Artículos

# Weighting perceptions: Psychometric properties of the obesity preconception and weight-related problem scales for Mexican preadolescents

## Evaluando percepciones: Propiedades psicométricas de las escalas de preconcepciones sobre la obesidad y problemas relacionados con el peso en preadolescentes mexicanos

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Abstract: Childhood obesity is a global public health issue, for which Mexico reports exceptionally high rates. This study aimed to develop and provide psychometric evidence for two scales: one that assesses preconceptions about obesity and another that evaluates weight-related problems in Mexican preadolescents. A non-probabilistic sample of 247 overweight or obese fifth and sixth-grade primary school students from Mexico City was used ($\bar{X}$ =10.40, SD=0.65 years of age, $\bar{X}$ =23.61, SD=3.11 BMI). After exploratory and confirmatory factor analyses, both scales demonstrated evidence of structural validity. The scales and subscales achieved moderate internal consistency and concurrent validity by being significantly associated with health-related quality of life. The results highlight the importance of addressing both the physical and psychological aspects of childhood overweight and obesity. The weight-related problem and the attitudes and preconceptions towards obesity scales are valuable

tools for future research and intervention programs designed to improve the well-being of overweight or obese children in Mexico.
Keywords: Overweight, Obesity, well-being, psychometrics, childhood development.
Resumen: La obesidad infantil es un problema de salud pública global, y México registra tasas particularmente altas. Este estudio buscó desarrollar y proveer evidencias psicométricas para dos escalas: Una que evalúa preconcepciones sobre la obesidad, y la otra, problemas asociados con el peso en preadolescentes mexicanos. Se utilizó una muestra no probabilística de 247 estudiantes de quinto y sexto grado de primaria con sobrepeso u obesidad de la Ciudad de México ($\bar{X}$ =10.40, D.E.=0.65 años de edad, $\bar{X}$ =23.61, D.E.=3.11 IMC). Tras análisis factoriales exploratorios y confirmatorios, ambas escalas mostraron evidencia de validez estructural. Las escalas y subescalas alcanzaron una consistencia interna moderada, así como validez concurrente al asociarse significativamente con la calidad de vida relacionada con la salud. Los resultados subrayan la importancia de abordar los aspectos físicos y psicológicos del sobrepeso y obesidad infantil. Las escalas de los problemas relacionados con el peso y las actitudes y preconcepciones hacia la obesidad son herramientas valiosas para futuras investigaciones y programas de intervención destinados a mejorar el bienestar de los niños con sobrepeso u obesidad en México.
Palabras clave: Sobrepeso, obesidad, bienestar, psicometría, desarrollo infantil.

## Introduction

Childhood obesity has become one of the most critical public health concerns worldwide. According to the World Health Organisation (WHO), in 2020, more than 340 million children and adolescents aged 5 to 19 were overweight or obese (**WHO, 2020).** This figure is alarming, considering that the global prevalence of childhood overweight and obesity has increased tenfold in the past forty years (NCD Risk Factor Collaboration, 2017). Childhood overweight and obesity not only represent a challenge in terms of physical health but are also associated with a variety of psychological problems, such as low self-esteem, depression, and anxiety (Godina-Flores et al., 2023; Pulgarón, 2013). Children and adolescents who are overweight or obese are more prone to bullying and stigmatisation, which can exacerbate existing emotional and psychological issues(Rausch Herscovici & Kovalskys, 2015). Furthermore, childhood obesity has immediate implications for children and adolescent physical health and increases the risk of developing chronic diseases in adulthood, such as type 2 diabetes, cardiovascular diseases, and hypertension(Instituto Nacional de Salud Pública, 2022; Puhl & Latner, 2007).

Mexico faces a severe public health crisis due to high rates of childhood overweight and obesity, ranking among the top countries in the world for this issue (Hernández-Cordero et al., 2017; United Nations International Children's Emergency Fund World Health Organisation [UNICEF], 2018). According to the 2022 National Health and Nutrition Survey (ENSANUT), 38% of school-aged children are overweight, and 36% obese. The prevalence of children with overweight or obesity has increased in recent decades, driven by changes in dietary and physical activity patterns. Recent figures reveal that in the past 16 years, the national prevalence of obesity has risen from 30.4% to 36.9%, reflecting a worrying trend that requires urgent attention. The consumption of ultra-processed foods and sugary drinks has increased significantly, while physical activity levels have decreased, contributing to this health problem (Instituto Nacional de Salud Pública, 2022; Mercado-Mercado, 2023; Turnbull et al., 2019).

