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## Exploring experiences of people with knee osteoarthritis who received a physiotherapist-delivered dietary weight loss and exercise intervention: a mixed methods study

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**Running Head:** Weight loss diet by physiotherapists

**Abstract (250 words)**

**Objective.** Explore the experiences of people with knee osteoarthritis who received a very low energy diet (VLED) and exercise program from a physiotherapist.

**Methods.** Mixed methods study involving questionnaires (n=42) and semi-structured interviews (n=22) with randomized control trial participants with knee osteoarthritis who had received a 6-month physiotherapist-delivered VLED weight loss and exercise intervention. Questionnaires measured participant satisfaction, and perceptions about physiotherapist's skills/knowledge in delivery of the dietary intervention (measured on 5–7 point Likert scales). Interviews explored participant's experiences and were analysed based on the principles of reflexive thematic analysis.

**Results.** Questionnaire response: 90%. Participants were satisfied with the program (95%), confident their physiotherapist had the required skills (84%) and knowledge (79%) to deliver the dietary intervention, felt comfortable talking to the physiotherapist about weight (74%), and would recommend others see a physiotherapist for the intervention they undertook (71%). Four themes were developed from the interviews: 1) one-stop-shop of exercise and diet; 2) physiotherapist-delivered weight loss works (unsure initially; successfully lost weight); 3) physiotherapists knowledge and skills (exercise is forte; most thought physiotherapists had the necessary weight loss skills/knowledge, but some disagreed); 4) physiotherapists have a role in weight loss (physiotherapists are intelligent, credible, and trustworthy; specific training in weight loss necessary).

**Conclusion.** This study provides, to our knowledge, the first documented perspectives from people with osteoarthritis who have received a physiotherapist-delivered weight loss intervention. Findings suggest physiotherapists may have a role in delivering a protocolised dietary intervention for some people with knee osteoarthritis with overweight and obesity.

**Key words:** Osteoarthritis; knee; weight loss; maintenance; pain; physiotherapist; diet; qualitative; overweight; obesity.

**Abbreviations:** OA: osteoarthritis; VLED: very low energy diet

**Word count:** 3960

Accepted Article

## Significance and Innovations

- Exercise and weight loss is recommended for management of knee osteoarthritis, yet many people can find it difficult to access clinicians who are skilled in the delivery of exercise and weight loss diet. Our recent randomised controlled trial found that a diet and exercise program delivered by a physiotherapist was effective for weight loss and symptoms in people with knee osteoarthritis. However, the acceptability of the program among the participants who received the intervention was unknown.
- Most participants who received the diet and exercise program from a physiotherapist felt the program was effective, convenient, and that it enabled continuity and integration of care. However, some participants did not believe their physiotherapist had an adequate depth of knowledge about weight loss.
- Most participants felt that physiotherapists had a role in weight loss, but believed training was required to address perceived limitations in their knowledge beyond the standard protocolised program delivered.
- This research adds to a significant contemporary conversation about the feasibility and acceptability of extended practice roles of healthcare practitioners in weight management.

## Introduction

Around two-thirds of people with osteoarthritis (OA) have overweight or obesity <sup>1</sup>. This comorbidity has been linked to more severe OA-related pain and disability <sup>2</sup> and increased odds of requiring costly joint replacement surgery <sup>3</sup>. Higher body weight is also one of the few modifiable risk factors for OA progression <sup>4</sup>. As such, almost all current clinical guidelines for OA management recommend weight loss, alongside exercise, as a core treatment for people with OA who have overweight or obesity <sup>5</sup>.

There is evidence that losing 5-10% of body weight can lead to clinically meaningful reductions in joint pain in people with knee OA and overweight or obesity <sup>6</sup>. However, losing weight is difficult, often requiring support and supervision from healthcare practitioners to ensure long-term success <sup>7</sup>. Our team <sup>8</sup>, and others <sup>9,10</sup>, have shown weight loss interventions involving dietitian-delivered weight loss diets combined with exercise programs lead to significant weight loss, and improvements in pain and function, in people with knee OA. Participants in our previous randomised controlled trial (RCT) intervention who received a dietitian-delivered very low energy diet (VLED) and physiotherapist-delivered exercise program were highly satisfied with their experiences, believing that both components were crucial to their weight loss success <sup>11,12</sup>. However, workforce capacity (e.g., number of accessible practicing dietitians <sup>13-16</sup>) remains an issue for access to best practice care in the face of rising rates of obesity <sup>17</sup> and OA <sup>18</sup>. Alternative models of care that expand current healthcare practitioner roles in those who commonly see people with OA, such as physiotherapists, may help address this barrier of access to care and the challenges of accessing multiple healthcare practitioners.

In Australia and the United States, physiotherapists outnumber dietitians by over 4:1 <sup>13-16</sup>. In the UK the ratio is over 7:1 <sup>19</sup>. Increasingly, the scope of physiotherapy as a profession is

evolving beyond exercise, and international physiotherapy societies (such as World Confederation of Physical Therapy) consider lifestyle support for weight management to be within the scope of contemporary physiotherapy practice <sup>20-25</sup>. Given that many of the behaviour change techniques used by physiotherapists to promote exercise and physical activity are also relevant to weight management (e.g., action planning/goal setting, feedback and monitoring) <sup>26</sup>, it is plausible that physiotherapists already possess some of the skills required to support dietary behaviour change. As such, one way in which to deliver combined weight loss and exercise programs is for physiotherapists to deliver both components. There is evidence that physiotherapists can be effectively trained in weight management, improving their knowledge and skills in weight management for people with OA and reducing their weight-stigmatising attitudes <sup>27</sup>. However, while people with OA are open to physiotherapists engaging in a role in weight management, some are uncertain about whether physiotherapists would have the skills and scope of practice needed to address weight <sup>24</sup>. To our knowledge, no prior studies have examined the experiences and perceptions of people with OA who have received a combined weight loss and exercise program from a physiotherapist, including any barriers or facilitators to success that may have implications for the future role of physiotherapists in weight management. Thus, the aim of this study was to explore the experiences of people with knee OA who received an exercise and weight loss program from a physiotherapist as part of an RCT <sup>28</sup>.

