



A retrospective cross-sectional study comparing health-related quality-of-life in females with lipoedema and bilateral leg lymphoedema

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ABSTRACT

Background: Lipoedema is a condition of abnormal accumulation of painful adipose tissue, usually in the lower body of women. The disproportionate subcutaneous adipose tissue may negatively impact health-related quality of life (HRQoL). There are currently no patient reported outcome measures (PROM) specifically designed to assess the HRQoL in individuals with lipoedema. The aim of this study was to compare scores on validated lower limb lymphoedema PROMs between females with lipoedema and lymphoedema.

Methods: In a private lymphoedema clinic in Australia between 1 October 2021 and 22 August 2023, individuals assigned female at birth, aged 18 years and older who consented to the entry of de-identified data into a research databank and completed the Lymphoedema Quality of Life tool (LYMQOL-leg) and/or Lymphoedema Symptoms Intensity and Distress Survey (LSIDS-L) for the legs were included in this study. Between group analysis was conducted on 151 participants who were either diagnosed with lipoedema ($N = 90$) or bilateral leg lymphoedema ($N = 61$). Participants with both conditions were excluded.

Results: Participants with lipoedema reported significantly higher burden scores for symptoms ($p = 0.003$), appearance ($p = 0.003$) and mood ($p = 0.011$) in the LYMQOL-leg survey when compared to participants with bilateral leg lymphoedema. Participants with lipoedema also reported significantly worse LSIDS-L scores for neurological sensation ($p = 0.003$), biobehavioral ($p = 0.016$) and resource ($p = 0.008$) questions compared to participants with lymphoedema.

Conclusions: This study highlights that although females with lipoedema and lymphoedema experience similar symptoms, their experiences differ in specific outcomes that influence their HRQoL. These findings warrant further investigation into the HRQoL concerns of individuals with lipoedema.

1. Introduction

Lipoedema almost exclusively affects women and is characterised by the accumulation of painful subcutaneous adipose tissue commonly presenting disproportionately in the lower body [1,2]. Lipoedema often presents during hormonal changes that accompany puberty, pregnancy and menopause [3,4]. Insufficient knowledge and awareness of

lipoedema often leads to a misdiagnosis of lymphoedema or obesity due to similarities in presentation [4]. Individuals with lipoedema sometimes experience an increased volume in their affected areas similar to individuals with lymphoedema, however in lymphoedema it is characterised by the excessive accumulation of protein-rich fluid in the interstitial space due to an impaired or dysfunctional lymphatic system [5,6]. Symptoms experienced by individuals with lymphoedema can be

Abbreviations: BMI, Body Mass Index; EORTC QLQ-C30, European Organisation of Research and Treatment for Cancer Quality of Life Questionnaire-Core 30 questions; HRQoL, Health-related quality of life; ICF, International Classification of Functioning, Disability and Health; ISL, International Society of Lymphology; KMO, Kaiser-Meyer-Olkin; LSIDS-L, Lymphoedema Symptoms Intensity and Distress Survey- Leg; LYMQOL-leg, Lymphoedema Quality of Life-Leg; PHQ-9, Patient Health Questionnaire-9; PROMs, Patient related (or reported) outcome measures; QoL, quality of life; SF-36, 36-Item Short Form Survey; WHO, World Health Organisation; WHOQOL-BREF, World Health Organisation Quality-of-Life Scale.

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accompanied with heaviness, tingling sensation, increased extremity temperature, discomfort, difficulties walking, and impaired physical and social functioning [7,8].

Changes in appearance in women with lipoedema may lead to helplessness, shame, guilt, and self-stigmatisation, and the individual may become highly dissatisfied with the appearance and function of their own body [9]. The presence of mental health issues, such as depression and internalised weight shaming, can reduce the individual's motivation to partake in daily activities [10]. Additionally, accumulation of painful adipose tissue may impact physical capacity, such as walking or participating in physical activity [10,11]. One study identified that individuals with lipoedema had a lower health-related quality of life (HRQoL), compared to the general female population, with lipoedema stage inversely related to HRQoL [12]. Improving HRQoL is an integral goal of treatment, as these physical and psychological symptoms can prompt some individuals with lipoedema to avoid professional and social activities they enjoy [13]. Although these psychological aspects are problematic, there is limited research indicating their effects on internal and external factors.

Currently, there are no lipoedema-specific patient-reported outcome measures (PROMs) to assess the HRQoL in individuals with lipoedema. PROMs are structured questionnaires that provide insight from a patient's perspective on the impact a condition has on their day-to-day lives [13]. An individual's HRQoL can be measured through PROMs and in some instances, they can be used to assess the effectiveness of treatment interventions [13]. However, condition-specific HRQoL questionnaires are sensitive compared to generic tools in assessing the HRQoL of a person with that condition [14]. Current studies reporting on HRQoL in individuals with lipoedema use generic tools such as 36-Item Short Form Survey (SF-36) and World Health Organisation Quality-of-Life Scale (WHOQOL-BREF). Studies have also used lymphoedema-specific questionnaires to measure HRQoL in individuals with lipoedema, however there is little research comparing HRQoL in individuals with lipoedema and lymphoedema using these measures [6,15]. While similar symptoms experienced by individuals with lipoedema cause them to be grouped with individuals with lymphoedema, the severity, and effect these symptoms have on their functional capacity and emotional wellness may be different [7].

The primary aim of this study was to compare HRQoL in females with bilateral lower limb lymphoedema to those with lipoedema. We aimed to assess the HRQoL and symptom severity using two different validated PROMs designed for individuals with lower limb lymphoedema in the absence of validated lipoedema-specific PROMs. Since there is a commonality in the symptom profiles of these two conditions (e.g. discomfort, heaviness and body image issues), lymphoedema-specific measures were deemed most suitable. There were also two secondary aims: 1) To determine if an association exists between the overall Quality of Life (QoL) and Lymphoedema Quality of Life- Leg (LYMQOL-leg) domain scores in females with lipoedema and their diagnosis stage, type and body mass index (BMI); and 2) To identify items within the lymphoedema-specific surveys that performed differently between females with lipoedema or lymphoedema, by examining the factor structure of each survey.

