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PREVALENCE OF DISORDERED EATING BEHAVIORS AND ITS RELATION WITH BODY MASS INDEX: A TWENTY-YEAR ANALYSIS

TESIS

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CONTENTS

ABSTRACT

Prevalence of disordered eating behaviors and its relation with body mass index: A twenty-year analysis

Despite of the large amount of epidemiological studies, there is still a considerable debate about the prevalence of disordered eating behaviors (DEB) in women, such as restrictive dieting, fasting, binge eating, use of laxatives and/or diuretics, and self-induced vomiting, since it is not clear whether they have increased, decreased or remained stable through the years. In addition, literature suggests that individuals with a greater/lesser body mass index (BMI) are more likely to present DEB, but insufficient studies have analyzed this hypothesis according the severity of each behavior. Therefore, the purpose of this research was to examine over a 20-year period, the prevalence of DEB in women according their BMI. The total sample was N= 2738 Mexican college women between the ages of 17 to 29 (x= 19.95, SD= 1.92). Data was collected from 1994 to 2013 and was divided into two periods (Time 1: 1994-2003 and Time 2: 2004-2013) to examine statistical differences when comparing two 10-year periods. DEB were measured using some items of the Eating Attitudes Test and of the Bulimia Test. DEB prevalence were calculated according three severity levels (low, medium, high); Cross-tabulations to examine the prevalence in different BMI categories; and Chi square tests, to examine the statistical differences. The results showed that in college women, overweight and obesity prevalence have significantly increased during the last 20 years, going from 18.4% to 25.5%, and from 2.7% to 8.8%, respectively. Restrictive dieting (26.3%) and binge eating (13.8%) were the two more common DEB, followed by use of laxatives and diuretics (8.7%), self-induced vomiting (4.1%) and fasting (1.5%), Surprisingly the DEB were more frequent in normal weight women than in those with overweight or obesity. Restrictive dieting was the only DEB that showed a statistical increase over time in medium (from 0.8% to 3.2%; $X^2(1) = 16.63$, $p < 0.001$) and high (from 0.3% to 1.9 %; $X^2(1) = 12.47$, $p < 0.001$) severity but only in the obesity group. Finally in Time 2 it was observed a significant decrease in the DEB's prevalence. It is concluded that restrictive dieting still is the more common weight control method, DEB are more frequent in normal weight women and DEB showed a decreased prevalence over time.

Key words: Disordered eating behaviors, prevalence, women, body mass index, Mexico.

RESUMEN

Prevalencia de las conductas alimentarias de riesgo y su relación con el índice de masa corporal: Un análisis de 20 años

A pesar de la gran cantidad de estudios epidemiológicos, todavía existe un debate considerable sobre la prevalencia de conductas alimentarias de riesgo (CAR) en mujeres, tales como dieta restrictiva, ayuno, atracón, uso de laxantes y/o diuréticos, y vómitos auto-inducidos, ya que no es claro si han aumentado, disminuido, o se han mantenido estables en el tiempo. Además, la literatura sugiere que los individuos con un alto o bajo índice de masa corporal (IMC) tienen más probabilidades de presentar CAR, pero pocos estudios han analizado esta hipótesis en función de la severidad de cada conducta. Por lo tanto, el propósito de esta investigación fue examinar, durante un período de 20 años, la prevalencia de las CAR en mujeres según su IMC. La muestra total fue de N = 2738 universitarias mexicanas, de entre 17 y 29 años de edad (x = 19.95, DE = 1.92). Se recopilaron datos desde el año 1994 hasta 2013, y se les dividió en dos períodos (Tiempo 1: 1994-2003 y Tiempo 2: 2004-2013) para examinar las diferencias estadísticas al comparar entre dos periodos de 10 años. Las CAR se midieron utilizando algunos reactivos del Test de Actitudes Alimentarias y del Test de Bulimia. Se calculó la prevalencia de CAR en función de tres niveles de severidad (baja, media, alta); tablas de contingencia para examinar dicha prevalencia de acuerdo a las diferentes categorías de IMC; y pruebas Chi cuadrado para conocer las diferencias estadísticas. Los resultados mostraron que, en mujeres estudiantes universitarias, las prevalencias de sobrepeso y obesidad aumentaron significativamente durante los últimos 20 años, pasando de 18.4% a 25.5%, y de 2.7% a 8.8%, respectivamente. La dieta restrictiva (26.3%) y el atracón (13.8%) fueron las dos CAR más comunes, seguidas por el uso de laxantes y diuréticos (8.7%), el vómito auto-inducido (4.1%) y el ayuno (1.5%). Sorprendentemente, las CAR fueron más frecuentes en las mujeres de peso normal que en aquéllas con sobrepeso u obesidad. La dieta restrictiva fue la única CAR que mostró un incremento significativo a través del tiempo, en los niveles medio (de 0.8% a 3.2 %; $X^2(1) = 16.63$, $p < 0.001$) y alto (de 0.3% a 1.9 %; $X^2(1) = 12.47$, $p < 0.001$) de severidad, pero esto sólo en el grupo con obesidad. Finalmente en el Tiempo 2 se observó una disminución estadísticamente significativa en la prevalencia de las CAR. Se concluye que la dieta restrictiva sigue siendo el método de control de peso más común, que las CAR son más frecuentes en las mujeres de peso normal y que hubo una disminución en la prevalencia de las CAR a través del tiempo.

Palabras clave: Conductas alimentarias de riesgo, prevalencia, mujeres, índice de masa corporal, México.

INTRODUCTION

Eating disorders (ED) such as anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED) are psychopathologies that involve clinically significant abnormalities in the attitudes and behaviors related to food ingestion, which results in the impairment of physical health or psychosocial functioning (American Psychiatric Association [APA], 2013; Mancilla et al., 2006).

In the last two decades the study of epidemiology on ED has increased significantly, yielding important information that helps us to characterize these psychopathologies in terms of occurrence, risk, trends over time, etc. For example, it has been documented that these disorders affect mainly adolescent and young women (Garner, 2008; Smink, van Hoeken, & Hoek, 2012), and some lifetime prevalence rates for AN, BN and BED are 0.9%, 1.5% and 3.5% among women, and 0.3%, 0.5% and 2.0% for men (Hudson, Hiripi, Pope, & Kessler, 2007).

Also, it has been highly reported that ED not otherwise specified (a heterogeneous, not well define group of ED) are more prevalent than specific disorders in both clinical and community samples (Machado, Machado, Gonçalves, & Hoek, 2007; Mancilla-Diaz et al., 2007; Olesti et al., 2008). This information suggests that disordered eating behaviors must be isolated and studied individually, due to their clinical relevance, as these behaviors may act as important risk factors, not only because individuals who present them at early and late adolescence are more likely to develop an ED in adulthood, but also because these

individuals are more susceptible to depression, low self-esteem, anxiety, substance abuse and suicide attempts (Garner & Keiper, 2010b; Kotler, Cohen, Davies, Pine, & Walsh, 2001; Nunes, Barros, Anselmo, Camey, & Mari, 2003; Preti, Rocci, Sisti, Camboni, & Miotto, 2011; Tylka & Mezydlo, 2004).

Some examples of these risky behaviors are: restrictive dieting, fasting, self-induced vomiting, and abuse of laxatives and/or diuretics, all these behaviors performed as weight control methods; Binge eating is also considered a risky behavior of ED, especially when it emerges as a stress response. Although body mass index (BMI) is not a behavior, it could be considered as a risk indicator since some studies have found that, in adolescents and young men and women, disordered eating behaviors are more frequent as the BMI increases (Kiziltan, Karabudak, Ünver, Sezgin, & Ünal, 2006; Nunes et al., 2003; Unikel, Saucedo-Molina, Villatoro, & Fleiz, 2002). An emaciated BMI is also associated to eating pathologies, especially in AN.

The present study will refer to these behaviors as **disordered eating behaviors (DEB)**, as they are strictly related with the diagnostic criteria proposed by the *Diagnostic and Statistical Manual of Mental Disorders* ([DSM-5], APA, 2013) and because they are powerful predictors of the development of full-blown ED (Garner, 2008; Jacobi, Abascal, & Taylor, 2004; Nunes et al., 2003).

Despite of the large amount of epidemiological studies, there is still a considerable debate about the prevalence of DEB in women, since it is not clear whether they have increased, decreased or remained stable through the years. This has important implications to health

planners and policy makers who base their decisions, in part, on these types of results. In addition, literature suggests that individuals with a greater/lesser BMI are more likely to present DEB, but insufficient studies have analyzed this hypothesis per behavior, and there is the need to know the spectrum of the DEB in terms of severity or frequency levels (low, medium, high), because this data will provide more accurate information that could contribute to enhancing the design of preventive and intervention programs. Moreover, it is well known that an early identification of DEB may significantly improve the treatment of ED as well as quality of life (Forman-Hoffman, 2004; Hoek & van Hoeken, 2003).

Finally, examining longitudinal studies is especially valuable when the interest of the researcher is to know the evolution of certain behaviors over time. Therefore, the purpose of this research was to examine over a 20-year period, the prevalence of disordered eating behaviors in women according their BMI.

BACKGROUND

1. EATING DISORDERS

The concept "eating behavior" denotes a highly complex phenomenon involving different factors such as culture, economic status, food availability, social context, and sometimes, moods. For this reason, the study of eating behavior needs to go beyond its biological explanation, considering the human being as a biopsychosocial entity. In other words, eating behavior represents a relationship between the individual and the environment, where food transcends its status of mere meal and is endowed with multiple emotional, physical, and interpersonal meanings that exceed the nutritional field. An example of a significant disturbance in these areas could be eating disorders (Academy for Eating Disorders, 2010; Garner & Keiper, 2010a; Mancilla et al., 2006).

The fifth edition of the DSM (APA, 2013) includes several changes in the chapter *Feeding and Eating Disorders*. For instance, binge eating disorder (BED) was recognized as a well-defined disorder, anorexia nervosa (AN) and bulimia nervosa (BN) were revised, and pica, rumination, and avoidant/restrictive food intake were removed from the category *Disorders Usually First Diagnosed in Infancy*, C*hildhood or Adolescence*. The purpose of these changes is to decrease the number of individuals diagnosed with "eating disorder not otherwise specified" providing a more accurate diagnosis, and therefore, a better treatment plan.

It is worth mentioning that AN and BN are closely linked psychopathologies, because they share certain clinical features and, at the same time, a significant number of patients switch

from one syndrome to the other during the course of the disorder (Behar, 2004). However, diagnostic criteria for AN, BN, and BED result in a classification scheme that is mutually exclusive, so during a single episode, only one of these diagnoses can be assigned.

Described below are the diagnostic criteria proposed by DSM-5 (APA, 2013) for AN, BN, BED, Other Specified Eating Disorders, and Unspecified Eating Disorders.

Anorexia Nervosa

For the diagnosis of AN (APA, 2013), the following criteria must be met:

A. Restriction of energy intake relative to requirements, leading to a significantly low body weight in the context of age, sex, developmental trajectory, and physical health. Significantly low weight is defined as a weight that is less than minimally normal or, for children and adolescents, less than that minimally expected.

B. Intense fear of gaining weight or of becoming fat, or persistent behavior that interferes with weight gain, even though at a significantly low weight.

C. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or persistent lack of recognition of the seriousness of the current low body weight.

Specify whether:

Restricting type: During the last 3 months, the individual has not engaged in recurrent episodes of binge eating or purging behavior (e.g., self-induced vomiting or the misuse of

laxatives, diuretics, or enemas). This subtype describes presentations in which weight loss is accomplished primarily through dieting, fasting, and/or excessive exercise.

Binge-eating/purging type: During the last 3 months, the individual has engaged in recurrent episodes of binge eating or purging behavior (e.g., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

Specify if:

In partial remission: After full criteria for AN were previously met, Criterion A (low body weight) has not been met for a sustained period, but either Criterion B (intense fear of gaining weight or becoming fat or behavior that interferes with weight gain) or Criterion C (disturbances in self-perception of weight and shape) is still met.

In full remission: After full criteria for AN were previously met, none of the criteria have been met for a sustained period of time.

Specify current severity:

The minimum level of severity is based, for adults, on current body mass index (BMI; see below) or, for children and adolescents, on BMI percentile. The ranges below are derived from World Health Organization categories for thinness in adults; for children and adolescents, corresponding BMI percentiles should be used. The level of severity may be increased to reflect clinical symptoms, the degree of functional disability, and the need for supervision.

Mild: BMI ≥ 17 kg/m²;

Moderate: BMI 16–16.99 kg/m²;

Severe: BMI 15–15.99 kg/m²;

Extreme: BMI < 15 kg/m²

Bulimia Nervosa

For the diagnosis of BN (APA, 2013), the following criteria must be met:

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by the following two aspects:

1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than what most individuals would eat in a similar period of time under similar circumstances.

2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).

B. Recurrent inappropriate compensatory behaviors in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, or other medications; fasting; or excessive exercise.

C. The binge eating and inappropriate compensatory behaviors both occur, on average, at least once a week for 3 months.

D. Self-evaluation is unduly influenced by body shape and weight.

E. The disturbance does not occur exclusively during episodes of AN.

Specify if:

In partial remission: After full criteria for BN were previously met, some, but not all, of the criteria have been met for a sustained period of time.

In full remission: After full criteria for BN were previously met, none of the criteria have been met for a sustained period of time.

Specify current severity:

The minimum level of severity is based on the frequency of inappropriate compensatory behaviors (see below). The level of severity may be increased to reflect other symptoms and the degree of functional disability.

Mild: An average of 1–3 episodes of inappropriate compensatory behaviors per week.

Moderate: An average of 4–7 episodes of inappropriate compensatory behaviors per week.

Severe: An average of 8–13 episodes of inappropriate compensatory behaviors per week.

Extreme: An average of 14 or more episodes of inappropriate compensatory behaviors per week.

Binge Eating Disorder

For the diagnosis of BED (APA, 2013), the following criteria must be met:

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:

1. Eating in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than what most people would eat in a similar period of time under similar circumstances.

2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).

B. The binge eating episodes are associated with three (or more) of the following:

1. Eating much more rapidly than normal.

2. Eating until feeling uncomfortably full.

3. Eating large amounts of food when not feeling physically hungry.

4. Eating alone because of feeling embarrassed by how much one is eating.

5. Feeling disgusted with oneself, depressed, or very guilty afterward.

Specify if:

In partial remission: After full criteria for BED were previously met, binge eating occurs at an average frequency of less than one episode per week for a sustained period of time.

In full remission: After full criteria for BED were previously met, none of the criteria have been met for a sustained period of time.

Specify current severity:

The minimum level of severity is based on the frequency of episodes of binge eating (see below). The level of severity may be increased to reflect other symptoms and the degree of functional disability.

Mild: 1–3 binge eating episodes per week.

Moderate: 4–7 binge eating episodes per week.

Severe: 8–13 binge eating episodes per week.

Extreme: 14 or more binge eating episodes per week.

Other Specified Eating Disorders

This category is applied when the individual does not meet the full criteria for any of the ED. It is important that the clinician communicate the specific reason of why individual is classified in this section (e.g., "bulimia nervosa of low frequency").

These are examples of presentation that can be classified as "other specified":

1. Atypical anorexia nervosa: All of the criteria for AN are met, except that despite significant weight loss, the individual's weight is within or above the normal range.

2. Bulimia nervosa (of low frequency and/or limited duration): All of the criteria for BN are met, except that the binge eating and inappropriate compensatory behaviors occur, on average, less than once a week and/or for less than 3 months.

3. Binge eating disorder (of low frequency and/or limited duration): All of the criteria for BED are met, except that the binge eating occurs, on average, less than once a week and/or for less than 3 months.

4. Purging disorder: Recurrent purging behavior to influence weight or shape (e.g., self-induced vomiting; misuse of laxatives, diuretics, or other medications) in the absence of binge eating.

5. Night eating syndrome: Recurrent episodes of night eating, as manifested by eating after awakening from sleep or by excessive food consumption after the evening meal. There is awareness and recall of the eating. The night eating is not better explained by external

influences such as changes in the individual's sleep-wake cycle or by local social norms. The night eating causes significant distress and/or impairment in functioning. The disordered pattern of eating is not better explained by BED or another mental disorder, including substance use, and is not attributable to another medical disorder or to an effect of medication.

Unspecified Eating Disorders

This category applies to presentations where the symptoms characteristic of an eating disorder predominate causing clinically significant distress or impairment in social, occupational, or other important areas of functioning, but do not meet the full criteria for any of the ED. The unspecified eating disorder category is also used in situations in which the clinician chooses not to specify the reason (because he/she is not sure) why the criteria are not met for a specific ED, and includes presentations in which there is insufficient information to make a more specific diagnosis (e.g., in emergency room settings).

Finally, it is important to mention that some individuals only show isolated aspects of disordered eating behaviors. This is a matter of interest for research since most adolescents who seek ED treatment, do not strictly meet criteria for a specific ED (Fairburn & Harrison, 2003). Moreover, an early identification of these behaviors may significantly improve the treatment of the illness, as well as the quality of life (Forman-Hoffman, 2004; Hoek & van Hoeken, 2003).

