

Promoting dietary awareness: Home-dwelling older adults' perspectives on using a nutrition application

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Abstract

Aims and objectives: This study investigated older adults' experiences of using the Appetitus app with support from healthcare professionals.

Background: Good nutrition status is important for good health when ageing. However, as undernutrition remains a prevalent and persistent problem among older adults, the study explored whether technology affords innovative support for nutritional self-care among older adults.

Design: The study was explorative and qualitative in approach.

Methods: Appetitus was developed as a tablet-based application to prevent and alleviate undernutrition among older adults. Eighteen home-dwelling older adults used the app for 8 weeks. Older adults received home care, and local healthcare professionals introduced the app and gave support during the study.

Results: Appetitus served as a source of inspiration and a reminder of available, relevant food options. Appetitus encouraged some participants to eat or drink more by the end of the day while others became more aware of selecting food options to ensure sufficient protein, energy and fluids. However, some participants made no active effort to change their diet despite feedback from the app that suggested they did not eat or drink enough. Technical support from healthcare professionals facilitated participants' use of the app and tablet. Some participants also received more specific nutritional follow-up that helped to make their experience of using the app more meaningful.

Conclusion: Older adults' awareness about the importance of keeping a diet that helps prevent undernutrition was reinforced through the use of Appetitus and discussing nutrition with healthcare professionals.

Implication for practice: The findings affirm feasibility of using technology in nutritional interventions enhancing self-care among older adults.

KEYWORDS

computers, handheld, health promotion, home care services, older adults, protein-energy malnutrition, qualitative research

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1 | INTRODUCTION

Good nutrition status is a core premise for good health, well-being and independence in old age (Heflin, 2019). Eating enough and having a varied diet is important to ensure sufficient intake of micro- and macronutrients (Lorenzo-López et al., 2017). Unfortunately, the prevalence of malnutrition is high among older adults. Studies reports that close to 50% of older adults who receive home care services are at risk of developing malnutrition, and almost 9% are malnourished. It is often a result of a protein-energy deficit in their diet that leads to such undernourishment (Cereda et al., 2016). Reduced appetite is a major risk factor for undernutrition, as this is coupled with reduced food consumption and less interest in food (Jadczak & Visvanathan, 2019; van der Pols-Vijlbrief, Wijnhoven, Schaap, Terwee, & Visser, 2014). Changes in physical or cognitive function that increase older adults' dependence on others leave them vulnerable to reduced dietary variation and less able to maintain their habitual diet (van der Pols-Vijlbrief, Wijnhoven, & Visser, 2017; Tomstad, Söderhamn, Espnes, & Söderhamn, 2012).

Studies indicate that older adults frequently lack awareness of the importance of maintaining their weight as an important self-care activity in old age. They may lack sufficient or balanced knowledge of how unintended weight loss can start to impact their health negatively (Beelen et al., 2017; Craven, Lovell, Pelly, & Isenring, 2018; Winter, McNaughton, & Nowson, 2016). Technology-based interventions, including mobile applications (apps), are identified as promising strategies for promoting healthy eating and supporting positive changes in health behaviour (Bonilla et al., 2015; McCarroll, Eyles, & Mhurchu, 2017). Here are unique opportunities for self-monitoring and personalised, immediate feedback (Chen, Gemming, Hanning, & Allman-Farinelli, 2018). Dietary mobile apps are increasingly being used to support nutrition interventions. Two recent reviews indicate that self-monitoring dietary mobile apps can be efficient to support weight loss and promote positive dietary change among adults with obesity or chronic conditions such as diabetes and heart failure (El Khoury et al., 2019; McCarroll et al., 2017). Some tele-monitoring solutions and apps that target undernutrition among older adults have also been studied (van Doorn-van Atten et al., 2018; Kraft et al., 2012; Lindhardt & Nielsen, 2017). In these solutions, the users recorded their weight, appetite or selected items in their diet as part of a nutrition intervention. Paulsen et al. (2018) developed a more comprehensive self-monitoring dietary app for use in the hospital setting. These studies indicate that activating the older adults in self-care activities by the means of technology is feasible. However, to the best of our knowledge, self-monitoring dietary mobile apps with direct, personalised feedback have not been studied to address the specific challenge of undernutrition among home-dwelling older adults.

