Diet and physical activity after liver transplant: a qualitative study of barriers and facilitators to following advice

Short title
Diet and activity after liver transplant

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Title

Diet and physical activity after liver transplant: a qualitative study of barriers and facilitators to following advice.

Abstract

Background

Liver transplant recipients are given diet and physical activity advice to aid recovery and promote long-term health. This study aimed to explore patients’ experiences of receiving and implementing diet and physical activity advice after liver transplant and identify barriers and facilitators to following recommendations.

Methods

A qualitative descriptive design included purposive sampling of thirteen liver transplant recipients. Semi-structured audio-recorded interviews and inductive thematic analysis using a framework were undertaken concurrently to enable recruitment until saturation of themes occurred.

Results

Overall experiences varied between participants and settings, and over time. Seven themes emerged, all representing both barriers and facilitators to implementing advice. Poor capability and loss of confidence were barriers which improved in hospital as healthcare professionals enabled participants to set and achieve goals but remained key barriers after discharge from hospital. The format and consistency of advice influenced participants’ confidence in the healthcare team. Social support helped participants to return to and implement advice, but social networks could also have a negative influence. Advice and modelling of behaviour from other transplant recipients were facilitators. Symptoms, side-effects, co-morbidities and the environment presented barriers and facilitators. The desire to return to normal and coping strategies were drivers of behaviours, which were also influenced by participants’ beliefs and values.

Conclusions

The variation in experiences indicates a need for individually tailored advice that is consistent across the multidisciplinary team. Interventions for behaviour change that merit further investigation include goal setting, improving coping strategies, peer support and modifying the hospital and home environment.
Introduction

Immediately following liver transplant, patients are advised to follow a diet that is energy-dense and high in protein and to start mobilising to aid recovery (1; 2). However, long-term changes in diet and physical activity (henceforth referred to as activity) are recommended to reduce the risk of cardiovascular disease, cancer and osteoporosis, which is elevated in this patient group (3; 4). Despite some transplant centres providing patients with dietary counselling, physical therapy and activity advice, research indicates that many liver transplant recipients do not achieve the recommended levels of activity (5; 6) or dietary intake (7), evidenced by excessive weight gain (8) and metabolic syndrome (9) after transplant. Published studies which explore patients’ experiences after liver transplant have focused primarily on lived experience of transplantation (10) or adherence to medical care (11), with paucity of data about patients’ experience of implementing diet and physical activity advice.

The purpose of this study was to explore liver transplant recipients’ experiences of receiving and implementing diet and physical activity advice post-transplant and identify barriers and facilitators to following diet and activity recommendations. This knowledge is important to enable healthcare professionals to address barriers and better support recipients with these behaviours, and to inform the content and theory of lifestyle interventions developed for this specific patient population (12).

Methods

This qualitative descriptive research (13; 14) used a constructivist research paradigm to inform the research methods (15; 16). Further details about the design and approach are reported in supplementary information. This manuscript has been prepared using the standards for reporting qualitative research (17).

Research participants

Patients aged $\geq 18$ years and fluent in English, who had undergone a liver transplant at the Cambridge transplant centre 6 weeks or more prior to the study were eligible for inclusion. Patients who were unable or unwilling to provide informed consent were excluded. All patients attending the outpatient liver transplant clinic over a month were considered for inclusion ($n=69$). Purposeful sampling was used to include participants at different times post-transplant (6 weeks, up to 12 months and more than 12 months post-transplant) and with different needs for nutrition and physical therapy support. Recruitment and data collection continued until saturation of research themes was reached, where additional data did not lead to any new themes (18).
Fourteen patients were invited to participate. Thirteen agreed and were interviewed, including eight (62%) women and five (38%) men. Median age was 60 years (range 20-70) and median time post-transplant was 17 months (range 6 weeks – 14 years). Aetiology of liver disease included primary biliary cholangitis (n=4), non-alcoholic fatty liver disease (n=3), alcohol-related liver disease (n=2), primary sclerosing cholangitis (n=2), Budd-Chiari syndrome (n=1) and Wilson’s disease (n=1) (Table 1).