Given the high prevalence of childhood obesity in Mexico, it is crucial to address the psychological aspects that accompany this condition, as well as the prevention, management and treatment of its consequences. Children who are overweight or obese have a higher prevalence of mental health problems, including conduct and emotional issues, compared to their lower-weight peers, emphasising the importance of addressing both the physical and psychological aspects of this phenomenon (Beynon, 2023). Preconceptions about obesity and the perception of weight-related problems are critical factors affecting both the psychological and physical well-being of

children (Álvarez-Villaseñor et al., 2020; Godina-Flores et al., 2023; Turnbull et al., 2017).

Preconceptions, understood as preconceived beliefs and attitudes about people with obesity, can significantly influence children's self-esteem and mental health. These preconceptions often manifest as stigmatisation, discrimination, and bullying from lower-weight peers, which can lead to feelings of shame, low self-esteem, and depression in children who are overweight or obese (Pont et al., 2017; Puhl & Latner, 2007). Moreover, the stigma of obesity can exacerbate the problems associated with obesity, posing challenges for its treatment and prevention (Sánchez-Carracedo, 2022).

The perception of weight-related problems, on the other hand, refers to children's awareness and concern about the physical and psychological issues that may be associated with their weight. This perception can include concerns about body image, difficulties with physical activity, and the impact of their weight on overall health (Pulgarón, 2013; Rodríguez-Marín & Mercado, 2021). When children internalise negative preconceptions and experience weight-related problems, they experience greater depression, stress, anxiety, and a higher likelihood of developing eating disorders (Álvarez-Villaseñor et al., 2020; Godina-Flores et al., 2023; Griffiths et al., 2010).

Parents and teachers play a crucial role in shaping children's preconceptions and attitudes toward being overweight or obese. Research has shown that negative parental attitudes or preconceptions about weight can influence children's self-image and eating behaviours (Eisenberg et al., 2003; Lytle et al., 2011; Turnbull et al., 2017). Additionally, negative preconceptions and perceptions can be perpetuated by children's social environment, including family, friends, and school (González-Toche et al., 2017; Mercado-Mercado, 2023).

Weight-related stigmatisation experiences can negatively affect children's mental health, leading to issues such as anxiety, depression, and low self-esteem (Puhl & Latner, 2007; Sánchez-Arenas & Ruíz-Martínez, 2015). Research suggests that children who experience weight-related bullying have a significantly higher risk of these psychological problems compared to their lower-weight peers (Rausch Herscovici & Kovalskys, 2015). In addition to stigma and bullying, children and adolescents who are overweight or obese also report a lower quality of life compared to their lower-weight peers (Griffiths et al., 2010).

In recent years, there has been growing interest in studying preconceptions about obesity and weight-related problems due to their significant impacts on children's physical and mental health. Various studies have addressed these topics, providing evidence on how these variables influence the lives and treatment of children who

are overweight or obese (Aceves-Martins et al., 2022; López-Alarcón, 2020; Pompa et al., 2018).

Preconceptions about obesity have been found to vary by age and sex. Findings suggest that girls and adolescents are particularly vulnerable to negative preconceptions about obesity, highlighting the need for targetted interventions for these groups (De-Jongh-González et al., 2023; García Rodríguez, 2018; Latner et al., 2005). Negative preconceptions about obesity have been associated with children's self-image and eating behaviour (De-Jongh-González et al., 2022; Pont et al., 2017). Internalised negative beliefs could lead to disordered eating behaviours and a higher risk of developing eating disorders. Similarly, children who are overweight or obese experience poorer health-related quality of life, more weight-related problems such as headaches and stomachaches, and more behavioural problems compared to their lower-weight peers (Förster et al., 2021).

