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Quality of life following aesthetic liposuction: A prospective outcome study☆

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Summary *Background:* The authors' previous research suggested the hypothesis that aesthetic surgery in general has a positive impact on quality of life (QoL). This prospective study aimed to investigate the indication-specific effect on QoL in patients undergoing aesthetic liposuction. To our knowledge, no other prospective study has been conducted using standardised and validated questionnaires with a comparable return rate and sample size.
Methods: Sixty-four patients underwent aesthetic liposuction. Forty-two patients met the inclusion criteria, and 38 of them answered one set of questionnaires preoperatively and the follow-up set at six months post-operatively. The testing instrument included a self-developed, indication-specific questionnaire and four standardised and validated questionnaires with German norm data available: Questions on Life Satisfaction, Modules (FLZ^{M}, German version), the Freiburg Personality Inventory-Revised (FPI-R), the Rosenberg Self-Esteem Scale (RSES) and the Patient Health Questionnaire (PHQ-4).

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Results: Our self-developed indication-specific questionnaire showed high satisfaction with the postoperative results. The FLZ^{M} demonstrated significant improvements for all modules, concerning life in general ($p = 0.02$), health ($p = 0.04$) and body image ($p = 0.02$). Moreover, the FPI-R revealed a significant improvement in emotional stability ($p < 0.01$). Moreover, the PHQ-4 showed a significant reduction in overall psychological distress ($p = 0.03$) and anxiety ($p = 0.01$).

Conclusion: Liposuction had significant impact on QoL. The surgery led to a higher satisfaction not only with the result of intervention and the outer appearance specifically but also with life and the state of health generally. It improved emotional stability and reduced anxiety. Therefore, the authors' hypothesis in a previous research was confirmed for this specific indication prospectively.

Introduction

In contemporary society, beauty and physical appearance are continuously gaining importance. The Greek philosopher Plato recognised long ago that 'beauty is a natural superiority'. Yet, the actual ideal of beauty displays a fundamental component of the present society. The desire to be attractive and the wish to match the prevailing ideal of beauty are important for many people. Unrealistic ideals portrayed by the media are mainly unattainable for most people in a natural way. Because of this, the demand for aesthetic plastic surgery and elective procedures is continuously increasing. Patients take the risk of possible complications such as infections and wound healing disorders to improve not only their body image but also their life in general.

Presently, liposuction is one of the most frequently performed procedures in aesthetic plastic surgery. In Germany, it was the most commonly performed aesthetic surgery for both women ($n = 5847$) and men ($n = 1189$) in 2016.[1] In this context, patients´ postoperative satisfaction and changes in quality of life (QoL) are important parameters for the evaluation of surgical success.

For decades, the concept of QoL has been gaining importance not only in medical literature but also in healthcare in general.[2] This derives to some extent from the World Health Organization (WHO) defining health as a 'state of complete physical, mental and social well-being and not merely the absence of disease'.[3] QoL is a complex and multidimensional construct and involves psychological and physical health, as well as social, economic, environmental and cultural aspects.[4]

Our study was designed to specifically evaluate QoL after aesthetic liposuction in a prospective setting.

Patients and methods

This prospective outcome study was designed at the Department of Plastic Surgery and Hand Surgery, Technical University of Munich, Germany. Between June 2015 and April 2018, 64 patients undergoing aesthetic liposuction in different areas of the body were asked to participate in this study. Twenty-four patients rejected their participation, as they perceived the questionnaires as too private and time-consuming. Therefore, they were excluded. A total of 42 patients fulfilled the inclusion criteria, resulting in an inclusion rate of $42/64 = 66\%$. Thirty-eight out of possible 42 patients completed both sets of questionnaires at T0 and T1. The return rate concerning included patients was high and amounted to $38/42 = 90\%$. The overall return rate for all patients undergoing aesthetic liposuction during this time reached $38/64 = 59\%$. Only patients who paid for the procedure by themselves were included. Patients suffering from lipoedema, gynaecomastia or any other medical indication for liposuction were excluded from this study. Patients with lipoedema were examined within another study of our research group. Patients not answering the questionnaires both at T0 and at T1 or patients with missing postoperative availability were also excluded.

