Original paper

Prevalence of breast ptosis and related quality of life in women

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Abstract

Introduction: Although breast ptosis is assumed to be an indicator of ageing and plays important role in a woman's attractiveness and body satisfaction, there is a paucity of epidemiological and quality-of-life data.
Aim of the research: To provide epidemiologic benchmark for rejuvenation claims in breast aesthetic surgery.
Material and methods: We examined the prevalence of breast ptosis and measured its impact on women's quality of life by using the Rainbow score and BREST-Q questionnaire. A total of 605 volunteers participated in Study 1, and data from 1907 photomodels was analysed in Study 2.
Results: Among women aged 18–22 years, clinically significant ptosis was present in 30% and 36% participants of Study 1 and Study 2, respectively. Severity of breast ptosis, but not age, was correlated with breast-related quality-of-life scores. Significant differences in all breast-related quality-of-life measures were found between non-ptotic, mildly ptotic, and severely ptotic respondents. The self-reported degree of ptosis influenced the difference in breast satisfaction when clothed or naked ($H(4) = 70.926$, $p < 0.001$). Women self-declaring an adolescent breast shape expressed significantly higher desired breast positioning than all other groups ($p < 0.006$). Women with ptotic breasts assumed a higher degree of breast ptosis in age-matched peers compared to women without breast ptosis ($p < 0.001$). Additionally, we found a tendency for underestimation of breast ptosis in younger age groups and a tendency for overestimation of breast ptosis in older age groups.
Conclusions: Breast ptosis is a prevalent phenomenon in young adult women. One's breast ptosis status has a negative impact on quality of life and biases one's perception of age norms.

Introduction

Female breasts attract male attention and play a critical role in the evaluation of female physical attractiveness [1, 2]. Males exhibit cross-cultural systematic directional preferences for firm, non-ptotic breasts [3]. Breast ptosis, associated with age (and hence considered a signal of ageing), number of pregnancies, history of significant weight loss, larger bra cup size, higher body mass index (BMI), and smoking, is generally perceived as unattractive and affects women's self-image [4]. The health burden of living with a high degree of breast ptosis was found to be comparable with that of mastectomy or cleft lip and palate [5]; therefore, surgical improvement of ptosis with mastopexy has become one of the most common aesthetic procedures worldwide. Nonetheless, there is a paucity of normative data concerning onset of breast ptosis as well as studies measuring quality of life of affected women.

Aim of the research

The general objectives of this study were to estimate prevalence of breast ptosis in age groups and to quantify the impact of breast ptosis on women's quality of life. Our secondary objectives were to investigate how accurately women predict the degree of breast ptosis in their age-matched peers and if the desired breast shape is universal or dependent on a woman's age or their own breast ptosis grade.

Material and methods

Study 1

Consecutive adult females presenting to the lead author's dermatological private practice for non-breast related issues were invited to take part in the study. The exclusion criteria were history of breast lesions, trauma, or surgery.

An online survey was created in LimeSurvey (LimeSurvey, Hamburg, Germany). Respondents were asked to assess the following: a) the degree of breast ptosis of their own breasts, b) the average breast shape in their age-matched peers, and c) the 'ideal' desired breast shape with respect to degree of ptosis based on the Rainbow scale [6]. For each question, both frontal and lateral templates were shown to the respondent.

The Rainbow scale consists of five reference photographs, and its lateral template is largely equivalent to the drawings of the Kirwan scale of breast ptosis [7]. Grades 3 to 5 are equivalent to grades I to III in Regnault's breast ptosis classification [8]. Additionally, respondents were asked to assess their breast-related quality of life and satisfaction. For this purpose, the Satisfaction with Breasts, Psychosocial Well-being, and Sexual Well-being modules of the BREAST-Q [9] patient-reported outcome instrument were used. Those modules are universal for all BREAST-Q questionnaires

Study 2

Anthropometric analyses were performed on a professional photomodel image database. Media databases were previously shown to be a valid source of anthropometric data [10]. The database consists of casting photographs of 2073 Czech photomodels aged 18–68 years, taken in standardised frontal and profile poses with the same lighting setup. The images were classified by two researchers according to the Rainbow scale [6]. Mean ratings were used for the analysis. An experienced aesthetic medicine practitioner evaluated images for signs of previous breast surgery.