## Methods

All participants provided written informed consent and The University of Melbourne (Australia) Human Research Ethics Committee approved the study (#1955042.3). This study is reported in accordance with the Consolidated criteria for Reporting Qualitative research (COREQ) guidelines <sup>29</sup>.

## *Design*

This study was nested within the POWER RCT<sup>28,30</sup>, which evaluated the effectiveness of a physiotherapist-delivered diet and exercise program for people with knee OA and overweight or obesity (Trial Registration: NIH US National Library of Medicine, Clinicaltrials.gov NCT04733053, Feb 1, 2021).

The design of the qualitative component of this study was based on the qualitative paradigm of interpretivism. According to this paradigm, knowledge about a phenomenon is developed by gathering perceptions and interpretations of participants who experience it<sup>31</sup>. A phenomenological framework was used<sup>32</sup>, which focuses on the lived experiences of people involved with the issue being researched

## *Participants and recruitment*

Participants were those who were randomised to the Diet+Exercise intervention arm of the overarching POWER RCT<sup>28,30</sup>. Inclusion criteria for the RCT have been previously described in detail<sup>28</sup> and include: a diagnosis of knee OA using the National Institute for Health and Care Excellence clinical OA criteria<sup>33</sup>; history of knee pain  $\geq 3$  months; knee pain on most days of the past month; knee pain during walking over the past week of  $\geq 4$  on an 11-point numeric rating scale (NRS); body mass index (BMI)  $>27$  kg/m<sup>2</sup>; willing to monitor blood pressure if using hypertensive medication and light-headed/dizzy during the trial; able to give informed consent and participate fully in trial procedures. Exclusion criteria included: aged over 80 years; weight  $>150$  kgs (due to complexity of additional nutritional requirements); on a waiting list for/planning knee/hip surgery or bariatric surgery in next 6 months; previous arthroplasty or recent surgery (past 6 months) on affected knee; inflammatory arthritis (e.g. rheumatoid



arthritis); weight loss >2 kg over past 3 months; actively trying to lose weight; unwilling to continue current dietary patterns if randomized to the exercise group; conditions where the dietary intervention necessitated medical monitoring (Type 1 diabetes; Type 2 diabetes requiring medication except metformin; warfarin use; stroke/cardiac event in past 6 months; renal problems (unless clearance obtained from general practitioner and estimated glomerular filtration rate >30 mL/min/1.73m<sup>2</sup>); fluid intake restriction; unstable cardiovascular condition); neurological condition affecting lower limbs; vegan dietary requirements (due to complexity of delivering a nutritionally complete diet with the dietary intervention); unable to speak English.

All 42 participants who had been randomised to the Diet+Exercise arm of the RCT, except for the first participant from each of the six treating physiotherapists, were invited to participate in the qualitative component of this study within 1-3 weeks of completing the 6-month intervention. The first participants from each physiotherapist were not invited as it was assumed that their experience in the intervention may have differed from the rest of the cohort, given that the physiotherapists had only seen mock and practice patients prior to the start of the trial.

#### *Physiotherapist-delivered weight loss and exercise intervention*

Details of the Diet+Exercise intervention have been published <sup>28</sup>. Briefly, participants completed a 6-month program involving diet and exercise/physical activity components delivered by a physiotherapist. The program included six videoconferencing (Zoom Video Communications Inc., California USA) consultations with a physiotherapist for supervision of a VLED <sup>34</sup> and prescription of a strengthening home exercise and physical activity program. Consultations lasted 75 minutes initially (45 minutes for diet component) and 50 minutes thereafter (30 for minutes diet component). The strengthening exercise component was based on an established program <sup>8,35,36</sup> and included 5-6 lower limb customized strengthening

exercises performed 3 times per week at a moderate intensity using body weight +/- resistance bands. A personalized and progressive physical activity plan was developed in collaboration with the participant.

The Diet intervention included three phases (Table 1):

- Phase 1 (Intensive) with the aim of 5-10% body weight loss included a VLED where two meals per day were replaced with very low-calorie products (Optifast® meal replacements (Nestlé Health Science, Rhodes, Australia) or Optislim® (OptiPharm Pty Ltd, Clayton, Australia) for vegetarians) with a low-carbohydrate third meal, for a total of approximately 800 calories per day;
- Phase 2 (Transition) when participants reached their target weight or at 13 weeks, whichever came first, they transitioned off the diet which involved reintroducing carbohydrates and moving to one meal replacement per day over a two-week period;
- Phase 3 (Healthy eating) aligned with the principles of the Commonwealth Scientific and Industrial Research Organisation total wellbeing diet <sup>37</sup>, involving a high protein, low glycaemic index carbohydrate, low fat diet.

Trial participants received each component of the intervention for free, at no personal cost. This included up to 14-weeks' worth of Optifast® meal replacements.

Prior to RCT commencement, the six participating RCT physiotherapists underwent ~20 hours of mandatory comprehensive training in the delivery of the diet component, including: (i) self-directed e-learning modules (~10-12 hours over 6 weeks); (ii) six practice consultations delivering sessions 1, 2 and 4 of the Diet+Exercise program to one 'mock' patient (research

team member) and one ‘practice’ patient with knee OA through which they received feedback from the mock patients and researchers.

### *Quantitative measures*

Participants completed online questionnaires pre- and post-intervention<sup>28</sup>. Questions related to perceptions, experiences, and acceptability of the program.