Additionally, there was no financial interest for our patients to take part in the study. The study did not affect the surgical procedure itself. Power-assisted liposuction (PAL) using tumescent local anaesthesia (TLA) was performed by the same surgical team in all cases.

The study consisted of two sets of questionnaires. Patients received the preoperative questionnaires (time 0) personally during their last appointment before the surgery. Six months later, the second set of questionnaires was also handed out personally or mailed to the patients. Patients who did not respond within two weeks were reminded by phone or email according to our study protocol in a neutral manner. Questionnaires were returned by an average of 6.4 months after the surgery. Our universityś ethics committee authorised the study (approval number 252/14 TUM). All authors adhered to the Declaration of Helsinki and to the STROBE guidelines at all times.

Questionnaires

The testing instrument of this prospective study comprised a set of questionnaires with a self-developed, indication-specific part and, in addition, the following four standardised and validated questionnaires: FLZ^{M}, FPI-R, RSES and PHQ-4. The questionnaires were completed by the participants preoperatively (time 0) and six months postoperatively (time 1).

1. S*elf-developed indication-specific questionnaire for liposuction.* This questionnaire includes questions on personal data, regarding age, weight, education, profession, family status and health condition. In addition, it evaluates patients´ situation before and after the

treatment concerning expectations, satisfaction with the result, effects and complications of the procedure.

2. *Questions on Life Satisfaction, Modules (FLZ^M, German version)*. The FLZ^M was developed at the Department of Psychosomatic Medicine of our university by Herschbach and Henrich. It measures patients´ subjective life satisfaction. It is used in various studies as patients´ scores can be compared to German norm data (general life satisfaction: $n = 2534$, health satisfaction: $n = 2218$).[5] The questionnaire is composed of three modules concerning general life satisfaction, health-related satisfaction and satisfaction with the outer appearance, i.e. body image. Relevant aspects for those three modules are assessed regarding the subjective importance and the subjective satisfaction on a five-tier scale (scales 1–5). The weighted satisfaction (WS) can be calculated using the following formula: WS (weighted satisfaction) = (importance − 1) × (2 × satisfaction − 5), resulting in scores from −12 up to +20 for each item.[6] Moreover, there is a sum score for each module, which represents the global satisfaction in the respective area of life.
3. *Freiburg Personality Inventory-Revised (FPI-R)*. The FPI-R is a psychological testing method that uses a questionnaire to display certain dimensions of personality.[7] German norm data are available ($n = 3740$)[7] and can be compared with patients´ outcome.

   The entire FPI-R contains 138 items in ten different standard scales (12 items each) and two additional scales (14 items each).[7] In this study, we focus on the subscale 'emotionality' (FPI-R N: emotionality/neuroticism) comprising 14 items, which can be answered with 'agree' (1 point) or 'disagree' (0 points). The achieved sum score is converted into stanines using 14 standardised age- and gender-specific tables. Lower sum scores represent a higher life satisfaction, emotional stability, self-esteem and calmness.[7]

4. *Rosenberg Self-Esteem Scale (RSES)*. The RSES[8] is an internationally used questionnaire in medical literature measuring a personś self-esteem. Norm data were published for a total of 53 nations (total: $n = 16{,}998$, Germany: $n = 782$). In this study, we compared with the German norm data.[9] Participants assess a total of 10 items, which include five positively worded and five negatively worded statements. The responses are measured on a scale from 'strongly disagree' (1 point) to 'strongly agree' (4 points). Negative statements are evaluated vice versa. Following this, the sum score ranges from 10 to 40. Scores above 30 were an indicator for 'high self-esteem' in previous studies.[9]
5. *Patient Health Questionnaire (PHQ-4)*. The PHQ-4 is a brief questionnaire with available German norm data ($n = 5003$)[10] assessing depressive disorders and anxiety. It is composed of a depression scale (PHQ-2)[11] and an anxiety scale (GAD-2),[12] consisting of two items each. Patients were asked to rate how often they have been bothered by certain problems on a scale from 'not at all' (0 points) to 'nearly every day' (3 points) during the last two weeks. This results in a total score ranging from 0 to 12, which represent general psychological distress (0-2 = none, 3-5 = mild, 6-8 = moderate, 9-12 = severe). Moreover, scores of ≥3 in each subscale represent a cut-off threshold for probable existence of depressions or anxiety disorders.[13]