When this project was first initiated (2015), we reviewed available nutrition apps for use in Norway. They focused on weight loss, and they required users to record food and beverage consumption in great detail. The challenges with detailed recordings are recognised

What does this research add to existing knowledge in gerontology?

- Health technologies that are easy to use can support older people's engagement in nutrition self-care and enhance awareness of dietary measures to prevent malnutrition.
- Older adults manage and are interested in adoption of relevant health technologies.

What are the implications of this new knowledge for nursing care with older people?

- Tools with opportunities for self-evaluation of diet increase older adults' interest and awareness of appropriate dietary habits in old age.
- Technology for self-evaluation of diet can innovate nutrition care provision by activating the patient and support individualised and focused dialogs between healthcare professionals and their patients.

How could the findings be used to influence policy or practice or research or education?

- Adoption of health technologies in home care services can support active ageing initiatives that focus on preventative activities and patient engagement in care.
- Studies of this kind can guide and expand the development of self-care interventions among older adults.

in the literature, concluding that freely available apps are less relevant or feasible to older adults at risk of undernutrition (Hingle & Patrick, 2016; Shriver, Roman-Shriver, & Long, 2010). Therefore, our research project included development of a tablet-based nutrition app named *Appetitus*. The goals of *Appetitus* were to provide older adults with nutritional advice to encourage weight gain or weight maintenance.

A recent review points out how ease of use and perceived value of the technology is crucial for older adults' engagement with, uptake of and adherence to using health technology (Matthew-Maich et al., 2016). Furthermore, sufficient support to overcome potential learning difficulties is considered important for older adults when they are introduced to health technologies (Wildenbos, Peute, & Jaspers, 2018). In this study, we explored the experiences of home-dwelling older adults who used the *Appetitus* app in a home care setting. Norwegian home care services are offered on a need bases and the system seeks to support independent living despite increasing care needs. Older adults receive home care services while living in their own private home or in supervised, independent living arrangements as local authority housing tenants.

To capture older adults' user experience and perceived value of using *Appetitus*, we asked the following research questions:

1. What was older adults' experience of using the Appetitus app with support from healthcare professionals?
2. How did older adults consider influence on their diet when using Appetitus?

2 | METHODS

2.1 | Study design and sampling

This study has an inductive, explorative qualitative design with convenience sampling (Polit & Beck, 2012). The study was conducted between November 2016 and January 2017. Eighteen older adults from three Norwegian municipalities used the Appetitus app for 8 weeks. We recruited older adults that received home care services. Local healthcare professionals were asked to recruit individuals over 65 years of age, which they considered could benefit from participation in a nutrition intervention. We sought participants without pronounced cognitive decline, who could learn to use Appetitus on the tablet computer independently. Our sample demonstrates diversity in age, care needs, technological experience and nutrition status (Table 1).

Initially, 28 older adults were recruited. Of these, six decided not to participate before the study started; one died, and three others withdrew shortly after the study started. Two explained their withdrawal with increased illness burden, and one found reporting food and beverage consumption too tiring.

Participants were provided with an iPad with the Appetitus app and mobile Internet (3G) installed. Thirteen local healthcare professionals were responsible for training and supporting the participants during the study period. Healthcare professionals included nurses, nurse aids and nursing students. We met with healthcare professionals prior to the trial period to clarify recruitment and follow-up procedure. To foster understanding of what project participation entailed, Appetitus was shown to the older adults when they were asked to participate. We expected healthcare professionals to meet with the participants at least three times to support use of the iPad and Appetitus and to discuss nutrition. In the follow-up, emphasis was primarily placed on providing training in basic functions of the tablet (turn on and off, charge the tablet) and how to use the Appetitus app. In line with common practice in Norwegian home care, nurses and nurse aids were responsible for nutritional follow-up, as certified dietitians is a limited resource in the municipalities. However, the healthcare professionals' reported time constraints and personal insecurities in nutritional knowledge as barriers for follow-up (Farsjø, Kluge & Moen, 2019).

