

BMJ Open Acceptability and perceptions of a 12-week telehealth exercise programme with dietary advice to increase plant-based protein in people with non-alcoholic fatty liver disease: a programme evaluation using mixed methods

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ABSTRACT

Objectives Telehealth may offer a cost-effective, accessible and convenient healthcare service model; however, the acceptability, safety and perceptions of telehealth delivered lifestyle interventions in those with non-alcoholic fatty liver disease (NAFLD) is unknown. **Design** This was a mixed-methods evaluation of a telehealth delivered 12-week exercise, dietary support and behavioural change programme (Tele-ProEx). **Setting and participants** 12 adults receiving the intervention (47–77 years) with NAFLD living in Australia. **Outcome measures** Participants were assessed postintervention via questionnaires to evaluate acceptability and satisfaction with the programme, usability (exercise app) and perceptions of safety. Semistructured interviews were also conducted, and qualitative thematic analysis was used to identify themes.

Results Participants reported moderate to high acceptability (overall mean±SD scores out of 5: exercise programme 3.9±0.5; dietary support to increase plant protein intake 4.0±0.7; behavioural modification 3.6±0.4). Satisfaction was high (overall mean score 3.7±0.3 out of 4), the programme was perceived as safe (overall mean score, 4.4±0.5 out of 5) and app usability was above average (mean score 75.6±5.2 out of 100). Thematic analysis revealed participants perceived telehealth as being comparable to face-to-face interactions with health professionals. Common exercise barriers were alleviated by the personalised programme, while participants with low previous exposure to plant protein foods found the dietary recommendations challenging. Social support and engagement were deemed important for supporting motivation and adherence.

Conclusions In adults with NAFLD, a telehealth delivered multifaceted lifestyle programme was well accepted and perceived as safe, indicating telehealth offers a viable delivery model in this population. Key features important to participants were the personalised and flexible approach

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study included a high-risk cohort of middle-aged and older adults with non-alcoholic fatty liver disease and comorbidities who are likely to benefit most from such a remotely delivered and monitored programme.
- ⇒ The study includes both quantitative and qualitative methods to assess participants' experiences with the multifaceted telehealth-based lifestyle programme.
- ⇒ The small sample size and predominantly female cohort limit the generalisability of the findings.
- ⇒ A semistructured and flexible interview approach facilitated participants' perceptions of the programme to be explored.
- ⇒ Assessing participants for readiness to change would have provided further context to the findings.

utilising engaging delivery methods that featured social support.

Trial registration number ACTRN12621001706864.

INTRODUCTION

Behavioural modification incorporating dietary improvement and increased physical activity are cornerstones to treatment recommendations for those with non-alcoholic fatty liver disease (NAFLD).¹ However, motivation and self-efficacy for adopting such lifestyle changes in those with NAFLD are low,^{2 3} with only 20% meeting current physical activity guidelines,⁴ and retention and long-term adherence to lifestyle (diet and exercise) interventions reported to be challenging.⁵ Emerging evidence indicates that telehealth

may represent a cost-effective, convenient and alternative behaviour change delivery model to increase access to evidence-based lifestyle interventions that support behavioural change in those with chronic diseases.^{6 7} Importantly, telehealth can overcome common barriers experienced by face-to-face community and clinical lifestyle programmes including reducing wait times, travel^{8 9} and facilitating timely and regular patient–practitioner communication and follow-ups.⁷ This is important as there is evidence that more routine monitoring of patients with chronic disease can facilitate improved long-term behavioural changes.¹⁰ However, there is considerable heterogeneity in the adherence (21%–84%) to lifestyle interventions delivered via telehealth in older adults with chronic disease,^{11–13} including those with NAFLD.¹⁴ Previous qualitative research exploring experiences and perceptions of exercise and dietary interventions delivered via telehealth in those with chronic diseases found that participants perceived telehealth as being convenient and time-saving, while lack of face-to-face connection, maintaining engagement and technology were recognised challenges.^{15–17} However, there is limited research investigating the acceptability and perceptions of lifestyle interventions delivered via telehealth in those with NAFLD.^{18 19}

We completed a 12-week randomised controlled feasibility trial assessing the feasibility (adherence, retention) of an exercise and dietary programme incorporating a personalised, home-based, muscle strengthening exercise programme with healthy eating recommendations emphasising higher protein intake from predominately plant-based sources delivered and monitored by health professionals via telehealth (Tele-ProEx) to adults (>45 years) with NAFLD.²⁰ Our results demonstrated that the Tele-ProEx programme was safe (only one exercise-related adverse event) and retention was high (89%), while overall adherence defined as $\geq 66\%$ for the exercise programme and $\geq 80\%$ to the plant protein recommendations was modest at 52% and 32%, respectively.²⁰ However, there was evidence of greater weight loss and improvement in physical function (sit to stand performance) for those in the Tele-ProEx group compared with controls.²⁰ Building on these findings in middle-aged and older Australian adults with NAFLD, the aim of this mixed-methods study was to evaluate the acceptability, usability, satisfaction and participants' perceptions, barriers and facilitators to the Tele-ProEx exercise and dietary programme delivered remotely via telehealth.