Statistical analysis

All statistical calculations and procedures were performed with the use of the R environment v4.4.2 [11]. Results of the tests were considered to be statistically significant if their respective *p*-values were less than 0.05.

In general, one-way analysis of variance (ANOVA) was performed to compare means of quantitative variables between more than two independent groups. In case of assumptions violations, Kruskal-Wallis tests were performed instead. In the case of revealing statistically significant differences between groups, post-hoc pairwise comparisons tests with Bonferroni adjustment were conducted (*t*-tests or Wilcoxon rank sum tests with continuity correction, respectively). In the case of two independent means comparisons, the Welch two-sample *t*-test was performed.

While analysing the dependence between two variables (with the dependent quantitative one), linear regression models were built if appropriate assumptions were met (i.e. linear relationship between variables visible on the scatter plot with a high absolute value of Pearson's correlation coefficient *R*, statistically significant model coefficients, and high coefficient of determination R^2).

Results

Breast ptosis severity according to age

There were 605 women aged 18–79 years (mean age = 30.85, SD = 9.76) who self-selected to meet Study 1 inclusion and exclusion criteria and participated in the survey. The percentage distribution of breast ptosis degrees in age groups is presented in Figure 1 A. Due to the high dispersion and moderate positive correlation (R = 0.43) of the age raw values and self-assessment of the breast ptosis (Figure 1 C), the Rainbow score was aggregated with respect to the age values using the mean. Furthermore, the linear regression model of the mean Rainbow score depending on the age was established. According to the calculated linear regression model (R = 0.71, R^2 = 0.5), the mean age of women developing mild breast ptosis (Rainbow score 2) was 17 years, while for clinically relevant breast ptosis (Rainbow score 3) the mean age was 44.5 years (Figure 1 E); however, clinically ptotic breast became dominant over non-ptotic breast in the cohort of women 28–32 years old, and mildly ptotic breasts were dominant in the 18–22-year-old group (Figure 1 A).

A total of 1907 database entries from Study 2 included high-resolution frontal and profile images of the models' breasts. Ninety models were excluded from further analysis because of visible signs of previous breast surgery. Again, due to the high dispersion and moderate positive correlation (R = 0.27) of the age raw values and the Rainbow scale score of the breast ptosis (Figure 1 D), the Rainbow scale score was aggregated with respect to the age values using the mean, and the linear regression model of the mean Rainbow score depending on the age was determined. According to the calculated linear regression model (R = 0.91 R^2 = 0.83), the mean age of adult media models achieving mild and clinically relevant breast ptosis (Rainbow grade 3) was estimated at 23.5 and 41.7 years, respectively (Figure 1 F).

Breast-related quality-of-life scores

No significant differences between age categories were observed for satisfaction with breast score ($F(6, 598) = 0.267$, $p = 0.952$), sexual well-being score ($F(6, 588) = 0.985$, $p = 0.435$), and the total satisfaction score ($F(6, 598) = 0.879$, $p = 0.51$).

One-way analysis of variance (ANOVA) for the dependent variables describing satisfaction with breasts score, psychosocial and sexual well-being scores, as well as a total satisfaction scores in different levels of the between-groups factor, and the self-reported degree of ptosis, were conducted. Post-hoc *t*-tests for pairwise comparisons with the Bonferroni adjustment were further applied in cases of ANOVA test significance. The results showed significant higher satisfaction with the breasts (mean = 60.49, SD = 14.484) for woman declaring Rainbow grade 2 breasts compared to all other grades ($F(4, 600) = 22.22$, $p < 0.001$). There were also differences between grade 1 (mean = 54.55, SD = 17.294) and grade 4 (mean = 45.72, SD = 11.696) ($p = 0.008$), grade 3 (mean = 53.52, SD = 13.313) and grade 4 ($p < 0.001$). There were no differences between grades 1 and 3 ($p \approx 1$). For details see Figure 2 A.

