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# Perceived body shape, standardized body-mass index, and weight-specific quality of life of African-American, Caucasian, and Mexican-American adolescents

**Todd C. Edwards · Donald L. Patrick · Anne M. Skalicky · Yi Huang · Andrea D. Hobby**

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**Abstract**
*Purpose* To examine associations among perceived body shape, standardized body-mass index (zBMI), and weight-specific quality of life in African-American, Caucasian, and Mexican-American adolescents, aged 11–18 years.
*Methods* Self-report questionnaires were administered to 454 adolescents between 11 and 18 years of age, of whom 53% were females, 33% were Caucasians, 30% were African-Americans, and 37% were Mexican-Americans. Thirty-four percent had a healthy zBMI, 20% were overweight, and 46% were obese.
*Results* In examining the adjusted *R*-square and *R*-square changes among stepwise regression models, the model with depressive symptoms (adjusted *R*-square = 0.34), perceived body shape (adjusted *R*-square = 0.49), and female sex (adjusted *R*-square = 0.53) appears to be the most parsimonious and explanatory model for these data. Race/ethnicity and age did not enter the equations, due to their significance levels being greater than the probability of removal (0.1).
*Conclusions* This study demonstrates the importance of including the perceptual measures of weight-specific quality of life and perceived body shape in studies of and interventions with overweight and obese adolescents. Including these perceptual measures may provide increased insight into the motivations and values of overweight and obese youth and thus be useful for designing more effective weight interventions.

**Keywords** Adolescent · Obesity · Ethnicity · Quality of life

**Abbreviations**

| | |
|---|---|
| CDC | Centers for disease control and prevention |
| *n* | Sample size |
| QoL | Quality of life |
| zBMI | Standardized body-mass index |

## Background

### Adolescent body image perception

Adolescent females across all weight categories are consistently more dissatisfied with their body shape than adolescent males [1]. Among females, Caucasian adolescent females appear more likely than their ethnic minority counterparts to compare themselves to dominant American cultural standards for "thinness" [2], and to be more likely to view themselves as overweight [3]. The relationship between obesity and body image in males has received less research attention, but there is some evidence that overweight and obese males may not experience body image dissatisfaction in the same way as overweight females [1].

Dissatisfaction with body image has been shown to correlate positively with negative eating attitudes and food behaviors such as binge eating and unhealthy dieting practices [4] and negatively with level of physical activity [5, 6]. Chaiton et al. [7, 8] found that among adolescent

T. C. Edwards (✉) · D. L. Patrick · A. M. Skalicky · Y. Huang
Department of Health Services, University of Washington, Campus Box 359455, Seattle, WA 98195-9455, USA
e-mail: toddce@u.washington.edu

A. D. Hobby
Department of Health Services, University of California, Los Angeles, CA, USA

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females, standardized body-mass index (zBMI) accounted for 62% of depressive symptoms through its association with perceived pressure to be thin and body dissatisfaction, with pressure to be thin uniquely related to depressive symptoms. Among adolescent males, only body dissatisfaction was associated with depressive symptoms.

### Anthropometric measurement of adolescent weight status

Standardized body-mass index (zBMI) is defined as weight (kg)/[height (m)]$^2$, normalized to population (z distribution). Although zBMI has generally been accepted as a reasonable measure of weight status, it has the significant limitation of not reflecting adiposity very well [9]. zBMI is also based on age- and sex-specific norms, which are not ethnicity and or race-specific [10, 11].

### Adolescent quality of life and obesity

Quality of life (QoL) is defined as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" [12]. QoL is a diffuse, but widely accepted concept that is "affected in complex ways by the person's physical health, psychological state, level of independence, social relationships, and the person's relationships to salient features of the environment" [13]. Because of its multi-faceted and multi-level nature, the concept of QoL has potential for providing a useful framework for assessing the many effects of obesity upon the lives of adolescents, both as an outcome measure and as a potential predictive or mediating factor [14, 15]. QoL measures also augment the traditional clinical focus on diagnosis and symptom management by providing information regarding the perspectives of adolescents themselves.

