

Concurrent validation and reliability of the silhouette scale to assess body image in adolescents living in a high altitude region of Peru

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ABSTRACT

Background: To verify the validity and reliability of the silhouette scale to assess self-perception of body image in adolescents living in a high altitude region.

Methods: A descriptive cross-sectional study was designed in 1149 adolescents (366 males and 783 females) with an age range of 12 to 17 years from an altitude region of Peru. The actual weight and height of the adolescents were evaluated. Body mass index (BMI) and Tri-ponderal Index (TPI) were calculated. Body image was evaluated through the silhouette method proposed by Stunkard (scale from 1 to 9 silhouettes). Concurrent validity was analyzed by Spearman correlations between the values of the body image scale and the anthropometric indicators.

Results: There was a moderate correlation between the silhouette scale and anthropometric indicators (BMI and TPI) in both sexes. In females it was ($R= 0.52$ to 0.56 , $p<0.001$) and in males ($R= 0.34$ to 0.47 , $p<0.001$). The limits of agreement of the Bland-Altman plot reflected a high degree of agreement between the measures (retest). The correlation coefficient of agreement in males was $R=0.83$. In females it was $R= 0.90$ and in both sexes it was $R= 0.88$. The mean differences in males were 0.18 points, in females 0.08 points and in both sexes 0.11 points.

Conclusion: The Stunkard silhouette scale is valid and reliable to assess body image in adolescents of both sexes in a high

altitude region of Peru. The results suggest its use and application in contexts where anthropometric equipment is lacking.

KEY WORDS

Body perception, self-image, psychological factors, anthropometric assessment, mental health, adolescent development.

INTRODUCTION

Body image has been classically defined as the image of our own body that we form in our mind¹. It is a complex psychological construct, which is composed of a body perceptual schema, emotions, thoughts and associated behaviors that influence the way a person relates to his or her own body and to his or her environment².

Body image is often influenced by various sociocultural factors, such as beauty ideals, social expectations and the media, which can shape the way people perceive and value their body³⁻⁵.

In general, its assessment includes the subjective measurement of body size (how a person perceives his or her body), the estimation of body attractiveness (which body type a person considers most attractive), and perceptions related to one's own body shape and size⁶. On the other hand, in epidemiological studies quantitative measurement involves the use of objective tools, such as anthropometric tests (weight and height) and/or anthropometric indices³. These actual characteristics allow for a comprehensive assessment of body image at various stages of life.

In this context, the body image silhouette scale originally proposed by Stunkard et al.⁷ represents one of the first tools developed that has been widely used to assess body image

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perception by silhouettes in diverse populations around the world^{8,9}. In addition, several international studies have demonstrated its usefulness, validity and reliability when applied in adolescents from diverse sociocultural contexts⁹⁻¹².

These investigations highlight that, during the stage of growth and development, adolescence represents a period of intense and rapid physical changes, leading to an alteration in the perception of body characteristics. This can be a critical time for the development of body image¹³. Because dissatisfaction with one's own body can arise due to social pressures and beauty ideals. So, it becomes an important public health problem that can negatively influence various aspects of adolescent health. Such as self-esteem, eating, and emotional well-being, and may be related to eating disorders, depression, and anxiety^{5,14}.

In essence, given the diversity of body sizes by ethnicity and the social and cultural differences between populations, the Stunkard et al.⁷ silhouette scale has not, to our knowledge, been validated for samples of adolescents living in a high-altitude region of Peru.

This suggests the need to adapt or develop instruments that consider the specific body characteristics of these populations. So that body perception can be accurately assessed in particular geographical and cultural contexts^{3,12}. Moreover, we currently live in an increasingly multicultural and multilingual environment, in which scales are used as decision support in populations with diverse sociocultural characteristics¹⁵. Therefore, aspects such as climate, history, sociopolitical circumstances, health, economy and ethnicity could be relevant factors when measuring self-perception¹⁶, especially for adolescents living in a high altitude region of Peru.

In general, physiological adaptation to high altitude conditions, may present differences in their physical growth and body adiposity compared to adolescents from other regions¹⁷. Which underlines the importance of having assessment tools that accurately reflect these particularities and promote a deeper understanding of their self-perception of body image in relation to their unique environment.

Therefore, the aim of the study was to verify the validity and reliability of the silhouette scale for assessing body image self-perception in adolescents living in a high-altitude region. The study seeks to determine if this tool is adequate to reflect the particularities of physical growth and body adiposity in this population, allowing an accurate assessment in relation to their unique geographic and sociocultural environment.