Statistical analysis

Statistical analysis was performed using SPSS 25.0 (SPSS, Inc. Chicago, IL). We employed unpaired (comparison of sample at T0 or T1 vs norm data) and paired (comparison of sample at T0 vs T1) sample t-tests and set the level of statistical significance to a maximum of 5% ($p < 0.05$). Given that for some data the normal distribution hypothesis was rejected in Kolmogorov–Smirnov and/or Shapiro–Wilk tests, results of all statistical comparisons of T0 vs T1 were additionally tested with the non-parametric Wilcoxon signed-rank test for paired samples. In the vast majority of cases, the results of the Wilcoxon signed-rank tests were in line with the results of the paired t-tests as presented in the tables. Any differences are highlighted in the text, and results of Wilcoxon signed-rank tests are available upon request.

Results

Self-developed indication-specific questionnaire

The study group consisted of 32 women and 6 men. The mean patient age was 37.82 ± 11.85 years (ranging from 19 to 64 years). The mean body mass index (BMI) of our patients was 24.65 ± 4.01 kg/m^2 (range, 18.62 to 33.66 kg/m^2); hence, the majority of patients were considered having normal weight. The correction of the waist, belly, lateral and medial thigh was the predominant procedure, comprising more than 50% of the cases. The main reasons for seeking liposuction were the wish to be 'more content with oneś own bodily appearance' (86.5%) and feeling more attractive (86.5%). Most patients preoperatively reported on 'difficulties in choosing suitable clothes'. A total of 28.9% of patients in our study group underwent other aesthetic procedures before, on average 2.09 surgeries. The overall burden following liposuction was moderate and was rated 4.8 on a scale from 0 to 10. Moreover, we observed that 47.4% of our patients perceived the burden 'as high as expected' and 36.8% as 'higher than expected'. Postoperative local complications that occurred most frequently were 'swelling' (50.0%), 'hardening' (36.8%) and 'paraesthesia' (34.2%), and severe complications did not occur. Surprisingly, 28.9% of our patients did not report any complications at all. There was a high postoperative satisfaction of our patients with the overall result, rated 7.7 on a scale from 0 to 10. In most cases, postoperative benefits were 'feeling more attractive' (76.3%), 'having less difficulties in finding the right clothes' (73.7%) and 'being more satisfied with oneś own bodily appearance' (68.4%). Many patients were more satisfied with their physical fitness (27.0%) and their sex life (18.4%) and social life (15.8%). In addition to this, some patients reported an increase in their occupational capacitance (5.3%). A total of 52.6% perceived their QoL in general as 'improved' after liposuction. The majority

Table 1 Questions on Life Satisfaction, Modules (FLZ^M): general life satisfaction.