A recent review of the literature found that obesity was associated with lower QoL in children and adolescents across several domains including physical functioning, psychological well-being, social functioning, and overall health-related quality of life [16]. Among the QoL domains impacted, physical and social functioning appeared to be the most affected, with some evidence that emotional functioning was affected, and minimal evidence of school functioning being affected. Modi et al. [17] found that among adolescents who were extremely obese (BMI $\geq$ 40), Black adolescents scored higher on health-related quality of life than did Caucasian adolescents. In other studies, adolescent obesity has been associated with poor perceived health [18, 19], low self-esteem [20], depression [21, 22], and social isolation [23]. This is the first study to compare the ability of zBMI and perceived body shape to predict weight-specific QoL in a multi-ethnic community sample of adolescents.

The aim of this study was to examine the associations among perceived body shape, zBMI, and weight-specific QoL in African-American, Caucasian, and Mexican-American adolescents. Because QoL and body shape are both primarily perceptual concepts, it was hypothesized that body shape would be more strongly associated with YQoL-W total score than zBMI, which is an anthropometric (verifiable) concept. Based on past studies, it was also hypothesized that males and African-Americans would report higher weight-specific QoL than females and Caucasians and Mexican-Americans respectively.

## Methods

### Study sites

A convenience sample of adolescent participants was recruited in Seattle, Washington and Los Angeles, California, from a broad array of sources. Study flyers, advertisements, and/or recruitment letters were disseminated through community centers, schools, primary care clinics, and youth programs. Recruitment was also conducted via health fairs and youth events and through health professionals and youth educators. Adolescent participants received a $20 cash or gift card for completing a 40-min questionnaire, and a brief anthropometric examination afterward. Prior to administering the questionnaire, participants' parents or guardians were asked via telephone screen to provide some information about the participant including date of birth, sex, and any major medical conditions. Parents/guardians provided informed written consent for their son or daughter to participate in the study, and adolescent participants provided informed written assent. All study procedures and materials including recruitment scripts, consent/assent forms, and study questionnaire were approved by the Institutional Review Boards of the University of Washington—Seattle and the University of California—Los Angeles, and written informed parent consent/adolescent assent was obtained in-person prior to study procedures being administered.

### Participants

The study was limited to participants 11–18 years of age, and prospective participants were excluded if they were not (as reported in parent telephone screen) African-American, Mexican-American, or Caucasian, or if they had been told by a doctor that they had a major co-morbid condition

which had a greater impact on their life than weight (as assessed by the parent/guardian). The sample was stratified such that approximately equal numbers of participants were recruited with respect to sex (male, female), age (11–14, 15–18), race/ethnicity (African-American, Mexican-American, Caucasian) and zBMI (healthy weight, overweight, obese). Between Seattle and Los Angeles, a total of $n = 454$ participants were enrolled and completed the study questionnaire/anthropometric measurement.

## Study measures

*zBMI* is defined as weight (kg)/[height (m)]$^2$, normalized to population ($z$ distribution). Participants were assigned to weight status groups defined by the weight standards for children and adolescents as established by the US Centers for Disease Control and Prevention (CDC) [24]: (1) Healthy weight (5 to <85th percentile), (2) overweight (85 to <95th percentile), and (3) obese (≥95th percentile). Weight and height were measured following a standard protocol, and were measured after the study questionnaire was administered in order to not influence how participants responded to weight-related aspects of the questionnaire. A portable SECA Road Rod 214 Stadiometer was used to measure height [25] and a portable Tantita BWB-800 S Digital remote display weighing scale with a capacity of 440 lbs in 0.2-pound graduations was used to measure weight [26]. Height and weight were each measured twice, recorded, and the two measurements averaged. If there was greater than 1 cm or 1.0 kg difference between the two measurements, a third measurement was taken and the outlier discarded.

