

Exploring the acceptability of, and adherence to, a  
carbohydrate-restricted, higher fat diet as an instrument for  
weight loss in women aged 40-55 years

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## **Abstract**

It is well recognised that aging in females is associated with a predilection for weight gain. Women with abdominal obesity are known to be at especially high risk of cardiovascular and metabolic disease, as well as associated poorer overall health outcomes. Many of these metabolic disorders however, can be alleviated through weight loss. The increasing evidence around the impact of hormonal function on weight gain and body composition validates the need for further investigation into the dietary effect on menopause-affected hormones.

Current dietary and weight-loss guidelines, considered to be 'best practice', equate to promotion of a diet with a macronutrient profile comprising high levels of carbohydrate, moderate amounts of protein, and minimal fat. In contrast to this traditional 'best practice' approach, an alternative weight-loss strategy promoting a model of eating that is lower in carbohydrate, moderate in protein, and higher in fat has been posited as an effective weight-loss option. The low carbohydrate, high fat (LCHF) dietary approach recognises that the macronutrient composition of the diet itself may have a positive impact on weight loss due to hormonal interactions.

This exploratory study investigated the acceptance of, and adherence to, a LCHF diet in women aged 40 – 55 years. The primary outcome measures of this study were barriers to and motivators for acceptance of and adherence to this way of eating. Secondary outcomes included mood state, adherence, satiety levels, and weight loss. The aim of this study was to determine factors affecting women aged 40 – 55 years in modifying dietary behaviours and maintaining those behaviours while undertaking a LCHF way of eating. The hypothesis underpinning this study was that LCHF - through its macronutrient profile - has the potential to enhance an individual's adherence to the behavioural lifestyle modifications required to reduce weight and improve metabolic health outcomes. Furthermore, adherence to dietary modifications could be maximised by the combination of appropriate health behaviour theories (HBT), the web-based nature of the study, and the satiating effect of LCHF food options.

Overall, mean percentage weight loss from baseline to study completion was 5.6%. Weight loss was greatest in participants with the highest average adherence levels across the study period. The overall average adherence level of 83.5% was a positive outcome and reflected focus

group results around factors that impacted adherence. These key findings included support by family members, in particular spouses, who appeared to act as both a barrier and motivator to adherence, satiety, or feeling of fullness, and being prepared, in particular having acceptable LCHF options readily available.

Findings from this study suggest that a LCHF way of eating was both acceptable and feasible for study participants. Furthermore this way of eating elicited weight loss and allowed adherence to the dietary intervention, possibly through the mechanism of improved satiety. While findings suggest that LCHF may be a promising weight loss approach for this population, further research is required for this target group.

# Table of Contents

Abstract.....	2
Table of Contents .....	4
List of Tables .....	9
List of Figures .....	9
List of Abbreviations .....	11
Acknowledgements .....	13
Declaration.....	15
Co-Authored Works .....	16
Chapter 1: Introduction .....	17
1.1 Background to the research.....	17
1.2 Significance of the research.....	19
1.3 Study aims .....	20
1.4 Study limitations.....	20
1.5 Study delimitations .....	20
1.6 Thesis structure and outline .....	21
Chapter 2: Literature review - An evidenced-based exploration into LCHF weight-loss strategies for middle-aged women.....	23
2.1 Introduction.....	23
2.2 Menopause, oestrogen, and insulin resistance.....	25



2.3 Insulin, leptin and weight gain .....	28
2.4 Weight loss interventions.....	30
2.5 Application of behaviour change theory in dietary intervention .....	37
2.6 Summary .....	43
 Chapter 3: Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years: Intervention design and rationale.....	45
3.1 Preface.....	45
3.2 Introduction.....	46
3.3 Methods.....	49
3.3.1 Participants .....	49
3.3.2. Protocol .....	49
3.3.3 Measures .....	50
3.3.4 Intervention description .....	51
3.3.4.1 Nutrition approach.....	51
3.3.4.2 Theoretical framework for intervention delivery .....	51
3.3.3 Intervention components .....	52
3.3.3.1 Website .....	52
3.3.3.2 Resources .....	53
3.4 Discussion .....	55
 Chapter 4: Intervention Resource .....	58

<b>4.1 Preface.....</b>	<b>58</b>
<b>4.2 Background Information.....</b>	<b>59</b>
4.2.1 Introduction.....	59
4.2.2 About the Study .....	60
4.2.3 The Research Team.....	61
<b>4.3 Food Lists .....</b>	<b>62</b>
4.3.1 Foods to Include .....	62
4.3.2 Foods to Avoid.....	63
4.3.3 A Basic Eating Plan .....	64
4.3.4 Shopping List.....	65
<b>4.4 Tips and Tricks .....</b>	<b>66</b>
4.4.1 Socialising .....	66
4.4.2 Alcohol.....	67
4.4.3 Travel.....	68
4.4.4 Carb Flu .....	69
4.4.5 Snacks .....	70
4.4.6 Drink Options.....	71
<b>4.5 LCHF Recipes .....</b>	<b>72</b>
4.5.1 Main meals .....	72

4.5.2 Cakes and desserts .....	73
4.5.3 Breakfast options .....	74
4.5.4 Sauces and Dressings.....	75
4.5.5 Snack Options .....	76
<b>4.6 Overview of Program Timeline and Weekly Content .....</b>	<b>77</b>
4.6.1. Programme Commencement .....	77
4.6.1 Blog/Posts – Week 1 .....	78
4.6.2 Blog/posts - Week 2 .....	81
4.6.3 Blog/posts - Week 3 .....	84
4.6.4 Blog/posts - Week 4 .....	87
4.6.5 Blog/posts - Week 5 .....	90
4.6.6 Blog/posts - Week 6 .....	93
4.6.7 Blog/posts - Week 7 .....	96
4.6.8 Blog/posts - Week 8 .....	99
<b>Chapter 5: Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years. ....</b>	<b>102</b>
<b>5.1 Preface.....</b>	<b>102</b>
<b>5.2 Background.....</b>	<b>103</b>
<b>5.3 Methods.....</b>	<b>106</b>
5.3.1 Intervention.....	107

5.3.2 Participants .....	107
5.3.3 Questionnaire / scales .....	107
5.3.3.1 Profile Of Moods States .....	108
5.3.3.2 Adherence scale .....	108
5.3.3.3 Satiety scale .....	109
5.3.3.4 Self-reported weight .....	109
5.3.3.5 Focus groups .....	109
5.3.4 Data analysis .....	110
<b>5.4 Results.....</b>	<b>111</b>
5.4.1 Survey data .....	112
5.4.2 Focus group data.....	115
<b>5.5 Discussion .....</b>	<b>118</b>
<b>5.6 Conclusion .....</b>	<b>123</b>
<b>Chapter 6: Discussion .....</b>	<b>125</b>
<b>6.1 Preface.....</b>	<b>125</b>
<b>6.2 Introduction.....</b>	<b>126</b>
<b>6.3 Key Findings .....</b>	<b>126</b>
6.3.1 Additional findings .....	132
<b>6.4 Implications of research .....</b>	<b>135</b>
<b>6.5 Summary .....</b>	<b>137</b>

References .....	138
Appendices .....	147
Appendix 1: Ethics approval, Auckland University of Technology Ethics Committee .....	147
Appendix 2: Participant Information Sheet .....	148
Appendix 3: Consent Form .....	150
Appendix 4: Weekly questionnaire .....	151
Appendix 5: Screening Questionnaire .....	162
Appendix 6: Recruitment advertisement .....	164

## List of Tables

Table 3.1: Timetable and mode of intervention component delivery .....	50
Table 3.2. Description of intervention components .....	54
Table 5.1. Focus group schedule of questions .....	111
Table 5.2: Transcripts supporting focus group themes .....	116

## List of Figures

<b>Figure 5.1:</b> Self-reported satiety (◆), adherence (■), and change in weight (▲), presented by low, medium, and high adherence level, and for all participants combined. ....	113
¶ (¶ <b>HYPERLIN</b> Self-reported satiety (◆), adherence (■), and change in weight (▲) for selected individual participants .....	114

**Figure 5.3.** POMS: Vigour (◆), TNMS (■), TMDS (▲), changes in weight (x) and adherence.

POMS: Profile of mood states; TMDS: Total mood disturbance, Score TNMS: Total negative mood score. .... **115**

## List of Abbreviations

AUC	Augmented usual care
AUT	Auckland University of Technology
AUTEC	Auckland University of Technology Ethics Committee
BMI	Body mass index
CCK	Cholecystokinin
CVD	Cardiovascular disease
DNL	De novo lipogenesis
FFQs	Food frequency questionnaires
GI	Gastrointestinal
HBT	Health behaviour theory
HDL	High density lipoprotein
IRS	Insulin resistance syndrome
LCHF	Low carbohydrate, high fat
LDL	Low density lipoprotein
LPL	Lipoprotein lipase
NZ	New Zealand
POMS	Profile of mood states
RCT	Randomised controlled trial
SCT	Social cognitive theory
SDT	Self determination theory
SF	Short Form
SOC	Stages of change
TPB	Theory of planned behaviour

TMDS	Total mood disturbance score
TNMS	Total negative mood score
TTM	Trans-theoretical model
WHO	World Health Organisation



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## Declaration

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed .....

Date .....

## Co-Authored Works

McPhee, J., Zinn, C., & Oliver, M. (2014). Exploring the acceptability of, and adherence to, a low carbohydrate, high fat diet as a weight-loss approach in women aged 40-55 years: Intervention design and rationale. Manuscript submitted for publication to *Nutrition and Health*.

McPhee, J., Zinn, C., & Oliver, M. (2015). Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years. Manuscript submitted for publication to *International Journal for Current Research*.

The contributions for the papers are as follows:

Article 1: Exploring the acceptability of, and adherence to, a low carbohydrate, high fat diet as a weight-loss approach in women aged 40-55 years: Intervention design and rationale. McPhee J (70%), Zinn C (20%) & Oliver M (10%)

Article 2: Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years. McPhee J (80%), Zinn C (10%) Oliver M (10%)

# Chapter 1: Introduction

## 1.1 Background to the research

In February 2012, following several years of investigating personal weight-loss options, I made the decision to embark on a low carbohydrate high fat (LCHF) diet. The opportunity arose through a workplace challenge, and was coupled with the guidance of a NZ registered nutritionist. I was a 47-year-old woman struggling to keep my weight under control while following national public health dietary and physical activity recommendations. These dietary guidelines, considered 'best practice', equated to a diet comprising high levels of carbohydrate, moderate amounts of protein, and minimal fat (Ministry of Health, 2003). Whilst previous attempts to lose weight using both fat and calorie restriction had elicited weight loss, I had been unable to either sustain implemented dietary modifications, or maintain achieved levels of weight loss. My weight was trending upwards at a rate corresponding to average weight gain for a woman of my age (Brown, Williams, Ford, Ball, & Dobson, 2005). I recognised the opportunity I was being offered, and the benefit of making major modifications to my diet. Furthermore, I recognised the value of trialling a new diet with the assistance of a health professional and within a supportive workplace environment.

Modifying my diet to a LCHF eating model, I removed high carbohydrate foods and ingredients (i.e. bread, rice, pasta, flour, starchy vegetables, and most processed and packaged foods), and increased the amount of green leafy vegetables, nuts, seeds, and full fat foods such as dairy, coconut oil, olive oil, seafood, meat, and poultry. By default, my diet changed to one that was based on whole foods; that is foods that are minimally processed and packaged. This way of eating elicited weight loss and appealed to me in several ways, one of which was that I felt satiated by the foods I was consuming. The resultant feeling of fullness created a reduction in the amount of food I desired overall, which helped me to adhere to the dietary regime. In support of my own experience, evidence shows that compared to carbohydrate, dietary fat does have a greater satiating effect on women (Chambers & Yeomans, 2011). The impact on satiety indicates that from an adherence point of view, a LCHF diet could be an equally and perhaps even more effective weight-loss strategy as the mainstream guidelines of fat restriction and overall calorie restriction (Volek & Westman, 2002).

As I embarked on my personal weight-loss intervention, I observed women of a similar age noticeably gaining weight; women that I knew were exercising regularly and eating a 'balanced' diet dominated by whole grain breads and cereals, and fruit and vegetables. Furthermore, I recognised they were following 'mainstream' dietary guidelines dispensed by health professionals and frequent public health and media communications. These 'mainstream' guidelines involved consuming a calorie-controlled diet with a high carbohydrate, low fat macronutrient profile. These women were undertaking what they believed to be the correct strategy for losing and maintaining weight. Clearly these messages were not having the desired impact from a weight loss perspective.

Evidence derived from both peer reviewed studies and from practice suggests that while LCHF diets provide effective weight loss outcome (Sacks et al., 2009; Samaha et al., 2003), adherence to any diet is a strong predictor of weight loss success (Alhassan, Kim, Bersamin, King, & Gardner, 2008). I was aware that the support I had garnered in undertaking the LCHF dietary modifications in a group situation had contributed to my ability to adhere to the LCHF diet. I appreciated however, that many women lack the support to adhere to dietary modifications for a period necessary to elicit weight loss. Evidence suggests that participants in structured weight-loss programmes achieve improved weight-loss outcomes when compared to those endeavouring to lose weight autonomously, and that adherence is often higher during monitored research and supported interventions (Ammerman et al., 2002). In addition, I realised that further investigation is required around the acceptability of LCHF food options for middle-aged women. Furthermore, in their role as mothers and/or wives, middle-aged women are often responsible for preparing food for family members, and therefore acceptability and convenience factors for the wider family group is important and warrants investigation.

Inconsistency in weight change observed across dietary weight-loss trials is multifactorial, but according to (Sacks et al., 2009) might be attributable to physiological mechanisms, such as insulin-resistance (McClain, Otten, Hekler, & Gardner, 2013). For many women the prevalence of central adiposity and features of metabolic syndrome (i.e. diabetes, insulin resistance, and dyslipidaemia) develop as a result of a reduction in the hormone oestrogen in the approach to middle age (Carr, 2003). Oestrogen is recognised as having a modulating effect on the hormone insulin, a hormone responsible for facilitating fat storage and energy modification

(Ferland, Château-Degat, Hernandez, & Eckel, 2012). Withdrawal of oestrogen levels has been posited as a cause of increased body fat across the life stages of women (Gozansky, Brooks, & Kohrt, 2007). Furthermore, insulin resistance may predispose individuals to be less successful in adhering to a traditional low fat, high carbohydrate diet, causing higher rates of attrition and negatively impacting on weight loss (McClain et al., 2013).

As mothers, wives, employees and career women, women fulfil a multitude of demanding nurturing, familial, and societal roles (Bullers, 1994), frequently disregarding their own health requirements to address those of family members (Artazcoz, Borrell, Benach, Cortès, & Rohlfs, 2004). Women approaching middle age and menopause are no less susceptible than other population groups to the confusion and debate around effective and sustainable weight-loss strategies. It is apparent that further research is warranted to investigate barriers and motivators to women of this age group, in making lifestyle changes required to elicit weight loss and improve metabolic health. The gap in knowledge pertaining to adherence and acceptability of a low carbohydrate diet as a weight-loss option for middle-aged women has created a demand for further investigation into these factors.

## **1.2 Significance of the research**

This study will investigate factors affecting women aged 40 – 55 years in modifying and maintaining dietary behaviours while undertaking a LCHF way of eating for weight-loss purposes. Employing a mixed methods approach, drawing from multiple data sources and research methods, the research will provide a detailed account of factors that may impact acceptability of, and adherence to, a LCHF way of eating.

The intervention was designed utilising evidence-based best practice approaches to dietary modification, and will investigate the utility and appropriateness of utilising a health behaviour theory (HBT), internet-based intervention in this population group. The research and the review of current literature will begin to bridge the significant research gap in the barriers and motivators to adherence to the LCHF dietary approach and to weight-loss interventions in the target population. Findings may inform the development, implementation, and evaluation of future research in this field.

### **1.3 Study aims**

The research has two main aims; both are in the context of middle-aged women as a population group. These aims will be achieved by the delivery of an intervention that draws upon best practice HBT and employs the delivery method of internet technology.

1. To determine factors influencing the adherence to and acceptability of a LCHF diet.
2. To investigate barriers to and motivators for acceptability of and adherence to a LCHF diet.

### **1.4 Study limitations**

1. The self-report nature of the data collected limits the accuracy of data components such as adherence and satiety levels, and true weight measures.
2. The possible disparity in participant interpretation of the LCHF eating model meant full compliance with the intended diet could not be quantified.

### **1.5 Study delimitations**

1. The research was not designed as a randomised controlled trial (RCT) to assess the weight loss efficacy of LCHF eating, but rather was designed to measure acceptability and adherence of this way of eating by employing a mixed methods (descriptive, qualitative) approach. As a result weight-related outcome measures cannot be directly attributed to the intervention.
2. An Auckland-based sample was selected for convenience purposes, due to the focus groups needing to be conducted in one place, the most convenient place being Auckland.
3. Age criteria were set to encompass a range of ages across the middle-age spectrum. While it is unclear whether age or menopausal status has the greater bearing on weight gain in women, this selected age criteria included a probable level of menopausal symptoms impacting metabolic health and weight status.
4. While a prescribed eating plan was not provided, resources provided participants with a comprehensive guide and recommended food choices. It is possible that participants



may have interpreted and translated the LCHF eating model differently, consuming a range of macronutrient profiles.

5. The study was conducted over an eight-week period. A longer study may have assessed longer-term levels of adherence.

## **1.6 Thesis structure and outline**

This thesis is presented as a series of chapters that include a combination of original research and associated reviewed literature. Chapter 1 describes the background, limitations, and delimitations of the study. Following on from this, Chapter 2 comprises a literature review exploring the current knowledge base on weight gain in pre-menopausal women, and the associated hormonal interaction. The review profiles weight-loss strategies appropriate to this population, and highlights the need for further investigation into diet and the effect of menopause-affected hormones, in particular insulin. It also describes the gap in knowledge pertaining to the translational aspects of adherence and acceptability of low carbohydrate diets as a weight-loss option for middle-aged women, thereby creating a demand for investigation into these factors. Theories underpinning health behaviours and behaviour modification are explored along with the design of effective and sustainable weight-loss interventions. Chapter 3 comprises a description and rationale of the design of the weight-loss intervention. It describes the development and implementation of an internet-based LCHF-based dietary behaviour change intervention: the Women's Health Research Programme. With the application of HBTs, this programme was designed to allow for individual participants' existing stage of change, and level of knowledge around the LCHF dietary guidelines. The chapter outlines the methodology employed and investigates application of appropriate HBTs to optimise adherence and subsequent success of weight-loss programmes. Furthermore, a description and justification of the use of internet technology as an appropriate medium for programme delivery for this population is described. This chapter has been presented in the form of a peer-reviewed journal article and is currently under review with *Nutrition and Health*. Chapter 4 displays the full set of web-based resources made available to LCHF Women's Health Research Programme participants. Chapter 5 describes and discusses issues surrounding adherence to, and acceptability of the weight loss intervention, using the Women's Health Research Programme. This chapter is centred on the concept that satiety derived from eating in the LCHF way

positively impacts adherence. A combination of descriptive and qualitative focus group data is presented. A mixed methods approach was applied by using descriptive information derived from quantitative data, to inform the qualitative component of the study. Additional factors impacting women's adherence, i.e. family, spousal and social support, and lifestyle adaptations enhancing adherence are presented and discussed. This chapter has been presented in the form of a peer-reviewed journal article and is currently under review with The International Journal for Current Research. The sixth and final chapter comprises an overall discussion of the thesis topic, connecting findings from previous chapters with the existing body of research, and providing an in-depth overview of factors influencing adherence to weight-loss strategies. This chapter will explore the theory that a LCHF diet is an appropriate weight-loss option for middle-aged women. Furthermore, it will investigate additional concepts arising from the research that could further impact adherence and acceptability of the LCHF approach.

It is important to recognise that as a result of this thesis being presented as a literature review combined with two stand-alone peer-reviewed research papers, a level of repetition is unavoidable. Such repetition is noted in the introduction sections in Chapters 2, 3 and 5, as the same rationale encompasses all three components of this research.

## **Chapter 2: Literature review - An evidenced-based exploration into LCHF weight-loss strategies for middle-aged women.**

### **2.1 Introduction**

Worldwide, overweight and obesity rates have more than doubled in the last three decades, with 1.4 billion adults over the age of 20 years currently classified as overweight (body mass index (BMI) 25–29.9 kg/m<sup>2</sup>) or obese (BMI ≥ 30 kg/m<sup>2</sup>) (World Health Organization [WHO], 2006). Furthermore, obesity has become one of the most common nutrition-related conditions globally (WHO 2013). Defined as excessive or abnormal accumulation of fat, overweight and obesity present a significant risk to a person's health and are major risk factors contributing to the incidence of chronic disease including diabetes, cardiovascular disease (CVD) and some cancers (WHO 2013). While there is some indication that obesity rates are abating, certain population groups exhibit disproportionate rates of obesity and thus are at greater risk of related complications. For example, while global overweight and obesity rates are relatively similar between females and males (35% versus 34%, respectively), substantially more women than men are classified as obese (14% versus 10%, respectively) (WHO 2013).

It is well-recognised that aging in females is associated with a predilection for weight gain (Brown et al., 2005). While weight gain *per se* cannot be attributed to the onset of menopause, hormonal activity at this life stage is associated with an increase in both body fat and central adiposity (S. R. Davis et al., 2012). It remains unclear however, as to whether aging is the cause, or whether weight gain in pre-menopausal and menopausal women is due to associated hormonal vicissitudes. Women with abdominal obesity (i.e. the accumulation of fat around the abdomen) are known to be at especially high risk of cardiovascular and metabolic disease, as well as associated poorer overall health outcomes and lower quality of life (Carr, 2003). This relationship holds true for middle-aged women; with women classified as overweight or obese exhibiting higher rates of metabolic irregularities including hypertension and diabetes, as well as reduced mental health and energy levels (Brown et al., 1998). Many of the metabolic disorders which are attributable to the reduction in oestrogen (as exhibited in conditions such as abdominal adiposity, insulin resistance, and dyslipidaemia) however, can be alleviated through

weight loss (Carr, 2003).

Current dietary guidelines, considered to be 'best practice', equate to the promotion of a diet with a macronutrient profile comprising high levels of carbohydrate, moderate amounts of protein, and minimal fat (Ministry of Health, 2003). While weight-loss interventions are largely based on these guidelines, and are fundamentally built on calorie or energy restriction, there remains no consensus over the optimal ratio of dietary macronutrient composition in enhancing long-term weight loss (Das et al., 2007). This 'best practice' weight loss approach may result in short-term weight loss, however, it has had little impact on global overweight and obesity prevalence (WHO 2013). An alternative nutrition paradigm for weight loss, i.e. the LCHF way of eating, is founded on the hypothesis that a major contributor to obesity and overweight is actually the distribution of energy internally, and a defect in hormonal response to fat metabolism (Acheson, 2010). As such, the LCHF way of eating has been implicated as an equally effective and safe weight-loss strategy as a traditional fat-restricted diet (Volek & Westman, 2002). It is probable that a LCHF diet may suppress appetite and subsequently positively impact adherence to weight-loss interventions (Volek, VanHeest, & Forsythe, 2005). Furthermore, it has become apparent that dietary fat has a satiating effect on women (Chambers & Yeomans, 2011).

Approximately 20% of individuals attempting to lose weight are able to successfully sustain weight loss and achieve long-term weight maintenance (Wing & Hill, 2001). With the development of health behaviour theories (HBT) to better understand the determinants of health behaviours (Noar & Zimmerman, 2005), it is probable that intervention design for weight-loss studies can be enhanced by appropriate and multi-levelled application of HBT (Ammerman, Lindquist, Lohr, & Hersey, 2002). However, efficacy of behaviour change theory does appear to depend on the type of behaviour being modified (Glanz, Rimer, & Viswanath, 2008). While there remains no clear understanding as to the most effective behavioural intervention for eliciting dietary change (Ammerman et al., 2002), the complexities of behaviours impacting long-term weight loss may be addressed through the application of several HBTs.

It is well recognised that the nature of delivery and design of weight-loss interventions, and the suitability to the target population, contributes to their success (Tate, Wing, & Winnett, 2001).

Internet technology carries distinct benefits as a medium for such interventions. Not only does this technology allow for a greater population reach, it also provides additional flexibility in relation to venue and time of access to information. Furthermore, this medium provides an additional capability to combine and communicate a range of alternative forms of media, such as video and photographic material. In support of the use of web-based weight-loss programmes, Collins et al. (2010) concluded that creating evidence-based programmes fashioned on HBT might favourably impact outcomes of weight-loss interventions.

There is a clear requirement for evidence-based information on which to formulate dietary recommendations, and for effective and sustainable interventions to reduce body size and improve metabolic outcomes in middle-aged and peri-menopausal women. This review will focus on two key areas from a substantial body of evidence surrounding the topic of weight loss and weight loss maintenance. Firstly, it will examine the hormonal responses to energy consumption and the consequent impacts on weight status. A detailed account of the interaction of dietary and sex hormones including insulin, and leptin, on both metabolic health and weight gain in middle-aged women and in the general population will be presented. Secondly, the review will examine several aspects of weight loss interventions. It will explore the efficacy and safety of the LCHF weight-loss approach compared with traditional low fat dietary strategies in a range of population groups. Furthermore, an examination of the literature pertaining to HBT, the application of appropriate theory to weight loss-strategies, and subsequent impact on weight loss outcomes will be presented.

## **2.2 Menopause, oestrogen, and insulin resistance**

Menopause is defined as the absence of menstruation for 12 consecutive months. This life stage is preceded by peri-menopause, and is characterised by menstrual irregularity, commencing when the menstrual cycle length changes from an established pattern to one less consistent than in previous cycles (Burger, Dudley, Robertson, & Dennerstein, 2001). The lack of a consistent age heralding the onset of menopause has created uncertainty around whether aging or menopausal status impacts the metabolic health of women (S. R. Davis et al., 2012). While weight gain, particularly an increase in central adiposity, increases in post-menopausal women, this physiological response commences during peri-menopause. Metabolic disorders

(i.e. diabetes, insulin resistance, and dyslipidaemia) in peri-menopausal and menopausal women are largely determined by weight status (Lobo, 2008).

It appears that for many women, the prevalence of central adiposity and features of metabolic syndrome transpire as a result of a reduction in oestrogen (Carr, 2003). During menstruation, women are likely to experience decreased caloric ingestion at the late follicular phase, associated with increased oestrogen levels, and a lower resting metabolic rate during the early follicular or lowered oestrogen levels stage (Gozansky et al., 2007). This suggests that withdrawal of oestrogen levels may contribute to an increase in total body fat in women (Gozansky et al., 2007). Furthermore, it is understood that oestrogen has a modulating effect on the hormone insulin, and on lipoprotein lipase (LPL; a water-soluble enzyme responsible for breaking down triglycerides), both of which are recognised as impacting central adiposity (Ferland et al., 2012). LPL is instrumental in the role of regulating the supply of fatty acids to various tissues for either storage or oxidation (Wang & Eckel, 2009). LPL positioned on fat cells facilitates fat storage; conversely LPL positioned on muscle cells directs the fat into the muscle cell to be burned as energy. The activity of LPL on muscle cells is ameliorated in younger women by the presence of oestrogen, thereby decreasing fat accumulation (Panotopoulos, Raison, Ruiz, Guy-Grand, & Basdevant, 1997). As oestrogen levels decline in the approach towards menopause, the positioning of LPL is transferred to fat cells, favouring storage, rather than oxidation of fat. Additionally, the physical positioning within the body (e.g. abdominal region) of LPL is facilitated by oestrogen. The activity of LPL in younger women is higher on cells below the waist, with a repositioning of LPL activity to the cells above the waist coinciding with increasing age, and consequent declining oestrogen levels. Many of the metabolic disorders which are attributable to the reduction in oestrogen can be alleviated through weight loss (Panotopoulos et al., 1997). It is apparent that the normal interactions occurring between oestrogen and insulin are contributing factors to weight gain in women throughout the life stages. Middle aged women however, are at greater risk of the prolonged and centralised weight gain through perpetually decreasing oestrogen levels (Carr, 2003).

Declining oestrogen levels are also a contributing factor to well-recognised and undesirable vasomotor symptoms which can occur during the onset of menopause (Thurston et al., 2009). Furthermore, it has become apparent that these menopausal symptoms which include hot

flushes and night sweats, are known to be augmented by the prevalence of obesity (Thurston et al., 2009). Additional associations between insulin resistance and both vasomotor symptoms and obesity indicate that the three are interconnected. A study investigating the correlation between hot flushes and insulin resistance in post-menopausal women (Bertoni et al., 2009) concluded that the prevalence of hot flushes among late transitional menopausal women with insulin resistance was 91.3%. While the relationship was not shown to be statistically significant between those women who were insulin resistant and those who weren't, women with insulin resistance experienced hot flushes that were more intense than insulin sensitive women. Comparable research has concluded that hot flushes may contribute to the thickening of the carotid intima media (thickness of the inner two layers of the arterial wall), a marker associated with incidence of CVD (Ozkaya et al., 2011). Vasomotor symptoms are well known to be associated with impaired quality of life. Evidence suggesting that vasomotor symptoms may also contribute to incidence of CVD adds to the need for investigation into weight-loss options tailored to this age group.

Conflicting theories exist that an imbalance between oestrogen and progesterone, or 'oestrogen dominance', facilitates adverse menopausal symptoms (Prior, 2005). Furthermore, while there is an assumption that all women suffer similar menopausal symptoms, there is evidence suggesting that women from different cultures experience menopausal symptoms in contrasting ways (Weismiller, 2009). In Japanese women for example, chilliness is more prevalent than the hot flushes typical in European women (Lock, Kaufert, & Gilbert, 1988; Weismiller, 2009). It has become evident that lifestyle and environmental factors are key contributors to individuals' physiological response to menopause (Huang et al., 2010), however, it appears that there are further issues to be considered with respect to reversal and/or prevention of menopausal symptoms.

While optimal levels of the hormone oestrogen are vital to good health in women, when present in excess quantities, or in the absence of adequate levels, oestrogen appears to have a potentially toxic effect (Prior, 1998). While debate continues around oestrogen status and aging, theories promoting both oestrogen dominance and decreased oestrogen levels, characterise resulting symptoms in a similar manner. There appears to be agreement that lifestyle modifications such as a diet low in processed foods and abundant in vegetables can counteract

both hormonal imbalance and incidence of typical menopausal symptoms. Weight loss underpins management of metabolic disorders, with even modest weight loss shown to improve visceral adiposity and insulin resistance (Carr, 2003).