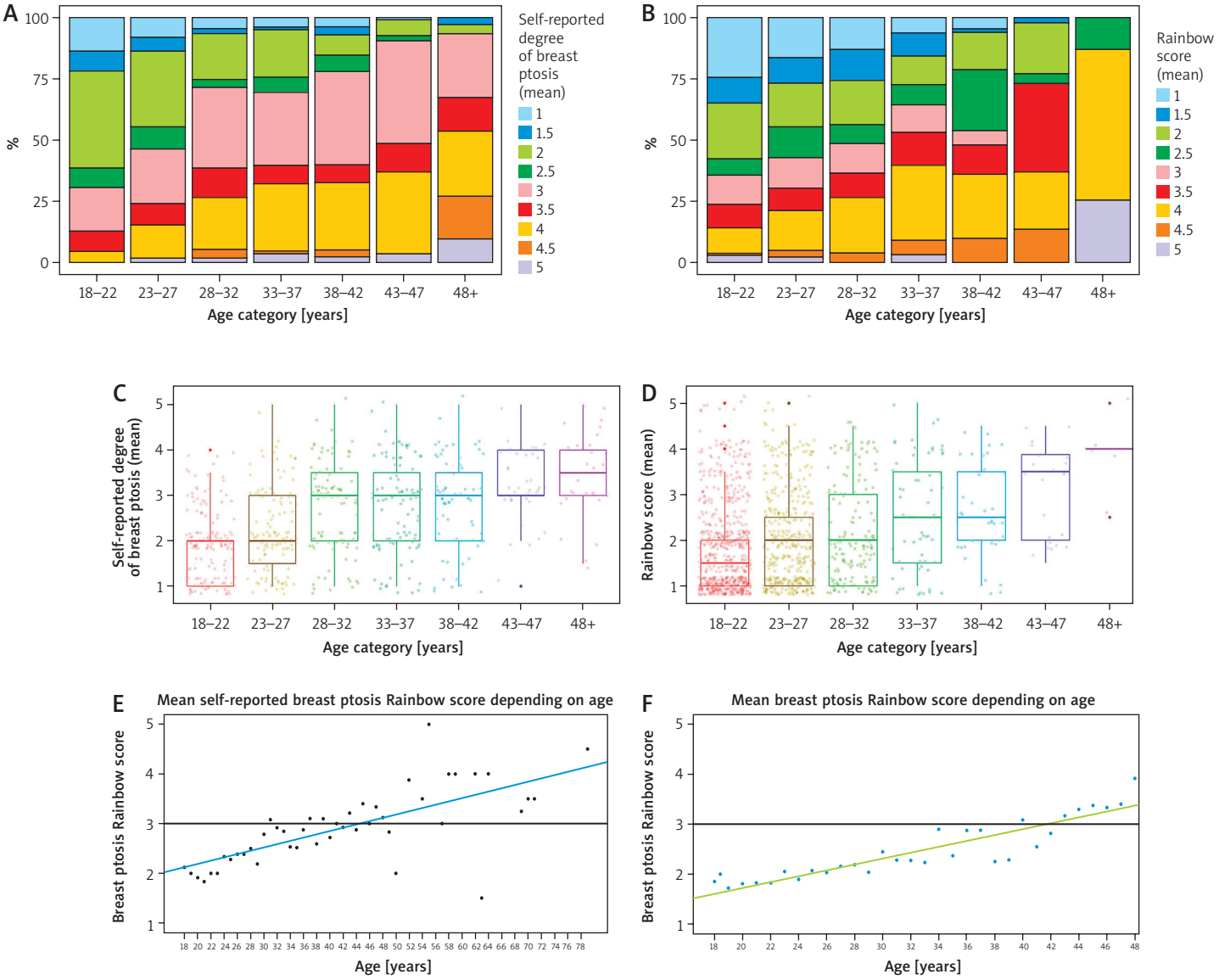

Figure 1. Breast ptosis severity according to age. Charts **A, C,** and **E** present data from Study 1, charts **B, D,** and **F**, and **E** from Study 2. Stacked bar charts (**A, B**) represent percentage distribution of Rainbow scale scores in age groups. Values above 3 represent clinically significant breast ptosis. Boxplots (**C, D**) represent dispersion of raw values of self-assessment of the breast ptosis in age groups. Lower row charts (**E, F**) represent linear regression models of the mean Rainbow score depending on age

When the psychosocial well-being score of the BREAST-Q instrument was analysed, the results showed significant differences between different self-reported degrees of ptosis ($F(4, 598) = 7.263$, $p < 0.001$), see Figure 2 B. Women declaring Rainbow grade 4 breasts rated their psychosocial well-being score (mean = 53.68, SD = 17.892) significantly lower than those declaring grade 1 ($p = 0.005$, mean = 63.09, SD = 20.654), grade 2 ($p < 0.001$, mean = 65.51, SD = 19.148), and grade 3 ($p = 0.030$, mean = 60.57, SD = 19.620).

