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Obesity prevention messages, risk behaviors for eating disorders and body mass index. Cluster analysis

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Abstract. Public health experts have argued that obesity prevention campaigns can have negative health effects such as risk behaviors for eating disorders. This study aimed to identify the relationship between body mass index, the presence of risk behaviors for eating disorders, and hearing to obesity prevention messages. The adolescents were measured to calculate their body mass index. The presence of risk behaviors for eating disorders was evaluated, and the number and frequently of obesity prevention messages they heard was registered. A cluster analysis was used for the statistical analysis. Among the results it was found, that the adolescents reported hearing an average of seven different obesity prevention messages in one week; the most commonly heard message was measure your waist. The most common risk behaviors for eating disorders seen in the adolescents were excessive exercise and fear of gaining weight. One cluster were identified obese adolescents that reported hearing fewer obesity prevention messages and presented various risk behaviors for eating disorders. Other cluster were normal weight adolescents that reported hearing more obesity prevention messages and presented few risk behaviors for eating disorders. In conclusion, it is advisable to design campaigns that simultaneously prevent obesity and risk behaviors for eating disorders.

Keywords. Obesity, health messages, adolescents, eating disorders.

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1. Introduction

Faced with the problem of obesity in Mexican society, health authorities use the media to broadcast messages promoting a healthy lifestyle. Such messages encourage people to be physically active, eat a balanced diet, and maintain a healthy weight (Secretaría de Salud de México [SSA], 2013a) as for example: eat fruits and vegetables, drink water, reduce fat, sugar, and salt intake, exercise, get active, and practice a sport. Other messages refer to body mass index (BMI) and measurement of the waist circumference, such as weigh yourself and measure your waist (Instituto Mexicano del Seguro Social [IMSS], 2015; SSA, 2013b).

Public health experts, however, have argued that obesity prevention campaigns can have negative health effects (Couch et al., 2018; Simpson et al., 2017). Some studies have observed that, after obesity prevention campaigns are implemented, children, adolescents and women may feel insecure about their weight or have a desire to lose weight. They may eat less or skip meals, engage more frequently in binge eating, go on more diets, exercise more or obsess over their weight (Frances and Bulik, 2008; Neumark-Sztainer et al., 2009; Shentow-Bewsh et al., 2016).

These actions are known as risk behaviors for eating disorders (RBED). An RBED refers to individual practices geared towards controlling or reducing body weight, in response to biological, psychological, or sociocultural circumstances. RBED include: binge eating, fasting or going on restrictive diets, using laxatives or diuretics, self-induced vomiting, and excessive exercise. RBED, together with low self-esteem and body dissatisfaction, are key factors in the development and diagnosis of eating disorders. Eating disorders are mental illnesses related to eating habits and excessive concern for weight and body image. Types of eating disorders include anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified (Campbell and Peebles, 2014).

The objective of this study was to evaluate the relationship between BMI, hearing to obesity prevention messages and the presence of RBED using a cluster analysis. A cluster analysis is a descriptive technique that classifies individuals into homogeneous groups according to their positive association between variables, without distinguishing between dependent and independent variables. This type of analysis is typically used in marketing research to classify customers into groups according to their behavior or purchasing interests (Gleason et al., 2015).

2. Materials and methods

1.1. Study participants

The survey was conducted with students in a school in Mexico City. In total, 460 adolescents participated, representing about 25% of the entire school population. The average participant age was 12.7 ± 0.9 years; 46% of respondents was male and 54% female. Written informed parental consent was requested of all participants. All necessary measures were taken to preserve the privacy of the students, and the study was approved by the Research and Ethics Commission of the Medical School at the National Autonomous University of Mexico.