2. DISORDERED EATING BEHAVIORS

Disordered eating behaviors are disturbed and unhealthy eating patterns that may act as important risk factors, not only because those who present them at early and late adolescence are more likely to develop an ED in adulthood, but also because these individuals are more susceptible to depression, low self-esteem, anxiety, substance abuse, and suicide attempts (Garner & Keiper, 2010b; Kotler et al., 2001; Nunes et al., 2003; Preti et al., 2011; Tylka & Mezydlo, 2004).

Some examples of risky behaviors are: binge eating, restrictive dieting, fasting, self-induced vomiting, and abuse of laxatives and/or diuretics. These behaviors have been identified in some studies as "abnormal eating behaviors" (Forman-Hoffman, 2004; Nunes et al., 2003), "eating disturbances" (Mousa, Al-Domi, Mashal, & Jibril, 2010), "unhealthy eating behaviors" (Neumark-Sztainer, Wall, Eisenberg, Story, & Hannan, 2006), etc., but this study will refer them as **Disordered Eating Behaviors (DEB)**, since they are strictly related to the diagnostic criteria proposed by DSM-5 (APA, 2013), and because they are powerful predictors of the development of full-blown ED syndromes (Garner, 2008; Jacobi, Abascal et al., 2004; Nunes et al., 2003).

While not a behavior itself, Body Mass Index (BMI) could be considered a risk indicator, as several studies have found that in adolescents, and young men and women, DEB are more frequent as the BMI increases (Kiziltan et al., 2006; Nunes et al., 2003), while an emaciated BMI is also associated to eating pathologies, and especially in AN.

In order to have a better understanding of all DEB, a description of each behavior is provided:

Binge Eating

Binge eating is defined as those episodes in which a person eats significantly more food, in a short period of time, than most people would eat under similar circumstances, accompanied by feelings of lack of control[1]. The type of food consumed during binges varies across individuals, but most patients report a preference for hyper-caloric food. It is important to note that binge eating is characterized more by an abnormality in the amount of food consumed than by a craving for a specific nutrient (APA, 2013; Hudson et al., 2007). Binge eating usually occurs in secrecy or as inconspicuously as possible.

In community samples, binge eating is more common in men than women. A study by Saucedo-Molina and Unikel (2010) revealed prevalence rates in high school girls and boys of 4.2% *vs*. 6.8% respectively, and for undergraduate women and men of 2.8% *vs*. 4.2% respectively. The presence of the behavior was determined by selection of the answer "very frequently". Although prevalence rates in women were lower than those for men, they still represent an important proportion of women at risk.

The most common antecedent of binge eating is negative affect. Other triggers include interpersonal stressors and negative feelings related to body weight, body shape, and food (Neumark-Sztainer, Wall, Guo et al., 2006). Binge eating is associated with obesity, and this

[1] An indicator of loss of control is the inability to refrain from eating or stop eating once started and eat too quickly even when he or she is not hungry (APA, 2013).

condition (especially morbid obesity) is associated with increased risk of mortality (Hudson et al., 2007; Solomon & Manson, 1997). The main concern of this behavior is that those who suffer from binge eating, commonly do so because they have been restricting their intake, which could lead them to fall in a vicious circle where the more they diet, the more they binge, and vice versa. Because of this, restrictive dieting is also considered a DEB.

Restrictive Dieting

The association between restrictive dieting and ED is probably one of the most often quoted in theories on the etiology of these psychopathologies, perhaps because historically it is one of the most common methods used by society for weight control (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). Restrictive dieting is defined as the intentional avoidance or restriction of food intake in order to reduce body weight or to prevent weight gain (de Lauzon-Guillain et al., 2006; Garner, 2008; van Strien & Oosterveld, 2008).

Body weight concerns induce people, especially women, to engage in unbalanced, unsupervised, and unhealthy diets, which may lead to numerous negative physical and psychological consequences. For example, in adolescents rigorous dieting may cause delayed linear growth and delayed puberty (Daee et al., 2002). Other physical signs and symptoms include continuous and crippling fatigue, dizziness, blurred vision, heart palpitations, abdominal distress, and headaches. Mood swings and depression also can be caused by physiological changes, such as electrolyte imbalances, dehydration, and hormone and vitamin deficiencies (Ruusunen, 2013).

Despite the belief that dieting is conducive to weight reduction, this behavior (performed without medical/nutritional supervision) has been associated with an increased risk of long-term weight gain. Ironically, rather than being a solution to obesity, restrictive dieting may actually be one of the causes (Garner, 2008).

Some data reported by Patton, Selzer, Coffey, Carlin, and Wolfe (1999), support the magnitude of clinical relevance of restrictive dieting. Fifteen-year-old girls classified as dieters were five times more likely to develop an eating disorder compared to non-dieters, and severe dieters were 18 times more likely.

However, it is important to mention that restrictive dieting is not the only body weight control method performed by some individuals; there are more extreme methods such as fasting.

Fasting

Fasting may lead to serious nutrient and mineral deficiencies. An absolute fast is defined as abstinence from all food and liquid for a defined period, usually a single day (24 hours), or several days (Maughan, Fallah, & Coyle, 2010).

The short-term effects of fasting lead to several negative consequences, some of them are: lower body temperature, shortness of breath, abnormally slow heart rhythm, electrolyte imbalances, weakness, and fatigue. Fasting has detrimental impacts in the long-term as well, for example, not only can it cause serious damage to the immune system, but also in many other organs, including permanent kidney and liver infections or failure, severe

hypoglycemia leading to neurological and mental deterioration, loss of menstrual cycle due to lack of hormone and estrogen by the ovaries, osteopenia[2], osteoporosis[3], high risk of heart attack, lung collapse, perforated ulcers, etc., factors that significantly compromise the life of the individuals who engage in this clinically relevant behavior (Maughan et al., 2010).

Psychologically, even one day without eating may cause dysfunctional cognitive function, limiting individuals' ability to perform daily tasks and causing drastic changes in judgment, concentration or alertness. Other psychological consequences derived from fasting could be: anxiety, depression, irritability, outbursts of anger, and significantly decreased interest in sexual urges, hobbies, and education, among others (Toro & Castro, 2004).

Self-induced vomiting

This behavior can be defined as the intentional act of releasing the gastric contents by the mouth, through self-induced, sustained contractions of the abdominal muscles and diaphragm, generated by stimulation of the palatal area around the uvula with the hand, finger, or some other item (Merriam-Webster Dictionary, 2013).

Self-induced vomiting performed as a weight control method may become frequent, habitual, and difficult to eradicate. Sometimes people describe it as having become an

[2] Defined as the reduction of bone mass due to a decrease in the osteoid synthesis rate or any decrease in bone mass below the normal for age and sex (World Health Organization [WHO], 2007).
[3] It occurs when bones lose an excessive amount of their protein and mineral content, particularly calcium. As a result, bones become fragile and break easily. Even a sneeze or a sudden movement may be enough to break a bone in someone with severe osteoporosis (WHO, 2007).

almost automatic reflex after eating, and, in severe cases, the mere thought of food may cause strong nausea.

Vomiting causes dehydration due to the large volume of fluid that is lost during the act. The effect of dehydration can lead people to believe they have lost weight when in fact, they have only lost fluid. This is because when the stomach suddenly contracts to vomit, around 50% of its content is pushed further down into the intestine where it will be digested and absorbed. Although half of the food contents of the stomach stay in the body, vomiting causes a significant loss of essential minerals. The habit of repeatedly drinking water and vomiting in order to wash out all stomach content, speeds up this mineral loss, but the worst part is that, in each attempt, gastric acids severely damage the esophagus (Eating Disorders Network South East Scotland, 2009).

Long-term self-induced vomiting can provoke relevant health problems, such as: broken blood vessels in the eyes, dental erosion, severe tooth decay, gum disease, mouth and esophagus ulcers, headaches, fainting, blisters and scabs on the back of the hands, stomach pains, and, in some cases, the onset of throat or stomach cancer (Eating Disorders Network South East Scotland, 2009).

Electrolyte imbalance is another negative consequence of self-induced vomiting; and this effect is also produced by the misuse of laxatives or diuretics.

Use of laxatives and/or diuretics

The clinical relevance of this behavior, the use of laxatives and/or diuretics, has to do with drug self-prescription. These drugs are easy to obtain, and for some people are considered a common weight control method. However, using drugs with the purpose of forcing the body to react in unnatural ways, may suggest the entrance of a psychopathological circuit.

Laxatives are drugs that stimulate intestinal activity and fecal elimination, while diuretics stimulate renal activity and increase urine emission.

The abuse of laxatives causes abdominal cramps, constipation, diarrhea and incontinence due to the induction of irregular and forced bowel activity (Crispo, Figueroa, & Guelar, 1996). A person taking laxatives to control weight is also going to cause damage to the inside intestinal wall, and experience periods of water retention.

Diuretics work on reducing water retention, and only temporarily decrease the amount of water in the body. Their use can cause dehydration, electrolyte imbalances, and specifically potassium deficiencies that can result in hospitalization. Prolonged use of diuretics can lead to fluid retention even when the diuretics are discontinued (Crispo et al., 1996; Toro & Castro, 2004).

The practice of any of the DEB mentioned above, may be reflected in BMI, since the individuals who engage in these extreme weight-control methods dangerously alter the metabolism of the body. This occurs essentially for two reasons. The first is because water is the most important need of the body, and when a person misuses laxatives and/or

diuretics and engages in self-induced vomiting, they endanger the body through severe dehydration, and the lack of water inhibits the interchange of electrolytes between the brain and the blood, particularly certain molecules of the metabolic process which are only water-soluble. The second reason is because metabolism requires not only energy, but also specific nutrients, such as proteins, nucleic acids, lipids, minerals and vitamins. An imbalance between the total daily energy expenditure and the daily intake will slow the basal metabolism and cause the body set point to rise until the body weight rises uncontrollably for the person, driving them to a constant weight gain though they engage in extreme restrictive dieting behaviors (Miján, Mateo, & Pérez, 2004).

Body Mass Index

This index establishes a proportional relationship between weight and height. It is calculated as weight in kilograms/height in meters^2. It is the most widely used measure in anthropometry applied, especially in health sciences. The WHO (2004) suggests this measure as a potential discriminator allowing a quick, simple, and inexpensive diagnostic tool in order to classify people from emaciated to obese. The ranges proposed by WHO are: Severe thinness (BMI ≤ 16); Underweight (BMI 16.1-18.4); Normal weight (BMI 18.5-24.9); Overweight (BMI 25-29.9); Obese (BMI ≥ 30); Obesity Class I (BMI 30-34.9); Obesity Class II (BMI 35-39.9) and Obesity Class III (BMI ≥ 40). In Mexico, the Official Norm (NOM-043-SSA2-2012) describes the BMI classification for Mexicans. The ranges are exactly the same as those proposed by the WHO, the only difference is that there is a special categorization for

men and women of short height (Women < 1.50 mts; Men < 1.60 mts; [Secretaría de Salud, 2012]).

In this study, BMI is considered a clinically relevant indicator, since some studies have found that obesity class III (BMI ≥40) is associated with BED and unhealthy weight control practices; in contrast, low BMI (<18.5) is significantly associated to AN (Hudson et al., 2007; Unikel et al., 2002). Moreover Fairburn, Cowen, and Harrison (1999), in an etiological study with general psychiatry patients and a group of non-psychiatric controls, found that almost a third of the subjects with BED and 40% of those with BN, reported childhood obesity, as compared with 13% to 19% of the control group.

Although very few studies have examined the relationship between BMI and DEB, it is important to continue studying this relation since the anthropometric indices represent and give meaningfulness to body image (Ocampo et al., 2014). Besides, BMI acquire different significances depending on the ideal body established in each culture, which may lead the individual to develop from body dissatisfaction to DEB (Mumford & Choudry, 2000).

It is important to mention that whenever possible this measure must be taken by professionals, as some individuals experience a distorted body weight and shape, making self-reported BMI neither an accurate nor reliable measure.

3. MAIN CONCEPTS IN EPIDEMIOLOGICAL RESEARCH

Epidemiological research is an applied branch of science that studies disease and health in human populations in three dimensions: biological or physical, perceptual or psychological, and social or behavioral (Kleinbaum, Kupper, & Morgenstern, 1982). Besides providing valuable information that helps us characterize an illness in terms of occurrence, risk, trends over time, etc., this type of research is an important tool to predict and control the course of an illness.

Empirical research in epidemiology necessarily involves quantification (like other sciences), which is an indispensable method to evaluate numerically the demographic health by three related procedures: measurement of variables, estimation of population parameters, and statistical testing of one or more hypotheses (Moreno-Altamirano, Lopez-Moreno, & Corcho-Berdugo, 2000).

Measurement, in a broad sense, is the assignment of values (numbers) to each unit of observation (e.g., specific feature of a subject, population or event), according to an *a priori* rule. Thus, measurement of variables involves classification of persons into categories (e.g., case or non case) as well as the positioning of people along a continuum (e.g., age; Moreno, López, & Hernández, 2007).

Kleinbaum et al. (1982) states that the ***estimation*** of population parameters "involves the mathematical derivation of a summary value for one or more quantities of interest" (p. 25). In other words, estimation values are essential in epidemiological research since they help

us describe the proportion of ill people in a specific geographical zone, and are useful when comparing two or more populations.

The three basic frequency measures in the epidemiological field are *incidence*, *prevalence* and *mortality.* These frequency measures and estimates are fundamental requirements for drawing meaningful causal inferences from the observations, and must be considered in both the design and analysis stages of the study.

Frequency Measures

Incidence

The incidence expresses the volume of new cases over a specific period of time, allowing an estimation of the velocity with which individuals of a specific population will develop a disease (Striegel-Moore, Franko, & Ach, 2006). The study of new cases is important for conceptualizing disease etiology.

Incidence is commonly expressed in terms of 1 per 100,000 based on the population per year. According to Hoek (2006), most incidence studies used psychiatric case registers or the medical records of health care institutions from a circumscribed area. However, Hoek also warns that calculating incidence using only these sources will provide an underestimation of the incidence in the community, because not all subjects will be referred to (mental) health care facilities or be hospitalized. Therefore, it is unclear whether the increase in cases reported by the care facilities reflects an actual increase in the incidence in the community. In this respect, Guerro-Prado, Barjau and Chinchilla (2001) emphasize

the importance of carrying out epidemiological studies with community samples, in order to achieve conclusions more reflective of reality.

Prevalence

This frequency measure refers to the number of individuals in relation to the total population that suffer from a disease in a specific period of time (Moreno et al., 2007). It is calculated by dividing the number of ill individuals (numerator) by the total number of individuals in the sample, including those who suffer. The prevalence can be expressed in different spaces of time, for example as point prevalence, period prevalence, and lifetime prevalence (Hoek, 2006).

The point prevalence is the prevalence at a specific point in time, e.g. January the 1st of a specific year. The period prevalence is the point prevalence plus annual incidence rate (the number of new cases in the following year) usually expressed in a one-year period. The lifetime prevalence is defined as the number of individuals that have experienced an illness or a disorder at any time (Hoek & van Hoeken, 2003; Hunter & Risebro, 2011; Smink et al., 2012).

Prevalence measures are useful for describing the frequency of recurrence diseases; this means individuals characterized by alternating periods of clinical symptoms and remission[4].

[4] Remission refers to the absence of active disease. Remission does not mean that illness is cured. For example in cancer, there may still be cancer cells present that are undetectable by tests. If a cancer returns after it has been in remission, it is defined as a recurrence of that cancer (Merriam-Webster Dictionary, 2013).

Mortality

One could describe the mortality rate as an incidence rate in which the event being measured is death. Mortality rates are often used as one of the indicators of illness severity. The standard measures of mortality are the crude mortality rate (CMR) and the standardized mortality ratio (SMR). The CMR is the number of deaths within the study population over a specified period, and SMR is the ratio of observed deaths in the study population to expected deaths in the population of origin (Smink et al., 2012).

Epidemiology employs different types of research, such as experimental (artificial manipulation of the study factor with randomization), quasi-experimental (artificial manipulation of the study factor without randomization), and observational (no artificial manipulation of the study factor). The main objectives of the latter type of research are: a) estimate disease frequency and time trends, b) test specific etiologic hypotheses and estimate chronic health effects, and c) generate new etiologic hypotheses and suggest mechanisms of causation.

Given that the present project is of the observational type, some relevant methodological aspects are described below.

Types of Epidemiological Observational Research

Epidemiologists most often use the observational study, in which there is no artificial manipulation of the study factor. Observational studies are commonly divided into two subtypes based on the degree of *a priori* knowledge regarding the disease.

A ***descriptive*** study usually is conducted when little is known about the occurrence, the natural history, or the determinants of a disease. The objectives are to estimate the disease frequency or trends over time in a particular population, and to generate more specific etiologic hypotheses.

An ***analytic*** (or etiologic) study is conducted when enough is known about the disease, before the investigation, that a specific *a priori* hypothesis can be tested. The objectives are to identify risk factors for the disease, estimate the effects of the disease, and suggest possible intervention strategies (Hernández & López, 2007).

Observational research is often the most practical or feasible to conduct, although these studies are not always less expensive or less time consuming than experimental studies. Another potential advantage is that observational studies are often carried out in a more natural setting, creating a study population that is more representative of the target population. This feature has important implications to health planners and policy makers who base their decisions partly on the results of epidemiological investigations; and just as it is essential to choose the proper type of study, it is also important to choose the best possible method of sample selection.