*Perceived body shape* was assessed by the pictorial body image assessment (PBIA), a single body silhouette selection item (Fig. 1). The PBIA silhouettes were derived from Stunkard et al. [27] but modified to encompass larger body shapes. The silhouettes range from underweight (BMI < 19) to highly severe obesity (BMI > 50) [28].

*Depressive symptoms* were assessed with the Children's Depression Inventory-Short Version (CDI-S), a 10-item self-report symptom-oriented instrument designed to discriminate between children and adolescents aged 7–18 years with a psychiatric diagnosis of major depressive or dysthymic disorder as opposed to those with other psychiatric conditions or non-selected normals [29].

*Weight-specific quality of life* was assessed by the total score of the Youth Quality of Life Instrument—Weight Module (YQoL-W). The YQoL-W is a 21-item weight-specific QoL instrument with three domain scores (Sense of Self, Social Life, and Environmental Factors) and a total

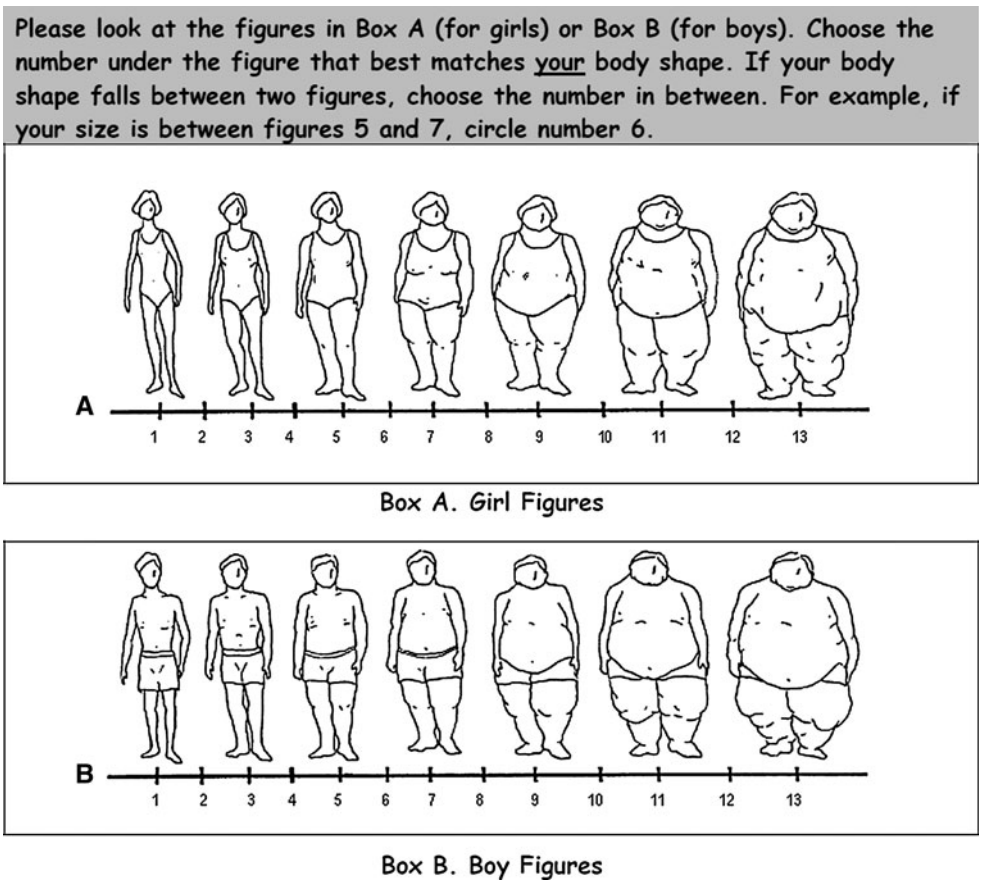


**Fig. 1** Pictorial body image assessment (PBIA). Used with permission: Madelyn H. Fernstrom, Ph.D.; Director, Weight Management Center, University of Pittsburgh Medical Center

score that was developed via qualitative work with a multicultural sample of overweight and obese adolescents. The YQOL-W has established measurement properties, including construct validity, internal consistency, test–retest reliability, and responsiveness to change. See Morales et al. [14], and Patrick et al. [15], for the published papers on the measurement properties of the YQOL-W.