2. Methods

2.1. Participants

Previously collected baseline data from individuals who attended the Australian Lymphoedema Education, Research and Treatment (ALERT) Centre between 1 October 2021 and 22 August 2023, who were clinically confirmed to have either lipoedema of the legs or bilateral leg lymphoedema, were included in this cross-sectional retrospective study. These individuals consented for their routinely collected data to be stored and used for ethically approved research. This data is stored electronically in the REDCap data management system. Participants

from this databank were included in the study if they were assigned female at birth, aged 18 years and older, and completed either the LYMQOL-leg or Lymphoedema Symptoms Intensity and Distress Survey-Leg (LSIDS-L) online as part of their healthcare. Participants were excluded if they only had lipoedema of the arms, had leg lymphoedema alongside their lipoedema and did not complete either of the surveys. Ethical approval for the use of this retrospective data was granted by the Macquarie University Human Research Ethics Committee (52022613936765).

The clinical diagnosis of lipoedema and lymphoedema were made by medical consultants specialising in rehabilitation medicine and experienced in lymphology. Lipoedema diagnosis was confirmed based on the primary criteria of being female with the bilateral symmetrical enlargement of adipose tissue of the lower limbs [16]. A further five of the following secondary criteria were required to be evident to have a confirmed lipoedema diagnosis: pain or tenderness in the legs; a disproportionate fat distribution to the lower limbs, a negative Stemmer's sign in the toes, where the skin above the proximal phalanges on the second toe can be pinched; a family history of lipoedema; non-pitting swelling in the legs and feet assessed by firm thumb pressure of 30 s; or easy bruising in the legs; and non-response to weight loss or elevation [16,17]. The type and stage of an individual's lipoedema was classified following the Wounds UK Best Practice Guidelines [18]. Participants with lymphoedema were staged using the International Society of Lymphology (ISL) staging. The ISL stages have been published previously [19].

3. Measures

3.1. Anthropometry measures

Standard clinical measures were conducted on all participants by experienced research officers. Height and weight were recorded to the nearest 0.1 cm and 0.1 kg, respectively. Body mass index (BMI) was calculated and participants with lipoedema also underwent waist and hip circumferential measures, where waist-to-height and waist-to-hip ratio was calculated. Waist-to-hip ratios are common measures, used to identify disproportion between the torso and lower body [4]. As disproportion is a characteristic of lipoedema, only participants with lipoedema underwent waist-to-hip measures [4].

3.2. Patient reported outcome measures

The LYMQOL-leg survey, a lymphoedema-specific measure of HRQoL assesses four domains, including symptoms, body image/appearance, function, and mood. Each item is assessed using a 4-point Likert-type scale (1 = not at all, 2 = a little, 3 = quite a bit, 4 = a lot). Mean scores for each domain were calculated with lower scores indicating better HRQoL [20]. If less than 50% of the questions in a domain were answered by a participant, the domain was scored 0. Participants also scored their overall QoL on a 0 to 10 scale (0 = poor, 10 = excellent) (16). The original (40-question) and modified (27-question) published versions of the LYMQOL-leg questionnaire were analysed in this study.

The LSIDS-L questionnaire examines the intensity and distress of each reported lymphoedema symptom in the legs comprising of seven clusters including, soft tissue sensation, biobehavioural, resource, sexuality, neurological sensation, function, and activity [21]. Participants indicate the presence of a symptom through 36 'yes' or 'no' questions [21,22]. A 'yes' answer prompts subscales for intensity and distress, both rated from 1 'slight' to 5 'severe' [21,22]. Every 'no' response is scored as 0 and a 'yes' response is out of 10. A cluster score is generated by taking the average of the items scored within the cluster. A maximum of 5 missing responses are allowed for the calculation to be valid, otherwise the participant was removed from the cluster analysis.

3.3. Statistical analysis

Descriptive statistics were conducted on both groups. Using JASP software (Version 0.16.4, Netherlands) the relationship between conditions, highest level of education, marital and employment status were assessed using a chi-squared test where significance was set at $p \leq 0.05$. Independent sample *t*-tests were conducted on participant characteristics, LYMQOL-leg domains scores and LSIDS-L clusters scores. We also used independent sampled *t*-tests to analyse each of the 40 LYMQOL-leg and 36 LSIDS-L items separately. As there are currently no lipoedema-specific PROMs, an analysis of each item was conducted to identify specific characteristics contributing to the differences in domains/clusters. Normality was assessed through the Shapiro-Wilk test and the effect size was presented as Cohen's *d* ($<0.2 =$ trivial, $0.2 =$ small, $0.5 =$ moderate, $0.8 =$ large) [23]. If the variables were not normally distributed the Mann-Whitney *U* test was conducted where the effect size was given by the rank biserial correlation ($<0.01 =$ trivial, $0.1 =$ small, $0.3 =$ moderate, $0.5 =$ large) [24]. All data were expressed as mean and standard deviation. The alpha level of significance was set at $p \leq 0.05$. The internal consistency of both the LYMQOL-leg and LSIDS-L questionnaires and their domain/cluster was determined by Cronbach's alpha. Internal consistency of each subscale was analysed to ensure the items were measuring their intended constructs. To identify the reliability of these PROMs across different populations, internal consistency was conducted separately for participants with lipoedema and lymphoedema. The internal consistency is considered acceptable when Cronbach alpha >0.7 .

Multiple linear regressions were also conducted to identify if any associations exist between the overall QoL score (answered in the LYMQOL-leg) and lipoedema type and stage or LYMQOL-leg domains. We also performed a linear regression analysis on the association between BMI and domain scores from the LYMQOL-leg. Durbin-Watson checks were used for correlation between residuals to validate the tests. All data was presented as unstandardised means (B) and standard error (SE). Confidence intervals (95% CI) were also reported. The Alpha level of significance was set at $p \leq 0.05$.

Finally, exploratory factor analysis (EFA) was performed on both the lipoedema and lymphoedema group survey responses to evaluate whether survey items performed differently between participants. Kaiser-Meyer-Olkin (KMO) was used to determine if the data was suitable for factor analysis, $KMO >0.80$. The EFA was performed only for the Modified LYMQOL-leg. Extraction was performed through Unweighted Least Squares factor extraction, chosen as normal distribution is not assumed. Oblimin rotation with Kaiser Normalisation was used and the factor loading was assessed with a cut off set at 0.3. After examining factors through both scree plots and eigenvalues, it was concluded that the original four factor structure suggested by the developers was most appropriate for this data set [20]. Reliability analysis using Cronbach's alpha was conducted for each factor. The EFA and internal consistency analysis were performed using IBM SPSS (version 27.0, Armonk, NY).