On a 5-point Likert scale ranging from “strongly disagree” to “strongly agree”, participants were asked to rate:

- Their self-reported confidence in different healthcare practitioners (general practitioners, dietitians, and physiotherapists) to deliver a dietary weight loss intervention, collected pre- and post-intervention;
- Their belief that their trial physiotherapist was knowledgeable about weight loss and had the skills to support them to lose weight, collected post-intervention;
- Their confidence their physiotherapist could help them lose weight, collected post-intervention;
- Whether or not they felt judged by their physiotherapist about their weight, collected post-intervention;
- Whether or not they felt comfortable discussing weight with their physiotherapist, collected post-intervention;
- Whether or not they felt that they could trust their physiotherapist’s dietary advice, collected post-intervention;
- Whether they would recommend others to see a physiotherapist for this dietary weight loss intervention, collected post-intervention.

On a 7 -point Likert scale ranging from “extremely dissatisfied” to “extremely satisfied”, participants were asked to rate their satisfaction with treatment program, collected post-intervention;

### *Qualitative interviews*

An interview guide was developed (Table 2). It was structured around the Theoretical Framework of Acceptability <sup>38</sup>, which was developed to define a consistent approach for reporting and assessing acceptability of healthcare interventions. The interview questions sought to explore participant-specific experiences with the physiotherapist-delivered Diet+Exercise intervention in the RCT. Telephone semi-structured interviews were conducted by personnel not involved in the POWER RCT: RN, a physiotherapist and researcher trained and experienced in qualitative research methodologies and PC, a non-clinician research assistant who is trained and experienced in qualitative methods. Interviews were audio-recorded and transcribed verbatim by an external provider of transcription services. All data were de-identified and securely stored on a password protected university server.

### *Data analysis*

Quantitative data were analysed by calculating means and standard deviations, or counts and frequencies, in SPSS (IBM Statistics, USA).

To understand the participants’ perspectives we employed an inductive reflexive thematic analysis <sup>39</sup>, facilitated by NVivo version 12 software <sup>40</sup>. To enhance understanding, interpretation, and reflexivity, data were analysed collaboratively by two authors RN and BJL (a researcher with qualitative experience and no clinical physiotherapy background or involvement in the RCT). First, RN and BJL each read and re-read all interview transcripts to

familiarize themselves with the data. Notes were taken on initial thematic impressions and interpretations and these were then reviewed relative to the research questions. Data were then coded and grouped collaboratively by RN and BJL into related topics and categories. Next, both researchers developed initial themes by further refining codes and adapting, merging, and sorting them. To promote trustworthiness and transparency of findings, an audit trail of analytical decisions was used, and a third author (KA, a physiotherapist with qualitative experience who was involved in the development of the larger RCT) reviewed final themes. All researchers strove to be cognisant of their own personal and professional viewpoints, given some of their experience could be considered as having ‘insider status’ in the physiotherapy advocacy community.

## Results

### *Quantitative data*

All 42 participants who were randomized to the Diet+Exercise program responded to questionnaires at baseline, and 38 (90%) participants responded to questionnaires at six month follow-up. Participants were predominantly female (64%), with a mean age of 61 (standard deviation [SD] = 7) years and a mean body mass index at baseline of 35.2 (SD = 5.3) kg/m<sup>2</sup> (Supplementary Table 1). After the intervention, participants had lost an average of 8.1% (SD = 5.2%) of their body weight. 75% of participants surpassing the desired 5% body weight loss.

Quantitative data relating to perceptions and experiences with delivery of weight loss diet are shown in Table 3. Before commencing the intervention, half of the participants (50%) reported being confident a physiotherapist could deliver a weight loss program, which increased after the end of the intervention (65%). Overall, participants were satisfied with their experiences receiving a weight loss program from a physiotherapist in the trial; >79% believed their

physiotherapist was knowledgeable in weight loss and had the skills to support weight loss, and >70% were confident their physiotherapist could help them lose weight, felt comfortable discussing their weight with the physiotherapist, and would recommend others to see a physiotherapist for a weight loss program.

### *Qualitative data*

Interviews were undertaken with 22 of the 42 participants in the Diet+Exercise program (Table 4). The remaining 14 participants did not respond to the interview invitation. Over half (68%) were female and employed full time (68%). Participants lost, on average 9.1% (SD = 4.5%) of their body weight at the end of the program (range +1.1 % body weight gain to -22.2% body weight loss)

Four themes (with up to three subthemes each) were developed: 1) One-stop-shop of exercise and diet; 2) physiotherapist-delivered weight loss works (unsure initially; successfully lost weight) 3) depth of physiotherapists knowledge and skills (exercise is forte; most thought physiotherapists had the necessary weight loss skills/knowledge, but some disagreed ); 4) physiotherapists have a role in weight loss (physiotherapists are intelligent, credible, and trustworthy; specific training in weight loss is necessary). A summary of themes, subthemes, and additional exemplary quotes are in Table 5.

### *Theme 1: One-stop-shop of exercise and diet*

A clearly identified advantage of the program was only needing to see a single clinician. Participants felt that this saved them time, was convenient, and kept them more accountable. They also believed that only consulting with one clinician ensured that there was consistency in information received, and meant that their clinician could ensure that both the diet and

exercise programs were fully integrated. The diet and exercise programs were perceived to complement one another, and therefore, to participants, it made sense that both were delivered by the same clinician.

*“I think one of the things was obviously having a bit of consistency talking to the one person. So that was one of the advantages I think – you know, it reduces, just from a practical standpoint, having two meetings in the one.” P10*

#### *Theme 2: Physiotherapist-delivered weight loss works*

*Unsure initially:* Participants reflected on initially feeling unsure and sceptical about the effectiveness and suitability of having the diet delivered by a physiotherapist. They perceived that a physiotherapist’s expertise was in exercise and ‘hands-on’ therapy, rather than diet and nutrition. However, participants acknowledged that, after beginning the program, they were surprised by the benefits and realised weight loss could be within physiotherapists’ scope.

*“I wasn't really expecting that the physio – what I understand about physio is when you hurt, when you hurt your shoulder, hurt something, and then they will try to give you exercises to strengthen something again. That's the only thing I know about physiotherapy -so yeah, it was something different. I wasn't expecting anything that – yes, I was surprised.” P14*

*Successfully lost weight:* Participants experienced positive weight loss outcomes – reporting high levels of satisfaction with their experiences. To them, the fact that the program ‘worked’ and led to significant weight loss was proof that it is possible for physiotherapists to deliver an effective weight loss diet. This reflects our quantitative data, where 95% of participants were satisfied with the Diet+Exercise program (Table 3).

