Association between the Stages of Change according to the Transtheoretical Behavior Model and Obesity in Individuals Attending Primary Care in the State of Guanajuato

ABSTRACT

Obesity is a significant public health issue, marked by excessive adipose tissue accumulation, heightening the risk of numerous diseases. In Mexico, adult obesity rates surpass the global average. The Transtheoretical Model of Behavior, conceived by Prochaska and DiClemente, emphasizes individuals' readiness to alter behaviors, such as enhancing healthy food intake and physical activity—crucial for weight reduction.

Aims: This study aims to evaluate the association between the stages of change in the Transtheoretical Model of Behavior and obesity prevalence in adults attending primary health care in Guanajuato.

Study Design: An observational and cross-sectional study.

Place and Duration of Study: The study was conducted in primary health care settings across the state of Guanajuato, Mexico, over a period of six months.

Methodology: The study included a sample of 164 adults. Participants' Body Mass Index (BMI) and abdominal circumference were measured. A questionnaire was administered to determine their stage of change in the Transtheoretical Model: precontemplation, contemplation, preparation, action, and maintenance. The association between these stages and obesity prevalence was analyzed.

Results: There was a significant association between the maintenance stage and a lower prevalence of obesity. Participants in the maintenance stage exhibited lower BMI and consistent values compared to those in other stages. Additionally, barriers and facilitators to adopting and sustaining healthy behaviors were identified. Most participants were in the precontemplation and contemplation stages, indicating a need for continuous education and support to help them progress to more advanced stages of behavior change.

Conclusion: This study provides evidence for developing personalized interventions based on the Transtheoretical Model of Behavior to enhance obesity prevention and treatment in primary care settings.

Keywords:Body Mass Index, Healthy Behavior, Obesity, Primary Care, Stages of Change, Transtheoretical Model of Behavior.

1. INTRODUCTION

Obesity is characterized by the excessive accumulation of adipose tissue, which poses a health risk [1]. It also constitutes a significant public health challenge globally. In 2016, the worldwide prevalence in adults was estimated at 12%, which equates to approximately 650 million individuals.

Analyses indicate that between 1980 and 2016, the incidence of obesity has tripled [2]. Moreover, the World Obesity Federation warns that if adequate measures are not implemented, this figure could surpass one billion people by 2030 [3]. In Mexico, the prevalence of obesity in adults is 36.9%, and the prevalence of overweight is 38.3%, figures well above the global average [4].

Available evidence supports the notion that obesity is a complex and chronic disease, characterized by a heterogeneous nature. Addressing this disease requires an individualized strategy that considers a wide range of factors [5]. Among these factors, lifestyle changes stand out as first-line measures. These changes can result in a reduction of body weight by 5% or more over a period of three to six months [6]. However, it is essential to recognize that for a healthy lifestyle to be successfully implemented, patients must be willing to adopt a behavior change approach.

In this regard, the Transtheoretical Model of Behavior (TTM), developed by Prochaska and DiClemente, presents itself as a valuable conceptual approach to addressing behavior change in weight control programs. This model is based on identifying the individual's readiness to modify their behaviors, such as increasing the consumption of healthy foods and physical activity, ultimately influencing body weight reduction [7]. The TTM offers a framework that allows for understanding and adapting intervention strategies according to each person's stage of change: precontemplation, contemplation, preparation, action, and maintenance; making it a promising tool for addressing obesity in the primary care setting. De Freitas et al. conducted a randomized controlled trial with Brazilian women over 20 years old who were overweight or obese. Lifestyle interventions, including physical exercise and nutritional education, were provided to both the control and experimental groups. Additionally, individual counseling based on the TTM for weight loss was implemented in the experimental group. The results showed significant differences in favor of the experimental group [8].

The purpose of this research was to evaluate the association between the "maintenance" stage according to the TTM and the prevalence of obesity in adults attending primary care centers in the State of Guanajuato.

2. METHODOLOGY

The protocol was approved by Ethics Committee for Research from Hospital General de San Luis de la Paz.

The study design was observational, cross-sectional, analytical study, with a universe of 200 people attend the Primary Health Care CAISES Pardo in Guanajuato, México, and the study was developed between February-May 2024.

A simple random sampling was conducted among adults attending CAISES, and they were invited to participate.Anthropometric Data Collection: Participants were weighed and measured using the SECA digital scale, following the manufacturer's specifications. Abdominal circumference was measured with the cloth tape measure, ensuring the measurement was taken at the navel level and at the end of a normal exhalation.

