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Does loneliness impact intentional weight loss? The role of obesity-related disadvantages and comorbidities

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ABSTRACT

Objective: Loneliness is increasingly recognized as a significant factor influencing health outcomes, including weight management. Nevertheless, its role in intentional weight loss remains underexplored. The 12-month digital Healthy Weight Coaching (HWC), in Finland, offers a real-world context to investigate this relationship. We explored whether baseline loneliness affects weight loss during HWC and whether comorbidities or perceived obesity-related disadvantages mediate this relationship.

Methods: Data were included from participants enrolled in the HWC between 2016 and 2020. Baseline assessments included loneliness, comorbidities, and perceived obesity-related disadvantages. Weight was self-reported weekly, with body mass index calculated from interpolated weights at three, six, nine, and 12 months. Generalized estimating equations were used to analyze the impact of baseline loneliness on weight change, and ordinary least squares regression analyses were used to analyze mediation.

Results: Participants who felt lonely, somewhat lonely, or not lonely at baseline achieved comparable weight loss. However, higher loneliness was linked to greater perceived obesity-related disadvantages, psychological distress, number of comorbidities, and lower vitality, indirectly leading to lesser weight loss.

Conclusions: Loneliness did not directly hinder weight loss but was linked to health and psychosocial challenges that may indirectly reduce success, highlighting the need for holistic support in weight management.

Trial registration: The trial is registered at clinicaltrials.gov (Clinical Trials Identifier NCT04019249).

1. Introduction

Loneliness—a persistent subjective feeling of social isolation (Cacioppo and Patrick, 2008)—affects approximately 7 % of the general middle-aged population, with Northern European countries consistently reporting the lowest prevalence compared to other regions (Surkalim et al., 2022). However, loneliness is more prevalent among individuals with obesity, as a higher body mass index (BMI) has been linked to increased loneliness (Jung and Luck-Sikorski, 2019; Rotenberg et al., 2017). In one study, loneliness was associated with a higher prevalence of overweight or obesity—61.8 % among those feeling lonely versus 53.8 % among those not reporting loneliness (Lauder et al., 2006).

Obesity and loneliness share numerous detrimental consequences at both individual and societal levels, including declines in physical and mental health (Avila et al., 2015; Dixon, 2010; Hawkley and Capitanio, 2015), and an increased risk of premature mortality (Guh et al., 2009; Holt-Lunstad et al., 2015). Research suggests that these conditions may interact synergistically, amplifying their combined negative effects on physical and emotional well-being (Jung and Luck-Sikorski, 2019).

Research on the impact of loneliness on weight loss remains limited, with existing studies focusing primarily on periods of social isolation. During the stay-at-home orders of the COVID-19 pandemic, individuals with obesity faced increased weight management challenges, with 70 % struggling with intentional weight loss due to social isolation and pandemic-related disruptions (Almandoz et al., 2020). Beyond these exceptional circumstances, loneliness has not been directly studied in

Abbreviations: BMI, Body Mass Index; GEE, Generalized Estimating Equations; HWC, Healthy Weight Coaching; IWB, Internalized Weight Bias.

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the context of intentional weight loss, yet it is linked to factors that may hinder weight management, including mental health issues, body image concerns, and physical health problems (Heiskanen et al., 2013). Conditions such as pain (Masheb et al., 2015) and low vitality (Wimmelmann et al., 2018) can further complicate weight loss efforts. Additionally, an individual's attitudes toward obesity play a role in treatment outcomes, as internalized weight bias can negatively impact weight loss efforts (Forouhar et al., 2023). Previously, we reported that greater perceived disadvantages of obesity were associated with higher levels of loneliness (Ahola et al., 2024). However, to our knowledge, no studies have examined whether comorbidities or perceived disadvantages of obesity mediate the relationship between loneliness and intentional weight loss. Understanding this relationship may help tailor more effective obesity interventions for individuals experiencing loneliness.