4. Results

4.1. Participant demographics

Ninety females diagnosed with lipoedema and sixty-one females diagnosed with bilateral leg lymphoedema were assessed for study inclusion. Four participants with lymphoedema and another participant with lipoedema did not complete the LYMQOL-leg questionnaire, however all participants completed the LSIDS-L questionnaires and were included in this study. Item completion varied across both LYMQOL-leg and LSIDS-L questions, due to missing or 'prefer not to answer' responses.

Participant characteristics are presented in Table 1. Participants with lymphoedema were significantly older when compared to those with

Table 1
Lipoedema and lymphoedema participant characteristics.

Characteristics	Lymphoedema (n = 61) Mean ± SD (range)	Lipoedema (n = 90) Mean ± SD (range)	t	p-value
Age (years)	55.2 ± 16.9 (19–87)	48.4 ± 14.1 (19–82)	−2.689	0.008
BMI	33.0 ± 10.7 (20–56)	34.6 ± 7.8 (19.3–56.8)	3205.0	0.081*
Height (cm)	163.4 ± 6.3 (146–180)	163.1 ± 6.9 (147–182)	−0.357	0.722
Weight (kg)	87.7 ± 27.8 (52–162)	92.0 ± 20.5 (51.9–140.3)	3210.0	0.078*
Waist Circumference (cm)		93.2 ± 15.2 (65–138)		
Hip Circumference (cm)		121.2 ± 17.2 (75–167)		
Waist/Hip Ratio		0.8 ± 0.1 (0.6–1.4)		
Waist/Height Ratio		0.6 ± 0.1 (0.4–0.9)		
Current employment status (Number (%))				
Casual	0 (0)	1 (1.1)		
Employed full time	20 (32.8)	30 (33.0)		
Employed part time	3 (4.9)	13 (14.3)		
Full time carer	3 (4.9)	0 (0)		
Homemaker	1 (1.6)	2 (2.2)		
Maternity leave	1 (1.6)	0 (0)	$\chi^2(11) = 17.24$	0.101
On disability support	1 (1.6)	4 (4.4)		
Retired	16 (26.2)	16 (17.6)		
Self employed	6 (9.8)	2 (2.2)		
Student	2 (3.3)	2 (2.2)		
Unemployed	3 (4.9)	6 (6.6)		
No answered	5 (8.2)	13 (14.3)		
Marital status (Number (%))				
Living with partner	6 (9.8)	12 (13.3)		
Married	34 (55.7)	36 (40)		
Separated/divorced	4 (6.6)	8 (8.9)		
Single	11 (18.0)	18 (20)		
Widowed	5 (8.2)	7 (7.8)	$\chi^2(4) = 2.34$	0.674
No answer	1 (1.6)	9 (10)		
Highest level of education completed (Number (%))				
Diploma	9 (14.8)	11 (12.1)		
Less than Year 10	1 (1.6)	1 (1.1)		
Postgraduate degree	13 (21.3)	11 (12.1)		
Undergraduate degree	14 (23.0)	22 (24.2)		
Year 10	4 (6.6)	2 (2.2)		
Year 11	2 (3.3)	2 (2.2)		
Year 12	6 (9.8)	10 (11.0)	$\chi^2(6) = 2.91$	0.820
No answer	12 (19.7)	32 (35.2)		

Bold: Significant difference between the groups ($p < 0.05$). *Indicates the Mann-Whitney U test was used due to violation of normality assumptions, where the test statistic (t) = W. BMI: body mass index, cm: centimetres, kg: kilograms, n: number of participants, SD: standard deviation, t: test statistic, %: percentage.

lipoedema ($p = 0.008$, $d = -0.45$). Lipoedema and lymphoedema specific characteristics are shown in Table 2. Participants with lipoedema and lymphoedema had varying types. Stage 2 was the most common ISL stage, with 80% of lymphoedema participants within this stage.

Table 2
Lipoedema and Lymphoedema type and stage.

Characteristics	Lipoedema (n = 90) Mean ± SD n(%)
Lipoedema stage	
Stage 1	13 (14.4)
Stage 2	43 (47.8)
Stage 3	34 (37.8)
Lipoedema type	
Type I	19 (21.1)
Type II	22 (24.4)
Type III	40 (44.4)
Type v	9 (10.0)
	Lymphoedema (n = 61) Mean ± SD n (%)
Primary lymphoedema	30(49.2)
Secondary cancer related lymphoedema	17(27.9)
Secondary non-cancer related lymphoedema	14(23)
ISL Stage	2.0 ± 0.4
ISL Stage 1	7(11.5)
ISL Stage 2	49(80.3)
ISL Stage 3	5(8.2)

n: number, SD: standard deviations, ISL: International Society of Lymphology.

Table 3
LYMQOL-leg overall QoL and domain scores for participants with lipoedema and lymphoedema.

Questions	Group	N	Mean ± SD	W	p-value
Overall, how would you rate your quality of life at present?	Lym	57	5.65 ± 2.06	2651.0	0.644
	Lip	89	5.82 ± 1.87		
Domain scores					
Function domain score	Lym	57	1.90 ± 0.82	2636.0	0.691
	Lip	89	1.91 ± 0.75		
Modified Function domain score	Lym	58	1.90 ± 0.78	2484.0	0.787
	Lip	88	1.89 ± 0.75		
Symptoms domain score	Lym	57	1.80 ± 0.57	3265.5	0.003
	Lip	89	2.11 ± 0.61		
Modified Symptoms domain score	Lym	58	1.90 ± 0.64	3158.0	0.015
	Lip	88	2.15 ± 0.61		
Mood domain score	Lym	57	2.01 ± 0.79	3167.0	0.011
	Lip	89	2.36 ± 0.80		
Modified Mood domain score	Lym	58	2.01 ± 0.79	3181.0	0.012
	Lip	88	2.36 ± 0.81		
Appearance domain score	Lym	57	2.39 ± 0.77	3274.0	0.003
	Lip	89	2.82 ± 0.75		
Modified Appearance domain score	Lym	58	2.50 ± 0.81	3295.0	0.003
	Lip	88	2.93 ± 0.75		

Note: A higher score = a worse outcome. All results are reported from Mann-Whitney U test due to violations of normality. Question: ‘Overall, how would you rate your quality of life at present?’ a higher score = a better outcome. Bold: Significant difference between the groups ($p < 0.05$). *Italics*: Moderate or large effect size between groups. Lip: lipoedema, Lym: lymphoedema, N: number of participants, SD: standard deviations, W: test statistic.