Sampling Method

Alternative procedures for selecting the subjects are considered based on three different contexts: 1) restricting the eligibility of potential subjects into the study population; 2)

Incorporating random sampling procedures in the selection process; and 3) stratifying the distribution of potential subjects prior to selection.

Restriction refers to the process of narrowing the eligibility of potential subjects; ***random sampling*** is when the selection of subjects ensures that each person has the same probability of being sampled; and ***stratified*** *sampling* is used when researchers need to ensure an adequate number of cases for a wide range of risk factors. In more detail, stratified sampling is the independent selection of subjects from mutually exclusive subpopulations, or strata, of the target population (Kleinbaum et al., 1982). Strata are formed when researchers face one or more of the following conditions: 1) known or suspected risk factor in a certain population, 2) factors related to the convenience of sampling, or 3) to deal with an infrequent (or rare) disease. Stratified sampling is used to make the analysis more efficient or the data collection more feasible.

Type of Population

According to Kleinbaum et al. (1982), a ***fixed cohort*** "…is a group of subjects identified at a hypothetical point in time and followed for a given period for detection of new cases of disease. The cohort is 'fixed' in the sense that no entries are permitted into the study after the onset of follow-up, though subsequent losses may occur as a result of non participation, migration from the study area, death, or other forms of attrition" (p. 56). This kind of population is generally used for incidence studies.

Conversely, a ***dynamic population*** "…may gain and lose subjects over the course of the follow-up period" (Kleinbaum et al., 1982, p.56). In other words, we can study different subjects with the same features (e.g., age, geographical area, gender). If the size and the age distributions of the dynamic population remained constant during the follow-up period, we refer to it as stable.

Longitudinal studies may involve either a fixed cohort or a dynamic population (Hernández, Fernández-Collado, & Baptista, 2006).

Method of Data Collection

Data collection can be considered primary or secondary; the classification depends on the conditions under which observations were first recorded.

Primary data is collected for the purpose of the study, according to its protocol. Such data may be prospective, retrospective or ambispective[5], and involve any type of directionality. The data is obtained through personal interviews, medical examinations and tests, questionnaires, or direct observation of behavior. Many studies combine features of both prospective and retrospective designs (Kleinbaum et al., 1982; Singh, 2006).

Secondary data is collected for purposes other than those of the main study. Generally, secondary data must be abstracted and modified for the study. This data is obtained from the individuals' records (e.g., medical records, employment records, death certificates,

[5] In ambispective designs, one primary variable is measured prospectively and the other retrospectively, or one primary variable is measured in both ways.

disease registries) or from group records (e.g., U.S. census, vital statistics, or national health examination surveys). Thus, secondary data is usually retrospective, and is frequently used to perform ecological analysis, since disease information often is not available at the individual level in large populations (Kleinbaum et al., 1982; Singh, 2006).

Timing

Timing refers to the chronological relationship between the onset of the study (or, more specifically, the time of the most recent data gathering) and the occurrence of the primary phenomena under study.

In a completely ***prospective study,*** "the researcher observes directly the variable of interest or disease after the onset of the study; this is especially convenient when observations must be recorded according to a protocol" (Kleinbaum et al., 1982, p.58). Thus, the directionality of a completely prospective study is always forward or non-directional, but never backwards.

On the contrary, in a completely ***retrospective study*** "the variable of interest or the disease occurs before the onset of the study" (Kleinbaum et al., 1982 p.58). The researcher obtains information about the primary variables from records (e.g., censuses, insurance records, vital statistics) and/or from the recall of previous events by subjects, their relatives, or friends.

4. EPIDEMIOLOGY ON EATING DISORDERS AND DISORDERED EATING BEHAVIORS

Prevalence of eating disorders

In the last decade, publications about epidemiology on ED have increased significantly, yielding important information; for example:

1) AN, BN and BED affect mainly adolescents and young women with a median age of onset ranging from 18 to 21 years (Hudson et al., 2007; Smink et al., 2012).

2) Comparisons by gender have reported that AN and BN are less common in males than females, with clinical populations generally reflecting approximately a 10:1 female-to-male ratio (APA, 2013).

3) Lifetime estimated prevalence of AN, BN and BED are 0.9%, 1.5% and 3.5% in non clinical females, and 0.3%, 0.5% and 2.0% among men (Hudson et al., 2007).

4) A 5-year study in women aged 10-39, suggested an incidence rate of 4.7 per 100,000 person-year for AN, and 6.6 per 100,000 person-year for BN (Currin, Schmidt, Treasure, & Jick, 2005). To our knowledge no incidence studies on BED currently exist.

5) Crude mortality rate for AN was 5.1 deaths per 1000 person-years, translating into 5.1% per decade or 0.51% per year, and one in five individuals with AN who died had committed suicide. For BN a weighed mortality rate of 1.74 per 1000 person-years was found, which means that per year 0.17% of BN patients die (Arcelus, Mitchell, Wales, & Nielsen, 2011), to our knowledge no deaths by BED have been reported.

As noted, all epidemiological measures reflect important data; however this study will focus exclusively on prevalence, since this measure is the most important for planning health services and administering medical care facilities. The number of prevalent cases at any time is one determinant of the demand for health care.

Unfortunately, inconsistencies detected in epidemiological research, have generated confusion about the real state in prevalence of DEB (in terms of trends).

Prevalence of disordered eating behaviors

In South Australia, Hay, Mond, Buttner, and Darby (2008) assessed the prevalence of DEB in women at two different times, the first in 1995 (*M* = 43.4, *SD* = 19.2 years) and the second in 2005 (*M* = 45.1, *SD* = 24.5 years), finding the point prevalence as follow: 3.2% and 7.5% for binge eating; 1.3% and 2.1% for purging behaviors; 2.5% and 5.2% for strict dieting, respectively. This data evidence an increase in the prevalence of DEB over time.

A set of studies carried out by Keel and colleagues evaluated, based on longitudinal designs, the point prevalence of DEB (Heatherton, Mahamedi, Striepe, Field, & Keel, 1997), BN symptoms (Keel, Heatherton, Dorer, Joiner, & Zalta, 2006) and BN and other unspecified eating disorders of BN (Keel, Gravener, Joiner, & Haedt, 2010). They reported rates for purging behaviors, defined as the use of vomiting, laxatives or diuretics to control weight, of 5.1% in 1982, 3.5% in 1992, and 4.3% in 2002, concluding that these behaviors did not change significantly across cohorts. However, point prevalence in binge eating (29.2% in

1982, 20% in 1992, and 14.8% in 2002), and fasting (19.6% in 1982, 12.7% in 1992, and 11.1% in 2002) decreased significantly from 1982 to 2002 (Keel et al., 2006).

Systematic review

When there is marked uncertainty in a specific topic, such as the prevalence of DEB, it is recommended to carry out a systematic review to gather relevant, valid, and reliable information, selected under rigorous methodological criteria, in order to discuss inconsistencies among studies, so as to redesign and improve future research (Beltrán, 2005). In this sense, some literature reviews have tried to explain the epidemiology of ED (from 1981 to 2002; Hoek & van Hoeken, 2003), of other specified eating disorders (OSED; among 1980 to 2003; Chamay-Weber, Narring, & Michaud, 2005), and of the combination of ED and OSED with a limited search of only the Spanish population (from 2000 to 2010; Peláez, Raich, & Labrador, 2010). Finally, to our knowledge, there are only two extensive studies including ED, OSED and DEB that analyzed studies from the last three decades (Jacobi, Abascal et al., 2004; Chisuwa & O'Dea, 2010), however the study carried out by Chisuwa & O'Dea only reviewed Japanese studies.

The aim of this literature review was to systematically analyze empirical studies that have provided prevalence estimates of DEB in women, specifically related to restrictive dieting, fasting, laxative or diuretic abuse, self-induced vomiting, and/or binge eating. Particular attention will be paid to methodological differences across studies.

METHOD:

Following the PRISMA statement guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyses; Moher, Liberati, Tetzlaff, Altman, & the PRISMA group, 2009) a search of articles was carried out in February 2013, in the *MEDLINE* and *SCIENCEDIRECT* databases. Different combinations of the following key words must be contained in the title, abstract and/or within the article's key words: *Eating disorders, eating disorders not otherwise specified* (term known as OSED in DSM-5 [APA, 2013])*, anorexia nervosa, bulimia nervosa, prevalence, and women.* Since the last extensive review took place before 2000, to be eligible for this review, studies had to be published between January 2000 and January 2013.

To choose the studies for this review, the relevance and adequacy of each eligible paper was examined according the following selection criteria:

Inclusion criteria: a) studies must be based on community sample, and b) studies must assess at least one of the behaviors of interest (restrictive dieting, fasting, misuse of laxatives and diuretics, self-induced vomiting and/or binge eating).

Exclusion criteria: a) studies based on clinical samples or only on ~~a~~ male population; b) exclusive assessment of other epidemiological measures (e.g., incidence or mortality); c) papers written in languages other than English or Spanish; and d) dissertations.

Each article was analyzed using data extraction sheets, based on the axes proposed by Sánchez-Sosa (2004). The data extraction sheets included the following aspects: a) sample (geographical zone, age/gender, selection, size/sample-size power/response rate); b) research design; c) instruments; and d) main results (prevalence rates).

RESULTS:

Search results

The first search yielded a total of 2,024 abstracts, of which, 1,711 were excluded for: being related to the medical field, going deeply in psychiatric comorbidity or intervention programs, or for evaluating cognitions associated to eating disorders, such as: body dissatisfaction, perfectionism, thin ideal internalization, etc. Of the remaining 313 articles, 217 were excluded because: only incidence rates were reported, they were dissertations, were written in a language other than Spanish or English, were reviews or the sample included only men, pregnant women, or clinical cases. Of the remaining 96 studies, 76 were excluded for: reporting only AN, BN and/or OSED prevalence rates. The 20 remaining studies that met the inclusion criteria, were published between 2001 and 2010.

Data analysis

a) Sample

G*eographical zone.* Most of the studies were from United States (25%, *n*= 5), followed by Canada, China and Mexico (10%, *n*= 2 per country). The remaining studies were carried out in nine different countries (see Table 1).

Settings. The studies were from two different settings: 16 (80%) from educational institutions, and 4 (20%) were from home settings (Hay et al., 2008; Hudson et al., 2007; Nunes et al., 2003; Westenhoefer, 2001).

Table 1

Classification of studies according to the country where they were published

Continent	Country	Number of publications
America	U.S.A.	5
	Mexico	2
	Canada	2
	Brazil	1
	Trinidad & Barbados	1
Total		11 (55%)
Europe	Germany	1
	Portugal	1
	Hungary	1
Total		3 (15%)
Asia	China	2
	Turkey	1
	United Arab Emirates	1
	Jordan	1
Total		5 (25%)
Oceania	Australia	1
Total		1 (5%)

Age *and gender.* More than half of the research papers (55%, *n*= 11) worked with adolescent samples, meaning participants between the age of 11 to 19 years, 20% (*n*= 4) of the studies included adults older than 19 years old (Hay et al., 2008; Hudson et al., 2007; Kiziltan et al., 2006; Westenhoefer, 2001), and 25% (*n*= 5) combined two different sample types, including adolescents and young adults, ranging in age from 10 to 29 years old (Machado et al., 2007; Neumark-Sztainer, Wall, Eisenberg et al., 2006; Nunes et al., 2003; Tam, Ng, Man, & Young, 2007; Tölgyes & Nemessury, 2004). Regarding gender, in this review most of studies included men and women (60%, *n*= 12); however it is important to underline that given the purpose of the present review, we limit the "*Findings*" section to only female prevalence rates, since this population present the highest risk of developing DEB (APA, 2013).

Sample selection. Of the 20 articles, 12 (60%) used randomized samples, 4 (20%) used convenience samples, and the other 4 (20%) did not describe the type of sampling method they utilized (see Table 2 and 3).

Sample size, sample-size power and response rate. In this review it was observed that 75% (*n*= 15) utilized a sample size of less than 3,000, 15% (*n*= 3) included a sample size of over 3,000 and less than 10,000 (Ackard, Fulkerson, & Neumark-Sztainer, 2007; Hay et al., 2008; Unikel-Santocini, Bojórquez-Chapela, Villatoro-Velázquez, Fleiz-Bautista, & Medina-Mora, 2006), and 10% (*n*= 2) of the articles examined samples of over 10,000 participants (Barriguete-Meléndez et al., 2009; Forman-Hoffman, 2004). Only two (10%), of the 20 articles, reported sample-size power (Barriguete-Meléndez et al., 2009; Tam et al., 2007). Response rates also varied according to the authors, 70% (*n*= 14) stated a good response rate, 20% (*n*= 4) mentioned that they did not reach their goal response rate, and 10% (*n*= 2) did not mention the level of response.

Table 2
Longitudinal Studies

Study	Country	Gender	Age	Sample (*N*)	Instruments	Type of prevalence	Research design	Prevalence only in women (%)						Trend
								Restrict. dieting	Fasting	Laxatives	Diuretics	Vomiting	Binge eating	
Westenhoefer (2001)	West Germany	Men & Women	18-96	1990 M(862) W(911) 1997 M(928) W(1202)	- Standardized face-to-face Interview based on DSM-IV criteria - 10 questions *ex profeso.*	Point prevalence	Long. 1 stage	1990 (42.0) 1997 (35.9)*		1990 (4.4) 1997 (2.7)*	1990 (4.3) 1997 (3.1)*	1990 (1.1) 1997 (1.1)	1990 (2.0) 1997 (1.2)	Decreasing
Neumark-Sztainer, Wall, Eisenberg et al. (2006)	United States of America	Men & Women	17-20	M(1130) W(1386) ≈	- Project EAT II Survey 1 Yes/No question per behavior	Period prevalence	Long. 1 stage	1999 (49.7) 2004 (46.1)	1999 (21.2) 2004 (20.3)	1999 (1.8) 2004 (2.9)	1999 (2.1) 2004 (2.0)	1999 (8.2) 2004 (6.5)		Relative stability
Unikel-Santocini et al. (2006)	Mexico	Men & Women	12-19	1997 M(4676) W(5079) 2000 M(1675) W(1611) 2003 M(1533) W(1529)	- Brief Questionnaire for Risky Eating Behaviors (Unikel et al., 2004)	Point prevalence	Long. 1 stage	1997 (18.5) 2000 (14.7) 2003 (14.7) **Σ**	1997 (18.5) 2000 (14.7) 2003 (14.7) **Σ**	1997 (1.9) 2000 (7.0) 2003 (8.0)** **Σ**	1997 (1.9) 2000 (7.0) 2003 (8.0)** **Σ**	1997 (1.9) 2000 (7.0) 2003 (8.0)** **Σ**	1997 (3.3) 2000 (7.6) 2003 (5.9)**	Increasing
Crowther et al. (2008)	United States of America	Women	*x*=19.1 *SD*=3.3	1990-1992 (1176) 1993-1995 (1739) 1996-1998 (1926) 1999-2001 (1021) 2002-2004 (982)	- Eating/Dieting Questionnaire - BULIT (Smith & Thelen, 1984) - BULIT-R (Thelen, Farmer, Wonderlich, & Smith, 1991)	Point prevalence	Long. 1 stage		1990-92 (6.5) '93-'95 (7.4) '96-'98 (7.8) '99-'01 (9.1) '02-'04 (8.1)	1990-92 (0.9) '93-'95 (1.4) '96-'98 (1.1) '99-'01 (0.6) '02-'04 (1.6)	1990-92 (0.4) '93-'95 (1.7) '96-'98 (1.5) '99-'01 (2.0) '02-'04 (2.7)**	1990-92 (1.8) '93-'95 (2.2) '96-'98 (1.6) '99-'01 (1.3) '02-'04 (2.3)	1990-92 (7.7) '93-'95 (7.3) '96-'98 (7.6) '99-'01 (9.0) '02-'04 (8.5)	Relative stability
Hay et al. (2008)	Australia	Men & Women	1995 *x*=43.4 *SD*=19.0 2005 *x*=45.1 *SD*=24.5	1995 M(1216) W(1785) 2005 M(1290) W(1757)	- 5 questions *ex profeso* based on EDE (Fairburn & Cooper, 1993)	Point prevalence	Long. 1 stage	1995 (2.5) 2005 (5.2)** **Σ**	1995 (2.5) 2005 (5.2)** **Σ**	1995 (1.3) 2005 (2.1) **Σ**	1995 (1.3) 2005 (2.1) **Σ**	1995 (1.3) 2005 (2.1) **Σ**	1995 (3.2) 2005 (7.5)**	Increasing

Note: Restrict Dieting= Restrictive Dieting; M= Men; W= Women; *x*= Mean; *SD*= Standard deviation; Long.= Longitudinal; *= Prevalence is significantly lower than time one ($p < .05$); **= Prevalence is significantly higher than time one ($p < .05$); ≈ = Same subjects were followed up; BULIT= Bulimia Test; BULIT-R=Bulimia Test Revised; EDE=Eating Disorder Examination; **Σ**= Authors collapsed into one category more than one restrictive or purgative behavior.