	Norm data 2001			Study group T0			*t*-Test T0 vs norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Friends	2536	8.08	6.33	37	6.22	6.29	(1.79)	0.08	
Hobbies	2531	6.31	6.26	37	5.59	6.66	(0.65)	0.52	
Health	2524	8.06	7.51	37	8.38	7.97	0.24	0.81	
Income	2537	6.49	7.27	37	9.03	6.35	2.41	0.02	*
Work	2462	5.45	7.30	37	7.57	5.92	2.15	0.04	*
Living conditions	2533	8.33	6.40	37	9.81	7.70	1.16	0.25	
Family life	2519	9.84	6.94	37	10.19	8.11	0.26	0.80	
Partner relationship	2509	7.90	7.69	37	6.24	7.98	(1.26)	0.22	
Sum score	2534	60.49	37.31	37	63.03	32.77	0.47	0.64	
	Norm data 2001			Study group T1			*t*-Test T1 vs norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Friends	2536	8.08	6.33	37	9.11	6.37	0.98	0.34	
Hobbies	2531	6.31	6.26	37	8.14	6.80	1.63	0.11	
Health	2524	8.06	7.51	37	11.05	7.45	2.42	0.02	*
Income	2537	6.49	7.27	37	9.81	5.64	3.54	0.00	*
Work	2462	5.45	7.30	37	7.70	6.15	2.20	0.03	*
Living conditions	2533	8.33	6.40	37	9.57	8.24	0.91	0.37	
Family life	2519	9.84	6.94	37	9.68	8.96	(0.11)	0.91	
Partner relationship	2509	7.90	7.69	37	8.57	9.39	0.43	0.67	
Sum score	2534	60.49	37.31	37	73.62	33.58	2.36	0.02	*
	Study group T0			Study group T1			*t*-Test T1 vs. T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Friends	37	6.22	6.29	37	9.11	6.37	3.24	0.00	*
Hobbies	37	5.59	6.66	37	8.14	6.80	2.18	0.04	*
Health	37	8.38	7.97	37	11.05	7.45	1.87	0.07	
Income	37	9.03	6.35	37	9.81	5.64	0.97	0.34	
Work	37	7.57	5.92	37	7.70	6.15	0.13	0.90	
Living conditions	37	9.81	7.70	37	9.57	8.24	(0.23)	0.82	
Family life	37	10.19	8.11	37	9.68	8.96	(0.56)	0.58	
Partner relationship	37	6.24	7.98	37	8.57	9.39	1.95	0.06	
Sum score	37	63.03	32.77	37	73.62	33.58	2.51	0.02	*

This table provides summary statistics for the Standardised Self-Assessment on Life Satisfaction (FLZ). Norm data from Henrich and Herschbach[6] and the study group at T0 and T1 are shown. Two-tailed *t*-tests for the equality of mean values are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs norm data/paired *t*-test for the comparison of T1 vs T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level).

of our study group assessed their general state of health pre-operatively as 'good' (57.9%), whereas postoperatively, it was mainly assessed as 'very good' (50.0%). A total of 84.2% would decide on the same operation 'certainly' (55.3%) or 'quite likely' (28.9%) again and 80.9% would recommend it 'certainly' (42.1%) or 'quite likely' (38.8%) to a friend under similar circumstances.

Questions on life satisfaction questionnaire

Compared to German norm data, satisfaction with the items 'income' and 'work' was significantly higher at all times. Postoperative scores for 'health' ($p = 0.02$) and life in general (sum score, $p = 0.02$) were significantly higher when compared with the German norm data. Comparing pre- and post-operative results of our patients, the module 'General Satisfaction' showed postoperatively a significant increase in satisfaction with 'friends' ($p < 0.01$), 'hobbies' ($p = 0.04$) and life in general (sum score, $p = 0.02$). Note that the result for 'hobbies' is slightly insignificant at the 5% level ($p = 0.053$), while the result for 'health' is significant at the 5% level ($p = 0.034$) when using the Wilcoxon signed-rank test (Table 1).

Regarding the second module, 'Satisfaction with Health', the results for the items 'fitness' ($p = 0.04$), 'ability to relax' ($p \leq 0.01$) and 'energy' ($p = 0.01$) were below the German norm data before the procedure. After the surgery, there was no significant difference anymore concerning these items. We found statistically significant higher satisfaction with the items 'mobility' (T0 and T1: $p \leq 0.01$) and 'independence from assistance' (T0: $p = 0.02$, T1:

Table 2 Questions on Life Satisfaction, Modules (FLZ[M]): Satisfaction with Health.