*“I thought it was really, really good. I have been to a dietitian in the past, but I didn't have any success there. But this time I felt I had success. I had success because I lost eight kilos. I mean, that to me is quite amazing.” P16*

### *Theme 3: Depth of physiotherapists knowledge and skills*

*Exercise is forte:* Although participants believed their physiotherapist had the knowledge and skills required to deliver the weight loss diet, some still got the impression that their physiotherapist had much stronger skills and confidence in the delivery of exercise. They perceived that their physiotherapist seemed less comfortable discussing weight loss and/or dietary issues related to the program, and that it was not as ‘automatic’ as when discussing the exercise component. Some participants felt that their physiotherapist treated the weight loss component of the program as more of an ‘add on’ to the exercise program.

*“I think that exercise prescription, you could see that that was the area of expertise ... he just kind of knew that stuff really automatically. The diet stuff, not quite as automatic.” P19*

*Most thought physiotherapists had the necessary weight loss skills/knowledge, but some disagreed:* Most participants believed that their physiotherapist had sufficient knowledge and skills to effectively deliver the weight loss diet in the intervention. In general, they trusted the information the physiotherapist gave them and, overall, had confidence that the physiotherapist knew what they were talking about. In contrast, some participants felt that these skills/knowledge were ‘superficial’ – and that the physiotherapist was just ‘reading from the book’ or following a ‘script’. Some believed their physiotherapist lacked deeper knowledge about nutrition and lacked skills relating to dietary behaviour change. This was particularly



apparent when unique issues/side-effects arose that were not addressed within the intervention booklets. This sub-theme broadly reflects our quantitative findings, where 21% did not agree that their physiotherapist was knowledgeable about weight loss, and 29% did not believe their physiotherapist could help them lose weight (Table 3).

*“I consider physios – they’re really knowledgeable - she was certainly very, very knowledgeable... they have the practicality of the books behind them as well. Not only for the exercises, but all about ketosis and the recipe book. It was like a holistic programme that looked at you and I felt really held in someone's hand to make a success of what I was trying to do.”*

P16

*“it was referring you to – like, get your green book out, get your blue book out, that not the strength of knowledge in food and nutrition... I don’t think the person I had knew enough about food and nutrition - the way that he talked about food was almost just reading from the book. That if it was to work, they would have to understand probably a bit more about eating triggers”*

P1

*Theme 4: Physiotherapists have a role in weight loss*

*Physiotherapists are intelligent, credible, and trustworthy:* Overall, participants thought that physiotherapists were, as a health profession, highly qualified and intelligent. They were perceived to be a respectable and trustworthy source of knowledge and advice – and participants therefore assumed they would be highly capable to deliver a weight loss program. Participants believed that physiotherapists could easily obtain the skills and knowledge necessary to deliver a weight loss diet.

*“I mean I naturally assumed that the physio would have some experience in – I don’t know if qualifications is the right word, but that they are qualified to talk to diet – so I didn’t really think that there was – when they go, that they know what they’re talking about; that wasn’t really an issue for me.” P10*

*Specific training in weight loss is necessary:* Participants thought physiotherapists could have a role in the delivery of weight loss diets in the future – as long as they received the same level of training as what was provided to physiotherapists in the overarching trial. However, some participants thought more training was needed in common dietary side effects and how to deal with them. Some participants also felt that additional training in food and nutrition was necessary (e.g., for participants who were vegetarian or had different dietary needs or allergies), as well as behaviour change techniques/knowledge that were specific to diet and weight loss.

*“if the physiotherapist has the same amount of training as the guy I was dealing with, yeah, absolutely. I wouldn't hesitate. But as we all know, most physiotherapists are there to do more work on your body, muscle and bone manipulation. Dieting isn't one of their fortes unless you're lucky enough to catch up with someone like I have, like I use.” P11*

## **Discussion**

This study explored the perspectives of people with knee OA about the acceptability of a physiotherapist-delivered weight loss program within the POWER RCT. Overall, participants were satisfied with the program and most would recommend others to see a physiotherapist for a weight loss program. Participants felt that the strengths of the physiotherapist-delivered combined diet and exercise program were that it was effective for weight loss, enabled continuity of care from a credible healthcare practitioner and was convenient. While

participants described being somewhat unsure initially, their intervention experience led them to believing physiotherapists had a role in weight loss, but some felt that there were limitations to the depth of their physiotherapist's knowledge and skills in this space.

While we have previously found people with knee OA and overweight and obesity to be open to physiotherapists engaging in weight loss alongside exercise in the management of knee OA<sup>24</sup>, this is, to our knowledge, the first study to explore the experiences of people with knee OA who have received such an intervention. People who had received the same protocolized Diet+Exercise intervention in our earlier RCT<sup>8</sup>- but delivered by a dietitian believed that the professional guidance and encouragement provided, as well as accountability to their dietitian, was crucial to their weight loss success and to overcoming the initial challenges of a VLED (e.g., common side effects of headaches, fatigue, and constipation)<sup>11</sup>. This contrasts somewhat with some findings of the present study. While most participants felt their physiotherapists had the required knowledge to support them in weight loss, some felt that there was a limit to the depths of physiotherapists' VLED skills and knowledge, particularly surrounding management of side effects or diet alternatives beyond the protocolized program. These perspectives were similarly held by the trial physiotherapists who delivered the intervention<sup>41</sup>.