METHODOLOGY

Type of study and sample

A descriptive cross-sectional study was designed in 1149 adolescents (366 males and 783 females) with an age range of 12 to 17 years from an altitude region of Peru. The sample selec-

tion was non-probabilistic (convenience). Four secondary schools in the urban area of Puno (Peru) were evaluated. This region is located at 3820 meters above sea level.

The schoolchildren studied come from two main geographical areas and ethnic groups (Quechua and Aymara). For example, according to a previous study, Cossio-Bolaños et al.¹⁷, consider indigenous schoolchildren as those whose parents have both surnames originating from the region (Quechua or Aymara) and mestizos, those who have at least one surname of Spanish origin, reflecting a mix between indigenous and European ancestry.

Schoolchildren who signed the informed consent form, those who completed the body image scale and the anthropometric measurements of weight and height were included. Those who were enrolled for the second time in the same grade and those who were not in the age range (12 to 17 years) were excluded. The study was conducted in accordance with the Helsinki declaration for human beings and the ethics committee of the Universidad Nacional del Altiplano, Puno, Peru (020/2023).

Techniques and procedures

A team of 4 physical education professionals was formed to collect data on body image and anthropometric measurements. All of them had ample experience in evaluations. Data collection was carried out in April and June 2024 at the schools' facilities.

The silhouette method proposed by Stunkard et al.⁷ was used to measure body image. The silhouettes or body sizes were organized in increasing order from left to right (these are on a scale of 1 to 9 for both sexes (1: thin and 9: obese). This procedure was carried out in the traditional way with pencil and paper and lasted approximately 10 to 15 minutes. The schoolchildren were first asked to choose their current body size. The silhouette categories were: silhouette 1 corresponded to thinness (BMI < 18.5), silhouettes 2 to 4 with normoposity (18.5 < BMI < 25), silhouette 5 with overweight (25 ≤ BMI < 30) and silhouettes 6 or higher with obesity (BMI ≥ 30). The silhouette scale was evaluated twice (test and retest). The interval was 7 days between both measurements.

Anthropometric measurements were evaluated using the protocol proposed by Ross-Marfell-Jones¹⁸. Weight and height were evaluated with as little clothing as possible (barefoot, shorts and T-shirt). For body weight, a Tanita digital scale (United Kingdom, Ltd.) with an accuracy of 0.1 kg and a range of 0.1 kg to 150 kg was used. For height, a portable stadiometer (Hamburg, Seca, Ltd.) with an accuracy of 0.1 mm and a measurement range of 0.0 cm to 220.0 cm was used.

Body mass index (BMI) was calculated using the formula: BMI = weight (kg)/height (m)², the Tri-ponderal Index (TPI) was calculated using the formula: BMI = weight (kg)/height (m)³.

Statistics

The data set was subjected to the Kolmogorov-Smirnov K-S normality test. Descriptive statistics of arithmetic mean, standard deviation, range were analyzed. Significant differences between both sexes were verified by means of the t-test for independent samples. Concurrent validity was analyzed by Spearman correlations (nonparametric) between the values of the body image scale and the anthropometric indicators. For reliability, the intraclass correlation coefficient (ICC) and the Bland-Altman diagrams¹⁹ were used to evaluate the concordance between test and retest of the body image silhouette scale. The significance of $p < 0.05$ was adopted in all calculations. Calculations were performed in Excel spreadsheets, SPSS 18.0 and MedCalc 11.1.0.

RESULTS

Regarding the variables characterizing the adolescents studied, there were no differences in age between the sexes ($p = 0.480$). Males presented higher weight and height than

females ($p < 0.001$). On the contrary, females presented higher BMI, TPI and Current Image Perception than males ($p > 0.001$). Table 1 shows the anthropometric characteristics and the mean and \pm SD values of the Current Image Perception of the adolescents investigated.

The relationships between the body image silhouette scale and anthropometric indices such as BMI and PTI in both men and women reflect a moderate relationship. This means that as the value of the silhouette scale increases, the values of anthropometric indices such as BMI and ITP also increase. These relationships were stronger in women ($R = 0.52$ to 0.56 , $p < 0.001$) than in men ($R = 0.34$ to 0.47 , $p < 0.001$). Table 2 shows the correlations between the study variables.

