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RESEARCH

Psychometric analysis of the obesity risk control scale in mexican young people

Análisis psicométrico de la escala control del riesgo de obesidad en jóvenes mexicanos

Análise psicométrica da escala de controle de risco de obesidade em jovens mexicanos

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Abstract

Introduction: Obesity is a public health problem that has been increasing in the young population. The health-promoting behavior that prevents it is obesity risk control, which is part of the nursing taxonomy outcomes; however, it does not have any reliability or validity precedents. **Objective:** To evaluate the psychometric properties of reliability, exploratory and confirmatory factor analysis of the Obesity Risk Control scale in young Mexicans. **Methodology:** Correlational cross-sectional descriptive study. It included 167 young people with normal weight and overweight enrolled in a public university in Mexico, using non-probabilistic sampling. Young people who were not available due to illness, disability or temporary academic leave were excluded. Sociodemographic data card, Family Affluence Scale questionnaire and Obesity Risk Control scale were used. The research adhered to Mexican ethical and legal principles. Reliability was estimated with Cronbach's α coefficient and construct validity with exploratory and confirmatory factor analysis. **Results:** The average age of the participants was 19 years, overweight was predominant and young people sometimes showed control of the risk of obesity. Reliability was α = .927. The Obesity Risk Control scale consisted of two factors and 16 items, with explained variance of 56.2%. **Conclusions:** The Obesity Risk Control scale is reliable and valid to be employed in young Mexicans; however, it is suggested to review the content validity and criterion validity in the described population.

Key words: Obesity; Body Mass Index; Factor Analysis; Standardized Nursing Terminology; Nursing Process (DeCS).

Resumen

Introducción: La obesidad es un problema de salud pública que se ha incrementado en la población joven. La conducta promotora de la salud que la previene es el control del riesgo de obesidad, la cual forma parte de los resultados de la taxonomía de enfermería; sin embargo, no cuenta con antecedentes de fiabilidad ni validez. **Objetivo:** Evaluar las propiedades psicométricas de confiabilidad, análisis factorial exploratorio y confirmatorio de la escala Control del Riesgo de Obesidad en jóvenes mexicanos. **Metodología:** Estudio descriptivo correlacional. Incluyó a 167 jóvenes con normopeso y sobrepeso inscritos en una universidad pública en México, por muestreo no probabilístico. Se excluyó a jóvenes quienes no se encontraron presentes por enfermedad, incapacidad o baja académica temporal. Se empleó la escala Control del Riesgo de Obesidad. La investigación se apegó a principios éticos y legales de México. La fiabilidad se estimó con el coeficiente α de Cronbach y la validez de constructo con análisis factorial exploratorio y confirmatorio. **Resultados:** La edad promedio fue 19 años, en los jóvenes predominó el sobrepeso y a veces demostraron control del riesgo de obesidad. La escala de control del riesgo de obesidad obtuvo una fiabilidad de α = .927, se conformó por dos factores y 16 ítems, con varianza explicada del 56.2 %. **Conclusiones:** La escala Control del Riesgo de Obesidad es fiable y válida para ser empleada en jóvenes mexicanos; sin embargo, se sugiere revisar la validez de contenido y validez de criterio en la población descrita.

Palabras clave: Obesidad; Índice de Masa Corporal; Análisis Factorial; Terminología Normalizada de Enfermería; Proceso de Enfermería (DeCS).

Abstrato

Introdução: A obesidade é um problema de saúde pública que tem aumentado na população jovem. O comportamento promotor de saúde que o previne é o controle do risco de obesidade, que faz parte dos resultados da taxonomia de enfermagem, porém, não possui histórico de confiabilidade ou validade. **Objetivo:** Avaliar as propriedades psicométricas de confiabilidade, análise fatorial exploratória e análise fatorial confirmatória da escala Obesity Risk Control em jovens mexicanos. **Metodologia:** Estudo descritivo transversal correlacional. Foram incluídos 167 jovens com peso normal e com sobrepeso matriculados em

uma universidade pública do México. Foram excluídos os jovens que não estiveram presentes durante a coleta de dados por motivo de doença, invalidez ou afastamento acadêmico temporário. Amostragem não probabilística. Foram utilizados ficha de dados sociodemográficos, questionário Family Affluence Scale e escala Obesity Risk Control. A investigação aderiu aos princípios éticos e legais do México. A confiabilidade foi estimada com o coeficiente α de Cronbach e a validade de construto com análise fatorial exploratória e confirmatória. **Resultados:** A média de idade foi de 19 anos, predominou o sobrepeso e, por vezes, os jovens demonstraram controle do risco de obesidade. A confiabilidade foi α = 0,927. A escala de controle de risco de obesidade foi composta por dois fatores e 16 itens, com variância explicada de 56,2%. **Conclusões:** A escala de controle de risco de obesidade é confiável e válida para ser usada em jovens mexicanos; no entanto, sugere-se revisar a validade de conteúdo e a validade de critérios na população descrita.