Table 3
Cross-sectional studies

Study	Country	Gender	Age	Sample (*N*)	Instruments	Type of prevalence	Research design	Prevalence % (only in women)					
								Res. Diet	Fasting	Laxatives	Diuretics	Vomiting	Binge eating
Jones et al. (2001)	Canada	Women	12-18	(1739)	- Diagnostic Survey for Eating Disorders	Point prevalence	Cross-sect. 1 stage	23.0		1.1	0.6	8.2	15.0
Huon et al. (2002)	China	Women	12-19	(1246)	- Dieting Status Measure (Strong & Huon, 1997) - Questions *ex profeso* according DSM-IV criteria	Point prevalence	Cross-sect. 1 stage	0.6		2.2		1.8	3.5
Bhugra et al. (2003)	Trinidad and Barbados	Women	13-19	(362)	- Key questions of BITE - Questions *ex profeso* on DEB - Bulimic Diagnostic Interview based on DSM-III-R criteria	Lifetime prevalence	Cross-sect. 2 stage	Stage 1 4.1 Stage 2 3.6 Σ	Stage 1 1.4 Stage 2 3.6 Σ	Stage 1 8.8 Stage 2 0.3 Σ	Stage 1 0.3 Stage 2 0.3 Σ	Stage 1 1.9 Stage 2 0.8	Stage 1 Stage 2 1.4
Nunes et al. (2003)	Brazil	Women	12-29	(513)	- EAT 26 (Garner, Olmsted, Bohr, & Garfinkel, 1982) - BITE (Henderson & Freeman, 1987)	Point prevalence	Cross-sect. 1 stage	7.8	3.1	8.5	2.8	1.4	
Forman-Hoffman (2004)	United States of America	Men & Women	13-19	M(7674) W(7674)	- Youth Risk Behavior Survey (Brener et al., 2002)	Point prevalence	Cross-sect. 1 stage	40.6 ‡	12.6 ‡	4.8 ‡ Σ		4.8 ‡ Σ	
Jonat & Birmingham (2004)	Canada	Men & Women	12-19	M(156) W(225)	- EAT 26 - Questions ex profesoon DEB	Point prevalence	Cross-sect. 1 stage	9.3		8.4 Σ	8.4 Σ	8.4	17.3
Tölgyes & Nemessury (2004)	Hungary	Men & Women	10-29	M(248) W(332)	- Subscale of severity from BITE	Point prevalence	Cross-sect. 1 stage			0.9	0.3	1.8	3.9
Eapen et al. (2006)	United Arab Emirates	Women	13-18	(495)	- EAT 40 (Garner & Garfinkel, 1979) - Interview based on KSADS and DSM-IV criteria	Point prevalence	Cross-sect. 2 stage	Stage 1 --- Stage 2 9.1		Stage 1 --- Stage 2 0	Stage 1 --- Stage 2 0	Stage 1 --- Stage 2 0	Stage 1 --- Stage 2 3.2
Kiziltan et al. (2006)	Turkey	Men & Women	18-24	M(150) W(150)	-Specific items from BITE -Questions *ex profeso* on Dieting	Point prevalence	Cross-sect. 1 stage	11.3	10.0	0	0.7	1.3	16.0

(*continues*…)

Table 3

Cross-sectional studies (*...continued*)

Study	Country	Gender	Age	Sample (*N*)	Instruments	Type of prevalence	Research design	Prevalence % (only in women)					
								Res. Diet	Fasting	Laxatives	Diuretics	Vomiting	Binge eating
Ackard et al. (2007)	United States of America	Men & Women	*x*= 14.9 *SD*= 1.7	M(2377) W(2357)	-Project EAT Survey -Yes/No Questions *ex profeso* according DSM-IV criteria	Period prevalence	Cross-sect. 1 stage			9.4 ∑		9.4 ∑	11.0
Hudson et al. (2007)	United States of America	Men & Women	Older than 18	M(1220) W(1760)	- Face to face National U.S. Survey - Questions from the CIDI (Kessler & Üstün, 2004)	Point prevalence	Cross-sect. 1 stage						2.5
Machado et al. (2007)	Portugal	Women	12-23	(2028)	- EDE-Q (Fairburn & Beglin, 1994) - Interview based on EDE 12th (Fairburn & Cooper, 1993)	Point prevalence	Cross-sect. 2 stage	Stage 1 ---		Stage 1 1.6	Stage 1 1.8	Stage 1 2.9	Stage 1 ---
								Stage 2 0.9		Stage 2 0.3	Stage 2 0.6	Stage 2 0.9	Stage 2 1.2
Tam et al. (2007)	China	Men & Women	10-21	M(1288) W(1012)	- EAT 26 (Garner et al. 1982)	Period prevalence	Cross-sect. 1 stage	51.7 ‡				3.0 ‡	
Barriguete-Melendez et al. (2009)	Mexico	Men & Women	10-19	M(12527) W(12529)	- Brief Questionnaire for Risky Eating Behaviors Unikel et al. (2000)	Point prevalence	Cross-sect. 1 stage	1.5	2.1	0.3	0.3	0.5	9.4
Mousa et al. (2010)	Jordan	Women	10-16	(326)	- EAT 26 (Garner et al. 1982) - EHQ (Greenfeld, Quinlan, Harding, Glass, & Bliss, 1987)	Point prevalence	Cross-sect. 1 stage			7.4 ∑	7.4 ∑	11.0	16.9

Note: Res. Diet= Restrictive Dieting; M= Men; W= Women; *x*= Mean; *SD*= Standard Deviation; CIDI= World Health Organization Composite International Diagnostic Interview; EDE-Q= Eating Disorder Examination-Questionnaire; EDE 12th = Eating Disorder Examination 12th edition; EHQ= Eating Habits Questionnaire; ‡= Results include men and women; ∑= Authors collapsed into one category more than one restrictive or purgative behavior.

b) *Research design*

The majority of studies reviewed (*n*= 12, 60%) used a single-stage cross-sectional design to evaluate DEB, a two-stage cross-sectional design was used by 15% (*n*= 3) of the studies (Bhugra, Mastrogianni, Maharajh, & Harvey, 2003; Eapen, Mabrouk, & Bin-Othman, 2006; Machado et al., 2007; see Table 3). A single-stage longitudinal design was used in five studies (25%), where follow-ups varied from 5 to 15 years (see Table 2). None study used a two-stage longitudinal design.

c) *Instruments*

Table 2 and 3 show the different measures utilized to evaluate DEB. Of the 20 studies reviewed, 19 used at least one self-report questionnaire among their measures, and five (25%) employed only self-report questionnaires (Crowther, Armey, Luce, Dalton, & Leahey, 2008; Mousa et al., 2010; Nunes et al., 2003; Tam et al., 2007; Tölgyes & Nemessury, 2004). The screening instruments utilized most frequently were the *Eating Attitudes Test* (EAT) and the Bulimic Investigatory Test, Edinburgh ([BITE], Henderson & Freeman, 1987). Four studies employed the 26-item version (Garner et al., 1982), and one the 40-item version (Garner & Garfinkel, 1979; while the BITE was used by four studies (20%).

Four studies identified DEB with self-report measures and clinical interview (Bhugra et al. 2003; Eapen et al., 2006; Machado et al., 2007; Westenhoefer, 2001). The interviews utilized were based on the 3rd Rev. ed. (APA, 1987) or the 4th ed. of the DSM; APA, 1994), the Eating Disorder Examination (EDE, 12th ed; Fairburn & Cooper, 1993), and the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS).

A combined system, of screening instruments plus questions *ex professo*, was the selected method in three investigations (Huon, Mingyi, Oliver, & Xiao, 2002; Jonat & Birmingham, 2004; Kiziltan et al., 2006) and only one study utilized face-to-face interview to evaluate DEB (Hudson et al., 2007).

Finally, eight investigations (40%) assessed DEB through National Surveys. However, only three were specialized in ED, with the most common being the Project EAT Survey (Ackard et al., 2007; Jones, Bennett, Olmsted, Lawson, & Rodin, 2001; Neumark-Sztainer, Wall, Eisenberg et al., 2006). The other five surveys were focused on different aspects such as the Drug and Alcohol in Student Population Survey, the Youth Risk Behaviors Survey, and the National Health Survey, including only some questions related to DEB.

It is worth highlighting that in the analysis section, the term "paper-and-pencil instruments" refers to the use of tests such as self-report questionnaires, surveys, and/or *ex professo* questions to assess DEB.

d) *Main results*

Type of prevalence. The majority of studies (*n*= 16, 80%) assessed point prevalence of DEB, whereas that three studies evaluated period prevalence (15%; Ackard et al., 2007; Neumark-Sztainer, Wall, Eisenberg et al., 2006; Tam et al., 2007), and one study (5%; Bhugra et al., 2003) calculated lifetime prevalence (see Tables 2 and 3). Although for comparison purposes it would be ideal to analyze studies with the same type of prevalence, it was decided to include all measures of prevalence (point, period and lifetime prevalence) for

the analysis. Therefore, it is suggested that the reader take into account that from the 20 papers reviewed, four studies estimated period and lifetime prevalence.

Prevalence rates. Also, for a better understanding of the data, studies were classified according to the research design (longitudinal *vs.* cross-sectional).

Restrictive dieting. Eleven of the 15 cross-sectional studies reported this behavior. Eight of them used a single-stage procedure, and of these eight, five were from the Americas and three were from Asia. All of the studies from the Americas utilized paper-and-pencil instruments. The highest prevalence rates were reported in one study from the United States (40.6%), followed by two studies from Canada that reported 23.0% and 9.3%. Regarding Latin America, one study from Mexico reported 1.5% and a study from Brazil reported 7.8%. Studies from Asia, also used paper-and-pencil instruments, yielded the following prevalence rates: 51.7% and 0.6% in China, and 11.3% in Turkey (see Table 3).

Table 3 depicts three two-stage studies. Bhugra et al. (2003) reported a prevalence rate in restrictive behaviors (dieting and fasting) of 3.6% in a Trinidadian sample; Eapen et al. (2006) documented a prevalence of 9.1% in a sample of women from United Arab Emirates; and Machado et al. (2007) stated a prevalence of 0.9% in a Portuguese sample. Even though these studies used similar methodologies, the prevalence rates were substantially different.

Paying special attention to longitudinal studies (n= 5), it was observed that four of them assessed restrictive dieting. Only one study used face-to-face interviews with a sample of German people (Westenhoefer, 2001), reporting a significant decrease over the period surveyed (1990 to 1997), dropping from 42.0% to 35.9% (p< .05). On the contrary, Hay et

al. (2008) used paper-and-pencil instruments and clustered restrictive dieting and fasting, and finding an increase in prevalence rates of 2.5% in 1995 to 5.2% in 2005 ($p < .002$) in an Australian sample. However two other studies, that also using paper-and-pencil instruments, suggested a relative stability over time, one from the United States (Neumark-Sztainer, Wall, Eisenberg et al., 2006) and the other from Mexico (Unikel-Santocini et al., 2006), although this latter study collapsed, same as Hay et al., dieting and fasting into one category (see Table 2).

Fasting. Five of the 15 cross-sectional studies assessed this behavior; four of them used a single-stage procedure and, of these four, three were from the Americas and one was from Asia. All studies utilized paper-and-pencil instruments, and the highest prevalence rates were reported in studies from the United States (12.6%) and from Turkey (10.0%), and the lowest prevalence rates were reported in Brazil (3.1%) and Mexico (2.1%; see Table 3).

Of the five longitudinal studies, four assessed fasting. As it noted in the previous section, Hay et al. (2008) reported a statistical increase over time in this behavior (clustered restrictive dieting and fasting) in an Australian sample. The other three longitudinal studies, with American and Mexican samples (Crowther et al., 2008; Neumark-Sztainer, Wall, Eisenberg et al., 2006; Unikel-Santocini et al., 2006), noted fairly stable results over the years (see Table 2).

Binge eating. Twelve of the 15 cross-sectional studies reported this behavior; nine of them used a single-stage method. Five of these were from the Americas, three from Asia and one from Europe. All studies from the American continent utilized paper-and-pencil

instruments, and the highest prevalence rates, at 17.3% and 15.0%, were reported in two studies from Canada. Two studies were carried out in the United States reporting 11.0% and 2.5%, and finally, one study from Mexico reported 9.4%. Studies from Asia used paper-and-pencil instruments, yielding the following prevalence rates: 16.9% in Jordan, 16.0% in Turkey, and 3.5% in China and with the same methodology, one study from Europe, reported 3.9% in a Hungarian sample (see Table 3).

Three of the 15 studies used a two-stage procedure. Bhugra et al. (2003) reported a prevalence rate of 1.4% in a Trinidadian sample; Eapen et al. (2006) documented in a sample of women from United Arab Emirates a prevalence of 3.2%; and Machado et al. (2007) stated a prevalence of 1.2% in a Portuguese sample (see Table 3).

Four of the five longitudinal studies assessed binge eating. A statistical increase over time in this behavior was reported in two studies using paper-and-pencil instruments. One of them was from Unikel-Santocini et al. (2006) who reported increasing prevalence rates from 3.3% to 5.9% in a Mexican sample, and the other from Hay et al. (2008), found an increase in an Australian sample from 3.2% to 7.5%. On the other hand, the other two longitudinal studies with samples from the United States and German (Crowther et al., 2008; Westenhoefer, 2001) showed relative stability over the years (see Table 2).

Purgative behaviors. Six of the 20 studies clustered self-induced vomiting, abuse of laxatives and diuretics into one category, calling them purgative behaviors. This clustering masks the individual prevalence rates of these behaviors. Consequently, the prevalence analysis was

focused only on those studies that reported prevalence rates for each behavior and not with those that combined more than one behavior.

Abuse of laxatives. Eight of the 15 cross-sectional studies assessed the use of laxatives. Six used a single-stage design, and three of them were from the Americas, two were from Asia, and one was from Europe. All studies utilized paper-and-pencil instruments. The highest prevalence rates were reported in Brazil (8.5%), while Mexico and Canada reported prevalence rates equal to or less than 1.1%. Studies from Asia yielding the following prevalence rates: 2.2% in China, and 0% in Turkey. There is one study from Europe, carried out in Hungary, reporting 0.9% (see Table 3).

Three out of the twenty studies used a two-stage method. Bhugra et al. (2003) reported a prevalence rate of 0.3% in a Trinidadian sample population; Eapen et al. (2006) documented a prevalence of 0% in a sample of the United Arab Emirates; and Machado et al. (2007) stated a prevalence of 0.3% in a Portuguese sample (see Table 3).

Of five longitudinal studies, three assessed the use of laxatives. One study from Germany reported a decreasing trend (4.4% in 1990 and 2.7% in 1997); in contrast, two studies from the United States found a relative consistence through the years (see Table 2).

Abuse of diuretics. Seven of the 15 cross-sectional studies assessed this behavior. Five used a single-stage procedure, and three of them were from the Americas, one was from Europe, and one was from Asia. All studies utilized paper-and-pencil instruments. The highest prevalence rate was reported in Brazil (2.8%), while prevalence rates from Mexico, Canada, Hungary and Turkey fell between 0.3% and 0.7%. On the other hand, two studies used a

two-stage method. The first, performed in the United Arab Emirates, documented a prevalence of 0% (Eapen et al., 2006), while the second in Portugal stated a prevalence rate of 0.6% (Machado et al., 2007; see Table 3).

Out of five longitudinal studies, three assessed the use of diuretics. One study from Germany reported a decreasing trend, from 4.3% in 1990 to 3.1% in 1997. While one study from the United States found a stable prevalence rate over five-years: 2.1% in 1999 and 2.0% in 2004 (Neumark-Sztainer, Wall, Eisenberg et al., 2006). The third study found an increase in prevalence rates falling between 0.4% and 2.7% over a twelve-year period (Crowther et al., 2008; see Table 2).

Self-induced vomiting. Twelve of the 15 cross-sectional studies evaluated this behavior. Nine of them used a one-stage design: four were from the Americas, one was from Europe, and four were from Asia. Each of the studies utilized paper-and-pencil instruments. The highest prevalence rates were reported in three studies: by Mousa et al. (2010) in a Jordanian sample (11.0%), and by Jones et al. (2001) and Jonat and Birmingham (2004), both of which were from Canadian samples (8.2% and 8.4%, respectively). In contrast, the prevalence in Mexico, Brazil, Hungary, Turkey and China showed ranged from 0.5% to 3.0% (see Table 3).

Three studies used a two-stage procedure (see Table 3), and all obtained prevalence rates less than 1.0% (Bhugra et al., 2003; Eapen et al., 2006; Machado et al., 2007).

Of the five longitudinal studies, three assessed vomiting. All of them found a fairly stable prevalence rate over the years. One of these studies (Westenhoefer, 2001) found, with a

standardized face-to-face interview, the same prevalence rate in 1990 and 1997 (1.1%). The other two studies were carried out in the United States using paper-and-pencil instruments. Neumark-Sztainer, Wall, Eisenberg et al. (2006) found prevalence rates of 8.2% in 1999 and 6.5% in 2004, and Crowther et al. (2008) reported prevalence rates that ranged from 1.8% to 2.3% over a twelve-year period (see Table 2).

Reviewing the prevalence rates across the 20 studies, it was observed that restrictive dieting was the DEB with the highest prevalence rate, followed by fasting and binge eating. Purgative behaviors showed the lowest prevalence rates.