The limits of agreement of the Bland-Altman plot are shown in Figure 1. For males in the retest of the silhouette scale ranged from -1.50 to 1.9 points. In females it ranged from -1.08 to 1.30 points and in both sexes it ranged from -1.2 to 1.5 points. The concordance correlation coefficient for males was $R = 0.83$. In females it was $R = 0.90$ and in

Table 1. Characteristics of the sample studied

| Variables | Males (n= 366) | | Females (n= 783) | | p |
|-----------------------------------|----------------|------|------------------|-----|-------|
| | X | SD | X | SD | |
| Age (years) | 15.0 | 1.4 | 15.2 | 1.4 | 0.480 |
| Anthropometry | | | | | |
| Weight (kg) | 55.5 | 11.2 | 54.0 | 9.0 | 0.013 |
| Height (cm) | 163.2 | 8.6 | 154.7 | 5.2 | 0.001 |
| Anthropometric indices | | | | | |
| BMI (Kg/m ²) | 20.8 | 3.6 | 22.5 | 3.4 | 0.001 |
| TPI (Kg/m ³) | 12.8 | 2.7 | 14.6 | 2.3 | 0.001 |
| Perception of current image (PCI) | 3.4 | 1.5 | 3.9 | 1.3 | 0.001 |

X: Mean, SD: Standard deviation, BMI: Body mass index, TPI: Tri-ponderal index.

Table 2. Relationship between the values of the silhouette scale with anthropometric indicators in both sexes

| Anthropometric Indexes | Males | | Females | | Both sexes | |
|--------------------------|-------|-------|---------|-------|------------|-------|
| | R | p | R | p | R | p |
| BMI (Kg/m ²) | 0.47 | 0.001 | 0.56 | 0.001 | 0.54 | 0.001 |
| TPI (Kg/m ³) | 0.34 | 0.001 | 0.52 | 0.001 | 0.47 | 0.001 |

BMI: body mass index, TPI: Tri-ponderal index.

both sexes it was $R = 0.88$. The mean differences in men were 0.18 points, in females 0.08 points and in both sexes 0.11 points.

The comparisons of the anthropometric indicators (BMI and TPI) aligned according to silhouette scale (from 1: Thin, 2 to 4 normopeso, 5: Overweight and >6: Obesity) in both sexes are observed in Figure 2. For example, in BMI, females presented significantly higher values in relation to males from silhouette 3-4-5-6, whose values are higher from 1.45 to 2.02 kg/m², and in the TPI, females presented higher values in silhouettes 2-3-4-5-6 compared to men, these values being higher from 1.02 to 2.03 kg/m³, however, in silhouette 1 and 7 there were no significant differences.

DISCUSSION

The aim of the study was to verify the validity and reliability of the silhouette scale for assessing self-perception of body image in adolescents living in a high altitude region. The study sought to verify concurrent validity, using as a method the actual BMI values and reliability through retesting.

The results have shown that the silhouette scale of Stunkard et al⁷ is a good indicator to assess body image in relation to anthropometric indicators (BMI and TPI), both in males and females, although slightly stronger in females.

The results obtained in this study indicate that the correlations between silhouettes and anthropometric indicators were