	Norm data 2001			Study group T0			*t*-Test T0 vs norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Fitness	2220	8.09	7.01	37	5.76	6.41	(2.19)	0.04	*
Ability to relax	2214	7.40	6.50	37	3.57	6.78	(3.41)	0.00	*
Energy	2215	9.14	6.53	37	6.30	6.35	(2.70)	0.01	*
Mobility	2210	9.07	6.96	37	12.86	6.90	3.31	0.00	*
Vision and hearing	2217	11.03	7.03	37	12.86	7.34	1.51	0.14	
Freedom from anxiety	2204	8.10	6.71	37	7.08	6.86	(0.90)	0.38	
Freedom from aches and pains	2217	9.10	7.39	37	8.38	6.92	(0.63)	0.53	
Independence from assistance	2215	12.45	6.72	37	14.92	6.29	2.37	0.02	*
Sum score	2218	74.39	41.54	37	71.73	35.28	(0.45)	0.65	
	Norm data 2001			Study group T1			*t*-Test T1 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Fitness	2220	8.09	7.01	37	8.32	6.80	0.20	0.84	
Ability to relax	2214	7.40	6.50	37	6.27	7.98	(0.86)	0.40	
Energy	2215	9.14	6.53	37	8.70	7.65	(0.35)	0.73	
Mobility	2210	9.07	6.96	37	13.19	7.25	3.43	0.00	*
Vision and hearing	2217	11.03	7.03	37	12.27	7.54	0.99	0.33	
Freedom from anxiety	2204	8.10	6.71	37	9.70	7.28	1.33	0.19	
Freedom from aches and pains	2217	9.10	7.39	37	10.65	7.91	1.18	0.24	
Independence from assistance	2215	12.45	6.72	37	14.84	6.58	2.19	0.03	*
Sum score	2218	74.39	41.54	37	83.95	42.42	1.36	0.18	
	Study group T0			Study group T1			*t*-Test T1 vs T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Fitness	37	5.76	6.41	37	8.32	6.80	1.99	0.05	
Ability to relax	37	3.57	6.78	37	6.27	7.98	2.93	0.01	*
Energy	37	6.30	6.35	37	8.70	7.65	1.98	0.06	
Mobility	37	12.86	6.90	37	13.19	7.25	0.26	0.80	
Vision and hearing	37	12.86	7.34	37	12.27	7.54	(0.77)	0.44	
Freedom from anxiety	37	7.08	6.86	37	9.70	7.28	1.89	0.07	
Freedom from aches and pains	37	8.38	6.92	37	10.65	7.91	1.69	0.10	
Independence from assistance	37	14.92	6.29	37	14.84	6.58	(0.11)	0.92	
Sum score	37	71.73	35.28	37	83.95	42.42	2.16	0.04	*

This table provides summary statistics for the Standardised Self-Assessment on Life Satisfaction (FLZ). Norm data from Henrich and Herschbach[6] and the study group at T0 and T1 are shown. Two-tailed *t*-tests for the equality of mean values are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs norm data/paired *t*-test for the comparison of T1 vs T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level.

$p = 0.03$) before and after the surgery than the norm population. This could possibly derive from the higher average age (46.0 years) of the norm population.[5] In addition to that, our study group had significantly higher scores for the point value 'ability to relax' ($p = 0.01$) and the sum score ($p = 0.04$) post liposuction. Note that the result for 'fitness' is also significant at the 5% level ($p = 0.043$) when using the Wilcoxon signed-rank test (Table 2).

Considering the results of the third module 'Satisfaction with Body Image', there was a significantly higher satisfaction with liposuction-relevant body areas such as 'abdomen' ($p = 0.01$), 'waist' ($p < 0.01$), 'hips' ($p < 0.01$) and 'thighs' ($p < 0.01$) post-procedure. Moreover, our patients were significantly more satisfied with their 'weight' ($p = 0.01$) and their outer appearance in general (sum score, $p = 0.02$) after liposuction (Table 3).

Freiburg Personality Inventory

In comparison with the general German population, our study patients were both pre- and post-operatively emotionally more stable. The Freiburg Personality Inventory revealed a significant improvement in emotional stability after the surgery ($p < 0.01$) (Table 4).

Rosenberg Self-Esteem Scale

The results of the Rosenberg Self-Esteem Scale illustrated a significantly higher self-esteem of our study group than German norm data before ($p = 0.05$) but not after ($p = 0.09$) liposuction. Pre- (33.47) and post-operative (33.34) results in measurements of self-esteem were both considered high,

Table 3 Questions on Life Satisfaction, Modules (FLZ^M): Satisfaction with Body Image.