Significant differences were also found in the sexual well-being score for different levels of declared degrees of ptosis ($F(4, 590) = 14.35$, $p < 0.001$). The lowest sexual well-being score was noted for women declaring grade 4 (mean = 51.89, SD = 19.470), significantly lower than for women declaring grade 1 ($p < 0.001$, mean = 65.57, SD = 23.667), grade 2 ($p < 0.001$, mean = 69.96, SD = 21.959), and grade 3 ($p = 0.012$, mean = 60.28, SD = 21.036). The highest sexual well-being score observed for women declaring grade 2 was also significantly higher ($p < 0.001$) than for those declaring grade 3 (Figure 2 C).

Eventually, significant differences in total satisfaction score were also observed ($F(4, 600) = 17.11$,

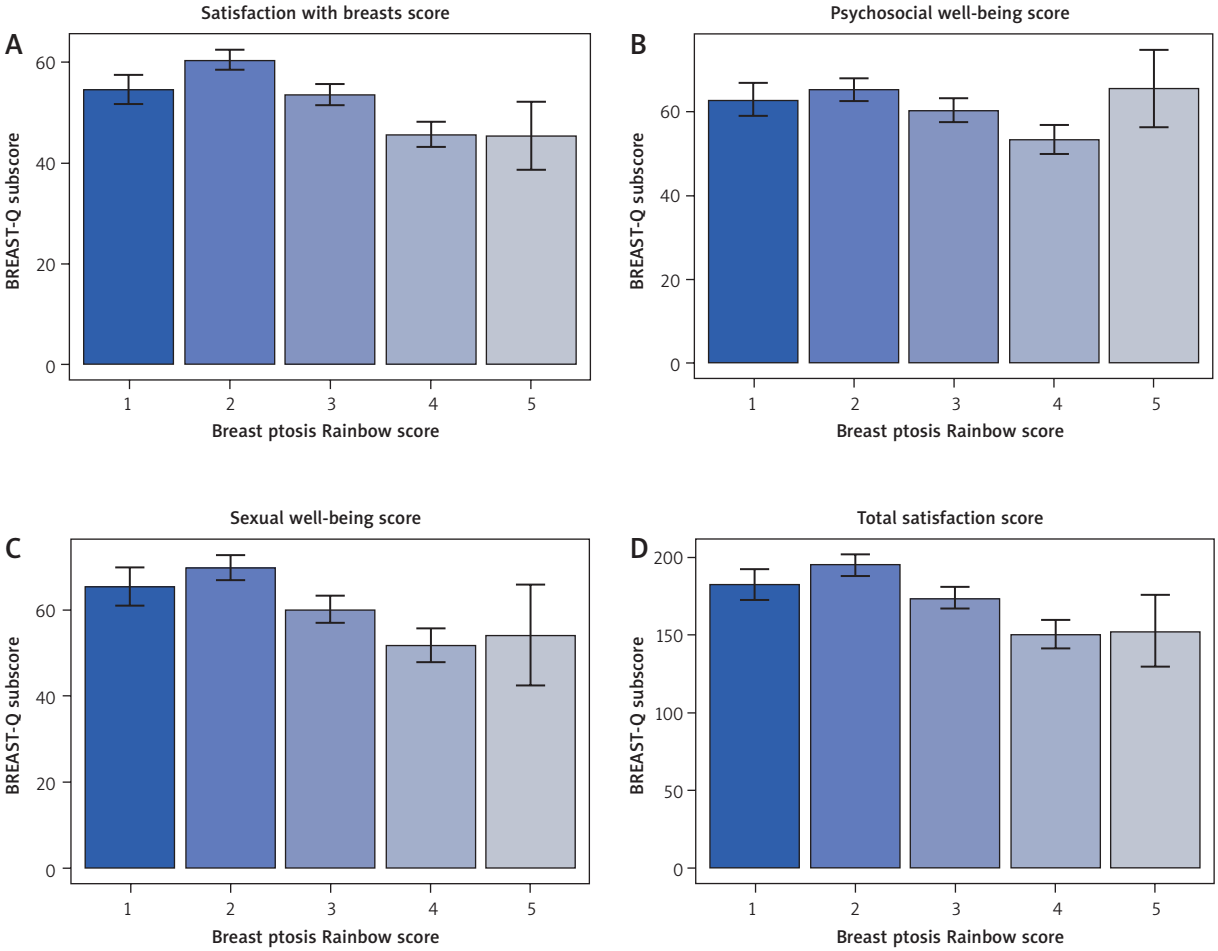

Figure 2. Breast-related quality of life scores. Charts represent 'Satisfaction with Breasts" (**A**), "Psychosocial Well-being" (**B**), and "Sexual Well-being'" (**C**) subscores, as well as total score (**D**) of BREAST-Q patient-reported outcome instrument measuring breast-related quality of life. Bars represent mean scores while whiskers show 95% confidence intervals

$p < 0.001$). The lowest total satisfaction coincided with Rainbow grade 4 (mean = 150.40, SD = 53.736), which was significantly lower ($p < 0.001$) than for women declaring grade 1 (mean = 182.49, SD = 53.736), grade 2 (mean = 194.93, SD = 50.001), and grade 3 (mean = 173.71, SD = 47.329). The highest total satisfaction coincided with Rainbow grade 2 and was significantly higher ($p < 0.006$) than for women declaring clinically evident breast ptosis (Figure 2 D).