Palavras-chave: Obesidade; Índice de Massa CorporaLl Análise Fatorial; Terminologia Padronizada em Enfermagem; Processo de Enfermagem (DeCS).

Introduction

Obesity is a worldwide public health problem [1]; obesity is defined as an abnormal or excessive accumulation of fat that can be detrimental to health and can be identified in people with a Body Mass Index (BMI) greater than 30 kg/m2 [2]. In the epidemiological transition, an increase in obesity has been identified in the young population, in women and in people with low socioeconomic status [3].

The United Nations defines the youth population as those between 15 and 24 years of age. They represent 16% of the world's population, that is, 1200 million [4]. In Mexico, the prevalence of obesity in young people is evident as their age increases, in this sense, young people between 15 and 17 years of age report 32.1% to 32.3% of obesity, while those over 20 years of age show a prevalence of approximately 76% [5]. In this regard, it is estimated that young people with obesity have a 5 times higher risk of passing this state of health into adulthood, compared to young people with normal weight [6].

Obesity in young people is considered a risk factor for the development of some chronic diseases and cardiovascular diseases [7]. Some of the modifiable factors to prevent obesity are regular physical activity [8, 9], acquiring healthy eating habits [10, 11] and receiving help from a social network such as family and friends to encourage them to adopt healthy behaviors [12, 13].

To support the above, the nursing professional can use the Nursing Process as a disciplinary work methodology to guide actions towards the achievement of the healthy behavior, and in turn, incorporate a

theoretical nursing model that allows them to describe and explain the phenomenon of interest, such as the Health Promotion Model that is aimed at achieving health-promoting behavior, with the purpose of improving the individual's health status, functional ability and quality of life at all stages of human development [14]. In this case, the health-promoting behavior is to control the risk of obesity in young people. Obesity Risk Control (ORC) is defined as personal actions to prevent, eliminate or reduce the threat of obesity. Among the actions that can be assessed within this behavior are regular weight control, controlling factors that favor overeating, making healthy food choices and performing regular physical activity, among others [15].

Some of the instruments that allow the evaluation of healthy behaviors to prevent obesity, specifically eating habits and physical activity, are the Health Behavior in School-Aged Children questionnaire [16], Lifestyle Questionnaire II [17], Weight Self-Regulation Inventory [18] and World Physical Activity Questionnaire [19], which have been validated in young people. In addition, there is the Obesity Risk Control scale in the Nursing Outcomes Classification (NOC), which corresponds to the results of the nursing taxonomy [15]; however, even though it is a scale suggested by nursing professionals worldwide, and based on the review of scientific literature, it has no history of evaluation of its psychometric properties (reliability and validity) in Mexico or internationally.

In relation to the above, it should be taken into account that psychometric measurements in the area of health should be reliable and valid in the context and population of interest, so that the construct evaluated can be identified. One of the most frequently used coefficients to determine the reliability of an instrument is Cronbach's alpha, which estimates the degree to which all test items covary with each other [20]. Regarding validity, this evaluates the degree to which evidence and theory support the interpretations of the scores inherent in the use of the test. For this study, only construct validity, which analyzes the internal structure of the ORC scale, was considered to verify empirically whether the items conform to the dimensionality expected by the construct [21].

In this sense, it is essential that the outcome scales used by the nursing professionals are reliable and valid, because they serve as a resource for the care planning stage in the Nursing Process, and based on this, the cyclical process of implementation and evaluation of the nursing care can be completed through specific indicators that determine the current health status of the person and its evolution [15]. The aim of this study was to evaluate the psychometric properties of reliability, exploratory and confirmatory factor analysis of the ORC scale in young Mexicans.