METHODS

Study design

This mixed-methods study was nested within a 12-week community-based, two-arm, randomised controlled feasibility study in which adults with NAFLD aged >45 years were randomised to receive either the exercise and protein (Tele-ProEx) intervention delivered via telehealth or usual care (controls). All participants

allocated to the intervention group who completed the study completed online questionnaires post intervention (12 weeks) to collect information on acceptability, perceptions of safety and overall satisfaction with the intervention. Additionally, participants were invited to take part in small group semistructured interviews (via Zoom) to collect qualitative information on their experiences, perceptions and explore facilitators and barriers to the telehealth exercise, dietary and behavioural support programme. All assessments were conducted remotely with the participants at their own home. The study was conducted between September 2022 and February 2023. The trial was registered with the Australian and New Zealand Clinical Trial Registry <https://www.anzctr.org.au> (ACTRN12621001706864). Prior to participation, all participants provided informed written consent (electronically).

Participants

As previously reported,²⁰ 28 middle-aged and older adults aged 47–77 years with NAFLD were randomised to the Tele-ProEx (n=14) or control group (n=14), from which 12 participants from the intervention group (86%) who completed the trial agreed to take part in interviews at the conclusion of the study. Full details of the participant inclusion and exclusion criteria have been previously described.²⁰ Briefly, participants with NAFLD (confirmed by ultrasound or biopsy and/or elevated serum alanine aminotransferase level (>20 U/L female, >30 U/L male)) with no other liver disease, consuming ≤ 1 (females) and ≤ 2 (males) alcoholic drinks per day were included. Participants were excluded if performing >1 session of resistance training per week and/or 150 min moderate physical activity per week or with absolute contraindications to exercise²¹ or had experienced weight loss/gain >5 kg in the previous 3 months. Those following a vegetarian or vegan diet and/or consuming >2 protein-rich supplements per week were also excluded. Participants were also required to have a mobile phone, tablet or computer with text message functionality.

Intervention

Details of the Tele-ProEx exercise and dietary intervention have been previously published and described in detail.²⁰ In brief, participants were prescribed (via Zoom consultation, week one) a 12-week individualised, home-based muscle strengthening exercise programme administered by a qualified accredited exercise physiologist (EP) using the web-based exercise prescription platform and app TeleHab (VALD Health, Brisbane, Australia). The programme consisted of three sessions per week (~25 min duration) consisting of 6–8 exercises (major muscle groups) with two sets of 10–12 repetitions per exercise at a moderate intensity (5 'hard' to 8 'very hard' RPE scale), with a new programme prescribed in week six. Participants were also instructed to complete 2 weekly aerobic training sessions (eg, brisk walking) per week (≥ 60 min in total). Additionally, participants attended two

small group (~2–3 participants) video consultations with the EP (weeks 2 and 6) to monitor progress and enhance motivation and for the participants to ask any questions. Regarding the dietary intervention, a healthy eating plan was devised by a nutritionist and focused on increasing dietary protein intake to 1.2–1.5 g/kg/day from predominantly plant-based sources (legumes, tofu and tempeh, nuts and seeds) with protein serving recommendations determined based on age and sex.^{22 23} The healthy eating plan was centred on a modified heart-healthy Mediterranean style dietary pattern.²⁴ Specifically, participant recommendations were to consume at least three serves per day of protein from all sources: 2 serves per day from plant protein such as nuts and seeds and/or tofu/legumes and/or beans and 7–10 ½ serves per week (range to accommodate individual daily total protein requirements: 3 ½ serves for males aged ≥51 years and females 45–50 years, 3 serves for females aged ≥51 years) from animal sources, including seafood (≥2 serves), poultry (≤2 serves), eggs (2–4 serves), red meat (<2 serves) and limiting processed meat (≤1 serve). Participants were educated about the dietary programme in week one via a video consultation with the study nutritionist and received additional resources via email (serving sizes, plant-based recipes, sample meal plans). Participants attended additional small group (~2–3 participants) video consultations in weeks 2 and 6 to provide feedback on protein checklists and receive further information and tips on increasing plant protein intake. Online protein checklists were completed in weeks 2, 6, 9 and 12 and used to monitor adherence to the protein recommendations. Macronutrient intake was assessed via three 24-hour recalls using the Research Food Diary app and analysed using Foodworks Version 10 (Xyris, Australia) nutrient analysis software. To further support behavioural change, participants received 3–4 text messages each week providing health-based tips for increasing plant protein and physical activity and motivational support to adhere to the programme.