Consistent with contemporary understanding of the individualized complexity of weight regulation and sustained health behaviours required for weight management, not all participants believed a physiotherapist-delivered diet intervention was for them. By the end of the Diet+Exercise intervention, despite 75% of participants surpassing the desired 5% body weight loss, around one-third (35%) were still not confident that a physiotherapist could effectively deliver a dietary weight loss program in a real-world setting. In contrast, over 90% of participants were confident that a dietitian could deliver a dietary weight loss program. Our

findings suggest a physiotherapist-delivered weight loss intervention will not be acceptable to all patients with knee OA and overweight or obesity. People with a preference/desire for more specific/detailed nutritional advice and support may not be satisfied with a physiotherapist-delivered weight loss program. In contrast, those who are content to be guided through a highly structured/protocolised diet may find that delivery by a physiotherapist is sufficient.

A clear advantage for the participants interviewed in this study was the pragmatic nature of a combined model of care, where participants had one practitioner overseeing both the diet and exercise components of their treatment. Physiotherapists were perceived as trustworthy and credible experts in exercise and health promotion, and thus well positioned to deliver a combined model of care. These sentiments align with previous research <sup>22,24,42,43</sup>, and are important as perceived credibility is a fundamental element of therapeutic rapport <sup>44</sup>, which influences engagement with diet and exercise programs. Further to this, participants saw the coherence between diet and exercise, and felt they were clearly integrated, perspectives held by other people with knee OA <sup>24</sup>. On this basis, it is equally feasible that dietitians could be upskilled in exercise delivery for the management of knee OA in extended practice roles to facilitate patient access to best practice care, and this is an area for future research. However, from an access to care perspective, physiotherapists more frequently are first contact practitioners or receive referrals from general practitioners, for people with knee OA <sup>45</sup>, and thus extended scope of practice models including physiotherapists are likely to have greater impact for people with knee OA or chronic musculoskeletal disease with comorbid obesity.

Our findings highlight a number of considerations for future implementation and scale-up of physiotherapist-delivered weight management. First, consistent with previous research, <sup>24,25,41</sup> participants in our study believed that physiotherapists would require further specific training

in weight loss to be able to effectively deliver a dietary intervention outside the research environment. Our physiotherapists undertook approximately 20 hours of comprehensive training, involving e-learning modules as well as six practice consultations. Despite this, some participants believed that their physiotherapist still lacked sufficient knowledge and skills, and some believed more training would be required to be able to provide patients with specific nutritional advice. Pathways to enable onward referral to a dietitian for additional expert nutritional advice and support, if needed, may be beneficial for some participants and would be required in a wider implementation model. However, it is worth acknowledging that our physiotherapists were still relatively inexperienced with weight loss delivery – having only delivered the intervention to seven participants each. Second, if physiotherapist-delivered weight loss interventions are to be implemented beyond the research setting, the feasibility and costs of clinician training would need to be considered. Third, the VLED was selected for our RCT intervention on the basis it is a highly protocolized weight loss program, mitigating the need for extensive nutritional training and not designed to emulate an expert dietitian-delivered individualised weight loss intervention. Understanding whether patients would be willing to subsidise products themselves would be key for implementation. Finally, another consideration for future implementation and scale-up is the need for patient education. Given that our participants were initially sceptical about the effectiveness of a weight management program delivered by a physiotherapist, the development of effective marketing and patient education resources may be necessary to set expectations. This could include information outlining the pros (e.g., ‘one-stop-shop’ for exercise and diet) and cons (e.g., may not be suitable for people who prefer more specific/detailed nutritional advice) of a physiotherapist-delivered weight loss diet, as well as reassurance about its safety and effectiveness.

Several methodological factors should be considered when interpreting this study. Participants were recruited from a RCT, with strict inclusion/exclusion criteria, which they had volunteered for knowing that a physiotherapist would be delivering a weight loss intervention in a supported and credible research environment. Therefore, the findings may not be generalisable to usual clinical practice environments and may overestimate the acceptability of a physiotherapist-delivered weight loss program. It is also important to acknowledge that our participants received the entire intervention (including physiotherapist consultations and meal replacement products) for free. This may have influenced their perceptions about the acceptability of the intervention, and their levels of satisfaction. Physiotherapists who delivered care in the POWER RCT received training in the delivery of a highly protocolised diet (VLED), and therefore our findings may not be generalisable to alternative physiotherapy-delivered diet interventions supported by different training models. Fourteen participants did not respond to the invitation to an interview. As such, it is possible only those with more positive perceptions about the intervention volunteered for an interview, and therefore our findings may again overestimate the acceptability of physiotherapist-delivered weight loss. Ninety-five percent of the 22 participants who consented to participate in the qualitative component of this study achieved the desired 5% body weight loss at the end of the RCT, compared with 76% of the 38 participants in the Diet+Exercise group. While we have reported the quantitative data for all 38 Diet+Exercise participants here, our qualitative data may be biased towards those who successfully lost weight and/or had positive experiences with Diet+Exercise. With respect to credibility of the work, we developed a research team with a diverse and complementary range of professional backgrounds and expertise (physiotherapy, OA, dietetics, endocrinology, translational medicine). Another strength of this work is the use of both quantitative and qualitative methods, which deepens our understanding of people's perceptions about physiotherapist-delivered weight loss interventions.

## Conclusions

This study provides, to our knowledge, the first documented perspectives from people with OA who have received a physiotherapist-delivered weight loss intervention. Findings suggest physiotherapists may have a role in delivering a protocolised dietary intervention for some people with knee OA with overweight and obesity. This research adds to a significant contemporary conversation about the feasibility and acceptability of extended practice roles of healthcare practitioners in weight management.

### *Author contributions*

KLB, KA, RSH, PS, NEF, MH JQ, JP conceived the idea for the study. KA and KLB developed the interview guide, PC and RN conducted the interviews, and RN, BL and KA conducted the analyses. BJL and KA wrote the first draft of the manuscript and all authors had input into its development and finalisation.

### *Ethics approval*

This study was approved by the University of Melbourne Human Research Ethics Committee (HREC 1955042).