**Data collection**

Data were collected over a three-month period via a semi-structured interview with each participant. Data were collected and analysed concurrently. Participants chose a face-to-face or telephone interview and the location. Interviews took place in a quiet private room in the hospital, a hotel meeting room or in the participant’s own home. Each interview was undertaken by one of four researchers who were clinical dietitians with experience in working with transplant recipients. Four interviewers were required for ethical reasons so participants were interviewed by a dietitian with no involvement in their clinical care. The format was informed by a topic guide (supplementary information) which was developed by the researchers with patient and public involvement from transplant recipients not participating in the study. The topic guide evolved as the study progressed to ensure data were collected on new topics that emerged from interviews. Interviews lasted between 40 and 120 minutes and were audio-recorded and transcribed verbatim by one of the researchers (LS). Identifiable information was removed from the transcripts. To achieve consistency between interviewers all were well acquainted with the topic guide, and the lead researcher (LS) listened to all recordings and led reflexive meetings after each interview. There was no pattern in interview length between interviewers.

**Data analysis**

NVivo 11 (19) was used to aid inductive thematic analysis using a framework for data management, as described by Ritchie et al. (20). Two researchers (LS and AMC) undertook the analysis. The first four interview transcripts were coded independently and used to develop a thematic framework. LS and AMC then jointly indexed the remaining transcripts as they became available. For the remaining transcripts, new codes were developed for data that did not fit into the framework and the framework was adjusted. Previous transcripts were reviewed in order to apply these new codes. When all transcripts had been indexed and displayed in charts, LS, AMC and AM reviewed the data in each theme, mapped the range and diversity of views and experience, and developed further themes to describe links and patterns within the data. Reflexive diaries and a record of analytical
thinking were maintained by the researchers throughout and were used to aid data collection, analysis and interpretation of findings (see supplementary information).

**Results**

Overall, seven themes were identified that describe participants’ experiences after the transplant in hospital, whilst recovering at home and with long-term diet and activity behaviours. Findings are illustrated with anonymised quotations. Further illustrative quotes can be found in supplementary information.

1. **Beliefs and values**

1.1 **Early after transplant**

In the first days following transplant, participants lost confidence in their abilities with diet and physical activity. This led to some feeling incapable and fearful of eating and mobilising.

“You don’t know anything because you’re not a doctor or a, or a nutritionist… I felt constantly inferior… you just seem to forget any contextual knowledge that you ever had” (P7).

Encouragement, achieving goals and experiencing benefits of following advice improved self-efficacy and motivated participants to continue implementing advice.

“You can see the weight going on, you know you, it’s something tangible really if it does go on because you think ‘oh right this really works’” (P5).

1.2 **After discharge from hospital**

Once home, participants were unsure of how to balance sufficient activity to progress, without doing too much and risking injury. This led to fear, uncertainty, lack of confidence and feeling “built up for a fall” (P13).

“I seem to have been just left to just fend for yourself and you don’t know what [activity] you can or should and shouldn’t be doing…I’ve been scared… and it’s frightening not to do too much and then not to do enough” (P5).

In contrast, some participants felt capable of setting goals and progressing activity levels without further support.

1.3 **Beliefs about advice**
Participants who believed that implementing advice would be beneficial, or that current or past behaviour may have a negative impact on health described following advice.

“You’ve got to do it [have a healthy lifestyle], you’re only killing yourself if you don’t do it” (P2).

Conversely, those who viewed the advice as harmful or not beneficial described not changing their behaviour. Recognising but not valuing the potential impact of behaviour on health, and not being willing to accept the perceived costs or deprivation of behaviour change, such as less enjoyment from food due to reduced fat intake, were also barriers.