BREAST-Q questionnaire sub-scores were further analysed for differences in breast satisfaction when clothed or naked in view of the declared breast ptosis degree and the respondent's age. Due to insufficiently numerous groups defined by both factors (self-reported degree of ptosis and the age category), two separate Kruskal-Wallis tests were performed. First, the correlation of age category was examined, and the results showed that there were no significant differences in the breast satisfaction when clothed or naked for women in different age categories ($H(3) = 8.558$, $p = 0.2$, Figure 3 A). However, the self-reported degree of ptosis influenced the difference in breast satisfaction when clothed or naked ($H(4) = 70.926$, $p < 0.001$). The highest mean value of the difference in breast satisfaction when clothed or naked was observed for women with Rainbow grade 4 (mean = 2.06, median = 2, SD = 1.590), which was significantly higher than for women reporting grade 1 ($p < 0.002$, mean = 1.02, median = 1, SD = 1.769), grade 2 ($p < 0.001$, mean = 0.82, median = 1, SD = 1.419), and grade 3 ($p < 0.010$, mean = 1.4, median = 1, SD = 1.657). Differences were also significant between women declaring grade 2 and grade 3 ptosis ($p = 0.001$), see Figure 3 B.

The desired breast shape

To compare the desired breast shape in various age categories, the Kruskal-Wallis test was conducted. It showed that the age category affected the desired breast shape ($H(6) = 12.8$); however, the result approached the limit threshold ($p = 0.046$). Indeed, post-