### **2.3 Insulin, leptin and weight gain**

The hormone insulin plays a key role in overall homeostasis, primarily the maintenance of energy stores, and the regulation of plasma glucose (Gerozissis, 2008). All carbohydrates in food are ultimately transformed into glucose, entering intestinal cells through facilitated diffusion, a process dependent on insulin. Following a meal high in carbohydrates, the resultant rise in blood glucose levels acts as a stimulus facilitating secretion of insulin from the pancreas (Baura et al., 1993). Responsible for driving glucose from the blood into skeletal and adipose cells, insulin stimulates glucose oxidation for the production of energy. Insulin release is initialised by the secretion of gastrointestinal (GI) tract hormones, including gastrin, cholecystokinin (CCK) and secretin (Beglinger & Degen, 2004). In contrast, homeostatic imbalance occurs in the instance of either insufficient or abnormal insulin production, or decreased insulin sensitivity (Reaven, 1993), with the resultant dysregulation contributing to metabolic syndrome, also known as insulin resistance syndrome (IRS). Metabolic syndrome comprises a collection of disorders related to IRS including abdominal obesity, and elevated blood pressure and triglyceride levels (Grundy, 2006)

High carbohydrate diets create a continual surge in circulating insulin, causing glucose storage in the cells, with excess carbohydrate stored as fat, via a process known as de novo lipogenesis (DNL) (Hellerstein, 1999). While surplus dietary fat can be stored in adipose tissue, the storage and metabolism of excess dietary carbohydrate is more limited and complex (McDevitt et al., 2001). The intricacies of DNL are still not fully understood, and are controversial. In defective metabolic conditions, the resultant elevation of insulin (in response to carbohydrate consumption) has the effect of reducing reactivity, and decreasing the sensitivity, of the cells to the action of insulin, contributing to insulin resistance (Samaras & Campbell, 2005). Insulin resistance can be defined as a reduction in insulin-stimulated glucose uptake into skeletal muscle. Glucose uptake is a key mechanism in the maintenance of normal glucose homeostasis (Samaras & Campbell, 2005). Continued and excess carbohydrate ingestion promotes insulin



production and resultant fat storage. Over time, excessive insulin production results in a condition known as hyperinsulinaemia, reducing the effects of insulin and resulting in accumulation of fatty acids in the blood stream (Niswender & Schwartz, 2003). Hyperinsulinaemia is enhanced by defective insulin elimination rate and insulin resistance and contributes to a range of metabolic conditions including hypertension and obesity. These actions contribute to and are highly correlated with risk factors for type 2 diabetes and CVD (Gaspard, 2009). Furthermore, the effect of hyperinsulinaemia on body tissues is widespread and it appears that a defect in insulin mechanisms predisposes individuals to develop non-insulin dependent diabetes mellitus and CVD (Lin et al., 2004). This deficiency signals a major link between obesity and diabetes (Lin et al., 2004). Furthermore, even in the presence of normal blood glucose responses, high and prolonged levels of insulin, usually through carbohydrate ingestion, can negatively impact health outcomes (Samaras & Campbell, 2005).

The interaction between hormone activity in relation to satiety and food intake is critical in our understanding of obesity prevention and reversal (Schwartz, Woods, Porte, Seeley, & Baskin, 2000). While short-term incongruities occur throughout the digestive process, energy intake and expenditure is maintained effectively over the span of several meals (Schwartz et al., 2000). CCK plays a key role in energy homeostasis, particularly following ingestion of lipids. This hormone slows the process of gastric emptying, extending the period of stomach distension after eating (Beglinger & Degen, 2004). This postprandial process has the potential to induce satiety, reducing further requirement for nutrient consumption and reducing risk of over eating (Beglinger & Degen, 2004). The presence of CCK in the small intestine, specifically the duodenum and jejunum, delays the transit of partially digested food through the small intestine, contributing further to the sensation of fullness and subsequent cessation of nutrient ingestion. While CCK provides an immediate response to food ingestion and digestion, its synergy with the hormone leptin is a contributing factor to energy homeostasis. Leptin is acknowledged most frequently in relation to obesity, providing signals to the brain of the presence of fat in cells and the resultant availability of energy stores (Morton, Cummings, Baskin, Barsh, & Schwartz, 2006). Leptin (synthesised and secreted by adipose tissue) circulates at a level correlating to body fat content. Furthermore, studies have shown that leptin is the signal indicating fullness while eating (Morton et al., 2005).

As women approach menopause and oestrogen levels decline, the resulting increase in central adiposity (Poehlman, Toth, & Gardner, 1995) exposes them to the health risks associated with metabolic syndrome (Carr, 2003). Consequently, consideration needs to be made as to the impact that aging and sex have on hormonal response and resulting weight status. Furthermore, in industrialised nations, food consumption is affected on a daily basis by non-biological influences including emotional, social, and convenience factors (Beglinger & Degen, 2004). These factors can significantly impact our food choices, including how much and when we eat. It is essential therefore, that consideration be given to the spectrum of factors influencing homeostasis when addressing obesity and resulting metabolic disorders. Hormonal, behavioural, environmental and macronutrient profiles of food are all elements contributing to a person's dietary behaviour and therefore must be considered simultaneously.

## **2.4 Weight loss interventions**

Current dietary guidelines considered 'best practice' for optimal health and weight control promote a diet high in carbohydrate, moderate in protein and limited in fat. Current weight loss interventions and practice are largely based on these guidelines, and are fundamentally built on calorie, or energy, restriction alongside enhanced energy expenditure. This weight-loss approach may result in short-term success, but has had little impact on rates of overweight and obesity, which have increased globally in the past 30 years (WHO 2013). As a consequence questions have been raised around the efficacy of 'best practice' weight loss recommendations in bringing about sustained weight-loss (Volek & Westman, 2002).

An alternative weight-loss strategy has been proposed; one that promotes eating in such a way that is low in carbohydrate (<75g), moderate in protein (30-40% of total energy), and high in fat (50-60% of total energy; obtaining fat from foods such as nuts, avocado, olive oil and animal fats). Findings across a range of RCTs designed to compare weight-loss interventions have shown that low carbohydrate diets could be equally as effective as traditional low fat diets for eliciting weight loss, and may even be more promising in positively impacting metabolic outcomes (Hu et al., 2012). While there is a dearth of longitudinal studies investigating long-term effects of low carbohydrate diets, a meta analysis on RCTs conducted in this field showed

low carbohydrate diets to be more effective than low fat diets in the short-term (six months) relating to several health outcomes.

Several studies have examined the efficacy of low carbohydrate diets over a short-term (12 month) period. Stern et al. (2004) did conclude that low carbohydrate diets were more effective for improving overall metabolic outcomes than low fat diets. In their study, participants were randomly assigned to either a low carbohydrate (< 30g carbohydrate per day) or a conventional low fat diet (restricted caloric intake by 500 calories per day with < 30% calories from fat) for 12 months. Mean ( $\pm$ SD) weight change for individuals on the low carbohydrate diet was  $5.1 \pm 8.7$  kg compared with  $3.1 \pm 8.4$  kg on the conventional diet; the difference in weight loss between the two groups was not significant ( $-2.0$  kg [95% CI,  $-4.9$  kg to  $1.0$  kg]). Differences were noted however, in the timing of weight loss in both groups across the 12-month period. Participants on the low carbohydrate diet maintained most of their six-month weight loss, whereas for those on a conventional diet, weight loss continued throughout the 12-month study period (Stern et al., 2004). Similar outcomes were shown by Foster et al. (2003) who reported participants that were randomly assigned to a low carbohydrate diet (<20g carbohydrate per day, gradually increasing until stabilisation of weight) lost more weight over a six-month period than those assigned to a conventional low fat diet (1200-1500 kcal per day, 60% carbohydrate, 25% fat and 15% calories protein), but that differences did not persist at 12 months. In both studies, the low carbohydrate diet was associated with improved serum triglycerides and increased high-density lipoproteins (HDL) cholesterol (Foster et al., 2003; Stern et al., 2004). Whilst there remains an absence of long term research on the efficacy and safety of low carbohydrate diets, evidence does suggest that low carbohydrate diets elicit favourable metabolic outcomes (Stern et al., 2004). In the absence of long-term research on low carbohydrate diets, a caveat remains around the safety of the LCHF approach to eating. Future studies evaluating low carbohydrate diets in terms of longer-term (24 month and beyond) cardiovascular outcomes are required before they can be adopted as mainstream dietary options.

Several studies have examined the macronutrient profile of different diets in order to demonstrate the efficacy of both weight loss and metabolic effects. A recent two-year study investigating weight-loss effects of reduced calorie diets of a variety of macronutrient compositions reported a range of results (Sacks et al., 2009). The study involved 811

overweight adults who were randomly assigned to one of four dietary treatment groups: 1) low fat, average protein (20% fat, 15% protein, 65% carbohydrates), 2) low fat, high protein (20% fat, 25% protein, 55% carbohydrates), 3) high fat, moderate protein (40% fat, 15% protein, 45% carbohydrates), and 4) high fat, high protein (40% fat, 25% protein, 35% carbohydrates). Participants in each of the four diet groups achieved an average weight loss of 6 kg in the first six months or 7% of their initial weight. Changes in risk factors for CVD however, differed across the diets. All diets resulted in decreased triglycerides comparably (between 12-17%), however, the highest carbohydrate diet was the only diet that did not decrease fasting serum insulin levels. The average decrease in fasting insulin for the remaining three diets was 6-12%, with the highest protein diet showing the greatest reduction (10% vs. 4%, despite not being a statistically significant finding). In a similar study conducted by Dansinger et al. (2005), participants were randomly assigned to either: Atkins (low carbohydrate <20g, high fat), Zone (40% calories carbohydrate, 30% fat, and 30% protein), Weight Watchers (calorie restriction), or Ornish (fat restriction, <10% calorie fat) diet groups. Results showed that while all four diets elicited weight loss at one year, increased adherence rather than macronutrient profile was associated with greater weight loss. In addition, no single diet produced satisfactory adherence rates, with progressively decreasing adherence scores indistinguishable among the four diets. While neither study showed significantly improved weight loss by specific macronutrient profile, it is apparent that adherence may be an important characteristic of successful weight-loss strategies. Therefore, factors contributing to adherence warrant further investigation.

Comprehensive findings have been reported as a result of a collection of meta-analyses in the subject area of safety and efficacy of low carbohydrate diets. In an analysis of the effects of non-calorie restricted low-carbohydrate diets versus low-fat diets, Nordmann et al. (2006) concluded that at six months, participants on a low carbohydrate diet had lost more weight than those on a traditional low fat diet (-3.3 kg; 95% CI -5.3 to -1.4 kg). This difference in weight loss was no longer obvious after 12 months (-1.0 kg; 95% CI, -3.5 to 1.5 kg). The low carbohydrate diet, however elicited favourable changes to both triglycerides (-22.1 mg/dL [-0.25 mmol/L]; 95% CI, -38.1 to -5.3 mg/dL [-0.43 to -0.06 mmol/L]), and HDL cholesterol (4.6 mg/dL [0.12 mmol/L]; 95% CI, 1.5-8.1 mg/dL [0.04-0.21 mmol/L]) (Nordmann et al., 2006) compared to low fat diets. In contrast, however, total cholesterol and low-density lipoprotein

(LDL) cholesterol levels changed more favourably in individuals on low-fat diets (Nordmann et al., 2006). Interpretation of these lipid fractions is contentious and discussion around LDL cholesterol measure is fraught with controversy. It appears that LDL particle number is superior to LDL cholesterol level as a marker for heart disease (Kratz, Cullen, & Wahrburg, 2002). Therefore, as particle size was not assessed in these studies, low levels of LDL in individuals on a low fat might not be considered a meaningful or positive result. These findings have been supported in a meta-analysis conducted on weight loss and low carbohydrate diets in type 2 diabetics (Dyson, 2008). All studies reported reductions in body weight with no deleterious effects on cardiovascular risk in individuals undertaking a low carbohydrate diet. It appears that reduced carbohydrate diets are safe and effective over the short term for people with type 2 diabetes.

It can be difficult to distinguish whether macronutrient profile or energy content is the main causative factor in dietary weight loss. Furthermore, gauging which macronutrient has greater impact on weight loss and metabolic health is also challenging. When one macronutrient component in a diet is changed, a corresponding macronutrient must be adapted to allow appropriate caloric value to be reached. A review conducted on the efficacy and safety of low carbohydrate diets in a range of populations found that the greatest weight loss occurred among those participants receiving diets with the lowest caloric content, independent of macronutrient profile (Bravata et al., 2003). No statistical difference was noted in weight loss between low carbohydrate and traditional low fat diets. Corresponding findings by Hu et al. (2012) concluded that reductions in weight and additional metabolic risk factors were not significantly different between a low carbohydrate or low fat diet. They did, however determine that low carbohydrate diets appeared to have beneficial effects on weight loss and metabolic risk factors (Hu et al., 2012). Notably, as with previously reviewed studies, there were variances in characterisation of macronutrient profile between these studies. Hu et al., (2012) characterised a low carbohydrate diet as one comprising  $\leq 45\%$  energy from carbohydrate and low fat diets as  $\leq 30\%$  energy from fat. In contrast, Bravata et al. (2003) characterised the diets in terms of grams per day (g/d), defining a low carbohydrate diet as  $\leq 60\text{g/d}$  with additional assessment conducted on total calories consumed daily. Diets classified as low carbohydrate by Bravata et al. were lower in calories (mean 1446 kcal/d), while diets classified as high carbohydrate were higher in calories

(mean 1913 kcal/day). The low carbohydrate diet, while higher in fat remained lower in calories. The heterogeneous nature of the studies between classifications of macronutrient profile and participant characteristics creates difficulties in accurately comparing study results. It is important therefore, that when assessing macronutrient profiles, total calorie content is also assessed and considered.

A small number of RCTs investigating the efficacy of low carbohydrate diets have been conducted specifically on pre-menopausal and menopausal women. One such study, designed to compare weight loss in this population, explored four contrasting dietary approaches. Participants were randomly assigned to either the Atkins (very low carbohydrate, high protein), Zone (low carbohydrate), LEARN (Lifestyle, Exercise, Attitudes, Relationships, and Nutrition; low in fat, high in carbohydrate, based on national guidelines) or Ornish (very high carbohydrate) dietary approaches (C. D. Gardner et al., 2007). Outcomes from this study were similar to that of Stern et al. (2004), whereby women who were assigned to the lowest carbohydrate diet lost more weight and experienced more favourable overall metabolic effects at 12 months than women assigned to follow the alternative diets (C. D. Gardner et al., 2007). Total energy intake did not differ among diet groups at baseline or any subsequent time point. At two and six months, the weight change for the Atkins group was significantly greater than for all other groups ( $p = 0.05$ ) and at 12 months weight change was significant between Atkins and Zone only. Secondary analyses was conducted on this data examining the relationship between insulin resistance and dietary adherence (McClain et al., 2013). Findings showed that participants were less likely to adhere to, and lose weight on a low fat diet if they were insulin resistant compared to those that were insulin sensitive. These results are compelling as they suggest that insulin resistance status through the mechanism of carbohydrate intolerance may affect dietary adherence to weight loss diets. This may result in higher rates of recidivism and diminished weight loss success in insulin resistant participants following low fat diets (McClain et al., 2013). A similar six-month randomised trial, conducted by McAuley et al. (K. McAuley et al., 2006; K. A. McAuley et al., 2005), compared both a high fat and high protein diet to a conventional high carbohydrate diet in obese pre-menopausal and menopausal women. Ad libitum food consumption was advised for all three dietary groups and no one diet was formally energy restricted. All three groups consumed diets of similar macronutrient profiles at baseline

with energy intake remaining similar between groups over the six-month study duration. Participants on the high fat and high protein diets lost significantly more weight ( $-7.1\text{kg} \pm 2.79$ ;  $-6.9\text{kg} \pm 3.74$ ) than those on the high carbohydrate diet ( $-4.7\text{kg} \pm 3.76$ ) over a six-month period. Fasting triglycerides decreased in all three diets, however the decrease was significant only in the high protein and high fat dietary groups. These collective findings clearly indicate that by nature, low carbohydrate diets elicit less insulin response and could be an effective and safe weight-loss option for middle-aged women.

A similar result was obtained in a study conducted by Brehm et al. (2003). Women assigned to a low carbohydrate diet in a RCT designed to compare a low carbohydrate and a restricted calorie, low fat diet, found the low carbohydrate non-restricted calorie diet to be a more effective weight-loss option. Participants in the low carbohydrate diet were advised to consume  $\leq 20\text{g}$  carbohydrate per day for the first two weeks, increasing to  $< 60\text{g}$  for the remainder of the study, however overall calorie intake was not restricted. In contrast, the low fat diet group was advised to consume a calorie-restricted diet comprising 55% carbohydrate, 15% protein, and 30% fat. Women in the low carbohydrate lost significantly more weight ( $7.6 \pm 0.7\text{ kg}$ ) after three months and after six months ( $8.5 \pm 1.0\text{ kg}$ ) than their low fat diet counterparts ( $4.2 \pm 0.8$  and  $3.9 \pm 1.0\text{ kg}$ ) at three and six months respectively (Brehm et al., 2003). Similarly, a study conducted to investigate whether a low carbohydrate, high protein diet (intervention) compared to a high carbohydrate, low fat diet (usual care) would result in greater weight loss and decreased perceived hunger, found that both diets elicited significant weight loss over a six-week period ( $p<0.1$ ) (Nickols-Richardson, Coleman, Volpe, & Hosig, 2005). Women in the intervention group consumed  $<20\text{ g}$  carbohydrate/day in the first two weeks and increased their carbohydrate intake by five g/week to  $40\text{g}$  carbohydrate/day at week six. Dietary protein and fat intakes were unlimited and calorie intake ad-libitum. Macronutrient composition of the high-carbohydrate/low-fat diet reflected mainstream guidelines, with energy intake restricted to 1,000 to 1,700 k/cal per day. Women in the intervention group lost significantly more body weight (5.7%) compared with women in the usual care group (3.3%) after six weeks of dietary intervention ( $p<0.05$ ). Of relevance, a more recent study conducted by Foraker et al. (2014) to assess changes in blood pressure and blood lipids in premenopausal women, found positive outcomes in both dietary groups with no significant difference found between groups. Participants were assigned to either

a low-fat (20% of total calories fat, 20% protein, and 60% carbohydrates) or a low-carbohydrate (40% of total calories carbohydrates, 30% protein, and 30% fat) diet. Individually derived calorie recommendations/goals based on basal metabolic rate and activity levels were used to establish participant calorie intake. In light of these findings, additional research is warranted to further assess the efficacy of low carbohydrate diets, particularly in this population group. Clearly, however, longer-term weight loss trials are required to accurately assess the most efficacious macronutrient profile and suitability to middle aged women.

The weight-loss trials reviewed display a range of diverse characteristics in their intervention design and also include a range of macronutrient profiles in the trial diets. This creates difficulty in pinpointing the exact aspect to which the benefit can be attributed. While results of weight loss trials in general show a reduction in weight and improved metabolic profile in the short term (e.g. reduced serum insulin levels, LDL levels, and blood triglycerides, and increased HDL), both efficacy and comparison of weight-loss treatments has been less successful over the long term (Davis & Addis, 1999). This can be attributed to several factors, primarily the absence of a consistent benchmark on which to assess successful weight loss in individuals (Wing & Hill, 2001). In addition, the heterogeneity of weight-loss interventions, inconsistent reporting of findings, lack of consensus of the definition of what constitutes 'long term' and diversity of target populations impact comparison of weight-loss approaches (Stunkard & McLaren-Hume, 1959).

One of the key issues in the literature when comparing these studies is the inconsistency that exists between classifications of both low carbohydrate, low fat and traditional diets used in interventions. Further disparity exists as to whether macronutrient or caloric profile has the greater impact on weight loss (Hu et al., 2012). Traditional low fat diets are frequently defined by controlled calorie intake, however low carbohydrate diets could be similar in calorie profile to a low fat restricted calorie diet. The satiating effect of the fat component of a low carbohydrate diet appears to elicit a reduced requirement for both frequency of meals and amount of food consumed at each meal. Studies presented in this review comparing high and low carbohydrate diets show that reduced calorie diets, provided there is adequate adherence, will elicit weight loss regardless of macronutrient profile. Diets that were lower in carbohydrate however, displayed favourable outcomes for middle-aged women particularly in the prevalence of insulin



resistance (McClain et al., 2013). As women approach an age that occurrence of insulin resistance is prevalent, it is vital that weight-loss options reflect this phenomena.

While metabolic benefits may be attributable to the greater short-term weight loss in the low carbohydrate diets in several studies, changes were greater than those expected from weight loss alone, suggesting that the macronutrient profile of low carbohydrate diets could positively impact metabolic outcomes (Ajala, English, & Pinkney, 2013; Foster et al., 2003). In future studies, homogeneity of studies assessed should be considered to make studies more comparable (Ajala et al., 2013). Consistent across all meta-analyses, however, is the agreement that further research is required to investigate the long-term effects of low carbohydrate diets on weight-loss and metabolic measures (Dyson, 2008; Nordmann et al., 2006).

## **2.5 Application of behaviour change theory in dietary intervention**

The increasing prevalence of overweight and obesity underscores the need for evidence-based, interventions for weight management tailored to relevant populations. Evidence suggests that the application of HBT in intervention design can enhance intervention outcomes (Ammerman et al., 2002). However, the efficacy of behaviour change theory itself and the impact it can have on interventions does appear to depend on the type of behaviour being modified (Glanz et al., 2008). Four HBTs have been identified as appropriate for eliciting dietary health behaviour change. Firstly, the Trans-Theoretical Model of change (TTM), also known as Stages of change (SOC), addresses the steps involved in adopting significant lifestyle changes (Zimmerman, Olsen, & Bosworth, 2000).

While traditionally developed to address smoking behaviours (Prochaska, Wright, & Velicer 2008), the TTM is recognised as an appropriate application for dietary modification and weight loss goals (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). The TTM engages the integration of principles and procedures from a series of leading HBTs (Prochaska, 2013) and recognises that people often need to make multiple attempts at behaviour change to progress between stages and that relapses typically occur periodically. As a result, progression can be spiral-like, characterised by recycling through behaviour-change stages (Schwarzer, 2008). Four key behavioural stages underpin the core constructs of the TTM: 1) SOC, 2) Processes of change, 3) Decisional balance, and 4) Self-efficacy; each stage comprising a

number of behavioural constructs. SOC for example, encompasses pre-contemplation (no intention to take action in the next six months), contemplation (intends to take action in the next six months), preparation of change (intends to take action in the next thirty days), action (changed overt behaviour for less than six months), maintenance (changed overt behaviour for more than six months), and termination (no temptation to relapse and 100% confidence in sustaining behaviour change). All of these stages are particularly pertinent to weight loss-related behaviour change (Prochaska & Norcross, 1999).

TTM offers a theoretical framework for multiple behavior weight management interventions (Johnson et al., 2008). One recent TTM-based study designed to examine the impact of tailored, home-based, physical activity and dietary interventions in overweight and obese adults showed positive treatment effects in the first six months, which were sustained to 24 months. Furthermore, a statistically significant difference in weight loss, 2.1 kg ( $p < 0.05$ ) was found in favour of the treatment group (Johnson et al., 2008). Participants were randomised to intervention or control group; the intervention group receiving home-based behaviour interventions at baseline, six, 12, and 24 months, and the control group receiving no treatment. Individuals were grouped into a specific SOC stage based on recognised SOC assessment tools, appropriate to behaviour change (Prochaska et al., 2005). Significant effects for targeted behaviours were demonstrated both in the first six months and beyond, while treatment for weight did not occur until 24 months. This may be because weight loss is not a health behaviour, but an outcome of multiple behaviour changes (Johnson et al., 2008). This study supports the concept that applying TTM constructs to multi-behaviour interventions has the potential to add a positive effect to behaviour change and consequent weight loss outcomes (Van Gaal, 2005). This study holds implications for understanding behaviour change in multiple-behaviour interventions, reflecting that weight-loss can be an outcome of several behaviour changes. Dietary behaviours can be impacted by several factors, including emotional, and environmental as well as adherence factors. Application of TTM allows for these issues to be addressed and assessed.

Evidence suggests that not all studies employing HBT achieve augmented outcomes. A similar study comparing weight-loss outcomes achieved from a TTM-based intervention found no significant difference in weight loss between augmented usual care (AUC) and intervention

groups in both a short-term timeframe (i.e. six and 12 months) or a long-term timeframe (i.e. 18 and 24 months) (Logue et al., 2005). In this RCT, 665 obese patients were recruited within the primary care setting, and received either dietary and physical activity advice alone or coupled with TTM-based behavior therapy at six monthly intervals. The mean weight change from baseline for the TTM group to the end of follow-up was -0.39 kg (SE = 0.38; 95% CI = -1.1, 0.4). The mean weight change for the AUC group was -0.16 kg (SE = 0.42; 95% CI = -1.0, 0.7). The difference of 0.23 kg greater weight loss in the TTM group was not significant ( $p = 0.50$ ) and had a 95%CI of -1.4, 0.9. These data do not support the theory that obese patients in this population would lose more weight if exposed to the TTM model in addition to usual care. It is plausible that in this population usual care may be sufficient to elicit weight loss (Logue et al., 2005). It is clear that while TTM can provide improved weight-loss outcomes, consideration must be made for the key aspects of the study, including population, appropriate HBT and programme design.

While evidence presented in the preceding studies demonstrates some significant improvements in weight loss among those receiving a TTM-based intervention, the methodological heterogeneity among the studies (and in some cases lack of non-TTM control groups) has reduced the ability to draw tangible or conclusive verification on the impact of TTM on weight loss related behaviours. Furthermore a review aimed to assess the use of the TTM SOC as a theoretical framework for dietary interventions for weight loss management for overweight and obese adults provided little evidence on the impact of TTM SOC interventions on sustainable weight loss (Mastellos, Gunn, Felix, Car, & Majeed, 2014). The mean difference between the intervention and control groups ranged from 2.1 kg to 0.2 kg at 24 months. Results culminating from studies, while supporting the application of HBT in behaviour change interventions, promote further investigation into the probable requirement for a mixed model approach to applying HBT to weight-loss interventions.

The second HBT of relevance to weight loss interventions is the Social Cognitive Theory (SCT); a model commonly applied in the design of weight-management interventions. This theory recognises that health behaviour is a function of characteristics of a person, their behaviour, and their environment (Baranowski et al., 2003). Traditionally used in understanding factors that influence human behaviour, more recently SCT has been applied to the design of interventions

required for the practical challenges in medicine and public health such as condom use and asthma treatment utilisation (Baranowski et al., 2003). Furthermore, self-efficacy or one's belief in one's capacity to make and sustain a behaviour change, is the most powerful determinant within SCT and is a frequently analysed psycho-social construct in nutrition behaviour (Fontaine & Cheskin, 1997).

Self Determination Theory (SDT), the third relevant HBT and similar to SCT, proposes that behaviour change will occur and persist if autonomously or independently motivated (Williams, Grow, Freedman, Ryan, & Deci, 1996), and highlights the fundamental need for a person to evolve and be part of a social scenario. The three primary needs identified in the SDT are competence, autonomy, and relatedness, leading to one's motivation to act or undertake a behaviour change. SDT is therefore recognised as an appropriate theory applied to weight loss interventions (Palmeira et al., 2007).

The fourth HBT commonly applied to health behaviour change is the Theory of Planned Behaviour (TPB), which focuses on theoretical constructs regarding motivational factors such as determining likelihood of performing a specific health behaviour (Glanz et al., 2008). TPB, used to intervene in several health behaviours including weight control, provides a framework for identifying factors that affect behaviour, such as attitudes and an individual's perceived control over a behaviour. In support of the TPB, intentions to lose weight have been accurately predicted on the basis of attitudes, subjective norms, and perceived control. This has been demonstrated in a study conducted by Schifter et al., (1985) which showed that a predictor of weight loss was the degree to which the women believed that they had control over their body weight. Women who strongly intended to lose weight and also believed that they were capable of doing so were most likely to succeed (Schifter & Ajzen, 1985). A more recent weight-loss study designed to examine the utility of the TPB constructs for exercise and diet behaviour, showed similar results with significant decreases in BMI and body fat percentage occurring from baseline to post. Analyses revealed diet adherence was predicted by intention, but failed to predict exercise adherence or exercise intention (R. E. Gardner & Hausenblas, 2004).

Several studies have demonstrated the benefit of employing a multi-level approach to application of HBT in weight-loss interventions. A recent study designed to predict weight loss

applied four leading health behaviour change theories: SCT, TTM, TPB and SDT (Palmeira et al., 2007). In this study, participants attended educational sessions for approximately four months. Sessions included educational content and practical application in the areas of physical activity and exercise, diet and eating behaviour, and behaviour modification. After the four-month phase, subjects were randomly assigned to one of three longer-term interventions. While weight decreased significantly ( $-3.6 \pm 3.4\%$ ,  $p < .001$ ) across behaviours, there was substantial individual variability. Weight change was significantly predicted by each of the HBTs analysed, in particular those using self-efficacy, TTM, or SCT. These two models showed strength for prediction of weight loss with short-term weight-loss outcomes more effectively explained by dietary-related constructs compared to exercise models. While not designed as a weight-loss trial, this study provides strong evidence for the benefit of HBT, in particular TTM and SCT in strengthening weight-loss interventions.

Efficacy of the mixed method approach to HBT has been investigated in relation to weight loss. Foreyt et al. (1991) undertook a study to assess the effectiveness of a culturally adapted weight-loss programme for achieving long-term weight-loss in Mexican Americans. This study, known as Cuidando el Corazon -CEC Taking Care of Your Heart, utilised a family-oriented approach to achieve lifestyle behaviour change (Foreyt, Ramirez, & Cousins, 1991). Three approaches were implemented; 1) comparison group receiving booklet including behaviour change, nutrition and exercise information, 2) individual group, receiving the same manual plus educational and motivational classes and, 3) family group receiving the manual, classes that emphasised changes to the whole family's diet and exercise behaviour. Weight loss was significantly greater in the family and individual groups; however, weight loss was greatest in the group receiving the most behavioural support (i.e. the family group). While not reporting a specific HBT within the study design, application of family and behavioural support clearly impacted weight loss in the studied population. A sub-sample of the Cuidando el Corazon participants was analysed to assess whether the usefulness demonstrated by TTM in behaviour change for smoking and alcohol addiction could be transferred to an obesity weight-loss programme (Surís, Trapp, DiClemente, & Cousins, 1998). Results supported the use of TTM in weight-loss interventions, verifying that stage profiles of subjects were similar to the alternative comparison behaviours, smoking, and alcohol addiction. These findings recognise that no one

theory is a perfect fit for augmenting dietary behaviour modification and that characteristics of multiple theories should be considered in the design of weight-loss interventions

Similar positive weight-loss outcomes were found by Tate et al., who reported the results of an internet-based weight-loss intervention, with one group receiving intervention only and the other, intervention plus behavioural counselling support (Tate et al., 2001). The authors concluded that adding a behavioural counselling component to the intervention significantly improved weight loss in diabetic subjects. More participants in the behaviour theory group achieved the 5% weight-loss goal (45% vs. 22%  $p = 0.005$ ) at six months, and greater changes in waist circumference ( $p = 0.005$ ). While this study was designed primarily to assess the viability of the internet as a medium for delivering weight-loss interventions, rather than to evaluate the HBT component, the authors acknowledged the value of added behaviour counselling in producing beneficial weight-loss outcomes. Further research evaluating an internet-delivered dietary intervention found that application of SOC to be a suitable behavioural model for tailoring and delivering web-based resources (Ramadas, Quek, Chan, Oldenburg, & Hussein, 2011). Correspondingly, research assessing a website promoting a specific eating plan, the Mediterranean diet, advocated the use of the several HBTs in the development of web-based resources (Papadaki & Scott, 2006).