“If I see a dietitian, that’s what she’s going to tell me isn’t she, ‘We don’t want you growing overly large’, ha, if that happens it happens, I’m not bothered” (P6).

1.4 Beliefs about self

“Self-determination” was described as a facilitator to implementing advice. Other participants described being “lazy”, not “self-motivated” and “not particularly good at following peoples’ advice” as barriers.

2. Healthcare professional support and advice

2.1 Good support

For inpatients, support from ward staff was an essential enabler, for example to access supplement drinks and through encouragement to mobilise and eat. However, when support was lacking this was a barrier.

“Quite frequently breakfast would be almost at lunch time because there was nobody to help me feed… there were some times when they were very much on the ball and would get it done and other times when they just couldn’t” (P3).

Support from dietitians and physiotherapists enabled participants to follow advice. Participants’ ability to implement advice was improved when advice was brief, tailored and regularly adapted as their needs changed.

“It’s just reiterating, even though you tell us, I tend to forget” (P5).

“The fact that it wasn’t just a meal plan and then everybody gets the same one, it was very much individually tailored” (P7).
Getting support at the right time when needed was important, for example when a problem was encountered. However, participants could not always anticipate their support needs in advance. “Being able to ask her [dietitian] about lifestyle stuff was helpful, especially once I had a life again…. once you come across a problem, getting the answer to that is, is vital because otherwise you can’t move on… Unless I encounter any problems, I don’t really know what to say [to the dietitian]” (P7).

2.2 Insufficient support

Some participants felt better support was needed: in hospital; to be more physically active after discharge from hospital; for preventing unwanted weight gain; and with long-term healthy behaviours. “A little bit more help with and a bit more advice on diet and exercise would have been useful” (P11).

Participants expressed desire for physical activity guidance and “benchmark” (P5) to know how much they should be able to do and by when, particularly after discharge from hospital. “Vague” advice that was not sufficiently tailored to the individual was difficult to implement. “There was no real advice around exercise, you know, what would be safe to do” (P3).

2.3 Healthcare professional approach

Participants were reluctant to engage with healthcare professionals who did not have an empathetic approach, whereas those who were confident and knowledgeable with an empathetic and encouraging approach had a positive impact on patients’ willingness to listen to and adopt advice. “With the food and the exercise, it’s actually your life, you actually have to live it and I think that the empathy that you get for that is really important. If it had been any other way I don’t think I would have followed the advice frankly” (P7).

2.4 Consistent and clear advice

Consistent messages about diet and activity across the healthcare team made participants feel more confident about advice. Participants valued advice more when its importance was highlighted by doctors and surgeons. Participants who experienced advice as conflicting found this confusing and lost confidence in healthcare professionals.
“I was like well that’s not what [the other dietitian] said …and I think it’s from then I just thought, I’m not even listening to you” (P6).

3. Social support and influence

3.1 Family and friends

3.1.1 Support and encouragement

Support from family and friends was needed. For example, palatable nourishing food provided by visitors during hospital admission was important for those who disliked the hospital food.

“It was a good job my sister bought me a big bag of goodies that I could dive into because otherwise I think I would have starved to death” (P13).

Support to shop for and prepare food and with regaining mobility was needed at home as participants were not physically capable of this when first discharged from hospital. Some described their partners’ encouragement as the main driver of their activity and dietary intake.

“I was supposed to eat three meals a day and I used to try and push it off and my wife just pushed it back on me…the only reason I did things was because of my wife really pushing me. I’d rather sit down and do nothing really” (P4).

Some participants needed permission and support from their family to prevent too much physical activity too soon. Participants’ family and friends being present when advice was given enabled them to review this independent of healthcare professionals.

“I usually ask questions, and quite frequently with my family around because I just wasn’t taking anything in at the time at all, so it was them [family] that kept pushing it, you know and saying you can’t do this, you won’t be able to do that and, don’t worry about it as it comes up we’ll deal with it.” (P3).