2.1.1 | Appetitus

The recommendations in Appetitus are derived from the Norwegian nutritional guidelines for prevention and treatment of undernutrition (Findalen et al., 2012; Guttormsen et al., 2009). Appetitus suggests a

TABLE 1 Information about participating older adults (n = 18)

| | |
|---|------------|
| Gender | |
| Female | 12 |
| Male | 6 |
| Age | |
| Years, mean (range) | 81 (68–95) |
| Living arrangements | |
| Living alone | 12 |
| Living with spouse | 6 |
| Experience with touch technology | |
| No prior experience | 10 |
| Prior experience (tablet or smartphone) | 8 |
| Organisation of grocery shopping | |
| Independent | 6 |
| Receiving help from family or home care organisation | 12 |
| Dependence in food preparation | |
| Independent; make dinner regularly | 8 |
| Partly independent; | |
| Heats precooked dinner or eat at senior centre | 7 |
| Dependent; need all meals prepared and served | 3 |
| Nutritional status according to Mini Nutritional Assessment—Short form (MNA-sf) | |
| Malnutrition | 3 |
| Risk of malnutrition | 10 |
| Normal nutrition status | 5 |
| Body mass index (BMI) | |
| Mean (range) | 25 (19–37) |
| Weight development during trial | |
| Stable weight or weight gain | 11 |
| Weight loss | 6 |
| Missing | 1 |

meal plan, with four main meals and two snack meals a day. By covering the full day, the meal plan implies that night fasting should be <2 hr (Jadczak & Visvanathan, 2019). The version of Appetitus tested here included pictures of 147 dishes. Pictures of meals and beverages sought to present common, varied and easily available meals in appetite-friendly presentations. The app user could record their food and beverage consumption. They could adjust the portion size (by percentage) to better reflect consumption when calculating nutritional value, but the content in the image of the dish was not adjustable. Calculation of recommended, daily intake is based on the algorithm 30 kcal energy, 1.2 g protein and 30 ml fluid per kilogram body weight (Findalen et al., 2012). The calculated nutritional value of the recorded meals and beverages is presented as filling in a figure (Figure 1, left) and as graphs that visualises protein, energy and fluid consumption relative to recommended, daily intake (Figure 1, right). Users who reached their energy and fluid goals for the day received feedback in the form of a full figure smiling and making a cheering sound.