It is well recognised by health researchers that no one theory will be the perfect fit for any one health-based intervention. Furthermore, development of theory-based research and evaluation is dependent on study design, measures and procedures, and their relevance to the population, health behaviour and organisation at hand (Glanz et al., 2008). While use of theory assists in identifying the generalisability of weight-loss programmes between both populations and health behaviours, difficulties arise in comparing the effectiveness of these studies due to variations in application and translation of specific HBTs, the intervention methodology itself, and the tools employed to facilitate measurement (Glanz et al., 2008).

While the above-mentioned studies promote the use of HBT in weight-loss intervention design, recognition of the need for flexibility and combination of HBTs is necessary. Approximately 40% of women and 20% of men are attempting to lose weight at any one time (Serdula et al., 1999); this indicates that many within the general population are already positioned within the SOC

spectrum at least in the contemplation stage. In light of this concept, offering an alternative weight-loss intervention, drawing from relevant constructs of the range of appropriate HBTs, could elicit behaviour change in individuals.

## **2.6 Summary**

While it is well-documented that diets lower in carbohydrate and higher in fat are an effective means for reducing weight and improving cardiovascular risk factors in the general population (Nordmann et al., 2006), there is a paucity of information on the benefits of this diet on middle-aged or pre-menopausal women. In the absence of agreement by the scientific, academic, and nutritional communities on the issue of sustainable weight loss strategies, a myriad of commercial, fad and non-scientific based diets have emerged. This notion combined with the current knowledge base on weight gain in pre-menopausal women, suggests a compelling link between decreased oestrogen levels and insulin homeostasis. It is vital therefore that investigation continues on weight loss strategies appropriate to this population, exploring the complete hormonal spectrum and investigating interactions between digestive and sex hormones. The increasing evidence around the impact of hormonal function on weight gain and body composition validates the need for further investigation into the dietary effect on menopause-affected hormones. It has become apparent that a diet that is lower in carbohydrate and therefore elicits a decreased insulin response may be an optimal dietary approach in this population.

The gap in knowledge pertaining to adherence and acceptability of low carbohydrate diets as a weight-loss option for middle-aged women has created a demand for further investigation into these factors. By changing their own dietary behaviours to a more positive model, women have the ability to influence the dietary behaviours of family members and those around them. They are a key population to consider when designing sustainable behavioural weight-loss interventions. Furthermore, an improved understanding of the theories underpinning health behaviours and behaviour modification may provide insight into the design of effective and sustainable weight-loss interventions (Noar & Zimmerman, 2005). While evidence suggests that application of HBT in intervention design can positively impact intervention outcomes, (Ammerman et al., 2002), further investigation is required to determine effective health

behaviour theories that pertain to the modification of dietary behaviours.



## **Chapter 3: Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years: Intervention design and rationale.**

### **3.1 Preface**

The previous chapter identified the need for efficacious weight-loss interventions for middle-aged women, with findings suggesting that the LCHF diet might be an appropriate approach for this population. The review examined the efficacy and safety of the LCHF weight-loss approach compared with traditional low fat dietary strategies in a range of population groups. The current knowledge base on weight gain in pre-menopausal women was examined in the context of the impact of and interaction between decreased oestrogen levels and insulin homeostasis. Furthermore, the application of HBT and associated use of internet technology was also reviewed and was deemed to be important mechanisms for intervention design for modifying dietary behaviour.

These findings directly informed the development of the study intervention, as presented in this chapter. This chapter comprises a description and rationale of the design of the weight-loss intervention and describes the development and implementation of the Women's Health Research Programme. The chapter outlines the methodology employed and explores application of appropriate HBTs to optimise adherence and subsequent success of weight-loss interventions. Through application of HBTs, this programme was designed to allow for individual participants' existing stage of change, and level of knowledge around the LCHF dietary guidelines. Furthermore, a description and justification of the use of internet technology as an appropriate medium for programme delivery for this population is described.

## 3.2 Introduction

Worldwide, overweight and obesity rates have more than doubled in the last three decades, with 1.4 billion adults over the age of 20 years classified as overweight (BMI 25–29.9 kg/m<sup>2</sup>) or obese (BMI ≥ 30 kg/m<sup>2</sup>) (WHO 2006). Defined as excessive or abnormal accumulation of fat, overweight and obesity present a significant risk to a person's health and are major contributing factors to chronic diseases including diabetes, CVD, and some cancers (WHO, 2013). Invoking further concern, certain population groups exhibit disproportionate rates of obesity and accordingly are at greater risk of related complications. For example, while global obesity rates are relatively similar between females and males (35% versus 34%, respectively) more women than men are classified as obese (14% versus 10%, respectively) (WHO, 2013). Furthermore, women with abdominal obesity are known to be at especially high risk of cardiovascular and metabolic disease (Carr, 2003). It is well-recognised however that the negative metabolic impact of obesity can be reversed through weight-loss strategies (M. J. Davis & Addis, 1999).

While most weight-loss strategies are formulated on calorie restriction, there remains no consensus over the optimal ratio of dietary macronutrient composition in enhancing long-term weight loss (Das et al., 2007). Accordingly, a number of studies have investigated the efficacy and safety of low carbohydrate compared to low fat diets (Hu et al., 2012; Sacks et al., 2009; Samaha et al., 2003; Yancy, Foy, Chalecki, Vernon, & Westman, 2005). While it appears that low carbohydrate diets are more effective than low fat diets in achieving weight loss at six months, weight loss appears to become consistent between dietary approaches at 12 months (Klein, 2004; Stern et al., 2004). Of note, adherence to weight-loss interventions appears to correlate with the magnitude of early (i.e., first six months) weight loss (Alhassan et al., 2008). In addition to these findings, it has become apparent that in comparison to carbohydrate, dietary fat has a greater satiating effect on women (Chambers & Yeomans, 2011). By stimulating satiety and consequently suppressing appetite, the fat component of the LCHF diet appears to positively impact adherence levels (Volek, VanHeest, & Forsythe, 2005). This theory is supported by the trial of Nikols-Richardson et al. (2005) investigating the impact of a low-carbohydrate/high-protein diet compared with a high-carbohydrate/low-fat diet on satiety in overweight premenopausal women. The study concluded that participants consuming a low carbohydrate/high protein diet had a lower perceived hunger ( $6.3 \pm 4.1$  vs  $3.2 \pm 2.4$ ,

respectively) throughout the six-week study period than high carbohydrate/low fat group ( $7.1 \pm 4.0$  vs  $5.9 \pm 3.8$ , respectively) (Nickols-Richardson et al., 2005).

The existing and accepted theory of regulation of weight through energy balance, and energy deficit, while fundamental to the concept of weight loss is not in itself having a major effect on the global obesity epidemic. The alternative restricted-carbohydrate, higher fat diet is founded on the hypothesis that a major contributor to obesity and overweight is actually the distribution of energy internally, and a defect in hormonal response to fat metabolism (Bruning et al., 2000). As a consequence, a LCHF diet has been implicated to be an equally effective and safe weight-loss strategy to either a fat or calorie restricted diet (Volek & Westman, 2002).

There is also a body of evidence that suggests that irrespective of the macronutrient composition of the diet, the medium selected for delivering weight-loss interventions impacts adherence and subsequent success of a programme (Tate et al., 2001). The rapid increase in access to internet technology has made internet and web-based programmes a feasible and logical mode for delivery of public health interventions such as weight loss and weight maintenance (Tate et al., 2001). A recent review on the effectiveness of web-based weight loss and weight maintenance interventions concluded that web-based programmes have the potential to achieve favourable weight-loss outcomes (Levy, Finch, Crowell, Talley, & Jeffery, 2007). Internet technology carries distinct benefits, including the ability to combine and communicate a range of alternative forms of media, such as video and photographic material. In support of the use of web-based weight-loss programmes, Collins et al. (2010) concluded that creating evidence-based programmes fashioned on HBT might favourably impact results of these programmes. In addition, it has become evident that the use of a mixed methods approach to applying HBT to interventions elicits more favourable outcomes than interventions aimed at one level of behaviour (Elder, Schmid, Dower, & Hedlund, 1993). For example, the TTM posits that interventions tailored to an individual's needs are required to facilitate behaviour change (Prochaska, 2013). Supporting this concept, web-based programmes allow participants to access information at a personal level and provide additional support and communication should it be required. In contrast, a systematic review and meta-analysis conducted by Neve et al. (2010) found that web-based interventions are able to achieve outcomes similar to other lifestyle treatment options (e.g. face-to-face and group counselling). Evidence suggests web-

based weight-loss programmes will have greater success however, if designed to be consistent with participant needs and values (Weinstein, 2006). Furthermore, these programmes should operate at a level of complexity that is comprehensible and relevant to the target population (Weinstein, 2006).

Correspondingly, SDT proposes that behaviour change will occur and persist if autonomously or independently motivated (Williams et al., 1996). This concept highlights the fundamental need for a person to evolve and be part of a social scenario (Ryan & Deci, 2000). While web-based programmes rarely involve face-to-face contact, participants benefit from the knowledge that they are part of a wider group, facing similar emotions and experiences (Glanz, 1980). A third HBT, SCT, widely applied in weight-loss interventions, recognises that health behaviour reflects an individual's character and environment (Baranowski et al., 2003).

Effective weight-loss strategies, targeting at-risk populations through appropriate media, remain a critical public health priority and merit ongoing investigation (Levy et al., 2007). While attrition rates in weight-loss programmes are known to be high, increased adherence to a programme can lead to successful and sustained weight loss (Greenberg, Stampfer, Schwarzfuchs, & Shai, 2009)

The LCHF Women's Health Research programme was developed in response to the need for robust evidence on sustainable weight-loss options for middle-aged women. The aim of this programme is to determine factors affecting women aged 40 – 55 years in modifying dietary behaviours and maintaining those behaviours while undertaking a LCHF way of eating. The hypothesis underpinning this study is that the LCHF macronutrient profile has the potential to enhance an individual's adherence to the behavioural lifestyle modifications required to reduce weight and improve metabolic health outcomes. Furthermore, levels of adherence could be maximised by a combination of the web-based nature, satiating effect of LCHF food options, and the application of appropriate HBTs to this study. This paper outlines the theoretical foundations, components, and methodology of the LCHF Women's Health Research programme.

### **3.3 Methods**

#### **3.3.1 Participants**

The LCHF Women's Health Research programme was an exploratory study investigating acceptance of, and adherence to, a LCHF diet in 40 – 55 year old women. Overweight or obese NZ-based women were recruited to participate in the LCHF Women's Health Research programme. The study was advertised through Auckland University of Technology (AUT) university networks between February and March 2014 (Appendix 6). Potential participants were pre-screened to determine eligibility using a recruitment questionnaire (Appendix 5). Participants were accepted into the study if they met the following criteria: (i) were female, (ii) were aged between 40 and 55 years, (iii) had a BMI between 25 and 35.99, reflecting a BMI status of overweight or obese, (WHO 2006) (iv) were not currently following any prescribed weight-loss programme, (v) were weight-stable (weight had remained steady for the past six months), and (vi) were not already consuming a low carbohydrate diet. Screening was accomplished through self-reported measures of weight, height, and a three-day food diary to assess dietary eligibility.

#### **3.3.2. Protocol**

Following enrolment and prior to commencement of the study, participants were sent a baseline questionnaire via the online questionnaire programme Question Pro. Question Pro utilises the appropriate formatting functionality required for the development of this questionnaire design, and is a recognised tool for delivering online questionnaires (Voorheis, Singleton, Silvers, Snead, & Moroney, 2004). The baseline questionnaire comprised questions relating to demographic information, a three-day food diary, Profile of Mood States (POMS) Short Form (SF) (aligning with subsequent weekly questionnaires), weight, and self-reported weight. During the intervention, weekly questionnaires (Appendix 4) were distributed to participants each Sunday throughout the study period, with the final questionnaire administered at week eight (end of intervention). Timing of intervention delivery components is detailed in Table 3.1. The questionnaire and reminder prompt was re-sent the following Tuesday to participants who had not responded.

The Auckland University of Technology Ethics Committee (AUTEC) approved this study (Appendix 1). Information sheets (Appendix 2) were distributed and consent was obtained from participants prior to enrolment in the study (Appendix 3).

Table 3.1: Timetable and mode of intervention component delivery

Week	Mode of delivery	Description	Reference Page
0	Email	Email communication was employed prior to launch of the study to communicate participant requirements and to send relevant web-site links.	
0	Website	Participants emailed web-link to intervention website linking directly to relevant web pages.	Background, Information The Research Team
0	Website	Prior to commencing the LCHF diet, participants were emailed a link to a post providing support to embark on the programme.	Food Lists Week One
1-8	Blog	Tri-weekly support posts sent directly from the website.	Blog 1-24
1-8	Email	Emails sent prompting participants to access website, alerting to new recipes and current media of interest.	Recipes Media
1-8	Email	Responses to individual queries as required.	

### 3.3.3 Measures

The electronic questionnaires included a POMS SF (Shacham, 1983), a Hunger/Fullness Scale, a self-rated percentage sliding-scale score (ranging between 1 and 100) of adherence to the LCHF dietary regime supported by a food frequency questionnaire, and a self-reported body weight as detailed below. The POMS SF is a comprehensive assessment of transient and fluctuating moods (McNair, Lorr, & Droppleman, 1992; Shacham, 1983) and was chosen to quantify any stress-response to the LCHF diet. The Hunger/Fullness Scale was developed to assist in gauging participant hunger levels over the previous seven-day period. The scale comprises seven identifiable states of hunger/fullness, presented in the questionnaire as a visual analogue scale to allow for flexibility and accuracy of responses. While no published evidence of validity exists, a satiety scale configured as a visual analogue scale, is commonly used in dietary practice and a widely accepted tool to assess subjective appetite sensations

(Raben, Tagliabue, & Astrup, 1995). The questionnaire also included an additional component in the form of a food frequency questionnaire. Questions were designed to act as a prompt for participants as to their adherence to the LCHF diet, asking them to note the number of occasions over the past seven days they consumed a range of high carbohydrate foods not recommended on the LCHF diet.

### **3.3.4 Intervention description**

#### *3.3.4.1 Nutrition approach*

The food choices endorsed, reflected an overall daily macronutrient profile comprising moderate amounts of protein, limited carbohydrate (50-100g), and moderate-to-high amounts of fat (50-60% of total energy). This macronutrient profile is considered to be a-restricted carbohydrate diet, anticipated to induce weight loss in participants (Mullins, Hallam, & Broom, 2011). Food options excluded cereals and grains, starchy vegetables and legumes, and included all meats, eggs, non-starchy vegetables, fruit (in moderation), full-fat dairy product, nuts, seeds, and cooking fats (olive oil, coconut oil, butter).

#### *3.3.4.2 Theoretical framework for intervention delivery*

The intervention and associated resources were drawn from components of several HBTs. A combination of TTM eliciting SOC principles, SCT and SDT informed the theoretical base of this study. Positing that individual behaviour changes are not made suddenly, completely or permanently (Prochaska et al., 2008), TTM theorises that interventions should be tailored to an individual's current stage of change (Prochaska et al., 2008). To commit to an eight week weight-loss intervention, participants were likely to have been in either the; (i) contemplation, or (ii) preparation spectrum of the stages of change constructs (Prochaska & Norcross, 1999). Accordingly, resources were designed to provide the appropriate level of information for participants to embark on and adhere to the LCHF diet, without the need for face-to-face or personal one-on-one guidance. These included advice on foods to include and avoid, LCHF appropriate recipes, and snack options. Further information was provided addressing possible side effects of these dietary changes, and how to manage situations that could impact participants' ability to adhere to the LCHF diet. Loosely based on further TTM constructs

processes of change (Prochaska & Norcross, 1999), these included: (i) managing social situations, (ii) garnering social support for behaviour change, (iii) explaining major changes in established dietary habits to family, friends and colleagues (iv) remaining adherent when travelling and socialising, and (v) managing periods of emotional upheaval. Additional tri-weekly posts (sent on Mondays, Wednesdays and Fridays) further addressed these conceivable barriers to adhering to the LCHF diet. Spontaneous email communications between the researcher and participants and responses from weekly questionnaires provided a platform for subsequent posts to be developed.

Likewise both SDT and SCT have been successfully employed to change dietary behaviours and elicit weight loss (Palmeira et al., 2007; Silva et al., 2008). SDT highlights that individuals share an intrinsic need to be integrated into a social scenario (Williams et al., 1996). The LCHF Women's Health Research programme participants were effectively part of a cohesive group, embarking on a prescribed weight-loss programme. Mutual anonymity, an ethical requirement throughout the study period, prevented sharing of participant information. Weekly posts however, were delivered in a tone denoting the group-based characteristic of the programme. Coupled with SDT, SCT, based on determinism between environment, behaviour, and the associated interactions, further informed resource development. Strategies were employed to address findings that the internet, while a feasible medium for delivering weight related behaviour-change programmes, can be less acceptable to some participants than personal or one-on-one communication (Harvey-Berino, Pintauro, & Gold, 2002). An interactive forum was included to encourage discussion amongst participants and the researcher. This forum addressed queries and provided a medium for communication between participants. While participation in the forum was not compulsory, an opportunity was created for all participants to benefit from group discussion and contribute if desired.

### **3.3.3 Intervention components**

#### **3.3.3.1 Website**

Participants were provided with access to the LCHF Women's Health Research website, on completion of the baseline questionnaire. Resources appearing in the website included detailed guidelines on food choices within the spectrum of the LCHF wholefood nutrient profile, food lists,



and recipes (Table 2). The website was created as a medium for delivery of information and resources, and to act as a platform of communication between the lead author and participants. Resources were designed and delivered to be consistent with findings from an evidence base of research into web-based weight-loss programmes. Furthermore, the web-based nature of the programme delivery allowed for flexibility in time and venue for access of information.

#### *3.3.3.2 Resources*

Further information relevant to the target population included: (i) 'tips and tricks', (ii) LCHF recipes, (iii) basic eating plans, and (iv) lists outlining foods to include and avoid (Table 2). Furthermore, consideration was made to weekly participant data with subsequent posts adapted to reflect themes emerging each week. An additional resource in the form of a hard-copy LCHF Guide allowed participants to access relevant LCHF based information in case internet technology was not accessible. This resource comprised information aligning with that contained on the website. While providing recommended foods and LCHF background information, blog/posts and content added throughout the eight-week study were available only on the website. The resources were designed to provide support at a level that addressed the diversity of participant needs and knowledge, and aligned with current 'stage of change'. Table 3.2 presents a detailed description of the intervention components, featuring an outline and timeline adhered to throughout the LCHF Women's Health Research programme.

Table 3.2. Description of intervention components

Component	Element	Description
<b>Website</b>	Study Introduction	Detailed information on the LCHF Women's Health Research programme, including research team biographies, study background, and participant expectations.
	Food lists	Comprehensive lists outlining foods to include and avoid based on unprocessed whole foods. Provision of recommended pantry items enabling adherence to LCHF guidelines.
	Tips and Tricks	Pages outlining situations and emotions likely to impact adherence to the LCHF diet; e.g. preparing for travel, enlisting family and social support. Additional pages included information on the suitability of alcohol in the LCHF diet.
	Recipes page	Recipes were developed and formatted under headings: Meals, Snack Options, Sauces and Dressings, Cakes and Desserts, and Breakfast. All recipes comprised appropriate LCHF ingredients of recommended macronutrient profile.
	Ask a Question	Interactive forum for participants to communicate with the researcher. Designed to motivate conversation and incite support between participants.
	Media	Additional LCHF reading material, including links to websites providing scientific background, books by renowned LCHF authors, and current media updates.
<b>Blog/Post</b>	Let's Get Started-Day	Introduction and simple strategies to adhere to LCHF.
	Mid-Week-Day 3	Addressing common emotions as a result of dietary behaviour change.
	It's Friday!	Managing social situations while adhering to LCHF diet.
<b>Week Two</b>	Week 2- A Bit About Weight loss	Addressing diversity of rates of weight loss between individuals.
	Let's Get Serious	Provision of further detail on precise macronutrient profile to consume the recommended < 75g carbohydrate per day.
	It's Easter	Strategies to address traditionally celebratory and social situations.
<b>Week Three</b>	The Question of Fats	Provision of evidence on the efficacy of the high fat component of LCHF.
	Week 3- Pep talk	Encouragement at the halfway point of the study.
	Low Carb-Your New Normal	Noticing positive changes as a result of the LCHF diet and accepting lifestyle changes as permanent behaviours.
<b>Week Four</b>	Lunches and a Story	Revision of suitable lunch options and importance of adequate food preparation.
	Struggling-You are Not Alone	Recognition of the temptation to revert to 'non recommended', high carbohydrate foods and encouragement to return to the LCHF guidelines.
	Gut Feelings	Outline on 'gut health' and related benefits of a LCHF diet.
<b>Week Five</b>	The Comfort of Food	Request for participant feedback on foods that were noticeably missed on a LCHF diet.
	Your Feedback	Request for feedback on topics participants require further information on in order to continue to adhere to the LCHF diet.
	Stress Less	The impact of stress on weight loss and wellbeing.

<b>Component</b>	<b>Element</b>	<b>Description</b>
<b>Week Six</b>	The Low Carb Template	Recognising that individuals require a diversity of lifestyle options. Provision of encouragement for participants to put measures in place to ensure LCHF could be a permanent lifestyle choice.
	Back to Stress and Hormones	Encouragement for participants to address and manage stress levels.
	What's Good About LCHF	Request for participants to share the components of LCHF that were most appealing and motivating.
<b>Week Seven</b>	Mix it Up and Keep it Interesting	Avoidance of monotony, links to popular recipes and encouragement to experiment with LCHF food options.
	Family Life	Sharing of personal family experiences and responses from family members to LCHF dietary modifications.
	Carbs and Wine	Clarification of carbohydrate content of wine and strategies and recommendations for reducing alcohol intake.
<b>Week Eight</b>	Week 8 of 8	Acknowledgement of final week of the intervention and encouragement for participants to prepare to continue with dietary modifications.
	Weight Loss and Recipes	Further discussion on weight loss and acknowledgment of diversity of personal weight loss.
	The last Post	Acknowledgment of conclusion of the intervention.

### 3.4 Discussion

While traditional weight-loss interventions have focused on calorie and/or fat restriction, aligning with current public health guidelines (Ministry of Health, 2003), the LCHF Women's Health Research Programme employed a LCHF non-calorie controlled approach to weight loss. This exploratory study utilised a web-based medium to deliver a weight-loss intervention to women aged 40-55 years, designed to primarily determine the acceptability of, and adherence to, a LCHF diet. The hypothesis underpinning this study proposes that the LCHF dietary approach may enhance an individual's adherence when coupled with the important behavioural lifestyle modifications required to reduce weight and improve metabolic health outcomes. This enhanced adherence from LCHF eating would be mediated by the satiating physiological response from the high fat component elicited by the LCHF diet. It was further hypothesised that levels of adherence could be maximised by the web-based nature of delivery, and application of appropriate permutations of HBTs. While it became evident that the relatively novel LCHF approach to weight loss appealed to participants, it was imperative to deliver the intervention applying appropriate theory and design for eliciting sustainable weight loss.

Consideration of the feasibility and practical approach to weight-loss interventions is essential for them to have any attempt at bringing about sustained change. Furthermore, it is well recognised that at any one time, 43.6% of women are attempting to lose weight (Serdula et al., 1999). This has led to an understanding that the target population were likely to have attempted weight-loss previously, and were therefore vulnerable to both attrition and non-adherence. The challenge of creating an intervention appropriate to the target population therefore resulted in the application of a combination of HBTs addressing behaviour change at an individual level, with additional consideration of social and environmental factors. Participants were instructed and encouraged to access components of the website that were appropriate to their current stage of change. In addition to providing a basis of information to enable participants to embark on the LCHF diet, the web-based element of the study allowed an individually determined level of access based on individual progress with the programme. The application of HBT, particularly the TTM aspect, informed the development of components of the resource endorsing an appropriate macronutrient profile and advice on managing situations with the potential to negatively impact dietary change. Aligning with SDT, the resources allowed participants to undertake dietary behaviour modifications, while maintaining their existing lifestyles within their own social and environmental settings.

A major limitation to this intervention may be the need by certain participants for face-to-face and group-based support networks. In acknowledging this gap in the intervention design, a strategy was implemented to support participants who indicated the need for added assistance. While all participants received group-based support for managing situations including travel, socialising, and food choice and preparation, further allowance was made for participants who required a one-on-one approach. This was implemented through personal email communication on an as-needed basis. Future web-based weight-loss interventions may benefit from providing both structured one-on-one support, and allowing for communication between participants. It is essential that consideration is made to the needs of participants, and that programme facilitators are empathetic and react to individual requirements. Measurement of the effectiveness of weight-loss programmes would require careful and considered analysis in order to elucidate efficacious intervention components. Furthermore, interventions should operate at a

level of complexity that is comprehensible and relevant to the target population (Weinstein, 2006).

The LCHF Women's Health Research programme resource was developed and implemented to support women through dietary behaviour change, providing a level and depth of information that promoted participant autonomy. Key strengths of this study were the flexibility allowed through the web-based design of the intervention, and the application of appropriate HBTs. Evidence suggests that the use of a mixed methods approach in application of HBT to interventions, elicits more favourable outcomes than interventions aimed at one level of behaviour (Elder et al., 1993).

The mixed methods approach to applying HBT to the LCHF Women's Health Research programme endorsed a multi-level intervention, integrating behaviour change models with both the medium of delivery and required dietary modifications. Such an approach appears to appeal to the targeted population, allowing flexibility, autonomy, and, as is hypothesised, enhancing adherence to suggested dietary behaviour practices. Whether long-term behaviour change and weight loss can be maintained through this approach remains to be established. This programme, however, was designed to allow for individual participant's existing stage of change, and level of knowledge around the LCHF dietary guidelines. It is evident however that the LCHF approach to weight loss warrants further investigation. While future studies are required to determine the most efficacious design and delivery of weight-loss interventions, consideration of specific issues contributing to adherence to dietary modification in the targeted population is essential. Future interventions targeted at middle-aged women should consider primarily the nutrient profile of a diet and associated relevance to internal physiology, and secondly the integration of HBT into weight-loss programmes.


## **Chapter 4: Intervention Resource**


### **4.1 Preface**

Chapter 3 provided a detailed account of the rationale and development of the Women's Health Research Programme intervention. This chapter delivers a summary of the intervention components including a comprehensive inventory of the web pages and content. This chapter has been submitted as a journal article and was therefore limited to brief descriptions of this information only.

## 4.2 Background Information

### 4.2.1 Introduction

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## Introduction



Welcome to the **LCHF Women's Health Research Project**. Firstly, thank you for agreeing to participate in this study. It is an important area of research with the potential to benefit not only women in our age group and life stage but our husbands and families as well.

Over the next few weeks with the help of this website I am going to provide real life, down to earth, tips and tricks and recipes to make sure that you can take most carbohydrates out of your life and keep them out.

The reason I know I can help you with this is that two years ago I started on the same path as you are now; I cut most carbohydrate out of my diet. Over the next few months I watched how my weight dropped, my energy levels improved and my mindset changed. What started as an experiment has become a way of life. I no longer obsess about my weight. I broke the "sugar habit", and believe me, I had a bad habit!

My experiences are going to enable you to get through those times when you are struggling with how to prepare food to suit everyone in your home, how to manage **social situations**, stay **low carb while travelling**, and to make sure that you always have access to tasty and fulfilling foods. Don't worry; it's not all rabbit food either, there will be foods which have been forbidden for years which will now be back on your menu, and you will find that the food you are preparing for yourself is going to be fine for the whole family.

Things you need to know about cutting sugar out of your diet:

- You don't have to give up **cooking** and **baking**, there are recipes we can adapt to allow you to cook up a storm, and feel better for it
- You are going to miss some favourite foods but you will find replacements which are tasty and satisfying
- Your friends will laugh at you and tell you that "everything in moderation" is the only way to live. Your turn to laugh will come in 3 months' time when you are looking and feeling great, believe me those friends will quietly start to cut down on their own sugar intake

Things you need to know about me:

- I am passionate about making the low carbohydrate way of living that is achievable for "normal" people who live busy, social lives
- I love to cook and have worked in several cafes and restaurants in and around Auckland
- I am 49 and a mother of two adult children in their 20's who haven't broken the sugar habit
- I am a nicer person (or so I am told) when I have a glass of wine in my hand



### WOMENS HEALTH

ABOUT ▾

» INTRODUCTION

» THE STUDY

» RESEARCH TEAM

FOOD LISTS ▾

TIPS AND TRICKS ▾

RECIPES ▾

BLOG

ASK A QUESTION

MEDIA

Facebook

Twitter

Recipes

YouTube

Email


Contact



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## 4.2.2 About the Study

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Log Out







## The LCHF Women's Health Study

### Introduction to the LCHF Women's Health Study

**What's going to happen:**

The LCHF Women's Health Study is an 8-week low carbohydrate, higher fat eating programme. This website has been designed to provide you with the knowledge you need to successfully undertake this eating plan.

By now you will have completed your baseline questionnaire, so it is time to prepare yourself for the next 8 weeks of good wholesome eating. I have created a list of **foods to include** and **foods to avoid**. If you follow this guide you will soon be familiar with the foods you need to include every day and those to avoid.



Over the next 8 weeks you will receive:






- Updates from me twice a week with further tips and tricks
- A weekly questionnaire to complete online
- Access to a **questions and answer section** supported by a team of low carb experts to answer any questions that you may have throughout the programme.
- The means to communicate with fellow participants through the question and answer section


**To help you get started go to the **Basic Eating Plan** tab**

It is important to increase the amount of vegetables you eat every day, and in particular green and leafy vegetables such as spinach and broccoli. There is no limit to the amount of these vegetables you should eat. This will ensure that you are getting all of the nutrients and fibre that you need each day.

The second point to remember is to increase the amount of natural fats (avocado, salmon, olive oil, almonds, coconut cream etc) in your diet. This doesn't mean that you can eat unlimited amount of fat, it means that you should eat a lot of vegetables, a moderate amount of protein (meat, poultry, eggs, fish) but include these fats each day. Fat helps to keep you feeling full and stops you feeling hungry. Fat is critical to help you to adhere to the LCHF eating plan. Replace those reduced fat items from your fridge with full fat options with no added sugar. Note that reduced fat items are usually higher in sugar.

And thirdly a common trap for low carbers in the first few weeks of embarking on this lifestyle. Don't over eat protein. Protein is converted to glucose and causes a similar reaction to carbohydrate. This can hinder weight loss on a low carb diet.