4.2. HRQoL outcomes from LYMQOL-leg survey

Non-parametric results of the LYMQOL-leg analysis are presented in Table 3, as the normality assumptions were not met. Participants with lipoedema scored significantly worse in the appearance ($p = 0.003$, $r_B = 0.29$), symptoms ($p = 0.003$, $r_B = 0.29$) and mood domain score ($p = 0.011$, $r_B = 0.25$) with a small effect size, when compared to those with lymphoedema. The overall QoL scores when asked, how do you rate your quality of life at present, were not significant when comparing participants, with a trivial effect size ($p = 0.644$, $r_B = 0.05$). The internal consistency for the LYMQOL-leg can be found in Table 4. The overall internal consistency of the LYMQOL-leg was very strong (lipoedema $\alpha = 0.953$ and lymphoedema $\alpha = 0.954$). Full analysis of the LYMQOL-leg questionnaire is presented in Supplementary Table S1.

4.3. HRQoL outcomes from LSIDS-L survey

Table 5 shows the results of the LSIDS-L analyses, with an extended analysis in Supplementary Table S2. Non-parametric tests were reported due to normality violations. The neurological sensation ($p = 0.003$, $r_B = 0.29$), biobehavioural ($p = 0.016$, $r_B = 0.23$) and resource ($p = 0.008$, $r_B = 0.29$) cluster score was significantly worse in participants with lipoedema compared to participants with lymphoedema, with small effect sizes. The internal consistency for the LSIDS-L is shown in Table 4. The overall internal consistency of the questionnaire was very strong (lipoedema $\alpha = 0.922$ and lymphoedema $\alpha = 0.933$). However, the Cronbach alpha scores varied across the seven clusters, with scores ranging from 0.657 to 0.839 for participants with lipoedema and 0.512 to 0.895 for participants with lymphoedema showing some unreliability.

4.4. Associations between HRQoL and participant characteristics

The multiple linear regression analysis in Table 6 indicated that lipoedema stage and type, were significantly associated with the overall perceived QoL score, $R^2 = 0.195$, $F(2,87) = 10.55$, $p < 0.001$. The lipoedema stage was the only independent predictor of QoL, with a lower lipoedema stage associated with a better QoL score ($B = -1.10$, $SE = 0.26$, $p < 0.001$, 95% CI = -1.63 to -0.58). The model predicting the association of LYMQOL domain scores and BMI was significant ($R^2 = 0.218$, $F(5,140) = 7.81$, $P < 0.001$). A higher BMI was significantly associated with a worse appearance domain score ($B = 2.91$, $SE = 1.08$,

Table 4
The internal consistency of the LYMQOL-leg and LSIDS-L questionnaires.

Questionnaire	Domain/ Cluster	Lipoedema Consistency (α)	Lymphoedema Consistency (α)
LYMQOL-leg	Total	0.953	0.954
	Function	0.947	0.935
	Symptoms	0.863	0.902
	Mood	0.896	0.883
	Appearance	0.902	0.889
LYMQOL-leg Modified	Total	0.931	0.933
	Function	0.916	0.886
	Symptoms	0.730	0.734
	Mood	0.896	0.883
	Appearance	0.895	0.890
LSIDS-L	Total	0.922	0.933
	Soft tissue sensation	0.796	0.895
	Neurological sensation	0.839	0.861
	Function	0.701	0.731
	Biobehavioural	0.778	0.819
	Resource	0.702	0.759
	Sexuality	0.667	0.512
	Activity	0.657	0.635

LYMQOL-leg: Lymphoedema quality of life for the leg. LSIDS-L: Lymphoedema symptoms intensity and distress for the leg. α : Cronbach alpha coefficient.

Table 5
LSIDS cluster analysis for participants with lipoedema and lymphoedema.

Clusters	Group	N	Mean ± SD	W	p-value
Soft tissue sensation	Lym	61	4.84 ± 2.86	2341.5	0.154
	Lip	89	4.15 ± 2.34		
Neurological sensation	Lym	61	1.88 ± 2.22	3526.0	0.003
	Lip	90	2.67 ± 2.22		
Function	Lym	59	1.45 ± 2.62	2885.5	0.159
	Lip	87	1.71 ± 2.39		
Biobehavioral	Lym	58	2.87 ± 2.12	3222.0	0.016
	Lip	90	3.67 ± 1.90		
Resource	Lym	46	3.26 ± 3.48	2157.0	0.008
	Lip	73	4.97 ± 3.39		
Sexuality	Lym	58	3.24 ± 2.66	2959.5	0.132
	Lip	89	3.96 ± 2.83		
Activity	Lym	58	2.88 ± 3.04	2972.0	0.116
	Lip	89	3.56 ± 2.88		

Note: A higher score = a worse outcome. All results are reported from Mann-Whitney U test due to violations of normality. Bold: Significant difference between the groups ($p < 0.05$). *Italics*: Moderate or large effect size between groups. Lip: lipoedema, Lym: lymphoedema, N: number of participants, SD: standard deviations, W = test statistic.

$p = 0.008$, 95% CI = 0.77 to 5.05), function domain scores ($B = 2.51$, $SE = 1.24$, $p = 0.045$, 95% CI = 0.056 to 4.96) and perceived overall QoL score ($B = -1.26$, $SE = 0.43$, $p = 0.004$, 95% CI = -2.10 to -0.42). Through a multiple linear regression analysis of the participants perceived QoL was significantly associated with LYMQOL-leg domain scores, $R^2 = 0.328$, $F(4,141) = 17.19$, $P < 0.001$. A significantly better QoL score was associated with a better mood ($B = -0.83$, $SE = 0.22$, $p < 0.001$, 95% CI = -1.23 to -0.40) and function score ($B = -1.05$, $SE = 0.23$, $p < 0.001$, 95% CI = -1.50 to -0.59).

4.5. Exploratory factor analysis of LYMQOL-leg survey

Bartlett's test of sphericity was significant when analysing the modified LYMQOL-leg survey completed by participants with either lipoedema or lymphoedema ($X^2 = 2545.02$, $df = 325$, $p < 0.001$) and were sufficiently sampled ($KMO = 0.86$), indicating that EFA was appropriate. Supplementary Table S3 displays the loadings for the four factors of the LYMQOL-leg survey. The obtained factor structure of questions related to appearance, function and mood were equivalent to the developers. One question had a small cross loading, while 4 questions did not load into their anticipated factors with symptom questions performing the worst. The internal consistency for the symptoms factor

Table 6
Association of participant characteristics and QoL in women with lipoedema and lymphoedema.