To investigate the complex relationship between loneliness, obesity-related disadvantages, comorbidities, and weight loss, we: 1) Examined whether baseline loneliness affects weight loss outcomes over a 12-month digital obesity care program; 2) Investigated whether comorbidities or perceived obesity-related disadvantages mediate this relationship. We hypothesized that higher baseline loneliness is associated with reduced weight loss and that the relationship between baseline loneliness and weight loss is partially mediated by comorbidities and perceived disadvantages, such that individuals with greater levels of loneliness report more comorbidities and higher perceived disadvantages, which in turn predict less weight loss.

2. Methods

2.1. Intervention

This study utilized data from participants in the Healthy Weight Coaching (HWC) program (Suojanen et al., 2020). The HWC is a 12-month real-world digital weight management program developed at the Abdominal Centre of Helsinki University Hospital, in Finland, as part of the HealthyWeightHub.fi service ("Healthvillage," 2025). The HWC program focuses on behavioral weight management, with web-administered weekly exercises covering key themes such as diet, physical activity, sleep, stress management, and mental well-being. It also incorporates elements from several therapeutic models—such as cognitive-behavioral, acceptance and commitment therapy, solution-focused therapy, and psychodynamic therapy—to promote sustainable weight loss and maintenance. The program emphasizes developing coping strategies, fostering self-reflection and self-compassion, and encouraging practical lifestyle changes.

Participants were referred to the program by licensed physicians within Finnish healthcare system. Each participant was assigned a personal coach (nurse, nutritionist, physiotherapist, or psychologist) who provided tailored, periodic one-on-one written feedback to support behavior change and weight management efforts. All coaches participated in extensive training in behavioral therapy, and followed a standardized protocol, to ensure uniform content and structure of support regardless of their backgrounds. Although each participant had a designated coach, the coaches collaborated and consulted as needed, providing consistent, high-quality support across all coaching domains. For the current analyses, we considered data from all consenting patients enrolled in the HWC between October 2016 and September 2020, who had completed a two-week trial period. We excluded patients using other weight loss methods beyond the HWC program, those who did not respond to the loneliness question at baseline, and those with missing weight data at three months.

Demographic data of age and sex were retrieved from the national register. Due to the digital nature of the program, all other data were collected online. At baseline, patients self-reported height and weight. For weight measurements, they were instructed to use a home scale and to weigh themselves in the morning after voiding. Thereafter, weekly weight measurements were encouraged, and these data were used to interpolate weight at three, six, nine, and 12 months. Interpolated weights were used to calculate BMI (kg/m^2). For three-, six-, nine-, and 12-month time points, we also calculated percent weight changes compared to baseline.

Study met the institution's guidelines for protection of human subjects concerning safety and privacy (the Ethics Committee of the Helsinki and Uusimaa Hospital District, 327/13/03/00/2015, GDPR update 587/2019). Informed consent was obtained for experimentation with human subjects.

2.2. Questionnaires

Over the course of the program, participants completed a range of questionnaires (Suojanen et al., 2020). Relevant to the current study, the following questionnaires were included.

Loneliness. Loneliness was assessed at baseline, six months, and 12 months using a single question, "Do you feel lonely?" (Luanaigh and Lawlor, 2008), with three response options: not at all (1), somewhat (2), and yes (3).

Comorbidities. Participants completed a 42-item questionnaire, at baseline, assessing the presence of various somatic and psychiatric diseases (yes/no). Additional diseases were reported in a free-text format. All comorbidities were coded based on the ICD-10 classification (World Health Organization, 1992) and the total number of comorbidities was calculated.

Perceived disadvantages of obesity. At baseline, six months, and 12 months, we assessed the perceived disadvantages of obesity using a 22-item questionnaire asking the participant to "Assess how much overweight or obesity causes [item] in your life", with items related to mental health (stress, self-esteem issues, body-image issues, shame, guilt, melancholy, sadness, depression), physical health (illness, occasional pain, constant pain, poor physical fitness), social health (loneliness, relationship issues, boredom, lack of hobbies, social withdrawal), vitality (sleep disturbances, fatigue, tiredness) and occupational issues (poor work environment, unemployment). Each item had three response alternatives (not at all = 1; to some extent = 2; very much = 3). Individual items were summed to yield a score ranging from 22 to 66, with higher scores indicating greater perceived disadvantages. For the current analyses, baseline data were used.