	Study group T0			Study group T1			*t*-Test T1 vs T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Hair	37	7.46	6.85	37	6.73	7.69	(0.59)	0.56	
Ears	37	7.95	5.49	37	7.95	6.02	-	1.00	
Eyes	37	11.38	5.91	37	10.35	6.68	(1.05)	0.30	
Nose	37	7.27	5.40	37	7.62	6.08	0.36	0.72	
Mouth	37	10.89	6.05	37	10.95	6.62	0.05	0.96	
Teeth	37	11.00	7.04	37	11.22	6.96	0.21	0.84	
Facial hair	37	6.73	5.86	37	5.92	7.65	(0.65)	0.52	
Chin/neck	37	6.05	6.28	37	6.62	6.63	0.60	0.56	
Shoulders	37	5.76	5.56	37	6.51	6.04	0.75	0.46	
Breasts	37	3.97	7.61	37	4.68	6.80	0.66	0.51	
Abdomen	37	(0.73)	8.01	37	4.38	8.83	2.81	0.01	*
Waist	37	0.68	8.73	37	6.89	8.39	3.45	0.00	*
Hips	37	(0.35)	8.33	37	6.97	8.32	3.94	0.00	*
Penis/vagina	37	6.59	5.82	37	7.59	7.07	0.98	0.33	
Bottom	37	2.70	8.07	37	5.22	7.46	1.73	0.09	
Thighs	37	(0.81)	9.06	37	6.57	8.34	4.38	0.00	*
Feet	37	5.22	6.29	37	4.95	5.55	(0.29)	0.77	
Hands	37	8.00	6.86	37	8.73	6.44	0.98	0.33	
Skin	37	9.24	6.56	37	9.16	7.26	(0.08)	0.94	
Body hair	37	6.62	6.70	37	5.81	7.59	(0.61)	0.55	
Height	37	5.68	7.43	37	6.92	7.61	1.58	0.12	
Weight	37	1.27	8.30	37	4.57	6.30	2.82	0.01	*
Sum score	37	122.57	75.89	37	156.30	102.27	2.45	0.02	*

This table provides summary statistics for the Standardised Self-Assessment on Life Satisfaction (FLZ). The study group is shown at T0 and T1. Two-tailed *t*-tests for the equality of means are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs. norm data/paired *t*-test for the comparison of T1 vs. T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level).

while no significant alteration in patients´ self-esteem could be detected post-surgery (Table 5).

Patient Health Questionnaire

At time 0, our patients reached a total score of 2.71, which is significantly higher than German norm data ($p = 0.02$) and suggests mild psychological distress. Examining the anxiety subscale, a significantly higher value than that in the normal population was detected ($p = 0.01$). After performing liposuction, no more differences to the normal population could be determined. The total score showed a significant reduction to 1.74 ($p = 0.03$) postoperatively, which implies the disappearance of psychological distress. Additionally, a significant decrease in the anxiety subscale was shown after the body contouring procedure ($p = 0.01$) (Table 6).

Discussion

In previous studies of our research group with a focus on aesthetic plastic surgery, an increase in QoL following aesthetic procedures could be identified.[14-20] When assessing the success of a treatment, QoL displays an important criterion in addition to the objective clinical outcome. Attention should be paid to the fact that QoL is subjective and multidimensional. To evaluate the complex construct of QoL, standardised and widely accepted testing instruments have to be used. Simple but differentiated methods are preferred.[21] Hence, we employed an extensive and diverse set of validated questionnaires in our investigation. Psychometric quality criteria such as objectivity, reliability, validity, specificity and sensitivity are essential elements of reliable QoL tools.[22] Reliability and validity of the RSES, FLZ^M and PHQ-4 are considered high in various international samples.[5,10,23,24] The FPI-R provides high objectivity, validity and good reliability.[7]

When using QoL-measuring instruments, generic and indication-specific tools are differentiated. The standardised and validated questionnaires used in this study are generic and generally applicable for all procedures in plastic, reconstructive and aesthetic surgery. Indication-specific aspects are not represented sufficiently in generic QoL tools. Hence, we evaluated important liposuction-relevant and individual factors in our self-developed questionnaires. Nevertheless, it would be desirable from an academic perspective if a standardised liposuction-specific questionnaire was developed. Another interesting measuring instrument is the Body-QoL®.[25,26] This recently developed questionnaire did not exist in German language at the time of the start of our prospective study.