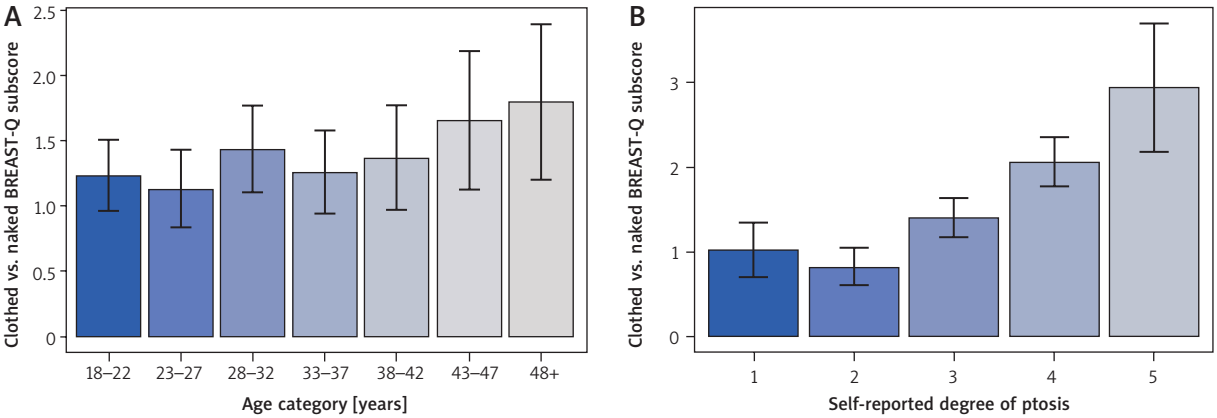

Figure 3. Satisfaction with breasts when clothed and naked. Charts represent differences in BREAST-Q questionnaire subscores when clothed or naked (1d, 1h, 3d vs. 1g, 1k, 3e) with regards to participant age (**A**) and self-reported breast ptosis Rainbow score (**B**), Bars represent mean scores while whiskers show 95% confidence intervals

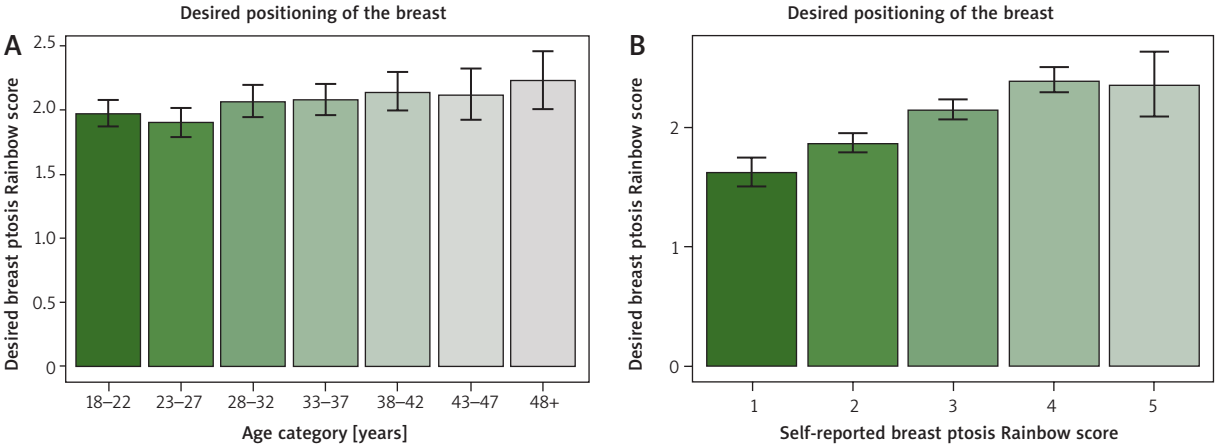

Figure 4. Desired breast shape. Charts represent desired breast shape, as exemplified on frontal and lateral photographic templates of the Rainbow scale according to respondents' age (**A**) and self-reported breast ptosis (**B**). Bars represent mean scores while whiskers show 95% confidence intervals

hoc Wilcoxon rank sum tests with continuity correction with Bonferroni adjustment for multiple testing that were used to compare all pairs of groups did not reveal any significant differences (Figure 4 A).

Again, the Kruskal-Wallis test was performed, and the results showed significant differences in the desired positioning of the breasts between groups with different self-reported degree of ptosis ($H(4) = 96.832$, $p < 0.001$). Post-hoc Wilcoxon rank sum tests with continuity correction with Bonferroni adjustment proved that women self-declaring the adolescent breast shape (Rainbow grade 1, non-ptotic) expressed significantly higher (mean = 1.63, median = 2, SD = 0.521) desired breast positioning (lower Rainbow score) than all other groups ($p < 0.006$) (Figure 4 B). The same dependency held between women declaring Rainbow grade 2 (mean = 1.88, median = 2, SD = 0.514) and those declaring ptotic breasts - grade 3 (mean = 2.15, median = 2, SD = 0.571) or grade 4 (mean = 2.40, median = 2, SD = 0.687) ptosis ($p < 0.001$), as well as between those declaring grade 3 and those declaring 4 degree ($p = 0.013$).

Estimation of breast shape in peer group.

We compared self-reported degree of breast ptosis with respondent-reported expected grade of breast ptosis in age-matched peers. The results indicate that on average women correctly estimated ptosis in their age groups; however, women older than 38 years tended to overestimate the degree of breast ptosis in their age-matched peers, while younger women tended to underestimate it (Figure 5 A).