2.3. Statistical analyses

Baseline differences were assessed using Fisher's Exact test (for three-group comparisons) and the Chi-squared test (for two-group comparisons) for categorical variables, and one-way ANOVA (three groups) and independent samples *t*-test (two groups) for continuous variables.

Generalized estimating equations (GEE) were employed to analyze overall changes in loneliness throughout the intervention, and the impact of baseline loneliness on weight change. To minimize attrition bias, GEE incorporates all available data points and utilizes estimated means in the analysis. A gamma distribution with a log link function was used for weight change due to its positive skewness.

Exploratory factor analysis (maximum likelihood and varimax rotation) was conducted to create factors for the Perceived disadvantages of obesity -questionnaire, selecting factors with eigenvalues >1.0. Factor scores, calculated using the regression method (sum of items multiplied by their factor loadings), were used as continuous variables. The "loneliness" item from this questionnaire was not included in the factor analysis to avoid multicollinearity.

To study mediation, ordinary least squares regression analyses were utilized to examine the relationship between loneliness (antecedent variable) and weight development (outcome variable), with the number of reported comorbidities and Perceived disadvantages of obesity (the total score and the factor scores from the factor analysis-derived

disadvantages of obesity clusters) introduced as mediating variables. The mediation analyses were conducted using the PROCESS macro for SPSS Version 4.2 (Hayes, 2022), with 95 % bootstrap confidence intervals derived from 5000 random samples to assess indirect effects. Age, sex, and baseline BMI were used as confounding variables in mediation analyses.

Analyses were conducted with IBM SPSS Statistics for Mac OS, version 28.0.0.0 (IBM Corp., Armonk, NY, USA), and $p < 0.05$ was considered statistically significant. Figures were drawn with GraphPad Prism and Canva.

3. Results

3.1. Participants

The analyzed sample consisted of 1537 participants (Supplementary Fig. 1, Table 1). Those excluded were heavier (mean weight, 115 kg vs. 110 kg, $p < 0.01$; mean BMI, 40.1 kg/m^2 vs. 39.0 kg/m^2, p < 0.01) and had a higher proportion of men (20.6 % vs. 16.3 %, $p = 0.02$). Compared to those excluded, those included were older (50.6 years vs. 49.5 years, $p = 0.04$).

3.2. Association between loneliness and weight loss

Altogether, 176 (11.4 %) of the 1537 participants reported feeling lonely and 637 (41.4 %) feeling somewhat lonely (Table 1). Several characteristics differed across the loneliness categories. Of the three loneliness groups, participants who reported feeling lonely were the youngest, had the highest BMI, the greatest number of comorbidities, and the highest Perceived disadvantages of obesity score.

Overall, there was a decrease in the reported weight throughout the 12-month intervention (χ^2 648.56, df = 4, p < 0.01). In contrast, we observed no changes in the level of reported loneliness over time (χ^2 2.34, df = 4, $p = 0.67$). Notably, the three baseline loneliness groups exhibited comparable weight loss during the intervention (χ^2 6.03, df = 8, $P = 0.64$), as reflected in both absolute (Fig. 1a) and relative (Fig. 1b) weight changes. At 12 months, average relative weight loss was −4.4 % (SE = 0.68) in the "lonely" group, −3.7 % (SE = 0.78) in the "somewhat lonely" group, and − 4.3 % (SE = 1.52) in the "not lonely" group.

Table 1
Descriptive characteristics of the adult individuals with overweight or obesity ($N = 1537$) participating in the digital 12-month Healthy Weight Coaching in Finland between 2016 and 2020, by loneliness status.