### WOMENS HEALTH

ABOUT ▾

▸ INTRODUCTION

▸ **THE STUDY**

▸ RESEARCH TEAM

FOOD LISTS ▾


TIPS AND TRICKS ▾


RECIPES ▾


BLOG


ASK A QUESTION


MEDIA


Facebook


Twitter

Recipes

YouTube

Email

Contact



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## 4.2.3 The Research Team



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### The LCHF Women's Health Research Team



Lead Researcher:  
Julia McPhee

Academic Supervisors:  
Dr Caryn Zinn and Dr Melody Oliver

I have a background in managing major health research projects, however it was my personal interest and experience in living the low carb lifestyle that lead me to developing this research project. I am very excited about conducting my own study and I am looking forward to sharing with you what I have learned through my own experiences. At the same time I would like to learn how we can make this diet achievable and sustainable for all women, particularly those in a life stage that includes major hormonal upheavals and associated health issues. This study will form the basis of my Masters Thesis in Public Health.

My primary supervisor, Dr Caryn Zinn is a registered NZ dietician. Caryn teaches in the area of both public health and sports performance nutrition. Caryn is leading the way in LCHF across NZ and is well regarded internationally in this area.

Dr Melody Oliver is a public health researcher with specialist expertise in health-promoting behaviours in children and their families. Her experience in conducting high quality research projects is well recognised nationally and internationally.

Caryn and Melody will provide guidance to ensure that this research project is conducted in methodologically sound manner. Their support will be invaluable to this study and will ensure that our findings can be shared effectively.





#### WOMENS HEALTH

- ABOUT ▾
- » INTRODUCTION
- » THE STUDY
- » RESEARCH TEAM
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- RECIPES ▾
- BLOG
- ASK A QUESTION
- MEDIA

 Facebook

 Twitter

 Recipes

 YouTube

 Email


 Contact




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## 4.3 Food Lists

### 4.3.1 Foods to Include

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RNZN

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## Foods to Include




You will notice that by following this guide you will be avoiding most packaged and processed foods. It is important that you increase the amount of vegetables (from the list below) that you include in your diet on a daily basis. Remember too that 'fat is your friend as long as you are not eating carbohydrates', so please include good fats in your diet daily; avocado, olive and coconut oil, butter.

### What you can eat:

- Plenty of fresh vegetables, in particular those grown above the ground; lettuce, spinach, tomatoes, asparagus, zucchini, cucumber, capsicum, carrots, broccoli, cauliflower
- Avocados
- Meat, poultry and fish (keep the fat on)
- Eggs
- Nuts and seeds – especially almonds, walnuts, macadamia and brazil nuts, sunflower seeds, pumpkin seeds and linseed
- Nut butter such as almond, macadamia and cashew and Tahini
- Cheese, cream, butter, sour cream, cream cheese, milk (full cream)
- Coconut cream and coconut milk
- Olive oil (as a dressing with salad vegetables), coconut oil (for cooking)
- Yoghurt (full fat Greek, avoid low fat and sweetened options)
- Fruit but no more than 1 piece per day (not banana or grapes due to the very high carb count). A good guide is 'what's in season within reason'. Berries are a good option and frozen are fine
- Any of the recipes included in this website


**NOTE:** If you are in doubt as to whether you should or should not eat a particular food a good motto is;


"If in doubt, leave it out!" and then ask me in the question section!!





### WOMENS HEALTH


- ABOUT ▾
- FOOD LISTS ▾
- FOODS TO INCLUDE**
- FOODS TO AVOID
- BASIC EATING PLAN
- LCHF SHOPPING STAPLES
- TIPS AND TRICKS ▾
- RECIPES ▾
- BLOG
- ASK A QUESTION
- MEDIA


Facebook


Twitter

Recipes

YouTube


Email


Contact



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## 4.3.2 Foods to Avoid


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**WOMENS HEALTH**







**WOMENS HEALTH**

ABOUT ▾

FOOD LISTS ▾

> FOODS TO INCLUDE

**> FOODS TO AVOID**

> BASIC EATING PLAN

> LCHF SHOPPING STAPLES

TIPS AND TRICKS ▾

RECIPES ▾

BLOG

ASK A QUESTION

MEDIA

## Foods to Avoid


Avoid all foods on the list below. If you do need to purchase processed foods check the label and only purchase options with less than 10g carbohydrate per 100g. The lower the better. Avoid reduced fat options, they will generally have a higher sugar content.


### What you can't eat:


- All bread and bread products (this includes whole grain options, rolls, pita bread – avoid ALL bread products!)
- Rolled oats and breakfast cereals
- Rice white and brown (this includes sushi, rice crackers, rice noodles)
- Chickpeas, lentils, hummus, soybeans, and other pulses
- Sugar in all its forms – plain sugar, castor sugar, maple syrup, golden syrup, honey
- Pasta and pizza
- Hamburgers, fries and most takeaways
- Lollies and chocolate
- Beans and legumes
- Dried fruit
- Fruit juice
- Beer, cider and liqueurs
- Cakes, biscuits, muffins, crackers (unless the recipes have been accessed from this website)
- Potato chips, rice crackers, corn chips, pop corn and packaged snacks
- Potato, kumara, pumpkin and corn on the cob (or any corn).
- Pastry
- Flour, plain and wholemeal and all flour based products
- Banana, grapes, canned and stewed fruit
- Processed sauces and condiments (tomato sauce, sweet chilli sauce, low fat mayonnaise)
- Honey, jam, golden syrup, rice syrup, agave
- Polyunsaturated oils (canola, rapeseed, soybean oil, and corn oil) EAT ONLY OLIVE AND COCONUT OIL


**NOTE:** If you are in doubt as to whether you should or should not eat a particular food a good motto is;


**"If in doubt, leave it out!"** and then ask me in the question section!!


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 Twitter

 Recipes

 YouTube


 Email


 Contact

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### 4.3.3 A Basic Eating Plan

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## Basic Eating Plan

Include vegetables when ever possible in meals and snacks






### Breakfast



Any of the following options are good;

- 2 eggs poached, scrambled, or fried (in butter or coconut oil), served with avocado, bacon, mushrooms
- Omelette filled with vegetables and cheese
- Yoghurt, Greek full fat, with fresh or frozen berries. Add LSA and Chia seeds for some texture






### Lunch




Salads are ideal. Either prepare and take with you to work, or keep a stock of fresh ingredients in your workplace fridge.

- Spinach, lettuce, tomatoes, carrot, boiled egg, cheese, avocado etc, add some cold chicken, tinned fish or left over cold meat.
- Use an olive oil dressing or try the **Garlic Aioli** recipe provided
- Alternatively take left overs from last night's dinner. Most recipes provided taste even better the next day

### Dinner



This is probably the easiest meal to create and prepare. Your choice of meat, poultry, or fish and salad or vegetables is an ideal option. There are several recipes provided on this website, and although you WON'T be including bread, potatoes, pasta or rice, there are some easy alternatives. Try my cauliflower rice recipe and remember to include some fat with this meal, olive oil on your salad, a cream or coconut sauce with your meat. Trawl through the recipe pages and be creative. Add your own favourite fresh herbs and flavourings, but don't be tempted to add sauces such as tomato or sweet chilli sauce, they are laden with sugar.



## WOMENS HEALTH

ABOUT ▾

FOOD LISTS ▾

> FOODS TO INCLUDE

> FOODS TO AVOID

> BASIC EATING PLAN

> LCHF SHOPPING STAPLES


TIPS AND TRICKS ▾


RECIPES ▾


BLOG


ASK A QUESTION


MEDIA


Facebook


Twitter

Recipes

YouTube

Email


Contact




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#### 4.3.4 Shopping List

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## LCHF Shopping Staples



The list below contains many of the ingredients I use on a regular basis for cooking meals, snacking, baking and preparing quick easy meals on the go. I haven't added quantities here so you will need to judge for yourself how much of each item you need to purchase. It is important that you do not let yourself go hungry so make sure you have purchased enough food that you always have a supply of good food to prepare meals with and to snack on. All of the foods below should be available at your local supermarket.

- Eggs – Make sure you have plenty of eggs on hand. They are a versatile ingredient for many low carb recipes and a good snack option
- Full fat yoghurt
- LSA\* (Ground Linseed, Almond, Sunflower seeds)
- Chia seeds\* (gluten free section of your supermarket)
- Fresh or frozen berries
- Full cream milk
- Cream
- Coconut cream
- Cheese – Cheddar, blue vein, or any of the myriad of great cheeses available
- Vegetables – Lettuce, spinach, tomatoes, cucumber, carrot, capsicum, broccoli, cauliflower
- Avocado – I am giving avocado a line of it's own as it is a fantastic addition to low carb meals and snacks
- Cooked chicken – handy to have in the fridge as a snack or to make quick and satisfying salad
- Fruit – what's in season within reason! (keep to a minimum)
- Olive oil
- Coconut oil
- Almonds roasted or raw
- Coconut – desiccated or threaded
- Almond butter
- Whole ginger, fresh garlic, raw chilli (these ingredients can be used fresh or if you prefer, buy pre-crushed, it will save you time)
- Fresh herbs of your choice
- Natvia or Stevia ( natural sweeteners)

\*Chia seeds are a versatile little seed, high in protein and dietary fibre and great for digestion.

\*LSA is good source of protein, fibre and omega 6 and 9 essential fatty acids.



### WOMENS HEALTH

ABOUT ▾

FOOD LISTS ▾

- > FOODS TO INCLUDE
- > FOODS TO AVOID
- > BASIC EATING PLAN
- > LCHF SHOPPING STAPLES


TIPS AND TRICKS ▾


RECIPES ▾

BLOG

ASK A QUESTION

MEDIA

 Facebook


 Twitter

 Recipes

 YouTube

 Email


 Contact




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## 4.4 Tips and Tricks


### 4.4.1 Socialising


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## Socialising

Most of our social time involves friends, food and alcohol, and the food we eat when socialising and eating out is usually carbohydrate based.


You might find some people take it personally and can be hostile to the changes you are making. Don't let this deter you; you will get good at making the changes quietly and without a lot of fuss. To avoid over-eating those pre-dinner snacks, have a healthy snack, smoked salmon, nuts, or a boiled egg, before you leave home.

If you are entertaining at home, prepare low carb platters and snacks. You don't have to provide the chips and crackers for your friends, do them a favour and introduce them to low carb options. Make a platter using:

- Slices of cucumber instead of crackers
- Almonds and mixed nuts
- Cheese
- Sliced meats
- Smoked salmon
- Sliced carrots, celery and capsicum
- Make cream cheese, yoghurt or sour cream based dips or buy dips without added sugar such as Lisa's Feta based dips or Tzatziki (yoghurt and mint)

In restaurants, order sauces to be served on the side if possible. Avoid desserts, just order coffee.

Drink a lot of water. Not just when you are socialising, keep your water intake up throughout the day, but make sure you drink water when you are out at night. Low carb beer and red and white wine are ok, but you will feel a lot better if you cut down on the amount you normally drink. Replace alternate glasses of wine with sparkling mineral water, and drink it out of a wine glass. This way people won't even notice that you are not drinking! Always have a bottle of water when you go out and take diet soft drink options to help cut down on alcohol.

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[ABOUT ▾](#)

[FOOD LISTS ▾](#)

[TIPS AND TRICKS ▾](#)

[CARB FLU](#)

[SNACKS - WOMEN](#)

[SOCIALISING](#)

[LCHF PRODUCTS TO PURCHASE](#)

[DRINKS](#)

[TRAVEL](#)

[FATS](#)

[SOME BASIC FACTS ABOUT INSULIN](#)

[ARTIFICIAL SWEETENERS](#)


[THE ALCOHOL QUESTION](#)


[RECIPES ▾](#)


[BLOG](#)


[ASK A QUESTION](#)


[MEDIA](#)


Facebook


Twitter

Recipes

YouTube



Email

Contact


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## 4.4.2 Alcohol



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### The alcohol question: How does alcohol fit into the low carb lifestyle?

This is a big question, and a deal breaker for many people considering the low carb lifestyle. Other websites and low carbers might recommend permanent abstinence from alcohol, but not me. Alternatively I definitely would not recommend increasing your alcohol intake.

If you are actively trying to lose weight then no more than one glass of wine per day. Alternatively there is no harm at all in having several alcohol free days per week and you will benefit from it.


Alcohol is not metabolised as carbohydrate and does not send blood sugar into orbit, however alcohol will become your body's first energy source before carbohydrate or fat, hence not the best option when actively trying to lose weight. There are vastly differing **carb counts** in different types of alcohol. Wine, red and white are better options than beer and if you drink spritz; gin, vodka and whiskey are ok but ONLY use diet option for mixers.

I strongly advise you to keep alcohol consumption to a minimum. You are more likely to make the wrong food choices when drinking alcohol. Your bodies will be going through some changes as you detox and your tolerance for alcohol will reduce.

### Further reading







<http://www.liquitsugar.com/resource-sheets/the-lowdown-on-alcohol/>


I disagree with Sarah's comment on beer



### WOMENS HEALTH



- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
  - › CARB FLU
  - › SNACKS - WOMEN
  - › SOCIALISING
  - › LCHF PRODUCTS TO PURCHASE
  - › DRINKS
  - › TRAVEL
  - › FATS
  - › SOME BASIC FACTS ABOUT INSULIN
  - › ARTIFICIAL SWEETENERS
  - › THE ALCOHOL QUESTION
- RECIPES ▾
- BLOG
- ASK A QUESTION
- MEDIA

 Facebook    Twitter    Recipes    YouTube    Email    Contact




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## 4.4.3 Travel








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## Travel




Whether it is for work or holiday travel can be a testing time for 'low carbers'. Always travel with a supply of foods to snack on during the day so you are not tempted to choose carb laden snacks at airports cafes etc. Most places you travel to, you will be able to purchase low carb options, but finding the time to shop in a new city can be difficult.

Take foods which can be purchased in sealed packages;

- almonds and mixed nuts
- cheese slices
- small cans of tuna or salmon

When you are flying, it is not compulsory to eat everything on your plate! Eat what fits into your eating plan and leave the rest. Drink plenty of water during the flight, and keep moving.

Hotel breakfasts usually have good options. A breakfast consisting of eggs, bacon and vegetables: such as creamed spinach, tomatoes, mushrooms etc will help you to feel full for longer periods and less likely to snack during the day.









Business lunches usually consist of carbohydrate dense foods ending in an array of sweet cakes and slices, but usually provide fruit. If the only lunch option is sandwiches or rolls, remove meat and salad from bread rolls, dispense with the roll and eat the meat and salad! Don't be tempted by the cakes and sweets, just stick with fruit and coffee. Just make sure that you are always prepared and have an alternative with you to combat those carb filled foods. You will soon notice that 'I need a sleep' feeling you get after the usual carb laden lunch will no longer hit you. It might help to get up and move at any opportunity at meetings and conferences. It is not natural or good for you to be sitting for long periods.

## My Travel Story

But travel isn't always glamorous or easy. See below for pictures of a work related trip I did recently to Nauru. The accommodation was very basic with no refrigeration. Note that my food choices were dubious at best! I taught the cook at the local (and only) breakfast bar how to fry eggs. By his reaction to my request I gather it was a new experience for him. Most restaurants were Chinese and it was difficult to find food that wasn't deep fried and covered in a sweet sticky sauce. So I did my best to stay as low carb as possible, but once I returned home I was very quick to return to my low carb staples. Always remember that if you fall off the low carb wagon occasionally, don't worry, just get back on board and carry on. This is a way of life not just a quick fix. None of us are perfect so do the best you can in certain situations but get back on board the low carb lifestyle as soon as you can.

Most concerning about my trip to Nauru though was the fact that the locals fared a lot worse than I did. While I could afford to buy vegetables, this was not a luxury available to most locals. Their food options consisted of very high carbohydrate foods such as 2 minute noodles, white rice, soft drinks, and some meat when the ship arrived in town each month. Not surprisingly Nauru has one of the highest rates of obesity in the world. For a small and once beautiful country their reliance on Western aid to provide food has resulted in a diet high in processed carbohydrate and lacking in fresh food, making them a global statistic for all the wrong reasons.





### WOMENS HEALTH

ABOUT ▾

FOOD LISTS ▾

TIPS AND TRICKS ▾

> CARB FLU

> SNACKS - WOMEN

> SOCIALISING

> LCHF PRODUCTS TO PURCHASE

> DRINKS

> TRAVEL

> FATS

> SOME BASIC FACTS ABOUT INSULIN

> ARTIFICIAL SWEETENERS


> THE ALCOHOL QUESTION


RECIPES ▾


BLOG


ASK A QUESTION


MEDIA


Facebook


Twitter

Recipes

YouTube

Email



Contact




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#### 4.4.4 Carb Flu



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## Carb Flu

Be aware and ready but don't be concerned!

You may have heard of 'Carb Flu'. This is a combination of symptoms that you may or may not suffer on the first few days of embarking on a low carb eating plan:

- Headaches
- Constipation
- Bad breath
- Lack of energy or fatigue

To avoid or at least minimise these symptoms:

### Drink plenty of water

- As you reduce carbohydrate intake and eliminate carbs from your system, you will lose water. A lot of initial weight loss is due to this loss of water, but it is important that you keep hydrated. Water will also help you feel full in these first few days.


### Don't be afraid to eat more salt than usual

- Processed foods are notoriously high in salt, so when you eliminate these foods (bread, cereal, tinned and bottled and packaged foods) from your diet you are also reducing your salt intake considerably. This can contribute to those headaches and fatigue, so add little salt to meals

### Constipation







- If you are eating plenty of fresh vegetables and drinking plenty of water this should not be a problem


Remember that you are making some major modifications to your diet, so some side effects are to be expected. It is a small price to pay for some major health and lifestyle benefits. Please use the forum to share your experiences; it may help other participants understand their own experiences.



#### WOMENS HEALTH


- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- » CARB FLU
- » SNACKS - WOMEN
- » SOCIALISING
- » LCHF PRODUCTS TO PURCHASE
- » DRINKS
- » TRAVEL
- » FATS
- » SOME BASIC FACTS ABOUT INSULIN
- » ARTIFICIAL SWEETENERS
- » THE ALCOHOL QUESTION
- RECIPES ▾
- BLOG
- ASK A QUESTION
- MEDIA


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#### 4.4.5 Snacks

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## Snacks

In the early days of reducing carbohydrates from your diet, make sure that you always have something to snack on close by. Before you reach for a snack though, have a glass of water. Often, particularly in the early days of eating low carb, you will feel hungry when in fact you just need a drink of water.

The following snack options are easy to carry or store in your office drawer or handbag.

- Roasted or raw almonds
- Boiled eggs (boil several eggs on Sunday so you always have them available to snack on during the week)
- Fresh fruit, 1 serving only per day. Eat fruit which is in season and locally available. Berries are the best option, low in carbs and high in additional nutrients.
- Slices of cheese
- Natural unsweetened (not low fat) Greek yoghurt
- Carrot and celery sticks and cucumber or avocado slices



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ABOUT ▾

FOOD LISTS ▾

TIPS AND TRICKS ▾

▸ CARB FLU

**▸ SNACKS – WOMEN**

▸ SOCIALISING

▸ LCHF PRODUCTS TO PURCHASE

▸ DRINKS

▸ TRAVEL

▸ FATS

▸ SOME BASIC FACTS ABOUT INSULIN

▸ ARTIFICIAL SWEETENERS

▸ THE ALCOHOL QUESTION

RECIPES ▾

BLOG

ASK A QUESTION

MEDIA

Facebook

Twitter

Recipes

YouTube



Email

Contact


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#### 4.4.6 Drink Options




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## Drinks

### Drinks to avoid




- Sugar sweetened soft drinks – Coke, Fanta, Solo, Lemonade etc
- Juice – this includes processed and freshly squeezed juice
- Sports drinks – Mizone, Sustegen, Gatorade etc
- Sweetened flavoured water

### Drinks to include





- Water – sparkling water is a refreshing alternative to standard drinking water
- Tea and coffee – add cream as an alternative to milk to help you feel fuller
- Diet soft drinks – keep to a minimum





### WOMENS HEALTH


- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
  - CARB FLU
  - SNACKS – WOMEN
  - SOCIALISING
  - LCHF PRODUCTS TO PURCHASE
  - DRINKS
  - TRAVEL
  - FATS
  - SOME BASIC FACTS ABOUT INSULIN
  - ARTIFICIAL SWEETENERS
  - THE ALCOHOL QUESTION
- RECIPES ▾
- BLOG
- ASK A QUESTION
- MEDIA


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## 4.5 LCHF Recipes

### 4.5.1 Main meals

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## Meals




### Roast Vege Salad

17th Dec, 2014 | by Julia McPhee

Roast Vege Salad Instructions Toss vegetables in a roasting dish with olive oil, salt, pepper, extra garlic and ginger and vinegar. Bake at 175 degrees for around 30 minutes or until vegetables are cooked but still have texture. When vegetables are cooked, toss spinach through and serve. This salad goes well with all roasted and [...]

[Read more](#)




### Low Carb Lasagne

10th Dec, 2014 | by Julia McPhee

This dish is a good option reheated for lunch the following day. As with most of the recipes the flavours get even better over night.

[Read more](#)




### Low Carb Shepherds Pie

6th Dec, 2014 | by Julia McPhee

Low Carb Shepherds Pie Instructions Heat coconut oil in a pan and sauté beef mince with chopped onion. Add chopped vegetables and grated carrot to the cooked mince. Cook on a low heat until meat is cooked. Add tomato paste. Continue to cook on a low heat until the vegetables are well cooked. If [...]

[Read more](#)




### Creamy Chicken Casserole

24th Nov, 2014 | by Julia McPhee

Creamy Chicken Casserole Instructions Sautée chicken thighs in coconut oil, add crushed garlic, chilli and ginger. When chicken has browned slightly add cream, chicken stock, chilli powder and a sprinkle of chilli flakes. Cut capsicum, zucchini and onion into large chunks and add with whole button mushrooms and limes to the chicken cream mixture. [...]

[Read more](#)



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FOOD LISTS ▾

TIPS AND TRICKS ▾

RECIPES ▾

> SAUCES AND DRESSINGS

> CAKES AND DESSERTS

> SNACK OPTIONS


> BREAKFAST


> MEALS


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## 4.5.2 Cakes and desserts




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## Cakes and Desserts




### Chocolate Blueberry Clusters

1st Apr, 2014 | by Julia McPhee

Chocolate Blueberry Clusters Instructions Melt chocolate over a low heat, stirring constantly. Place around 5 blueberries into each of 10 mini muffin tins or paper patty cups. Pour melted chocolate over each to cover blueberries and refrigerate. These little treats are for dark chocolate lovers, but the blueberries give a burst of sweet flavour.

[Read more](#)




### Coconut Lime Cakes

21st Mar, 2014 | by Julia McPhee

Coconut Lime Cakes Instructions Place 2 limes in a bowl and cover with water. Place in the microwave and heat for around 3 minutes or until limes are soft. Place cooked limes in a blender and blend until well pulped. Beat Eggs, and coconut cream, add limes and remaining ingredients and mix well. Finally [...]

[Read more](#)




### Fresh Fruit Ice-cream

12th Mar, 2014 | by Julia McPhee

Fresh Fruit Ice-cream Instructions Blend all ingredients until smooth. If you have an ice-cream maker, follow the manufacturers instructions. Alternatively, place in freezer and blend again when mixture is nearly frozen. Serve immediately. Note that this recipe is best eaten at once as there are no additives to stop it freezing solid. I have never [...]

[Read more](#)




### Low Carb Carrot Cake

10th Mar, 2014 | by lowcarb


Low Carb Carrot Cake Instructions Beat eggs, melted butter, Natvia, and vanilla together. Add grated carrot, walnuts, and coconut then mix almond meal spices and baking powder. Bake in a 25cm tin at 170 degrees C for 40 minutes or until firm to touch. A knife inserted into the cake should come out clean. Beat icing [...]


[Read more](#)





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- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- RECIPES ▾
  - SAUCES AND DRESSINGS
  - CAKES AND DESSERTS
  - SNACK OPTIONS
  - BREAKFAST
  - MEALS
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## 4.5.3 Breakfast options

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# Breakfast



## Low Carb Bread

19th Apr, 2014 | by Julia McPhee

Low Carb Bread Instructions Mix dry ingredients. Add beaten eggs and coconut oil. Lastly add boiling water and mix well. It will be quite a thick mixture. Spoon into a greased loaf tin and bake at 180 degrees for around 20 minutes or a knife inserted comes out clean. Cool and slice into 5 [...]

[Read more](#)



## Crunchy Grain-free Granola

19th Apr, 2014 | by Julia McPhee

Crunchy Grain-free Granola Instructions Put nuts in the blender and pulse until ground but not completely. You want some larger pieces for texture. Add cinnamon and mix through. Mix the oil through nut mixture, then egg. Spread on an oven tray and cook at 180 until nuts have started to brown and mixture is [...]

[Read more](#)



## Cheese and Vege Omelette

1st Apr, 2014 | by Julia McPhee

Omelette Instructions Lightly whisk eggs and water or cream together. Add salt and pepper. Heat a large fry pan, add coconut oil and when hot pour in egg mixture. When the egg has cooked and there is just a small amount of wet egg mixture on the top, add your veges and cheese to half [...]

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- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- RECIPES ▾
  - SAUCES AND DRESSINGS
  - CAKES AND DESSERTS
  - SNACK OPTIONS
  - BREAKFAST**
  - MEALS
- BLOG
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## 4.5.4 Sauces and Dressings



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## Sauces and Dressings




### Flavour Burst

10th Apr, 2014 | by Julia McPhee

Chilli Paste Chilli Garlic Ginger Kaffir lime leaf Lime or lemon juice Olive oil Instructions Put equal amounts of fresh chilli, garlic and ginger (choose amounts to your own tastes) Into a blender with 2 kaffir lime leaves and enough lime juice and olive oil to make a paste. Have this paste on hand to [...]

[Read more](#)




### Blue Cheese Sauce

21st Mar, 2014 | by Julia McPhee

Blue Cheese Sauce Instructions Melt butter in a small pot. Add onion and cook until soft. Add cheese and stir until softened. Add cream gradually until the sauce has reached your preferred consistency. Add spring onions and serve immediately. Serve with steak of your choice.

[Read more](#)




### Coconut Herb Dressing

21st Mar, 2014 | by Julia McPhee

Coconut Herb Dressing Instructions Place all ingredients in a blender and blend until nearly smooth. The flavours in this dressing get stronger the longer this dressing is left to sit. This dressing is great on a salad, seafood and chicken. Stored in fridge it will last for several days.

[Read more](#)




### Garlic Aioli

22nd Feb, 2014 | by Julia McPhee


Aioli is an excellent dressing to have on hand. It takes a bit of time to make but makes around 2 cuos and lasts well in the fridge.


[Read more](#)





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- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- RECIPES ▾
- SAUCES AND DRESSINGS
- CAKES AND DESSERTS
- SNACK OPTIONS
- BREAKFAST
- MEALS
- BLOG
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## 4.5.5 Snack Options


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# Snack Options




## Low Carb Crackers

10th Apr, 2014 | by Julia McPhee

Low Carb Crackers Instructions Combine all ingredients in a food processor or blender until well mixed. The mixture should hold together in a ball. Roll into small balls and press flat. Place on baking paper on a tray in the oven and cook for 20 minutes at 175 degrees. Store in an air tight container. [...]

[Read more](#)




## Kale Chips

5th Apr, 2014 | by Julia McPhee

Kale Chips Instructions Turn your oven on to 175 Celsius and line a baking tray with greaseproof paper. Cut off the thick stalks from the kale and tear kale into pieces the size of the palm of your hand. Lay them out on the oven tray in one layer, drizzle with olive oil, and sprinkle [...]

[Read more](#)




## Salami Sandwich

5th Apr, 2014 | by Julia McPhee

Salami Sandwich Instructions The picture speaks for itself. Just layer ingredients with salami on top and bottom and enjoy a tasty fulfilling snack.

[Read more](#)




## Guacamole

3rd Apr, 2014 | by Julia McPhee


Guacamole Instructions Mix avocado with yoghurt. Add crushed garlic, chopped tomato and red onion, and flavour to taste with salt, pepper, lemon juice, and fresh or crushed chilli. Add a small tin of tuna for a higher protein snack (sounds unusual but is actually very tasty).


[Read more](#)





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- ABOUT ▾
- FOOD LISTS ▾
- TIPS AND TRICKS ▾
- RECIPES ▾
  - » SAUCES AND DRESSINGS
  - » CAKES AND DESSERTS
  - » **SNACK OPTIONS**
  - » BREAKFAST
  - » MEALS
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## 4.6 Overview of Program Timeline and Weekly Content

### 4.6.1. Programme Commencement



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## Welcome to your Low Carbohydrate High Fat (LCHF) Women's Health Research website.

This week spend some time familiarising yourself with the website so that you are ready to start next week (Monday 7<sup>th</sup> April). Take a look at the [Foods to Avoid](#) and [Foods to Include](#) tabs and prepare yourselves for some fresh and wholesome eating! For more about the study and my background, take a look at the [Introduction](#) and [The Study Tabs](#).

There are some house-keeping issues we need to get out of the way first.

### Disclaimer

All of the information provided in and through the website located at <http://www.lCHF.co.nz/womens-health/> is intended solely for general information. This website has been designed to provide generalised advice to support participants to undertake the LCHF way of eating. It does not endeavour to prescribe dietary plans or provide consultation.

The information contained on this website is not a substitute for medical advice. If at any time while participating in this study you have concerns around any health conditions or existing medication, please notify your GP.


### Your input into this study

You will soon be receiving your login details. You will need these to access the [Question and Answer](#) section. I believe that this section will be a key support resource for us all. Please feel free to ask questions, share your experiences and generally get involved with discussions within this section. Any questions I am unable to answer will be put to my panel of experts and answered as quickly as possible. No questions or statements will be released until I have approved them. This is standard procedure for these forums.

### Your website

And finally I want you all to be aware that this is your study and your website. While I have a lot of experience in the area of LCHF, as the project progresses I want you to guide me with the type of information you need to assist you to adhere to the LCHF lifestyle. And now.....


## GOOD LUCK AND GOOD EATING





3rd Apr, 2014 | by Julia McPhee  
Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)


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## 4.6.1 Blog/Posts – Week 1

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## Lets Get Started-Day 1

If you haven't already had a good look around the website, try to do so. There is a lot of information here that will help you get started and get through the first few days of low carb living. You are making some major modifications to your diet so read through the tabs that you think are relevant and ask any questions in the [Ask a Question](#) section.