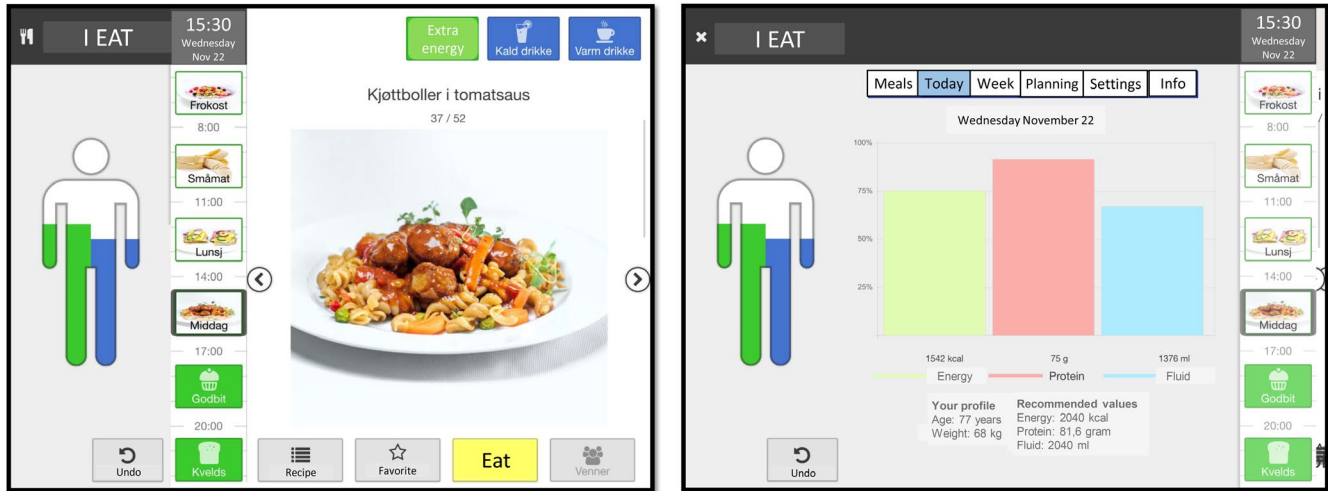


FIGURE 1 Screenshots from the Appetitus app

| Category | Sub-category | Theme |
|-------------------------------------|---|---|
| Dietary habits persist | Well-established routines persist, even from childhood | Mobilisation of self-reflection on dietary habits |
| Inspiring variety | Pictures stimulate appetite Dishes are familiar | |
| Insights regarding own diet | App illustrates a healthy diet App legitimises unhealthy choices | |
| Increased focus on food | Increased attention to food and diet Attention paid to figures and graphs Reactions to feedback from figures and graphs Reflections on weight gain | Stimulation of reflections on nutritional value in user's diet |
| User experience with the app | Reflections on registration: accuracy, representativeness Patterns of registration App intuitive to learn and use | Support from healthcare professionals' added meaning and assurance when using Appetitus |
| Follow up from health professionals | A shared focus on nutrition A technical focus in follow-up | |

TABLE 2 Categories, subcategories and themes

In design of Appetitus app's user interface, special care was taken to make it attractive and usable for older adults. This included compensation for potential vision limitations by ensuring good contrast, large interaction elements (buttons) and large text (Kascak, Rébola, & Sanford, 2014). All the main functionalities were included in the app's home screen: possibility to browse meal and beverage suggestions, consumption reporting and feedback on energy and fluid requirements (Figure 1, left). To access additional functions, the user had to perform a planned activity, pressing on the cutlery symbol for 2 s. This was deliberately implemented to keep it easy to orient in the app and to prevent users from unintentionally accessing additional functions, which was an identified challenge in testing a previous version of the app.

2.2 | Ethical considerations

The Norwegian Centre for Research Data approved the study (project number 44004). Older adults received oral and written information before providing their written consent.

2.3 | Data collection

Data were collected by the first author (CF) or by a research assistant (ALJ). The researchers met study participants in their home, prior to starting using the app, for structured interviews to gather demographic, nutritional and care needs information. Participants

were interviewed a second time after they had used the app for 8 weeks. These interviews were semi-structured and were supported by a thematic interview guide (Polit & Beck, 2012). Each interview began with an open question about the participant's experience of participating in the study. To learn more about user patterns and experiences, participants were invited to show how they had used the app. In addition, the researcher elicited participant's views on the healthcare professionals' role and the support they provided.

Interviews lasted from 19 to 49 min, on average 33 min. All interviews were audio-recorded and transcribed. The recorder malfunctioned in one interview, and the first author took detailed field notes immediately afterwards for use in the subsequent analysis.

2.4 | Analysis

Qualitative content analysis of the data was based on the procedure described by Graneheim and Lundman (2004). To begin analysis, we gained an overview by reading the interview transcripts. We used the research questions to focus the selection of meaning units (sentences and paragraphs) in the material. The identified meaning units were sorted into six categories. Next, the meaning units were condensed and we created subcategories. In the final stage of the analysis, three main themes were identified: (a) mobilisation of self-reflection on dietary habits; (b) stimulation of reflections on nutritional value in user's diet; and (c) support from healthcare professionals' added meaning and assurance when using *Appetitus*. The analysis process is presented in Table 2.

HyperRESEARCH version 3.7.1 supported the first part of the analysis. Excel 2016 and Word 2016 were used in the later stages.

3 | RESULTS

A majority of the participants explained that they used the app daily to log their food and beverage consumption, except when sick or travelling. The rest used the app more sporadically, often with support from the healthcare professionals. The results capture the participants' various perspectives and experiences within the specified themes. The study sought insight into how the various perspectives related to nutritional status and weight development, or how often the participants said they used the app, but no clear patterns were identified in this regard.

3.1 | Mobilisation of self-reflection on dietary habits

The *Appetitus* app presents pictures of a selection of meals, snacks and beverages, reminding participants of meals they might like but had not eaten for a while. Many participants described how their diet had become more varied as a result of inspiration by the app,

and some reported that they actively used it for meal planning and grocery shopping. As one informant put it:

The presentation of dishes is nicely set up. I find it very inspiring. I make my lunch every day, and I use suggestions from the app.