Data collection

Acceptability

At completion of the intervention, participants were asked to rate their acceptability of different aspects of the (1) exercise and (2) dietary programme and (3) behavioural modification content (text messages) via three separate six-item questionnaires recorded on a 5-point Likert scale (1 (strongly disagree), 2 (disagree), 3 (neither disagree nor agree), 4 (agree) or 5 (strongly agree)), with the mean score of the six questions calculated for each questionnaire. A mean score of ≥3 and ≥4 was considered moderate and high acceptability, respectively.

Satisfaction

Participants' satisfaction with several components of the intervention (eg, interactions with research staff, privacy and information received) was assessed via a six-item questionnaire recorded on a 4-point Likert scale

(1 (poor), 2 (fair), 3 (good) or 4 (excellent)), with the mean score for the six questions calculated. A mean score of ≥2 and ≥3 was considered moderate and high satisfaction, respectively.

Perceptions of safety

Participants' perceptions of safety with the home-based exercise programme were recorded on a 5-point Likert scale (1 (strongly disagree), 2 (disagree), 3 (neither disagree nor agree), 4 (agree) or 5 (strongly agree)), with the mean score for the five questions calculated. A mean score of ≥3 and ≥4 was considered a moderate and high perception of safety, respectively.

Usability

Perceived usability of the TeleHab exercise app was assessed using the System Usability Scale (SUS) at study completion.²⁵ This 10-item questionnaire included questions related to ease of use, technical confidence, complexity and required knowledge of participants. Responses were rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), and a total SUS score was calculated by first normalising scores for each question (positive oriented questions are subtracted by 1 and negative oriented questions are subtracted from 5) before adding the individual scores and multiplying by 2.5, which results in a score ranging between 0 (worst) and 100 (absolute best). A total score of >68 is considered above average and >80 as high usability.²⁵

Semistructured interviews

At completion of the 12-week intervention, 12 participants completed semistructured interviews with the study investigator (CF, female), a PhD candidate with a master's degree (Human Nutrition). The interviews investigated participants' perceptions and experiences with the three core intervention components (muscle strengthening programme, dietary programme and behavioural support material). A set list of interview questions developed by the research team (online supplemental table 1) was designed to elicit responses from participants about barriers and facilitators to adherence, perceptions of telehealth as a delivery model, behavioural change and changes in motivation. Where necessary, based on the participant responses, prompts were used to clarify or obtain additional information. All interviews were conducted remotely via video conferencing (Zoom) at the participants' home and were performed within 1 week of participants completing the intervention. Each interview lasted approximately 20 min and was audio recorded with the participants' permission, deidentified and transcribed verbatim using the online app, Otter.ai (Mountain View, USA), with all data stored in a password-protected master datafile.

Data analysis

Descriptive characteristics were calculated using STATA SE software V.17.0 and data reported as mean (SD) or counts and proportions. Responses from the

semiquantitative questionnaires were scored on a 5-point Likert scale (1=strongly disagree, 5=strongly agree) or 4-point Likert scale (1=poor, 4=excellent) and presented as mean (SD) and/or median (IQR). All transcribed interviews were coded by study investigator (CLF) using NVivo (V.14, QSR International, Doncaster, Victoria, Australia), adopting a reflexive thematic analysis framework as outlined by Braun and Clarke: (1) become familiarised with the data, (2) generate codes, (3) construct themes, (4) review themes, (5) define and name themes and (6) finalise the report.^{26 27} First, CLF reviewed all transcripts to become immersed in the data before conducting line-by-line coding of each transcript, with codes being developed and modified throughout the coding process. Potential themes were then identified to describe patterns in the data, with each stage carried out until no new themes were identified. A second researcher (coauthor TP and accredited practising dietitian), who had no direct involvement in the delivery of the trial, also read the transcripts, cross-checked all codes and any discrepancies and/or differences were discussed until consensus was obtained. A third researcher (coauthor ESG, an advanced accredited practising dietitian with qualitative research experience) then discussed and refined the themes with CLF before all authors discussed thematic categories and a final consensus was agreed on.

RESULTS

Participant's characteristics

Participants for this mixed-methods study were 12 older adults with NAFLD, aged (mean±SD) 63.8±7.4 years, 83% were female and 41.7% (n=5) were overweight and 50% (n=6) were obese. The mean±SD habitual moderate-vigorous physical activity at baseline was 58±110 min per week and 42% (n=5) of participants reported the presence of at least one chronic disease in addition to NAFLD.

