e-SPEN Journal 8 (2013) e235–e240

Contents lists available at ScienceDirect

e-SPEN Journal

journal homepage: http://www.elsevier.com/locate/clnu

Psychological well-being response to high protein and high carbohydrate weight loss diets in overweight and obese men: A randomised trial

Janna Lutze [a, *], Pennie Taylor [a], Grant D. Brinkworth [a], Belinda Wyld [a], Julie Syrette [a], Carlene J. Wilson [b], Peter M. Clifton [c], Manny Noakes [a]

[a] CSIRO Preventative Health Flagship and CSIRO Animal, Food and Health Sciences, Adelaide, Australia
[b] Discipline of Public Health, Flinders University of South Australia, Adelaide, Australia
[c] School of Pharmacy and Medical Sciences, University of South Australia, Australia

ARTICLE INFO

Article history:
Received 4 June 2013
Accepted 18 August 2013

Keywords:
Diet composition
Weight loss
Mood
Psychological
Obesity

SUMMARY

Background & aims: High protein, low fat (HP) diets have established efficacy for weight management, but their effects on psychological well-being, particularly in men have not been well studied. This study compared an energy controlled HP diet with a high carbohydrate, low fat (HC) diet on psychological well-being after 1 year.

Methods: 117 obese men (mean ± SD, age 49.6 ± 9.2 years; BMI 31.2 ± 4.2 kg/m^2) were randomised to consumption of either an energy restricted (~7 MJ/day), HP diet (n = 57; 35% of total energy as protein, 40% carbohydrate, 25% fat) or an isocaloric, HC diet (n = 61; 17% protein, 58% carbohydrate, 25% fat) for 52 weeks. Body weight and psychological well-being was measured with Profile of Mood States (POMS), Bachman's Self Esteem scale and the SF-36 instruments at baseline (week 0), week 12 and week 52.

Results: Weight loss was (mean ± SEM) 8.9 ± 0.4 kg (8.6%) at Week 12 and 10.5 ± 0.8 kg (10.5%) at Week 52 ($p < 0.001$ for time); no difference between groups ($p = 0.91$ time × diet effect). POMS subscales (anger-hostility, vigour-activity, confusion-bewilderment, tension-anxiety, depression-dejection, fatigue-inertia) and total mood disturbance score and the majority of SF-36 subscales significantly improved at one year ($p \leq 0.05$ for all). Self-esteem did not change significantly during the intervention ($p = 0.075$). No effect of diet composition was evident for any of the psychometric measures assessed ($p \geq 0.5$ for time × diet effect).

Conclusions: In overweight and obese men, weight loss on hypocaloric HP and HC diets were both effective in improving mood and general psychological well-being over one year.

Registered under anzctr.org.au Identifier no. ACTRN 12606000002583.

1. Introduction

Obesity is a global epidemic, with a higher proportion of males compared to females classified as being overweight.[1] In particular, men have a shorter life expectancy and are at greater risk of chronic disease compared to women.[1] This has led to greater emphasis on men's health and increased scientific focus on the development of effective weight loss and maintenance dietary interventions in men.

A growing body of evidence suggests that compared to a conventional hypocaloric, low fat (<30%), high carbohydrate (HC) diet, the replacement of some carbohydrate for protein may promote abdominal weight loss, increased satiety and improve cardiovascular risk markers.[2–7] However, to date, these studies have been largely conducted in women with limited data available in men. Moreover, the effect of higher protein, low fat (HP) diets on mood and psychological wellbeing remains largely unexplored.[8] Since negative emotions may promote overeating,[9] it is important to establish whether particular dietary patterns result in negative

* Corresponding author. CSIRO Animal Food & Health Sciences, PO Box 10041, Adelaide, South Australia 5000, Australia. Tel.: +61 8 83038882; fax: +61 8 83038899.
E-mail address: janna.lutze@csiro.au (J. Lutze).

2212-8263/$36.00
http://dx.doi.org/10.1016/j.clnme.2013.08.002

mood responses that could counteract attempts to achieve long term weight loss maintenance.

To date, only a limited number of studies have examined the effects of an energy reduced HP diet compared to an isocaloric HC diet on psychological wellbeing. In 2007, a small pilot study in obese women with polycystic ovary syndrome (PCOS) showed that after 16 weeks, significant reductions in depression and improvements in self esteem occurred in the HP diet group only and not the HC diet group.[10] In contrast, Grave et al.[11] showed that both a HP and HC diet similarly improved psychosocial profile in morbidly obese adults after 1 year. However, this study was conducted in a majority group of women. Previous studies have reported differences in acute mood responses between genders following the intake of meals varying in protein and carbohydrate levels,[12,13] and therefore whether similar responses are evident over the long term and in men remain largely unknown and require examination.

Therefore, the aim of this study was to assess the long-term effects of an energy restricted HP diet compared to an isocaloric HC diet on mood and psychological wellbeing in overweight and obese men.