Methodology

This is a descriptive cross-sectional correlational design study [22]. The inclusion criteria were young people (between 15 and 24 years), both sexes, with normal weight and overweight according to the definition of Obesity Risk Control (ORC), enrolled in a public university in Aguascalientes, Mexico, who had access to a mobile device or computer with internet connection to answer the online questionnaire. Those who were not available during data collection due to illness, disability or temporary academic leave were excluded of the study. The population consisted of 250 students. The sample was calculated with the STATS 2.0 statistical program, with a confidence interval of 95%, an error level of 5% and a prevalence of 50%; the calculated sample was 151 participants; however, a non-response rate of 10% was added, so the final sample was 167 young people. This calculation was consistent with the stipulations of the psychometric validity of instruments, since at least 5 observations should be considered for each item of the scale [23].

Participants were recruited through non-probabilistic sampling, within school hours, in virtual modality, following the measures of social distancing for COVID-19. A sociodemographic data form was used to collect information, including age, sex, weight, height, BMI and socioeconomic level. Weight (kg) and height (cm) data were obtained through self-reporting, which were adequately related to real measurements with Intra-class Correlation Coefficient (ICC) = .956 and .953, respectively, and BMI with ICC = .892 [24, 25]. Socioeconomic level was measured using the Family Affluence Scale (FAS) questionnaire, consisting of 4 questions that evaluated the family purchasing power of the participants [26].

The Obesity Risk Control (ORC) scale was used, developed by a group of nursing professionals after a review of scientific literature, and consists of 26 items, with a 5-point Likert-type responses, where 1 = never to 5 = always [15]). Although the number of dimensions is unknown, some of the aspects evaluated are physical activity, information on obesity, calorie control, diet plan, and use of community resources, among others. The ORC scale has no history of reliability or validity in Mexico or internationally.

The overall scoring of the ORC scale was based on the recommendation established in the Nursing Outcomes Classification (NOC) [15], considering the mode obtained in each of the indicators, mode 1 point = the young people never performed actions for ORC, mode 2 points = rarely demonstrated ORC, mode 3 points = sometimes demonstrated ORC, mode 4 points = frequently demonstrated ORC, and mode 5 points = always demonstrated ORC. Additionally, the proposal to evaluate the ORC scale for research purposes considered the sum of the indicators obtained and their transformation to indexes from 0 to 100, resulting in the following classification: 0 to 20 points = never demonstrated ORC; 21 to 40 = rarely demonstrated ORC, 41 to 60 = sometimes demonstrated ORC, 61 to 80 = frequently demonstrated ORC and 81 to 100 = always demonstrated ORC. Regarding the reliability of the instrument, Cronbach's α method was used, considering a value of .80 as acceptable [20], the reliability obtained by the young participants with normal weight and overweight was .927.

The average time to answer the questionnaire was 15 minutes. The research adhered to the ethical and legal principles set forth in the Regulations of the General Health Law on Research in Mexico [27], Chapter I, Article 13 Kind Treatment, Article 14 Informed Consent, Article 16 Confidentiality, Article 17 Classification of Research as Minimal Risk, Article 21 and 22 Dissemination of Results in Research Articles; as well as Chapter III of the Letter of Assent and Chapter V regarding avoidance of retaliation for withdrawal from participation. Authorizations from COFEPRIS (N° 19-CI-19-039-046) and CONBIOETICA (N°19-CEI-004-20180614) were obtained.

Data capture, processing and analysis were carried out with the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics and frequency distribution were used to characterize the participants [28]. To determine construct validity, in the Exploratory Factor Analysis (EFA), Bartlett's test of sphericity (p = .000) and Kaiser-Meyer Olkin's Test of Adequacy (KMO) were performed, where values close to 1 were expected. For the initial factorial solution, the principal component extraction method was used, and the factors were simplified by means of Varimax rotation, excluding factor loadings of less than .30. In the rotated factorial solution, the Kaiser criterion was followed, conserving the factors with eigenvalues > 1 [23, 29]. In the Confirmatory Factor Analysis (CFA), the x^2 value and the normalized Goodness-of-Fit (GFI), Adjusted Goodness-of-Fit Index (AGFI), and the Tuker-Lewis Index (TLI) fit indexes were considered; in these, a value of ≥ .95 was indicative of good model fit and ≥ .90 is acceptable. For the Root Mean Square Error of Approximation (RMSEA) index the value ≤ .05 was indicative of good fit, and the value ≤ .08 is acceptable [21].

Results

The mean age of the young people was 19 years; 82% were female, 59.3% had a medium socioeconomic level; the mean BMI was 27.3% kg/m^2, SD = 2.7, which meant overweight. The mode obtained from the Obesity Risk Control (ORC) scale was 3 points, indicating that the participants sometimes demonstrated ORC. According to the indexes, the mean was 43.0, SD = 16.7, where, 66.5% of the participants sometimes demonstrated ORC.