Here are some key points to keep in mind:

### Don't let yourself get hungry



- When you are hungry you are more likely to go for a quick carb loaded fix. So just don't!
- Think about what you are eating, prepare your own food whenever possible and be mindful about the food you eat
- Eat until you have had enough an no more
- By including more **fat in your diet** (avocado, olive oil, cheese, coconut cream and coconut oil etc) you will feel fuller sooner and for longer







### Drink plenty of water

- Always have a bottle or glass of water close by
- Sparkling mineral water can make a refreshing change to tap or bottled water
- Thirst often feels like hunger. If you feel hungry first have a drink of water, if you are still hungry reach for a **low carb snack**

### Tell people around you what you are doing and why

- By telling friends and colleagues about the changes you are making to your diet you are setting up support networks and are more likely to get encouragement from those around you
- It will help to change the food culture in your working, social and family environment
- You might be surprised that some people actually start making small low carb changes to their own diet. Making positive changes in other peoples lives is very rewarding
- Talking about it helps you to understand what you are doing and why you are doing it

### Choose your low carb treat




- Have something everyday that you look forward to and that makes you feel good. For me it was my coffee (no sugar), a very occasional diet coke or a small amount of dark chocolate (85% cocoa). You will lose the need for sweet treats very quickly but they can make a difference in the first few days.

6th Apr, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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BLOG


ASK A QUESTION


MEDIA


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Twitter

Recipes

YouTube

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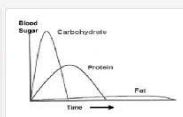
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## Mid Week – Day 3



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TIPS AND TRICKS ▾

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BLOG

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## Ok most of you are all well underway with your LCHF lifestyle.

It is very possible that you will be starting to feel quite tired or suffering from headaches. These symptoms are very common and nothing to worry about. Please go to the [Carb Flu](#) tab in Tips and Tricks and read further. These symptoms will pass, your energy levels will return, and most likely you will have more energy than ever before.

There is a lot of information for you on this website to help you start out on a low carb lifestyle, so here is some basic science on the why a low carb diet makes perfect sense.

## Some things you may not realise:

- Weight loss has little to do with discipline, we need to look at WHAT we eat, not HOW MUCH we eat
- Eating low carbohydrate meals allow you to eat enough to be satisfied while still losing weight – without the need to count calories
- Eating fat does not make you fat and eating fat helps decrease the fat storing hormone insulin

## What happens when we eat carbohydrate:

- A meal or snack high in carbohydrate will generate a rise in blood glucose. To adjust for this the pancreas secretes the hormone insulin into the blood stream
- Insulin is a fat storing hormone, storing excess carbohydrate as fat promoting accumulation of body fat.
- Insulin tells your body to use more carbohydrate and less fat
- To lose fat the insulin response must be lowered
- To make matters worse as blood sugar increases, insulin rises causing an immediate drop in sugar. This results in hunger very quickly after a meal
- This leads to cravings for sweet foods and so the cycle continues....
- As if that's not bad enough, as we age and approach or go through menopause, food takes longer to digest, insulin increases over this prolonged digestion time and more fat is stored because of this increased insulin

To put it simply:

## TOO MUCH SUGAR TURNS TO FAT



8th Apr, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## End of Week 1



So your first 5 days of LCHF are nearly up and I trust all is going well. Feedback has been good and some good questions have been posted in the [Ask a Question](#) section. The weekend is here and new challenges will be thrown your way. Take a look at the [Socialising](#) tab for tips on staying low carb when you are out.

## Weekend Food Ideas

You may find that you have more time on your hands (or not) and will have access to food that you might be safe from when you are at work or out and about during the week. Stock up on some of the [LCHF staples](#) and try some cooking. Here are some great catering ideas if you are entertaining over the weekend. I guarantee no complaints from you guests. You don't need to compromise your lifestyle for your friends and family. You will be doing them a favour by introducing them to some wholesome, tasty, low carb foods.



- Cook breakfast: eggs, bacon, avocado, tomato
- Prepare a lunch or evening platter: nuts, cucumber, cheeses, [guacamole](#) etc
- Dinner: [Roast lamb platter](#) (replace lamb with barbecued or roasted meat of your choice)
- Try some baking: [Low Carb Carrot Cake](#) and an easy no bake dessert [Chocolate Blueberry Clusters](#) are a great way to finish a meal and impress your friends.

## Weekend Movement Ideas

We haven't spoken about exercise yet. This is because firstly I believe that most of you are trying out the LCHF diet as a weight loss option. While exercise is important for health, it will have little impact on weight loss. What you eat will make the difference not how much you move. As you progress through the weeks living LCHF your energy levels will improve and you will find yourself moving more. Do try to move more, stand more, walk whenever possible.

## If you already exercise regularly:

- Continue to do what you are comfortable doing
- If you are feeling tired in these early days of LCHF just take a walk and get some fresh air.

## If exercise is new to you:

- Try to walk for 10-20 minutes per day. Go with a friend and talk about the changes you are making to your lifestyle, it's always good to talk about it!

Most importantly though, if you fall off the 'low carb' wagon at any time, get back up and carry on. Enjoy your digression, none of us are perfect! Be resilient and move on with your low carb eating plan.



10th Apr, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## 4.6.2 Blog/posts - Week 2



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## Week 2 – A bit about weight loss

### Weight loss



Just a quick note about weight loss at this stage in your low carb diet. Everyone experiences weight loss at a different rate. For some the weight drops rapidly, for others not so fast. If anyone's husband or partner is joining them on the low carb journey, you may be frustrated by the speed that their weight is dropping. This is always annoying and unfortunately I cannot provide the science behind this phenomenon.

So if your weight is not dropping, or not as quickly as you would like, just be patient. Have a think about some of the things I have highlighted in the past week:

- Make sure you are including plenty of good fats daily – avocado, olive oil, nuts as well as plenty of vegetables (broccoli, spinach, cauliflower etc)
- Protein converts to glucose so although we need moderate amounts, just make sure that you are not over eating protein when you could be having a little more fat
- Eat until you are full and no more. Be instinctive with your amounts. This diet is not a licence to eat unlimited amounts protein and fat. Let your body guide you as to how much you need to eat and be mindful about what and how much you are eating
- Drink plenty of water
- Enjoy the added benefits of eating low carb; more energy, a reduction in mood swings, a more even temperament, glowing skin.....

### Reading Labels

So we are heading into Week 2 and I want to start looking at food labels and how to read them accurately. The first thing to remember is always take your reading glasses shopping! Manufacturers make nutritional panels unreadable to the population that most needs to read them!

### When buying packaged foods:

- Always look for products with the lowest carbohydrate and sugar
- Look at the amount of carbohydrate per 100g so that you can compare products more accurately
- Aim for less than 5g carbohydrate and less than 5g sugar per 100g
- Don't be concerned about the amount of fat, it is the sugar we are interested in. In general; lower fat means higher sugar and higher fat lower sugar

### Take a Look at the two yoghurts below

#### Natural yoghurt:



NUTRITIONAL INFORMATION	
PER 100g	
ENERGY	274 kJ (65 kcal)
PROTEIN	3.2g
TOTAL FAT	2.0g
SUGAR	7.4g
CARBOHYDRATE	7.4g
SODIUM	0.1g
DIETARY FIBRE	0.0g
DIETARY FIBRE	0.0g

- Carbohydrate per 100g = 7.4g
- Sugars per 100g = 7.4g
- Fat per 100g = 2.0g

#### Fruit flavoured yoghurt:



NUTRITIONAL INFORMATION	
PER 100g	
ENERGY	274 kJ (65 kcal)
PROTEIN	3.2g
TOTAL FAT	2.0g
SUGAR	13.4g
CARBOHYDRATE	14.7g
SODIUM	0.1g
DIETARY FIBRE	0.0g
DIETARY FIBRE	0.0g

- Carbohydrate per 100g = 14.7g
- Sugars per 100g = 13.4g
- Fat per 100g = 0.7g

- Note the significantly higher carbohydrate in the lower fat fruit flavoured yoghurt
- While the natural yoghurt is over 5.0g carbohydrate per 100g, it is definitely the preferred choice in this case
- Note that while the natural yoghurt is lower in fat than flavoured alternative, it is still relatively low fat. I would prefer a higher fat option

13th Apr, 2014 | by Julia McPhee  
Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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# WOMENS HEALTH



## Week 2 – Lets Get Serious



I gather from feedback and comments that you all understand and have done a great job of embarking on the LCHF lifestyle. This week I want to get more specific about the maximum amount of carbohydrate we should be including in our diet each day.

### You have removed:

- Bread, pasta, rice and grains, cereal and rolled oats
- Cakes, biscuits, lollies and chocolate
- Potatoes, kumara, fries
- Bananas and excess amounts of fruit

### And replaced with:

- Green leafy above ground vege
- Healthy fats – coconut products, olive oil, avocados, oily fish such as salmon, full fat dairy
- Nuts and seeds – almonds, macadamia, cashew, sesame, sunflower, pumpkin, flaxseed
- Plenty of meat, seafood and poultry

Aim for less than 100g carbohydrate and ideally around 75g of carbohydrate per day.

If you are following the LCHF website and associated advice, and it appears to me that you all are, you will already be consuming under 100g of carbohydrate per day.

### Support Resource

You should have received your LCHF hard copy manual in the post (if not please let me know and I will resend it). You will see the food lists in the manual include carb counts of a variety of foods per 100g serve or per average serve. This will help you calculate how much carbohydrate you are consuming.

Check out the following carb count in some common foods.

### Per serve:

- |   |                                    |
|---|------------------------------------|
| ■ 1 Apple – 17g carb                    | ■ ¼ cup Blueberries – 4.0g         |
| ■ 1 Banana – 22.1g carb                 | ■ 10 Almonds – 0.6g carbs          |
| ■ 1 Flat white coffee – 10.5g carb      | ■ 1 Egg boiled – 0.1g carb         |
| ■ 1 cup Pasta – 41.9g carb              | ■ Coconut cream ½ cup – 4.6g carb  |
| ■ 2 slices Wholemeal bread – 27.1g carb | ■ ½ cup Cream – 2.3g carb          |
| ■ 1 cup Brown rice – 57.2g carb         | ■ 1 cup Chicken cooked – 0.0g carb |

You can see how quickly your daily carb count will increase when you add in a piece of fruit. Alternatively note the low carb count in nuts, chicken and cream. Assume all counts are 'net carbs'

### Note:

I am not trying to make things complicated. You don't have to weigh all your foods. I just want you to be aware of the carb count in common foods. Think about what you are eating now and before long these decisions will be instinctive and driven by your enjoyment of good wholesome foods and how they make you feel. This can make a difference to weight loss and is a good way to seek out those hidden carbs that you might be including in your diet without realising it.

16th Apr, 2014 | by Julia McPhee

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# WOMENS HEALTH



## It's Easter!



Easter can be a big weekend for **travel** and **socialising**, but there is no reason for you to compromise your low carb habits. And before we go any further hot cross buns are NOT low carb! There are however some really good very low carb chocolate options if you really want to enjoy some chocolate this weekend.

Lindt has an 80% and a 90% cocoa option. For dark chocolate lovers this is a real treat. For those of you who have always had a sweet tooth, as you break the sugar habit the bitter dark chocolate flavour and texture will become a welcome pleasure.

NOTE: While higher in carbs than we would like, dark chocolate has added health benefits and actually helps control blood sugar levels. One or two pieces a day will not do any harm at all.



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## Eating out this weekend:

Eating out and staying low carb is challenging but not impossible. Hidden sugars in restaurant meals can be avoided by:

- Asking for sauces and gravies to be served in a dish on the side
- Potato to be replaced by a salad
- Have a coffee instead of dessert
- Leave those mints on the counter as you pay for your bill
- Replace toast on cooked breakfasts with mushroom

Entertaining at home is a good way to keep control over what is being served and your friends and family will enjoy it.

- Have a barbecue or 'low carb' as I like to call it
- If you enjoy a **roast lamb** on Easter Sunday, serve it with **roasted vegetable salad**
- Try the **Berry Strudel** for dessert served with fresh cream

Have a glass of wine but don't over do it. We don't always make the best decisions after a glass or 3 of wine!

Follow these tips and you will feel better the next morning for keeping to your low carb eating plan.



But remember if you break some rules, get over it and move on. It is Easter after all!

17th Apr, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## 4.6.3 Blog/posts - Week 3

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# The Great Fat Debate

I thought it was a good time to discuss the fat debate in more depth. Why after all these years of promoting high carbohydrate low-fat diets are we now doing a completed u-turn and advising that we increase consumption of good quality natural fats and avoid all sugar and most carbohydrate. This is a big mind shift for most of us.

Here are some facts that you are probably already aware of ;

## Since we started eating low-fat foods:

- World wide rates of obesity have doubled
- Diabetes in the USA has tripled
- The Incidence of cancer and heart disease have increased

Fat is a very effective blood sugar stabiliser so by limiting our fat intake we have increased our desire for sugar. Foods popularised by low fat high carb dietary advice such as rice, wholegrains, and potatoes, produce a quick spike in blood sugar levels that in turn creates an insulin spike. As we have discussed, an excess of insulin blocks our body's capacity to burn fat and the resulting fall in blood sugar levels causes more hunger and a desire for more carbohydrate.

And additionally lack of essential fatty acids creates the sense of famine, forcing our bodies to convert more carbs in to fat.



## Which fat?

For many years we have been replacing good natural fats with processed trans- fats or vegetable oils.

Avoid consumption of these processed vegetable oils on the low carb diet (or any diet!). The inflammatory nature of these fats is known to contribute to heart disease and some cancers.

## The bad fats – Inflammatory

- Margarine, Corn oil, Safflower, sunflower, and soybean oils.

## Good Fats – non-inflammatory

- Coconut oil, Olive oil
- Butter, Cream
- Avocado, Almond, walnuts, macadamia nuts and oil
- Pumpkin and sunflower seeds, Flaxseeds and flaxseed oil
- Fatty fish (salmon)

But the real crime we have committed with low fat diets is making people think that to lose weight you need to go hungry. We now know that this is not the case, and if you have been following the advice provided on this website, cut your carbs and increased good natural fats, then the chances are that you are not feeling hungry. A few days of carb withdrawal symptoms (or longer for some) is common but as you continue eating low carb, and increase the fats in your diet, you should notice a difference in your skin, hair, energy levels and weight.

## And by the way;



- SUMO wrestlers eat a lot of carbs and very little fat, and sleep after a meal. They recognise that large insulin responses as a result of a high carb meal is an effective way to store fat

21st Apr, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## Low Carb – Your New Normal



I am hoping that you are all noticing the positive changes in yourselves that are being reflected in the data I am receiving each week. Weight-loss varies so much from person to person. If you are thinking that your weight-loss has not been as rapid as you would like, think of it this way. Spread that weight-loss over the eight-week period of the study and realise that if you continue to adhere the way that most of you are, or try to be a little stricter, the results will speak for themselves.

You are at a stage in the programme when eating low carb will be getting easier, and you are noticing positive changes to your weight, energy levels, and wellbeing. Its time to step it up or at least stay focussed at the level you are at.

### Make low carb your 'new normal'

This might help

### My 'Just Don't' strategy



I have this little thing I say to myself (and others, but not usually out loud) when I consider eating something that is really out of the low carb realm. It's 'JUST DON'T'. Don't get me wrong I am no saint when it comes to treats but if there is a low carb option available, I'll take it. I think we have passed the stage of having to eat high carb food so as not to offend anyone. Its time that everyone recognises the positive changes you are making. I'm betting that many of you will have had some influence over those around you by now will be noticing that other are at least

considering going low carb!

### This weekend think about:

- Trying to get you adherence closer to 90% over the next week if you are not there already
- Do some cooking or baking make your 'treats' low carb
- If necessary say Just Don't!
- Accepting that low carb is your new normal

### But most importantly, think about:

#### ■ YOURSELF

24th Apr, 2014 | by Julia McPhee

Posted in: WOMENS HEALTH

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## Week 3 – Pep Talk



## Stay Motivated:

- From what I can gather some are finding it a little easier than others, however it appears that everyone is on board and adhering for a significant amount of the time. That's excellent!
- Take time each day to think about what you are going to eat and make sure you are including foods that you enjoy
- Let's get some benefit out of the fact that there are 20 women in the same boat and get some conversation going on the [Ask a Question](#) tab. I can share my experiences but there is nothing more powerful for motivation than knowing others are in the same situation and experiencing the same emotions at the same time
- If you are not wanting to have your name visible in the [Ask a Question](#) section just send me your query/experience/advice and I will post it anonymously

Remember this is your study and your website so let's get it working for everyone

## Winter



I noticed a strange thing the first winter that I lost weight on the low carb diet; I felt the cold more than ever before. I have heard the same thing from others who have taken on the low carb lifestyle.

## To get you through the first weeks of winter:

- Drink hot drinks – green tea, coffee, tea (beware of the amount of milk you are having in hot drinks, it adds up and milk does need to be considered in your daily carb count)
- Try some of the winter casseroles in the [Recipe](#) section, they are tasty and satisfying
- A bit of exercise does wonders for increasing body heat so keep moving and take every opportunity to move throughout your day
- I can't emphasise enough how important those good quality natural fats are for keeping you feeling fuller and satisfied for longer

Weight loss is a powerful motivator. It will happen at a different rate for everyone. One thing is the same for us all; the more you adhere the more consistent your weight loss will be. So hang in there, low carb will work for you but you do have to work for it!!



22nd Apr, 2014 | by Julia McPhee

Posted in: [WOMENS HEALTH](#)

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## 4.6.4 Blog/posts - Week 4






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## Week Day Lunches

I think that lunch is probably the hardest meal of the day to keep interesting, and let's face it, a good lunch can really make your day. Salads are a good option, but every day? That can get a bit dull.

- Get into the habit of cooking more than you need at dinnertime and heat up the left-overs at work for lunch the next day. **Thai Meatloaf** is a good option.
- If you are making a salad for lunch, make it a good one, make a 'Super Salad'; use avocado, boiled egg, cheese, some cold meat and a good range of fresh vegetables and some nuts for texture. Top with olive oil to make sure your salad is satisfying.
- Don't forget your almonds or mixed nuts for snacking on during the day
- Be brave and make some **Low Carb Bread** to take to work. Eat it toasted with your salad or make a sandwich!
- Take an apple or pear to work (your one piece of fruit for the day). Slice and serve with almond butter. This is what I call making a meal out of an apple.
- Keep a water bottle on your desk and drink plenty throughout the day.

Try making this **Low Carb Chocolate Cake**, delicious if you like the flavour of dark chocolate. Serve with a little cream or yoghurt. Take it to work and share it, your colleagues will be pleasantly surprised.

## And now for a story

Please make time to read the story below from a long suffering friend of mine who after 2 and ½ years of putting up with my low carb lectures, finally gave it a go. It will inspire you and you just might see a bit of yourselves in Sonia!

### Sonia's Story

I've never been one to religiously take on and hold to a regime of diet or exercise. Micro bursts of physical activity or eating regimes have peppered my life but the simple fact is that I have absolutely no affinity with the whole diet and exercise regimes of the modern first world psyche. It bores me terminally.

However the sad fact is that as I reached middle age my body simply refused to effortlessly burn off my energy levels (and fat levels) simply by breathing alone. So a few micro-bursts of lifestyle changes have come and gone over the past few years – Boot camp, trying to eat more fruit (yuck), trying to eat less (drinking less was never an option), and fasting a couple of days a week. Well the fasting thing was pretty successful. I did it for over a year and it achieved noticeable results not only in my physical appearance but also my mental agility. But – it clearly wasn't enough. For a start it was getting boring (again) and I was still overweight (no – I am not going to give my weight).

Fortunately for me, Julia McPhee is a very good friend of mine and for over two years she has 'persistently' heralded the benefits of a low-carb lifestyle. Although I (and others) gave her no end of grief when she would harp on endlessly about it, none of us could deny the incredibly positive results we witnessed as our friend dropped weight she had been trying to shed for years. Always a sensible eater and a mad exerciser, the low-carb diet literally tipped the scales for her and she looks fantastic. Not only did she look fantastic when the weight first came off but she STILL looks fantastic over two years later.

Of course I didn't take it on. No bread, pasta, rice, cereal, potatoes – for goodness sake – how ridiculous is that? More to the point, when it came to me, how much hard work would that be for me to implement not only into my lifestyle but also a family of a husband and two adult children? Then another person in our group embraced the lifestyle and his results were just as amazing.

So I gave it a go. I didn't tell Julia of course. Couldn't have her thinking she had won me over after years of me ridiculing her! Plus I didn't want to broadcast it in case I just couldn't do it. In case it was too hard. In case I got bored and gave it up.... In case it didn't work....

I started really simply by stopping sugar in my tea and coffee. Then I moved on to stopping the bread. That was easier than I thought it would be, so I moved on to stopping the high carb vegetables, pastas, rice and pulses. I took simple, slow steps and before I knew it, I was eating a low-carb diet.

I can do it. It is not too hard. I'm not bored. And. It worked!

In four months I have lost 8 kilos. I feel fantastic and everyone around me noticed – including Julia. So I couldn't hide it any longer and had to concede that she is right. I am not as regimented as my friend. I do have little carb and sugar treats, but rarely. There are difficulties. Being lactose intolerant I can't enjoy all that full fat yoghurt and milk, but this is a good thing because it means I can continue hassling Julia to find me a replacement food.


Now I am moving on to converting my husband. That will be a bit difficult but I am determined because I cannot deny the health benefits I have gained from this eating regime and I fully intend us to share those health benefits for many years to come.

If you are in doubt – just give it a go. You will be pleasantly surprised.

27th Apr, 2014 | by Julia McPhee  
Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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87

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## Adherence to LCHF



I've had some feedback that some weeks the LCHF programme has been more difficult to adhere to, some weeks the weight drops faster than others, and some weeks it all seems too hard. Thank you to everyone who has shared their thoughts with me. Where possible I post feedback in the [Ask a Question](#) section, so please keep an eye on this section.

## If LCHF was easy:

- We wouldn't need to do this study because global health statistics would already be fantastic (slight exaggeration maybe)
- Wholesome healthy eating would be the 'norm' for everyone
- The high carb foods that we have been encouraged to eat and consequently crave would be long gone from the supermarket shelves due to poor sales and decreasing consumer demand

## But

Unfortunately that is not the case. Our reliance on high carbohydrate and low fat food has made us more reliant on sugar to satisfy us and consequently we are storing fat exceptionally well!

The difficulty in making the change from a high carb to a low carb diet is that we need to re-train our bodies to burn fat. That's what our bodies did before sugar hit our food chain; burn fat.

A few things are very common in the first few weeks of embarking on a low carbohydrate diet. Firstly it takes a while to stop craving sweet foods and break that sugar habit, secondly energy levels can drop and constipation can occur, temporarily thank goodness. You can do this, I did and I had a serious sugar habit!

## Remember this study is about adherence and acceptability of LCHF diets.



Reducing sugar/carbohydrate will induce weight loss, reduce blood pressure, and increase energy levels, but we need to explore how this can be achievable for everyone. Regardless of how well you adhere each week, regardless of how much weight you lose, your data is invaluable to this study and you are doing the right thing for your health and wellbeing.

You are all awesome and I thank you all for taking this 'low carb' journey with me.

30th Apr, 2014 | by Julia McPhee

Posted in: [WOMENS HEALTH](#)

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# WOMENS HEALTH



I remember when I first went low carb, while I craved the crunch of crusty french bread and missed sushi like a long lost friend, I noticed some very positive changes to my stomach's behaviour. I no longer had that gassy grumbling stomach all afternoon at work, following my usual 'healthy' lunch of wholemeal sandwiches or sushi. I have heard this from numerous low carbers since, and for many this is when the penny drops.

The gut or alimentary tract transfers food to the digestive organs, and plays a significant role in our general health. A balance between the 'good' and 'bad' gut flora is crucial. Increasingly, gastrointestinal problems such as Irritable Bowel Syndrome (IBS), acid reflux, auto-immune disease, obesity, diabetes, and depression are being linked to gut health.

## Gut Imbalance is caused by:

- Sugar: A diet high in refined carbohydrates and processed foods promotes the growth of bad bacteria
- Stress
- Antibiotics: That's why we take probiotics while on antibiotics, to reverse the damaging effect that they have on our gut.
- Dietary toxins such as wheat and industrial seed oils (canola, soy etc.)



## And how do we improve gut health:

- By removing most carbohydrate we have effectively taken a big step in the right direction of improving gut health
- Manage stress
- Eat prebiotic foods or foods high in soluble fibre foods daily – green leafy veges, seeds and nuts, avocado, fermented foods such as pickled vege\* (Sauerkraut, gherkins, pickled onions), hard cheese.



So look after your gut and good health will follow. Just more reasons to reduce those carbs, and continue to eat a balance of wholesome foods recommended in a low carb diet.



\*When buying pickles check the label and choose the lowest carb option. Note that I have personally not included a lot of fermented foods in my diet but am working on some recipes and will post over the weekend.

1st May, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## 4.6.5 Blog/posts - Week 5



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## Your Feedback

Ok so this is what you miss and how you deal with it (or don't deal with it!). Thanks for all the feedback.

- Garlic cheese naan bread when out for a curry, and fries with vinegar when my husband is munching away at them

I can so relate to this and good that you are not giving in. At the end of the 8 weeks be less strict and try them again but not daily and not as a rule

- 4 weeks ago I would have said chocolate. I couldn't get by without eating chocolate but now I'm ok. I really can't think of any food that I absolutely crave that makes this program difficult. I love what I'm eating. I find going out sometimes a bit difficult but normally get through it.

So pleased to hear it!

- I thought it would be chips (crisps) that I miss the most ... however, I had some while we were on holiday and they were not as nice as I thought they would be. So probably crispy fried spicy chicken (not KFC - more like chilli spiced chicken) and beer.

Good to keep that beer at bay and again once the 8 weeks is up give the spicy chicken a go, occasionally

- I must admit I have not had really any cravings. I miss lentils/dahl the most, I did eat regular sushi, but it was more that I was short of time and did not really like sandwiches.
- On the weekend I attended by niece's 21st and I was able to eat lovely blue cheese, drink wine or soda with bitters. I did have a piece of cake and it was literally a sliver 2cm wide. Although nice, I didn't drool over it and feel like another. It was just "nice"
- My greatest challenge is having/making enough time to try out more recipes - may be now I have a few weekends to myself!
- I made the grain free granola (minus the cinnamon as I am not really a fan) and the LCHF bread in the weekend. Love them both! I ate the granola for brekky every day with yog and blueberries, then had it again sprinkled on my salad for dinner!! Just wondered if too much of it has a laxative effect though? Think I need to cut down the amount I am having!

Regarding the laxative effect of Grain Free Granola, well for some of you, by the sounds, this may not be a bad thing!!

- I love what I'm eating. I find going out sometimes a bit difficult but normally get through it.

Take a look at the [socialising tab](#), although I am sure you have already.

And lastly a really relevant comment from one of my supervisors who is giving LCHF a go:

- I think week 4 is the hardest so far - novelty has definitely worn off, and if it wasn't for Jon doing it too and being so disciplined, it would have been more difficult. Feeling really good though.



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- TIPS AND TRICKS ▾
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- ASK A QUESTION
- MEDIA

## Breakfasts



A few comments have come through on breakfasts and how difficult it is to find good easy options and tasty. It is important that you find something that you like, but mix it up a bit and treat yourself to cooked breakfasts at the weekend when you have more time.

- Eggs poached scrambled, fried with avocado and tomato
- Omelette
- Yoghurt with LSA and or Chia seeds
- Yoghurt with Grain Free Granola
- Eggs, bacon, mushrooms, tomatoes

Any advice from others who have found any good breakfast options?

6th May, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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# WOMENS HEALTH



## Stress

I am doing Workplace Wellbeing presentation tomorrow to an industry and business group. No Workplace Wellbeing presentation can be delivered without considering stress, and the research I have done this week has given me insight into the impact that stress has on wellbeing weight loss, illness, and disease.



Stress makes our bodies burn carbohydrate. While we are trying very hard to turn our bodies into 'fat burning machines', the hormones released when we are stressed, cortisol and adrenaline, trigger our bodies to burn carbohydrate. For our ancestors, the cavemen, this was a very good thing and more often than not saved their lives, alerting them to danger and enabling them to react instantly and appropriately. For us in the 21<sup>st</sup> century however, stress can be a prolonged and daily occurrence, meaning that we are not giving our bodies the opportunity to reset itself into fat burning mode. While the cavemen were not burning fat they were storing it for the possibility of long periods of starvation, starvation that we are very unlikely to experience in

2014!

I know that since I have cut most carbs from my diet, I seem to suffer from stress less often, but when I do get stressed I deal with it better. I still do feel stressed sometimes and I am aware that my health behaviours are at most risk at these times. I tend exercise less and eat more of those old favourite comfort foods.

Keep this in mind this weekend, relax, and enjoy yourself your family and your friends. Get some fresh air and prepare yourself

for next week, a week of good eating, lots of movement, and less stress.



8th May, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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# WOMENS HEALTH



I have to come back to stress for several reasons. Firstly the more reading I do on the subject the more apparent it becomes that stress, weight-gain and hormonal imbalance are all very closely related and in our age group these issues are key to our health and wellbeing. Secondly I know that we all suffer from stress, many of us on a daily basis.



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ABOUT ▾

FOOD LISTS ▾

TIPS AND TRICKS ▾

RECIPES ▾

BLOG

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The good thing is that a diet high in many of the foods promoted by the LCHF diet and in particular:

- Cruciferous vege – broccoli, cauliflower, spinach
- Flaxseeds (linseeds), sesame seeds
- Organic or non-grain fed meats, seafood, and poultry. Note that most beef in NZ is grass fed, however organic is a good option
- Healthy natural fats



and low in

- Processed carbohydrates
- Sugar
- Industrial oils

can contribute to reducing hormonal imbalance and stress.

Move more

Exercise is a great way to relieve stress and take time out for yourself

- Go for a walk with a friend or on your own
- Just move more throughout your day. If possible stand at work (or home) for longer periods
- If you are already an avid exerciser keep it up, even when things get tough.]

Eat mindfully

- Eat wholefoods (LCHF based)
- Make your food own when possible
- Be prepared for unexpected and often stressful situations where you won't have access to good wholesome low carb options. Carry water, nuts, and if takeaway and processed foods are your only option, choose the best option (salads, yoghurt and I have been known to buy sandwiches and rolls and eat the filling, discard the bread)

Sleep well:

There are many issues that we are all dealing with that are not that easy to fix or manage and it is always tempting to drop the health behaviours that are actually most important in times of high stress. I can't help you deal with stress but I hope I have helped you to understand the impact that it is having on all other health behaviours. You won't relieve stress over night, but as the study draws to an end this is a key consideration in knowing that you can continue on this pathway permanently. If you do these three things well:

- Eat, Sleep, and Move

14th May, 2014 | by Julia McPhee

Posted in: WOMENS HEALTH

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## 4.6.6 Blog/posts - Week 6

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## What's good about LCHF

I have put together a montage of comments from those I received this week for what's working for you all. I haven't included all comments, however these sum up what most of you have reported.


### This is what you said:



"I think my body finally gets it!! I'm no longer ruled by the clock or eating just for the sake of it. The family is joining in and enjoys the meals 'lighter in carbs' Hubby had a burger @ Wendy's and told me that the buns were so sweet, he hated it. Also commented on how people can have the huge 500ml drink after a meal, so much sugar!"