Women with self-reported ptotic breasts (≥ Rainbow grade 3) assumed a higher degree of breast ptosis in age-matched peers (mean = 3, median = 3, SD = 0.758 versus mean = 1.82, median = 2, SD = 0.611) than women with non-ptotic breasts (Welch two-sample *t*-test *p*-value < 0.001, Figure 5 B).

Discussion

Several studies have identified aging as a significant risk factor for breast ptosis, but their applicability was limited by study population factors. Previous stud-

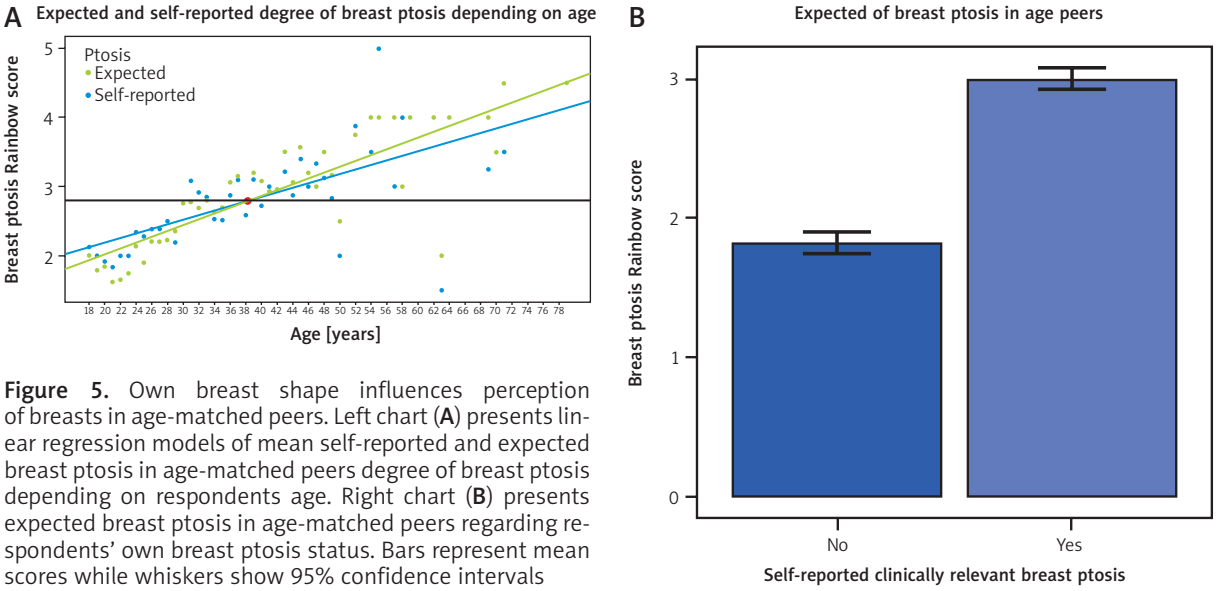

Figure 5. Own breast shape influences perception of breasts in age-matched peers. Left chart (**A**) presents linear regression models of mean self-reported and expected breast ptosis in age-matched peers degree of breast ptosis depending on respondents age. Right chart (**B**) presents expected breast ptosis in age-matched peers regarding respondents' own breast ptosis status. Bars represent mean scores while whiskers show 95% confidence intervals

ies either examined populations limited only to parous women seeking elective mastopexy [4] or middle-aged breast cancer patients [12]. In the study of Huang *et al.* [13] patients' age was only dichotomised as pre- and postmenopausal. To the best of our knowledge, the presented study is the first to propose a clear regression model of breast ptosis with age. Counterintuitively, the modelled mean age at which breast ptosis became clinically significant was higher for respondents from the general population than for professional photomodels (44.5 vs. 41.7 years); however, it was the latter model that had a higher coefficient of determination R^2 (0.5 vs. 0.83) with stronger data correlation (0.71 vs. 0.91), which implies that the model is better fitted to data. Both results correlate quite well with measurements of the effect of breast ptosis on the perceived woman's age [14]. The perceived age for a woman with Kirwan's grade C breast ptosis (equivalent of Rainbow grade 3) was estimated to be 40.7 years. A quite narrow difference between actual mean age measured in our study and perceived age in the study of Groyecka *et al.* [14] suggests that female age can be accurately inferred from breast shape, which indicates breast ptosis is a genuine cue of female age and may serve as a marker of residual fertility.

