. Epicardial fat mass may be a sensitive indicator of cardiovascular risk. The third aim of this study was to (i) determine the relationship between obesity and PAT volume and (ii) effectively evaluate the impact of caloric restriction and associated weight reduction on epicardial fat volume via cardiac magnetic resonance imaging (CMR). This is the first study to show a reduction in PAT volume is associated with caloric restriction.

DECLARATION OF ORIGINALITY

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the copyright Act 1968.

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ACKNOWLEDGEMENTS

I wish to express sincere appreciation to my supervisors, Professor Gary Wittert and Professor Stephen Worthley who have provided invaluable support and guidance.

Thank you to all the staff from the Department of Medicine, Cardiovascular Research Centre, Cardiac Outpatients, Wakefield MRI, and Adelaide Cardiology Echo Department who have given me support through my PhD. I would especially like to thank the administrative staff Angela Hooper, Susan Rogers, and Emily Wooldridge. Thank you to Andrew McAinch for assistance with the dietary plan.

I would like to acknowledge Pharmacy Health Solutions Pty Ltd for providing KicStart.

Thank you to all the volunteers who participated in my studies.

Finally, I wish to thank my family for their continuous love and support.

LIST OF ABBREVIATIONS

AHA	American Heart Association
AF	Atrial fibrillation
BMI	Body mass index
BP	SF-36 domain: Bodily pain-intensity of bodily pain or discomfort
cFT	Calculated free testosterone
CHD	Coronary heart disease
CMR	Cardiac magnetic resonance
CRP	C-reactive protein
CT	Computed tomography
CV	Coefficient of variation
CVD	Cardiovascular disease
DBP	Diastolic blood pressure
ECHO	Echocardiography
ED	Erectile dysfunction
EF	Ejection fraction
Em	Mitral annular early relaxation velocities
FAI	Free androgen index
FMD	Flow mediated dilatation
FOV	Field of View
fT	Free testosterone
GE	Gradient-echo
GH	SF-36 domain: General health-general health perceptions

HDL	High density lipoprotein
IIEF	International index of erectile function
IMVS	Institute of Medical and Veterinary Science
IMT	intimal–medial thickness
IPSS	International prostate symptom scale
IVRT	Isovolumic relaxation
LAP	Left atrial pressure
LCD	Low calorie diet
LDL	Low density lipoprotein
LUTS	Lower urinary tract symptoms
LV	Left ventricular
LVEDV	LV end diastolic volume
LVESV	LV end systolic volume
MH	SF-36 domain: Mental health-psychological distress and wellbeing
MRI	Magnetic resonance imaging
NTG	Nitroglycerin
OSA	Obstructive sleep apnoea
PAT	Pericardial adipose tissue
PC	phase contrast
PF	SF-36 domain: Physical function-limitations in physical activities because of health problems
PSLAX ED	Parasternal long view, end diastole
PSLAX ES	Parasternal long view, end systole
PSSAX ED	Parasternal short axis view, end diastole

PSSAX ES	Parasternal short axis view, end systole
QOL	Quality of life
RAH	Royal Adelaide Hospital
RDI	Recommended daily allowance
RE	SF-36 domain: Role emotional-limitations in usual role activities because of emotional problems
RP	SF-36 domain: Role physical-limitations in usual role activities because of physical health problems
RT3DE	Real time 3-dimensional echocardiography
RV	Right ventricular
SBP	Systolic blood pressure
SD	Sexual desire
SDI-2	Sexual Desire Inventory 2
SE	Spin echo
SEM	Standard error mean
SF	SF-36 domain: Social functioning-limitations in social activities due to physical or emotional problems
SF-36	36-item Short form health survey
SHBG	Sexual hormone binding globulin
SWT	Systolic wall thickening
T	Testosterone
TC	Total cholesterol
TDE	Tissue Doppler Echocardiography

TE	Echo time
TR	Repetition time
TrueFISP	Fast imaging with steady state free precession
TT	Total testosterone
TTE	Transthoracic Echocardiography
TVI	Tissue velocity imaging
VLCD	Very low calorie diet
VT	SF-36 domain: Vitality-energy and fatigue
W	Weight
WC	Waist circumference
WHO	World Health Organisation