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Table 1. Diet intervention

Phase	Aim	Diet	Timing	Physiotherapy session principles & topics
<b>Phase 1: Intensive weight loss via ketogenic VLCD</b>	Weight loss of 5-10% body weight loss, replacing 2 meals per day with meal replacement products and a third low carbohydrate meal.	Ketogenic VLCD (800 kcal (3280 kJ) per day with a carbohydrate intake of $\leq$ 50-60 g per day including 2 x meal replacements, 1 x meal of high protein, low carbohydrate consisting of protein, non-starchy vegetables or salad, and a tablespoon of oil/fat (if gall bladder in situ) per day) OR Modified ketogenic VLCD if participant unwilling to undergo ketogenic diet (number and frequency of meal replacements negotiated with participant) OR Healthy eating plan (if participant unwilling to undergo Ketogenic or modified ketogenic VLCD)	Weeks 0-12 maximum (Physiotherapy sessions 1, 2, 3 +/-4)	<u>Session 1:</u> Introduction and collaborative development of a tailored management plan including weight loss goals and weight loss target and information about the ketogenic diet.  <u>Sessions 2-3:</u> Discuss progress and use motivational interviewing principles to help motivation, self-efficacy and to overcome barriers preventing participants completing their weight loss plan, progress and familiarize participants with their resource booklets. Specific weight loss topics and activities: <ul style="list-style-type: none"> <li>• Portion sizes</li> <li>• Carbohydrates and glycaemic index</li> <li>• Supermarket shopping guide</li> <li>• Healthy snacks</li> <li>• Choosing a support person</li> <li>• If-Then Planning</li> <li>• Identifying eating triggers</li> <li>• Overcoming barriers to losing weight and keeping it off</li> <li>• Hunger level scale</li> </ul>
<b>Phase 2a: Transition of ketogenic diet onto healthy eating plan</b>	Transition to 1 meal replacement per day and re-introduce low GI carbohydrates for one meal and maintain one low carbohydrate meal.	Transition to healthy eating plan including 1 x meal replacement, 1 x meal of high protein, low carbohydrate, 1 x meal of low GI carbohydrates +/- protein for two weeks.	Two-week period starting Week 13 OR when participant lost 10% body weight OR if participant was unwilling or wished to discontinue ketogenic diet *  (Physiotherapy session 4 or 5)	<u>Session 4:</u> To discuss progress and use motivational interviewing principles to help motivation, self-efficacy and to overcome barriers preventing participants for the transition phase, progress and familiarize participants with their resource booklets. Specific weight loss topics and activities: <ul style="list-style-type: none"> <li>• Transition and potential challenges and strategies</li> <li>• Healthy eating habits</li> <li>• Identifying eating habits</li> <li>• Changing thought patterns</li> <li>• Food diary</li> </ul>
<b>Phase 2b: Healthy eating plan for weight maintenance</b>	<b>AIM:</b> To adopt a healthy eating plan for weight maintenance.	Healthy eating plan of 3 meals per day including high protein, low glycaemic index carbohydrate, low fat foods consistent with the principles of the CSIRO total well-being diet	From end of transition to end of study at week 24 and beyond (Physiotherapy session 5 and/or 6)	<u>Session 5 &amp; 6:</u> To discuss progress, discharge goals and considerations and use motivational interviewing principles to help motivation, self-efficacy and to overcome barriers to healthy eating phase, progress and familiarize participants with their resource booklets. Specific weight loss topics and activities: <ul style="list-style-type: none"> <li>• Healthy eating progress</li> <li>• Managing food portions</li> <li>• Choosing low GI foods</li> <li>• Snacking</li> </ul>

- Food diary
- Problem solving for adherence
- Weight and food diaries
- Relapse management and problem solving
- Weight monitoring and considerations for returning to a ketogenic VLCD in future
- Major barriers
- Role of physical activity
- Other options for multidisciplinary input

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VLCD = very low calorie diet; GI = glycaemic index, CSIRO = Commonwealth Scientific and Industrial Research Organisation Total Well-being diet <sup>46</sup>.

\* Meal replacements were provided to participants free of charge for 14 weeks (12 weeks for the ketogenic diet and 2 for the transition). If a participant did not wish to transition off the ketogenic diet by 14 weeks or if they wanted to recommence the diet between weeks 14 and 24 they were required to purchase the meal replacement products at their own cost.

Table 2. Semi-structured interview guide

TFA Domain	Interview question
<b>Affective attitude</b>	<p>1. Can you tell me a bit about why you volunteered for the study?</p> <p><i>What were your initial thoughts/feelings when you read that a physiotherapist would be delivering the weight loss program?</i></p>
<b>Burden</b>	<p>2. Traditionally, a dietitian would deliver a weight loss program like this. What do you think were the advantages of receiving a weight loss program from a physiotherapist?</p> <p><i>Were there any advantages about the fact that it was combined with an exercise program?</i></p> <p>3. What were the disadvantages about receiving a weight loss program from a physiotherapist?</p> <p><i>What would have made these challenges easier?</i></p> <p><i>Were there any disadvantages about the fact that it was combined with an exercise program?</i></p>
<b>Self-efficacy</b>	<p>4. How did you feel about the weight loss knowledge and skills your physiotherapist had?</p> <p><i>What skills were they lacking? How could this be improved?</i></p> <p><i>How did this compare to how you felt about the physiotherapist's skills in exercise prescription?</i></p> <p>5. How did your experience in the trial compare to previous experiences you've had with weight loss?</p> <p><i>What was better? What was worse?</i></p> <p><i>Have you ever received weight loss advice from a dietitian? How did that compare to your experiences in this trial?</i></p>
<b>Perceived effectiveness</b>	<p>6. Can you describe what has changed for you as a result of being involved in the trial?</p> <p><i>Do you feel like you've been given the right knowledge/support to maintain your weight loss? Why/why not?</i></p>
<b>Feasibility, intervention adherence, and opportunity costs</b>	<p>7. Based on your experience in the trial, what do you think about physiotherapists delivering a weight loss program for people with overweight/obesity in the future?</p> <p><i>Is there anything you would change about the program, based on your experience?</i></p> <p><i>Would you recommend physiotherapist-delivered weight loss programs use the VLCD with patients? Why/why not?</i></p>
<b>Wrap up</b>	<p>8. Some argue that it's beyond physiotherapist's scope of practice to be providing weight loss support to patients. Based on your experience in this trial, what do you think about this?</p> <p><i>Why/why not?</i></p> <p>Thank you so very much for your time, is there anything else you would like to add or give as feedback from your experience?</p>