3.1.2 Expertise

Participants described receiving advice from family and friends who had knowledge and expertise of diet and physical activity. In some cases, this was sought when support was lacking from healthcare professionals, for example with physical activity.

“I also have a, a fitness instructor for a son…he had a booklet that had like exercises…so if they’d given me something like that to come home with…I think that would be helpful” (P13).
3.1.3 Influence

The behaviour of others influenced participants’ ability to follow dietary advice in both positive and negative ways, for example the pressure to eat unhealthy meals prepared by others and the positive influence of health and wellbeing amongst friends and social media. When talking about diet and activity for a healthy lifestyle, establishing healthy behaviours with other people was important.

“When I want to lose weight [my wife] helps me and, ur, then she went on a diet and I joined her. We do it very much together” (P2).

3.2 Other transplant recipients

Participants had confidence in advice from other transplant recipients. Modelling of diet and activity behaviours by other recipients encouraged participants to implement advice.

“I got a lot of confidence from [other recipient] because he had his transplant the year before and then went to the transplant games…that’s quite…inspiring. It made me think actually if he can do it then I can do it” (P8).

4. Symptoms, side effects and comorbidities

4.1 Symptoms and side effects

Participants described symptoms related to medication, the transplant surgery and liver disease as a barrier to implementing advice, for example, loss of appetite, taste changes, pain, fatigue, diarrhoea, nausea and vomiting. These were most common in the early post-transplant phase and improved for some as they recovered, however, for some ongoing or new symptoms continued to be a barrier for years.

Dietary restrictions due to transplant side effects, such as chyle leaks and hyperglycaemia, posed a challenge to finding suitable foods and meeting nutritional recommendations. In the early stages of recovery poor attention span and retention of information prevented participants from grasping and remembering advice.

“My brain was addled at the time … I just wasn’t taking anything in… I wasn’t mentally able to grasp it all in one go” (P3).
Being physically incapable of activity and eating due to loss of strength and stamina was a barrier and contributed to low self-efficacy and negative emotions for some participants. However, being malnourished and physically incapable could also motivate a desire to improve.

“I am probably more dedicated to doing it [exercise] because I want to get the muscle tone back, you know, and I don’t want to be on my knees at the top of a flight of stairs because my muscles are so fatigued” (P13).

When appetite returned, a strong and difficult-to-control hunger drive that required large volumes of food to satisfy and a change in food preference were described by some participants.

**4.2 Co-morbidities**

A range of co-morbidities were barriers to following advice. Some participants needed to avoid certain foods to manage their co-morbidities and some were not able to undertake the recommended levels of activity.

“Vegetables and fruit don’t suit my ulcerative colitis” (P11).

“I don’t do a great deal of physical activity because of the [retracted comorbidity] so I’m very limited” (P3).

For others, comorbidities, such as diabetes, encouraged the adoption of healthy behaviours to manage the condition.

**5. Environmental influence**

**5.1 In hospital**

In hospital there were physical barriers such as being attached to drip-stands, poor access to supplement drinks and a lack of opportunity for upper body exercise. However, the environment was also used as an opportunity to aid physical activity via goal setting and tracking progress.

“My aim was to try and get right around the, there’s a little block you know where you go all round the ward” (P5).

While some participants described good quality hospital food with a wide selection of options, others reported their dislike of hospital food as a barrier to implementing dietary advice.

“The food was awful and I don’t think that encourages appetite” (P9).

**5.2 Recovery at home**
Having greater control over food and more opportunity for activity at home, compared to hospital, were described as facilitators. Walking was an activity available to all and used to promote recovery.

5.3 Being physically active after recovery

Daily tasks of living that required physical exertion encouraged activity.

“[Physical activity] comes from things that need activity if you like, as opposed to looking for it...mow the lawn, do some gardening, walk to the shop, just general activities” (P12).