	All	Loneliness status			
	1537	Yes 176 (11.4 %)	Somewhat 637 (41.4 %)	No 727 (47.2 %)	P
Age, years	50.6 (11.6)	46.9 (12.9)	49.5 (11.4)	52.5 (11.2)	<0.01
Men, %	16.3	14.2	17.5	15.7	0.52
Body mass index, kg/m^2	39.8 (6.6)	41.0 (6.8)	40.0 (6.8)	39.3 (6.3)	<0.01
Number of comorbidities[†]	5.3 (3.0)	6.2 (3.2)	5.4 (3.0)	4.9 (2.9)	<0.01
Perceived disadvantages of obesity score[‡]	40.5 (8.6)	48.9 (8.0)	41.8 (7.8)	37.4 (7.7)	<0.01

Data are shown as mean values (standard deviations) for continuous variables and percentages for categorical variables. Loneliness was assessed at baseline using a single question, "Do you feel lonely?", with three response options: not at all, somewhat, and yes. To test the differences among the three loneliness groups, One-way ANOVA (df = 2) was used for continuous variables and the Fisher-Freeman-Halton exact 2-sided test for categorical variables.

[†] Number of comorbidities total $N = 1518$.

[‡] Perceived disadvantages of obesity score total $N = 1413$.

Nevertheless, individuals self-reportedly lonely and somewhat lonely had higher average weight at all time points compared to those not lonely (Fig. 1a), indicating a persistent association between loneliness and higher body weight despite similar trajectories of weight loss.

3.3. Factor analysis on the perceived disadvantages of obesity questionnaire

Five distinct domains were identified in the factor analysis of the Perceived disadvantages of obesity questionnaire at baseline, reflecting various aspects of the obesity experience (Supplementary Table 1):

1. Psychological distress (e.g., shame, self-esteem issues, body image concerns, guilt),
2. Social life (e.g., social withdrawal, relationship issues),
3. Vitality (e.g., fatigue, tiredness),
4. Somatic health (e.g., occasional or constant pain, illness), and
5. Depressive symptoms (e.g., depression, sadness, sleep disturbances).

These factors were then used in subsequent mediation models to assess their role in explaining how loneliness may indirectly influence weight change through obesity-related mental, physical, and social burdens.

3.4. Mediating role of obesity-related disadvantages and comorbidities

Loneliness did not directly impact weight change (kg) in any of the mediation models (Table 2, c'-paths). Instead, we identified several significant indirect effects. Specifically, the total Perceived disadvantages of obesity score mediated the relationship between baseline loneliness and weight development (Effect 0.16, BootSE 0.05, 95 % CI 0.06, 0.26) (Table 2, Fig. 2a). When examining the identified factors, two domains—Psychological distress (Effect 0.11, BootSE 0.03, 95 % CI 0.04, 0.17) and Vitality (Effect 0.02, BootSE 0.01, 95 % CI 0.01, 0.04)—showed significant mediating effects (Supplementary Figs. 2 and 3). These findings indicate that individuals reporting higher levels of loneliness at baseline experienced more obesity-related psychological and vitality disadvantages, which in turn were associated with smaller weight loss (kg) during the intervention. No significant mediation was observed for the Social life, Somatic health, or Depressive symptoms factors (Table 2).

The number of baseline comorbidities mediated the relationship between loneliness and weight development (Effect 0.04, BootSE 0.02, 95 % CI 0.01, 0.08), indicating that individuals with higher levels of loneliness had more comorbidities at baseline, which in turn was associated with less weight loss (Table 2, Fig. 2b).

4. Discussion

This study is the first to examine the role of perceived loneliness on weight loss in the context of a structured digital weight management program. Despite notable differences in baseline characteristics—including age, BMI, comorbidity burden, and perceived obesity-related disadvantages—our findings reveal that loneliness did not significantly influence weight loss outcomes. Although over half of the participants reported experiencing at least some degree of loneliness, they achieved similar absolute and relative weight loss during the 12-month intervention than those who did not report loneliness.