(Male, 85 years)

However, they also emphasised that key elements of their diet, such as eating fish twice a week, were based on well-established routines and habits. When talking about their nutritional practices, participants tended to focus on healthy parts of their diet, such as fruit and vegetables, fish and whole-grain bread:

I think it [*Appetitus*] can be an encouragement to eat a better and more balanced diet. But I think these [as suggested by the app] are dishes I have eaten my whole life. It is much the same as what we ate at home when I was a child. Only whole-grain bread. I grew up with a variety of fruit and vegetables. My mother was very concerned about food and making good choices—that we should eat healthily.

(Female, 95 years)

As this quotation illustrates, several participants found the dishes suggested by the *Appetitus* app as healthy and felt that using the app confirmed that their diet was good. For others, the app increased consciousness of more healthy choices. Suggestions for greater dietary variation were perceived as an important benefit of study participation. As one participant explained:

I think I eat a little healthier. I snack on some salad and cucumber and put it in my sandwich. Before, it was only brown cheese [Norwegian sweet cheese] or jam.

(Male, 85 years)

The app presents traditional desserts such as puddings, cakes and candy as choices for the afternoon snack. A few participants expressed surprise to find suggestions that they considered unhealthy:

And there were pictures of several different cakes. That surprised me a little. I used it [*Appetitus*] to remind me about what's OK to eat.

(Male, 78 years)

As this quote illustrates, the app served to legitimise what participants regarded as unhealthy choices. Some participants said they reinstated previously abandoned food options after using the app. Two participants told about various efforts to lose weight during adult life, and now both struggled with unintended weight loss and poor appetite. They described how using *Appetitus* led to reflection on their dietary choices in the light of the current situation.

3.2 | Stimulation of reflections on nutritional value in user's diet

Participants commonly used positive expressions to describe the feedback on energy and fluid consumption presented in the figure. Many were able to achieve their daily energy and fluid goals, and some reported instances of how the visualisation functions had led them to eat or drink more than usual in efforts to fill the figure. One participant described it as follows:

I think it's very amusing, yes! And it has happened that I only had the head left to fill, so I ate an orange or something in the evening, and then he cheered.

(Male, 91 years)

While most participants reported that they found it very rewarding to record their food and beverage consumption, others did not find this meaningful or even tiring. One informant described this experience as follows:

It takes some time. And when I'm not feeling well, then it feels like work— like: 'Oh, no, I don't want to do it'.

(Female, 72 years)

Some participants reported that their registrations rarely filled the figure. They understood this to mean that they had not consumed sufficient energy or fluids from food and beverages to reach their personal requirements, but they had not actively tried to change this.

Since getting diabetes, I have been constantly concerned about eating healthily. So, I have a fairly good overview, yes, about what I should eat. But I see that, according to this, I might not be getting enough energy.

(Female, 71 years)

As this quote illustrates, the participant's that showed lack of initiative to change explained that they based this consideration on common sense or on prior nutritional knowledge guiding their dietary patterns.

Participants also reflected on the accuracy of the feedback received from the app.

Then it's like [picture of sandwich with] eggs and tomato, but I only eat [sandwich with] tomato. I also eat caviar on its own, but here they show eggs with the caviar. It's not just simple things, and then it gets a little inaccurate [when I log my consumption].

(Female, 80 years)

At the beginning of the study, participants discussed with the healthcare professionals how to report their meals when they could not find exactly what they had consumed. They viewed this as learning

to be flexible by identifying something similar for registration purposes. Despite the challenges of exact registration, participants indicated that the visualisation function (the filling figure and the graphs) served to increase their focus on nutrition.

Yes, I was more attentive to what I had eaten, and I look at [graphs for] energy and protein consumption. One day, I was low on proteins, and I thought: 'Yes, well, I should pay more attention to what I choose to eat' because protein is important.

(Female, 84 years)

As this quote illustrates, participants felt that using the Appetitus app made them more aware of and interested in the nutritional value of their food. A few participants had also noticed a weight increase.

I paid more attention to what I eat. And I understand that I have put on some weight, I notice that on the waistband on my pants.

(Male, 90 years)

As this quote illustrates, they related weight gain to increased attention to diet and the alterations they made in dietary habits when using the Appetitus app. However, some participants carefully sought to maintain a steady weight.