In summary, it is possible to assume the longitudinal studies suggested a stable trend for restrictive dieting, fasting, use of laxatives and vomiting since there were no statistical differences in prevalence rates over the periods assessed. However, the suggested trends for binge eating and the use of diuretics were variable according to the statistical analysis reported.

CONCLUSIONS:

Although this review found inconsistent results among the studies analyzed, this is relevant, since systematic reviews provide a general overview of how the prevalence of DEB has been investigated. There are several factors that may be responsible for these conflicting findings. One explanation is simply that different types of prevalence were reported. It is common that prevalence rates are considered as one general epidemiological measure,

however these studies reported different types, and therefore, highlighted different objectives. In this literature review, 80% of the studies reported the point prevalence of DEB. This is reasonable in the ED field, as the time frame and frequency of these behaviors (within the past three months and twice a week according to DSM-5), is crucial data to determine the clinical relevance. Therefore, the point prevalence considers this aspect and gives a general view about the presence or absence of these behaviors among the population, allowing health services to provide facilities more in line with the needs of the society.

There is a considerable debate around the prevalence of DEB, as it is difficult to determine if they have risen, decreased, or remained stable over time. This dispute is not only related to the type of prevalence reported, but also to differences in methodologies among studies such as sample features, research design, and instruments. For instance, large samples are important in epidemiological studies in order to generalize findings; in this review 35% of the papers reported less than 1,000 participants. Although there is not a consensus about what defines "large samples", Jacobi, Hayward et al. (2004) have suggested for better estimations of prevalence rates, a sample size of at least 3,000 subjects in needed within a community-based study. However, size alone is not enough to assure the sample representativeness, it is also necessary to consider the method of sample selection and the response rate. The gold standard procedure in epidemiology for sample selection is randomization, and Punch (2003) established that good response rates in face to face surveys range from 80 to 85%, questionnaires sent by mail start at 60%, and a good response online is 30% or more, while in classroom surveys need to achieve 50% at least.

Based to these assumptions, most of the studies in this review achieved both the necessary response rates and randomization.

Regarding to research design, both cross-sectional and longitudinal studies yield relevant information, for instance, they allow us to predict strategies for prevention and intervention programs. Longitudinal studies may also suggest the trends of these DEB and as an additional bonus, acknowledge if the strategies carried out by health services are making a positive impact, over time, in the prevalence.

The last methodological challenge in this review has to do with instruments, in particular, two aspects: a) type of question, and b) answer options. The first point arises when we analyzed the different questions utilized to estimate the point prevalence of DEB. Questions, such as, "*Do you currently diet/binge/vomit twice a week…?*", "*during the past six months or in the past 1 year, did you have diet/binge/…*?" and "*have you ever diet/binge/…*?", were identified, demonstrating temporal differences, thus different types of prevalence. For instance, two studies carried out in the same country with similar sample sizes and similar participants' features, found extremely discrepant prevalence rates. Huon et al. (2002) assessed the prevalence rate of restrictive dieting through questions that refer to the current moment, finding 0.6%, while Tam et al. (2007) evaluated the same behavior with questions that inquired about the past year, yielding 51.7%. This suggests that the time frame expressed implicitly in questions have a significant influence in the prevalence rates. Moreover, it is common to use screening instruments to assess prevalence rates; however it is not enough to count with a wide recognized instrument, it is necessary to

carefully select items that reflect the presence of the behavior and not the attitude toward the behavior. For example, it is better to select items such as "*I vomit after eating*" instead of "*I would like to vomit after eating*".

The second point to discuss concerning instruments is the use of Likert scales to identify DEB, since criteria were not specified to consider presence or absence of the behaviors, which is crucial factor in epidemiological research. For example, in a Likert scale with five answer options (always, usually, sometimes, rarely and never), rigorous criteria may limit presence as "always" and absence as "never", but less exigent criteria may consider more than one answer option. This aspect was not a problem, as every study meticulously specified how the presence or absence of DEB was established.

Data collection is one of the most important methodological procedures in any research, because it provides a solid foundation for the results. In other words, it is the "raw material" that is used in the production of data that will form the basis of theories (Singh, 2006). Since the quality of data will determine the quality of the research, the selection of the instrument must be a careful decision as the responses of the instrument will be the core of the findings. In this respect, paper-and-pencil instruments are useful tools in epidemiological research to collect large amounts of information at a low cost per respondent. No matter which instrument is selected, it needs to achieve two important conditions: validity and reliability in specific populations (Bhattacherjee, 2012).

Prevalence of DEB in Mexico

In Mexico, epidemiology research on DEB has been limited to very few studies; nevertheless there is some important data (besides the two mentioned in the last section [Barriguete-Melendez et al., 2009; Unikel-Santocini et al., 2006]).

In 2000, a cross-sectional study was completed by a representative sample of high school students in Mexico City (Unikel et al., 2006). Eleven questions about disordered eating behaviors were included in the "*Encuesta sobre la Prevalencia del Consumo de Drogas y Alcohol en Población Estudiantil del Distrito Federal*". Results among girls (*n*= 5079) showed prevalence of 4.0% for dieting, 2.7% for fasting, 4.9% for binge eating, 1.2% for self-induced vomiting, 0.5% for laxatives, and 0.8% for diuretics. This data corresponds to the answer *"Very frequently"* which means two or more times per week. Authors underlined that these results place a significant number of girls at high risk for developing an ED. However, a limitation of this study is that the main objective of this survey was to assess the prevalence of drug, alcohol, and tobacco use, causing the possible misunderstanding of some questions.

Saucedo-Molina and Unikel (2010) also performed a cross-sectional prevalence research of DEB in an urban setting from Hidalgo State, in which 464 high school and college women participated. All of them answered a 10-question instrument developed under DSM-IV criteria. Results showed that two or more times per week, high school and college women engaged in dieting (3.3% - 4.4% respectively), fasting (0.5% - 1.6%), binge eating (4.2% -

2.8%), self-induced vomiting (0.5% - 0.4%), laxatives (0.9% - 0.4%), and diuretics (0.9% - 1.2%).

Finally, more recent data provided by the National Health and Nutrition Survey (ENSANUT, 2012) suggest that Mexican girls between the ages of 10-19, have the following prevalence rates: dieting 1.5%, fasting 0.8%, binge eating 4.4%, self-induced vomiting 0.3%, and use of laxatives and/or diuretics 0.4%. These data correspond to the answer option *"Very frequently"* (more than two times per week). It is important to highlight that the latter three Mexican studies (ENSANUT, 2012; Saucedo-Molina & Unikel, 2010; Unikel et al., 2006) only utilized one question to assess each DEB.

The analysis carried out in this literature review increases the understanding of the differences among studies about prevalence rates of DEB. However some issues need to be studied further:

The prevalence of DEB is inconsistent, mainly for dieting and binge eating behaviors; this could be attributed to the different frequency parameters used in each study in order to establish presence or the absence of the behavior.

There are very few longitudinal studies that estimate prevalence of DEB in Mexican women and, to our knowledge, no one has studied DEB with different frequency parameters. This valuable information could contribute to understanding the level of severity of each behavior and allow the Mexican Health Secretary may improve its strategies to prevent and treat eating disorders.

The only longitudinal study conducted in Mexico that estimated the prevalence of DEB (Unikel-Santocini et al., 2006) suggested that purgative behaviors and binge eating are increasing over time in an adolescent sample. There is the need to explore if young adult women show similar trends. In addition, the authors collapsed dieting and fasting in one category called "restrictive behaviors" and the use of laxatives, diuretics, and self-induced vomiting into another called "purgative behaviors". To create more accurate and specialized preventive programs it is necessary to know in detail the severity of each behavior.

Several studies suggest that DEB are more frequent as the BMI increases, but this asseveration is supported only by one Mexican cross-sectional study (Unikel et al., 2002). As it was mention above, there is the need to carry out longitudinal studies to know the trend of each DEB, and in addition, to consider the different BMI categories to confirm or reject the conclusion proposed by Unikel et al. As an additional bonus, to perform a longitudinal study will provide to the Ministry of National Health Services valuable information to launch prevention and intervention programs more accurate to the population profile.

OBJECTIVES

General objective:

The general purpose of this research was to examine, over a 20-year period, the point prevalence of disordered eating behaviors in Mexican adult women with different body mass index.

Specific objectives:

I) To assess the point prevalence of disordered eating behaviors within three severity levels: low, medium and high.

II) To classify the point prevalence of disordered eating behaviors according to different body mass index categories: severe thinness, underweight, normal weight, overweight and obesity.

III) To identify if the point prevalence of disordered eating behaviors (fasting, restrictive dieting, binge eating, use of laxatives or diuretics and self-induced vomiting) register statistically significant changes over a 20-year period, comparing the first 10-year period (1994-2003) to the second (2004-2013).

HYPOTHESES

Based on information obtained at both the international and national level, the following hypotheses were formulated:

- ✓ Restrictive dieting and binge eating will be more prevalent than fasting and purging behaviors (self-induced vomiting, use of laxatives or diuretics).

- ✓ From purgative behaviors, self-induced vomiting will be more prevalent.

- ✓ Women with high BMI (overweight or obesity) will report higher prevalence in disordered eating behaviors than normal weight women.

- ✓ The point prevalence in medium and high severity levels of disorder eating behaviors will be significant higher in the second period of time evaluated.

METHOD

Participants

The total sample in this study was *N*= 2738 women between the ages of 17 to 29 (*x*= 19.95, *SD*= 1.92). All participants were students from *Facultad de Estudios Superiores Iztacala* (FESI); this university is one of the five campuses that comprise the National Autonomous University of Mexico (UNAM). It is a public educational institution located in the metropolitan area from Tlalnepantla, Mexico State. Most of the participants' residences are also located in metropolitan areas (mainly from Tlalnepantla, Gustavo A. Madero, Naucalpan, and Ecatepec). These four districts are considered low-medium income urban areas (INEGI, 2010).

The data collection method used by this study was **data mining**, since the data were partially obtained from records collected by other researchers. Data mining is defined as "the process of extracting useful and understandable knowledge, previously unknown, from large amounts of data stored in different formats" (Hernández, Ramírez, & Ferri, 2004, p. 5). This process is often utilized in health services; for example, a group of doctors can analyze the evolution of infectious and contagious diseases among the population to determine the most common age range of people affected. This knowledge, properly validated, may be used by health ministers to establish vaccination policies.

The procedure in data mining is comprised of different stages. Given that the data come from different sources, they may contain incorrect or missing values. These situations are

treated in the selection, cleaning, and processing stage, in which the typos and incorrect data are removed or corrected. Finally, a specific strategy is decided in order to replace incomplete data. For this study missing data was replaced by the mean of each subscale per participant. When fewer than 80% of items were completed on the EAT and/or BULIT, the file was deleted. The "cleaning" included horizontal (variables) and vertical (cases) screening (Hernández et al., 2004).

From 1994 to 2009 data was collected by the *Proyecto de Investigación en Nutrición* (FESI-UNAM; *n*= 1259), and from 2010 to 2013 the author of this project collected data records (*n*= 1478). It is important to note that from 1994 to 2009 the sample was intentional and non-randomized, and from 2010 to 2013 the sample was stratified, including only students in the 3rd and 5th semester of different majors at the FESI-UNAM campus (i.e., biology, psychology, optometry, medicine, dentistry, and nursing). This was in order to gather –mostly– women between the ages of 19 to 26, and to obtain a representative sample from each major.

To obtain the sample size of each stratum from 2010 to 2013, the statistical program Stats© (Hernández et al., 2006) was utilized. In this software is necessary to provide the following information: a) population size, b) confidence interval (margin of error), c) estimated percentage of the sample, and d) confidence level (see Figure 1).

Figure 1. Example of sample size calculation through Stats© software

Once the sample size was obtained, the following formula was calculated: *Ksh= n/N* (Kish 1995). This formula determines the constant that will be multiplied by each stratum, where *n*= 346 and *N*= 3426; hence, 346/3426 = 0.1009.

Finally, the total number of students in each major per semester was multiplied by the constant, in this case 0.1009. For example, to obtain the representative sample of the 242 students from Biology in the 3rd semester, 242 was multiplied by 0.1009, which give us a total sample of 24.41 participants (see Table 4). The same procedure was performed for each year from 2010 to 2013, yielding an average of 366 questionnaires applied per year.

Table 4

Number of students enrolled in class 2010 per major and semester, as well as its representative sample

Major	Total	3rd	Representative sample	5th	Representative sample
Biology	823	242	24	209	21
Psychology	1928	578	58	495	50
Optometry	275	71	7	39	4
Medicine	2354	350	35	207	21
Dentistry	1789	411	41	439	44
Nursing	819	220	22	165	17
Total	7988	1872	187	1554	157

In order to make the data spanning 20 years as comparable as possible, the sample was divided into two time periods (see Table 5). The type of population was dynamic (Kleinbaum et al., 1982), as the subjects were different in each assessment but all of them shared similar features (age, geographical area, gender, etc.).

Table 5

Age and number of participants per period of time

			Age		
	Period of time	*N*	*X*	*SD*	Range
Time 1	1994-2003	1020	19.51	2.02	17-29
Time 2	2004-2013	1718	20.21	1.81	17-29

The selection of participants was according the following criteria:

Inclusion criteria

Signed informed consent

Available BMI information

Age within the established range (17-29 years old)

Elimination criteria

Not all items were answered

Participants reported being pregnant or having a chronic illness

Not Mexican

Design

This study was non experimental because no variable was deliberately manipulated, so that the phenomenon was observed in its natural context for its posterior analysis (Kerlinger & Lee, 2002).

Type of research

This research was longitudinal, because the data was collected at different points over time, to make inferences about possible changes; and retrospective, because the variables of interest occurred before the onset of the study. Thus, the researcher used existing data that had been collected in the past (Kleinbaum et al., 1982).

Instruments and measures

Informed consent form. This form is an informative document that describes the purpose of the research, the nature of the participants' involvement in it, and a confidentiality declaration (stating the information will only be used for research purposes). When a participant signs this form, they are assumed to be taking part in the research of their own free will.

General data sheet. This is a questionnaire which provides demographic information, as: age, current residency, pregnancy state, history of chronic illness for both the participant and their family, background related to body weight and ED, and e-mail in case they would like to know their results.

Eating Attitudes Test (EAT-40). Designed by Garner and Garfinkel (1979) to assess ED symptoms and as a screening instrument, it can detect current or incipient cases of AN. It is a self-reported questionnaire of 40 items with six answer options under a Likert scale going from "*never*" to "*always*". The EAT is the most widely used international questionnaire to measure symptoms and preoccupations related to ED. It was validated in Mexican women by Alvarez-Rayón et al. (2004), who suggested the cut-off point ≥ 28 (sensibility = 86% and specificity = 94%). Besides, they reported that EAT has an excellent internal consistency (α= .93). It is worth mentioning that for the present research item **10**, **30** and **37** were selected to assess **restrictive dieting**; item **5** and **38** for **fasting**; item **28** for **use of laxatives and diuretics**; and item **13** for **self-induced vomiting** (see Table 6).

Bulimia Test (BULIT). It is a self-reported questionnaire designed as a screening instrument for BN, based on the assessment of its main symptoms (Smith & Thelen, 1984). It is composed by 36 items under a Likert scale of five answer options. Regarding its validation for Mexican women, Alvarez, Mancilla, & Vázquez (2000) suggested the cut-off point ≥ 85 (sensibility = 80% and specificity = 97%), pointing out that BULIT has a good internal consistency (α= .88). For this investigation, items **1**, **3** and **8** were used to assess **binge eating**; items **7** and **34** for **use of laxatives and diuretics;** and items **15** and **30** for **self-induced vomiting** (see Table 6).

Body mass index. This index establishes a proportional relationship between weight and height. It is calculated as weight in kilograms/height in meters^2, and it is the most widely used measure in applied anthropometry, especially in health sciences. The WHO (2004) suggests this measure as a potential discriminator that allows a quick, simple and inexpensive diagnostic to classify from emaciate to obese. The ranges proposed by WHO are: Severe thinness: BMI ≤ 16; Underweight: BMI 16.1-18.4; Normal weight: BMI 18.5-24.9; Overweight: BMI 25-29.9 and Obese: BMI >30.

Apparatus

GPM anthropometer. The anthropometer is an extremely versatile instrument suitable for measuring nearly any linear dimension of the human body. The anthropometer consist of four interconnecting metal tubes, whose surfaces are engraved in millimeter intervals. With the four sections connected, the measuring range is from 0 to 2100mm.

Electronic scale Tanita® with capacity of 250kg to determine body weight.

Procedure

1. To collect data corresponding to 1994 to 2009 the classrooms of diverse majors were visited and groups conformed by 20 to 40 students answered the set of questionnaires.

2. Height and weight of participants were measured by a physical anthropologist. Measures were taken with no shoes and light clothing, and were recorded to the nearest millimeter and to the nearest 0.1 kilogram. The participants were asked to stand straight with head positioned in the horizontal Frankfurt plane, feet together and knees straight. For weight measures, participants were asked to stand facing forward, unassisted, in the center of the platform. The scale was checked for zero balance before each measurement. Only those who signed informed consent forms participated in the research.

3. Data was entered in the statistical program SPSS© by several members of the Proyecto de Investigación en Nutrición, FES-Iztacala.