While loneliness did not directly predict weight change, our mediation analyses revealed several meaningful indirect pathways that help explain how loneliness may still hinder weight loss efforts. Specifically, individuals who reported higher levels of loneliness also experienced more obesity-related disadvantages and a higher number of comorbidities. These factors, in turn, were each associated with less weight loss during the 12-month digital intervention. The overall Perceived disadvantages of obesity score significantly mediated the relationship

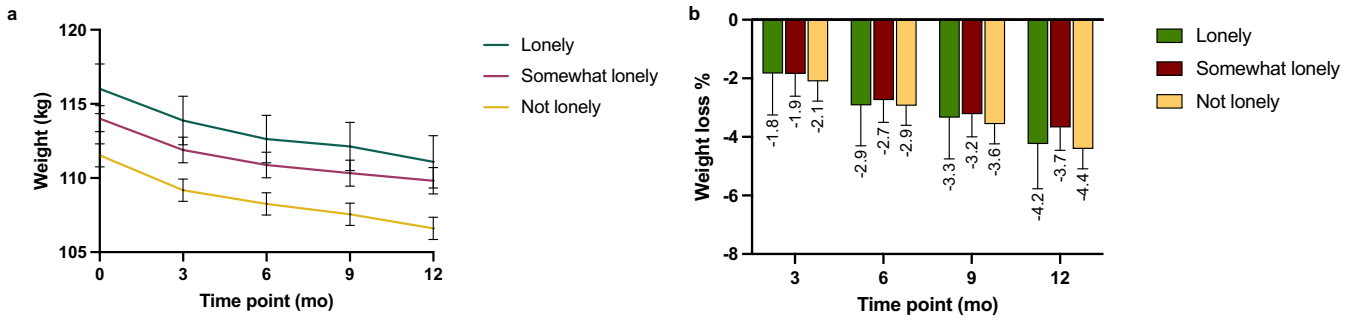

Fig. 1. Unadjusted weight changes in adults with overweight or obesity participating in the digital 12-month Healthy Weight Coaching program in Finland, by loneliness category (2016–2020).
Panel a) shows estimated mean weight trajectory; panel b) shows estimated mean percentage weight change. Analyses were conducted using General estimating equations. Values are presented with standard errors. $P = 0.33$ for both outcomes.

Table 2
Mediation of the association between baseline loneliness (X) and absolute weight change over the 12-month intervention (Y) by Perceived disadvantages of obesity (score and factors) and the number of comorbidities (M) in adult individuals with overweight or obesity participating in the digital 12-month Healthy Weight Coaching in Finland between 2016 and 2020.

Mediator	From X to M	From M to Y	Total effect	Direct effect	Indirect effect
	a-path B (SE), p	b-path B (SE), p	c-path Effect (SE), p	c'-path Effect (SE), p	a x b Effect (BootSE), LLCI, ULCI
Disadvant. obes.	5.14 (0.17), <0.01	0.03 (0.01), 0.01	0.05 (0.11), 0.63	−0.11 (0.12), 0.37	0.16 (0.05), 0.06, 0.26
$F^{Psychological\ distress}$	0.37 (0.02), <0.01	0.29 (0.09), <0.01	0.05 (0.11), 0.63	−0.05 (0.11), 0.63	0.11 (0.03), 0.04, 0.17
F^{Social}	0.43 (0.02), <0.01	−0.11 (0.09), 0.22	0.05 (0.11), 0.63	0.10 (0.12), 0.38	−0.05 (0.04), −0.13, 0.03
$F^{Vitality}$	0.09 (0.02), <0.01	0.27 (0.08), <0.01	0.05 (0.11), 0.63	0.03 (0.11), 0.63	0.02 (0.01), 0.01, 0.04
$F^{Somatic\ health}$	0.10 (0.02), <0.01	0.06 (0.11), 0.66	0.05 (0.11), 0.63	0.06 (0.11), 0.60	−0.01 (0.01), −0.02, 0.01
$F^{Depressive\ symptoms}$	0.16 (0.02), <0.01	0.17 (0.09), 0.06	0.05 (0.11), 0.63	0.03 (0.11), 0.81	0.03 (0.01), −0.01, 0.06
Comorbidities	0.77 (0.07), <0.01	0.06 (0.02), 0.02	0.08 (0.10), 0.47	0.03 (0.11), 0.77	0.04 (0.02), 0.01, 0.08