Acceptability

The overall mean±SD level of acceptability (average of 6 questions, scored out of 5) was 3.9±0.5 for the home-based muscle strengthening exercise programme, 4.0±0.7 for the plant-protein-based dietary intervention and 3.6±0.4 for the behavioural modification programme (text messages). For the individual questions regarding the muscle strengthening programme, participants agreed the prescribed exercises were easy to follow (mean±SD; 4.1±0.5), suited to their capabilities (3.9±1.0), the weekly time commitment was acceptable and reasonable (3.9±0.7) and the group online consultations were informative and helpful (3.9±0.5) (figure 1A). For the plant-protein-based nutrition intervention, participants reported they felt they spent adequate time with the nutritionist (4.3±0.6), the instructions outlining the higher protein intake/changes were clear (4.3±0.5), the time spent completing the nutrition programme was acceptable and reasonable (4.2±0.8) and the group online consultations were informative and helpful (4.1±0.7).

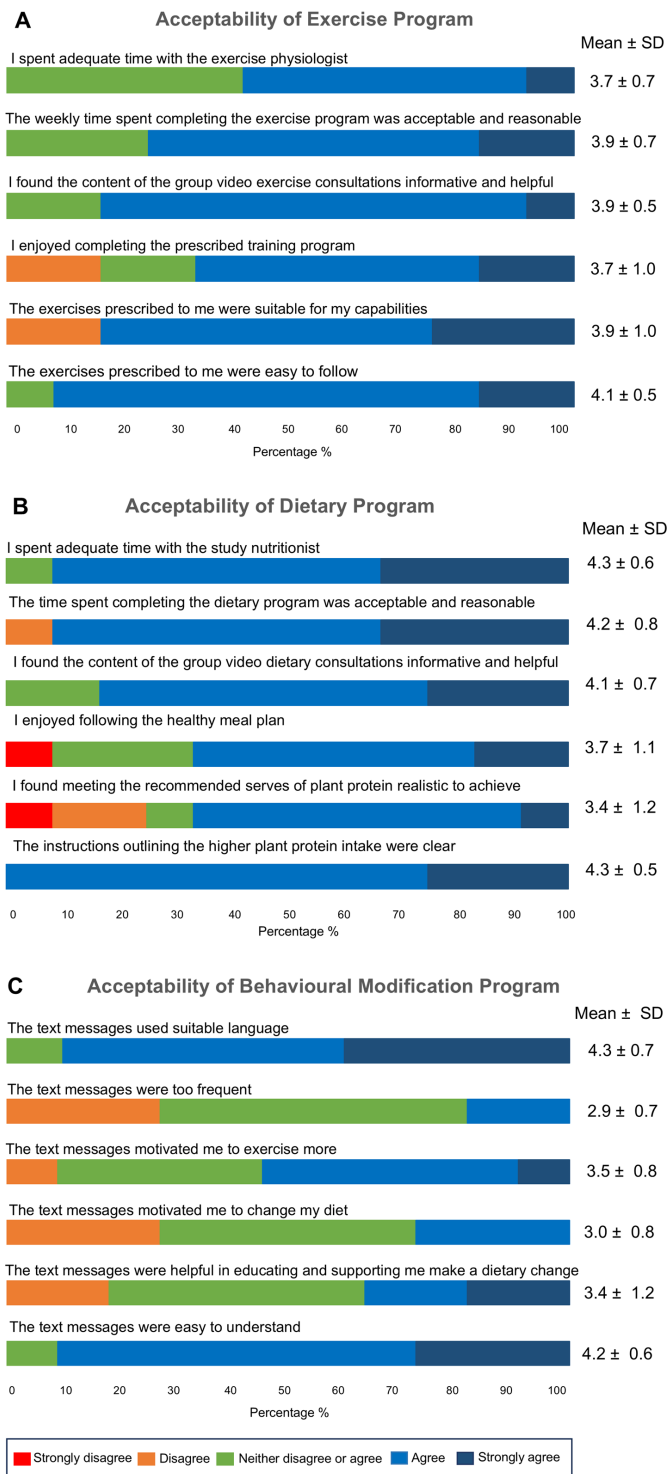


Figure 1 Percentage of participants who reported a score of 1 (strongly disagree), 2 (disagree), 3 (neither disagree nor agree), 4 (agree) or 5 (strongly agree) on the 5-point Likert scale and the mean and SD for the six individual questions related to the acceptability with the exercise programme (A), nutrition intervention (B) and behavioural modification (C) programme.