Model	N	R ²	p-value	Unstandardised coefficients		Standardised coefficients	t	p-value	95% CI for B	
				B	SE	β			Lower	Upper
QoL, Lip Type + Stage	Lip: 90	0.195	<0.001							
Lip Stage				-1.104	0.262	-0.407	-4.209	<0.001	-1.625	-0.583
Lip Type				0.228	0.160	0.137	1.422	0.159	-0.091	0.546
BMI + LYMQOL Domains	Lip: 89 Lym: 57	0.218	<0.001							
Function				2.510	1.241	0.214	2.022	0.045	0.056	4.964
Appearance				2.911	1.082	0.253	2.692	0.008	0.773	5.050
Symptoms				-0.549	1.654	-0.037	-0.332	0.741	-3.818	2.721
Mood				-2.134	1.146	-0.192	-1.862	0.065	-4.399	0.131
Overall QoL				-1.256	0.425	-0.269	-2.956	0.004	-2.095	-0.416
QoL + LYMQOL Domains				Lip: 89 Lym: 57	0.328	<0.001				
Function	-1.046	0.230	-0.416				-4.551	<0.001	-1.500	-0.592
Appearance	0.113	2.14	0.046				0.527	0.599	-0.311	0.537
Symptoms	0.215	0.327	0.068				0.658	0.512	-0.432	0.863
Mood	-0.830	0.216	-0.348				-3.841	<0.001	-1.258	-0.403

Bold: Significant difference between the groups ($p < 0.05$). B: unstandardised coefficients, BMI: body mass index, β: standardise coefficients, CI: confidence interval, Lip: Lipoedema, Lym: lymphoedema, LYMQOL: lymphoedema quality of life, N: number of participants, R²: coefficient of determination, SE: standard error, t: test statistic, QoL: quality of life. Note: QoL, Lip Type + Stage analysis included individuals with lipoedema only.

was below satisfactory ($\alpha = 0.567$).

Neither exploratory factor analyses conducted on the modified LYMQOL-leg survey for participants with lipoedema or lymphoedema produced a positive definite, therefore the Bartlett's test of sphericity could not be calculated. Supplementary Table S4 displays the factor loadings for participants with lipoedema. The obtained factor structure of questions related to function and mood were equivalent to the developers, however two functions questions cross loaded into other factors. Symptoms questions performed the worst, with three questions failing to load when significance was set at >0.30 and another question loaded into the incorrect factor. Internal consistencies of the displayed factors ranged from 0.829 (symptoms) to 0.946 (appearance). Supplementary Table S5 displays the factor loadings of the modified LYMQOL-leg survey for participants with lymphoedema. Seven items cross-loaded and 4 loaded on opposing factors. Internal consistencies of the displayed factors ranged from 0.863 (symptoms) to 0.918 (function). A small sample size hinders the accuracy of these exploratory factor analyses.

5. Discussion

This study compared the QoL of females with lipoedema and lymphoedema, highlighting clear differences between the two conditions in relation to their respective HRQoL concerns. Although similarities in appearance and symptoms may lead to misdiagnosis of lipoedema as lymphoedema, little is documented comparing the QoL of individuals living with these conditions. Our analysis highlights differences in experiences and concerns of females living with lipoedema when compared to females with lymphoedema. Females with lipoedema had a higher burdensome score in relation to their symptoms, appearance and mood. They also identified a higher impact on biobehavioural, neurological sensation and resource aspects compared to females with lymphoedema. These HRQoL concerns need to be acknowledged to improve the QoL of individuals living with lipoedema.

A positive focus on body image, as represented by body appreciation, is evident when an individual respects and accepts their own bodies and its ability to function, while rejecting unrealistic body standards [25,26]. A strong body appreciation can have a protective effect against adverse impacts of societal expectations [25,26]. Through our analysis participants with lipoedema were concerned about how they look as they struggle to find clothes that fit and would like to wear. This highlighted a lack of confidence in their appearance, confirmed through a worse biobehavioural and resource score in the LSIDS-L and appearance domain score in the LYMQOL-leg survey. Our study also identified that a

higher BMI was associated with a greater burdensome appearance score. The significantly low self-esteem present in individuals with lipoedema could be highly attributed to fat shaming stigmatisation [12,27]. As lymphoedema is widely known to be either primary resulting from a malformation at birth, or secondary cause by lymph node surgery, radiation or a consequence of trauma, individuals with lymphoedema may experience greater support and guidance through diagnosis and management [26,28,29]. In contrast, the exact aetiology of lipoedema is unknown and due to their body shape, increased BMI and lack of knowledge by health professionals and the general public, individuals with lipoedema may experience fat stigmatisation [4,30,31]. This then creates a barrier for effective lipoedema treatment and diagnosis as their concerns are not taken seriously by some health care professionals [12,32,33]. Through our analysis of the LSIDS-L survey participants with lipoedema highlighted a higher frustration with insurance cover, with a significantly worse biobehavioural score. Currently in Australia, there are no private health fund rebates for individuals with lipoedema, as it is not considered a medical condition. The expressed lack of self-confidence, appearance concerns and their disappointment with the current lipoedema health care is highly detrimental to their ability to accept and adapt to living with their condition, decreasing their HRQoL.

An individual's negative experience with fat stigmatisation affects their overall health and well-being [30]. Mental health conditions such as eating disorders, depression, fatigue and low self-esteem have been identified as highly prevalent amongst individuals with lipoedema, which is detrimental to their HRQoL [32]. Similarly, these findings were observed in our analysis as participants with lipoedema scored questions related to mood significantly worse than participants with lymphoedema. Participants with lipoedema noted feeling irritable, tense, depressed, and presented difficulties sleeping and concentrating on tasks. An online survey ($N = 98$) of Polish women with lipoedema using the Patient Health Questionnaire-9 (PHQ-9) reported that 59.2% of participants reported experiencing depressive symptoms [31]. Another study analysed 1298 surveys to determine the experiences of physical and mental health across stages of lipoedema [32]. In this survey, 40% of participants reported depressive symptoms and individuals with stage 3–4 were significantly more likely to report depressive symptoms compared to stages 1–2 and individuals with an unknown lipoedema stage [32]. Unlike our study these studies included self-diagnosed participants along with confirmed lipoedema diagnosed participants, with 41% of individuals in one of the studies identifying to be diagnosed with both lymphoedema and lipoedema [32]. These results are concerning; however, it is difficult to conclude lipoedema alone is the cause. A pilot study of 45 women diagnosed with lipoedema, identified that most participants included in the study had severe psychological symptoms for several months prior to developing lipoedema-related pain [34]. Although our study highlighted depressive feelings to be a concerning factor for participants with diagnosed lipoedema, these feelings cannot be attributed to lipoedema itself. Our analysis also identified that a lower burdensome mood score was associated with a better QoL score. Therefore, it is important that the psychological health of individuals with lipoedema is assessed to allow for improvements to be made to their HRQoL.