Data are presented as unstandardized regression coefficients (B) and standard errors (SE) for the a and b paths, effects and SEs for c and c' paths, and effects and bootstrap-estimated standard errors (BootSE) for the indirect effects. All analyses are adjusted for age, sex, and baseline body mass index. LLCI, lower level confidence interval; ULCI, upper level confidence interval; Disadvant. obes, Perceived disadvantages of obesity score; F, factor analysis-derived disadvantage of obesity-factor.

between loneliness and weight change, as did the Psychological distress and Vitality factors individually, highlighting the role of mental and physical energy-related burdens in this association. Additionally, the number of comorbidities also functioned as a mediator, showing that loneliness may contribute to a broader health burden that compromises treatment outcomes. These results suggest that loneliness alone does not determine weight loss in a self-motivated population, yet its link with broader psychological and physical challenges remains clinically important. Furthermore, the findings highlight the importance of addressing both psychological and physical health barriers when supporting individuals who experience loneliness in weight management interventions.

Although both our and previous studies show that loneliness is associated with higher BMI (Jung and Luck-Sikorski, 2019; Ahola et al., 2024), perceived loneliness does not appear to impact the response to a structured weight management intervention. The similar weight loss trajectories among the loneliness groups may reflect the program's ability to address these challenges. Importantly, the HWC (Suojanen et al., 2020) includes several components that may be especially beneficial for individuals experiencing loneliness. Group support and personalized coaching offer meaningful social interaction and encouragement, which may help to reduce perceived isolation and enhance motivation. According to our qualitative interview study, which explored factors supporting lifestyle changes, the personalized coaching approach was found to be crucial in fostering a sense of connection and support, particularly for participants who experienced loneliness (Joki et al., 2024). This support helped participants feel more engaged and motivated to continue with the program. Mindfulness exercises and stress reduction practices support emotional regulation and reduce avoidance-based coping strategies such as emotional eating. Encouraging participants to clarify and live according to their values can strengthen their sense of purpose and direction, while the structured nature of the program promotes routine and engagement in daily life. Finally, tools for increasing physical activity can help overcome inactivity and support both mental and physical well-being. Together, these elements may help individuals with loneliness address the challenges they face and improve their chances of successful weight loss.

The mechanisms underlying the link between obesity and loneliness are likely multifaceted and bidirectional. On one hand, loneliness may contribute to behaviors that promote weight gain, such as emotional eating, decreased physical activity, or lack of social accountability (Ahola et al., 2024; Pels and Kleinert, 2016; Sirois and Biskas, 2023). On the other hand, obesity-related stigma—manifesting through shame, guilt, and social judgment—can itself be a source of loneliness (Jung and Luck-Sikorski, 2019). Prior research has shown that individuals with obesity may exhibit lower levels of emotional trust and a reduced tendency to self-disclose (Rotenberg et al., 2017), which may lead to social withdrawal and limited social support. This complex relationship emphasizes the need to consider the unique challenges faced by individuals experiencing loneliness in weight management and further explore the aspects impacting the relationship between loneliness and weight.