4. To collect data corresponding to 2010 to 2013 the Department of Administrative Enrollment Controls of FESI-UNAM, provided information of how many students were enrolled in each major. Based on this information the representativeness of the sample was calculated (see Figure 1).

5. The aim and specific details of the research project was explained to the heads of each major in order to get a space in the students' classes for the application of the set of questionnaires, and to obtain participants' body weight and height.

6. Once the protocol was approved, classrooms were visited and the application of questionnaires and body weight measures were taken in the same way that was previously mentioned.

7. Data was entered in the statistical program SPSS© version 22 for windows 2010. The registers obtained from 1994 to 2009 were included in the database, however, since the original databases had been worked by other researchers, it was necessary to synchronize codes, organize them and enter missing data. Additionally, it was necessary to confirm that the electronic databases matched with the physical files. The final database was exhaustively reviewed to ensure its validity.

8. Finally, data of the whole 20-year period (1994-2013) was analyzed.

Variable Definitions

Table 6

Conceptual and operational definition of the variables evaluated

Variable	Conceptual Definition	Operational Definition	
		Instrument	**Indicator**
Restrictive dieting	Intentional avoidance or restriction of food intake in order to reduce body weight or to prevent weight gain (de Lauzon-Guillain et al., 2006; Garner, 2008).	Three items from **EAT-40:** 10. *Particularly avoid foods with high carbohydrate content* 30. *Eat diet foods* 37. *Engage in dieting behavior* Answer option codification: "*Never*" = 0; "*Rarely*" = 1; "*Sometimes*" or "*Often*" = 2; "*Usually*" or "*Always*" = 3	Sum of items 10+30+37 Score 0 = Never Score 1-3 = Low Severity Score 4-5 = Medium Severity Score 6-9 = High Severity
Fasting	Abstinence from all food and liquid for a defined period, usually a single day (24 hours), or several days (Maughan et al., 2010).	Two items from **EAT-40:** *5. Avoid eating when I am hungry* 38. *Like my stomach to be empty* Answer option codification: "*Never*" = 0; "*Rarely*" = 1; "*Sometimes*" or "*Often*" = 2; "*Usually*" or "*Always*" = 3	Sum of items 5+38 Score 0 = Never Score 1-3 = Low Severity Score 4-5 = Medium Severity Score 6-9 = High Severity

(*continues…*)

Table 6
Conceptual and operational definition of the variables evaluated (*…continuation*)

Variable	Conceptual Definition	Operational Definition	
		Instrument	**Indicator**
Binge eating	Episodes of eating significantly more food in a short period of time (2 hours) than most people would eat under similar circumstances, also must be accompanied by feelings of lack of control (APA, 2013).	Three items from **BULIT** 1. *Eat uncontrollably to the point of stuffing yourself (e.g., going on eating binges).* 3. *Have you ever keep eating until you thought you may explode?* 8. *I eat until being too tired to continue eating* Answer option codification: Item 1: a = 1; b = 2; c, d and e = 3 Item 3: a, b and c = 3; d = 2; e = 1 Item 8: a, b and c = 3; d = 2; e = 1	Sum of items 1+3+8 Score 3-4 = Low Severity Score 5-6 = Medium Severity Score 7-9 = High Severity
Self-induced vomiting	The intentional act of releasing the gastric contents by the mouth, through self-induced sustained contractions of the abdominal muscles and diaphragm (Merriam-Webster Dictionary, 2013).	Item 13 from **EAT**; 15 and 30 from **BULIT** 13. *Vomit after I have eaten* 15. *How often do you intentionally vomit after eating?* 30. *How often do you intentionally vomit after eating in order to lose weight?* Answer option codification: Item 13: "*Never*" = 0; "*Rarely*" = 1; "*Sometimes*" or "*Often*" = 2; "*Usually*" or "*Always*" = 3 Item 15: a and b = 3; c = 2; d = 1 and e = 0 Item 30: a = 0; b = 1; c =2; d and e = 3	Sum of items 13+15+30 Score 0 = Never Score 1-3 = Low Severity Score 4-5 = Medium Severity Score 6-9 = High Severity

(continues…)

Table 6
Conceptual and operational definition of the variables evaluated (*…continuation*)

Variable	Conceptual Definition	Operational Definition	
		Instrument	**Indicator**
Use of laxatives or diuretics	Intentional use of laxatives (activate intestinal activity) or diuretics (increases urine emission) as a weight control method.	Item 28 from **EAT**; 7 and 34 from **BULIT** 28. *I use laxatives or diuretics* 7. *I use laxatives or diuretics to control my body weight* 34. *I use diuretics to control my body weight.* Answer option codification: Item 28. "*Never*" = 0; "*Rarely*" = 1; "*Sometimes*" or "*Often*" = 2; "*Usually*" or "*Always*" = 3 Item 7: a, b and c = 3; d = 2; e = 1 Item 34: a, b and c = 3; d = 2; e = 0	Sum of items 28+7+34 Score 1-3 = Low Severity Score 4-5 = Medium Severity Score 6-9 = High Severity
Body mass index	Body measure which establishesa proportional relationship between weight and height (WHO, 2004).	It is calculated as weight in kilograms/height in meters^2	Severe thinness: ≤16.0 Underweight: 16.1-18.4 Normal weight: 18.5-24.9 Overweight: 25-29.9 Obesity: ≥30
Time	Chronological sequence of observations of a particular variable or behavior during a certain period (Silva, 2004).		1994-2003 = Time 1 2004-2013 = Time 2

Statistical Analysis

- ✓ Prevalence analysis to estimate the proportion of disordered eating behaviors in three severity levels (low, medium and high).

- ✓ Cross tabulations were performed to classify the prevalence of disordered eating behaviors in different BMI categories (underweight, normal weight, overweight and obesity) and in three severity levels.

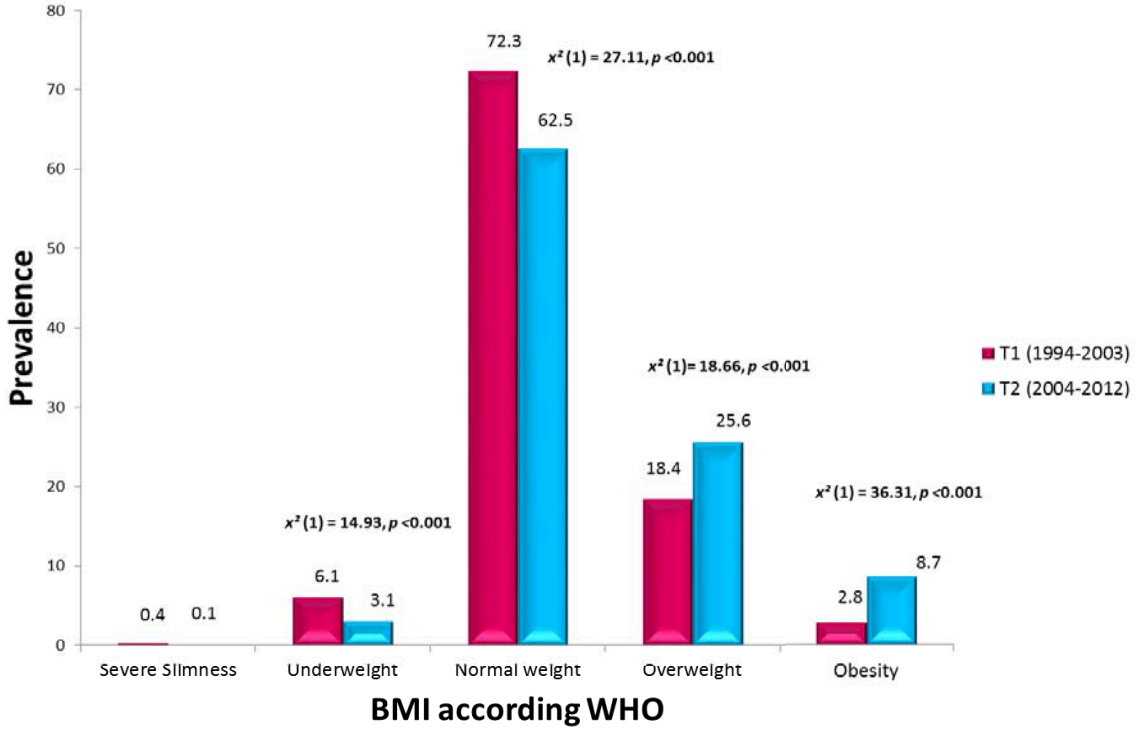
- ✓ Non-parametric analyses were used, several matrix of Chi square tests, to examine if statistical differences were detected in a 20-year period of time, comparing the first 10-year period (1994-2003) *versus* the second (2004-2013). To determine specifically in which weight categories were the differences, post-hoc Chi square tests per BMI group were performed using methods recommended by Siegel and Castellan (1988). This means that participants of each severity level were selected and then was performed a Chi square matrix of 5 x 2 (5 = different BMI categories, 2 = Time 1 and Time 2).

}

RESULTS

Body mass index

Figure 2 shows how the sample was distributed by body mass index (BMI), according the classification of World Health Organization (2004), in Time 1 (T1) *versus* Time 2 (T2). Statistical differences over time were found in: normal weight, overweight and obesity; highlighting that obesity prevalence increased over three times in T2, going from 2.7% to 8.8%. On the other hand, it is observed that very few cases fell into severe slimness category.

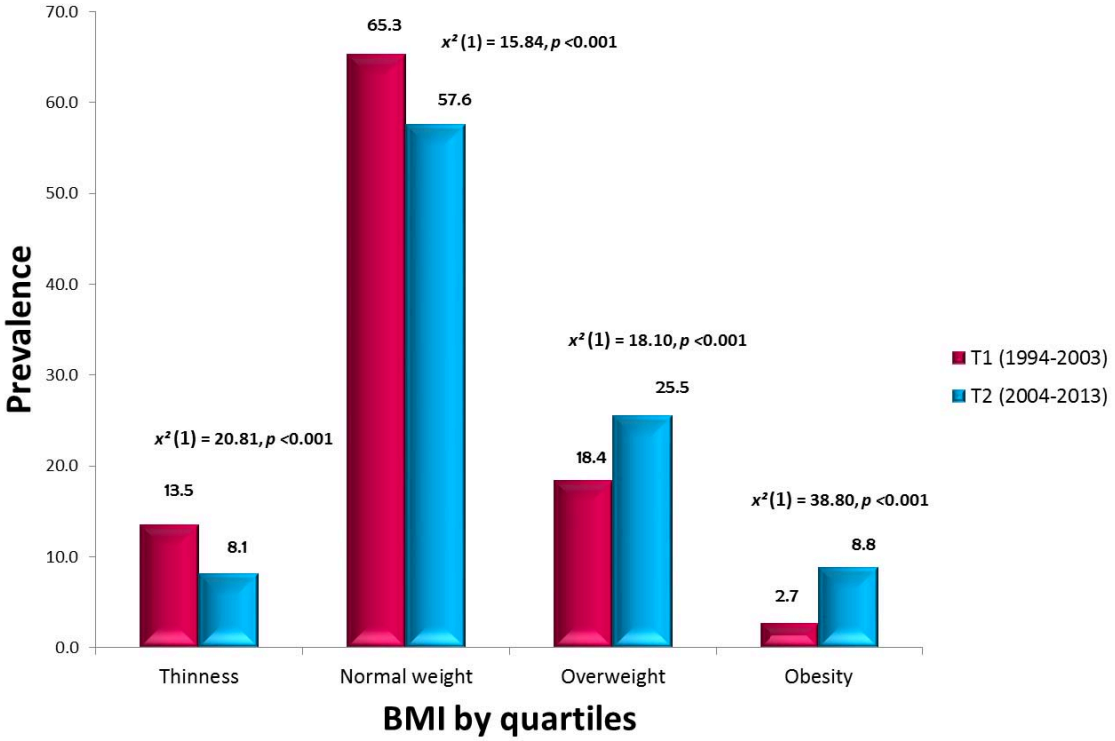


S. Slimness ≤ 16.0		Underweight 16.1 – 18.4		Normal weight 18.5 – 24.9		Overweight 25.0 – 29.9		Obesity ≥ 30	
T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
n= 4	*n*= 2	*n*= 62	*n* = 52	*n*= 737	*n*= 1074	*n*= 188	*n*= 440	*n*= 29	*n*= 150

* Note: Time 1 (T1) *N*= 1020; Time 2 (T2) *N*=1718

Figure 2. BMI distribution in Time 1 and Time 2 according WHO's classification.

In this study, BMI proposed by WHO did not classified enough subjects in severe slimness to carry out valid statistical analysis; therefore, it was necessary to make a new BMI classification by quartiles, resulting in four categories: thinness, normal weight, overweight and obesity. Figure 3 shows that the first quartile merged two entire weight categories (severe slimness and underweight) and the lower limit of "normal weight". Overweight and obesity classification remained almost with the same index proposed by the WHO. With this new classification all weight categories showed statistical differences over time.



Thinness		Normal weight		Overweight		Obesity	
14.1 – 19.4		19.5 – 24.9		25.0 – 29.9		≥ 30	
T1	T2	T1	T2	T1	T2	T1	T2
n=138	n=139	n=666	n=989	n=188	n=438	n=28	n=152

* Note: Time 1 (T1) N= 1020; Time 2 (T2) N=1718

Figure 3. BMI distribution in Time 1 and Time 2 by quartiles.

Table 7 shows comparisons between body measures in Time 1 *versus* Time 2. It is observed that the range of weight increased significantly in the second period, this means that in the first 10 years (1994-2003) the maximum weight registered was 98.0 kg while for the next 10 years (2004-2013) the maximum weight was 128.9 kg. Regarding BMI, during the first 10 years only one person was classified into the category of extreme obesity (BMI ≥ 40); while for the next 10 years eight people were classified into this category. Among the eight people with morbid obesity, four were detected in the year of 2013.

Table 7

Mean, standard deviation and range of body measures

	Time 1 (1994-2003) ***N*= 1020**	**Time 2 (2004-2013)** ***N*= 1718**
Weight	*X*= 56.95 *S.D*. = 9.09 Range: 36.0 kg – 98.0 kg	*X*= 60.02 *S.D*. = 11.67 Range: 34.7 kg – 128.9 kg
Height	*X*= 1.58 *S.D*. = 0.06 Range: 1.39 cm – 1.77 cm	*X*= 1.58 *S.D*. = 0.06 Range: 1.36 cm – 1.80 cm
BMI	*X*= 22.69 *S.D*. = 3.23 Range: 15.2 – 40.0	*X*= 24.05 *S.D*. = 4.07 Range: 14.1 – 47.9

Note: *X* = Mean; *S.D.* = Standard Deviation

Prevalence of ED symptomatology

Participants were classified with symptomatology of AN, based on the cut-off point from EAT-40 for Mexican population (≥ 28; Alvarez-Rayón et al., 2004). Considering the total sample, 11.8% women reported symptoms of AN in T1 and 6.8% in T2. Statistical differences were detected in thinness and normal weight categories showing a decreasing prevalence in the second period of time, while obesity showed an increasing prevalence going from 0.1% to 0.8% (see Table 8).

Regarding symptomatology of BN, this was measured based on the cut-off point from BULIT for Mexican population (≥ 85; Alvarez et al., 2000). From the total sample 12.7% reported symptoms of BN in T1 and 8.5% in T2. Statistical differences were found only in thinness (from 1.0% to 0.1%) and normal weight category (6.8% to 4.4%), showing a significant decrease over time.

Prevalence rates of participants who scored both cut-offs were lower than previous, (6.0% in T1 *vs.* 3.4% in T2) and statistical differences over time were found only in normal weight participants, showing a significant decrease in the second period assessed (from 4.0% to 1.8%; see Table 8). An analysis by age showed that people among 18 to 20 years were those who score both cut-offs.

Table 8

Comparisons over time in prevalence of symptomatology of anorexia nervosa and bulimia nervosa

		Thinness			Normal weight			Overweight			Obesity			Total		$X^2(1)$
		n	%	X^2	*n*	%	X^2	*n*	%	X^2	*n*	%	X^2	*n*	%	
Symptom. AN	**T1 (1994-2003) *N*= 1020**	17	1.7	**13.34****	76	7.5	**19.74****	26	2.5	0.77	1	0.1	**6.03****	120	11.8	19.87**
	T2 (2004-2013) *N*= 1718	6	0.3		62	3.6		35	2.0		14	0.8		117	6.8	
Symptom. BN	**T1 (1994-2003) *N*= 1020**	10	1.0	**10.95****	69	6.8	**7.39****	40	3.9	1.81	10	1.0	0.29	129	12.7	12.19**
	T2 (2004-2013) *N*= 1718	2	0.1		75	4.4		51	3.0		18	1.0		146	8.5	
Symptom. AN & BN	**T1 (1994-2003) *N*= 1020**	4	0.4	3.92	41	4.0	**12.27****	15	1.5	0.30	1	0.1	1.58	61	6.0	9.90**
	T2 (2004-2013) *N*= 1718	1	0.1		31	1.8		21	1.2		6	0.3		59	3.4	

Note: T1 = Time 1; T2 = Time 2; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when less than 5 cases were per cell.