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TFA = Theoretical Framework of Acceptability

**Table 3. Quantitative data relating to perceptions about delivery of weight loss program and experiences with physiotherapist-delivered weight loss (n=42)**

Measure	Pre-intervention	Post-intervention
Confident GPs can deliver dietary weight loss program, n (%) <sup>*</sup>	19/42 (45%)	20/38 (53%)
Confident dietitians can deliver dietary weight loss program, n (%) <sup>*</sup>	39/42 (93%)	35/38 (92%)
Confident physiotherapists can deliver dietary weight loss program, n (%) <sup>*</sup>	21/42 (50%)	24/37 (65%)
Satisfied with treatment program, n (%) <sup>†</sup>	-	36/38 (95%)
My physiotherapist was knowledgeable about weight loss, n (%) <sup>§</sup>	-	30/38 (79%)
My physiotherapist had the skills to support me to lose weight, n (%) <sup>§</sup>	-	32/38 (84%)
I had confidence my physiotherapist could help me to lose weight, n (%) <sup>§</sup>	-	27/38 (71%)
I felt judged by my physiotherapist about my weight, n (%) <sup>§</sup>	-	1/38 (3%)
I felt comfortable discussing weight with my physiotherapist, n (%) <sup>§</sup>	-	28/38 (74%)
I felt that I could trust the dietary advice from my physiotherapist, n (%) <sup>§</sup>	-	31/38 (82%)
I would recommend others to see a physiotherapist for this dietary weight loss intervention, n (%) <sup>§</sup>	-	27/38 (71%)

<sup>†</sup> Scored on a 7-point Likert scale with response options from “extremely dissatisfied” to “extremely satisfied” with participants indicating they are moderately or extremely satisfied deemed to be “satisfied” with the program

<sup>\*</sup> Response to statement ‘I am confident that a [general practitioner/dietitian/physiotherapist] could deliver a dietary weight loss program measured on a 5-point Likert Scale for each health practitioner, with participants answering “agree” or “strongly agree” deemed to be “confident”.

<sup>§</sup> At 6 months, agreement with the statement assessed on a 5-point Likert Scale ranging from “strongly disagree”, to “strongly agree” with participants scoring “agree” or “strongly agree” deemed to be in agreement

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**Table 4. Participant demographic characteristics (n=22)**

Code	Gender	Age	BMI at baseline	% body weight lost	Change in knee pain*	Consults attended <sup>b</sup>	Strengthening exercise adherence <sup>u</sup>	Physical activity adherence <sup>u</sup>	Diet adherence <sup>u</sup>	Overall satisfaction with care <sup>v</sup>
#P1	F	56-60	26-30	-7.5%	-3	6	6	7	7	6
#P2	M	46-50	30-35	-22.2%	-3	6	10	9	9	7
#P3	F	50-55	40-45	-9.6%	-4	6	6	6	9	6
#P4	M	60-65	26-30	-14.6%	-6	6	6	6	10	7
#P6	M	50-55	30-35	-6.8%	-2	6	2	2	8	7
#P8	F	56-60	30-35	-11.5%	-5	6	9	9	9	7
#P9	F	60-65	30-35	-11.7%	-3	6	7	7	8	7
#P10	F	46-50	30-35	-1.1%	0	4	6	6	6	7
#P11	M	56-70	36-40	-2.2%	-3	6	9	8	8	7
#P14	F	60-65	36-40	-6.2%	-2	6	9	9	8	7
#P13	F	56-60	30-35	-12.7%	-4	6	7	7	7	7
#P15	F	60-65	36-40	-7.7%	+1	6	7	8	10	7
#P18	M	60-65	26-30	+1.1%	-2	6	7	10	8	6
#P17	F	60-65	36-40	-9.4%	0	4	8	8	8	6
#P16	F	66-70	30-35	-9.9%	-1	5	8	9	10	6
#P19	F	60-65	36-40	-14.6%	-2	4	10	10	10	7
#P20	M	56-60	30-35	-9.6%	+2	4	10	10	9	6
#P21	F	50-55	40-45	-11.0%	-4	4	7	7	9	7
#P22	F	66-70	40-45	-10.8%	-5	6	8	8	6	6
#P23	F	66-70	26-30	-8.1%	-5	3	7	7	10	4
#P24	M	50-55	26-30	-11.4%	-3	6	7	8	9	7
#P25	F	60-65	26-30	-16.0%	-3	5	10	9	10	6
<b>Mean (SD)</b>		<b>59 (6)</b>	<b>34.1 (4.8)</b>	<b>-9.1 (4.5)</b>	<b>-2.6 (2.0)</b>	<b>5.3 (1.0)</b>	<b>7.5 (1.9)</b>	<b>7.7 (1.8)</b>	<b>8.5 (1.3)</b>	<b>6.5 (0.7)</b>

\* Measured on 0-10 Numeric Rating Scale, where 0='no pain' and 10='worst pain imaginable'

<sup>b</sup> Out of maximum of 6<sup>u</sup> Measured on 0-10 Numeric Rating Scale, where 0='not at all' and 10='completely as instructed'<sup>v</sup> Rated on 7-point Likert ranging 1='extremely unsatisfied' to 7='extremely satisfied'

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**Table 5. Themes, sub-themes, and exemplary quotes****Theme 1: One-stop-shop of exercise and diet**

“I think one of the things was obviously having a bit of consistency talking to the one person. So that was one of the advantages I think – you know, it reduces, just from a practical standpoint, having two meetings in the one.” P10

“it was two birds with the one stone really. We have a general catch up, then he'd go through what exercises were going to be for that week or fortnight or month. And then we'd speak about the nutritional side of things...they just run parallel as far as I was concerned.” P18