Our mediation analysis highlighted psychological distress and vitality as key explanatory mechanisms linking loneliness to poorer weight loss outcomes. Our findings align with previous research showing that loneliness is a risk factor for mental health challenges—including stress, shame, body image concerns, guilt, and low self-esteem—and weight management difficulties (Doane and Adam, 2010; Felske et al., 2021; Hawkley and Capitanio, 2015; Heiskanen et al., 2013; Shrivastava and Johnston, 2010; Steptoe et al., 2004; Wei et al., 2005). These difficulties are often associated with internalized weight bias (IWB), a form of self-

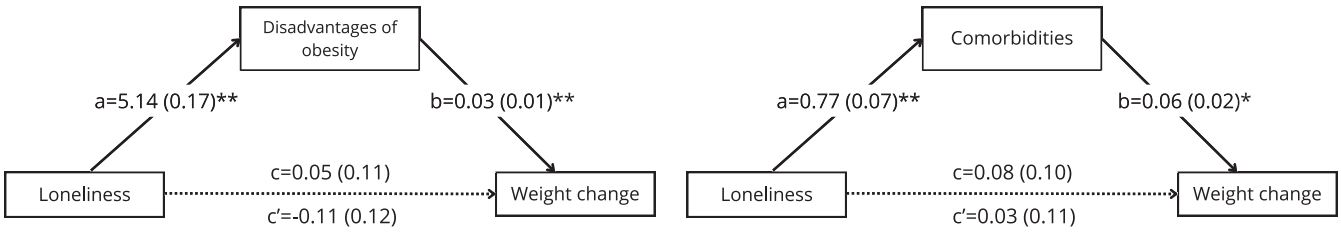

Fig. 2. Mediational models linking baseline loneliness to weight change in adults with overweight or obesity participating in the digital 12-month Healthy Weight Coaching program in Finland (2016–2020).
Panel a) mediation via perceived obesity-related disadvantages score; panel b) mediation via number of baseline comorbidities. Values represent unstandardized regression coefficients and standard errors. Significance: $*p < 0.05$, $**p < 0.01$. No total (c-path) or direct (c'-path) effects were observed.

directed stigma that can reinforce self-blame and reduce confidence in one's ability to change. IWB is known to correlate positively with loneliness and to predict poorer health outcomes and reduced success in weight loss efforts (Jung and Luck-Sikorski, 2019; Pearl and Puhl, 2018). While IWB was not directly measured in this study, the mediating effect of Psychological distress captured here may reflect this domain and its influence on treatment response. Similarly, diminished vitality, characterized by fatigue and poor sleep, may impair participants' ability to initiate and maintain physical activity or regulate eating behaviors, even within a well-supported framework. Previous research has identified vitality as a critical predictor of weight loss success in behavioral interventions (Ryan and Frederick, 1997), and our findings confirm its mediating role in this context.

Additionally, we found that comorbidities mediated the relationship between loneliness and weight loss. This aligns with broader literature indicating that loneliness is associated with chronic diseases (Liang et al., 2024). While some studies suggest comorbidities can motivate behavior change (Karmali et al., 2011), others report that they may obstruct it, particularly when multiple conditions interact to diminish energy, increase medication burden, or complicate daily routines (Masheb et al., 2015). The presence of comorbidities may amplify the difficulty of implementing lifestyle changes due to pain, fatigue, or mental strain, further complicating successful weight management for those already at higher risk.

Interestingly, not all perceived obesity-associated disadvantages mediated the relationship between loneliness and weight change. Factors related to social life, somatic health, and depressive symptoms did not significantly explain this association. One possible explanation is that the social life factor, despite its conceptual link to loneliness, may have been less relevant in the context of a digitally delivered intervention. The self-directed nature of the program may have reduced the impact of social limitations or stigma, allowing participants to engage without relying on interpersonal dynamics. For somatic health, which includes physical discomfort and pain, the lack of mediation might reflect that while such issues can complicate weight loss, they may not be strongly tied to loneliness in this sample—or may already be managed within individuals' existing coping frameworks. As for depressive symptoms, their non-significant role is somewhat surprising given their known connection to loneliness (Park et al., 2020). However, depressive symptoms may represent a broader psychological state with weaker direct ties to the specific behaviors driving weight change, compared to more proximal experiences like psychological distress or low vitality. Overall, these findings suggest that not all loneliness-related burdens are equally relevant for treatment response, highlighting the importance of identifying which psychological and physical experiences truly interfere with change.

