Innovative approaches to treat overweight and obesity in adults:
An investigation of a commercial web-based weight loss program

Melinda Jane Neve, BND (Hons)
A thesis submitted for the degree of PhD (Nutrition and Dietetics)
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Statement of originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

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Acknowledgement of collaboration

I hereby certify that the work embodied in this thesis has been done in collaboration with other researchers. I have included as part of my thesis a statement clearly outlining the extent of the collaboration, with whom and under what auspices.

................................................

Melinda Neve
Acknowledgement of authorship

I hereby certify that this thesis is in the form of a series of published papers of which I am a joint author. I have included as part of my thesis a written statement from each co-author, endorsed by the Faculty Assistant Dean (Research Training), attesting to my contribution to the joint publications.

............................................

Melinda Neve
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Conflict of Interest

Melinda Neve received a postgraduate scholarship top-up from SP Health Co Pty Ltd. There was in-kind support from SP Health Co in terms of provision of data but they had no role in the: design of the studies; analysis of data; writing of this thesis or the manuscripts it contains; or decision to submit the manuscripts for publication. SP Health collected some of the data. They reviewed each manuscript prior to submission, but not this thesis.
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARIA</td>
<td>Accessibility/Remoteness Index of Australia</td>
</tr>
<tr>
<td>BIA</td>
<td>Bioelectrical impedance analysis</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>cm</td>
<td>Centimetre</td>
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<tr>
<td>COPD</td>
<td>Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>CV</td>
<td>Coefficient of variation</td>
</tr>
<tr>
<td>DLW</td>
<td>Doubly labelled water</td>
</tr>
<tr>
<td>EI</td>
<td>Energy intake</td>
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<tr>
<td>GLMM</td>
<td>Generalised linear mixed model</td>
</tr>
<tr>
<td>HR</td>
<td>Hazard ratio</td>
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<tr>
<td>IPAQ</td>
<td>International Physical Activity Questionnaire</td>
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<tr>
<td>IQR</td>
<td>Interquartile range</td>
</tr>
<tr>
<td>IRSAD</td>
<td>Index of Relative Socioeconomic Advantage and Disadvantage</td>
</tr>
<tr>
<td>JBI</td>
<td>Joanna Briggs Institute</td>
</tr>
<tr>
<td>Kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>LOCF</td>
<td>Last observation carried forward</td>
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<tr>
<td>m</td>
<td>Metre</td>
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<tr>
<td>NUTTAB</td>
<td>Nutrient Data Tables for use in Australia</td>
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<tr>
<td>NWCR</td>
<td>National Weight Control Registry</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal digital assistant</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>SMD</td>
<td>Standardised mean difference</td>
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<tr>
<td>SMS</td>
<td>Short message service</td>
</tr>
<tr>
<td>TBW</td>
<td>Total body water</td>
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<tr>
<td>TEE</td>
<td>Total energy expenditure</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>---------------------------</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<tr>
<td>WMD</td>
<td>Weighted mean difference</td>
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Abstract

Overweight and obesity are a major cause of preventable death and morbidity; furthermore the associated health care costs are substantial. Given the growing obesity epidemic, effective behavioural interventions are urgently required to achieve initial weight loss and maintenance of lost weight long-term. Interventions also need to engage large numbers of overweight and obese individuals in a cost-effective manner. Internet or web-based behavioural interventions have emerged in recent years as an innovative medium for providing treatment. The primary purpose of this thesis is to establish the value of a commercial web-based weight loss program as a treatment option for overweight and obese adults. Four research studies were undertaken to meet this aim.

A systematic review of the available literature determined the effectiveness of web-based interventions on weight change. Meta-analyses provided promising, but not convincing, evidence that firstly, web-based interventions with enhanced features can achieve greater weight loss than those with education components alone and secondly, that web-based interventions to achieve maintenance of lost weight result in less weight regain compared to control groups without an active intervention.

A cohort study tracked usual participants (n=11341) of a commercial web-based weight loss program for up to 52-weeks. The program reached a large number of overweight and obese individuals at risk of obesity-related co-morbidities, due to their poor eating and exercise habits at enrolment. Participants on average achieved clinically important and statistically significant weight loss after 12- and 52-weeks membership periods. The study also found that use of website features was positively correlated with weight loss. However, use of the web-based program by participants was relatively low and highly variable. Participants aged 45 to 65 years, and with positive eating and physical activity habits at enrolment were less likely to stop using the program.

Participants of the cohort study, who agreed to be contacted for research purposes (n=5625), were followed-up 15-months post initial enrolment and invited to complete an online survey. The survey found that approximately one third of respondents reported ≥5% weight loss since enrolment, and that weight loss increased significantly with length of membership to the commercial program. Significant behavioural predictors of success (≥5% weight loss) included regular self-monitoring of weight, not skipping meals, not keeping snack foods in the house and eating takeaway foods infrequently.
A small sub-study evaluated the accuracy of energy intake estimated by a web-based food diary compared to total energy expenditure measured using doubly labelled water in weight stable overweight and obese women (n=9). Self-reported energy intake obtained from a web-based food diary was under-reported by 20% on average, which is consistent with other published dietary intake methods.

In conclusion, the study findings presented in this thesis provide evidence to support the use of web-based interventions as a treatment medium for overweight and obese adults, due to their ability to reach a large number of ‘at-risk’ individuals, ability to capture accurate energy intake data and potential to achieve clinically important weight loss. However, the findings also highlight that participant’s engagement with web-based interventions is an area that needs to be addressed as a key strategy to improve weight-related outcomes. The results have implications for overweight and obese individuals, clinicians and web-based program developers, and key recommendations for ongoing research into web-based weight management interventions are provided.