The convenience of having a gym at work, the availability of interesting and accessible walks, having a dog and good weather all facilitated activity. Bad weather and not having access to safe or enjoyable walking routes were barriers.

“There's no pavements, just hedgerows, so it’s difficult to sort of walk” (P12).

6. Coping

6.1 Threatened coping

Not recovering as expected threatened participants’ ability to cope, which was a barrier to implementing advice.

“As time goes on you think when am I going to get better? When all this pain and effort, when am I going to get pay back for that? …you start to get depressed a little bit and that, of course, affects your ability to eat” (P1).

6.2 Coping strategies

Achieving diet and activity goals, experiencing benefits of implementing advice, making progress towards ‘normal’ and sharing experiences with other transplant recipients helped participants to cope.

“Once I’d done the walk I felt so much better, I really felt brilliant, you know mentally as well as physically I think, because you think you’ve achieved something” (P5).

“You’re starting to get back to doing normal things, eating normal things, walking normally, you start to enjoy life again” (P1).

Participants felt responsible to “make the most of the second chance” (P11) which gave them a purpose and motivation with behaviours. For some, adopting healthy behaviours was described as a
way ofregaining control of health, reducing the risk of future ill-health, caring for the donated liver
and respecting the donor.

“We’ve been told that, you know, we’re high risk of diabetes, high risk of heart disease,
high risk of cancer so you just make sure you look after your health… because I don’t want
to be as ill as I was…I can control diet, exercise, you know, not all these other things
[medication side effects], so I should, I should try to.” (P8)

Others did not feel able to consider the impact of their behaviours on their future health as this
threatened their ability to cope.

“My coping mechanism has been one of this is my liver, I haven’t had a transplant, this is
my liver that’s been with me all my life so therefore to change anything dramatically, um,
and lose that mind-set is something that I didn’t want to do” (P12).

7. Returning to ‘normal’

7.1 A desire to return to ‘normal’

A desire to return to normal and the belief that diet and activity were important for this were
facilitators to implementing advice.

“I wanted to get on with life. I was walking around the block, and it was an effort but I made
the effort. I want to get back to something like normal as I used to be” (P1).

Some participants returned to their “usual” behaviours. Advice was easier to follow it was similar to
their “usual” behaviours.

“[Dietary advice] mostly chimed with what I was eating anyway… healthy sort of lifestyle
and healthy food” (P10).

“I have a grounding in, on the exercise side of it because it’s something that I’ve always
done” (P13).

Participants who found advice wasn’t “usual” for them reported it was more difficult to follow. For
example, participants who were used to following healthy eating guidance found it challenging to
introduce snacks to help manage diabetes or high energy foods to treat undernutrition.

“I never used to pick and stuff like that after, sort of, 7, 8 o’clock at night anyway. And
when you get asked to eat, have something to eat, you know, just before you go to bed [for
diabetes control], it just wasn’t me” (P4).
Others described introducing healthier foods or increasing physical activity as challenging.

“Throughout life I haven’t, but even, even pre transplant I wasn’t exactly over active… If you’re not a particularly active person then, you know, you do what you normally do, just live your life how you normally lived it” (P12).

7.2 A transition to ‘normal’

For some participants, transitioning from the diet required for their liver disease and recovery to a “normal” way of eating was challenging as the special diet had become the norm and an important part of managing their condition. Additionally for some participants, coming to terms with a normal body weight after being underweight for a prolonged period was challenging and they were slow to realise when weight may have increased too much as gaining weight was primarily perceived as positive and resolving malnutrition.

“Being so thin…you just get used to it, you stop telling yourself that it’s so like alien and now that I’m kind of normal sized it’s dysmorphic in my mind …. You know because I had to think the way that I looked when I was ill was kind of acceptable because, you know you have to, and now that I do look acceptable, I try and tell myself that this is actually normal” (P7).