"The first thing I did wrong was to have unlimited amounts of nuts and cream, like I used a 500ml a week in my coffees. Now I'm not bothered at all about the foods I can't have. Reckon it's just laziness preventing us from having healthy salads. It's quicker to grab a biscuit of bread and jam!"



"One thing that has really helped me and encouraged and motivated me, is writing my weight on my bathroom mirror, wait for it, EVERY MORNING. Of course my weight fluctuates, but the overall loss for me is very motivational. I do follow primal as opposed to Paleo and as such have raw dairy, and quite a bit of it. I take it to my coffee shop where they are happy to make my coffee with it. The other motivational thing, is having a friend do this too!"

"After the initial pleasing weight-loss, I have slowed right down and this has more to do with my levels of stress (horrendous at the moment!), as I have been quite good at 'making the right choices' food wise, so I should be looking like Twiggy!!!"




Thanks to all who have shared their experiences.


15th May, 2014 | by Julia McPhee


Posted in: **WOMENS HEALTH**


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# WOMENS HEALTH



There is not a lot that you don't already know about LCHF. You have battled through those early days of breaking habits, constipation, and have no doubt put up with opinions from supportive and not so supportive friends. On the other hand you should be feeling the benefits; expected and unexpected of the changes you have made.

The feedback I am receiving indicates that for many of you, if not all, low carb has become the 'new norm'. It's just what you do now. However, no matter how normal low carb has become, any rigid eating plan risks becoming boring. You need to mix it up, try new recipes and food combinations and make sure that low carb stays interesting and sustainable. Make sure you are eating food with texture, colour

and flavour, and do try some new recipes.



I am in the middle of making my weekly supply of **Grain Free Granola**. I am a creature of habit so that's my breakfast sorted for the week. Sprinkled over Greek yoghurt, the crunch and flavour puts a smile on my face, and I won't need to eat until well after lunchtime. I have been told that it adds flavour and texture to salad, and although this sounds bizarre, it is fantastic sprinkled on blue cheese. I really don't know how I worked that out but trust me, it is a great combination. I haven't tried it as a fruit crumble topping but I reckon I could make a relatively low carb apple crumble using my granola.

While not all of us are avid chefs and recipe creators, we all need to be capable cooks and develop a sense of adventure in the kitchen. Put a smile on someone's face by trying a new recipe and sharing it,

in the flesh and on line.

And before I finish, you may not realise it but your stories and experiences will make good reading and could really help other women trying to make lifestyle changes. If by chance you get some time or inspiration, get writing, put your thoughts and experiences on paper (on your computer anyway). It will force you to think about the changes you have made and the impact they have had on you and those around you. You might be surprised at some of the changes that have occurred once you sit down and think about it.

The more normal low carb gets for you, the further away these these stories will be, so do it now and please share them with me.

Be more mindful than I am though, I have been so carried away with this post that I have burnt my Crunch Grain Free Granola - true story!!

18th May, 2014 | by Julia McPhee

Posted in: **WOMENS HEALTH**

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## How many carbs and wine is too much?



### WOMENS HEALTH



This post is a bit of a cheat and a repeat of an earlier post on 'counting carbs'. I have had a few queries on how to count carbs and the exact amount of carbohydrate you should be consuming daily.

If you are adhering to the LCHF lifestyle 'most' of the time, your carb levels will be well below 100g per day. Aim for between 75 and 85 gm of carbohydrate per day. If you want to be specific and calculate the exact amount carbs you are eating there a few options for you.

You should have received your LCHF hard copy manual in the post. Note that food lists in the manual include carb counts for a variety of foods per 100g serve or per average serve. This will help you to calculate how much carbohydrate you are consuming.

Note: I am not trying to make things complicated. You don't have to weigh all your foods. I just want you to be aware of the carb count in common foods

### Per serve:

- 1 Apple – 17g carb
- 1 Banana – 22.1g carb
- 1 Flat white coffee – 10.5g carb
- ¼ cup Blueberries – 4.0g
- 10 Almonds – 0.6g carbs
- 1 Egg boiled – 0.1g carb
- Coconut cream ½ cup – 4.6g carb
- ½ cup Cream – 2.3g carb
- 1 cup Chicken cooked – 0 carb

(Assume all counts are 'net carbs')

You can see how quickly your daily carb count will increase when you add in a piece of fruit. Alternatively note the comparatively low carb count in nuts, chicken and cream.

### And the Alcohol Question Again

A small amount of **alcohol** will not stop weight loss, however try to limit yourself to 3 glasses a week of red or white wine. Avoid beer and if drinking spirits drink them with diet soda.

If you are drinking more wine than recommended and not losing weight, you know what you need to do! Just cut down, or as I like to say; just Don't!



23rd May, 2014 | by Julia McPhee

Posted in: [WOMENS HEALTH](#)

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## 4.6.7 Blog/posts - Week 7






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## Family Life





My husband calls himself low carb by default (my fault). He also expresses concern that the increase in fat in his diet could be contributing to a future of heart disease and early death. Actually he has never looked better. He weighs less than when we met 30 years ago, and is often the target of envy from friends and work mates; work mates who battle years of bad lifestyle choices, excess alcohol and a sedentary lifestyle. It does annoy me actually that he lost more weight, faster than I did. I believe he looks younger than I do, and I am the one making it happen!!

I am thinking about family because my son is home for a 4-day visit after being away for 3 months working in Australia. At 23 he is starting to realise that he needs to eat less, make better food choices and drink less beer. This is communicated to me, mind you, between mouthfuls of beer and toasted sandwiches, while lying on the couch watching TV.

Anyway tonight I will cook a low carbecue. A [roast lamb](#) and [pork belly](#) on the barbecue. I will cook a [roast vege salad](#) and serve it with [garlic aioli](#). We will drink a little wine and not too much beer for the men in my life. I'll make some [berry ice cream](#). Most likely no one will even register the lack of carbs. This is how you know that low carb is just normal in your household.

I have to hope that my kids recognise that the way I have chosen to live and eat is a good option. I hope they work out what they like, and take on the parts that suit them. I have no doubt that you have had similar experiences and responses from your own family and friends. It is important that we continue with what we think is right and let those around us watch and learn. Never compromise your beliefs and always understand that what is right for you is right for your family, they just might not realise it yet!





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20th May, 2014 | by Julia McPhee


Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)


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# WOMENS HEALTH



## Comfort Food



This week (today if possible) I would like you all to email me and tell me the one thing that you miss most or that makes LCHF challenging for you. Feel free to add how you manage this or what you do to alleviate your pain! I will put them together so you can all see how others are dealing with similar situations.

However, this week I want to talk about why we eat. Too often we eat not to alleviate hunger but for stress relief, reward or simply for comfort.

Typically we eat this way to make us feel better, however more often than not, it has the opposite effect, and we wish we hadn't.

### Comfort or emotional eating is easy to recognise:

- It comes on suddenly where as a physical hunger creeps up more gradually
- You crave specific foods, in particular sugar sweetened and processed carbs, where as true hunger can be alleviated by a variety of foods including healthy vegetables
- Its in your head, true hunger comes from your belly
- It often isn't satisfied when you are full and more often than not leads to regret and guilt

Since starting out low carb, I have been much more able to curb the need for those comfort foods, foods which were predominantly high carb and highly processed. It has made me wonder whether this was actually emotional eating or just sugar cravings!!

### Low Carb Comfort Foods

I love to cook and find it relaxing and satisfying to create my own comfort food. It makes me think more about what I eat, and an added bonus for me is that some of you might try these recipes and enjoy them with your own families.

And now, thanks to some serious time in the kitchen, polishing up my low carb baking and creating, I can have my cake and eat it too!

Next time you feel like a treat try my [Raw Berry Cake](#). It's pretty special and good for the whole family. Keep your portions small and enjoy a small piece without going overboard. If it is texture that you are missing try my [Low Carb Crackers](#) with cheese and if you just feel like a chicken salad sandwich, make some [Low Carb Bread](#). You can actually make a great cheese toasted sandwich with it. Spice up your breakfast with Grain [Free Granola](#).

And by the way I spent my Saturday preparing these treats for my week.

This: Became this: This: And This: And ended like this:



My Achilles heal by the way is fries, thin crispy fries. I don't have them often but occasionally I do, I enjoy and I move on.

4th May, 2014 | by Julia McPhee

Posted in: [WOMENS HEALTH](#)

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# WOMENS HEALTH



I remember when I first went low carb, while I craved the crunch of crusty french bread and missed sushi like a long lost friend, I noticed some very positive changes to my stomach's behaviour. I no longer had that gassy grumbling stomach all afternoon at work, following my usual 'healthy' lunch of wholemeal sandwiches or sushi. I have heard this from numerous low carbers since, and for many this is when the penny drops.

The gut or alimentary tract transfers food to the digestive organs, and plays a significant role in our general health. A balance between the 'good' and 'bad' gut flora is crucial. Increasingly, gastrointestinal problems such as Irritable Bowel Syndrome (IBS), acid reflux, auto-immune disease, obesity, diabetes, and depression are being linked to gut health.

## Gut Imbalance is caused by:

- Sugar: A diet high in refined carbohydrates and processed foods promotes the growth of bad bacteria
- Stress
- Antibiotics: That's why we take probiotics while on antibiotics, to reverse the damaging effect that they have on our gut.
- Dietary toxins such as wheat and industrial seed oils (canola, soy etc.)



## And how do we improve gut health:

- By removing most carbohydrate we have effectively taken a big step in the right direction of improving gut health
- Manage stress
- Eat prebiotic foods or foods high in soluble fibre foods daily – green leafy veges, seeds and nuts, avocado, fermented foods such as pickled vege\* (Sauerkraut, gherkins, pickled onions), hard cheese.



So look after your gut and good health will follow. Just more reasons to reduce those carbs, and continue to eat a balance of wholesome foods recommended in a low carb diet.



\*When buying pickles check the label and choose the lowest carb option. Note that I have personally not included a lot of fermented foods in my diet but am working on some recipes and will post over the weekend.

1st May, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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## 4.6.8 Blog/posts - Week 8

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# WOMENS HEALTH



## Weight loss







Firstly many of you have been concerned about plateaued weight loss. Everyone has had a plateau in weight loss at some stage in the last 7 weeks. For some it was week 3-4 and for others 6-7. Don't let this get you down and please don't consider changing back to your old habits. This is very normal, particularly in our age group. What you have to remember is that if you were not making the effort to lose or control weight, just by being 'middle aged' you would be gaining weight. Therefore if your weight is stable you are effectively losing weight. Just ride it out, stick to low carb all or most of the time and your weight will continue to trend downwards.

Another thing to consider is this; while we all strive for weight loss, you may have noticed that your body shape has started to change. Note how your clothes are fitting and use this as a guide to weight loss. My weight doesn't budge off 65kg (I came from 71kg) however I have dropped 2 dress sizes and now tend to monitor my weight by my clothes size just as much as by actual weight.

Continue to weigh yourselves regularly it is a very good way to make sure you stay focussed on weight loss.


## Recipes

### Converting traditional recipes to the low carb version



When you look at my cake recipes there is almost a template I follow. I generally replace flour with equal amounts of almond meal. I usually use between 4 and 6 eggs, to hold the mixture together. Two to three tbsp of Natvia is usually enough to replace 1 ½ - 2 cups sugar but test the mixture yourself and add more if necessary. If the recipe appears dry, add yoghurt until mixture resembles traditional cake mix texture. I avoid industrial oils such as soy and canola and use olive, coconut oil, or butter.

Any success that you have adapting recipes, please send them to me. We can post on the LCHF site and I will attribute recipes to the author. I am seriously considering the idea of creating the LCHF Women's Health Research Project Cookbook, and developing recipes that are true to our 'low carb template'.





28th May, 2014 | by Julia McPhee


Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)


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# WOMENS HEALTH



## Week 8 of 8!



As we begin the final week of the study there are a few things to keep in mind or some 'housekeeping' to discuss:

- Next week's questionnaire, your final Week 8 questionnaire, will include the three-day food diary that you completed in your baseline questionnaire prior to week 1. You will be asked to list in detail the foods you have eaten on 2 week days and 1 weekend day this week. I realise this is quite a big job and it will be easier if you log the food as you eat it on your reported days.
- For one reason or another some participants have not completed all questionnaires. This is not a problem, however it would be great to get Week 7 and 8 data from all participants. I realise that you are all busy but if you could take the time to complete the final questionnaires it would be appreciated.
- I will be coordinating focus groups, which will take place mid to late June. All participants' feedback is extremely valuable to this study and I will be endeavouring to arrange them at a time that suits most participants. Focus groups will be held at Millennium Centre in Mairangi Bay.

## Making low carb work

You will recall that the actual title of this study is: Exploring the acceptability of and adherence to a carbohydrate-restricted, high fat diet as an instrument for weight-loss in women aged 40-55 years.

While the study will be completed at the end of this week, I hope that for all of you the last 8 weeks have demonstrated the benefits of reducing carbohydrates from your diet. What I, and probably all of are interested in though is this;

- Is low carb something that you can sustain as a permanent lifestyle choice?
- Are there some parts that you will continue with and others that you feel are too difficult?
- Is this something that you would recommend to your friends and family?

I can see from the data and feedback that for many of you, the benefits of the lifestyle changes far out-weigh the sacrifices made. For all of us though we need to keep it real and make it work for us. As middle-aged women we are at a time in our lives that we should be enjoying life with family and friends while focussing on our own health. I hope this study has demonstrated how this can be done.

So this week think about 'where to from here'. Plan to spend the time that you have been spending reading my posts (well I hope you have!), reading and investigating LCHF further. The LCHF Women's Health Research Website will remain alive and will become the Human Potential Centre's official LCHF website, so will develop considerably. Further to this I have a personal low carb blog on which I will continue to add recipes and post my own experiences. This is where I would like to share your stories, so please, get thinking, get writing, and get your thoughts to me.

You have all been an inspiration to me and I truly believe that with your help this study will impact the health of others in our life stage.



26th May, 2014 | by Julia McPhee

Posted in: [UNCATEGORIZED](#) | [WOMENS HEALTH](#)

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# WOMENS HEALTH



## The Last Post

We have completed the final week of the Women's Health Research Project, but this is not the final week of your low carb lifestyle. We have moved from a diet to a way of life, and I hope that you will all continue with the low carb lifestyle to some extent as a permanent lifestyle choice.

You have all lost weight, your weight is still trending down, and if you want to lose more weight, as I am sure you all do, you need to continue with what you have been doing for the last 8 weeks.

So today I want to summarise some key points for you to keep in mind in the next few weeks.

Without the prompts of weekly questionnaires and weight reports to keep you focussed and on track, you could be tempted to veer off that low carb pathway.

### Remember this:

#### Always be prepared for any situation that might arise

- Day to day snacks
- Travel
- Socialising

#### If you are tempted with high carb treats

- Firstly: JUST DON'T
- Think about how you will feel afterwards and if you realise that you don't want to feel that way, have a glass of water, or low carb snack
- If you do indulge, just get back on board and move on

#### Continue reading and researching for yourselves

There is a lot of information to support low carb, by people who know a lot more than I do!

- I recommend that you at least follow
  - [www.profgiant.com](http://www.profgiant.com)
  - [www.dietdoctor.com](http://www.dietdoctor.com)

and of course:

- [www.jmcphee.com](http://www.jmcphee.com)

#### And manage your stress levels!

If you need validation as to whether to continue with the low carb lifestyle, consider these points:

- Improved energy levels
- Weight-loss
- Improved food choices
- Reduced aches and pains
- Friends are 'getting it' and have taken low carb on board

If you can say 'yes' any of these points then low carb is the right option for you.

So thank you all once again for participating in and supporting me to conduct the Women's Health Research Project. I look forward to meeting you all at the focus groups and I look forward to a social get-together with you all once all data collection has been completed.



29th May, 2014 | by Julia McPhee

Posted in: [WOMENS HEALTH](#)

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## **Chapter 5: Exploring the acceptability of, and adherence to, a LCHF diet as a weight-loss approach in women aged 40-55 years.**

### **5.1 Preface**

Chapters 3 and 4 provided the rationale for, and design and description of, the LCHF Women's Health Research Programme intervention and website. This chapter will explore issues surrounding adherence to, and acceptability of the intervention described in previous chapters. Descriptive information derived from quantitative data collected throughout the programme and qualitative findings from focus groups conducted at study completion are presented. This chapter also examines the concept that satiety derived from eating in the LCHF way positively impacts adherence. Additional factors impacting adherence and acceptability in this population group (i.e. family, spousal and social support, and lifestyle adaptations) are also presented and discussed.

## 5.2 Background

Global overweight and obesity rates have more than doubled in the last three decades, with 1.4 billion adults over the age of 20 years classified as overweight (BMI 25–29.9 kg/m<sup>2</sup>) or obese (BMI ≥ 30 kg/m<sup>2</sup>) in 2008 (WHO, 2006). A further cause of concern is that certain population groups exhibit disparate rates of obesity and are therefore at greater risk of associated complications. While it is well-recognised that comparable numbers of females and males are classified as overweight (35% versus 34%, respectively), more women than men are categorised as obese (14% versus 10%, respectively) (WHO, 2013).

Women classified as overweight or obese exhibit higher rates of metabolic irregularities including hypertension, diabetes, and reduced mental health and energy levels than their normal/underweight counterparts (Brown, Dobson, Bryson, & Byles, 1999). While it is well known that weight gain in females is associated with aging (Brown, Williams, Ford, Ball, & Dobson, 2005), it remains unclear as to whether aging itself is the cause or whether weight gain in peri-menopausal and menopausal women is due to related hormonal fluctuations. The prevalence of central adiposity and features of metabolic syndrome in many women transpire as a result of a reduction in oestrogen (Carr, 2003; Gozansky et al., 2007). Fortunately, many of the metabolic disorders attributable to decreased oestrogen levels (exhibited in conditions such as abdominal adiposity, insulin resistance, and dyslipidaemia) can be alleviated through weight loss (Carr, 2003). Furthermore, it is understood that oestrogen has a modulating effect on the hormone insulin and LPL; an enzyme responsible for breaking down triglycerides, both of which are recognised as impacting central adiposity (Ferland et al., 2012). During this period of mid-life weight gain and increasing metabolic risk for women, preventing gains in body fat and maintaining healthy weight status is essential (S. R. Davis et al., 2012).

Traditional 'best practice' weight loss dietary treatment undertaken in both research and practice is largely based on fat reduction and calorie (or energy) restriction. In general, weight-loss interventions (predominantly based on traditional weight-loss guidelines) are having little impact on either global obesity rates or sustained levels of weight loss. Furthermore, middle-aged women continue to fare poorly in a life stage in which weight-gain appears unavoidable. As central weight gain with menopause is associated with the development of insulin resistance

(S. R. Davis et al., 2012), there is increasing interest in weight-loss treatment options based on a macronutrient profile that elicits a reduced insulin response. In contrast to traditional 'best practice', an alternative weight-loss strategy promoting a model of eating that is lower in carbohydrate (<100g), moderate in protein, and higher in fat has been posited as an effective weight-loss option. This strategy recognises that the macronutrient composition of the diet itself may have positive impact of weight loss due to hormonal interactions.

While there remains no consensus over the most efficacious weight-loss strategy, it is recognised that both the traditional low fat and the more contemporary LCHF dietary strategies are successful in eliciting weight loss (Hu et al., 2012). Furthermore, there is evidence to suggest that LCHF diets can also be successful when compared with 'best practice' when it comes to improving health outcomes. Findings across several RCTs addressing both weight loss and health outcomes, show that LCHF diets outperform low fat diets in relation to metabolic risk factors (i.e. blood pressure, blood lipids: in particular HDL cholesterol and triglycerides, blood glucose, serum insulin levels and systemic inflammation) (Dansinger et al., 2005; Forsythe et al., 2008; C. D. Gardner et al., 2007; Stern et al., 2004). One such study explored four contrasting dietary approaches for weight loss. Participants were randomly assigned to the following dietary regimes: Atkins (very low carbohydrate, high protein), Zone (low carbohydrate), LEARN (Lifestyle, Exercise, Attitudes, Relationships, and Nutrition; low in fat, high in carbohydrate, based on national guidelines) and Ornish (very high carbohydrate) (C. D. Gardner et al., 2007). In this study, women assigned to follow the Atkins diet, which had the lowest carbohydrate intake, lost more weight and experienced more favourable overall metabolic effects at 12 months than women assigned to follow the Zone, Ornish, or LEARN diets. Secondary analyses examined the relationship between insulin resistance and dietary adherence to either a low fat or low carbohydrate diet, to investigate whether insulin resistance status affected dietary adherence (McClain et al., 2013). Findings showed that participants were less likely to adhere to, and lose weight on, a low fat diet if they were insulin resistant compared to those that were insulin sensitive. These results are compelling as they suggest that insulin resistance status through the mechanism of carbohydrate intolerance may affect dietary adherence to weight loss diets. This may result in higher rates of recidivism and diminished weight loss success in insulin resistant participants following low fat diets (McClain et al., 2013).

These findings clearly indicate that by nature low carbohydrate diets elicit less insulin response and could be an effective and safe weight-loss option for middle-aged women.

While weight loss in the short term appears to occur regardless of the type of diet applied, long-term sustainability of weight loss creates a greater challenge. Weight regain is frequently described in the literature as returning 12 months post intervention (Jeffery et al., 2000; Simkin-Silverman, Wing, Boraz, & Kuller, 2003). It appears that an important determinant of weight loss is adherence to the diet, irrespective of the particular macronutrient composition (Alhassan et al., 2008). A LCHF way of eating could have an advantage by eliciting both rapid weight loss in the first six months (Klein, 2004; Stern et al., 2004) and promoting satiety, and therefore adherence through the high fat composition of the diet (Volek & Westman, 2002). It has been suggested that in comparison to carbohydrate, dietary fat and protein have a greater satiating effect on women (Chambers & Yeomans, 2011; Yancy, Olsen, Guyton, Bakst, & Westman, 2004). Furthermore, a diet based upon participant preferences may improve long-term adherence (S. R. Davis et al., 2012). These findings add to a body of research suggesting that LCHF diets could be a superior weight-loss strategy to its low fat counterpart (Volek & Westman, 2002).

Irrespective of the macronutrient composition of a prescribed diet, the medium selected for delivering weight-loss interventions impacts adherence and subsequent success of a programme (Tate et al., 2001). Rapid increases in access to internet technology has made internet and web-based programmes a viable mode for delivery of public health interventions including weight loss and weight maintenance (Tate et al., 2001). A review on the efficacy of internet-based weight-loss interventions determined that web-based programmes have the potential to accomplish positive weight-loss outcomes (Levy et al., 2007). Furthermore, evidence suggests web-based weight-loss programmes will have greater success if designed to be both consistent with participant needs and values while operating at a level relevant to the intended population (Weinstein, 2006).

A further strategy that affects adherence in weight loss interventions is the application of HBT in intervention design (Ammerman et al., 2002). Dietary behaviours can be impacted by several factors, including emotional, and environmental as well as adherence factors. Application of

HBT allows for these issues to be assessed and addressed. Several studies have demonstrated the benefit of employing a multi-level approach to application of HBT in weight-loss interventions. A recent study designed to predict weight loss applied four leading health behaviour change theories: SCT, TTM, TPB and SDT (Palmeira et al., 2007). Weight change was significantly predicted by each of the HBTs analysed, with those using self-efficacy (via either TTM or SCT) most efficacious. It is well-recognised by health researchers that no one theory will be the perfect fit for any one health-based intervention and it has become evident that the use of a mixed methods approach to applying HBT to interventions elicits more favourable outcomes than interventions aimed at one level of behaviour (Elder et al., 1993).

Effective weight-loss strategies targeting priority populations through appropriate media, remain a critical public health priority and merit ongoing investigation (Levy et al., 2007). While attrition rates in weight-loss programmes are known to be high, increased adherence to a programme can lead to successful and sustained weight loss (Greenberg et al., 2009). The LCHF Women's Health Research Programme was developed in response to the need for robust evidence on sustainable weight-loss options for middle-aged women. The aim of this programme is to determine factors affecting women aged 40 – 55 years in modifying and maintaining dietary behaviours while undertaking a LCHF way of eating for weight-loss purposes. The premise underpinning this study is that using a web-based, HBT-design, the LCHF way of eating will result in maintained adherence through the mechanism of improved satiety derived from increased dietary fat, the strategic placement of protein, and the reduction of carbohydrate.

### **5.3 Methods**

The LCHF Women's Health Research Programme was an exploratory study investigating the acceptance of, and adherence to, a LCHF diet in women aged 40 – 55 years. The primary outcome measures of this study were barriers to and motivators for acceptance of and adherence to this way of eating. Secondary outcomes included mood state, adherence, satiety levels, and weight loss. During the intervention, weekly questionnaires were distributed to participants each Sunday throughout the study period, starting at baseline, with the final questionnaire administered at week eight (end of intervention). Focus groups were conducted

following completion of intervention. Ethical approval to conduct the study was provided by the host institution (Appendix 1).

### **5.3.1 Intervention**

A detailed outline of the LCHF Women's Health Research programme design and intervention components have been described elsewhere (McPhee, Zinn, & Oliver, 2014). In brief the internet-based intervention comprised an eight-week programme designed to determine factors affecting women aged 40 – 55 years in modifying dietary behaviours and maintaining those behaviours while undertaking a LCHF way of eating. Food choices reflected an overall daily macronutrient profile comprising limited carbohydrate (50-100g), moderate amounts of protein, and moderate-to-high amounts of healthy fat (i.e. natural fat options including mono-unsaturated and saturated; 50-60% of total energy). To optimise adherence, the intervention included substantial supporting web-based and printed resources, including recommendations of foods to include and avoid, basic eating plans, recipes, and regular blog/posts.

### **5.3.2 Participants**

Participants were eligible to participate if they met the following criteria: (i) were female, (ii) were aged between 40 and 55 years, (iii) had a BMI status of overweight or obese ( $25 > 36 \text{ kg/m}^2$ ) (WHO, 2006), (iv) were not currently following any prescribed weight-loss programme, (v) were weight-stable (weight had remained steady for the past six months), and (vi) were not already consuming a low carbohydrate diet.

An electronic poster advertising the study was sent via email through AUT (Auckland, NZ) university networks between February and March 2014 (Appendix 6). Screening for eligible participants was accomplished through self-reported measures of weight, height, and a three-day food diary to assess dietary eligibility.

### **5.3.3 Questionnaire / scales**

Questionnaires were administered using the Question Pro online format. Weekly questionnaires included a POMS SF (Shacham, 1983), a Hunger/Fullness Scale, and a self-rated percentage sliding-scale score (ranging between 1 and 100) of adherence to the LCHF dietary regime

supported with a food frequency questionnaire. Participants were also asked to submit self-reported body weight on a weekly basis.

#### *5.3.3.1 Profile Of Moods States*

The POMS SF is a comprehensive assessment of transient and fluctuating moods (McNair et al., 1992; Shacham, 1983) and was chosen to quantify any stress-response to the diet. The POMS SF questionnaire provides a measure of, (i) the tension/anxiety, (ii) depression, (iii) anger, (iv) vigour, (v) fatigue, and (vi) confusion levels of the participant. Additional mood items included in the POMS SF questionnaire contribute to each of the key constructs. Individual mood items in the POMS SF were rated on a five-point scale as follows: 0 = “not at all,” 1 = “a little,” 2 = “moderately,” 3 = “quite a bit,” and 4 = “extremely.” This measure allows for assessment of fluctuating emotions and can aid in effective evaluation of patterns of mood states within an individual. Individual moods scores for the five key constructs were calculated weekly for each participant and for the total mood disturbance score (TMDS). Negative mood states comprise constructs of: i) tension, ii) depression, iii) anger, iv) fatigue, and v) confusion. TMDS was calculated by adding the five negative mood states together and subtracting the positive mood state: vigour (McNair et al., 1992). Total negative moods scores (TNMS) were calculated by adding the sum of average negative moods states. TMDS, TNMS, and vigour data were presented as an average weekly score. Data were presented as an average across participants from baseline to programme completion.

#### *5.3.3.2 Adherence scale*

Perceived adherence to the LCHF diet by participants was monitored through a percentage scale with the aid of a food frequency questionnaire. The scale was presented in the questionnaire as a sliding scale from zero to 100%, with 0% representing no adherence and 100% representative of maximum adherence. An added suite of questions operated as a prompt for participants as to their adherence to the diet, asking them to note the number of occasions over the last week they consumed a range of high carbohydrate foods that are not recommended on the LCHF diet. These foods included bread, pasta, rice, cereals, cakes, and sweets. Food frequency questions were based around a modified version of the ‘Dietary Habits’



section of the '2008/2009 NZ Adult Nutrition Survey' (Ministry of Health, 2003). Response options were adapted to correspond to the weekly (seven day) questionnaire distribution.

#### *5.3.3.3 Satiety scale*

A hunger/fullness scale was applied to rate participant satiety levels over a previous seven-day period. The scale comprised seven discernible states of hunger/fullness, with one denoting the feeling of being 'very hungry' and seven representing the feeling of being 'much too full'. The scale was presented in the questionnaire as a visual analogue scale to allow for flexibility and precision of responses. Percentages were calculated for comparison with associated data. While no published evidence of validity exists, a satiety scale configured as a visual analogue scale, is commonly used in dietary practice and a widely accepted tool to assess subjective perceptions of appetite (Raben et al., 1995).

#### *5.3.3.4 Self-reported weight*

Participants provided weekly self-reported weight status. While weight change over the study period was not statistically assessed, weight loss is a factor contributing to both adherence to weight-loss strategies, and maintenance of weight loss (Alhassan et al., 2008). For the purpose of this study weight was not used as a primary variable but as a tool to indicate adherence and generate discussion in focus groups.

#### *5.3.3.5 Focus groups*

Data collected on perceived adherence levels to the LCHF food guidelines, using adherence scale (0-100%), informed the grouping of participants for focus groups. Average weekly adherence levels ranged between 64% and 94%, allowing for three group classifications (low, medium or high adherence). While focus groups were based around the three adherence levels, in the case of a participant being unable to attend the appropriate group for their adherence level, they were scheduled into the next convenient group. All weight-loss data are presented as a percentage weight loss in order to ensure standardisation in the variable across all participants.

#### **5.3.4 Data analysis**

All quantitative data were analysed and presented using descriptive statistics, allowing indicative patterns to emerge (Baumgartner, Strong, & Hensley, 2005). Data is presented in most cases as group findings as well as a number of individual case studies. Probability statistics were not applied, as the study design did not allow for this type of analysis. Patterns emerging from weekly POMS SF, adherence, satiety, and weight status were monitored and considered in development of focus group schedule and classification. POMS data were presented as an average across participants from baseline to programme completion. Table 5.1 presents the schedule of questions generated for use in focus group discussions.