Individuals with lipoedema can experience difficulties performing daily activities, that can cause physical distress and reduce the individual's motivation [10]. Interestingly in our participants with lipoedema their functional capacity was not significantly different when compared to individuals with lymphoedema, however they did highlight that they struggled to go up and down stairs. In comparison to ground-level walking, climbing stairs requires a larger range of knee flexion [35]. Peak external knee flexion moment is required when stair climbing, increasing the demand placed on the quadricep muscles [36]. One study found Individuals with lipoedema had up to a 30% decrease in quadricep muscle strength than individuals with obesity [10]. Decreased quadricep muscle strength in participants with lipoedema could potentially contribute to the difficulties experienced while using stairs

compared to participants with lymphoedema, as reduced shock absorption, dissipating joint loading, and high articular contact stress are consequences of muscle weakness [37]. Although overall function presented no significant differences, our analysis showed that a less burdensome functional score was associated with a better QoL score. Further research to evaluate the muscle strength of individuals with lipoedema is needed, as muscle strength highly influences the ability to perform functional tasks required in day-to-day activities. Early recognition of the functional limitations in individuals with lipoedema would encourage physical activity regimes to improve physical function and enhance HRQoL [10].

Individuals with lipoedema usually experience pain and heaviness in their lower body, decreasing their ability to perform daily activities [4,12,31,38]. The severity of symptoms varies amongst individuals, however, all have a direct impact on QoL [38]. Our analysis showed that participants with lipoedema reported higher amounts of pain in their legs, hips, and back compared to participants with lymphoedema. A scoping review using the ICF framework found that individuals with lipoedema experience persistent or chronic pain, which has notable effects on themselves, their families, and their social and professional environments [11]. Similarly, in our study participants with lipoedema reported worse pain scores and worse scores in the effect lipoedema has on their relationships with other people and their main support. This highlights that the focus should be on managing pain experienced by individuals with lipoedema. Reducing pain may allow them to participate in social activities they usually avoid, therefore helping to decrease lipoedema's negative impact on their relationships. Participants with lipoedema also demonstrated a significantly worse neurological sensation score compared to participants with lymphoedema, reporting achiness and pins and needles in their legs. This correlates with previously reported allodynic and neuropathic pain in the affected tissue, unique from symptoms experienced by individuals with obesity or lymphoedema [6]. Our study has indicated that providing individuals with lipoedema strategies to manage the severity of their symptoms may help improve their HRQoL, by improving their social environment.

Although both the LYMQOL-leg and LSIDS-L are valid and reliable tools to measure QoL and symptom severity, they are lymphoedema-specific PROMs. A recent validation study has shown good reliability and validity of the LYMQOL in individuals with lipoedema, however validation is yet to be assessed within an English-speaking population [39]. These Lymphoedema-specific, along with generic HRQoL PROMs currently lack appropriate content validity identifying their relevance, comprehensiveness and comprehensibility within a lipoedema population. Our analysis showed one question from the LYMQOL-leg and another from the LSID survey presented significantly lower burdensome scores in individuals with lipoedema compared to lymphoedema. These items were: does the swelling affect your leisure activities/ social life and in the past week have you experienced tightness in your leg(s). These results likely reflect condition-specific differences, as not all individuals with lipoedema experience swelling or increased leg volume, which can lead to tightness in the limbs [1,5]. These results highlight the importance of conducting content validity on these PROMs within the lipoedema population to identify the relevance of survey items. Strong content validity could be achieved through feedback from a sufficient sample of individuals living with lipoedema and healthcare professionals working with these individuals. The lack of a valid lipoedema-specific PROM impacts best practice in lipoedema management and should be a focus on future research helping to strengthen and monitor the HRQoL in individuals with lipoedema. For this reason, we conducted a factor analysis to explore the structure of the items in the LYMQOL-leg survey when it was completed by participants with lipoedema. The factorial structure of the modified LYMQOL-leg was similar to the developers in relation to function and mood, suggesting these questions may be valid for individuals with lipoedema [20]. Although participants with lipoedema indicated a worse symptom score compared to participants with lymphoedema, symptom questions performed poorly within

the structure. However, as the questionnaire was developed for individuals with lymphoedema these questions may not be an accurate representation of symptoms present in individuals with lipoedema. Interestingly 70% of the symptoms questions that participants with lipoedema scored significantly worse than participants with lymphoedema were not in the modified LYMQOL-leg survey and therefore were not analysed through our factor analysis. This suggests that the original symptom questions, although were not deemed constructive for individuals with lymphoedema they may be relevant to those individuals who have lipoedema [20]. Although the structure shows promise the authors highlight that this analysis was conducted with an insufficient sample size and the results can only be taken as a guide for future studies as they are inconclusive. This data can be used to form ideas to help develop a much-needed PROM for individuals with lipoedema.

This study presents several limitations. As previously stated, questions conveyed in these questionnaires may not be correctly addressing concerns related to lipoedema. Although an emerging validation study has shown good reliability and validity of the LYMQOL in individuals with lipoedema, it was conducted in a German population [39]. Further validation of the LYMQOL and LSIDS, including assessment of content validity in an Australian lipoedema population, is needed to confirm the PROMs reliability and validity. A potential weakness of this study is that all included participants were individuals who presented at a single private clinic, which may have reduced the generalisability of the results. Due to the retrospective design of this study, causality cannot be inferred from reported associations. Individuals with lipoedema were younger than those with lymphoedema and may have had additional comorbidities. Both factors could influence HRQoL outcomes and should be accounted for in future research. The final limitation is the absence of a control group. Following studies should consider these limitations to help strengthen our understanding of QoL in females with lipoedema.