Prevalence of DEB in four severity levels

Table 9 depicts that prevalence of restrictive dieting and binge eating were the highest among DEB in medium and high severity level. The prevalence of restrictive dieting at these levels of severity added 37.0% in T1 and 26.8% in T2, and these prevalence increase to 51.5% and 34.5% (respectively) when fasting adds; while prevalence of binge eating was 33.9% in T1 and 20.8% in T2. Regarding purgative behaviors, use of laxatives and diuretics were more common among participants (10.8% in T1 *vs.* 6.7% in T2) than self-induced vomiting (4.6% in T1 *vs.* 3.1% in T2) and all DEB showed a significant decrease in the second period assessed.

It is worth mentioning that due to the answer options of items for binge eating and use of laxatives/diuretics collapsed "never" and "rarely" into one answer option, in the present research both were engulfed in low severity.

Most participants fell into low severity level, a significant decrease over time was registered for fasting (49.2% in T1 *vs.* 39.1% in T2) and self-induced vomiting (14.9% in T1 *vs.* 6.1% in T2), while binge eating showed a significant increase in the second period evaluated (66.1% in T1 *vs.* 79.2% in T2).

Table 9

Comparisons over time in prevalence of disordered eating behaviors in four severity levels

		Fasting			Restrictive dieting			Binge eating			Use of laxatives and diuretics			Self-induced vomiting		
Severity	**Periods**	***n***	**%**	**X^2 (1)**	***n***	**%**	**X^2 (1)**	***n***	**%**	**X^2 (1)**	***n***	**%**	**X^2 (1)**	***n***	**%**	**X^2 (1)**
Medium & High	**T1 (1994-2003) *N*= 1020**	148	14.5	**32.49****	377	37.0	**31.28****	346	33.9	**57.35****	110	10.8	**14.20****	47	4.6	**4.22***
	T2 (2004-2013) *N*= 1718	132	7.7		460	26.8		358	20.8		115	6.7		53	3.1	
Never	**T1 (1994-2003) *N*= 1020**	370	36.3	**74.14****	210	20.6	**42.45****	---	---		---	---		821	80.5	**60.04****
	T2 (2004-2013) *N*= 1718	915	53.3		552	32.1		---	---		---	---		1560	90.8	
Low	**T1 (1994-2003) *N*= 1020**	502	49.2	**26.97****	433	42.5	0.49	674	66.1	**57.35****	910	89.2	1.58	152	14.9	**58.14****
	T2 (2004-2013) *N*= 1718	671	39.1		706	41.1		1360	79.2		1603	93.3		105	6.1	
Medium	**T1 (1994-2003) *N*= 1020**	139	13.6	**31.61****	220	21.6	**13.98****	258	25.3	**38.76****	60	5.9	**14.60****	22	2.2	1.54
	T2 (2004-2013) *N*= 1718	122	7.1		273	15.9		268	15.6		50	2.9		26	1.5	
High	**T1 (1994-2003) *N*= 1020**	9	0.9	0.24	157	15.4	**11.84****	88	8.6	**12.09****	50	4.9	1.99	25	2.5	2.65
	T2 (2004-2013) *N*= 1718	10	0.6		187	10.9		90	5.2		65	3.8		27	1.6	

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

Differences between Time 1 vs. Time 2 in DEB according BMI and severity level

Fasting

There were statistical differences when fasting was compared with all severity levels ($X^2(3) = 84.19$, $p < 0.001$) and between T1 (14.5%) and T2 (7.7%; [$X^2(1) = 32.49$, $p < 0.001$]). Then analyses were carried out per severity level, and statistical differences were found in the levels never ($X^2(1) = 74.14$, $p < 0.001$), low ($X^2(1) = 26.97$, $p < 0.001$) and medium ($X^2(1) = 31.61$, $p < 0.001$). Finally to determine specifically in which BMI categories were the differences, post-hoc Chi square tests per weight group were performed. This means that participants of each severity level were selected and then was performed a Chi square matrix of 4 x 2 (4 = different BMI categories, 2 = Time 1 and Time 2).

Regarding low severity level a significant decrease over time was noted in thinness (from 4.6% to 1.2%) and normal weight group (from 32.8% to 21.0%), while in obesity group was detected a significant increase (from 1.6% in T1 to 5.5% in T2).

In medium severity significant drops over time were detected in thinness (from 1.0% to 0.3%) and normal weight categories (from 8.4% to 3.5%; see Table 10).

Table 10

Prevalence of fasting, comparisons between T1 and T2 according BMI and severity level

		Thinness			Normal weight			Overweight			Obesity			$X^2(1)$
		n	***%***	X^2	***n***	***%***	X^2	***n***	***%***	X^2	***n***	***%***	X^2	
Never	**T1 (1994-2003) *N*= 1020**	80	7.8	1.56	238	23.3	**27.22****	44	4.3	**38.17****	8	0.8	**12.38****	**74.14****
	T2 (2004-2013) *N*= 1718	113	6.6		562	32.7		193	11.2		47	2.7		
Low Severity	**T1 (1994-2003) *N*= 1020**	47	4.6	**31.79****	335	32.8	**47.76****	104	10.0	0.96	16	1.6	**25.81****	**26.97****
	T2 (2004-2013) *N*= 1718	20	1.2		360	21.0		196	11.4		95	5.5		
Medium Severity	**T1 (1994-2003) *N*= 1020**	10	1.0	5.58*	86	8.4	**30.92****	39	3.8	2.49	4	0.4	0.45	**31.61****
	T2 (2004-2013) *N*= 1718	5	0.3		60	3.5		47	2.7		10	0.6		
High Severity	**T1 (1994-2003) *N*= 1020**	1	0.1		7	0.7		1	0.1		0	0.0		0.84
	T2 (2004-2013) *N*= 1718	1	0.05		7	0.4		2	0.1		0	0.0		

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when less than 5 cases were per cell

Restrictive dieting

Statistical differences were found when restrictive dieting was compared among all severity levels (X^2 (3) = 52.73, $p < 0.001$) and between T1 (37.0%) and T2 (26.8%; [X^2 (1) = 31.28, $p < 0.001$]). To determine in which severity levels were the differences, was carried out a new Chi square matrix of 4 x 2. Statistical differences were located in never (X^2 (1) = 42.45, $p < 0.001$), medium (X^2 (1) = 13.98, $p < 0.001$) and high (X^2 (1) = 11.84, $p < 0.001$) severity levels (see Table 11).

In severity level "never" were detected significant increases in prevalence rates of normal weight (from 12.8% to 21.4%) and overweight (from 1.9% to 4.5%) categories.

In medium severity, the groups of thinness (from 1.2% in T1 to 0.2% in T2) and normal weight (from 14.0% in T1 to 6.8% in T2) showed a significant drop in prevalence. Contrary to this findings, obesity group showed a significant increasing prevalence, going from 0.8% to 3.2%

A similar pattern was shown in high frequency level, where a significant decrease in the second period of time was noted in thinness (from 1.0% to 0.2%) and normal weight (from 10.3% to 4.9%) groups, while obesity increased the prevalence from 0.3% to 1.9% (see Table 11).

Table 11

Prevalence of restrictive dieting, comparisons between T1 and T2 according BMI and severity level

		Thinness			Normal weight			Overweight			Obesity			$X^2(1)$
		n	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	
Never	**T1 (1994-2003) *N*= 1020**	55	5.4	0.03	131	12.8	**31.21****	19	1.9	**13.43****	5	0.5	2.02	**42.45****
	T2 (2004-2013) *N*= 1718	90	5.2		367	21.4		78	4.5		17	1.0		
Low Severity	**T1 (1994-2003) *N*= 1020**	61	6.0		287	28.1		73	7.2		12	1.2		0.49
	T2 (2004-2013) *N*= 1718	41	2.4		420	24.4		197	11.5		48	2.8		
Medium Severity	**T1 (1994-2003) *N*= 1020**	12	1.2	**9.81****	143	14.0	**38.71****	57	5.6	**0.04**	8	0.8	**16.63****	**13.98****
	T2 (2004-2013) *N*= 1718	4	0.2		117	6.8		97	5.6		55	3.2		
High Severity	**T1 (1994-2003) *N*= 1020**	10	1.0	**7.03***	105	10.3	**28.33****	39	3.8	0.01	3	0.3	**12.47****	**11.84****
	T2 (2004-2013) *N*= 1718	4	0.2		85	4.9		66	3.8		32	1.9		

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when there were less than 5 cases per cell

Binge eating

Statistical differences were found when binge eating was compared among all severity levels (X^2 (2) = 57.36, $p < 0.001$) and between T1 (33.9%) and T2 (20.8%; [X^2 (1) = 57.35, $p < 0.001$]). To determine in which severity levels were the differences, was carried out a new Chi square matrix of 4 x 2. Statistical differences were located in low (X^2 (1) = 57.35, $p < 0.001$), medium (X^2 (1) = 38.76, $p < 0.001$) and high (X^2 (1) = 12.09, $p < 0.001$) severity levels (see Table 12).

It is worth reminding that binge eating only count with three severity levels. "Never" was removed since the authors of the instrument collapsed into one answer option "never" and "rarely", making impossible to determine which option was chosen for participants. In low severity level all BMI categories, except thinness, showed a significant increase prevalence over time going from 44.5% to 46.0% in normal weight, from 11.0% to 20.0% in overweight and from 1.5 to 6.7 in obesity.

In medium severity, a significant drop over time in prevalence was noted in thinness (from3.3% to 1.0%) and normal weight (from 16.0% to 8.4%). On the contrary, obesity group showed a significant increase in the second period assessed (from 0.9% to 1.8%). This means that two or three times a month participants reported to "eat uncontrollably to the point of stuffing themselves" and, "eat until being too tired to continue eating".

In high frequency level a significant decrease in prevalence was observed in thinness (from 1.0% to 0.3%), normal weight (4.8% to 3.1%) and overweight (2.5% to 1.5%; see Table 12).

Table 12

Prevalence of restrictive dieting, comparisons between T1 and T2 according BMI and severity level

		Thinness			Normal weight			Overweight			Obesity			$X^2(1)$
		n	***%***	X^2	***n***	***%***	X^2	***n***	***%***	X^2	***n***	***%***	X^2	
Low Severity	**T1 (1994-2003) *N*= 1020**	94	9.2	**5.47****	454	44.5	0.61	111	11.0	**36.08****	15	1.5	**38.61****	**57.35****
	T2 (2004-2013) *N*= 1718	116	6.8		791	46.0		338	20.0		115	6.7		
Medium Severity	**T1 (1994-2003) *N*= 1020**	34	3.3	**17.95****	163	16.0	**37.12****	52	5.1	0.78	9	0.9	**3.78***	**38.76****
	T2 (2004-2013) *N*= 1718	18	1.0		144	8.4		75	4.4		31	1.8		
High Severity	**T1 (1994-2003) *N*= 1020**	10	1.0	**5.58****	49	4.8	**4.88***	25	2.5	**3.54***	4	0.4	0.32	**12.09****
	T2 (2004-2013) *N*= 1718	5	0.3		54	3.1		25	1.5		6	0.3		

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when there were less than 5 cases per cell

Use of laxatives and diuretics

Statistical differences were found when use of laxatives and diuretics were compared among all severity levels (X^2 (2) = 17.14, $p < 0.001$) and between T1 (10.8%) and T2 (6.7%; [X^2 (1) = 14.20, $p < 0.001$]). To determine in which severity levels were the differences, was carried out a new Chi square matrix of 4 x 2. Table 13 shows that statistical differences were located only in low (X^2 (1) = 14.20, $p < 0.001$) and medium (X^2 (1) = 14.66, $p < 0.001$) severity levels.

In low severity level a significant decrease over time was observed in thinness (from 12.5% to 8.0%) and in normal weight (from 59.1% to 54.1%). The opposite effect was noticed in overweight (15.2% and 23.2%) and obesity (from 2.4% to 8.0%).

In medium severity level a significant drop in prevalence was detected in almost all BMI categories, except for obesity, being the following: Thinness from 0.5% to 0%; normal weight from 3.5% to 1.6%; and overweight from 1.7% to 0.8%.

No statistical differences were observed in high severity level.

Table 13

Prevalence of laxatives and diuretics, comparisons between T1 and T2 according BMI and severity level

		Thinness			Normal weight			Overweight			Obesity			$X^2(1)$
		n	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	
Low Severity	**T1 (1994-2003) *N*= 1020**	128	12.5	**15.32****	603	59.1	**6.60****	155	15.2	**25.56****	24	2.4	**37.08****	**14.20****
	T2 (2004-2013) *N*= 1718	137	8.0		929	54.1		399	23.2		138	8.0		
Medium Severity	**T1 (1994-2003) *N*= 1020**	5	0.5	**8.43****	36	3.5	**10.91****	17	1.7	**4.89***	2	0.2	2.19	**14.66****
	T2 (2004-2013) *N*= 1718	0	0.0		27	1.6		13	0.8		10	0.6		
High Severity	**T1 (1994-2003) *N*= 1020**	5	0.5		27	2.6		16	1.6		2	0.2		1.99
	T2 (2004-2013) *N*= 1718	2	0.1		33	1.9		26	1.3		4	0.2		

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when there were less than 5 cases per cell

Self-induced vomiting

Statistical differences were found when self-induced vomiting was compared among all severity levels ($X^2(3) = 64.63$, $p < 0.001$) and between T1 (4.6%) and T2 (3.1%; [$X^2(1) = 4.22$, $p < 0.05$]). To determine in which severity levels were the differences, was carried out a new Chi square matrix of 4 x 2. Table 14 shows that statistical differences were located only in never ($X^2(1) = 60.03$, $p < 0.001$) and medium ($X^2(1) = 58.14$, $p < 0.001$) severity levels. Post-hoc Chi square analyses per BMI group were performed to determine specifically in which weight categories were the differences.

Table 14 shows that in never level a significant increase prevalence over time was noticed only for thinness (which prevalence decreased from 11.5% to 7.5%). For overweight and obesity categories, the prevalence increased as follows: Overweight from 14.8% to 22.3%; and obesity from 2.3% to 8.0%.

In low severity statistical differences were detected only in thinness and normal weight and these indicated a significant drop prevalence over time, decreasing from 1.6% to 0.6% in thinness and from 10.1% to 3.0% in normal weight.

Although percentages are very low in high severity level, it is still alarming that in average 17 normal weight women have reported that at least two times per week they intentionally vomit after eating in order to lose weight.

Table 14

Prevalence of self-induced vomiting, comparisons between T1 and T2 according BMI and severity level

		Thinness			Normal weight			Overweight			Obesity			$X^2(1)$
		n	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	***n***	**%**	X^2	
Never	**T1 (1994-2003) *N*= 1020**	117	11.5	**12.70****	530	52.0	0.30	151	14.8	**22.87****	23	2.3	**38.60****	**60.03****
	T2 (2004-2013) *N*= 1718	128	7.5		911	53.0		383	22.3		138	8.0		
Low Severity	**T1 (1994-2003) *N*= 1020**	16	1.6	**5.65***	103	9.5	**16.78****	30	2.9	2.26	3	0.3	0.23	**58.14****
	T2 (2004-2013) *N*= 1718	11	0.6		52	2.9		35	2.0		7	0.4		
Medium Severity	**T1 (1994-2003) *N*= 1020**	3	0.3		14	1.4		4	0.4		1	0.1		1.53
	T2 (2004-2013) *N*= 1718	0	0.0		10	0.6		13	0.8		3	0.2		
High Severity	**T1 (1994-2003) *N*= 1020**	2	0.2		19	1.9		3	0.3		1	0.1		2.66
	T2 (2004-2013) *N*= 1718	0	0.0		16	0.9		7	0.4		4	0.2		

Note: T1 = Time 1; T2 = Time 2; * $p < 0.05$; ** $p < 0.001$

For valid statistical analysis, Fisher's correction was considered when there were less than 5 cases per cell

DISCUSSION

The main objective of this project was to examine, over a 20-year period, the point prevalence of disordered eating behaviors in Mexican adult women with different body mass index.

The first result related with body mass index (BMI), was that prevalence of overweight and obesity, significantly increased over time, going from 18.4% (T1) to 25.5% (T2) for overweight, and from 2.7% (Time 1) to 8.8% (Time 2) for obesity. This evidence is supported by the National Health and Nutrition Survey (ENSANUT, 2012), which reported that in Mexican women aged among 20-49 years, overweight prevalence increased from 25% to 35% and obese prevalence from 9.5% to 35.2% in a 24-year period (1988-2012). This survey reveals that the increasing prevalence of obesity in Mexico is the fastest documented in the world however, in the last period assessed (2006-2012), the trend showed a reduction in the acceleration of prevalence of overweight and obesity together.

Overweight and obesity are multifactorial and complex phenomena that involve public, social and individual aspects. Specifically in college women, the rapid increase in obesity could be due to several factors: a) Food industry promotes further fast-food (defined as food with low nutritional value and often high in fat, cholesterol, sugar and sodium), besides this kind of food is more accessible for students in terms of economic convenience and availability (Schmidt et al., 2005); b) sedentary lifestyle (defined as activities that do not substantially increase the energy expenditure above the resting level) is becoming more

common in adolescent and young population, since every day more activities of everyday life are solved in time sitting, so students are in risk not only to develop overweight and obesity but also cardiovascular diseases and metabolic syndrome (Farinola & Bazán, 2011); c) lack of sleep in college women is also an emerging risk factor for obesity, and it has been demonstrated that sleep deprivation (sleep less than 7 hours) could play a significant role in the etiology of obesity (Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005); and d) genetics, though the effect are smaller since the most common forms of obesity are probably the result of variations within a large number of genes (Unikel, Vázquez, & Kaufer-Horwitz, 2012).