Other studies underline the importance of addressing preconceptions about obesity and weight-related problems due to their profound impact on children's health and well-being, as stigmatisation and internalised negative beliefs can lead to various psychological issues, such as depression, anxiety, and low self-esteem, as well as disordered eating behaviours (Griffiths et al., 2010; Pompa et al., 2018; Puhl & Latner, 2007). Additionally, these factors can negatively affect children's quality of life, limiting their participation in physical and social activities and diminishing the clinical efficacy of treatment programs and preventive interventions (Pont et al., 2017; Turnbull et al., 2017).

Children and adolescents who are overweight or obese usually want to lose weight, making it crucial to promote healthy eating habits and explore efficacious psychosocial treatments and prevention strategies. They typically experience cycles of food underconsumption, rationalise their weight, and identify themselves as thinner than they are (Ávalos, 2022; García Rodríguez, 2018; Sánchez-Arenas & Ruíz-Martínez, 2015). These studies highlight the importance of addressing both the physical and psychological aspects of childhood obesity, such as preconceptions and weight-related problems, to improve the overall well-being of participants and increase the clinical efficacy of programs (López-Alarcón, 2020; Pompa et al., 2018; Rausch Herscovici & Kovalskys, 2015).

In the Mexican context, where the prevalence of childhood obesity continues to rise, it is crucial to develop interventions that address not only the physical aspects of obesity but also the perceptions and attitudes surrounding it. This is especially important given the high risk of developing chronic diseases at an early age and the additional barriers faced by low-income families in accessing healthy foods and physical activity opportunities (Aceves-Martins et al., 2022; García Rodríguez, 2018; Instituto Nacional de Salud Pública, 2022; Rodríguez-Marín & Mercado, 2021; Turnbull et al., 2017).

Current study

Given the growing need to understand the factors associated with the psychological well-being and symptomatology of overweight or obese children and adolescents, share the development and psychometric assessment of two scales, one regarding preconceptions about obesity and another regarding weight-related problems in Mexican preadolescents. These scales will provide valid and reliable tools for future research and implementing intervention and prevention programs. The study aims to gain a better understanding of how preconceptions and issues impact the well-being of preadolescents who are overweight or obese. This understanding can help develop more effective intervention strategies to create a more inclusive and supportive environment for these children and adolescents.

## Method

### Participants

This study followed an instrumental design (Ato et al., 2013) and used a non-probabilistic sample. We collected anthropometric and psychometric data from upper elementary school students in three public schools in Mexico City in November 2014. All fifth and sixth-grade students were eligible to participate. Only those students with signed informed consent from parents, who verbally agreed to participate, were in the respective schools at the time of the administration of the scales and had a BMI classifying them as overweight or obese, participated. Of the final 247 participants, most were boys (n=141, 57.1%) with obesity (n=135, 54.66%) and were between 8 and 12 years of age ($\bar{X}$=10.40, S.D.=0.65 years of age).

Participants weighed between 34 and 96 kilograms ($\bar{X}$ =49.98, *S.D.*=9.89) and were between 1.27 and 1.63 meters tall ($\bar{X}$ =1.44, *S.D.*=0.07). Based on the WHO classification, the BMI and biological sex of each participant were used to determine whether they were overweight or obese. For reference, girls of approximately eleven years of age with BMIs between 14.5 and 21 are considered average weight, BMIs between 21-24 are overweight, and BMIs >24 are obese (WHO, 2021). More sample characteristics can be found in Table 1.

**Table 1**

Sample Characteristics

| **Table 1***Sample Characteristics* | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total sample | | Overweight | | Obese | |
| | n | 247 | | 112 | | 135 | |
| Sex | | n | % | n | % | n | % |
| | Male | 141 | 57.09% | 57 | 50.89% | 84 | 62.22% |
| | Female | 106 | 42.91% | 55 | 49.11% | 51 | 37.78% |
| Grade | | n | % | n | % | n | % |
| | 5th | 121 | 48.99% | 51 | 45.54% | 70 | 51.85% |
| | 6th | 126 | 51.01% | 31 | 27.68% | 65 | 48.15% |
| | | M | S.D. | M | S.D. | M | S.D. |
| Age | | 10.40 | 0.65 | 10.43 | 0.65 | 10.37 | 0.66 |
| Weight | | 49.87 | 9.89 | 43.66 | 5.77 | 55.23 | 9.54 |
| Height | | 1.45 | 0.07 | 1.43 | 0.07 | 1.46 | 0.07 |
| BMI | | 23.61 | 3.11 | 21.13 | 1.33 | 25.66 | 2.63 |