In line with a recent study that reported clinically significant breast ptosis in 35% of healthy Congolese women aged 18–25 years [15], in our study 30% of Polish women aged 18–22 years self-reported clinically significant breast ptosis, further corroborating significant prevalence of breast ptosis in the young adult population. Previous research showed that the reduction of anatomical breast support due to a decline in breast skin elasticity becomes evident from the midtwenties [16], and concerns about ptosis become the most important breast-related complaint at the age of 27 years [17]. In our study population, clinically ptotic breast became more common than non-ptotic breast in the cohort of women 28–32 years old. Mildly ptotic breasts were dominant in the youngest cohort of women aged 18–22 years in Study 1. Even in Study 2, mildly ptotic breasts were dominant in this age cohort despite clear selection bias for higher attractiveness among adult media actresses. Significant prevalence of breast ptosis in women in their early twenties could indicate that breast firmness is an evolutionary cue of female nubility, not age in general. The nubile primiparas have a much lower risk of potentially life-threatening complications of labour and are more likely to have a successful reproductive outcome defined in an evolutionarily relevant way compared to women in their twenties [18]. However, as breast ptosis is also related to a history of significant weight loss, firm breasts could advertise general good health and thus potential, not only residual, fertility.

The significant prevalence of breast ptosis in young women raises some ethical questions of whether breast mastopexy surgeries should be called 'rejuvenating treatments'.

The utility of patient-reported outcome questionnaires, and a focus on patient-centred data, evaluating quality of life and body image, is well established for breast improvement surgeries. To the best of our knowledge, such questionnaires have never been applied in the study of breast ptosis. The mean BREAST-Q scores in the Polish population of this study were comparable to the published normative scores in the US population [19, 20]. Significant differences in all breast-related quality-of-life measures were found between non-ptotic, mildly ptotic, and severely ptotic respondents. The results of this study indicate that although Kirwan's breast ptosis classification (Rainbow score is

a photographic representation of this measure) was created with breast surgery planning in mind, it is also informative in predicting affected women's quality of life. Counterintuitively, quality-of-life scores reported by women with Rainbow grade 2 breasts, typical for fully mature women, were slightly higher than for women with grade 1, typical for adolescent women. This, however, corroborates with previous studies showing lower general body satisfaction among adolescents [21]. Additionally, results from our study indicate that wearing a bra significantly improves breast-related satisfaction with one's own body among women with clinically significant breast ptosis.

The novel finding of this study is the observation of significant differences in desired breast shape between non-ptotic and ptotic (grade < 3 vs. ≥ 3) respondents. Breasts considered 'ideal' by respondents who themselves had ptotic breasts were positioned lower on the chest than 'ideal' breasts as considered by respondents with non-ptotic breasts (mean Rainbow grade 1.85 vs. 2.30, $p = 0.004$). This suggests that "the own-body perspective" – an estimation bias of attractive weight estimation dependent on the observer's own body – reported by Tovee *et al.*, is a more universal body-related perceptive bias [22].

Women's expectations of the degree of breast ptosis in their age-matched peers turned out to be mildly modulated by their own age and greatly modulated by their own breast ptosis status. Women with ptotic breasts assumed a higher degree of breast ptosis in age-matched peers compared to women without breast ptosis. This finding again suggests that the body estimation bias dependent on the observer's own body reported by Tovee *et al.* with respect to body weight may in fact apply to wider set of bodily features [22]. Additionally, we found a tendency for underestimation of breast ptosis in younger age groups and a tendency for overestimation of breast ptosis in older age groups. Although speculative, we hypothesise that this divergence between actual and perceived incidence of breast ptosis may result from widespread interference with breast shape by wearing supportive bras in the studied population. In real-life conditions, the sight of under-wire-supported clothed breasts is the most common breast-related visual stimuli, which lends to biased reference for comparison and underestimation of the incidence of breast ptosis. We posit that wearing a supportive bra is an adaptative strategy, in evolutionary terms, to hide the actual age and thus advertise residual fertility. In conclusion, although traditionally considered as a symptom of ageing, breast ptosis is common in young adult women.

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Ethical approval

Reviewed and approved by the Nicolaus Copernicus University IRB; approval #KB482/2024.

Conflict of interest

The authors declare no conflict of interest.

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