Regarding the Exploratory Factor Analysis (EFA), the overall reliability Cronbach's α was .927. Bartlett's test obtained x^2 = 2326.4, gl 325, sig .000, KMO = .89. Six factors were identified as healthy nutritional pattern (9 items), caloric control (7 items), obesity control knowledge (4 items), weight control resources (4 items), hydration (1 item), and daily breakfast (1 item). The common variance explained was 65.6 % (Table 1).

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Table 1. Original Obesity Risk Control (ORC) Scale, 2022.

N°	Factor	Question	1	2	3	4	5
ORC1	Obesity Control Knowledge	You recognize the personal risk factors for obesity.					
ORC2		You recognize the consequences of obesity.					
ORC3		You get reliable information about obesity.					
ORC4	Healthy Nutritional Pattern	You commit to a healthy eating plan.					
ORC5		You regularly check your body weight.					
ORC6		You control the factors that drive you to overeat.					
ORC7		You control your personal eating pattern.					
ORC8		You control the family's eating pattern.					
ORC9		You control food portions to maintain a healthy weight.					
ORC10		You choose healthy food.					
ORC11		You prepare healthy meals.					
ORC12	Daily Breakfast	You have breakfast every day.					
ORC13	Healthy Nutritional Pattern	You choose healthy snacks.					
ORC14	Hydration	You drink water to maintain adequate hydration.					
ORC15	Calorie Control	You make adjustments to recipes to reduce calories.					
ORC16		You read food labels for nutritional content.					
ORC17		You introduce new healthy foods into your diet.					
ORC18		You make healthy choices when eating out.					
ORC19		You avoid high-calorie food.					
ORC20		You limit the consumption of high-calorie beverages.					
ORC21		You limit the intake of saturated fats.					
ORC22	Obesity Control Knowledge	You avoid the use of weight-loss drugs.					
ORC23	Weight Control Resources	You engage in regular physical activity.					
ORC24		You maintain a healthy sleep routine.					
ORC25		You get advice from a health professional to establish weight loss strategies.					
ORC26		You use available community resources to increase physical activity.					

Source: Self-development.
Adapted from: Moorhead, S., Swanson, E., Johnson, M., & Mass, M. Obesity Risk Management Scale. In: Nursing Outcomes Classification. 6th edition. Spain: Elsevier; 2018. p. 297.
ORC = Obesity Risk Control Item.

In the CFA, two of the factors of the previous EFA were eliminated because the hydration and daily breakfast factors contained only 1 item each, and the variance explained between them was 4.20%. The conformation of the four resulting models was based on the analysis of covariance matrix, the significant correlation of the factors, the squared multiple correlation $r^2 > .25$ and the measurement errors.

The factor of Weight Control Resources and Obesity Control Knowledge showed significant correlations within their items; however, some of them showed $r^2 < .25$, so these factors were excluded from the model (Table 2).

Table 2. Regression weights between the factors Control Weight Resources, Obesity Control Knowledge, and its squared multiple correlation, 2022. (n=167).

Variable			Estimator	S.E.	C.R.	p	r^2
ORC23	<---	Resources	1.000				.506
ORC24	<---	Resources	.634	.110	5.751	***	.217
ORC25	<---	Resources	.734	.122	6.002	***	.237
ORC26	<---	Resources	1.580	.203	7.772	***	.907
ORC1	<---	Knowledge	1.000				.584
ORC2	<---	Knowledge	1.054	.138	7.632	***	.748
ORC3	<---	Knowledge	.861	.143	6.035	***	.263
ORC22	<---	Knowledge	.882	.177	4.968	***	.178

Source: Self-development.
ORC = Obesity Risk Control Item; Resources = Weight Control Resources; Knowledge = Obesity Control Knowledge; $p < .001$.

Considering the above, the model adjustment was performed only with the factors Healthy Nutritional Pattern and Calorie Control, obtaining $x^2 = 262.2$, df = 103 ($p = .000$), GFI = .835 AGFI = .782, TLI = .884, RMSEA = .096, the common variance explained was 56.2 % (Table 3).

Table 3. Regression weights between the factors Healthy Nutritional Pattern, Calorie Control and their squared multiple correlation, 2022. (n=167).