**Instruments**

### *Weight-Related Problems*

To measure psychological and physical problems related to weight, we developed a 10-item self-report (e.g., *"Because of my weight, I felt sad and embarrassed"*) that is answered using a Likert-type scale ranging from 1 = *"Never"* to 5 = *"Always."*

### *Attitudes and Preconceptions about Obesity*

To measure these, another 10-item long self-report was developed (e.g., *"I think people with obesity cannot be trusted"*), which is answered using a Likert-type scale from 1 = *"Totally disagree"* to 5 = *"Totally agree."*

### *Health-Related Quality of Life*

We used the Mexican validation of the Kiddo-Kindl (KK) (Guadarrama et al., 2015) to measure this construct and its dimensions. The KK consists of a 22-item self-report (such as *"I have felt lonely"*), answered using a 5-point Likert-type scale from 1 = *"Never"* to 5 = *"Always."* The items respond to six latent factors: 1)

Self-esteem with items 3, 9 and 15; 2) School well-being with items 6, 12 and 21; 3) Lack of emotional well-being with items 8, 14, 20, 22 and 23; 4) Fun with Peers with items 2, 5, 11, 17 and 19; 5) Family Well-being with items 4, 10 and 16 and 6) Lack of Physical Well-being with items 1, 7, and 13. In this study, the scale displayed adequate internal consistency ($\omega$=0.78).

**Procedure**

We developed one bank of items containing relevant dimensions of weight-related psychological and physical problems and another bank of attitudes and preconceptions about obesity. We wrote the items to follow the same direction and to reflect the constructs and dimensions found in the national literature on the subject. Once expert judges had approved a pen-and-paper form containing a psychosocial inventory, the proposed scales and the Kiddo-Kindl were devised for cross-validation. Members of the research team contacted elementary schools through visits and emails. During the appointments with principals, the research team presented the methodology and shared the following materials: Informed consent detailing the study's contents, an anthropometric data collection plan, and the final test battery. Data collection was conducted in each school. During the day, groups of four students were called simultaneously to collect their anthropometric data. Once the data has been collected, the application of the psychological battery was administered in the classrooms. A team member asked the children to read the questionnaire to themselves and then answer it with the help of the teachers, who would read the questions aloud. The process lasted approximately 30 minutes.

**Ethical considerations**

The Instituto Mexicano del Seguro Social (IMSS) Ethics Committee approved the study protocol. Before data collection, researchers emphasised that participation was voluntary and shared the consent form with the parents of participating children. The informed consent form contained information regarding the scope of the project, potential risks and benefits derived from participation, as well as the confidentiality policy that highlighted how the data would be protected and used as determined by the guidelines of the code of ethics of the Mexican Society of Psychology (Sociedad Mexicana de Psicología, 2010) and the Declaration of Helsinki. Once consent forms were signed by parents and returned, researchers explained the project and confidentiality agreement in age-appropriate language to participants. They requested their verbal consent during the day of data collection. Participating children were treated as active participants who were valued and respected during the research

process. The team ensured that they were not exposed to stress and were aware they could decline to participate at any stage of the research process.

**Analysis**

Two random subsamples with roughly 120 participants each were extracted from the total database to follow cross-validation methods as proposed by psychometric literature (Brown, 2015;Kline, 2015;Lloret-Segura et al., 2014). The number of participants is adequate to detect medium-sized factor loadings for instruments with fewer than six factors (White, 2022; Wolf et al., 2013). In addition, missing data was less than .3% for the total sample, so we analysed complete cases. The first subsample was used to conduct Exploratory Factor Analyses (EFA) on both the Weight-Related Problems Scale (WRPS) and the Attitudes and Preconceptions about Obesity Scale (APOS). The second subsample was used for Confirmatory Factor Analyses (CFA) on the factorial structures extracted from the EFAs and the Kiddo-Kindl previously validated with Mexican adolescents by Guadarrama et al. (2015). Finally, all participants were included for a final convergent validity model where latent factors of the proposed scales and those from the Kiddo-Kindl were correlated. Item univariate and subscale multivariate normalities were assessed through the Shapiro-Wilk test and Mardia's coefficients. Univariate skewness and kurtosis values were used to determine whether there was a need for data transformation.