Data was recorded on a sheet with sociodemographic variables (sex, age, educational level) as well as anthropometric data: weight, height, and body mass index. Additionally, a validated questionnaire was applied to determine the participants' stage of change. The questionnaire consists of four questions designed to identify the stages of precontemplation, contemplation, preparation, action, and maintenance.

2.1 Criteria of selection

The criteria of selection were: to inclusion, men or women from 18 years or higher who attended the Primary Health Center Pardo in Guanajuato, México, and who signed the informed consent. As exclusion criteria, were patients known to have comorbidities that may directly affect weight as thyroid disorders, diabetes, metabolic syndrome; patients taking medications that could alter weight as antidepressants, corticosteroids; pregnant or breastfeeding women, as these conditions may influence weight and certain attitudes towards behavior change.

As elimination criteria werepatients without answer the questionnaire o rejected measure of the Body Mass Index

2.2 Variables

2.2.1 Variables Sociodemographic

- Sex, a nominal dichotomous qualitative variable defined as the categorization based on physiological and anatomical characteristics, classified as Female and Male.

- Chronological Age: A continuous qualitative variable defined as the time elapsed between the moment of birth and the present moment. It was measured in years.

- Educational Level: An ordinal qualitative variable defined as the degree of education according to stages in the Mexican educational model, measured by levels (Elementary, Secondary, etc.).

2.2.2 Independent

- Stage of Change in Behavior according to the TTM (Transtheoretical Model). An ordinal categorical qualitative variable defined as the process by which a behavioral change occurs, measured by different stages (Precontemplation, Contemplation, Preparation, Action, Maintenance).

2.2.3 Dependent

- *Body Mass Index. A continuous quantitative variable defined as the measure that evaluates a person's weight in relation to their height, which helps classify a healthy weight from those that are not, measured by decimal numbers. Units in kg / (height in m^2).*

2.3 Questionnaire

The questionnaire to measure stages of change consists of 4 questions aimed at identifying the participant's stage of change. Precontemplation: No specific time is defined to consider behavior change; Contemplation: Plans to address the possibility of change within at least 6 months; Preparation: Plans to implement behavior change within a month; Action: Currently carrying out the behavior change; Maintenance: Has maintained the behavior change for more than 6 months. Questions are based on this timeline to help identify each stage. The questionnaire has an inter- and intra-observer Kappa validity of 1.00 [9].

2.4 Calculation of Minimum Sample Size

If 62% of those in the maintenance stage are non-obese and 38% in the rest of the stages, the sample size is 76 in the maintenance stage and 76 in other stages with 95% precision and 80% power (Epi Info® 2021 version 7.2.5.0; CDC, Atlanta, GA, USA) [10].

2.5Statistical analysis

Descriptive statistics of the variables and inferential statistics between obesity (Overweight/Obese vs. Adequate) and the stage of change (In maintenance vs. Not in maintenance) were performed. Subsequently, a Chi-square test was conducted to determine if there is a significant association between Overweight/Obesity and being in the maintenance stage, and the odds ratio was calculated to determine the strength and direction of the association. Alpha value = .05 for all cases. The statistical analysis was performed using Stata 13.0 (Stata Corp., College Station, TX, USA).

3. RESULTS AND DISCUSSION

The sample was formed by 164 participants; their sociodemographic quantitative characteristics are show in table 1.

Table 1: Distribution of the Quantitative Characteristics of Participants (n=164)

Variable	Range	Mean ± Standard Deviation
Age (years)	18 to 93	50.66 ± 16.11
Weight (kg)	40.45 to 145	75.40 ± 18.54
Height (m)	1.39 to 1.86	1.59 ± 0.09
BMI (kg/m²)	16.57 to 50.77	29.86 ± 6.30
AbdominalPerimeter (cm)	65 to 156	99.41 ± 15.37

BMI: Body Mass Index

Source: Own elaboration

Most of our participants are women, comprising 76.22% of our population. Likewise, the educational level of most participants is secondary and primary, making up 67.68% of the population (Table 2).

Table 2. Distribution of the categorical characteristics of the participants (n=164)

Variable	n	%
Sex		
Women	125	76.22
Men	39	23.78
Educational Level		
None	7	4.27
Primary	47	28.66
Secondary	64	39.02
High School	30	18.29
Bachelor's Degree	16	9.76

Source: Own elaboration

The distribution of the sample for stages of change is homogeneous from 16 to 26%. For classification of BMI, predominates the participants with obesity 41.46% (Table 3).