6. Conclusion

This study compared the HRQoL of females with lipoedema and bilateral leg lymphoedema, using lymphoedema-specific PROMs. No significant differences were presented in overall QoL between females with lipoedema and lymphoedema. However, females with lipoedema scored significantly worse in mood, biobehavioural, resource, appearance, symptoms and neurological sensation domains when analysing both the LYMQOL-leg and LSIDS-L leg surveys. These findings highlight that females with lipoedema experience concerns related to their HRQoL that are separate from those experienced by females with lymphoedema. Further research into the HRQoL in individuals with lipoedema is encouraged to strengthen awareness and help construct a lipoedema-specific PROM to further identify and ultimately improve the QoL for individuals living with lipoedema.

CRediT authorship contribution statement

Rhiannon Stellmaker: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Belinda Thompson:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Helen Mackie:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Vincent Singh Paramanandam:** Writing – review & editing, Methodology, Formal analysis. **Kerry A. Sherman:** Writing – review & editing. **Louise Koelmeyer:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

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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:

Louise Koelmeyer reports financial support was provided by the Lipedema Foundation. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychores.2026.112562>.

Data availability

The datasets that support the study findings are not publicly available due to privacy and ethical restrictions. The data is available from the corresponding author on reasonable request.

References

- [1] T. Bertsch, G. Erbacher, R. Elwell, H. Partsch, International consensus document: lipoedema: a paradigm shift, *J. Wound Care* 29 (Sup11b) (2020) 1–51, <https://doi.org/10.12968/jowc.2020.29.Sup11b.1>.
- [2] K.L. Herbst, et al., Standard of care for lipoedema in the United States, *Phlebology* 36 (10) (2021) 779–796, <https://doi.org/10.1177/02683555211015887>.
- [3] J.R.M. Romeijn, M.J.M. de Rooij, L. Janssen, H. Martens, Exploration of patient characteristics and quality of life in patients with lipoedema using a survey, *Dermatol. Ther.* 8 (2) (2018) 303–311, <https://doi.org/10.1007/s13555-018-0241-6>.
- [4] M. Czerwinska, J. Teodorczyk, R. Hansdorfer-Korzon, A scoping review of available tools in measurement of the effectiveness of conservative treatment in lipoedema, *Int. J. Environ. Res. Public Health* 19 (12) (2022), <https://doi.org/10.3390/ijerph19127124>.
- [5] R. Stellmaker, B. Thompson, H. Mackie, L. Koelmeyer, Comparison of fluid and body composition measures in women with lipoedema, lymphoedema, and control participants, *Clin. Obes.* 14 (4) (2024), <https://doi.org/10.1111/cob.12658>.
- [6] F. Angst, S. Lehmann, A. Aeschlimann, P.S. Sandor, S. Wagner, Cross-sectional validity and specificity of comprehensive measurement in lymphedema and lipoedema of the lower extremity: a comparison of five outcome instruments, *Health Qual. Life Outcomes* 18 (1) (2020) 1–12, <https://doi.org/10.1186/s12955-020-01488-9>.
- [7] E. Duygu, Y. Bakar, I. Keser, An important tool in lymphedema management: validation of Turkish version of the patient benefit index-lymphedema, *Lymphat. Res. Biol.* 18 (1) (2020) 49–55, <https://doi.org/10.1089/lrb.2018.0036>.
- [8] P. Klermas, A. Johnsson, V. Horstmann, K. Johansson, Health-related quality of life in patients with lymphoedema - a cross-sectional study, *Scand. J. Caring Sci.* 32 (2) (2018) 634–644, <https://doi.org/10.1111/scs.12488>.
- [9] J.E. Dudek, W. Białaszek, P. Ostaszewski, Quality of life in women with lipoedema: a contextual behavioral approach, *Qual. Life Res.* 25 (2) (2016) 401–408, <https://doi.org/10.1007/s11136-015-1080-x>.
- [10] J. van Esch-Smeenge, R.J. Damstra, A.A. Hendrickx, Muscle strength and functional exercise capacity in patients with lipoedema and obesity: a comparative study, *J. Lymphoedema* 12 (1) (2017) 27–31.
- [11] L.M. Kloosterman, A. Hendrickx, A. Scafoglieri, H. Jager-Wittenaar, R. Dekker, Functioning of people with lipoedema according to all domains of the international classification of functioning, disability and health: a scoping review, *Int. J. Environ. Res. Public Health* 20 (3) (2023), <https://doi.org/10.3390/ijerph20031989>.
- [12] J. Falck, B. Rolander, A. Nygardh, L.L. Jonasson, J. Martensson, Women with lipoedema: a national survey on their health, health-related quality of life, and sense of coherence, *BMC Womens Health* 22 (1) (2022) 457, <https://doi.org/10.1186/s12905-022-02022-3>.