The EFAs were performed on polychoric correlation matrices between items. We used the Kaiser Meyer Olkin and Bartlett's Sphericity tests to assess sampling adequacy and factorisable matrices. KMO values above .7 indicate an adequate sample size to proceed, while a significant sphericity test indicates that the correlation matrix differs from an identity matrix and can be factorisable. The number of factors to extract was determined using Horn's parallel analyses, and factors were extracted using Weighted Least Squares (WLS) as this has shown robustness to multivariate non-normality and is a reliable estimator for ordered data (Lloret-Segura et al., 2014). As we expected correlations between latent factors for each scale, we assumed oblique factoring and chose direct oblimin rotation. We also estimated Average Variance Extracted (AVE), Composite Reliability Index (CRI) and Internal Consistency Coefficient (McDonald's $\omega$) for each factor, where AVE>.5, CRI>.7 and $\omega$>.7 are desired (Hair et al., 2006).

CFAs were then performed on the second subsample using the factorial structures extracted in the EFAs for both the WRPS and APOS, as well as the previously reported structure of the Kiddo-Kindl (Guadarrama et al., 2015). CFAs were performed using Diagonally-Weighted Least Squares (DWLS) as an estimator, given

their robustness to multivariate non-normality and adequacy with ordered responses (Li, 2016). Absolute fit was assessed using the chi-square statistic, where non-significant values indicate correspondence between the observed and implied covariance matrix. The close fit was evaluated using the Close Fit and Tucker-Lewis Indexes (CFI & TLI), where values above .95 indicate excellent fit. Residuals were quantified using the RMSEA and SRMR, where values lower than .08 indicate a good fit.

Finally, a structural model was constructed in which all scales were specified, and their latent variables were correlated together. We chose this approach as significant correlations would provide evidence of convergent validity from our scales to dimensions of health-related well-being. Analyses were performed in Rstudio v.4.0.1 using the MVN, psych, lavaan and semPlot packages.

## Results

All items in the EFA subsample (n=130) followed an approximately normal univariate distribution as skewness values were below |2| and kurtosis below |6| (Kim, 2013). The entire subset did not follow a multivariate normal distribution ($M_{Kurt}$=15.68, $p$<.001; $M_{skew}$= 6257.56, $p$<.001). KMO tests indicate sampling adequacy for both scales (i.e. WRPS = .83 and APOS = .78) and factorisable matrices, as both sphericity tests are statistically significant. In both cases, Horn's parallel analysis suggested a two-factor structure.

Two proposed items from the Weight-Related Problems Scale (WRPS) were discarded from the analysis, as they presented communalities of less than .4 and item-rest correlations of less than .2. The two factors of the WRPS scale present eigenvalues greater than one and explain 68% of its variance (43% and 25% respectively). The first factor is comprised of five items measuring psychological problems related to weight (such as *"Because of my weight I felt sad and discouraged"*), obtained high internal consistency ($\omega$=.91), more than adequate average variance extracted (*AVE*=.64) and high composite reliability (*CRI*=.89). The second factor consists of three items measuring the frequency and intensity of physical weight-related problems (such as *"I have frequent bodily discomforts due to being overweight"*). It obtained high internal consistency ($\omega$=.87), more than adequate average variance extracted (*AVE*=.66) and high composite reliability (*CRI*=.85); both factors show a moderate correlation ($r$=.53). The total scale also presents high internal consistency ($\omega$=.93).

Likewise, two items from the Attitudes and Preconceptions about Obesity Scale (APOS) were also discarded due to low commonalities and item-rest correlations; the final eight items of the APOS were arranged into two factors with eigenvalues higher than one, which

explained 55% of their variance (34 and 21%, respectively). The first factor measures perceptions about obesity (such as "*I believe people with obesity cannot be trusted"*) and displays adequate psychometric characteristics such as higher than satisfactory average variance extracted (*AVE*=.54), high composite reliability (*CRI*=.85) and a high internal consistency coefficient ($\omega$=.85). The second factor quantifies personal attitudes towards obesity (such as *"One of the worst things that can happen to me is gaining a lot of weight"*). This factor also displays adequate average variance extracted (*AVE*=.44), as well as moderate composite reliability (*CRI*=.78) and internal consistency ($\omega$=.79). Both factors present a low correlation between them (*r*=.31). The total scale also shows high internal consistency ($\omega$=.87). Table 2 contains subscale structures, factorial loadings, and internal consistency coefficients.