### Analyses

Prior to analysis, item responses were checked for out-of-range and missing values, and these were checked against the questionnaires that were completed by the participants and inconsistencies between the inputted data and the questionnaires were corrected. After data cleaning was completed, items' responses to the YQoL-W were re-coded such that a score of 10 indicated the highest QoL and 0 indicated the poorest QoL. All scores were then transformed to a 0–100 scale. Analysis of variance (ANOVA) post hoc tests, Pearson's correlation (two-sided), and stepwise multiple regression model selection (with probability of entry at 0.05 and probability of removal at 0.1) were conducted using SPSS 16.

## Results

### Participant characteristics

Of the 454 youth included in this study, (a) 53% were between 11 and 14 years of age, 47% were between 15 and 18 years; (b) 53% were females; (c) 33% were Caucasians, 30% African-Americans, 37% Mexican-Americans, (d) 34% with a zBMI percentile in the 5–84th percentile range (healthy weight), 20% in the 85–94th percentile range (overweight), and 46% ≥95th zBMI percentile range (obese); and (e) 51% were recruited in Seattle and 49% in Los Angeles (Table 1). Of the total number of adolescents screened ($n = 552$), 82% were successfully enrolled in the study, with 14% declining participation, 2% not ineligible due to race/ethnicity, 1% excluded because of other clinical conditions (e.g., Asperger's syndrome, depression), and 1% excluded because of study weight group quota already being met.

**Table 1** Sample characteristics ($n = 454$)

| | *n* | % |
|---|---|---|
| Age in years | | |
| 11–14 | 239 | 53 |
| 15–18 | 215 | 47 |
| Gender | | |
| Female | 239 | 53 |
| Male | 214 | 47 |
| Race-ethnicity | | |
| African-American | 137 | 30 |
| Caucasian | 149 | 33 |
| Mexican-American | 167 | 37 |
| Mother's education | | |
| Less than HS | 76 | 18 |
| HS/GED | 80 | 18 |
| Some college | 132 | 31 |
| College | 99 | 23 |
| Masters or higher | 41 | 10 |
| zBMI percentile | | |
| Healthy (5–84th) | 153 | 34 |
| Overweight (85–94th) | 90 | 20 |
| Obese (≥95th) | 210 | 46 |
| Recruitment site | | |
| Seattle | 232 | 51 |
| Los Angeles | 222 | 49 |

Sample sizes within characteristics may not sum to $n = 454$ due to missing values

### Univariate results

Across the range of body weight from healthy to obese, perceived body shape and depression symptoms significantly increased, while weight-specific QoL decreased (Table 2). In post hoc multiple comparisons, Fisher's least significant difference (LSD) tests showed significant differences between all pair-wise comparisons for weight-specific QoL ($P < 0.01$). As hypothesized, perceived body shape was more highly correlated with YQoL-W total score ($r = -0.56$, $P < 0.01$) than was zBMI ($r = -0.41$, $P < 0.01$). zBMI and body shape were correlated at 0.66, $P < 0.01$.

Males scored significantly higher ($x = 84.16$) than females ($x = 70.52$) on weight-specific QoL ($P < .01$), and significantly lower ($x = 2.41$) than females ($x = 3.04$) on depressive symptoms ($P < 0.05$). By race/ethnicity, the only significant finding was that African-Americans scored significantly higher on weight-specific QoL than both Caucasians and Mexican-Americans ($P < 0.01$).