Our patients' demographic data including age and BMI, which were found to be normal on average, were in line with the data of previous studies.[27-29] The rate of severe complications following liposuction is relatively low and ranges

Table 4 Freiburg Personality Inventory (FPI-R) – emotional stability.

	T0			
Stanine	1-2	3-7	8-9	Total
Category	Stable	Normal	Unstable	
N	4	31	3	38
%-share	11%	82%	8%	100%
	T1			
Stanine	1-2	3-7	8-9	Total
Category	Stable	Normal	Unstable	
N	9	29	-	38
%-share	24%	76%	-	100%

	Norm data 2001			Study group T0			*t*-Test T0 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	3740	5.78	3.68	38	5.03	1.98	(2.30)	0.03	*
	Norm data 2001			Study group T1			*t*-Test T1 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	3740	5.78	3.68	38	4.05	2.10	(5.00)	0.00	*
	Study group T0			Study group T1			*t*-Test T1 vs. T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	38	5.03	1.98	38	4.05	2.10	(3.75)	0.00	*

This table provides summary statistics for the Freiburg Personal Inventory (FPI-R) with regard to the emotional stability scale. Stanine-categorisation and norm data from Fahrenberg et al.[7] and the study group at T0 and T1 are shown. Two-tailed *t*-tests for the equality of mean values are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs. norm data/paired *t*-test for the comparison of T1 vs. T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level.

Table 5 Rosenberg Self-Esteem Scale (RSES).

	Norm data 2005			Study group T0			*t*-Test T0 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	782	31.73	4.71	38	33.47	5.10	2.06	0.05	*
	Norm data 2005			Study group T1			*t*-Test T1 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	782	31.73	4.71	38	33.34	5.58	1.75	0.09	
	Study group T0			Study group T1			*t*-Test T1 vs. T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	38	33.47	5.10	38	33.34	5.58	(0.16)	0.88	

This table provides summary statistics for the Rosenberg Self-Esteem Questionnaire (RSES). Norm data from Schmitt and Allik[9] and the study group at T0 and T1 are shown. Two-tailed *t*-tests for the equality of means are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs. norm data/paired *t*-test for the comparison of T1 vs. T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level).

from 0.7% to 1.4% according to existing literature, with the majority of patients showing local and reversible complications.[27,30-32] Overall, liposuction is a well-tolerated treatment inducing moderate burden.[28,30,33]

The findings of this prospective outcome study reaffirmed the positive impact aesthetic surgery has on QoL. Our findings showed that aesthetic liposuction significantly improves not only body image ($p = 0.02$) but also the satisfaction with life in general ($p = 0.02$). The high satisfaction of our study group with the surgical result is similar to the results of previous studies.[28,30,33-35] The surgery has a positive influence on emotional well-being and leads to significantly higher emotional stability ($p < 0.01$). In addition, we observed a significant reduction of mental distress ($p = 0.03$) and anxiety ($p = 0.01$). The postoperative psychological benefits shown in our study were also in line with findings of other studies.[34,36] In addition to these psychological benefits a variety of physical effects were displayed. Following the procedure, improvements of physical fitness, sexuality and occupational capacitance were shown. Furthermore, our patients´ satisfaction with their status of health ($p = 0.04$) and 'ability to relax' ($p = 0.01$) improved

Table 6 Patient Health Questionnaire (PHQ-4).