1.2 Information collection

While at school, the adolescents filled out a questionnaire that asked for general information (age and sex) and information about obesity prevention messages. They were asked to respond yes or no to the question: have you heard this message in the media (television, radio, internet or print media)? They responded to that question for each of the following messages: eat a healthy diet, reduce the consume high-fat foods, reduce the

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consume the foods sugar and sugar-sweetened beverages, reduce salt in your foods, eat fruits and vegetables, drink water, practice a sport, exercise, walk 30 minutes a day, weigh yourself, and measure your waist. When the students' response was positive (yes), they were asked how many times they had heard that message that week. Their response options were: daily, one to three times this week, and not this week.

To measure RBED, a short questionnaire was used to collect information on the following risk behaviors: fear of gaining weight, binge eating, loss of control over diet, self-induced vomiting, fasting, dieting, excessive exercising, and using pills, diuretics and laxatives (Unikel et al., 2004). The questionnaire, previously validated in Mexican adolescents, consists of ten questions with four answer options: never, sometimes, frequently and very frequently. Each answer has a score which are added at the end. The cut-off scores are: 0 to 6 points, low risk; 7 to 10 points, moderate risk; and over 10 points, high risk.

Weight and height were measured (without shoes or heavy clothing) using a seca 214 stadiometer and an omron HBF-514 digital scale. The adolescents' BMI was calculated by age and sex, using the World Health Organization (WHO) z-score classification: underweight: (≤-2.00); healthy weight: (-1.99 to 0.99); overweight: (1.00 a 1.99); and obese: (≥2.00) (De Onis et al., 2007).

1.3 Statistical analysis

The collected information was analyzed using the SPSS Statistics software. Descriptive statistics were used to describe the information, and the chi-squared (X^2) test was used to make comparisons among variables by age and sex, with statistical significance defined as $p<0.05$.

A multivariate cluster analysis was used, with a non-hierarchical method (k-means), and an analysis of variance using the F-test statistic. In this study, it was used to characterize groups of adolescents by age, BMI, presence of RBED, and hearing obesity prevention messages. Once the groups were defined, the X^2 ($p<0.05$) test was used to identify significant differences among them.

3. Findings

Obesity prevention messages

On average, the adolescents reported hearing seven of the eleven obesity prevention messages each day. The most frequently heard messages were measure your waist (56.7%) and weigh yourself (33.3%), while the most infrequently heard were eat fruits and vegetables (2.2%) and drink water (1.1%), are presented in Table 1. Upon comparing the frequency of hearing these messages by sex, it was found that men more frequently heard the messages reduce salt in your food ($X^2=6.2$; $p\leq0.05$) and walk 30 minutes a day ($X^2=5.7$; $p\leq0.05$).

Table 1. Frequency of obesity prevention messages heard by adolescents in Mexico City.

Obesity prevention message	Frequency heard (%)		
	Daily	1 to 3 times per week	Never
Reduce the consume the foods sugar and sugar-sweetened beverages	17.4	57.8	24.8

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Eat a healthy diet	2.8	48.5	48.7
Reduce the consume high-fat foods	14.1	60.0	25.9
Reduce salt in your foods	20.9	50.9	28.3
Eat fruits and vegetables	2.2	22.8	75.0
Drink water	1.1	12.8	86.1
Practice a sport	5.7	42.2	52.2
Exercise	3.7	32.8	63.5
Walk 30 minutes a day	18.5	49.3	32.2
Weigh yourself	33.3	53.7	13.0
Measure your waist	56.7	36.1	7.2

The study also revealed that underweight adolescents heard more frequently the message drink water (20.0%), those of normal weight heard more frequently exercise (70.6%), overweight adolescents more frequently heard reduce salt in your foods (20.8%), and obese adolescents more heard frequently eat a healthy diet (46.2%). No significant differences were found in comparing groups by sex.

Risk behaviors for eating disorders

The study found a 2.6% frequency of RBED classified as high risk. The most frequent RBED reported were: fear of gaining weight (20.0%) and excessive exercise (32.0%). The least reported RBED were: self-induced vomiting and using pills or diuretics. No statistically significant differences were found when comparing RBED by sex.