Focus groups were audiotaped and transcribed. Additional hand-written notes were taken by a research officer and used as a reference document to aid with focus group transcription. Data were analysed within QSR NVivo (version 10.1.0), allowing for classification and organisation of data (Bazeley & Jackson, 2013). The thematic analysis approach was used to analyse focus group data and examined themes emerging through participant responses. Scrutiny was applied to emergent patterns across all data, as well as specific adherence levels. Focus group data were examined at the three categorised adherence levels: low adherence, medium adherence, and high adherence. Findings addressed participants' perceptions of the concepts impacting their ability to adhere to the LCHF diet. Transcripts were examined several times with provision made for both key words and themes emerging from particular topics. This process involved the evaluation of textual data and identification and coding of identified and emerging themes.

Table 5.1. Focus group schedule of questions

---

How easy was it for you to keep to the 8-week LCHF diet?

What aspects of low carb made it easier to keep to the low carb diet over the 8-week study period?

What aspects made it more difficult to adhere over the 8 week study

Have you continued with LCHF?

Will you continue with LCHF?

Moving forward, now that the study has finished, what things would make you able to continue with the LCHF diet?

Are there any foods that you find unpleasant that were recommended for a LCHF diet?

Which foods were most appealing?

How well did LCHF fit in with your lifestyle?

How supportive were people around you when you embarked on LCHF?

Can you share with me, any situations that made sticking to LCHF more difficult?

What were the challenges and confusions around what to eat on a LCHF diet?

What difference did eating low carb foods make to your budget?

Do you have any comments around how full or hungry you felt while on the LCHF diet?

Is there anything regarding the programme and resources that you would like to talk about?

---

## 5.4 Results

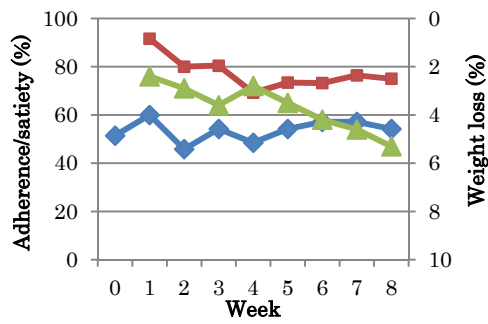
In total, eighteen women expressed interest in participating in the study; all were issued with eligibility questionnaires, with 15 women considered eligible to participate in the study. Two respondents failed to meet the study eligibility criteria. One respondent withdrew from the study immediately post week one, with a further respondent failing to complete measures following week three. Fifteen women completed the eight-week LCHF Women's Health Research programme. Three focus groups were conducted involving all 15 participants.

### 5.4.1 Survey data

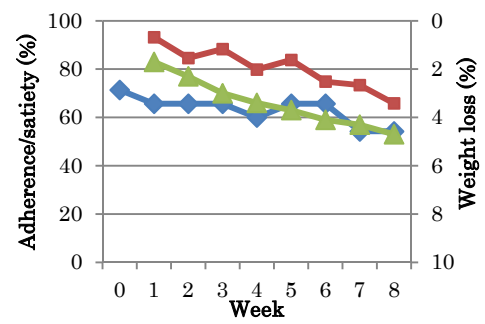
Adherence, satiety and weight loss outcomes are presented in Figure 5.1. Overall, mean percentage weight loss from baseline to study completion was 5.6%. The high adherence group recorded the greatest weight loss, 7% and concurrent with high self-report adherence (average adherence of 92.8%). The low and medium adherence groups (77.4% and 80.4%, adherence respectively) had a lower total weight loss (5.3% and 4.7%, respectively). Average self-reported satiety from baseline to study completion was 58.6%. The high adherence group's satiety level was slightly lower than the medium adherence group (61.9% versus 63.2%, respectively). Satiety levels appeared to be less consistent in the low adherence group in weeks one to three before becoming more consistent in weeks four to eight.

Individual measures showed greater variation over the eight-week study period. For example, participant three displayed low levels of satiety throughout the study period (average 39.2%), increasing slightly in weeks six to eight (Figure 5.2c). She did not return to the peak level of 57.1% (observed after week one of the study). Furthermore, participant three's average satiety level was below her baseline measure of 42.8%. Despite this, total percentage weight loss was 8.3%, and above average weight-loss for the group. While participant two (Figure 5.2b) displayed a higher and more consistent level of satiety (average 73.1%), her total weight loss was lower than participant one (4.7 versus 8.3%, respectively).

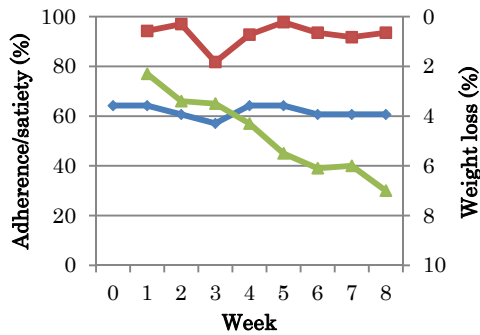
POMS TNMS, and TMDS data are presented in Figure 5.3. Figure 5.3a displays mood states data plotted in relation to percentage weight-loss data. Figure 5.3b, shows mood states data plotted against adherence. Average TNMS and TMDS showed positive trends, declining across the eight-week period. The greatest decline occurred in both TNMS and TMDS scores between baseline and week two (TNMS baseline = 28.6 week 2 = 11.7) and (TMDS baseline = 22.6, week 2 = 4.4).



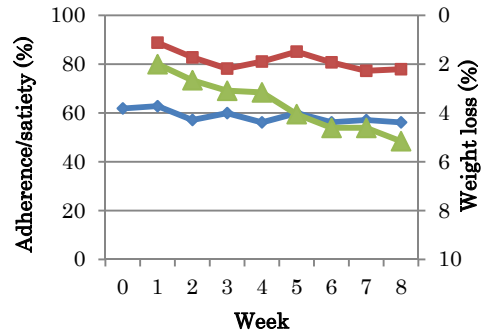
5.1a. Low Adherers



5.1b. Medium Adherers

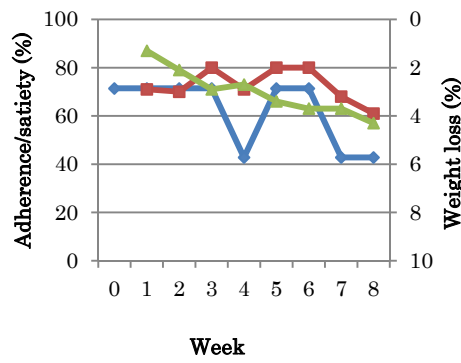


5.1c. High adherers

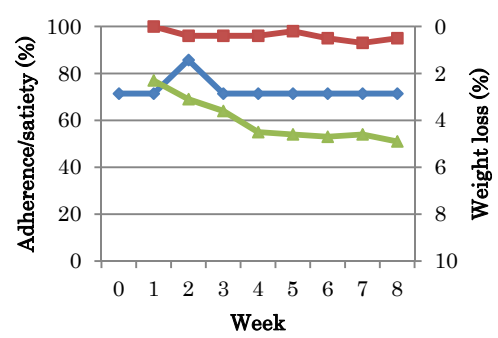


5.1d. Average of all participants

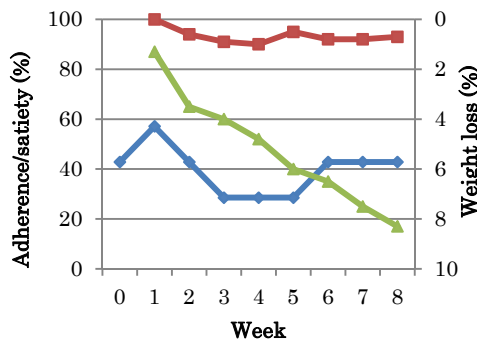
**Figure 5.1:** Self-reported satiety (◆), adherence (■), and change in weight (▲), presented by low, medium, and high adherence level, and for all participants combined.



5.2a. Participant 1 (Low adherence group)

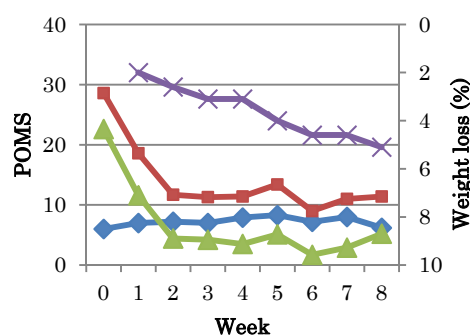


5.2b. Participant 2 (Medium adherence group)

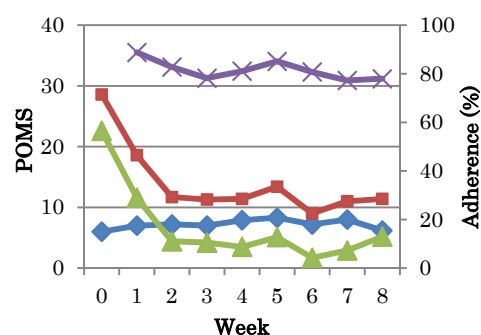


5.2c. Participant 3 (High adherence group)

**Figure 5.2.** Self-reported satiety (◆), adherence (■), and change in weight (▲) for selected individual participants.



**5.3a. POMS: Vigour, TNMS, TMDS and weight loss**



**5.3b. POMS: Vigour, TNMS, TMDS and adherence**

**Figure 5.3.** POMS: Vigour (◆), TNMS (■), TMDS (▲), changes in weight (x) and adherence. POMS: Profile of mood states; TMDS: Total mood disturbance, Score TNMS: Total negative mood score.

#### 5.4.2 Focus group data

Four over-arching themes pertaining to adherence to the LCHF model emerged from the three focus groups while undertaking the LCHF diet: (i) importance of support from family and peers, (ii) the need to be prepared, (iii) the feeling of fullness experienced, and (iv) the attitudes to acceptability of types of food recommended on the LCHF diet.

Table 5.24 outlines relevant key transcripts pertaining to the each of the themes identified. Note that focus group classification was based on participant adherence level on average over the eight-week study period. The levels comprised Low Adherence (mean adherence 77.4%), Medium Adherence (mean adherence 80.4%) and High Adherence (mean adherence 92.7%).

Table 5.2: Transcripts supporting focus group themes

Theme	Adherence group	Motivators	Barriers
Social support	Low	<ul style="list-style-type: none"> <li>I was lucky because my husband did it with me, he lost more weight than me which was really annoying</li> <li>At work we have got people who are doing it so I have good support all around me really</li> </ul>	<ul style="list-style-type: none"> <li>The only culprit has been my husband. He eats chocolate and peanuts and that drawer in front of the TV comes open, I tell you what it's hard when, he's sitting there munching away like that</li> </ul>
	Medium	<ul style="list-style-type: none"> <li>My husband said 'you are much better when you don't eat carbs, you are such a psycho'. No he means it in the nicest way, not quite so roller-coastering.</li> </ul>	<ul style="list-style-type: none"> <li>Work for me was the hard thing when people bring in chocolate and nuts</li> <li>She was supportive but others were like that's a bit odd. So then I didn't talk about it with them because they were very much like 'why are you doing that?'</li> </ul>
	High	<ul style="list-style-type: none"> <li>I found it quite easy, easier than any diet I have tried before. Especially when the rest of the family liked my meals more than their own meals. It just made it easier for me to just cook the same food for everybody</li> </ul>	<ul style="list-style-type: none"> <li>At work they were divided because I work at a health organisation and some of them were doing it and they were really keen and a couple came on board</li> </ul>
Preparation	Low	<ul style="list-style-type: none"> <li>I did my planning all the time, like putting my boiled eggs in the fridge and that sort of thing</li> <li>I brought an omelette maker to use in the microwave, at work but it's preparing it all the night before</li> <li>I just found it was the time and preparation</li> </ul>	<ul style="list-style-type: none"> <li>My husband was hospitalised and I was at the hospital for nearly a week, and I was buying the quiches at muffin break and eating out and leaving the pastry because what else can you do?</li> <li>I just found it was the time and preparation, by the time we had had dinner, then I would have to get my lunch ready and prepare my omelette to cook at work, I constantly seemed to be in the kitchen all time.</li> </ul>
	Medium	<ul style="list-style-type: none"> <li>For me its planning its having a weekly menu and say right, rather than in the morning scrambling for something, it's about sitting down making that plan making sure that I've got low carb bread in the freezer</li> </ul>	<ul style="list-style-type: none"> <li>When life became busy I couldn't plan enough to be able to take snacks and food to work. That was ok but that's why I would end up having toast at five in the morning just to keep me going and through</li> </ul>
	High	<ul style="list-style-type: none"> <li>I've got to make sure I've always got nuts or something healthy in my bag. I am not going to die of starvation, I can skip a meal, and yeah just making sure you are prepared.</li> </ul>	<ul style="list-style-type: none"> <li>You had to really think about what food you were sending and you know bread is good in the car, salads don't look very nice in the car, in and out of the chilly bin</li> </ul>



<b>Satiety</b>	Low	<ul style="list-style-type: none"> <li>I was similar in that I felt fuller and I tended to eat less, I certainly didn't need to snack at all. I just had breakfast lunch and dinner, and the occasional half a dozen nuts in between if I needed it but not really.</li> <li>It took a while, it took a while to get to that stage I would say, probably for me it was only in the last three or four weeks where I felt I wasn't hungry, but it did take a while.</li> </ul>	<ul style="list-style-type: none"> <li>I still get hungry; probably I should be adding more protein into my salad at lunchtime. And maybe a bit more yoghurt or something</li> </ul>
	Medium	<ul style="list-style-type: none"> <li>The fact that I never got hungry. I was amazed at how I didn't get hungry when I was really sticking to it. And I just didn't want to eat snacks and things, and when you were putting things</li> <li>Just not getting hungry was really interesting to me. I thought I've had hardly much to eat, 2 eggs for breakfast and I wouldn't even be thinking of food and that was 7.00 am to 1.00pm and I was like maybe I should be eating.</li> </ul>	N/A
	High	<ul style="list-style-type: none"> <li>And now I come home at three and I have an egg or I have a handful of nuts, or actually I am not very hungry. I am not very hungry.</li> <li>Definitively not hungry and before it was like full, starving, full starving, full starving and frequently, whereas now it's like ok I'll have a little bit of something. So you don't get that oh I'm starving anymore.</li> </ul>	N/A
<b>Factors impacting satiety</b>	Low	<ul style="list-style-type: none"> <li>I absolutely loved it but I like meat and fat so it worked well for me</li> </ul>	<ul style="list-style-type: none"> <li>It's just a bit of a shift for me because everyone has been going low fat low fat low fat and then all of a sudden going to this shift and thinking it's a funny thing</li> <li>I struggled with trying to put the high fat in, some of the fat I love, I love the fat on the pork chop, delicious, chicken skin, difficult I can knock that on the head so the low carb stuff was fine</li> </ul>
	Medium	<ul style="list-style-type: none"> <li>Eating fat was great. I don't need carbs! In addition, we would go out and it would be 'can I have a trim latte' and I was like 'can I have that with cream?'</li> </ul>	N/A
	High	<ul style="list-style-type: none"> <li>I found it very easy because you could have the high fat you didn't feel like you missed out on anything</li> </ul>	<ul style="list-style-type: none"> <li>Hardest thing for people is they don't believe you can eat the high fat and lose the weight</li> <li>Yes you get a bit shocked when you realise that you had 70gm of fat in that day</li> </ul>

Acceptability of LCHF food options	Low	<ul style="list-style-type: none"> <li>I love having an omelette for breakfast, the Greek yoghurt, and the nuts that's quite nice too.</li> <li>The nut cereal, I have that for dessert. I have Greek yoghurt cream a handful of berries that I have warmed up. It's really nice.</li> </ul>	N/A
	Medium	<ul style="list-style-type: none"> <li>The Greek yoghurt with LSA and berries is just like ice cream.</li> <li>But now I just cut the cheese slices and make that my sandwich. Cheese is the outside of my sandwiches</li> </ul>	N/A
	High	<ul style="list-style-type: none"> <li>I just to know I can get some meat with some veges or a salad with some nice dressing on it and the granola and cheese and it was all good</li> <li>We are eating whole naturally processed foods like cheese, like cream like meat, you know coconut so you are eating things that are natural</li> </ul>	N/A

## 5.5 Discussion

This research presents novel findings that both align with and add to the current body of literature around factors impacting adherence and acceptability of a LCHF dietary approach as a weight loss option for middle-aged women. This will be achieved by determining and addressing behavioural and environmental factors that impact dietary health behaviours in the population and relating them to the existing body of research.

Descriptive data collected throughout the study highlighted some expected and unexpected findings. Percentage weight loss was greatest in participants with the highest average adherence levels across the study period. While this reflects existing findings suggesting that adherence to weight-loss interventions impacts weight-loss outcomes (Greenberg et al., 2009; Klein, 2004), as probability statistics were not applied to this data, significance of these results remains uncertain. The overall average adherence level of 83.5%, and whilst it is a self-reported measure, it was a positive outcome and reflected the focus group results around factors that impacted adherence, such as feelings of fullness, and acceptability of LCHF food options.

Average weekly self-reported satiety levels were low across the study period. Focus group findings showed differential experiences of satiety by adherence group. Findings for the low

adherence group were in keeping with self-reported satiety levels. In contrast, those from the medium and high adherence groups reported feeling fuller throughout the study period. This issue has been addressed in subsequent paragraphs.

An interesting result of descriptive statistics displayed in the POMS data was a clear indication of the decrease in both TMDS and TNMS in the initial two weeks of the study. This study was not designed to assess causative factors of the intervention on participant mood states, however, the obvious downward trend in TMDS and TNMS is an indication that the LCHF way of eating could positively impact mood states. This characteristic of the study warrants investigation in future studies.

Four key themes emerged as impacting adherence to dietary modifications for women on the LCHF diet, and could be interpreted as both a barrier and motivator to adhering to dietary modifications. These themes, which included familial support, the importance of being prepared, satiety, and acceptability of LCHF food options will now be discussed individually.

While familial support is widely acknowledged as a contributing factor to adherence to a range of positive health behaviours, adherence to dietary modifications in particular is dependent on family support (Gorin, Powers, Koestner, Wing, & Raynor, 2014; Gorin et al., 2013; McLean, Griffin, Toney, & Hardeman, 2003). The current study findings on family support reflected those from earlier studies, whereby support by family members emerged as a primary motivator to adhering to weight loss interventions (Hammarström, Wiklund, Lindahl, Larsson, & Ahlgren, 2014; Visram, Crosland, & Cording, 2009). Dietary factors have been shown to directly impact immediate family members, therefore willingness by family, to adapt to and include the modified food choices in their own diet can enhance participant adherence (Gorin et al., 2013).

Furthermore, spousal involvement has been suggested as being of special importance in terms of providing emotional support for participants (McLean et al., 2003; Potz Kieffer, 2007). Indeed, results from the current study showed that participants experienced difficulties adhering when husbands were not supportive, however, participants whose husbands provided support or partook in the LCHF way of eating reported feeling motivated to adhere to the LCHF dietary approach. These results align with those reported by Hammerstrom et al. (2014) who found that husbands were both a major obstacle and a key motivator to adherence and behaviour change

in women. In addition, when husbands refused to eat new food, requiring women to cook two meals, workload increased considerably, and created barriers with adherence to a diet (Hammarström et al., 2014). Similar findings were reported by Gorin, et al. (2013) who reported a recognition of the influence that environment holds over food choices, suggesting that the home environment may be an important setting to target for intervention. Given that approximately 75% of daily calories are consumed within the home environment (Gorin et al., 2013), more research is warranted to determine how best to intervene and provide support in this setting. While environmental and behavioural changes that lead to weight loss and weight maintenance are required, future research should also investigate issues affecting food choices and preparation required when food is consumed outside of the home environment.

A subsequent theme, the importance of being prepared, was a theme that was also identified by Hammarström et al. (2014), who reported improved adherence when participants were well prepared for a range of situations. Competing demands on participants in the current study and the requirement for time spent outside of the home environment created difficulties in managing mealtimes and snacks in workplace, social and alternate environments. The associated study website provided information to guide participants on strategies to employ when eating outside of the home, including suggestions on how to adapt mainstream food options to be LCHF-appropriate. The limited choice of LCHF food options available in mainstream eateries such as cafes and bakeries, motivated some participants to create strategies to ensure LCHF food options were readily available.

These actions are reflective of strategies outlined in the SDT, recognising that a health behaviour is a function of characteristics of a person, their behaviour, and their environment (Baranowski et al., 2003). Participants who became familiar with LCHF food options and established practices so that they were prepared for all circumstances displayed motivation to adhere. It is also probable that participants developed these strategies as a result of HBT applied to this study through tailored resources. The study resource was developed and implemented to support women through dietary behaviour change, providing a level and depth of information that promoted participant autonomy. Drawing from components of several health behaviour theories, combining TTM eliciting stages of change principles, SCT and SDT, resources were tailored to an individual's current stage of change (Prochaska et al., 2008).

Participants were able to decide for their self, how much information they required and to what extent to access that information.

Furthermore, it is apparent from these outcomes and those from previous studies, that individuals with a lower self-efficacy for dietary change expect and therefore experience more barriers than motivators in daily life when intending to make dietary change (Baranowski, Cullen, & Baranowski, 1999). For example, participants who abstained from eating or were forced to manage with available options not appropriate on the LCHF diet, increased the likelihood of periods of non-adherence. This prerequisite for preparation, in itself, created a barrier with participants reporting dietary modifications causing additional effort in already busy lives. When LCHF practices became customary, time restraints became less burdensome and food preparation routines were easier to adhere to.

This finding is in keeping with the TPB, whereby a person's attitude toward a behaviour, and perceived behavioural control, combine to shape an individual's behavioural intentions and actions (Glanz et al., 2008). It must be considered that while many health behaviours require individuals to abstain permanently from a given behaviour (smoking cessation and drug abuse), food cannot be avoided completely. Therefore, dietary interventions need to be tailored to support participants to modify behaviour and sustain behaviour change in a food-dominated environment. Resources were developed in the context of providing information that was easily accessible and supported them to modify their behaviours in a range of situations. While individual engagement with specific resource components was not measured, participants commented that tri-weekly blog/posts added to a feeling of being supported and part of a wider group. This corresponds with research positing that participants benefit from the knowledge that they are part of a wider group, facing similar emotions and experiences (Glanz, 1980).

Satiety also emerged as a key theme contributing to participants' ability to adhere to the LCHF way of eating in this research. Several participants reported a satiating effect from the LCHF food options, thereby reducing the amount and frequency of food required daily. This finding corresponds with results from several studies investigating macronutrient profile of diets and the subsequent impact on satiety levels (Chambers & Yeomans, 2011; Hammarström et al., 2014; Volek & Westman, 2002). The exact macronutrient most impacting satiety, however, remains

uncertain. While some evidence suggests that the protein composition of a diet may increase satiety (Paddon-Jones et al., 2008), research by Volek et al. (2002) suggest that the both fat and protein are equally effective in improving satiety. This study was not designed to assess how individual macronutrient composition of the diet impacted satiety. Therefore it was not possible to know for certain whether participants were adhering to recommended levels of protein and fat, or which nutrient most impacted their satiety.

While focus group data indicated greater overall satiety on the LCHF diet, weekly adherence data failed to match these findings, adding further uncertainty over actual nutrient intake of intervention participants. The high adherence group enjoyed a more consistent level of satiety across the eight-week period, as recorded in both focus group and descriptive data. High and medium adherence groups reported that eating more fat was enjoyable and contributed to the feeling of fullness. In contrast, the low adherence group indicated a reluctance to take up high fat food options. This is a probable result of existing public health messages advising against dietary fat intake (Ministry of Health, 2003). This is understandable as it is a guideline that had been ingrained over time and is likely difficult to overcome with ease. It is also possible that participants in the low adherence group were often not satiated as a result of limited LCHF food options as a result of not being prepared for certain circumstances.

It is well recognised however, that hunger is not the sole motivator to eating, and an alternative rationale exists that explains eating habits. Eating is influenced by emotional, social and environmental factors, and individuals frequently turn to food for comfort, stress relief, or as a reward (Katterman, Kleinman, Hood, Nackers, & Corsica, 2014). Furthermore, food is seen as an important and enjoyable element of social and family gatherings making habitual eating habits harder to overcome (Katterman et al., 2014).

There are several limitations to this study, one being the use of self-reported measures. It is possible that the reliability of weekly self-report satiety measures were impacted by both time of day, and time since the preceding meal. Questionnaires were administered on Sunday each week, however participants were not advised of a specific time of day to complete them. It is also conceivable that inconsistencies in satiety could be attributable to differing food choices and resulting satiety levels between weekday and weekend.

Issues relating to recall, comprehension and social desirability bias, may have limited the self-reported adherence of participants to the LCHF way of eating. To mitigate this somewhat, food frequency questions were administered in conjunction with the adherence to prompt recall and provide consistency. The reliability of the responses however, remains uncertain. While food frequency questionnaires (FFQs) are commonly administered in intervention studies to track changes in dietary choices, it is recognised that FFQs may not be sufficiently specific to detect change. Furthermore, participants may report what they consider to be the desirable responses in context of the dietary approach (Cade, Thompson, Burley, & Warm, 2002), limiting the accuracy of these findings.

The introduction of food options, including those with a high fat content previously avoided in substantial quantities, appeared to positively impact adherence. Participants' enjoyment of specific foods including Greek yoghurt, almonds, and cheese was reported with participants commenting that these foods options made the LCHF diet acceptable and agreeable. It is conceivable that the fat content of these foods also contributed to satiety and the possibility of increased adherence. Furthermore, when food options endorsed in the LCHF approach were acceptable to family members, adherence was enhanced. In contrast however, family members not wanting to adhere to the participants' dietary modifications created barriers. Macchi et al. (2013) recognised that modifying the types and amounts of foods prepared in the home may be perceived by family members as a challenge to existing family norms, posing further barriers for women in adhering to weight-loss interventions.

## **5.6 Conclusion**

The current study findings suggest that a LCHF way of eating might enhance dietary adherence, and that a possible mechanism could be the improved satiety. Taken as a whole, the study findings indicate that this dietary approach was both acceptable and feasible for study participants. Moreover, results showed that for this population group, the intervention design was appropriate and the medium of delivery was effective. Further investigation is required into adherence over a longer time frame, and into acceptability and adherence issues with other population groups. Examination into weight loss approaches for middle-aged women specifically remains a relatively novel area of research. It is well known however, that by changing their own

health behaviours to a more positive model, women have the ability to influence the dietary behaviours of family members and those around them. They are therefore a key population group to consider when designing sustainable behavioural weight-loss interventions.



## **Chapter 6: Discussion**

### **6.1 Preface**

This chapter concludes the thesis as a whole. It provides a summary of findings in context of the current body of knowledge informing effective weight-loss strategies in the general population and for middle-aged women. Furthermore, it discusses evidence both from reviewed literature and current study findings around the safety and efficacy of the LCHF dietary approach as a weight-loss option for the target population. This thesis assumes the Pathway Two structure i.e. jointly authored research papers. Consequently, previous chapters have been necessarily succinct and focused on the principal issues of relevance to meet academic journal formatting requirements. As such, the opportunity has been taken to introduce additional results and discussion on further issues of relevance in this discussion chapter.

## **6.2 Introduction**

This research was inspired by a combination of a personal LCHF weight-loss journey and the need to understand acceptability and adherence of the LCHF dietary approach in middle-aged women. At the time of commencing this thesis, a discernible research gap existed in alternative weight-loss options for this population. The research has contributed to bridging this gap by determining barriers and motivators to adherence to the LCHF dietary way of eating; an approach that endorses a macronutrient profile comprising increased dietary fat, the strategic placement of protein, and the reduction of carbohydrate. In general, findings corroborate with those from similar studies in a range of population groups. This study however, provides some novel findings due to its exclusive focus on middle-aged women. By changing their own dietary behaviours, women have the ability to influence the dietary behaviours of family members and those around them. Accordingly, middle-aged women are a key population to consider when designing sustainable behavioural weight-loss interventions.

Findings from this study suggest that a LCHF way of eating might enhance adherence to weight-loss strategies, and that a possible mechanism in this phenomenon could be improved satiety. Taken as a whole, the study findings indicate that this dietary approach was both acceptable and feasible for study participants. Moreover, results showed that for this population group, the intervention design was appropriate and the medium of delivery was effective.

## **6.3 Key Findings**

The literature review underpinning this study examined the impact of hormonal function on weight status of middle-aged women in the context of dietary composition, and factors that may impact success of weight-loss dietary approaches. Key factors identified as relevant to weight status in this population were that: (i) hormonal function significantly impacts weight and body composition (and that a LCHF way of eating may be an appropriate weight loss mechanism for middle-aged women, and may confer additional metabolic benefits), (ii) adherence to a diet is a key determinant of weight loss, and (iii) medium of delivery can impact intervention effectiveness. The gap in knowledge pertaining to adherence and acceptability of low carbohydrate diets as a weight-loss option for middle-aged women was a key driver of the

subsequent research presented in this thesis.

Several key findings pertaining to adherence to the LCHF way of eating emerged from this research. Primarily, support by family members, in particular spouses, appeared to act as both a barrier and motivator to adherence. Subsequent themes included satiety or feelings of fullness, being prepared by ensuring LCHF options were readily available, and acceptability of new food options.

Familial support is widely acknowledged as a contributing factor to adherence to a range of health behaviours. Adherence to dietary modifications in particular is dependent on support from family (Gorin et al., 2014; McLean et al., 2003). Furthermore, McLean et al., (2003), suggests that involving spouses in behaviour change interventions can improve programme effectiveness. Current research supports this hypothesis, as LCHF Women's Health Research Programme participants reported experiencing difficulties adhering when family members and husbands were not supportive. Spouses who continued to consume foods that participants were attempting to avoid created a barrier to adherence, a concept supported by the comment: *'the only culprit has been my husband. He eats chocolate and peanuts and that drawer in front of the TV comes open, I tell you what, it's hard when, he's sitting there munching away like that'*. In contrast, participants whose husbands provided support or partook in the LCHF way of eating along with them, felt motivated, and reported improved adherence. For example, one participant commented: *'I was lucky because my husband did it with me, he lost more weight than me which was really annoying'*. A similar theme was identified in the work of Hammerström et al. (2014) with husbands reported to be both a major obstacle and a key motivator to adherence to dietary behaviour change.

Dietary factors directly impact immediate family members, therefore when family members adapt to and include the modified food choices in their own diet it becomes easier for participants to adhere (Hammarström et al., 2014). Ryden et al. (2011) found that social relationships both within and outside the home environment added barriers to adhering to dietary changes. The current study findings supports this concept with participants reporting that when they were able to replace traditional carbohydrate based foods with tasty and nutritious LCHF options for themselves and family members, it became easier for them to maintain dietary

modifications. Furthermore, it is well recognised that hunger is not the sole motivator to eating, and an alternative justification exists in explaining personal and social eating habits. In industrialised nations for example, food consumption is influenced by non-biological influences including emotional, social, environmental, and convenience factors (Beglinger & Degen, 2004). Aside from hunger and nourishment, individuals turn to food for comfort, stress relief, or as a reward (Katterman et al., 2014). The understanding that women are likely to fulfil the traditional household role of purchasing for, planning and preparing meals, provides opportunities to impact behaviours of family members. Conversely, barriers can be created in the absence of family support for these dietary changes. There remains a need for understanding of associated physiological and emotional influences to fully comprehend and address the impact of satiety on adherence and weight loss.