“I just think tying the two together is a really good way of doing it, because you feel like you don't have two people telling you different things or working at it from different angles, you have one person who's very aware of what they're asking you to do food-wise and also what they're asking you to do exercise-wise. And if you have two different people, they're not always going to understand what the other person is trying to achieve with their part” P19

“I think it's whenever you talk about weight loss, the two things you talk about is diet and exercise. And I think it makes sense that a physio is trained up for that, otherwise you're only dealing with part of the problem. And to get all of it from one resource, I think makes a lot of sense and could be quite successful.” P2

**Theme 2: Physiotherapist-delivered weight loss works**

Unsure initially

“I wasn't really expecting that the physio – what I understand about physio is when you hurt, when you hurt your shoulder, hurt something, and then they will try to give you exercises to strengthen something again. That's the only thing I know about physiotherapy -so yeah, it was something different. I wasn't expecting anything that – yes, I was surprised.” P14

“At the start, I was a bit unsure. I'd probably seen a physio once in my life [and thought] they deal with your motion of the body and not diet as such. So yeah, my initial reaction was a little bit doubtful of how that was going to work, but through the program, it just seemed to make sense.” P2

“I remember thinking to myself that was a bit different... If you had have asked me before this, I would have been sceptical. I wouldn't have known to recommend it one way or another. But now that I've experienced it, I think, yes, it's been great. You don't have to go and see two separate physicians to achieve what one can do” P20

Successfully lost weight

“I was blown away - I was quite happy about it - I feel I've got an extra set of tools to help me keep my weight down.” P13

“Yeah, surprisingly, it works. So they can. I mean, physiotherapists can [deliver a weight loss program]” P14

“I thought it was really, really good. I have been to a dietitian in the past, but I didn't have any success there. But this time I felt I had success. I had success because I lost eight kilos. I mean, that to me is quite amazing.” P16

“I did not have any issue with the information I received, I was very happy, and I achieved the goal. So that goes to show that the physio was able to assist me, support me and give me the right advice.” P8

**Theme 3: Depth of physiotherapists knowledge and skills**

Exercise is forte

“I think that exercise prescription, you could see that that was the area of expertise ... he just kind of knew that stuff really automatically. The diet stuff, not quite as automatic.” P19

“I think his knowledge in exercise was definitely higher. I don't know how much study he's done in weight loss.” P21

“I could tell that my physio was very knowledgeable in the exercise field, and it showed - Whereas weight loss is a different matter, it's not something that even nutritionists I would think get passionate about. It's about learning – weight loss is about learning, whereas physio is about doing and understanding the processes



that you have to do. They're different ways of doing things and I think that showed somehow." P8

Most thought physiotherapists had the necessary weight loss skills/knowledge, but some disagreed

"I consider physios – they're really knowledgeable - she was certainly very, very knowledgeable... they have the practicality of the books behind them as well. Not only for the exercises, but all about ketosis and the recipe book. It was like a holistic programme that looked at you and I felt really held in someone's hand to make a success of what I was trying to do." P16

"[My physiotherapist] was very good, but I feel like he'd actually really done his research. He wasn't just reading from what you guys had given them. They'd actually done a little bit more – he'd actually gone in wanting to make a difference." P3

"he was good. You know, he understood the importance of the diet and remaining in the right zone in terms of ketosis and everything. So you know, he was good in that sense, his education level and understanding was really strong." P6

"[physiotherapist name] was very knowledgeable. She was quite helpful with foods... She was really good and would explain something when I asked her a question. And she would also make suggestions that I could look at doing or fitting in, doing my exercises and then steps and things like that. She was very knowledgeable in what she was giving me instructions for all information on." P9

"it was referring you to – like, get your green book out, get your blue book out, that not the strength of knowledge in food and nutrition... I don't think the person I had knew enough about food and nutrition - the way that he talked about food was almost just reading from the book. That if it was to work, they would have to understand probably a bit more about eating triggers" P1

"she was probably more natural as a physio and a slightly more – perhaps seemed to be a bit more reading a script on the dietary stuff." P15

"I did wonder how well trained a physio is in nutrition and weight loss to give the program – I just wondered. It wasn't that I thought they weren't – I wondered how well they were trained. I wondered if it was their primary focus.: P8

#### Theme 4: Physiotherapists have a role in weight loss

Physiotherapists are intelligent, credible, and trustworthy

"I mean I naturally assumed that the physio would have some experience in – I don't know if qualifications is the right word, but that they are qualified to talk to diet – so I didn't really think that there was – when they go, that they know what they're talking about; that wasn't really an issue for me." P10

"I believe that a physiotherapist is the right person to do it. I actually had that in my mind anyway. This is the person dealing with you on a one-to-one level. Why isn't that person – Why would we think that person, just because maybe they don't have a dietetics degree or whatever? Why aren't we using these people more? But that's how I felt." P16

"It was just the whole weight loss thing, whether a physio was doing it. I figured they'd probably know what they were doing, because they're qualified people." P4

"because physiotherapists are intelligent people and they've got just as much knowledge as a dietitian has. Or they can gain that knowledge by just learning it, reading and being aware...I think it would work very well." P23

Specific training in weight loss is necessary

"if the physiotherapist has the same amount of training as the guy I was dealing with, yeah, absolutely. I wouldn't hesitate. But as we all know, most physiotherapists are there to do more work on your body, muscle and bone manipulation. Dieting isn't one of their fortes unless you're lucky enough to catch up with someone like I have, like I use." P11

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"I would say the training there would need to be a little bit more knowledge and

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understanding of how that program may detrimentally affect people. The other thing too is about this significant weight loss; I have a feeling that it also accelerated my hair loss as well. So there's things that – although we ticked a document that you couldn't be on it if you had kidney issues and stuff like that. Sometimes people are not really sure what they may or may not have. So we'd have to be really careful that – maybe before they conduct this program, that people would actually have and present a blood test of certain markers.” P13

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