### Multivariate results

The variables of sex, age, race/ethnicity, depressive symptoms, zBMI, and perceived body shape were introduced into stepwise regression models (Table 3). In examining the adjusted $R^2$ and $R^2$ changes among the models, the model with depressive symptoms (adjusted $R^2 = 0.34$), perceived body shape (adjusted $R^2 = 0.49$), and female sex (adjusted $R^2 = 0.53$) appears to be the most parsimonious and explanatory model for these data. Race/

**Table 2** YQoL-W total score and depression symptoms by demographic factors, zBMI, and body shape

| | YQoL-W total score | | | Depression | | |
|---|---|---|---|---|---|---|
| | Mean | SD | *r* | Mean | SD | *r* |
| Age in years | | | | | | |
| 11–14 | 77.68 | 24.51 | | 2.64 | 3.29 | |
| 15–18 | 76.28 | 25.57 | | 2.89 | 3.32 | |
| Gender | | | | | | |
| Female | 70.52** | 27.47 | | 3.04* | 3.46 | |
| Male | 84.16 | 19.67 | | 2.41 | 3.08 | |
| Race/ethnicity | | | | | | |
| African-American | 81.99** | 22.25 | | 2.74 | 3.22 | |
| Caucasian | 74.34 | 25.34 | | 3.02 | 3.38 | |
| Mexican-American | 75.27 | 26.38 | | 2.50 | 3.29 | |
| zBMI percentile | | | −0.41** | | | 0.15** |
| Healthy (5–84th) | 90.41** | 13.78 | | 2.16** | 2.70 | |
| Overweight (85–94th) | 78.01** | 23.85 | | 2.72 | 3.62 | |
| Obese (≥95th) | 66.83** | 27.13 | | 3.21** | 3.50 | |
| Body shape | | | −0.56** | | | 0.32** |

* $P < 0.05$

** $P < 0.01$

**Table 3** Stepwise multiple regression model predicting YQoL-W total score

| Model | Adjusted $R^2$ | $R^2$ change | $F(df1, df2)$ | Cohen's $f^2$* |
|---|---|---|---|---|
| Depression | 0.34 | – | $F(1, 445)$ | 0.50 |
| Depression, female | 0.38 | 0.05 | $F(2, 444)$ | 0.62 |
| Depression, body shape | 0.49 | 0.15 | $F(2, 444)$ | 0.96 |
| Depression, body shape, female | 0.53 | 0.04 | $F(3, 443)$ | 1.13 |
| Depression, zBMI | 0.45 | 0.11 | $F(2, 444)$ | 0.81 |
| Depression, zBMI, female | 0.50 | 0.05 | $F(3, 443)$ | 1.01 |
| Depression, body shape, female, zBMI | 0.54 | 0.20 | $F(4, 442)$ | 1.19 |

Dependent variable: Total YQoL-W score

Race/ethnicity reference group = Caucasian

Sex reference group = Male

* Effect size measure used in the context of $F$ test for multiple regression models. By convention, $f^2$ effect sizes of 0.02, 0.15, and 0.35 represent for small, medium, large, respectively [31]

ethnicity and age did not enter the equations, due to their significance levels being greater than the probability of removal (0.1).

## Discussion

The study findings support the hypothesis that perceived body shape is significantly related to weight-specific QoL, even more so than zBMI, and are consistent with the only other study known to address similar variables together in which it was found that perceived body shape, not zBMI, predicted life satisfaction and self-esteem in overweight Polish adolescents [30]. These findings are practically significant because many adolescent weight intervention studies focus exclusively on zBMI as an outcome, and without taking perceived body shape and weight-specific QoL into account, are missing potentially important information for increasing the effectiveness of these interventions. If weight interventions and/or weight loss do not lead to favorable changes in perceived body shape and/or weight-specific QoL from the adolescent's perspective, then such changes are less likely to be maximized and maintained.

The hypotheses regarding African-Americans and males having higher weight-specific QoL were supported in univariate analyses, although race/ethnicity dropped out as a significant predictor of weight-specific QoL when covariates were added. Also, as in previous studies, depressive symptoms were found to be inversely related to weight-specific QoL. It seems clear that obese Caucasian females especially are at elevated risk for depression and low-weight-specific QoL, and should be considered as a high priority group for counseling.