However, other participants described no change in their dietary intake or need to adapt to a new weight.

Discussion

This study contributes new insight into the topic of diet and activity after liver transplant, providing better understanding of both barriers and facilitators to receiving and implementing diet and activity advice. Barriers included loss of confidence in abilities, fear, inadequate support and conflicting and vague advice from healthcare professionals, negative social influence, low self-motivation, not believing in advice, not being willing to accept perceived costs of behaviour change, poor health and slow recovery, a difficult transition from a diet suitable for liver disease to a normal diet, and being slow to realise that weight gain was greater than recommended.

Facilitators included good support, encouragement and empathy from healthcare professionals, individualised timely advice that was consistent across the multidisciplinary team, being capable of setting goals to progress, the belief that implementing advice would be beneficial, self-determination, peer and social support and modelling, environmental opportunity, following advice as a way to cope, and experiencing benefits of implementing advice.
The process of liver transplantation is medically and surgically complex and liver transplant recipients follow diverse post-transplant recovery trajectories. Their wider health and social needs are also complex and vary substantially between individuals. This diversity is reflected in the range of responses received from participants. Results from this study highlight the potential for individualising lifestyle advice. Facilitating recipients to set personalised goals might be a useful method to tailor support for behaviour change. Goal setting is an effective intervention to increase activity in a diverse range of populations, including patients with chronic conditions and recovering from cancer, but there is no published evidence in transplant populations (21).

As described in Self-Regulation Theory, individuals need to compare their behaviour to a desired or acceptable standard in order to judge its appropriateness, and believe they are capable of change (22). Our findings suggest inadequate support with, and guidance about, the type and timing of activity that is safe after discharge from hospital is an important barrier that needs to be addressed to enable self-regulation. Similarly, other qualitative research has found uncertainty about how to progress activity due to participants’ inability to assess the safety of exercise after liver transplant (23). van Adrichem et al. (24) interviewed solid organ transplant recipients, including liver transplant, and found incapability and fear of injury could be overcome with expertise and training from physiotherapists.

Participants expressed desire for more support with preventing excessive weight gain after transplant. Post-transplant weight gain results in high levels of overweight and obesity and associated health problems, therefore, there is a need for evidence-based interventions (8). This study has identified factors that could facilitate weight management, for example helping patients to accept a ‘normal’ body weight after being underweight and support with timely transition to healthy eating. Participants described an excessive appetite during their recovery which was difficult to control. This may help to understand the association between uncontrolled eating and weight gain after liver transplant (25). The cause of increased appetite post-transplant is not understood. Hypotheses include recovery of malnutrition, hunger driven by immunosuppressive drugs (25), an appetite disorder for example due to vagal nerve innervation due to the hepatectomy (26), and/or due to addiction transfer (27).

Recipients require support with managing symptoms and side-effects of the transplant as these were described as barriers to implementing advice. Some participants experienced resolution of their symptoms and side effects, whereas others experienced ongoing or new issues years after their transplant. Dudley et al. (28) describes the liver transplant as “exchanging one health state for another” (p.1301). Ongoing health problems left participants feeling out of control and threatened
their ability to cope with the transplant experience as their expectations of recovery had not been met, and in turn influenced their behaviours (28). In a study exploring lived experience of liver transplant, recipients used activity to manage their symptoms (29). Physical activity is associated with better quality of life after liver transplant (30) and improvement in fatigue is experienced with activity (31). Therefore, facilitating behaviour change may be an effective way for healthcare professionals to help patients adapt to or improve symptoms.

Participants’ coping strategies influenced their behaviours. The desire to look after the transplanted liver has also been identified as a source of motivation for healthy behaviours in other studies (10; 23). However, we found that some participants did not feel able to consider the impact of their behaviours on their health as this threatened their ability to cope. We found no quantitative research with liver transplant recipients that investigates the influence of coping on health behaviours. In research undertaken with other patient groups adaptive coping is associated with positive behaviour change and maladaptive coping with negative behaviour change (32). The influence of coping strategies on health behaviours after liver transplant merits further investigation, such as studying the effectiveness of an intervention that teaches adaptive coping skills.