Usually I don't eat in the evening. But I thought, I have to fill this [figure]. So I actually ate a piece of bread in the evening, just to fill the figure. But I don't want to continue with this, because I don't want to gain weight.

(Female, 95 years)

And as this quote illustrates, some participants expressed reluctance to maintain newly established habits, such as eating an evening meal or more snack meals, simply because they did not want to gain weight.

3.3 | Support from healthcare professionals added meaning and assurance when using Appetitus

Some participants experienced a change in how the healthcare professionals responsible for technical and nutrition-specific follow-up attended to their nutritional needs, with greater individual focus and more time dedicated to talking about nutrition. Those who felt that the healthcare professionals devoted greater attention to their nutrition in the follow-up saw this as an important aspect of the study.

I think it [the follow-up from the healthcare professional] was nice. Yes, and useful! And that was maybe most important, because then I didn't feel that this

was something I was doing alone. There was someone who was interested –that things were going OK.

(Female, 84 years)

As this quote illustrates, participants characterised the attention as positive and as an opportunity to share. In attending to the participants' nutritional situation, the healthcare professionals were also, in a broader sense, showing concern about their health and well-being. In contrast, several participants said that the follow-up focused mainly on technical training on the iPad and Appetitus app, with little to no discussion or knowledge sharing regarding the app's nutritional information. These participants did not reflect further on this, but emphasised that they had managed to use the app independently since it was easy to use. They also noted that it was important to be able to call a healthcare professional if they had a technical problem. This was especially the case for those with less experience with the technology and helped them to gain confidence in using Appetitus and the iPad.

4 | DISCUSSION

Many subtle, small changes in the diet, often caused by increased dependency on others and decreased appetite, can leave older adults nutritionally vulnerable and at high risk of developing undernutrition. Reduced dietary variety, prolonged overnight fasting and less snacking are examples of such dietary changes (Jadczak & Visvanathan, 2019; van der Pols-Vijlbrief et al., 2017; Tomstad et al., 2012). Our results point to how the core elements in the designs of the app, meal plan that suggests spreading the meals throughout the entire day, presentation of meals and snacks in appetite-friendly pictures, and self-assessment with direct personalised feedback, can strengthen older adults' nutrition self-care and support positive dietary changes that can prevent undernutrition development. For example, several participants included extra snack or light meal in the evening. Such reduction of the overnight fasting can be important to prevent undernutrition, especially for those struggling with early satiation and low appetite (Jadczak & Visvanathan, 2019).

Giving the user instant feedback, as the Appetitus app does, seemed to motivate some of the participants to eat and drink a little more or make slight alterations to their diet to reach personal goals. Our findings concur with other studies reporting such effects of dietary registration. In a review of mobile health interventions that promotes healthy eating, McCarroll et al. (2017) noted that self-monitoring functionality in combination with tailored feedback was important components of the most successful interventions. For those at risk of under-consuming, self-assessment can also build awareness of nutritional needs and motivate sufficient eating and drinking (Holst, Rasmussen, & Laursen, 2011; Paulsen et al., 2018).

In contrast, some users reported that they rarely reached or got close to their recommended intake goals for energy, protein and fluids. This group said that they did not alter their diet despite receiving feedback suggesting that their food and beverage intake was too low to meet their personal recommended requirements. One

possible explanation for reluctance to change is that they were confident in current dietary choices, happy with their weight or even reluctant to gain weight. Therefore, they saw no need to change. This was also reflected in the results where weight was given little attention, and weight gain was not necessarily considered positive by the participants. There is evidence that older adults may express disbelief when faced with having risk of malnutrition or being undernourished, as they do not perceive themselves as nutritionally challenged (Beelen et al., 2017; Piantadosi et al., 2015; van der Pols-Vijlbrief et al., 2017; Reimer, Keller, & Tindale, 2012). The majority of the participants in this study was at malnutrition risk or malnourished as shown by the Mini Nutritional Assessment score (Table 1). However, they all had body mass index (BMI) levels within healthy, overweight or obese ranges for adults (Findalen et al., 2012). This may explain why they were not concerned about weight changes, or in some cases reluctant to gain weight.