Cluster analysis

Age was found to be not a statistically significant factor in the first cluster analysis ($F=0.44$; $p=0.65$), and so it was discarded for the second analysis. In that analysis, three groups were identified: 1 (n=214), 2 (n=156) and 3 (n=90). The variables and their statistical significance were: BMI ($F=383.1$; $p\leq0.05$), messages heard ($F=19.39$; $p\leq0.05$), and RBED reported ($F=336.44$; $p\leq0.05$). This three-cluster solution was used because it offered a relatively clear and precise differentiation of the groups, in accordance with the variables used in this study.

Group 1 contained 214 adolescents, representing 46.5% of the total sample. These adolescents heard seven obesity prevention messages each day, they had normal BMI and reported two of the ten RBED looked at in this study. Group 2 had 156 adolescents, 33.9% of the total. They also heard seven obesity prevention messages daily, but they had BMI corresponding to overweight, and reported four of the RBED. Group 3 had 90 adolescents,

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19.6% of the total. They heard five obesity prevention messages each day, had BMI corresponding to obesity, and presented eight of the ten RBED.

Statistically significant differences were found when analyzing each obesity prevention message heard among the three groups are presented in Table 2, with the exception of the message eat a healthy diet, which was reported heard equally by all three groups.

Table 2. Frequency of obesity prevention messages heard by adolescents, by groups identified using cluster analysis, Mexico City.

Obesity prevention message	Groups (%) 1 n=214	2 n=156	3 n=90	X^2	p
Eat a healthy diet					
Daily	2.8	1.9	4.4	5.64	0.23
1 to 2 times per week	52.3	42.3	50.0		
Never	44.9	55.8	45.6		
Reduce the consume the foods sugar and sugar-sweetened beverages					
Daily	19.2	14.2	18.9	26.31	0.00
1 to 2 times per week	66.8	50.0	50.0		
Never	14.0	35.9	31.1		
Reduce the consume high-fat foods					
Daily	18.7	9.6	11.1	18.95	0.00
1 to 2 times per week	64.0	58.3	53.3		
Never	17.3	32.1	35.6		
Reduce salt in your foods					
Daily	20.6	19.9	23.3	16.98	0.00
1 to 2 times per week	59.3	46.8	37.8		
Never	20.1	33.3	38.9		
Eat fruits and vegetables					
Daily	3.3	1.3	1.1	13.75	0.00
1 to 2 times per week	29.4	15.4	20.0		
Never	67.3	83.3	78.9		
Drink water					
Daily	1.4	0.0	2.2	13.75	0.00
1 to 2 times per week	17.8	6.4	12.2		
Never	80.8	93.6	85.6		
Practice a sport					
Daily	6.5	3.8	6.7	13.71	0.00
1 to 2 times per week	48.1	32.1	45.6		
Never	45.3	64.1	47.8		
Exercise				13.15	0.01

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Daily	5.1	2.6	2.2		
1 to 2 times per week	35.5	23.7	42.2		
Never	59.3	73.7	55.6		
Walk 30 minutes a day					
Daily	23.8	14.7	12.2	15.90	0.00
1 to 2 times per week	51.9	44.2	52.2		
Never	24.3	41.0	35.6		
Weigh yourself					
Daily	42.1	26.3	24.4	20.24	0.00
1 to 2 times per week	50.5	55.1	57.8		
Never	7.5	18.6	17.8		
Measure your waist					
Daily	61.7	48.7	58.9	13.74	0.00
1 to 2 times per week	34.1	38.5	36.7		
Never	4.2	12.8	4.4		

The analysis of each RBED in the three groups are presented in Table 3, finding also statistically significant differences, with the exception of using laxatives, which was not statistically significant in any of the groups.

Table 3. Risk behaviors for eating disorders among adolescents, by groups identified by cluster analysis, Mexico City.