2. Materials and methods

2.1. Participants

The participants and study design have been previously described elsewhere in a study reporting on separate outcomes.[14] Briefly, 123 overweight and obese men (BMI 27–40 kg/m^2), aged 20–65 years were recruited by public advertisement. Exclusion criteria were a medical history of cancer, liver, metabolic, gastrointestinal, renal, hepatic or coronary disease, or diabetes; the use of any drug therapy, medication or supplements on a regular basis that may interfere with bowel function, hypoglycaemic medication and drugs which affect insulin sensitivity; history of heavy alcohol consumption (>5 standard drinks/day). This study was approved by the Human Research Ethics Committee of the Commonwealth Scientific and Industrial Research Organisation and participants provided full written informed consent before participation.

2.2. Study design and dietary intervention

In a parallel study design, participants were initially block matched for age and BMI, then randomised by trial coordinators using computer-generated random number allocation to consume either an energy restricted high protein, low fat diet (HP, $n = 59$) or an isocaloric high carbohydrate, low fat diet (HC, $n = 64$) for 12 months in April 2005. Data collection was completed in July 2006.

The planned targeted macronutrient content of the two diets were (as % of total energy intake): HP diet: protein 35%, carbohydrate 40%, fat 25%; HC diet: protein 17%, carbohydrate 58%, fat 25%. The diets were planned to be isocaloric with a moderate energy restriction (total energy approximately 7000 kJ). To facilitate dietary compliance, the macronutrient profiles were structured into specific quantities of daily foods,[14] and participants met with a qualified dietician fortnightly during the first 12 weeks of the study and monthly thereafter to receive dietary counselling and assess dietary compliance. To further facilitate dietary compliance, participants were provided with digital weighing scales and supplied with key foods providing ~60% of the prescribed total energy intake, consistent with their allocated diet for the first 12 weeks of the study. Self monitoring and dietary compliance was achieved through completion of daily weighed food checklists during the initial 12-week intervention period and three days of food intake (1 weekend day and 2 weekdays) were analysed in each two week period using FoodWorks (Xyris 1998-2007 Version 5 Service Pack 1). At the cessation of the first 12-weeks, participants were asked to continue the principles of the assigned dietary patterns and received monthly dietary counselling until the completion of the one year study. Self monitoring through daily weighed food checklists was continued during the maintenance period (13–52 weeks) with three days of food intake (1 weekend day and 2 weekdays) analysed during each two week period.

At Week 0, 12 and 52, after an overnight fast, outcome measures were assessed at the Clinical Research Unit of the Commonwealth Scientific and Industrial Research Organisation (Adelaide, Australia). Body height was measured (week 0 only) to the nearest mm using a stadiometer (Seca, Germany) with participants barefoot, in a free-standing anatomical position. Body weight was measured to the nearest 0.01 kg using calibrated electronic digital scales (Mettler, model AMZ14), wearing light clothing. Psychological well-being was assessed using validated questionnaires, including Bachman's revision of Rosenberg's Self Esteem scale (BSE),[15] a 10 item tool that provides a single scored assessment of self esteem; the Short Form Health Status Survey (SF-36),[16] a generic tool for measuring general wellbeing and with a standardised scoring system that yields a profile of eight health scores and two summary measures (mental and physical well-being); and the Profile of Mood States (POMS).[17] The POMS measures six separate aspects of mood including tension-anxiety, depression-dejection, anger-hostility, vigour-activity, fatigue-inertia, and confusion-bewilderment. In addition, a total mood disturbance score (TMDS) was calculated by summing these scores (n.b. vigour-activity score subtracted). All instruments have been well documented as valid and reliable.[15,18,19] Prior to each clinic visit, a 24-h urine sample was collected for assessment of the urinary urea excretion to inform dietary compliance. Urinary urea was measured on a BM/Hitachi 902 Automatic Analyzer with a standard enzymatic kit (Roche Diagnostics Co, Indianapolis, IN). All research personnel involved in data collection were blinded to intervention assignment.

2.3. Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics software, version 20.0 (SPSS Inc, Chicago). Statistical significance was set at $p < 0.05$. All results are presented as mean ± SEM. Internal reliability for all psychological measurement instruments were confirmed in a study subsample using Cronbach's alpha coefficient >0.7 (Cronbach's alpha coefficient for POMS: 0.90, Bachman's Self Esteem: 0.87, SF-36: 0.80). Residuals were examined for assumptions of normality prior to hypothesis testing.

Group differences for baseline characteristics were compared using independent *t*-tests for continuous variables and chi-square tests for categorical data. Independent *t* tests were used to assess mean dietary intake data (macronutrients) at the two intervention periods (week 0–12 and week 13–52). To determine the effects of the diets on the outcome variables, intention to treat analysis (ITT) was performed on the primary outcomes (weight and psychological wellbeing measures) using a mixed model design with time and diet as factors and age as a covariate (interaction effect diet composition × time). Unstructured or auto regression covariance types was selected. Mixed model design allows all participant data to be included in the analysis and is preferable where dropout rates are high. Where a significant main effect was observed, post hoc comparisons were performed with Bonferroni's adjustment for multiple comparisons to determine differences between group means. A secondary, completers analysis including only participants who completed the study and had data available at all time points was also carried out (HP, $n = 32$; HC, $n = 34$). Independent *t*-tests were used to compare baseline outcome measures of those