The main limitation of this study is that the study participants were recruited through convenience methods and as such are not representative of underlying populations. We utilized a broad diversity of community and clinical channels to enroll participants, however, in order to obtain a sample as representative as possible. The strengths of the study are that it included a multi-racial/ethnic sample and that it included both community-based and clinic-based participants.

In conclusion, this study demonstrates the importance of including the perceptual measures of weight-specific quality of life and perceived body shape in studies of and interventions with overweight and obese adolescents. Including these perceptual measures may provide increased insight into the motivations and values of overweight and obese youth, and thus be useful for designing more effective weight interventions. More studies are needed to understand the role that perception of body shape plays in the quality of life of obese and overweight adolescents, and also the role it may play in designing effective interventions for controlling and reducing adolescent obesity.

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## References

1. Schwartz, M. B., & Brownell, K. D. (2002). Obesity and body image. In T. F. Cash & T. Pruzinsky (Eds.), *Body image*. New York: The Guilford Press.
2. Cash, T. F. (2002). Assessing body image states. In T. F. Cash & T. Pruzinsky (Eds.), *Body image*. New York: The Guilford Press.
3. Neff, L. J., Sargent, R. G., McKeown, R. E., Jackson, K. L., & Valois, R. F. (1997). Black-white differences in body size perceptions and weight management practices among adolescent females. *Journal of Adolescent Health, 20*(6), 459–465.
4. Levine, M. P., & Smolak, L. (2002). Body image development in adolescence. In T. F. Cash & T. Pruzinsky (Eds.), *Body image*. New York: The Guilford Press.
5. Neumark-Sztainer, D., Paxton, S. J., Hannan, P. J., Haines, J., & Story, M. (2006). Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *Journal of Adolescent Health, 39*(2), 244–251.
6. Bearman, S. K., & Stice, E. (2008). Testing a gender additive model: The role of body image in adolescent depression. *Journal of Abnormal Child Psychology, 36*(8), 1251–1263.
7. Chaiton, M., Sabiston, C., O'Loughlin, J., McGrath, J. J., Maximova, K., & Lambert, M. (2009). A structural equation model relating adiposity, psychosocial indicators of body image and depressive symptoms among adolescents. *International Journal of Obesity, 33*(5), 588–596.
8. Chaiton, M., Sabiston, C., O'Loughlin, J., McGrath, J. J., Maximova, K., & Lambert, M. (2009). A structural equation model relating adiposity, psychosocial indicators of body image and depressive symptoms among adolescents. *International Journal of Obesity (Lond), 33*(5), 588–596.
9. Kahn, H. S., Imperatore, G., & Cheng, Y. J. (2005). A population-based comparison of BMI percentiles and waist-to-height ratio for identifying cardiovascular risk in youth. *Journal of Pediatrics, 146*(4), 482–488.
10. Yan, W., Bingxian, H., Hua, Y., Jianghong, D., Jun, C., Dongliang, G., et al. (2007). Waist-to-height ratio is an accurate and easier index for evaluating obesity in children and adolescents. *Obesity, 15*(3), 748–752.
11. Del-Rio-Navarro, B. E., Velazquez-Monroy, O., Santos-Preciado, J. I., Lara-Esqueda, A., Berber, A., Loredo-Abdala, A., et al. (2007). Mexican anthropometric percentiles for ages 10–18. *European Journal of Clinical Nutrition, 61*(8), 963–975.
12. World Health Organization (WHO). (1994). *Measurement of quality of life in children*. Geneva: Division of Mental Health.