- [13] L.M. Beelen, A.M. van Dishoeck, E. Tsangaris, M. Coriddi, J.H. Dayan, A.L. Pusic, A. Klassen, D. Vasilic, Patient-reported outcome measures in lymphedema: a systematic review and COSMIN analysis, *Ann. Surg. Oncol.* 28 (3) (2021) 1656–1668, <https://doi.org/10.1245/s10434-020-09346-0>.
- [14] K. Churrua, C. Pomare, L.A. Ellis, J.C. Long, S.B. Henderson, L.E.D. Murphy, C. J. Leahy, J. Braithwaite, Patient-reported outcome measures (PROMs): a review of generic and condition-specific measures and a discussion of trends and issues, *Health Expect.* 24 (4) (2021) 1015–1024, <https://doi.org/10.1111/hex.13254>.
- [15] J. Lundanes, F. Sandnes, K.H. Gjeilo, P. Hansson, S. Salater, C. Martins, S. Nymo, Effect of a low-carbohydrate diet on pain and quality of life in female patients with lipedema: a randomized controlled trial, *Obesity (Silver Spring)* 32 (6) (2024) 1071–1082, <https://doi.org/10.1002/oby.24026>.
- [16] L.E. Wold, E.A. Hines Jr., E.V. Allen, Lipedema of the legs; a syndrome characterized by fat legs and edema, *Ann. Intern. Med.* 34 (5) (1951) 1243–1250, <https://doi.org/10.7326/0003-4819-34-5-1243>.
- [17] A.B. Halk, R.J. Damstra, First Dutch guidelines on lipedema using the international classification of functioning, disability and health, *Phlebology* 32 (3) (2017) 152–159, <https://doi.org/10.1016/j.jvsv.2017.04.012>.
- [18] Best Practice Guidelines, The Management of Lipoedema, Wounds UK, London, 2017.
- [19] The Diagnosis and Treatment of Peripheral Lymphedema, 2023 consensus document of the International Society of Lymphology, *Lymphology* 56 (4) (2023) 133–151, <https://doi.org/10.2458/lymph.6372>.
- [20] V. Keeley, S. Crooks, J. Locke, D. Veigas, K. Riches, R. Hilliam, A quality of life measure for limb lymphoedema (LYMQOL), *J. Lymphoedema* 5 (1) (2010).
- [21] S.H. Ridner, J.K. Doersam, D.P. Stollendorf, M.S. Dietrich, Development and validation of the lymphedema symptom intensity and distress survey-lower limb, *Lymphat. Res. Biol.* 16 (6) (2018) 538–546, <https://doi.org/10.1089/lrb.2017.0069>.
- [22] D.P. Stollendorf, M.S. Dietrich, S.H. Ridner, Symptom frequency, intensity, and distress in patients with lower limb lymphedema, *Lymphat. Res. Biol.* 14 (2) (2016) 78–87, <https://doi.org/10.1089/lrb.2015.0027>.
- [23] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*, Taylor & Francis Group: United Kingdom, 1988.
- [24] M.A. Gross-Sampson, *Statistical Analysis in JASP a Guide for Students 5 ed.*, Vol. 0.16.1, 2022.
- [25] C. Sullivan-Myers, K.A. Sherman, A.P. Beath, M.J.W. Cooper, T.J. Duckworth, Body image, self-compassion, and sexual distress in individuals living with endometriosis, *J. Psychosom. Res.* (2023) 167, <https://doi.org/10.1016/j.jpsychores.2023.111197>.
- [26] R. Andrew, M. Tiggemann, L. Clark, The protective role of body appreciation against media-induced body dissatisfaction, *Body Image* 15 (2015) 98–104, <https://doi.org/10.1016/j.bodyim.2015.07.005>.
- [27] J. Falck, K. Herbst, B. Rolander, A. Nygårdh, L.L. Jonasson, J. Mårtensson, Health-related stigma, perceived social support, and their role in quality of life among women with lipedema, *Health Care Women Int.* (2025) 1–19, <https://doi.org/10.1080/07399332.2025.2499487>.
- [28] L.C. Ward, in: S.A.S. Arin, K. Greene, Håkan Brorson (Eds.), *Bioelectrical Impedance Spectrometry for the Assessment of Lymphoedema: Principles and Practice*, 1 ed., Switzerland Springer, Cham, 2015 <https://doi.org/10.1007/978-3-319-14493-1>.
- [29] M. Naouri, M. Samimi, M. Atlan, E. Perrodeau, C. Vallin, G. Zakine, L. Vaillant, L. Machet, High-resolution cutaneous ultrasonography to differentiate lipedema from lymphoedema, *Br. J. Dermatol.* 163 (2) (2010) 296–301, <https://doi.org/10.1111/j.1365-2133.2010.09810.x>.
- [30] J.A. Krems, S.L. Neuberger, Updating Long-held assumptions about fat stigma: for women, body shape plays a critical role, *Soc. Psychol. Personal. Sci.* 13 (1) (2022) 70–82, <https://doi.org/10.1177/1948550621991381>.
- [31] J.E. Dudek, W. Białaszek, M. Gabriel, Quality of life, its factors, and sociodemographic characteristics of polish women with lipedema, *BMC Womens Health* 21 (1) (2021) 27, <https://doi.org/10.1186/s12905-021-01174-y>.
- [32] C. Clarke, J.N. Kirby, T. Smidt, T. Best, Stages of lipoedema: experiences of physical and mental health and health care, *Qual. Life Res.* 32 (1) (2023) 127–137, <https://doi.org/10.1007/s11136-022-03216-w>.
- [33] J. Falck, A. Nygårdh, B. Rolander, L.L. Jonasson, J. Mårtensson, Dealing with lipoedema: women's experiences of healthcare, self-care, and treatments—a mixed-methods study, *BMC Womens Health* 25 (1) (2025) 171, <https://doi.org/10.1186/s12905-025-03707-1>.
- [34] T. Bertsch, G. Erbacher, Lipoedema – myths and facts part 1, *Phlebologie* 47 (02) (2018) 84–92, <https://doi.org/10.12687/phleb2411-2-2018>.
- [35] A. Protopapadaki, W.I. Drechsler, M.C. Cramp, F.J. Coutts, O.M. Scott, Hip, knee, ankle kinematics and kinetics during stair ascent and descent in healthy young individuals, *Clin. Biomech. (Bristol)* 22 (2) (2007) 203–210, <https://doi.org/10.1016/j.clinbiomech.2006.09.010>.
- [36] J. Lewis, G. Freisinger, X. Pan, R. Siston, L. Schmitt, A. Chaudhari, Changes in lower extremity peak angles, moments and muscle activations during stair climbing at different speeds, *J. Electromyogr. Kinesiol.* 25 (6) (2015) 982–989, <https://doi.org/10.1016/j.jelekin.2015.07.011>.
- [37] L. Chen, J.J.Y. Zheng, G. Li, J. Yuan, J.R. Ebert, H. Li, J. Papadimitriou, Q. Wang, D. Wood, C.W. Jones, M. Zheng, Pathogenesis and clinical management of obesity-related knee osteoarthritis: impact of mechanical loading, *J. Orthop. Transl.* 24 (2020) 66–75, <https://doi.org/10.1016/j.jot.2020.05.001>.
- [38] R. Hansdorfer-Korzon, M. Czerwińska, J. Teodorczyk, J. Szamotulska, Assessment of lipoedema awareness among polish women- online survey study, *BMC Womens Health* 23 (1) (2023) 1–457, <https://doi.org/10.1186/s12905-023-02614-7>.
- [39] J. Mahler, V. Keeley, D. Obed, A. Bingöl, P.M. Vogt, C. Hadamitzky, Validation of the lymphedema quality of life questionnaire for German patients with lipedema, *Lymphat. Res. Biol.* 23 (6) (2025) 346–351, <https://doi.org/10.1177/15578585251382110>.