Doctors and surgeons develop trusting relationships with transplant recipients over many years and are influencers as patients hold their advice in high regard. Doctors coordinate overall treatment plans and have an important role with diet and physical activity care including recognising when specialist dietetic and physiotherapy support is required (33). The role of dietitians and physiotherapists is to translate the complex and nuanced nutrition and physical therapy science into effective patient care to facilitate behaviour change. Our findings highlight the importance of this multiprofessional involvement in nutrition and physical activity care as participants described need for consistent messages across the team and the value of diet and physical activity highlighted by doctors and surgeons.

The positive influence from other transplant recipients on behaviours found in our study suggests a peer support system could be a useful intervention for diet and activity behaviour change and merits further investigation. Hickman et al. also report confidence with activity increased with role modelling from other recipients (23). We identified no studies that have investigated the impact of peer support on health behaviours in transplant populations.

Our findings suggest the support of relatives and friends influence behaviours, therefore including them when providing diet and activity advice can be helpful. The provision of food by visitors was described as a facilitator to nutritional intake during inpatient stay, particularly for those who did not like the hospital food. Further investigation into how to optimise this support might be helpful,
for example the type of food provided by visitors and whether guidance should be provided so it meets dietetic recommendations.

We found the physical environment could be both an enabler and barrier to following advice. The importance of environment on behaviour is reflected in socioecological models of health promotion (34) with most research focusing on the macro-environment, such as the neighbourhood (35). There is limited evidence for the effectiveness of changes to the micro-environment, including the home and hospital settings (36). For patients with cancer, environmental opportunity for activity in the hospital is associated with the time spent in intentional physical activity (37). Equipment at home is correlated with increased activity in patients with diabetes (38). Healthcare professionals are well placed to enable patients to set up environmental opportunities and problem-solve environmental barriers that are relevant to their individual situation. The effectiveness of interventions that modify the home and hospital setting to promote behaviour change for transplant recipients is an area requiring research.

**Strengths and limitations**

The strengths of this research include the development of the topic guide with input from transplant recipients and healthcare professionals with appropriate expertise to ensure all relevant topics were covered. An inductive approach allowed the interview topics to evolve and the interviewers to explore experience in greater depth and breadth. The purposive sampling method ensured participants with a range of diet and activity support needs were included. The researchers kept reflexive diaries throughout the research process and the influence of their experiences, thoughts and preconceptions on the research were carefully considered to minimise bias.

Study limitations include undertaking the research at a single transplant centre where practice may not be representative across all centres. It would be valuable to triangulate these findings with wider research involving other transplant centres. All the researchers were dietitians and the participants were aware they were being interviewed by a dietitian. This could have led to social desirability bias in their responses (39). To minimise this the interviewers were independent of the participants’ care team. Patients who did not speak fluent English were excluded from the study which represented approximately 3% of the study site’s liver transplant recipient population.

**Conclusions**

In conclusion, the barriers and facilitators to following diet and physical activity advice described by liver transplant recipients varied between individuals and with their stage of recovery. The variation expressed indicates a need for individually tailored advice that is delivered at a personally
relevant time, which could be years after transplant, and in a manner that the patient finds acceptable. Consistent diet and activity advice that is reinforced by different members of the multidisciplinary team, but especially by doctors and surgeons, is important. The influence of family, friends and other patients on behaviours should be considered when providing advice. Interventions that might facilitate behaviour change and merit further investigation include individualised goal setting, improving coping strategies, peer support and modifying the hospital and home environment.

**Conflict of interest statement**

No conflicts of interest.

**Transparency Declaration**

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported. The reporting of this work is compliant with SRQR guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

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