## Table 2

Instruments, Items, EFA Factor Loadings and Consistencies

| **Table 2***Instruments, Items, EFA Factor Loadings and Consistencies* | |
|---|---|
| Scale or subscale | λ |
| Weight-Related Problems Scale (ω=.93) | |
| Psychological (ω=.91) | |
| 1. Because of my weight, I was ashamed | 0.94 |
| 2. Because of my weight, I was upset with myself | 0.91 |
| 3. Because of my weight, I felt sad and discouraged | 0.84 |
| 4. I ended up tired of trying to lose weight | 0.63 |
| 5. Because of my weight, my family scolded me | 0.60 |
| Physical (ω=.87) | |
| 6. I have intense bodily discomforts due to being overweight | 0.99 |
| 7. I have frequent bodily discomforts due to being overweight | 0.76 |
| 8. Being overweight bothered or annoyed me | 0.65 |
| Attitudes and Preconceptions about Obesity Scale (ω=.87) | |
| Preconceptions (ω=.85) | |
| 1. People with obesity are less intelligent | 0.91 |
| 2. I would avoid a person with obesity | 0.72 |
| 3. I think it is difficult to take obese people seriously | 0.69 |
| 4. I think people with obesity cannot be trusted | 0.67 |
| 5. Obese people make me feel a little uncomfortable | 0.65 |
| Attitudes (ω=.79) | |
| 6. One of the worst things that can happen to me is gaining a lot of weight | 0.87 |
| 7. I am worried about being obese | 0.67 |
| 8. I feel upset with myself when I gain weight | 0.66 |

The items in the CFA subsample (n=136) followed an approximately normal univariate distribution with no excess skewness or kurtosis values. The dataset did not follow a multivariate normal distribution ($M_{Kurt}$=14.07, $p$<.001; $M_{skew}$= 15213.27, $p$<.001). The Kiddo-Kindl measurement model without residual covariances obtained absolute fit, significant latent variances, and factor loadings. Internal consistency coefficients for the six factors ranged from $\omega$=.63 to ω=.76, while the total scale showed moderate

total internal consistency ($\omega$=.83). Model fit statistics for CFAs, and the convergent structural model can be found in Table 3.

## Table 3

Fit Statistics for Confirmatory Factor Analyses

**Table 3***Fit Statistics for Confirmatory Factor Analyses*

| Model | $\chi^2$ | df | *p* | CFI | TLI | RMSEA | 90% C.I. | SRMR |
|---|---|---|---|---|---|---|---|---|
| WRPS | 24.46 | 19 | 0.18 | 1 | 1 | 0.05 | [.000-.093] | 0.06 |
| APOS | 33.03 | 19 | 0.02 | 0.99 | 0.99 | 0.07 | [.027-.115] | 0.07 |
| Kiddo-Kindl | 217.48 | 194 | 0.12 | 0.99 | 0.99 | 0.03 | [.000-.049] | 0.08 |
| Convergent validity model | 658.84 | 620 | 0.14 | 0.93 | 0.92 | 0.02 | [.000-.026] | 0.06 |

*Note: WRPS = Weight-Related Problems Scale; APOS = Attitudes and Preconceptions about Obesity Scale*

Note: WRPS = Weight-Related Problems Scale; APOS = Attitudes and Preconceptions about Obesity Scale

The WRPS CFA reports absolute fit, significant latent variances, and factor loadings. Both factors obtained high internal consistency coefficients (Psychological: $\omega$=.84, Physical: $\omega$=.82), and the total WRPS obtained $\omega$=.88. Both factors now show a higher average variance extracted than in the EFA (AVE Psychological: .69 and Physical: .73), higher composite reliability (CRI Psychological: .92, Physical: .89) and a higher correlation between them ($r$=.60). On the other hand, the APOS only obtained close fit, yet reported significant latent variances and factor loading as well as high total internal consistency ($\omega$=.82). Both factors present high internal consistency (Perceptions $\omega$=.84, Attitudes $\omega$=.82), adequate average variance extracted (AVE Perceptions: .57 and Attitudes: .30), adequate composite reliability (CRI Perceptions: .86, Attitudes: .76) and a low correlation between them ($r$=.21).