Approximately one-quarter (24.6%) of participants indicated that meeting the recommended servings of protein was not realistic (figure 1B). Regarding behavioural modification text messages, participants indicated that

Table 1 Mean±SD scores to the 10 individual questions of the System Usability Scale and the overall score

Questions	Mean±SD
I think I would like to use the app frequently	3.9±1.0
I found the app to be unnecessarily complex	2.3±1.1
I thought the app was easy to use	4.2±0.6
I think that I would need the help of a technical person to use this app	1.8±0.8
I found that the various functions in the app were well integrated	3.8±0.7
I thought there was too much inconsistency in the app	2.0±1.0
I imagine that most people would learn to use the app very quickly	4.0±0.6
I found the app very cumbersome to use	2.3±1.1
I felt very confident using the app	4.1±0.8
I needed to learn a lot of things before I could get going with the app	1.8±0.8
Total score (out of 100)	75.6±5.2

Responses were scored on a 5-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (neither disagree nor agree), 4 (agree) or 5 (strongly agree).

they were easy to understand (4.2±0.6), the language used was suitable (4.3±0.7) and the messages were not too frequent. Lower motivation was reported by participants to change their diet (3.0±0.8) (figure 1C).

System Usability

The overall mean±SD usability of the TeleHab exercise app was 75.6±5.2, which is classified as above average (score>68) (table 1). For the 10 individual questions, participants in the Tele-ProEx group tended to agree that the app was easy to use, they felt confident using it and that most people would learn to use the app quickly. Participants also disagreed that they needed to learn a lot of new things before they could get going with the app and that they would need the help of a technical person to use it.

Satisfaction

The overall mean±SD level of participant satisfaction (average of 6 questions) was high (mean score 3.7±0.3 out of 4). Regarding the individual questions, participants rated their level of satisfaction as good or excellent (mean score 3.7–3.9 out of 4) for their overall experience with the Tele-ProEx intervention, the courtesy, respect, sensitivity and friendliness of research staff and their ability to answer questions, the respect for privacy and the quality of information received via the telehealth video sessions (figure 2). The quality of information received via email (which included information sheets on using the Research Food Diary, tips on using Zoom and exercise training tips and definitions) had the lowest mean level of satisfaction (3.4±0.5).

Perceptions of safety

The overall mean±SD score (average of 5 questions) for participants' perceptions of safety with the home-based exercise programme delivered via the TeleHab app was high (4.4±0.5 out of 5), with all participants agreeing or strongly agreeing (mean scores 4.4–4.5 out of 5) that they

felt safe completing the exercises at home and were given adequate instructions (figure 3). Most participants (83%, 10/12) also agreed/strongly agreed that the EP updated their exercise programme when necessary, the prescribed exercises were appropriate for their physical capacities, and they felt confident that they were completing the exercises correctly (mean scores 4.3–4.4 out of 5).

Thematic analysis of semistructured interviews

Five main themes emerged from the thematic analysis.

Theme 1: telehealth as model of service delivery

Participants conveyed that the online telehealth sessions they attended throughout the intervention (EP and nutritionist) were comparable to face-to-face appointments with health professionals and expressed that both their

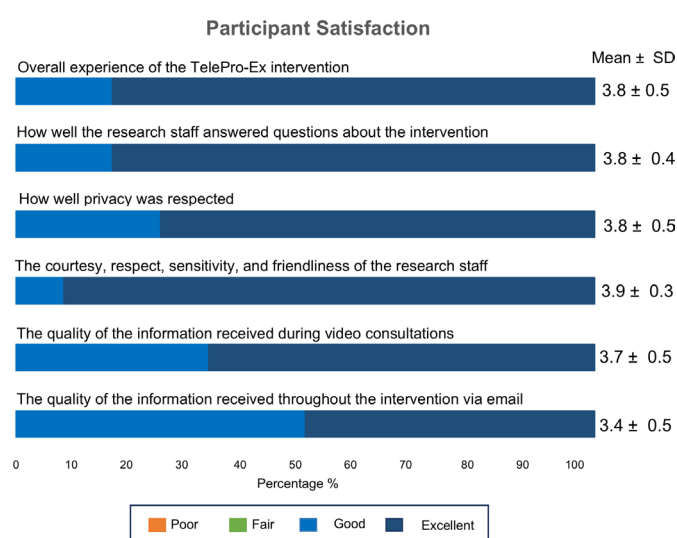


Figure 2 Percentage of participants who reported a score of 1 (poor), 2 (fair), 3 (good) or 4 (excellent) on the 4-point Likert scale and the mean and SD for the six individual questions related to the overall satisfaction with the Tele-ProEx programme.