It is important to acknowledge that introducing changes in long-standing behavioural patterns is a complex process. For example, some participants' registrations suggested need for major changes if they should reach recommended energy and protein goals. For those who did not reach the suggested goal, this might have a demotivating effect. Moreover, it is important to consider this issue in terms of the accuracy and relevance of feedback the users received. In Appetitus, the algorithm for personalised feedback on energy, protein and fluid consumption did not adjust for other individual factors, such as activity level (Findalen et al., 2012). Another concern is that registered food and beverage consumption may not fully reflect users' actual consumption, as the app only supported registration of predefined meals and beverages. Underreporting of energy intake is a known challenge in self-reported dietary data for reasons that may include limited specificity and difficulties in estimating or remembering portion size (Subar et al., 2015). As a measure of actual energy intake, self-reported energy intake should therefore be used with caution (Subar et al., 2015).

Healthcare professionals can play a vital role in supporting Appetitus users to interpret and understand the app's information output, and in suggesting dietary alterations and give professional nutritional support if the app points towards problematic situations, for example insufficient energy intake (Farsjø et al., 2019). However, healthcare professionals acknowledge that limited nutrition knowledge, competing tasks and time restrictions are potential barriers to good nutrition practices, leading to insufficient follow-up for those in need of support (Farsjø et al., 2019; Bauer, Halfens, & Lohrmann, 2015; Chen & Allman-Farinelli, 2019; Mowe et al., 2008). Despite the untapped potential with using nutrition apps to support individualised person-centred nutrition care, the uptake of app use in clinical practice is challenged, often attributed to lack of technical infrastructure, low awareness and mixed motivation to use nutrition apps among healthcare professionals (Chen et al., 2018; Paulsen, Varsi, Paur, Tangvik, & Andersen, 2019).

With the increasing use of technology in healthcare services and everyday life, a pressing concern is that the older adults may miss out because they are less likely to use Internet and health information

technologies (Fischer, David, Crotty, Dierks, & Safran, 2014). However, recent surveys point to growth in Internet use by older adults, and studies indicate that age becomes less important if tools are easy to use and training and support is provided when introducing new technologies (Anderson & Perrin, 2017; Göransson et al., 2018; Østensen, Gjevjon, Øderud, & Moen, 2017; Vaportzis, Giatsi Clausen, & Gow, 2017). In this study, a majority of informants reported to use the app regularly for 8 weeks to register their food and beverage consumption. Technical experience and competence were not identified as a major influencer nor barrier for participants' app use. This suggests that Appetitus is easy to use, and that participants received sufficient support from the healthcare professionals during the study.

The participants' experiences with the daily recording varied, while some found it rewarding, others indicated that they were glad when the study ended because they found it tiring to record their consumption. The fact that these participants nevertheless chose to continue their participation may be explained by their feelings of obligation to follow through and to show their commitment to participation. It can also be argued that the regular follow-up by healthcare professionals was important in maintaining their involvement over time. Previous research also points out the importance of healthcare professional attention in helping older adults to engage in self-reporting as a meaningful activity (Göransson et al., 2018; Holst et al., 2011).

4.1 | Limitations

We sought to recruit a varied sample of older adults receiving home care services in Norway. However, we acknowledge that our sample is small and may represent older adults that are experiencing better health, are cognitively fit and concerned with maintaining their health and more interested in technology. This may be partially supported by participants that dropped out of the study in an early phase, pointed to increased illness burden and experiencing the recording of their diet tiring. Another limitation in this study is that degree of accuracy in the feedback from the Appetitus app was not validated prior to study.

5 | CONCLUSION

This study reports on feasibility of using technology for early intervention to strengthen nutrition self-care among nutritionally vulnerable older adults. Most participants used the self-monitoring dietary function in the app regularly for 8 weeks. Support from healthcare professionals was considered important to build confidence to use the app and experiencing it as meaningful. Based on the results from this study, we suggest that dietary awareness is reinforced when dietary intake is visualised relative to personal need for nutrients and fluids. Our study suggests that such awareness can mobilise the user to implement dietary changes to make them less nutritionally

vulnerable, hence prevent a state of undernutrition. This is a hypothesis in need of further enquiry and warrants further investigation in larger studies with experimental design.

Implications for practice

- Dietary self-assessment with direct feedback supports awareness of healthy nutrition in old age.
- Tools developed specifically for older adults can increase opportunities active participation when interacting with healthcare services.

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