To test for evidence of convergent validity between the derived scales and the Kiddo-Kindl, we specified a structural model with the correlation between all latent variables. The model obtained absolute fit, and all instruments presented significant latent variances and factor loadings, implying that it accurately represents the existing associations between variables for Mexican preadolescents. All Kiddo-Kindl factors were correlated significantly with each other. As of the WRPS, the psychological problems factor correlated positively with lack of emotional and physical well-being on the Kiddo-Kindl subscales and the remaining three factors from our instruments, while also correlating negatively with the rest of the Kiddo-Kindl factors. The physical problems factor correlated positively with a lack of physical and emotional well-being while correlating negatively with

the family well-being factor, also in the Kiddo-Kindl. Except for the perceptions about obesity and school well-being, factors from the APOS did not present significant correlations to the Kiddo-Kindl. They only presented low correlations with the WRPS scale factors. The resulting structural correlation matrix can be found in Table 4.

## Table 4

Correlations between Latent Variables

**Table 4***Correlations between Latent Variables*

| | EWB | SLF | SWB | FWP | FWB | PWB | PSY | PHY | PRE | ATT |
|---|---|---|---|---|---|---|---|---|---|---|
| EWB | 1 | | | | | | | | | |
| SLF | -.35** | 1 | | | | | | | | |
| SWB | -.35** | .68*** | 1 | | | | | | | |
| FWP | -.40** | .72*** | .73*** | 1 | | | | | | |
| FWB | -.50*** | .53*** | .63*** | .58*** | 1 | | | | | |
| PWB | .70*** | -.29* | -.33* | -.38** | -.30* | 1 | | | | |
| PSY | .72*** | -.28** | -.19* | -.31** | -.22** | .37** | 1 | | | |
| PHY | .46*** | -0.16 | -0.30 | -0.10 | -.25** | .44** | .55*** | 1 | | |
| PRE | 0.04 | 0.03 | -0.26* | -0.16 | -0.12 | 0.20 | 0.07 | 0.13 | 1 | |
| ATT | 0.10 | -0.04 | 0.07 | 0.07 | 0.02 | 0.01 | .34** | .24* | .36** | 1 |

*Note: EWB: Lack of Emotional well-being, SLF: Self-esteem, SWB: School well-being, FWP: Fun with peers, FWB: Family well-being, PWB: Lack of physical well-being, PSY: Weight-related psychological problems, PHY: Weight-related physical problems, PRE: Preconceptions about obesity, ATT: Attitudes towards obesity. *p<.05, **p<.01, ***p<.001.*

Note: EWB: Lack of Emotional well-being, SLF: Self-esteem, SWB: School well-being, FWP: Fun with peers, FWB: Family well-being, PWB: Lack of physical well-being, PSY: Weight-related psychological problems, PHY: Weight-related physical problems, PRE: Preconceptions about obesity, ATT: Attitudes towards obesity. * p<.05, ** p<.01, *** p<.001. Importar_tabla5265c64616

## Discussion

This study aimed to develop and assess the psychometric properties of two scales for Mexican pre-adolescents: the Weight-Related Problems Scale (WRPS) and the Attitudes and Preconceptions about Obesity Scale (APOS). These scales were designed to address the growing need for valid and reliable tools to understand the psychological aspects of childhood overweight or obesity, which has become a significant public health concern in Mexico (Hernández-Cordero et al., 2017; Instituto Nacional de Salud Pública, 2022; UNICEF, 2018). Furthermore, these scales can disaggregate the psychological impact of overweight or obesity on children and adolescents, including associations with self-esteem, well-being, depression, and anxiety identified in previous research (Álvarez-

Villaseñor et al., 2020;Beynon, 2023; Puhl & Latner, 2007; Pont et al., 2017).

The WRPS has a two-factor structure, measuring psychological and physical weight-related problems. The factorial solution identifies experiencing feelings of shame, sadness and inadequacy as the most salient psychological problems faced by the participants. At the same time, the intensity and frequency of bodily discomforts are the most influential physical problems. Both factors exhibited high internal consistency, adequate average variance extracted, and high composite reliability.