Volek and Westman (2002) suggest that the LCHF weight-loss approach results in enhanced adherence through improved satiety or the feeling of fullness, likely derived from increased dietary fat. The current research supports this hypothesis with satiety emerging as a key factor contributing to participants' ability to adhere to the LCHF way of eating. Several participants reported a satiating effect of LCHF food options, reducing the amount and frequency of food required daily. Interestingly, this was not reflected in the quantitative data, with low average satiety levels reported across the study period. It is possible this was influenced by adherence to the prescribed LCHF way of eating, as focus group findings showed differential experiences of satiety by self-reported adherence. Self-reported satiety for the low adherence group was generally low, whereas those from the medium and high adherence groups reported feeling fuller throughout the study period. It is not possible from the current research to determine whether a significant difference in satiety existed between the adherence groups. One study that has quantitatively examined differences in satiety by dietary approach reported significantly lower feelings of hunger in premenopausal women who complied with a low-carbohydrate/high-protein diet compared to those who complied with a high-carbohydrate/low-fat diet (Nickols-Richardson et al., 2005)

Comments stemming from focus groups indicate that participants attributed their ability to adhere to this feeling of fullness; *'I was similar in that I felt fuller and I tended to eat less, I certainly didn't need to snack at all. I just had breakfast lunch and dinner, and the occasional*

*half a dozen nuts in between if I needed it but not really*'. It is probable that increased satiety and subsequent suppression of appetite was a consequence of the high fat component of the LCHF diet. This study was not designed to assess how individual macronutrient composition of the diet impacted satiety, therefore it is not possible to know for certain whether participants were adhering to recommended levels of carbohydrate, protein and fat, or which nutrient most impacted their satiety.

The application of HBT and associated use of internet technology are deemed to be important mechanisms for intervention design for modifying dietary behaviour (Collins et al., 2010). A recent review on the effectiveness of web-based weight-loss and weight maintenance interventions concluded that web-based programmes have potential to achieve favourable weight-loss outcomes (Levy et al., 2007). The intervention and associated resources developed for this study drew from components of several HBTs. A combination of TTM eliciting SOC principles, SCT and SDT informed the theoretical base of this study. Positing that individual behaviour changes are not made suddenly, completely, or permanently. TTM theorises that interventions should be tailored to an individual's current stage of change (Prochaska et al., 2008). The mixed methods approach to applying HBT to the LCHF Women's Health Research programme endorsed a multi-level intervention, integrating behaviour change models with both the medium of delivery and required dietary modifications. Such an approach appears to appeal to the targeted population, allowing flexibility, autonomy, and, as is theorised, enhancing adherence to suggested dietary behaviour practices. Whether long-term behaviour change, and weight loss can be maintained, through this approach remains to be established.

Participants acknowledged that resources, while making them feel part of a team, allowed autonomy in access of information: *'The twice weekly email, it just kept me on the straight and narrow. That was really great for me and made me feel part of a group and helped me to adhere'*. This supports the hypothesis that participants benefit from the knowledge that they are part of a wider group, facing similar emotions and experiences (Glanz, 1980). This theory was supported by comments made by one participant: *'I quite liked the online thing 'cause when I'm not busy at work I could just quickly do that. If I had to do it any other way I probably wouldn't have done the feedback because there was just no time'*. In contrast, another participant found the web-based characteristic of the study less convenient and commented: *'I am not a good*

*electronic user and I am more a chatterer. It just took me a while to navigate it initially and I just looked at what you sent us (blog/posts)'. An additional resource, in the form of a hard-copy LCHF Guide allowed participants to access information on LCHF food choices in case internet technology was not accessible. This resource comprised information aligning with that contained on the website, however blog/posts, and content added throughout the eight-week study were available only on the website. Participants who favoured hard copy as opposed to continually accessing resources through the Internet displayed a preference for this format: 'Your booklet was really helpful because I photo copied the pages and shoved them on the fridge'. These comments provide possible ways to improve resource and programme delivery. While the hard copy guide was designed as a supplementary resource to website material, it became evident that this flexibility in intervention delivery approaches was important for some participants (Beall, Baskerville, Golfam, Saeed, & Little, 2014).*

While not receiving specific dietary plans, participants received group/web-based support for managing situations including travel, socialising, food choices, and preparation; however, further allowance was made for participants who required a one-on-one approach. This was implemented through personal email communication on an as-needed basis. While the participants were effectively part of a cohesive group, embarking on a prescribed weight-loss programme, several commented that they would have benefitted from face-to-face contact with both the lead researcher and fellow participants. As noted earlier, this reflects findings suggesting that while rarely involving face-to-face contact, participants on web-based interventions can benefit from the knowledge that they are part of a wider group, facing similar emotions and experiences (Glanz, 1980).

It remains to be established whether long-term behaviour change and weight loss can be maintained through the LCHF dietary approach and method of delivery employed in this study. Through HBT integration into this programme, however, participants were given the skills, and were equipped with long-term maintenance strategies to continue LCHF dietary modifications when the study was completed. Findings from this study suggest that future web-based weight-loss interventions may benefit from providing both structured one-on-one support, and allowing for interaction between participants. Furthermore, this study supports the provision of alternative supplementary format for resource delivery in the form of hard copy if requested. In practice,

internet technology provides a platform for communicating with large numbers of participants, while allowing them to access information at level of complexity appropriate for individual stage of change.

A key finding emerged around the importance of being prepared. This corresponded to findings indicating improved adherence when participants were well prepared for a range of situations (Falk, Bisogni, & Sobal, 2000; Hammarström et al., 2014). It is apparent that competing demands on participants and requirement for time spent outside of the home environment created difficulties in managing meals when not eating at home. The study website provided information to guide participants on strategies to employ in these situations, including suggestions on how to adapt mainstream food options to be LCHF appropriate. Limited choice of LCHF food options available in mainstream eateries such as cafes and bakeries, motivated some participants to create strategies to ensure LCHF food options were readily available. A comment by one participant framed these scenarios concisely: *'My husband was hospitalised and I was at the hospital for nearly a week, day in day out and there was nothing there to eat that hasn't got a carb in it. And I was buying the quiches at muffin break and eating out and leaving the pastry because what else can you do?'*. This corresponds to findings from similar studies suggesting that eating out complicated dietary adherence, with participants describing this as one of the most difficult aspects of dietary change (Falk et al., 2000; Schlundt et al., 1996).

Participants who became familiar with LCHF food options and established habits so that they were prepared for all circumstances displayed motivation to adhere. These actions align with SDT, recognising that a given health behaviour is a function of characteristics of a person, their behaviour, and their environment (Baranowski et al., 2003). In contrast, it is apparent from this and previous studies that individuals with a lower level of self-efficacy for dietary change expect, and therefore experience more barriers than motivators in daily life when intending to make dietary change (Baranowski et al., 1999; Falk et al., 2000). For example, in this study participants who abstained from eating or were forced to manage with available non-LCHF options were less likely to adhere to the diet. This prerequisite for preparation, in itself, created a barrier with participants reporting that dietary modifications caused additional effort in already busy lives, with one participant commenting: *'When life became busy I couldn't plan enough to*

*be able to take snacks and food to work. That was why I would end up having toast at 5 in the morning just to keep me going and through*'. When LCHF practices became customary, time restraints became less burdensome and food preparation routines were easier to adhere to. This finding is in keeping with the TPB, whereby a person's attitude toward a behaviour, and perceived behavioural control, combine to shape an individual's behavioural intentions and actions (Glanz et al., 2008).

While statistical analysis was not applied to the data in this study, interesting trends emerged from the POMS SF data collected weekly. TNMS and TMDS decreased in the initial two weeks of dietary modification, which could indicate that the LCHF diet may be effective for modifying mood disturbance, and negative mood state during short-term weight loss. This finding is in contrast with findings from Lieberman et al. (1986), indicating that individuals who consume carbohydrate based snacks experienced increased positive mood states. It is also recognised that individuals use food as a tool for managing emotions and mood-swings (Savoca & Miller, 2001). As such, removing food options that might be perceived as comfort foods may create obstacles to dietary adherence. This component of the research requires further investigation and future studies would benefit from application of statistical analysis of this data in correlation to weight loss, adherence, and satiety levels on a LCHF diet.

### **6.3.1 Additional findings**

Two additional findings emerged from this research that are worthy of discussion. Firstly, attitudes around alcohol, in particular the place it holds in social situations and its impact on weight, appeared to be a factor that affected adherence to the intervention. The concept of alcohol playing a role in social situations was supported by comments made by participants that included: *'I mean it's my son's birthday and we have a big party tomorrow and everyone's coming for a drink, so all the parents are coming for a drink and I'll have a few drinks'*. Furthermore, participant comments suggested that alcohol provided emotional support: *'Just the alcohol I have found difficult, we've had a very stressful time as well over the last couple of months'*. Several women reported to have reduced alcohol consumption even more than recommended in the intervention resources over the eight-week study, stating that they no longer felt the need to drink alcohol: *'I've just kind of stopped drinking just because we had a*



*crisis a few weeks ago and I just have to have my head together and I'm trying to get better sleeps and all that sort of thing*'. The resource was designed to acknowledge this while suggesting a strategy to modify alcohol consumption. Resources developed for this study included recommendations that participants reduce the amount of alcohol habitually consumed to a maximum of one standard drink per day and less if possible. It appears that the guidelines of reducing alcohol, rather than abstaining completely, allowed women the freedom to modify this behaviour in a manner that was acceptable to them. This is in keeping with research recognising the part that alcohol plays in social lives and in the context of social support (Peirce, Frone, Russell, Cooper, & Mudar, 2000). In some instances the decision to reduce alcohol intake seemed to be related to the desire to continue to lose weight, which is itself a motivator to adhere to such interventions.

Secondly, the impact that rate of weight loss appeared to have on participant adherence, and motivation to continue with dietary modifications is worthy of discussion. Evidence suggests that rapid early weight loss has a positive impact on overall weight loss and adherence to dietary interventions, with initial weight loss positively related to longer-term weight loss (Jeffery, Wing, & Mayer, 1998; Nackers, Ross, & Perri, 2010). Focus group findings from the current study revealed that women believed that if they did not adhere to the dietary guidelines, their rate of weight loss would decrease or plateau. While weight-loss data was self-reported weekly, it appears that many participants were weighing themselves daily, and therefore more aware of daily fluctuations in weight. Several women commented that on days that they did not adhere to the LCHF diet as well as usual, weight loss the following day had often increased or plateaued. In the initial weeks of the study, participants were more focused on and aware of their weight loss. This attitude was displayed through communications with the interactive forum designed to allow participants to communicate with the researcher and each other. A common theme of these and direct communications with the lead researcher were queries around rate of weight loss and possible causes for declining or plateaued weight loss.

One possible cause was that women were not provided with information on the physiological characteristics of weight loss, and were therefore conceivably influenced by a lack of understanding on weight loss mechanisms. While short-term incongruities occur throughout the digestive process, energy intake and expenditure is maintained effectively over the span of

several meals (Schwartz et al., 2000). It is essential therefore, that consideration be given to the spectrum of factors influencing homeostasis when addressing obesity and resulting metabolic disorders. The hormonal, behavioural, environmental, and macronutrient profiles of food are all elements contributing to a person's dietary behaviour and therefore must be considered simultaneously.

Furthermore, educational material, developed at a level of complexity appropriate for programme participants should be considered in future studies. This could enable participants to undertake dietary behaviours with full understanding of the metabolic effect and intricacies of specific dietary approaches, and might impact adherence through this enhanced understanding of homeostatic responses. In a study conducted by Ramadas et al. (2011), a web-based programme was tailored according to each participant's SOC, where-upon on entry to the website, they were given previously validated SOC questions and directed to a recommendation page corresponding and based to both their personal SOC status and requirements. While the current intervention drew from the SOC approach (and materials developed accordingly), the approach utilised in this study did not enable distinction of participants into SOC categories. Consequently, all participants received the same level of intervention and same intervention materials. It is possible that acceptability and adherence may have been improved if the intervention had been adapted to individual SOC. Future research may benefit from considering tailoring the study website and materials to participant's SOC.

This study demonstrated extremely high and efficient responsiveness to participants' individual needs. This was achieved by an evidence-based series of resources that anticipated barriers participants may encounter in adhering to the LCHF dietary approach. In addition, participants were provided with individual feedback when requested. It is apparent that this characteristic of the study, while improving adherence over the study time frame, might be difficult to emulate in practice, unless individuals proactively seek out the services of appropriately trained nutritionists /dietitians to provide such advice and support.

Resource development for future studies could include a more effective forum, allowing for real time conversations. This interaction between participants could emulate the researcher-participant communication through shared experiences and emotions. This characteristic of

dietary behaviour change has been recognised in existing research (Glanz, 1980), implying that individuals benefit from being part of a wider group. This study will further impact current research in this field by the nature of the methodology. Results suggest the study design was appropriate for pragmatic implementation of a weight-loss intervention while providing the means to collect effective data to effectively inform study outcomes.

Clearly this research is a precursor for future studies in the area of weight-loss in middle-aged women and factors influencing adherence to such interventions. While findings contribute to the considerable gap in research around weight-loss interventions in this population they have also highlighted areas that warrant further investigation. Building on this knowledge, future studies are required to determine the most efficacious design and delivery of weight-loss interventions. Furthermore, consideration of specific issues contributing to adherence to dietary modification in the targeted population is essential. Future interventions targeted at middle-aged women should consider primarily the nutrient profile of a diet and associated relevance to internal physiology, and secondly the integration of HBT into weight-loss programmes.

## **6.4 Implications of research**

The body of literature informing this study comprised a substantial component on both weight-loss studies in general. A particular focus was placed on low carbohydrate diets and their efficacy and safety compared to traditional low fat diets. While the current study was not designed to measure metabolic outcomes, findings hold a meaningful place in this literature field. Dietary adherence has been implicated as an essential feature in the success of weight-loss interventions; however, studies assessing and investigating the association between adherence and weight-loss outcomes remain scarce (Alhassan et al., 2008). It has been suggested that increased adherence is associated with a greater weight loss than other characteristics such as macronutrient profile, or total calorie ingestion, of a diet (Dansinger et al., 2005). The LCHF Women's Health Research Programme was designed to assess adherence to and acceptability of a LCHF diet for middle-aged women, and revealed several key adherence issues, all of which could be characterised as both motivators and barriers to adherence. While these adherence factors were investigated in the context of the LCHF dietary approach, they could be relevant to both alternative health behaviours, and to weight-loss strategies in general.

One adherence factor that appears to distinguish the LCHF dietary approach from traditional dietary approaches however is the satiating impact of the LCHF food options. Future research would benefit from investigation into the association between satiety and tangible macronutrient profile levels of diets.

Findings drawn from the qualitative nature of this study, has contributed to filling gaps in the current literature pertaining to adherence and the practical implementation of weight-loss strategies for middle-aged women. The current research provides both evidence and practical recommendations to add to the existing body of knowledge around the LCHF dietary approach. Furthermore, these findings can be translated to inform weight-loss interventions in general, and the application of HBT in order to enhance adherence and subsequent success of weight-loss strategies in middle-aged women and other at-risk population groups. Taken together, the reviewed literature and current study findings indicate that the appropriate application of theories underpinning dietary behaviour modification can help inform effective and sustainable weight-loss interventions (Noar & Zimmerman, 2005). Further investigation is required however, into adherence over a longer time frame, and acceptability and adherence issues with other population groups in the context of LCHF.

The LCHF dietary approach, while questioning existing recommendations and guidelines to limit dietary fat intake, has and will continue to fuel debate in both academic and practice arenas. Recent media coverage has brought public attention to the LCHF dietary approach and has further fuelled the controversy amongst academics and practitioners. Through a review of the literature, findings from this research will help address several translational issues around the LCHF approach to eating, including adherence and acceptability of this diet. Furthermore, findings can contribute much needed translational evidence to the ongoing discussion between the two factions. A better understanding of barriers and motivators to an LCHF way of eating and the mechanism of improved satiety derived from increased dietary fat could substantially enhance existing weight-loss interventions. The compelling evidence around the efficacy of the LCHF dietary approach for the studied and general population has created a need for effective dissemination of study findings and recommendations. It is critical that evidence-based findings are considered and critiqued appropriately in public health and other research fields. Based on

the literature reviewed, it is plausible that no one diet is optimal, rather that dietary modification could be dependent on different markers or stages of metabolic and hormonal health status.

Key to bridging the gap between the two public health factions is a more comprehensive understanding of the term 'LCHF', as it is merely a 'whole food' dietary approach to eating. It is vital that there is clear understanding that the LCHF approach, while endorsing lower amounts of carbohydrate and higher amount of fats than traditional diets, includes a range of foods which overlap with those endorsed by traditional weight-loss approaches. These overlapping options include, and promote, unrestricted amounts of non-starchy vegetables, some starchy vegetables, and some fruit. From a dietary fat perspective LCHF endorses a range of fats from natural food sources rather than any one in particular. Eating whole foods that are minimally processed and packaged from a range of plants and animals is a common goal for all people who promote health.

## **6.5 Summary**

The current knowledge base on weight gain in middle-aged women, suggests a compelling link between decreased oestrogen levels and insulin homeostasis. While a body of research exists around the efficacy of the LCHF diet, there remains minimal evidence on translational aspects to this way of eating such as adherence and acceptability. Findings stemming from this study suggest that the LCHF style of eating may elicit weight loss and contribute to adherence to dietary intervention, possibly through the mechanism of improved satiety. Furthermore, food options endorsed appeared to be both appealing and acceptable to middle-aged women and family members. It is vital therefore that investigation continues on weight loss strategies appropriate to this population, exploring the complete hormonal spectrum, interactions between digestive and sex hormones, and objective assessment of metabolic health outcomes in the long term. In conclusion, while these findings suggest that the LCHF is an appropriate approach to weight loss for middle-aged women, further investigation is warranted into barriers and motivators of weight loss utilising this dietary model.

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## Appendices

### Appendix 1: Ethics approval, Auckland University of Technology Ethics Committee



AUTEC!  
SECRETARIAT

!

14 January 2014!

!

Caryn Zinn!  
Faculty of Health and Environmental Sciences!

!

Dear Caryn!

Re: Ethics Application:!! **13/339! Exploring! the! acceptability! of! and! adherence! to! a! carbohydrate! restricted, high! fat! diet! as! an! instrument! for! weight! loss! in! women! aged! 40! to! 55! years.!**

Thank you for providing evidence as requested, which satisfies the points raised by the AUT University Ethics Committee (AUTEC).!

Your ethics application has been approved for three years until 14 January 2017.!

As part of the ethics approval process, you are required to submit the following to AUTEC:!

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/researchethics>.!! When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 14 January 2017;!
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/researchethics>.!! This report is to be submitted either when the approval expires on 14 January 2017 or on completion of the project.!

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence.!! AUTEC approval needs to be sought for any alteration to the research, including any alteration for or addition to any documents that are provided to participants.!! You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.!

AUTEC grants ethical approval only.!! If you require management approval from an institution or organisation for your research, then you will need to obtain this.!! If your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply there.!

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us.!! If you have any enquiries about this application, or anything else, please do contact us at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz).!

All the very best with your research,!!

!

!

!

!

Kate O'Connor!  
Executive Secretary!  
Auckland University of Technology Ethics Committee!

Cc: Julia McPhee!

!

Auckland University of Technology Ethics Committee

WA505F Level 5 WA Building City Campus!

Private Bag 32006 Auckland 1142 Ph: 64 9 321 9999 ext 8316 Email: [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz)



## Appendix 2: Participant Information Sheet

# Participant Information Sheet



### Date Information Sheet Produced:

25/10/2013

### Project Title

Exploring the acceptability of, and adherence to a restricted carbohydrate, higher fat diet as an instrument for weight loss in women aged 40-55 years.\*

### An Invitation

My name is Julia McPhee. I am inviting you to participate in a research project. Your participation in the study is voluntary and you may withdraw at any stage. Please read through the information below carefully before making your decision. This research is funded by AUT postgraduate funding.

### What is the purpose of this research?

The aim of this research is to determine factors influencing the adherence to and acceptance of a carbohydrate-restricted higher fat diet. The research involves implementation of an 8-week weight loss programme in which you will be supported to undertake dietary changes, which include restricting your carbohydrate intake and including some fats in your diet. This research will form part of a Masters Thesis in Health Science.

### How was I identified and why am I being invited to participate in this research?

We are seeking women aged 40-55 years who are interested in participating in this programme, however we do need women who fit a specific criteria. Your eligibility will be confirmed through a screening questionnaire designed to assess your eligibility for participating in this study. Following this process, if you fit the criteria you will be sent notification of your inclusion in this study, your first questionnaire and access to the support website.

\*

### What will happen in this research?

This study involves participants undertaking an 8-week programme using a low carbohydrate, higher fat (LCHF) approach to weight loss. You will be provided with a link to a website to support you through the 8-week period. The website will include information on recommended foods, foods to avoid, recipes, and access to an interactive forum, and resources which allow you to monitor your carbohydrate and nutrient intake. Each week while you are on the LCHF diet you will be asked to complete a 10 minute on-line questionnaire designed to measure your mood state, adherence to, and satiety (hunger/fullness) levels while on the diet. The questionnaire will also ask for your body weight each week.

### Focus Groups

You will also be asked to participate in a focus group at the end of the 8-week period. Focus groups will take place in Auckland and will take around 1 hour each. Focus groups will be used to discuss your perceptions of the low carbohydrate, higher fat diet and will explore issues around adherence and acceptability to this diet.



**What are the discomforts and risks?**

We do not anticipate any discomfort to you through your participation in this study.

**How will these discomforts and risks be alleviated?**

If however you do feel discomfort or distress while participating in this study you can contact the AUT Counselling Service for a consultation at no cost to yourself.

**What are the benefits?**

You will be provided with access to a website providing support for you to complete the 8-week LCHF weight loss programme.

**How will my privacy be protected?**

Your data and identity will be confidential. No names or contact details will be stored with the dataset.

**What are the costs of participating in this research?**

There is no cost in participating in this research

**What opportunity do I have to consider this invitation?**

Please indicate by completing and submitting the attached on-line consent form that you would like to participate in this study. As soon as we receive your consent form, you will be asked to complete your first (baseline) questionnaire and you will then be provided with access to the LCHF support website.

**How do I agree to participate in this research?**

Please indicate by completing and submitting the attached consent form that you would like to participate in this study.

**Will I receive feedback on the results of this research?**

You will be provided with feedback on the results of the research at the completion of this study.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Caryn Zinn*, [czinn@aut.ac.nz](mailto:czinn@aut.ac.nz), 09 921 9999 ext 7842.

Concerns regarding the conduct of the research should be notified to the Executive

Secretary of AUTC, Kate O'Connor, [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz) , 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Researcher Contact Details: Julia McPhee, [jmcphee@aut.ac.nz](mailto:jmcphee@aut.ac.nz)

Project Supervisor Contact Details: Dr Caryn Zinn, [czinn@aut.ac.nz](mailto:czinn@aut.ac.nz), 09 921 9999 ext 7842

Approved by the Auckland University of Technology Ethics Committee on **14/01/2014**, AUTC Reference number **13/339**

## Appendix 3: Consent Form

### Consent Form



**Project title:** Exploring the acceptability of, and adherence to a restricted carbohydrate, higher fat diet as an instrument for weight loss in women aged 40-55 years.

**Project Supervisor:** Dr Caryn Zinn

**Researcher:** Julia McPhee

- ☐ I have read and understood the information provided about this research project in the Information Sheet dated 25/10/2013
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that I will be asked to take part in a focus group at the end of the study period
- ☐ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ To the best of my knowledge I am not suffering from any of the following conditions: Type 1 diabetes, renal, heart or liver disease, or endocrine disorder.
- ☐ I agree to take part in this research.
- ☐ I wish to receive a copy of the report from the research (please tick one):  
Yes ☐ No ☐

Participant's name:

.....

Participant's Contact Details:

.....

.....

.....

Date:

**Approved by the Auckland University of Technology Ethics Committee 14/01/2014**  
**AUTEC Reference number 13/339**

## Appendix 4: Weekly questionnaire

Survey: Week 1 LCHF Women's Health Research 14/04/14

**Welcome to the first of your weekly LCHF Women's Health Research Project questionnaires. Each week you will be asked questions about your general mood state, hunger/fullness, and adherence while you are completing the 8 week LCHF Women's Health Research programme. It will take approximately 10 minutes to complete the questionnaire, and you will be asked to complete this questionnaire each week over the eight week period.**

**Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain anonymous. If you have questions at any time about the survey or the procedures, you may contact Julia McPhee by email at the email on [jmcphee@aut.ac.nz](mailto:jmcphee@aut.ac.nz)**

**Thank you very much for your time and support. Please start with the survey now by clicking on the acceptance box below.**

**I have read the information sheet and consent form. I fully understand and agree to participating in this survey.**

☐ **I Agree**

---

**This section is about your mood state.**

**Below is a list of words that describe feelings people have. Please read each one carefully. Then click on ONE answer which best describes HOW YOU HAVE BEEN FEELING DURING THE LAST 24 HOURS.**

**Tense**

- ☐ Not at all
- ☐ A little
- ☐ Moderately
- ☐ Quite a bit
- ☐ Extremely

**Angry**

- ☐ Not at all

- A little
- Moderately
- Quite a bit
- Extremely

**Worn out**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Unhappy**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Lively**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Confused**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Peeved**

- Not at all
- A little
- Moderately

- Quite a bit
- Extremely

**Sad**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Active**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**On edge**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Grouchy**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

---

**Blue**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Energetic**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Hopeless**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Uneasy**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Restless**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Unable to concentrate**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Fatigued**

- Not at all

- A little
- Moderately
- Quite a bit
- Extremely

**Annoyed**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Discouraged**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Resentful**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Nervous**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Miserable**

- Not at all
- A little
- Moderately

- Quite a bit
- Extremely

**Cheerful**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Bitter**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Exhausted**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Anxious**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Helpless**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely



**Weary**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Bewildered**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Furious**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Full of pep**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Worthless**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Forgetful**

- Not at all

- A little
- Moderately
- Quite a bit
- Extremely

**Vigorous**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**Uncertain about things**

- Not at all
- A little
- Moderately
- Quite a bit
- Extremely

**Bushed**

- Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely
- 

**The following questions are to help assess the amount of food from the 'FOODS TO AVOID' list you might have consumed this week. This will help you to rate your adherence for the last seven days.**

---

**In the last 7 days on how many occasions did you consume bread/toast OR bread rolls?**

-- Select --

---

**On the last 7 days, on how many occasions did you consume pasta or noodles? This includes all pasta dishes, lasagne, and noodles such as**

**2 minute noodles, vietnamese noodles etc.**

-- Select --

---

**On how many occasions over the past 7 days did you consume starchy or root vegetables such as potatoes, kumara or pumpkin?**

-- Select --

---

**On how many occasions over the past 7 days did you consume legumes such as chickpeas, lentils, beans or peas (fresh or frozen)?**

-- Select --

---

**On how many occasions over the past 7 days did you consume rice? This includes brown or white rice and sushi.**

-- Select --

---

**On how many occasions over the last 7 days did you eat fast food or takeaways from places like McDonalds or Burger King? Think about breakfast, lunch, dinner and snacks.**

-- Select --

---

**On how many occasions over the last 7 days have you consumed crackers, and snacks such as rice crackers, potato chips, corn chips?**

-- Select --

---

**On how many occasions over the last 7 days did you drink fruit juices, soft drinks, sports drinks or energy drinks? Do not include diet varieties.**

-- Select --

---

**On how many occasions over the past 7 days did you consume lollies, sweets , chocolate or confectionary? (don't count very dark 85% cocoa chocolate)**

-- Select --

---

**On how many occasions over the past 7 days did you consume baked goods such as manufactured or homemade biscuits or cakes?**

-- Select --

---

**The next question is about adherence or how you were able to stick to the LCHF diet over the last 7 days.**

**Please indicate on the scale below how well you adhered to the LCHF diet in the last 7 days. For example if you feel that you ate only foods from the 'Recommended' food list then you would slide the scale to 100. If you feel that 50% of the food you ate was from the 'Recommended' food list, you would slide the scale to 50%. Please answer this question honestly and accurately.**



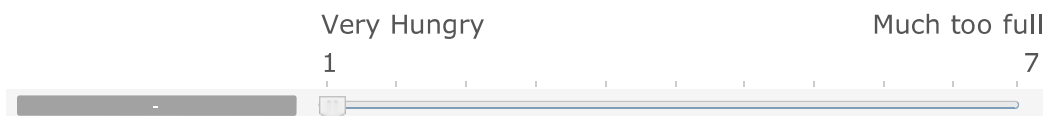
---

**The next question is about your feelings of satiety or Hunger/fullness.**

**Please indicate on the scale below your general feeling of satiety or hunger/fullness over the last 7 days:**

**Here's a little more about what the numbers mean:**

- 1: Very hungry; starving; desperate.**
- 2: Moderately hungry; ready to eat.**
- 3: Mildly hungry; beginning hunger.**
- 4: Neutral. You feel no sensations of hunger or fullness.**
- 5: Mildly full. You feel satisfied.**
- 6: Very full.**
- 7: Much too full.**



---

**What is your current weight in kilograms?**

-- Select --

**Now enter grams to the nearest 100 gms?**

-- Select --

---

---

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## Appendix 5: Screening Questionnaire

### Survey: LCHF Women's Health Research Project Recruitment S

Thank you for contacting me regarding the LCHF Women's Health Research Project.

The following survey has been designed to confirm your eligibility for this project.

Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact Julia McPhee by email at [jmcphee@aut.ac.nz](mailto:jmcphee@aut.ac.nz).

Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

---

What is your date of birth?

---

Please enter your current weight in kilograms

---

Please enter your current height in cms

---

Are you suffering from any of the following conditions:

Type 1 diabetes  
Renal disease  
Heart Disease  
Liver disease, or  
Endocrine disorder

---

If yes please specify

---

Are you currently on any specific dietary programme?

---

If yes please specify



## Appendix 6: Recruitment advertisement



Are you interested in losing weight and keeping it off using the Low  
Carbohydrate High Fat weight loss approach?

*Traditional weight loss programmes that promote the benefits of a diet high in carbohydrates and low in fat have done little to stem the global obesity epidemic. Research shows that a low carbohydrate, higher fat diet is an effective weight loss strategy, however there remain barriers to the uptake of this diet. This research will endeavour to determine the factors effecting women aged 40 – 55 years in modifying dietary behaviours and maintaining those behaviours while embarking on a low carbohydrate diet.*

If you are a woman aged between 40 and 55 years and interested in taking part in a weight loss programme using the low carbohydrate, higher fat approach, please contact me on the email provided below. I will then send you further information.

Julia McPhee

[jmcphee@aut.ac.nz](mailto:jmcphee@aut.ac.nz)

021 717 734

This research is being conducted as part of a Masters thesis in  
Public Health