Table 3. Distribution of status of obesity and change stage (n=164)

Variable	n	%
Stages of Change		
Precontemplation	33	20.12
Contemplation	43	26.22
Planning	30	18.29
Action	27	16.46
Maintenance	31	18.90
Obesity		
Obesity	68	41.46
Overweight	65	39.63
Adequate	31	18.90

Source: Own elaboration

In table 4 show the relationship between stages of change and obesity (P<.05).

Table 4. Cross-Tabulation of change stages with Obesity/Overweight

	Body Mass Index (kg/m^2)				X^2, df, p-value
Variable	**OW/OB**		**Adequate**		
	n	**%**	**n**	**%**	
Stages of Change					28.09, 4, .0001
Pre-contemplation	30	90.91	3	9.09	
Contemplation	40	93.02	3	6.98	
Planning	25	83.33	5	16.67	
Action	23	83.19	4	14.81	
Maintenance	15	48.39	16	51.61	

OW/OB: Overweight/Obesity, **df**: degrees of freedom.
Source: Own elaboration

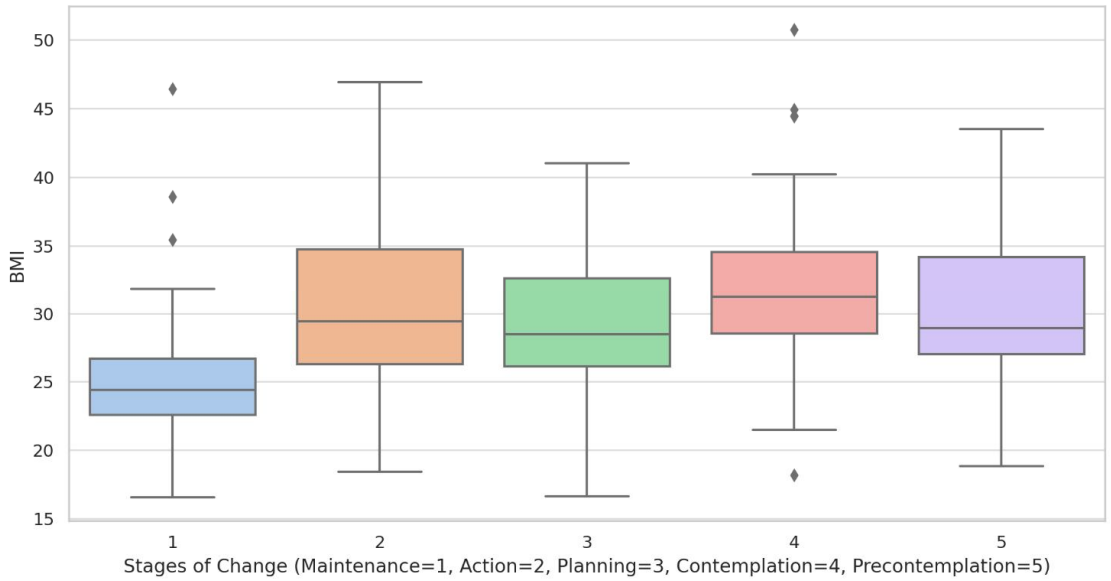
The effect of maintenance on overweight/obesity shows a strong relationship (P<.05) an a preventive effect of 89.53% to have overweight/obesity (Table 5).

Table 5. Cross-Tabulation of Overweight/Obesity by the maintenance stage

Variables	**Body Mass Index**				**X^2, df, P-value**	**OR (95%CI)**
	OW/OB		**Adequate**			
	n	**%**	**n**	**%**		
Maintenance	14	45.16	118	88.72	27.67, 1, .00001	0.1047 (-1.00 to -0.26)
Other Stages of TTM	17	54.83	15	11.27		

OW/OB: Overweight/Obesity, **TTM**: Transtheoretical Model of Behavior **CI**: Confidence Interval
Source: Own elaboration

The distribution of the population in each stage according to the TTM in descending order is 26.22% for the Contemplation stage, 20.12% for Pre-Contemplation, 18.9% for Maintenance, 18.29% for Planning, and 16.4% for Action.



Graph1: Relationship Between Stages Of Change And Body Mass Index
Source: Own elaboration

Association of the Transtheoretical Model with BMI

A significant association was identified between the different stages of the TTM and BMI with P-value 0.001 and a 95% CI (0.49 to 1.83). Notably, the most relevant association with BMI was identified in the maintenance stage, where a lower prevalence of overweight and obesity was found with P-value .00001, OR: 0.1047, 95%CI (-1.00 to – 0.26). For a more specific analysis between each Stage of Change, a boxplot was created to describe the distribution of BMI (Graph 1).