	Norm data 2010			Study group T0			*t*-Test T0 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	5003	1.76	2.06	38	2.71	2.46	2.37	0.02	*
Total category		None			Mild				
Anxiety subscale	5027	0.82	1.10	38	1.58	1.65	2.83	0.01	*
Depression subscale	5010	0.94	1.20	38	1.13	1.21	0.96	0.34	
	Norm data 2010			Study group T1			*t*-Test T1 vs. norm data		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	5003	1.76	2.06	38	1.74	2.82	(0.04)	0.97	
Total category		None			None				
Anxiety subscale	5027	0.82	1.10	38	0.82	1.61	-	1.00	
Depression subscale	5010	0.94	1.20	38	0.92	1.38	(0.09)	0.93	
	Study group T0			Study group T1			*t*-Test T1 vs. T0		
	N	Mean	SD	*N*	Mean	SD	*t*-Statistic	*p*-Value*	
Total score	38	2.71	2.46	38	1.74	2.82	(2.30)	0.03	*
Total category		Mild			None				
Anxiety subscale	38	1.58	1.65	38	0.82	1.61	(2.88)	0.01	*
Depression subscale	38	1.13	1.21	38	0.92	1.38	(0.85)	0.40	

This table provides summary statistics for the Patient Health Questionnaire-4 (PHQ-4). Norm data from Löwe et al.[10] and the study group at T0 and T1 are shown. Two-tailed *t*-tests for the equality of mean values are reported on the right-hand side (unpaired *t*-tests for the comparison of study group at T0 and T1 vs. norm data/paired *t*-test for the comparison of T1 vs. T0 within the study group).

* $p < 0.05$ (statistical significance at the 5% level).

significantly. The increase in satisfaction with the status of health observed by us is in line with Masoumi Lari's et al. research, which shows equivalent improvements.[36]

In contrast to other studies, a higher postoperative self-esteem could not be determined.[34,37-39] Masoumi Lari et al. provided evidence that higher preoperative self-esteem is associated with higher postoperative satisfaction.[36] This conforms to our qualitative overall finding that patients with high self-esteem (both pre- and post-operatively) generally show a high satisfaction with liposuction. The positive effect of liposuction on body image could also be identified in existing literature, which reported an improvement in body feeling and satisfaction with outer appearance.[28,29,38,39] In addition, we observed that most patients would decide on the same procedure again and would recommend it to others, which is congruent with the findings of other research.[27,33,35,37] By comparing patients undergoing aesthetic liposuction and those undergoing non-aesthetic liposuction, Koehler et al. determined a lower postoperative satisfaction in aesthetic patients.[27] For this reason, we categorised liposuction patients and analysed them separately in two different studies.

The six-month follow-up period enabled our patients to get accustomed to their final results. Hanke et al. proved that satisfaction with the outcome of liposuctions increases within the first six postoperative months.[30] Broughton et al. found that satisfaction remained stable from 6 months until two years post liposuction.[33] Similar results were shown by Goyen.[37] They demonstrated that positive lifestyle changes were maintained for up to two years after the procedure. According to those results, further follow-ups in the first two years post liposuction are not necessarily needed. Nevertheless, long-term follow-ups after several years would be interesting but difficult to conduct in terms of generating a sufficient number of respondents. Our study sample comprises up to 38 patient answers for each test, i.e. sample size clearly larger than 30, which is the foundation for a sound and meaningful statistical analysis. Particularly for highly specialised prospective studies in aesthetic plastic surgery, it is difficult to achieve a large number of patients. Comparable prospective studies present a lower number of patients.[29,38] In contrast to our prospective research, most studies focus exclusively on retrospective data and do not provide validated measuring tools. Response rates are low, ranging from 34.8% to a maximum of 65.3%.[27-29,33-38] In addition to this, they often represent surgical results of different surgical teams[29,30] - in our opinion, results are more comparable when performed by the same surgeon.

Conclusion

Aesthetic liposuction is a commonly performed, effective and well-tolerated procedure and results in an increased QoL postoperatively. Multidimensional QoL tools determined psychological, physical and social benefits following this procedure. This study confirmed authors´ ex ante hypothesis for this specific indication prospectively.

Further investigations in different geographical areas and studies focusing on male patients undergoing liposuction only would be highly relevant research areas and interesting for all aesthetic plastic surgeons in the future.

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Conflicts of interest

None.

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The work described in this article was approved by the ethics committee of the authors' university (approval number 252/14 TUM).

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