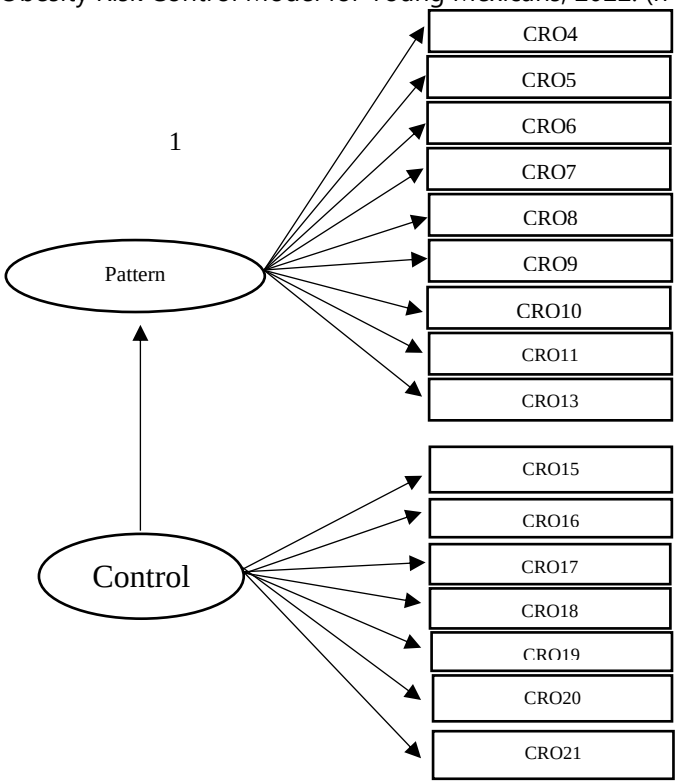
Variable			Estimator	S.E.	C.R.	p	r^2
ORC4	<---	Pattern	1.000				.628
ORC5	<---	Pattern	1.030	.099	10.374	***	.551
ORC6	<---	Pattern	.857	.094	9.089	***	.444
ORC7	<---	Pattern	1.118	.091	12.249	***	.711
ORC8	<---	Pattern	.841	.103	8.130	***	.368
ORC9	<---	Pattern	1.119	.103	10.845	***	.591
ORC10	<---	Pattern	.908	.082	11.119	***	.614
ORC11	<---	Pattern	.825	.084	9.848	***	.507
ORC13	<---	Pattern	.817	.086	9.534	***	.481
ORC15	<---	Control	1.000				.572
ORC16	<---	Control	.979	.115	8.510	***	.435
ORC17	<---	Control	.752	.089	8.455	***	.430
ORC18	<---	Control	.931	.091	10.250	***	.608
ORC19	<---	Control	.992	.089	11.110	***	.702
ORC20	<---	Control	.905	.102	8.889	***	.471
ORC21	<---	Control	.894	.094	9.497	***	.530

Source: Self-development.
ORC = Obesity Risk Control Item; Pattern = Healthy Nutritional Pattern, Control = Calorie Control; $p < .001$.

The proposed model showed a bidirectional correlation between the factors Healthy Nutritional Pattern and Calorie Control of r = .569, SE = .089, CR = 6.366 (p = .001). In this sense, the ORC model for young Mexicans consisted of two factors and 16 items, with a common variance explained of 56.2 % (Figure 1).

Once the resulting items were selected, it was decided to make the final scale with 16 interleaving questions to prevent acquiescence bias. Thus, the healthy nutritional pattern factor consisted of nine items (items 1, 3, 5, 7, 9, 11, 13, 15, 16) and calorie control of seven items (items 2, 4, 6, 8, 10, 12, 14) (Table 4).

Figure 1. Obesity Risk Control Model for Young Mexicans, 2022. (n=167).



Source: Self-development.

ORC = Obesity Risk Control Item; Pattern = Healthy Nutritional Pattern, Control = Calorie Control.

Table 4. Final Scale of Obesity Risk Control for Young Mexicans, 2022.

N°	Question	1	2	3	4	5
1.	You commit to a healthy eating plan.					
2.	You make adjustments to recipes to reduce calories.					
3.	You regularly check your body weight.					
4.	You read food labels for nutritional content.					
5.	You control the factors that drive you to overeat.					
6.	You introduce new healthy foods into your diet.					
7.	You control your personal eating pattern.					
8.	You make healthy choices when eating out.					
9.	You control the family's eating pattern.					
10.	You avoid high-calorie food.					
11.	You control food portions to maintain a healthy weight.					
12.	You limit the consumption of high-calorie beverages.					
13.	You choose healthy foods.					
14.	You limit the intake of saturated fats.					
15.	You prepare healthy meals.					
16	You choose healthy snacks.					