Maintenance (1):
The median BMI in this stage is within adequate values. Most BMI values are within a narrow range, and there are few outliers, indicating that BMI values are consistent in this stage. Therefore, we can conclude that the maintenance stage is associated with an appropriate BMI. The outliers may indicate that some individuals consider themselves in maintenance without truly being in this stage.

Action (2), Planning (3), Contemplation (4), and Precontemplation (5):
The median remains in the overweight range except in the precontemplation stage, where it is in obesity values. Compared to the maintenance stage, there is greater variability and more outliers.

3.1 Discussion

The main objective of this study was to establish an association between the Maintenance Stage of the TTM and BMI. The hypothesis was corroborated, showing a significant association indicating a lower prevalence of overweight and obesity among participants in the maintenance stage. Furthermore, a significant relationship between the different stages of the model and BMI was demonstrated. This information is relevant as it helps us better understand how stages of behavior change affect body weight control, providing evidence that can be used to develop more effective interventions for the prevention and treatment of overweight and obesity in primary care.

It is important to recognize that many participants were in the precontemplation and contemplation stages, representing 46% of the total. This highlights the need to continue educating patients to recognize and accept their condition of being overweight or obese. Additionally, it is essential to provide the necessary tools and resources that allow them to adopt and maintain healthy lifestyle habits. Education and support in these early stages are crucial to facilitate the transition to more

advanced stages of the Transtheoretical Model, which could increase the effectiveness of interventions aimed at the prevention and treatment of overweight and obesity. Evidence from works such as De Freitas et al. [8] and Berra-Ruiz E et al. [7] propose the use of motivational interviews, patient education, stimulus control, and 'self-liberation'—defined as the establishment of the belief that change is possible—as tools in these stages.

On the other hand, the prevalence of overweight in the study group was 38.41% and for obesity, it was 42.07%, slightly above the national average [4]. This highlights the need for more research focused on detecting barriers that perpetuate the prevalence and incidence of overweight and obesity in the state of Guanajuato. Understanding these barriers is crucial for developing effective prevention and treatment strategies that can be implemented at the local and regional levels.

It is important to detail the main pros and cons of the stages of change of the TTM identified in this work. Firstly, the model assumes that participants make coherent and organized plans, which is not always true. Some participants considered that stopping the consumption of certain products, such as soda, was a sufficient change, even though their diet remained high-calorie and of poor quality, and their lifestyle remained sedentary. For this reason, it was important to have trained interviewers to adequately identify the concepts of appropriate “dietary or exercise regimen.” Secondly, even if a patient is in the maintenance stage, if they start from a very high weight, they will still be in “inadequate” ranges, so we must consider that we could underestimate the association; therefore, context is highly relevant when identifying the stage of change. Likewise, one aspect that needs to be illuminated about the TTM for the adoption of a healthier lifestyle is understanding the dynamics of individuals at each stage of change, as proposed by Villalobos V et al. [10] An absolute advantage of this model is that it allows us to quickly assess a patient's readiness for any behavior change, enabling the physician to plan their medical advice more appropriately during the consultation.

Recalculating the sample size with the results obtained, 51.61% of mante and without overweight/obesity and 48.39% in another stages without overweight/obesity, the sample size should be 3786 in each group, with 95% of precision and 80% of power (EpiInfo, 7.2.5.0., 2021, CDC, Atlanta, GA, USA).

Finally, it is necessary to mention the limitations of the study. Firstly, the cross-sectional design of the study prevents establishing causal relationships between the stages of the TTM and obesity; only associations at a specific point in time can be observed. The study population is limited to adults attending primary care centers in Guanajuato, which may not be representative of other populations or regions. The stages of change were assessed through self-report questionnaires, which may be subject to social desirability biases and memory errors. Also, we should consider the sample size with the results obtained in this study.

4. CONCLUSION

In conclusion, this cross-sectional observational study has provided significant evidence on the association between the stages of the Transtheoretical Model of Behavior (TTM) and the prevalence of overweight and obesity in adults attending primary care centers in the state of Guanajuato. It was found that participants in the "maintenance" stage of the TTM have a lower prevalence of overweight and obesity compared to those in other stages. These findings highlight the importance of personalized interventions based on the TTM stages to promote healthy behaviors and control body weight. The study also highlights that most participants are in the precontemplation and contemplation stages, suggesting the need for greater education and support to encourage the transition to more advanced stages of behavior change. Interventions targeting these early stages are crucial to improving the effectiveness of overweight and obesity prevention and treatment.

CONSENT

All authors declare that written informed consent was obtained and signed by the subjects participating

ETHICAL APPROVAL

All authors hereby declare that the protocol was approved by Ethics Committee for Research from Hospital General Salamanca.

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