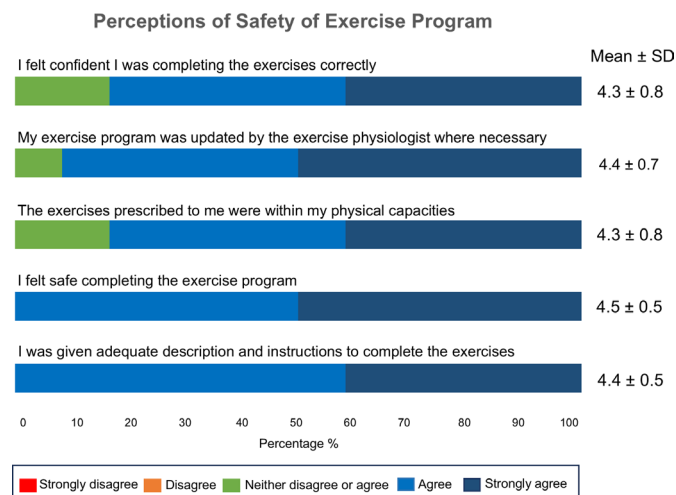


Figure 3 Percentage of participants who reported a score of 1 (strongly disagree), 2 (disagree), 3 (neither disagree nor agree), 4 (agree) or 5 (strongly agree) on the 5-point Likert scale and mean and SD for the six individual questions related to the perceptions of safety of the prescribed muscle strengthening programme.

experience and the quality of information provided in these sessions were equal, if not better, and therefore represented good value.

I don't think I could have got better input paying for somebody and seeing them in person so was really excellent, good value (Participant 2, Female).

Common barriers experienced with traditional face-to-face appointments with health professionals, including travel and time, were alleviated by telehealth as a delivery service model.

Oh, easy because it's in your home. You don't have to drive there I could sit in my pyjamas if I wanted to. I didn't have to get dressed up or anything like that. So quite convenient again (Participant 7, Female).

Participants commented that instructions and videos of the prescribed exercises embedded within the exercise app were helpful, enabling them to gain confidence in performing the exercises correctly and promoting safety at home. However, there were mixed responses regarding the apps' overall ease of use and flexibility.

I found the app itself to not be flexible enough. I think that once it started, it went through the series sort of in an order and you couldn't sort of stop it. Like to go back or start again. So, I thought if there was a bit more flexibility in the app, that would have suited me better (Participant 9, Female).

Theme 2: consuming plant protein

There were mixed responses from participants in terms of their acceptability to consuming plant proteins, especially tofu. This was influenced by participants' habitual intake, whereby those who already included plant protein

in their diet found the recommendations more achievable. For example,

I guess you know the lentils and those things were easy but the tofu I never really got used to it (Participant 8, Female).

However, in general, participants did report increased awareness about the benefits of increasing plant protein and overall diet quality.

I acknowledge that I have to have more legumes and, and more plant-based foods and it makes me feel better and I am fuller for longer, and that was something I was missing (Participant 7, Female).

Participants also perceived the dietary resources (eg, meal plans, plant-based recipes) they received at the start of the intervention as being helpful in implementing dietary change.

I think having a list of recipes to start off with was really helpful for me. It gave me something I could just go through without even having to think hard about it, and the minestrone soup, I have used that a lot (Participant 3, Female).

Theme 3: flexible exercise programme

Personalisation of the exercise prescription combined with remote delivery of the programme was perceived by participants to facilitate flexibility, which aided in making the exercise programme accessible and achievable for most participants to integrate into daily living.

And therefore, it fitted in with my routine really, really easily because I get up really early in the morning, so I've gone all right, well, that's the first thing that I'll do online every second day. So, I just found the exercise program was great (Participant 1, Female).

Participants also reported the individualised programme prescribed by an EP overcame recognised barriers to exercising such as lacking confidence due to low habitual physical activity levels and/or presence of comorbidities, physical limitations and/or past injuries.

I think the other thing that I really thought was good was the exercise program in terms of the way it was tailored to your particular needs. Because given that, I guess we've all got varying levels of fitness that felt that you sort of had something that was actually quite achievable (Participant 5, Female).

I can now see the benefit of consulting an exercise physiologist in terms of having a program that's more tailored to my particular deficits, is what I need to do (Participant 2, Female).

However, some participants still found motivation challenging and/or other commitments prevented them from adhering to the exercise programme.

The whole thing about me not doing the exercise program, doing what I should be doing is me and my mental thing. It's just that motivation (Participant 8, Female).

Theme 4: social support

Support through online social interaction with both peers and health professionals was identified as being important for participants and fostered a sense of connection.

Listening to other people on how they felt about certain things. And that helped to allay some of the fears in my head. No, I found that very good, very useful (Participant 6, Male).

In fact, some participants perceived sharing lived experiences with peers during the online sessions was just as important, or more important than the support from health professionals, and they sought further connection, for example, through a private study Facebook group.