The convergent validity analysis revealed several significant associations between the WRPS factors and Kiddo-Kindl subscales, particularly peer relationships and emotional and physical well-being. The associations reveal how preadolescents who are overweight or obese experience poorer health-related quality of life, increased emotional distress, lower self-esteem, and lower family, peer and school well-being than their lower-weight peers. This aligns with previous findings emphasising the interconnection between social, psychological and physical aspects of childhood obesity (López-Alarcón, 2020;Pompa et al., 2018;Pulgarón, 2013; Rausch Herscovici & Kovalskys, 2015;Rodríguez-Marín & Mercado, 2021). Additionally, weight-related psychological problems display more associations than physical problems, which suggests how the emotional burden of being overweight or obese is a critical factor in the prevention and treatment of the studied population (Ávalos, 2022;García Rodríguez, 2018;Sánchez-Arenas & Ruíz-Martínez, 2015; Turnbull et al., 2017).

At the same time, the APOS also revealed a two-factor structure, measuring preconceptions and attitudes towards obesity, with adequate to high psychometric characteristics. The APOS structure reflects biases regarding intelligence, personal value, and trust in people who are overweight or obese, as well as concern about gaining weight.

As highlighted by previous findings, negative preconceptions can lead to stigmatisation, discrimination, and bullying, which may, in turn, affect children's self-esteem and mental health, reflected in the association between preconceptions and school well-being (Álvarez-Villaseñor et al., 2020; Godina-Flores et al., 2023;González-Toche et al., 2017; Mercado-Mercado, 2023; Rausch Herscovici & Kovalskys, 2015). However, the APOS factors showed limited associations with other Kiddo-Kindl subscales, suggesting that attitudes and preconceptions about obesity might represent a distinct construct from general quality-of-life measures. Similarly, we found no associations between attitudes or preconceptions with emotional well-being or self-esteem unlike previous research (Aceves-Martins et al., 2022; Álvarez-Villaseñor et al., 2020; De-Jongh-González et al.,

2022;Eisenberg et al., 2003; Godina-Flores et al., 2023; Griffiths et al., 2010;Pulgarón, 2013;Rodríguez-Marín & Mercado, 2021).

Despite the promising results, this study has several limitations. The sample was limited to Mexican preadolescents, which may limit the generalisability of the findings to other populations or age groups. The study's cross-sectional nature prevents the assessment of the scales' stability over time or their sensitivity to change following interventions. The study did not include a clinical sample of children diagnosed with obesity, which could provide additional insights into the scales' performance in clinical settings. The study did not explore potential differences in scale performance based on gender or socioeconomic status, which could be essential factors in the context of childhood obesity. Finally, due to the limited number of participants, tests for measurement invariance between overweight and obese cohorts could not be performed.

## Conclusions

The WRPS and APOS show promise as valuable tools for assessing weight-related problems and attitudes towards obesity in Mexican preadolescents. These scales can contribute to a better understanding of the psychological aspects of childhood obesity. They may inform the development of more effective intervention strategies by targeting specific family and social dynamics that develop and reinforce this vulnerable population's preconceptions or beliefs about themselves. Weight-related problems could show variations over time by biological sex. This raises the possibility of exploring how physical discomfort and core beliefs may contribute to adolescent development and the sense of self. Moreover, these instruments could also be used to identify the effect of social media or other means of mass communication on preconceptions and beliefs about being overweight or obese.

Future research should focus on validating these scales in various populations, exploring their predictive validity, and investigating their utility in clinical settings. For instance, it could evaluate how preconceptions affect the clinical effectiveness of weight-loss interventions or whether clinical efficacy is maximised by focusing on psychological or physical problems. Finally, childhood obesity in Mexico is a multidimensional phenomenon, and these scales can contribute to the development of multidisciplinary efforts to treat and prevent childhood obesity from a holistic perspective.

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**Weighting perceptions: Psychometric properties of the obesity preconception and weight-related problem scales for Mexican preadolescents**
**Evaluando percepciones: Propiedades psicométricas de las escalas de preconcepciones sobre la obesidad y problemas relacionados con el peso en preadolescentes mexicanos**

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