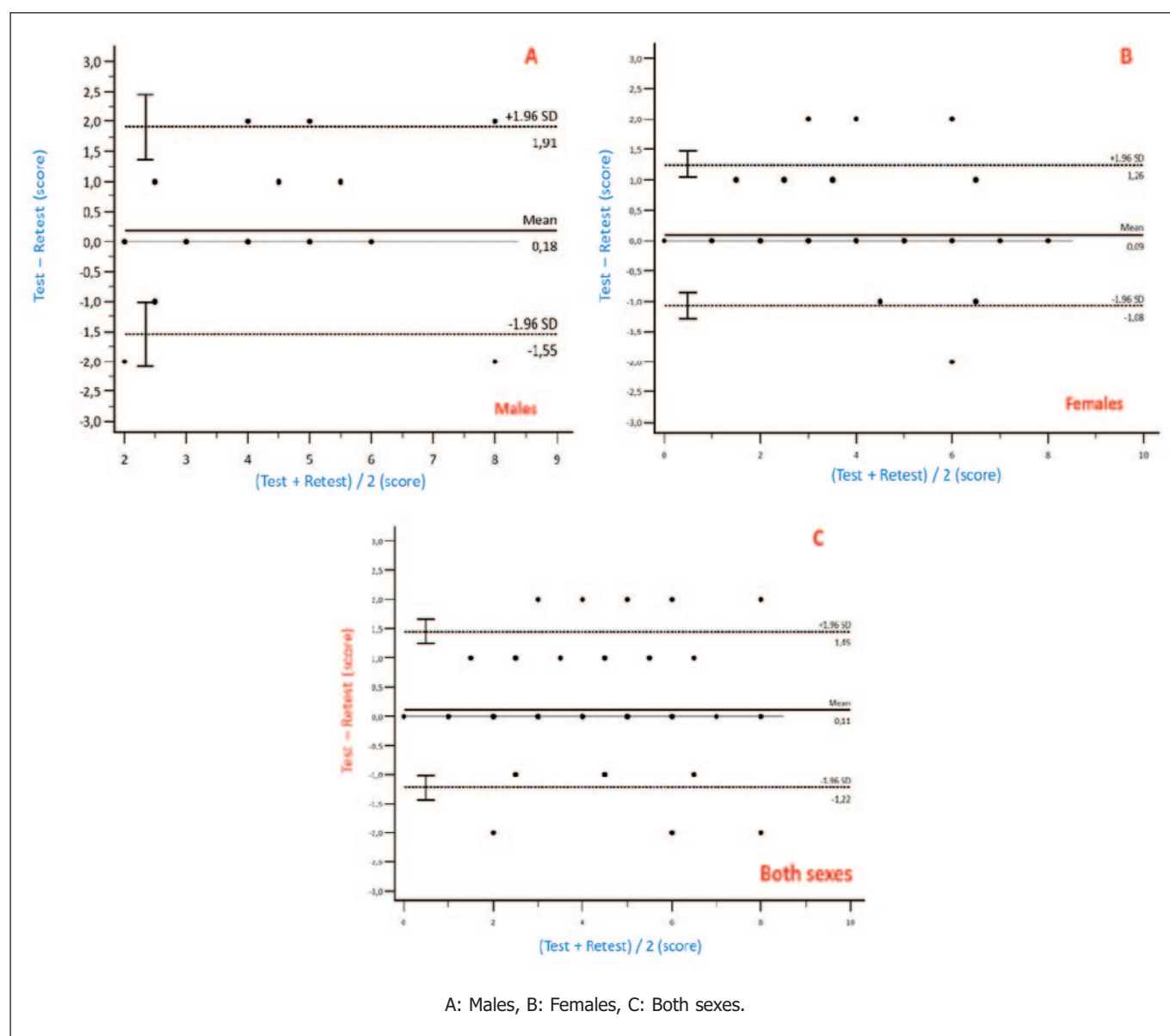


Figure 1. Bland-Altman plot evaluating the concordance between test-retest of the silhouette scale to assess body image in adolescents