I think it would be helpful to have a private Facebook group for the people that are involved because I think that sort of thing can be really encouraging to have chats with some of the other participants (Participant 5, Female).

Personal communication with research staff (EP and nutritionist) was also highlighted as being an important component of the intervention conducted via telehealth.

What I did like was, I guess the support, so you know, having you message or call or having our group chats. I think I like that (Participant 10, Female).

Theme 5: maintaining motivation

Motivation to adhere to the programme was impacted by external factors including the implementation of study-related accountability measures for adherence (exercise reminders, text messages, food diaries and staff check-ins).

And having the accountability around the exercise making me do it was obviously what I needed (Participant 11, Female).

Internal factors such as participants gaining a sense of achievement through perceived benefits of the intervention, both physical health and social (quality of life) benefits were also acknowledged as being motivating.

I think it will certainly make me much more likely to follow the guidelines. Knowing that with my last set of blood tests my liver function test, for the first time in about 20 years, completely normal, within normal range (Participant 3, Female).

I've gotta say, my motivation has changed heaps, I have become more mobile. I move a lot more and more confident in a lot of things like I would never get down on the ground and play with my grandson.

Whereas now I'm happy to jump on the ground (Participant 1, Female).

However, not all participants found the text message (behavioural change) component of the programme valuable.

I didn't find them particularly helpful. Because if I couldn't do something, I couldn't do it. You know, it wasn't that a text message would have prompted me, you know, it was other things that got in the way. So, I didn't find the text messages particularly helpful (Participant 9, Female).

DISCUSSION

The main finding from this mixed-methods study nested within a 12-week randomised controlled feasibility trial in middle-aged and older Australian adults with NAFLD was that participants reported high levels of acceptability, overall satisfaction, safety and usability to the multifaceted, exercise and higher plant protein dietary and behavioural change programme that was remotely delivered and monitored via telehealth. Thematic analysis from the semistructured interviews also revealed that participants perceived telehealth as a viable delivery model, which they perceived was comparable to face-to-face interactions with health professionals. In addition, some common barriers to exercise were alleviated by the individualised and flexible home-based exercise programme monitored remotely by EPs. Social support and a high level of engagement were also acknowledged as being important factors for motivating adherence to the intervention. In terms of the dietary approach, participants with a low previous exposure to plant protein sources found increasing intake challenging, but they did report increased awareness about the benefits of increasing plant protein to improve overall diet quality.

An important outcome from this study was that while overall adherence to the exercise (mean 52%) and dietary (plant and animal, mean 14%) components of the intervention did not meet desired targets,²⁰ participants with NAFLD reported a high level of acceptability and were satisfied with telehealth as a delivery service model to receive a home-based, muscle strengthening and dietary support lifestyle programme. In agreement with these findings, high levels of acceptability and satisfaction with lifestyle interventions incorporating exercise and/or diet delivered via telehealth have been reported in previous studies of adults with NAFLD and other chronic diseases such as obesity and chronic kidney disease.^{15 19 28} For instance, liver transplant participants undergoing a 12-week telehealth delivered lifestyle programme that focused on a Mediterranean eating pattern and home exercise training viewed telehealth sessions as being comparable to face-to-face appointments, but with less pressure and anxiety.¹⁹ Participants in the present study were also positive about the convenience and time saved

with the telehealth model, supporting better integration into daily living at a time and day most convenient to them. Previous qualitative studies and thematic analysis in those with chronic disease have shown that work demands and busy lifestyles are barriers to ongoing chronic disease management, with telehealth alleviating travel burden and providing increased flexibility.^{15–29} Collectively, our study and existing research highlight that telehealth is well accepted by older adults with chronic conditions and can, therefore, be offered as a viable tool for the implementation and monitoring of multidisciplinary lifestyle programmes for chronic disease management.

Current clinical guidelines recommend regular exercise for those with NAFLD,¹ yet it has been estimated that only one in five meet physical activity guidelines.⁴ Approaches to increase the uptake and adherence to regular exercise in those with NAFLD are therefore needed. In our study, participants identified the individually tailored home muscle strengthening programme and personalised feedback provided by the study EP delivered via an online exercise app supported adherence by overcoming barriers to exercise (eg, lacking confidence due to low habitual physical activity levels, physical limitations and previous injuries). For instance, 83% of participants perceived the prescribed exercises were within their physical capacities, and all participants reported they felt safe when completing the exercise programme. The participants in our study represented a high-risk cohort, with 42% reporting other comorbidities and 92% living with overweight or obesity, with previous research finding those with NAFLD often have perceived limitations (eg, comorbidities, injuries, fatigue) to exercise which may impact uptake and adherence.^{30–31} Other studies in older adults with chronic disease (including NAFLD) that prescribed an exercise intervention which was delivered remotely have reported that individualised exercise prescription incorporating personalised feedback promoted adherence by facilitating participant confidence and increased feelings of safety.^{19–32} Adopting a tailored approach is, therefore, important to increase uptake and adherence by making exercise attainable by promoting confidence and safety, especially in those with chronic conditions.