13. WHOQOL Group. (1994). The development of the world health organization quality of life assessment instrument (WHOQOL). In W. Kuyken & J. Orley (Eds.), *Quality of life assessment: International perspectives* (pp. 41–57). Berlin: Springer.
14. Morales, L. S., Edwards, T. C., Flores, Y., Barr, L., & Patrick, D. L. (2011). Measurement properties of a multicultural weight-specific quality-of-life instrument for children and adolescents. *Quality of Life Research, 20*(2), 215–224.
15. Patrick, D. L., Skalicky, A. M., Edwards, T. C., Kuniyuki, A., Morales, L. S., Leng, M., et al. (2010). Weight loss and changes in generic and weight-specific quality of life in obese adolescents. *Quality of Life Research, 20*, 961–965.
16. Tsiros, M. D., Olds, T., Buckley, J. D., Grimshaw, P., Brennan, L., Walkley, J., et al. (2009). Health-related quality of life in obese children and adolescents. *International Journal of Obesity(London), 33*(4), 387–400.
17. Modi, A. C., Loux, T. J., Bell, S. K., Harmon, C. M., Inge, T. H., & Zeller, M. H. (2008). Weight-specific health-related quality of life in adolescents with extreme obesity. *Obesity, 16*, 2266–2271.
18. Neumark-Sztainer, D., Story, M., Toporoff, E., Himes, J. H., Resnick, M. D., & Blum, R. W. (1997). Covariations of eating behaviors with other health-related behaviors among adolescents. *Journal of Adolescent Health, 20*(6), 450–458.
19. Swallen, K. C., Reither, E. N., Haas, S. A., & Meier, A. M. (2005). Overweight, obesity, and health-related quality of life among adolescents: The national longitudinal study of adolescent health. *Pediatrics, 115*(2), 340–347.
20. Eisenberg, M. E., Neumark-Sztainer, D., & Story, M. (2003). Associations of weight-based teasing and emotional well-being among adolescents. *Archives of Pediatrics and Adolescent Medicine, 157*(8), 733–738.
21. Blaine, B. (2008). Does depression cause obesity? A meta-analysis of longitudinal studies of depression and weight control. *Journal of Health Psychology, 13*(8), 1190–1197.
22. Goodman, E., & Whitaker, R. C. (2002). A prospective study of the role of depression in the development and persistence of adolescent obesity. *Pediatrics, 110*(3), 497–504.
23. Strauss, R. S., & Pollack, H. A. (2003). Social marginalization of overweight children. *Archives of Pediatrics and Adolescent Medicine, 157*(8), 746–752.
24. Kuczmarski, R. J., & Flegal, K. M. (2000). Criteria for definition of overweight in transition: Background and recommendations for the United States. *American Journal of Clinical Nutrition, 72*(5), 1074–1081.
25. SECA Road Rod 214 portable stadiometer. From http://www.stadiometer.com/214.html.
26. Tantita BWB-800 S Digital remote display weighing scale. From http://www.tanita.com/en/bwb-800s/.
27. Stunkard, A. J., Sorenson, T., & Schulsinger, F. (1983). Use of Danish adoption register for the study of obesity and thinness. In

S. Kety, L. P. Rowland, R. L. Sidamn, & S. W. Mathhysse (Eds.), *The genetics of neurological and psychiatric disorders* (pp. 115–120). New York: Raven Press.
28. Song, A. Y., Rubin, J. P., Thomas, V., Dudas, J. R., Marra, K. G., & Fernstrom, M. H. (2006). Body image and quality of life in post massive weight loss body contouring patients. *Obesity, 14*(9), 1626–1636.
29. Kovacs, A., Dhillon, J., & Walker, R. A. (2003). Expression of P-cadherin, but not E-cadherin or N-cadherin, relates to pathological and functional differentiation of breast carcinomas. *Molecular Pathology, 56*(6), 318–322.
30. Tabak, I., Mazur, J., Oblacinska, A., & Jodkowska, M. (2007). Body mass, self-esteem and life satisfaction in adolescents aged 13–15 years. *Medycyna Wieku Rozwojowego, 11*(3 Pt 1), 281–290.
31. Cohen J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York: Routledge.