Source: Self-development.

Discussion

With the objective of evaluating the psychometric properties of reliability, exploratory and confirmatory factor analysis of the ORC scale on young Mexicans, it was identified that more than half belonged to a middle socioeconomic level and that most of the participants were overweight.

As for the socioeconomic level, this was lower than that reported by a study [30], which reported that 70% had a medium income. This difference may be due to the fact that this study was carried out in a specific place, whose enrollment in the courses is characterized by the incorporation of a general population with low or medium income. Regarding the overweight of the young participants, this result was higher than that reported by the National Health and Nutrition Survey (ENSANUT), where 4 out of 10 were overweight [31]. However, the changes caused by the social distancing for the prevention of Covid-19 infection should be considered, which led to a decrease in the physical activity of students, and the consequent increase in exposure to "screen" time [32] due to the temporary suspension or closure of sporting events, training centers, gyms, parks and swimming pools as a control measure to mitigate the spread of the virus [33].

Regarding the psychometric properties of the ORC scale, the overall reliability's Cronbach's α was .927, higher than .80, which is the minimum recommended by the literature [20]. The EFA was significant, which allowed inferring the existence of the six initial factors, with explained variance of 65.6%, higher than the recommended value by the psychometric evaluation [29]. With respect to the CFA, the indexes evaluated did not indicate an acceptable model fit [21], which may be due to the prior elimination of four factors, including daily breakfast. However, eating breakfast is a protective factor against obesity, especially in men [9]. This was demonstrated by some researchers, who mentioned an increase in breakfast among students in Spain as a result of health policies focused on maintaining a healthy diet from an early age [34].

In this case, it is suggested to rearrange this question in a predetermined manner in another of the factors, or to include more items as suggested in the literature [20], likewise, for the hydration factor it is necessary to clarify the question and denote the importance of water consumption, since avoiding the intake of sugary

beverages contributes to the prevention of obesity [35]. Furthermore, this is reinforced in young people in whom the characteristic of responsibility predominates, which alludes to the will to achieve, planning, diligence and perseverance [36], showing a positive relationship with the limited consumption of sugar-sweetened beverages from an early age [37 - 38]. It is also necessary to consider the relationship between emotional eating and sugary drinks [39 - 40], which limits the Obesity Risk Control.

Regarding the elimination of the weight control resource factor, it may be due to the structure of the questions, since the use of community resources, medication consumption and sleep quality were joined. However, the availability and use of green spaces close to home, neighborhood safety and neighborhood infrastructure, make it possible to gradually increase energy expenditure and stay in shape, thus promoting longer periods of physical activation [41 - 42].

In relation to the ORC knowledge factor, its exclusion is attributed to the inconsistency with the conceptual definition of ORC, since it refers to the behavior that the person performs [15] and not to cognitive aspects. In this sense, action refers to a certain act that implies activity, movement or change, while knowledge is the understanding of something. Finally, the proposed scale of 16 questions indicated the best validity values; however, it is essential that the factors that represented the final ORC scale (nutritional pattern and calorie control) incorporate questions within these factors that address daily breakfast, intake and frequency of food consumed by young people on a regular basis, so that the explanation of the phenomenon in question can be expanded, as they are considered protective factors against overweight/obesity [34].

The limitations of this study are that weight and height were obtained by self-reporting, due to the fact that at the time of data collection there was an increase in the number of Covid-19 cases in Mexico, which made it necessary to reinforce sanitary measures and gradually incorporate students in the classroom to avoid contagion, a situation that should be addressed in future studies based on anthropometry. The results should be considered with caution for different populations, since it is expected that the older the age, the greater the responsibility for ORC actions.

Conclusions

Initially, the CRO scale is reliable and valid to be used in young Mexicans. The Exploratory Factor Analysis (EFA) estimated six factors (healthy nutritional pattern, calorie control, obesity control knowledge, weight control resources, hydration and daily breakfast); however, the Confirmatory Factor Analysis (CFA) found two factors (healthy nutritional pattern and calorie control), which should be analyzed in depth, since it is necessary to include questions within these factors that involve daily breakfast, food intake and food frequency.

It is suggested that future research evaluate the content and apparent validity of the construct for the age group of interest, considering the roles and the Mexican context for its applicability. In addition, it is suggested that the results of the nursing taxonomy be used in research projects, with prior psychometric validation. The use of this scale in various contexts is recommended in order to strengthen its empirical adequacy in the population of interest.

Conflict of interest

The authors state that they have no economic or professional conflicts of interest.

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