An important theme that emerged from our study was that at least one quarter of participants found meeting the weekly recommended plant protein servings challenging, despite overall acceptability to the dietary programme being high. As previously reported,²⁰ overall adherence to the plant protein recommendations was also relatively modest (mean 32%). This finding is likely explained by the relatively strict (and high) protein target levels set for this study (80% or higher adherence) and past exposure to different plant proteins being low and therefore a high level of behavioural change being required. For example, we found that the participants' mean habitual (baseline) intakes of plant compared with animal protein were low (0.9 vs 1.5 serves/day), with only 2 participants reporting consuming tofu and 67% of participants having legume intakes ≤ 1 serve/week. This finding is in

alignment with previous research in Western countries where consumption of plant foods falls below recommended levels, with animal protein intakes far exceeding plant protein (approximately 2:1 ratio).³³ Data from the 2011–2012 Australian Health Survey further reported that Australian adults' intake of protein-rich foods from legumes was only 4.8% compared with 63% from red meat and poultry.³⁴ Our thematic analysis revealed that some participants held unfavourable perceptions of some of the plant proteins, especially tofu, with prior research identifying those with habitual high meat intakes may have negative associations towards meat alternatives, be less willing to change eating habits^{35–36} and lack knowledge and confidence on how to prepare different plant-based proteins.^{37–38} Therefore, it can be hypothesised that in those with low previous exposure to plant proteins, a longer time frame and a more individualised approach with additional and ongoing support may be required.

Maintaining motivation and adherence to any lifestyle interventions, including those delivered via telehealth, is an ongoing challenge, and thus it is important to try and identify viable and effective strategies to address such issues.³⁹ We observed that participants in our study were more receptive to support and educational material that contained a level of personal engagement and social interaction (eg, individual or group video sessions) and were less responsive to passive tools such as reminders and non-personalised text messages. In part support of this finding, prior research assessing behaviour change interventions delivered via text messages has reported that untailored text messages are less engaging and less effective than tailored messages.⁴⁰ Several participants also expressed the desire for further opportunities for peer support such as a private Facebook page that would allow them to interact with others involved in the programme. Previous studies in those with chronic diseases have identified the importance of social support and engagement in creating motivation for behavioural change in lifestyle programmes delivered via telehealth.^{32–41} Furthermore, a systematic review of nine internet-based interventions (diet and/or physical activity) conducted in adults with type 2 diabetes revealed studies that achieved successful outcomes included components that were interactive, provided personalised feedback from health professionals and facilitated peer support (eg, live chat, message board).⁴² Using engaging delivery methods and creating opportunities for social support are therefore important considerations to enhance motivation when designing lifestyle-based telehealth interventions.

A notable strength of our study is the use of both quantitative and qualitative methods to assess NAFLD participants' perceptions and experiences of our lifestyle intervention delivered via telehealth, with high agreement between methods. However, there are several limitations. First, the cohort characteristics, being predominantly female and small sample size, restrict the generalisability of findings. Second, we were unable to assess changes in hepatic outcomes. Third, we did not screen

for each participant's readiness to change, which may have provided further context to our findings. Fourth, a greater intervention duration is likely required to establish longer-term habitual dietary changes, especially given the low consumption of plant protein throughout the Australian population and indeed in this cohort.

CONCLUSIONS

In middle-aged and older adults with NAFLD, a 12-week, home-based, exercise and dietary support programme incorporating a higher plant protein intake, delivered via telehealth was perceived as safe and acceptable, and participants expressed a high level of satisfaction. Thus, telehealth can offer a viable behaviour change model for lifestyle programmes in people with NAFLD. Incorporating an individualised approach with personalised feedback and using engaging delivery methods that incorporate social support were recognised as important factors to increase uptake and adherence and should be considerations for future telehealth interventions to improve participant engagement and behaviour change.

Contributors CLF, ESG, S-YT and RMD study design and question. CLF conducted the research. CLF, GA, TP and RMD analysed the data. CLF wrote the manuscript. CLF, ESG, S-YT, GA, TP and RMD reviewed and edited the manuscript. RMD is the guarantor of this work and takes responsibility for the integrity of the data and the accuracy of data analysis.

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Patient consent for publication Not applicable.

Ethics approval This study was approved by the Deakin University Human Research Ethics Committee (2021-359) and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent was given (electronically) by all participants at the time of recruitment.

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