To face this public health problem, Mexican government launched a campaign in 2011 urging people to exercise more, drink more water, and eat fruits and vegetables. In 2013 the Instituto Nacional de Pediatría (INP) launched the Nutrition Virtual Training Center, which aims to train human resources in applying different nutritional plans according specific populations. More recently in 2014 packed products having 275 kilocalories per 100 grams pays a tax of 8 percent and soft and energetic drinks will be regulated particularly for scholars, overweight and obese people (Secretaría de Salud, 2013). Finally, in 2014 the Comisión Federal para la Protección contra Riesgos Sanitarios (COFEPRIS) announced in the Diario Oficial de la Federación (2014) new labeling for packaged foods, making it mandatory to include a front-of-pack label with nutritional information about sugar, sodium, fats and caloric content per portion. Also COFEPRIS limited TV advertising of unhealthy products, specifically, junk food cannot be advertised from 14:30 to 19:30, schedules in which children and adolescents are more susceptible to watch TV programs. However since all these

policies are relatively recent, effects are not yet significant, in fact, it is expected that results of these policies will be reflected in Mexican population in 10 years further.

The second result has to do with the prevalence of symptomatology of AN, BN and both. In this research the prevalence of symptomatology of AN was 18.6% considering the 20 years assessed. This prevalence is similar to those reported in the international literature; for example, in United Arab Emirates was found that 23.4% of the students aged 13-18 years scored at or above the cut-off point from EAT-40 (Eapen et al., 2006), and in Canadian students aged 12-19, the prevalence was 17.3% (Jonat & Birmingham, 2004). Likewise, in Latino students (with similar ages than this study) the prevalence is also comparable, for instance in Brazil the prevalence was 16.5% in women aged 12-29 years (Nunes et al., 2003), and in Puerto Rican college women prevalence was 11.8% (Reyes-Rodríguez, et al., 2010). To our knowledge very few longitudinal studies about symptomatology of AN have been published, but there is one paper from Fortes, Almeida, Cipriani & Ferreira (2014) who assessed 290 Brazilian girl adolescents in three research stages (T1: first four months, T2: second four months and T3: third four months) finding a declining prevalence over time (21.2%, 9.6% and 5.2%, respectively). This finding corresponds with the significant decreasing prevalence in symptomatology of AN from this study (11.8% in T1 and 6.8% in T2). It is important to highlight that this comparison must be taken with precaution since sample ages were different.

The prevalence of BN symptomatology obtained in this study over a 20-year period was 21.2%, this prevalence was greater than the one reported by Nobakht and Dezhkam (2000) and Rojo et al. (2003) with prevalence rates of 4.79% and 2.0%, respectively, in schoolgirls from 12 to 18 years. Regarding longitudinal studies, Crowther et al. (2008) reported a relatively stable prevalence over a 15-year period (going from 1.0% to 3.2%), while the current research showed a significant decrease over time (from 12.7% in T1 to 8.5% in T2).

The first hypothesis in this research was that, restrictive dieting and binge eating will be more prevalent than fasting and purging behaviors. The hypothesis was confirmed with prevalence rates of 26.3% for restrictive dieting and 13.8% for binge eating in high severity. These results are consistent with those reported by Kiziltan et al. (2006; 11.3% and 16%, respectively), Jones et al. (2001; 23% and 15%, respectively) and Jonat and Birmingham (2004; 9.3% and 15%, respectively), however it is worth mentioning that these latter researches do not classify the prevalence by severity level.

One possible explanation why restrictive dieting is one of the most frequent DEB, is because historically has been considered as one of the most common methods used by society for weight control (Jacobi, Hayward et al., 2004), besides this behavior is more practical among young people than any other weight control method. College students often use the excuse of "I have already eaten" or "the lack of time" to avoid or skip meals, and when they have restricted for long time, it is very likely to fall into a binge eating (the second more prevalent DEB). People who fall into this vicious cycle of food restriction and binge eating, might be the reason why prevalence rates in both behaviors are high.

The association between restrictive dieting and binge eating also has a biological explanation: carbohydrates are the main source of energy for human body. Within a balanced dieting, 50% to 60% of calories are provided by carbohydrates (sugar, cereals, bread, pasta, potatoes, etc.). This is the first meal group that a dieter avoids from his/her daily intake, leading the organism into an urgent need of energy; if the individual continues restricting, the need will increase until the body resist no more and the binge eating will emerge. The consequence of binge eating combined with the stress and anxiety produced by the fear of an increasing body weight, will yield into a new feeding restriction. The only way to break this cycle is to stop dieting (Foulds, Brownley, Mo, & Bulik, 2009).

The major concern about restrictive dieting is that this behavior is becoming a "normal" style of feeding among young women; therefore this situation may lead to more extreme dieting methods, such as fasting. In this research the combined prevalence of medium and high severity of fasting was 22.2%, this means that participants often "like to feel their stomach empty" and "avoided eating when they were hungry". When comparisons over time were carried out, a significant drop was registered in the second period (from 8.4% in T1 to 3.5% in T2). These results are inconsistent with the longitudinal study of Unikel et al., (2006) performed with Mexican women aged 12-19 years, where they found higher prevalence rates of fasting (18.5% and 14.7%) and no statistical changes over time. One possible explanation is that their study is a National Survey, the amount of years considered in their study comprised only seven years and the sample was predominately adolescents, impacting in different ways on prevalence rates.

The second hypothesis regarding purgative behaviors, stressed that self-induced vomiting will be more prevalent than the use of laxatives and diuretics. This hypothesis was rejected since the prevalence resulted exactly in the opposite (being 8.7% for laxatives and diuretics and 4.1% for self-induced vomiting). This finding coincides with the longitudinal study of Westenhoefer (2001), and with two cross-sectional studies (Nunes et al., 2003; Huon et al., 2002).One possible explanation may be due to these drugs are easy to obtain, and they are promoted by media like common and natural strategies for weight control. As mentioned on background section, the misuse of laxatives and diuretics may cause incontinence, damage to the inside intestinal wall among other health impairment (Crispo, Figueroa, & Guelar, 1996), therefore it is necessary that government institutions such as COFEPRIS regulate the sale of these "miracle" products.

The third hypothesis proposed in this study was that women with high BMI (overweight or obesity) will report higher prevalence in DEB than normal weight women. The hypothesis was rejected, since normal weight women obtained the highest prevalence rates in all assessed behaviors. This finding differs to those found with Mexican population (Saucedo-Molina & Unikel, 2010; Unikel et al., 2002), where authors reported that in their samples (high-school and undergraduate students), girls with overweight and obesity presented higher percentages of DEB.

Possible explanations about why normal weight women get involve more in DEB are: 1) College women are particularly vulnerable because they are still in the process of learning their values, roles and developing their self-concepts. This population is also sensitive to

peer influence (Clark & Tiggemann, 2006; Gerner & Wilson, 2005; Hutchinson & Rapee, 2007) and find difficult to resist or even question the dominant cultural messages of the "ideal beauty" reinforced by the media, and 2) mass media provides body ideals each time more unreachable to women since female models are not only manipulated by unhealthy methods but also digitally, leading to a false new concept of real beauty. Particularly Mexican women complexion is quite different from European or American ideal bodies, for example, Table 7 shows that average weight and height in college Mexican women is 1.58 cm and 58.6 kg, meanwhile the average body measures of Americans / European models are 1.75 cm and 52.0 kg. These body measures are unreachable for most Latina women, besides, Mexicans with overweight tend to accumulate important fat percentages around their abdomen (ENSANUT, 2012), keeping them even more away from the "beauty ideal" and generating constant body dissatisfaction.

The fact that in this study, normal weight group presented higher prevalence rates of DEB suggest a serious health problem since women with no weight problems are performing high risk eating behaviors which may lead into an ED. Also it is worth mentioning that although it is impossible to ensure if the normal weight of participants is a consequence of the practice of these behaviors, still it is a warning for health professionals to focus in prevention programs aimed to normal weight women too.

The fourth hypothesis of this research was that medium and high severity levels of DEB will be significant higher in the second period of time evaluated. This hypothesis is partially accepted since this "increasing" effect was not observed in any DEB, on the contrary, all

DEB showed a significant decrease in the second period assessed. However, when a more detailed analysis (considering severity level and BMI category) was performed, a significant increase over time in restrictive dieting was detected in obesity group. These findings are impossible to compare with other studies, since to our knowledge, no researches have considered in one single analysis the severity, the BMI and the differences over time. However, the significant increase over time in restrictive dieting in this weight category, could reflect that campaigns launched by National Health Services have been internalized somehow by people with obesity, but still is unknown the reason why they are in high severity dieting, is it for improving their health? Or maybe is because they are in the pursuit of an ideal body? Therefore it is suggested that future research provide answers to these questions.

Analyzing generally the results of this research, is clear that the study of prevalence in DEB has remained poorly explored, making difficult to compare the results of this investigation and hampering to make conclusions regarding DEB's trend. For instance, the study of Crowther et al. (2008) and Neumark-Sztainer, Wall, Eisenberg et al., (2006) found stability of DEB prevalence over time; Unikel-Santocini et al. (2006) and Hay et al. (2008) found an increasing trend and finally Westenhoefer (2001) as well as this study, found a decreasing prevalence over time. Possible explanations to this constant debate may due to 1) cultural aspects and 2) methodological considerations.

Cultural aspects

Mexico is a wide culturally diverse country, with more than 120 million of inhabitants (INEGI, 2010). Culturally speaking it is impossible to say that there is only one Mexico, since people from each region (North, South and Center) are different not only in ethnic customs and geographical conditions but also in lifestyle and eating habits. The feeding influence in the North of the country is more Americanized than in any other region of Mexico. While feeding aims to meet the physiological needs of the individual, for Mexicans, eating behavior also serves as a means of social interaction and often is the "gold standard companion" of emotional factors. Obviously this cultural condition contrast with other countries, for instance, Germany is considered a country where people is more aware about health and wellness issues (Westenhoefer, 2001); supporting this proposal, the International Markets Bureau (2010) mention that experts and media have worked together to warn population about health risks caused by the practice of DEB, making the wellbeing as a lifestyle and marketing concept. Therefore for Germans, eating behavior aims in greater proportion to satisfy physiological needs. On the other hand, in Turkish population have been reported high prevalence rates in fasting and binge eating (Kiziltan et al., 2006). One possible explanation is that fasting is a behavior performed by Muslims girls for religious reasons; it is known that long periods without eating may lead an increased amount of food intake and this may be misunderstood as a binge eating, yielding high prevalence rates (Peláez, Labrador, & Raich, 2005). Thus, eating behavior for Muslims is linked to religious beliefs.

Based on these three examples is clear that the cultural role is relevant when eating behavior is studied. Therefore it is imperative to consider during the whole research the features of the population under study, such as are customs, religion, interpersonal relationships, among others.

Methodological considerations for future research

Given the methodological implications followed in any research may impact negatively or positively in the results, the following methodological considerations pretend to serve as a guideline in order to systematize future epidemiological research about the prevalence of DEB, providing useful tools that help to describe more accurately the real state of the population studied, as well as to have a greater scientific rigor:

1) *Sample*. It is suggested for future studies to take into account the representativeness of the population preferably through randomized methods, if it is not possible to achieve this criteria, Jacobi, Hayward et al. (2004) recommend a community sample size at least of 3000 participants, which may or may not be selected randomly. Also it is important to have a good response rate; it is suggested to follow the criteria proposed by Punch (2003).

2) *Research design*. If the aim of research is to know the point prevalence of DEB and ED, it is suggested to use a cross-sectional design. However if the purpose of the study is to determine if prevalence rates have risen, decreased or remained stable over time,

longitudinal designs are the most suitable to clarify this constant discussion in specialized literature.

3) *Instruments*. There are instruments developed specifically to assess DEB with epidemiological aims (Ferreira & Veiga, 2008; Hay, 1998; Unikel et al., 2004). According to the systematic review performed for this research, the EAT (version 40 and 26; Garner & Garfinkel 1979; Garner et al., 1982) was the most widely used instrument to assess the prevalence of DEB, however this instrument was created to measure attitudes and behaviors common among ED, not for epidemiological purposes. Regardless of the instruments utilized it is necessary to consider three crucial points: 1) The instruction should encourage the participant to answer thinking in the past three months, given the frequency proposed by DSM-5 (APA, 2013); 2) If the answer options of the instrument have a Likert scale is imperative that the authors explain which answer option(s) was/were chosen for "presence" and which for "absence" of DEB; and 3) Frequency parameters are determinant in ED, these should be reflected also in epidemiological data; for instance to engage in vomiting an average of 1-3 times per week during the past three months is enough to consider it as an indicator of presence of this DEB, therefore it is necessary to specify what does it mean "rarely, sometimes, often, usually, always" since each participant may attribute different frequency to each answer option and at the same time we can prevent the overestimation of prevalence rates. If the Likert scale goes from "never" to "always" it is suggested to consider the following frequency for each answer option: never = absence; rarely = once a month or less;

sometimes = two or more times a month; often = once a week; usually = two-six times a week; always = once a day or more.

The major contribution of this research is to have assessed –for the first time– in Mexican college sample, prevalence of DEB not only in a wide period of time (20 years) but also in different frequency levels and in different BMI categories. Furthermore this investigation utilized the same screening instrument over the 20 years, providing a good internal consistency to this study. The results from this research could serve as a basis for decision-making in health policy issues, impacting not only at the University level (FES Iztacala), but reaching wider layers as the State or even national stratums. This research provides data that can contribute to the development or adaptation of prevention and intervention programs aimed to ED, making them more sensitive to the needs of the population.

Limitations and suggestions for future research

* Although the sample in this study was large, only were included college women from metropolitan area of Mexico City making impossible the generalization to older women or community samples. Also it is suggested that future research comprise male samples since there is evidence that the practice of these behaviors are becoming more popular among adolescent boys and young men (Fortes, Cipriani, & Ferreira, 2013; Petrie, Greenleaf, Reel, & Carter, 2008).

* Despite of one of the strengths in this study was to have utilized the same instruments over 20 years, EAT and BULIT were not designed for prevalence purposes. It is suggested

that future research consider instruments that clearly state the presence or absence of the behavior, the frequency and if these behaviors have been presented during the past three months.

* Excessive exercise is also a relevant DEB but was not included in this investigation, so it is recommended that further research study the prevalence of this behavior since there is evidence that it is associated with muscle dysmorphia (Hale, Diehl, Weaver & Briggs, 2013).

* It is important to mention that most epidemiological studies in prevalence of DEB have performed in United States of America and Western Europe, therefore more Latino, Asiatic, African and Middle-East research is needed for an in-depth exploration of the cultural roles, modernization and globalization in the development and protection of DEB.

* As it was mention Mexico is a wide culturally diverse country, and this study only considered women from urban regions, so it could be relevant to carry out qualitative and quantitative research that include other urban and rural regions from the country, in which alternative DEB may take place. For example, instead of using laxatives and/or diuretics pills as a weight control method, commonly used in urban areas, it is likely that women from rural areas use herbal infusions or teas in order to purge themselves. This could be relevant information for prevention and intervention programs.

***** Although mass media have served as an important risk factor for the development of DEB, this media also may be an efficient way for promoting healthy eating habits and prevent DEB. It is suggested that commercials be supervised by health professionals in order to avoid giving mixed messages as discrimination or stigmatization of obesity.

* It is true that this study suggest in all behaviors a significant decrease over time, this is a good prognostic but at the same time this situation is also alarming since still there are cases reporting high severity of DEB. In addition it is known that health personal is not enough trained to detect symptoms of ED, or facilities are insufficient to treat cases. Therefore it is recommended to open more spaces where psychologists have a more active role, not only for assessment and development of prevention and intervention programs, but also working on enhancing physical activity, promoting adherence to weight-loss programs, and providing cognitive-behavioral techniques for the maintenance of healthy eating habits, self-esteem and body satisfaction, since these factors are sometimes undervalued by physicians even though they undoubtedly contribute to the development of DEB.

CONCLUSIONS

- ✓ Overweight and obesity prevalence have significantly increased during the last 20 years in Mexican college women, going from 18.4% (Time 1) to 25.5% (Time 2) in overweight, and from 2.7% (Time 1) to 8.8% (Time 2) in obesity.

- ✓ Restrictive dieting and binge eating were the two more common DEB among Mexican college women, with point prevalence of 26.3% and 13.8% respectively. On the other hand, fasting has a point prevalence of 1.5%, use of laxatives and diuretics 8.7% and self-induced vomiting 4.1%.

- ✓ The use of laxatives and diuretics was more common in this sample than self-induced vomiting as a weight control method.

- ✓ The present study provides evidence that DEB are more frequent in normal weight women than in those with overweight or obesity.

- ✓ Restrictive dieting was the only DEB that showed a statistical increase over time in medium and high severity levels. This phenomenon appeared specifically in obesity group. The rest of DEB showed statistical differences over time, indicating that fasting, binge eating, use of laxatives and diuretics as well as self-induced vomiting have decreased over time.

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