Risk behavior for eating disorder	Groups (%) 1 n=214	2 n=156	3 n=90	X^2	p
Fear of gaining weight					
A lot/frequently	6.0	16.7	60.0	178.2	0.00
Sometimes	27.6	52.6	34.4		
Never	66.4	30.8	5.6		
Binge Eating					
A lot/frequently	2.8	7.7	20.0	43.91	0.00
Sometimes	39.7	41.0	54.4		
Never	57.5	51.3	25.6		
Loss of control over diet					
A lot/frequently	3.3	2.5	27.8	87.45	0.00
Sometimes	18.2	28.8	36.7		
Never	78.5	68.6	35.6		
Self-induced vomiting					
A lot/frequently	0.0	0.0	3.3	24.52	0.00
Sometimes	1.4	1.3	7.8		
Never	98.6	98.7	88.9		

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Fasting					
A lot/frequently	0.5	0.6	10.0	58.27	0.00
Sometimes	2.8	10.3	21.1		
Never	96.7	89.1	68.9		
Dieting					
A lot/frequently	0.5	2.6	28.9	183.4	0.00
Sometimes	7.0	26.9	50.0		
Never	92.5	70.5	21.1		
Excessive exercising					
A lot/frequently	14.9	34.0	68.8	176.3	0.00
Sometimes	28.0	52.6	30.0		
Never	57.0	13.5	1.1		
Using pills					
A lot/frequently	0.0	0.0	3.3	25.34	0.00
Sometimes	0.9	0.0	5.6		
Never	99.1	100.0	91.1		
Using diuretics					
A lot/frequently	0.0	0.0	1.1	20.78	0.00
Sometimes	0.0	0.0	4.4		
Never	100.0	100.0	94.4		
Using laxatives					
A lot/frequently	0.5	0.0	2.2	11.85	0.06
Sometimes	0.9	0.0	3.3		
Never	98.6	100.0	94.4		

4. Discussion and conclusion

This study found that adolescents with a lower or normal weight were who heard more obesity preventive messages per day than those who were overweight or obese. Overweight or obese adolescents may be avoiding the messages as a response to pressure from health authorities and society, who make them responsible for their obesity. This gives the idea that a person with obesity is to blame for his/her risk behaviors for consuming high-fat foods and sugary drinks, and little or no physical activity (Ramos, 2015).

It was also observed that the messages reported being heard more frequently among adolescents were those that have to do with body measurement, such as weigh yourself and measure your waist. This finding reflects the adolescent concern about his or her body. However, these types of messages could have a negative effect on adolescent health because studies have described the psychological impact of encouraging adolescents to weigh themselves; they conclude that it is not useful and negatively affects mental health. It can lead young people to obsess over watching and controlling their weight (Neumark-Sztainer et al., 2006; Pacanowski et al., 2015). Adolescents are already worried about their body image; encouraging them to weigh themselves reinforces that concern, and compounds their dissatisfaction when their body doesn't look like the perceived ideal.

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Another important finding of the study was found in the group of obese adolescents with various RBED (between the more frequently were excessive exercise, dieting, and binge eating). This relationship can be explained with the results others studies of obese people, showing that they often accept the responsibility for their condition and seek to solve their weight problem (Greener et al., 2010), through behaviors that allow them to lose or control their weight. Among different motivations that can influence behavior from losing weight to to fomenting an obsession to do so, is to suffer weight discrimination. The messages contain images representing a thin body as a healthy body and obesity as an illness. This reaffirms social stereotypes that look down on obesity, creating fear among adolescents that they will be discriminated against, insulted, and/or ridiculed for their weight (Cruz-Licea et al., 2018; Puhl et al., 2013).

Finally, to avoid the relationship between obesity and RBED, it is necessary to carry out obesity and eating disorders prevention campaigns; however, it is recommended that when designing obesity prevention messages, it would do well to consider a more positive focus: to emphasize the health benefits of maintaining an adequate weight, to strengthen self-esteem and body satisfaction, promoting the diversity of body types, and to reaffirm that there is no ideal body type.

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