These findings carry important clinical implications for obesity care. Screening for loneliness, psychological distress, and low vitality at the start of a weight management program could help identify individuals who may face hidden barriers to success. Given that these factors were linked to reduced weight loss, early identification allows for timely, tailored support—such as additional coaching, strategies for managing fatigue, or referrals for simultaneous symptom management. Importantly, the results also reinforce that individuals with elevated psychological or physical burdens, including those experiencing loneliness, can still benefit meaningfully from structured digital interventions when these needs are acknowledged and supported.

This study has several key strengths. It is among the first to explore the relationship between loneliness and intentional weight loss, offering novel insights into an underexamined area. The large sample size, real-world digital intervention, and 12-month follow-up enhance the study's validity and generalizability. Grounding the study in established psychological frameworks, including Acceptance and commitment therapy, further supports the relevance of the findings. However, the observational design limits causal inference, and the use of study-specific questionnaires may affect the robustness of our findings. Unmeasured factors like education and income may have influenced results, and the predominantly female, ethnically uniform sample limits generalizability to more diverse populations. Professional backgrounds of coaches were not systematically recorded during the program's early years, limiting our ability to examine the potential impact of coach expertise on participant engagement and outcomes. However, the provided training and the use of standardized protocol helped to maintain consistency in the coaching approach. Finally, while the single-item measure for loneliness allowed simplicity and feasibility within the broader digital intervention, it inherently limits capturing the multidimensional nature of loneliness, including its emotional and social components. More comprehensive and validated instruments like the UCLA Loneliness Scale (Russell, 1996) offer greater depth by assessing different facets of loneliness and improving psychometric properties. Future research should consider employing such multidimensional scales to better delineate how various aspects of loneliness relate to health outcomes, potentially enhancing measurement precision and informing targeted interventions.

Our findings highlight the importance of personalized weight loss interventions that account for the unique challenges faced by individuals with loneliness, multiple health conditions, and higher levels of obesity-related disadvantages. Future research should explore whether changes in loneliness during an intervention predict treatment outcomes, offering insights into the dynamic role of social connection in weight management. Finally, incorporating more diverse populations in future studies would improve the external validity of the findings and ensure that conclusions are applicable across different demographic groups.

5. Conclusions

This study is the first to explore the impact of perceived loneliness on weight loss within a structured digital intervention. Individuals who reported feeling lonely also had consistently higher body weight throughout the intervention period, despite similar weight loss trajectories. While loneliness did not directly affect weight outcomes, it was associated with greater psychological distress, reduced vitality, and a higher burden of comorbidities, which indirectly explained poorer

weight loss outcomes. These findings highlight the importance of addressing mental and physical health barriers in weight management, particularly among individuals experiencing loneliness. Tailored support strategies that account for these challenges may enhance the effectiveness of digital interventions and ensure more equitable outcomes across diverse psychological profiles.

CRediT authorship contribution statement

Siniriikka A. Männistö: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Anu Joki:** Writing – review & editing, Data curation. **Laura-Unnukka Suojanen:** Writing – review & editing, Project administration, Data curation. **Mikko S. Venäläinen:** Writing – review & editing, Data curation. **Kirsi H. Pietiläinen:** Writing – review & editing, Supervision, Resources, Funding acquisition, Conceptualization. **Aila J. Ahola:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization.

Ethical approval and consent to participate

All procedures were performed in compliance with relevant laws and institutional guidelines and have been approved by the appropriate institutional committee (the Ethics Committee of the Helsinki and Uusimaa Hospital District, 327/13/03/00/2015, GDPR update 587/2019). The privacy rights of human subjects have been observed and informed consent was obtained for experimentation with human subjects.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript the author used ChatGPT (OpenAI, version GPT-4) to assists with language editing, improve clarity, and refine academic phrasing. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2025.108430.

Data availability

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research, supporting data are not available.

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