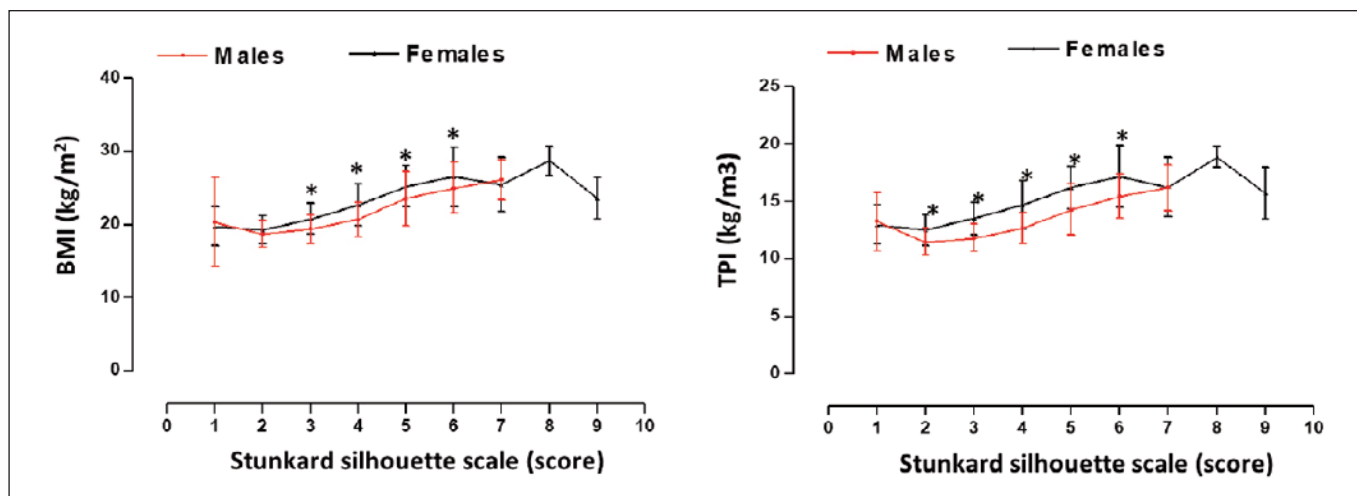


Figure 2. Comparison of anthropometric indicators (BMI and TPI) along the silhouette scale assessing body image in adolescents of both sexes

relatively low ($r = 0.47$ to 0.54) compared to the higher correlations reported in previous international studies ($r = 0.70$ to 0.80)^{3,9}. This discrepancy could be attributed to the methodology used in those studies, where body mass index (BMI) was self-reported, which could have influenced the accuracy of the observed correlations. This suggests that the validity of self-assessments may affect the relationship between silhouettes and anthropometric indicators, highlighting the importance of employing objective measures to obtain more consistent results.

In general, the values of the correlations obtained to evidence concurrent validation were consistent with previous international studies conducted in other regions of the world. This indicates that the Stunkard et al⁷ silhouette scaling is a good and valid indicator to assess body image in adolescents living in a high altitude region of Peru.

In relation to reliability, the results indicate that the silhouette scale evidenced minimal mean differences between test and retest in both sexes, in addition, the limits of agreement in the Bland-Altman analysis show a relatively small variability between test and retest measurements in both sexes, and even the degree of agreement is high, suggesting a good reliability of the body image scale for both sexes.

Another study that has used the retest to verify the reliability of the Stunkard et al⁷ silhouette scale has reported reliability values similar to the findings of this study¹⁰, although other studies, using the Figural Rating Scale developed by Collins²⁰, have also reported values similar to the present study^{21,22}.

These results highlight that the test and retest technique as a measure of stability is essential, since a high degree of agreement was obtained between the measures, suggesting that the scale used is reliable and consistent.

The study also verified that adolescents of both sexes showed a pronounced increase in BMI and TPI as silhouette levels increase from 1 to 9. This indicates that adolescents categorized at level 1 and 2 showed a slim BMI and silhouettes of 3 and 4 as normal and >5 as overweight. In addition, females, showed higher levels of BMI and TPI relative to males from silhouette 3 through six. This reflects not only differences in body composition between sexes, but also the need to consider specific intervention strategies that address these disparities and promote healthy habits among adolescents, especially in the case of females, who seem to be more predisposed to experience an increase in BMI and TPI.

In sum, the silhouette scale can be applied in sociocultural and demographic contexts where anthropometric equipment is lacking, offering an accessible tool for body image assessment when technical resources are limited. Indeed, health professionals need a valid and reliable tool to address this problem and its related factors in youth¹⁴. This type of subjective assessment is significant in promoting healthy lifestyles during this crucial stage of their lives²³.

The study has some limitations. For example, the type of sample selection was non-probabilistic, and the study focused on a specific population of adolescents in a high-altitude region of Peru, which may limit the generalizability of the results to other populations with different demographic and sociocultural characteristics. In addition, it is necessary to develop a longitudinal study in the future, with which it is possible to monitor changes in body image and weight status throughout the growth and development stage.

Also, the study presents some strengths, since it is the first study conducted at high altitude in Peru, which allows establishing a baseline for future research and achieving comparisons of changes over the years. This contribution is

significant because it provides a specific context that can be used in longitudinal studies to evaluate the evolution of body image.

On the other hand, this information obtained can serve as a reference for the implementation of health and wellness programs aimed at adolescents in similar contexts, offering data that can guide the design of specific interventions that address the health needs of young people.

CONCLUSION

The present study has demonstrated that the Stunkard et al.⁷ silhouette scaling is a valid and reliable tool for assessing self-perception of body image in adolescents residing in a high-altitude region of Peru. Although the correlations between silhouettes and anthropometric indicators (BMI and TPI) were moderate in comparison with international studies, the results suggest that the scale can be useful in contexts where anthropometric equipment is lacking, highlighting its applicability in the promotion of healthy habits.

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