

# Dietary Adherence, Glycemic Control, and Psychological Factors Associated with Binge Eating Among Indigenous and Non-Indigenous Chileans with Type 2 Diabetes

Sylvia Herbozo · Patricia M. Flynn · Serena D. Stevens · Hector Betancourt

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## Abstract

**Background** Despite the strong association between obesity and binge eating, limited research has examined the implications of binge eating on dietary adherence and psychological factors in ethnically diverse type 2 diabetes patients.

**Purpose** This study investigated the prevalence of binge eating and its association with dietary adherence, glycemic control, and psychological factors among indigenous and non-indigenous type 2 diabetes patients in Chile.

**Method** Participants were 387 indigenous (Mapuche) and non-indigenous (non-Mapuche) adults with type 2 diabetes. Self-report measures of binge eating, dietary adherence, diet self-efficacy, body image dissatisfaction, and psychological well-being were administered. Participants' weight, height, and glycemic control (HbA<sub>1c</sub>) were also obtained.

**Results** Approximately 8 % of the type 2 diabetes patients reported binge eating. The prevalence among Mapuche patients was 4.9 %, and among non-Mapuche patients, it was 9.9 %. Compared to non-binge eaters, binge eating diabetes patients had greater body mass index values, consumed more high-fat foods, were less likely to adhere to their eating plan, and reported poorer body image and emotional well-being.

**Conclusion** Results of this study extend previous research by examining the co-occurrence of binge eating and type 2 diabetes as well as the associated dietary behaviors, glycemic

control, and psychological factors among indigenous and non-indigenous patients in Chile. These findings may increase our understanding of the health challenges faced by indigenous populations from other countries and highlight the need for additional research that may inform interventions addressing binge eating in diverse patients with type 2 diabetes.

**Keyword** Binge eating · Type 2 diabetes · Dietary adherence · Glycemic control

## Introduction

Binge eating disorder (BED), characterized by recurrent episodes of uncontrollable overeating in the absence of compensatory behaviors, is a significant clinical problem that occurs more frequently among overweight and obese individuals [1, 2]. Research indicates that binge eating and BED are associated with various medical and psychiatric comorbidities. For instance, results from a 5-year longitudinal study revealed that individuals with BED had an increased risk of metabolic syndrome (hypertension, dyslipidemia, or type 2 diabetes), relative to a matched comparison group without BED [3]. Other research has demonstrated that binge eating and BED are associated with increased body mass index (BMI) [4], higher rates of diabetes and hypertension [5], lower self-efficacy for healthy eating and exercise [6], poorer body image [7], and increased likelihood of other mental disorders such as depression and anxiety [8, 9].

While there are significant psychological and medical consequences of BED in the general population, the occurrence of binge eating among diabetes patients is associated with additional complications that have implications for the

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S. Herbozo · P. M. Flynn · S. D. Stevens · H. Betancourt  
Loma Linda University, 11130 Anderson St., Loma  
Linda, CA 92350, USA

H. Betancourt  
Universidad de La Frontera, Francisco Salazar 1145,  
4811230 Temuco, Araucanía, Chile

S. Herbozo (✉)  
Department of Psychology, Loma Linda University, 11130 Anderson  
Street, Loma Linda, CA 92350, USA  
e-mail: sherbozo@llu.edu

management and progression of diabetes. Most studies in this area, however, focus on patients with type 1 diabetes [10]. The limited research examining binge eating among type 2 diabetes patients reveals that compared to patients without binge eating, those with binge eating are diagnosed with diabetes at a younger age; are more likely to be women; have a higher BMI; and report greater depressive symptoms, poorer quality of life, and more weight-related impairment [11–13]. In addition, results from a study on disordered eating behaviors among women with type 2 diabetes indicated poorer self-efficacy for diet and exercise self-management in women with binge eating as compared to those without binge eating [12]. Moreover, weight loss interventions appear to be less effective for diabetes patients with binge eating. Results of a randomized control trial revealed that weight loss was the most poor among diabetes patients that continued to binge eat over the course of the study [14]. In regard to glycemic control, findings are mixed with some studies indicating no association with binge eating or BED [11, 12, 14, 15] while one study reported a significant positive association with BED among ethnically diverse type 2 diabetes patients [16].

Population-based data from 14 countries indicates a BED prevalence rate of 1.4 % [5] whereas the prevalence among individuals with type 2 diabetes varies considerably ranging from 1.4 to 25.6 % [17]. However, most studies on disordered eating and diabetes do not include ethnic minority populations [10] or diabetes patients from countries other than the United States. This is noteworthy given that the prevalence of diabetes has increased in many developing countries partly due to changes in food consumption [18]. In Chile, over half of the national population is considered overweight [19] and the prevalence of diabetes (10.2 %) is one of the highest among all countries in South America [20]. Moreover, rates of obesity have increased significantly and the prevalence of type 2 diabetes has tripled over the last 15 years among Mapuches, the largest indigenous population in Chile [21, 22]. Still, little is known regarding the prevalence of binge eating among type 2 diabetes patients and the associated dietary behaviors and psychological factors that may impact the management and progression of diabetes in countries like Chile. This is particularly the case for indigenous populations that have experienced significant cultural and lifestyle changes associated with economic development and globalization.

The purpose of this study was to examine the prevalence of binge eating and its association with dietary adherence, glycemic control, and psychological factors among ethnically diverse type 2 diabetes patients in Chile. This study addresses some of the limitations of research in this area, such as the focus on type 1 diabetes patients and non-Latino White samples as well as the incomplete psychological characterization of type 2 diabetes patients with binge eating [10]. A better understanding of the dietary behaviors and psychological needs of type 2 diabetes patients among diverse populations

with binge eating could allow for more effective intervention approaches that may curb the numerous complications associated with the co-occurrence of binge eating and diabetes. Furthermore, the study of indigenous (Mapuche) and mainstream non-indigenous (non-Mapuche) patients in Chile may shed light on the co-occurrence of binge eating and diabetes in Latin America and indigenous diabetes populations in other countries.

## Materials and Methods

### Study Population and Procedures

A total of 400 (Mapuche;  $n=146$ , non-Mapuche;  $n=254$ ) type 2 diabetes patients from urban and rural areas of La Araucanía Region of Chile participated in the study. Thirteen participants were excluded from statistical analyses due to missing data resulting in a sample of 387. The mean age was 58 (SD=5.82), 62 % were women, and average year of education was 8.39 (SD=4.77). Of the total sample, 37 % ( $n=144$ ) were Mapuche and 63 % ( $n=243$ ) were non-Mapuche. The mean BMI was 31.71 (SD=5.82), and approximately 89 % of the sample was overweight or obese (BMI  $\geq 25$ ).

Research approval was obtained from the public university ethics committee for research and the regional office of the Chilean Ministry of Health (SEREMI de Salud, Region de La Araucanía). Participants were recruited through health care personnel and flyers posted and distributed at public and private health care centers. Individuals interested in participating contacted the study research office at which time they were provided with information on the study and were screened for inclusion criteria (minimum age of 18 years, self-identified ethnicity as either Mapuche or non-Mapuche, diagnosis of type 2 diabetes for at least 1 year, non-insulin dependent). Those interested in participating scheduled a time for data collection at one of the data collection locations.

Two research assistants were present during data collection. The research assistants reviewed the informed consent form with participants, obtained written consent, and then distributed the questionnaire. Once the questionnaire was completed, a trained research assistant measured the participant's height and weight and administered the HbA<sub>1c</sub> test. Participants were given their HbA<sub>1c</sub> results as well as the equivalent to \$10 USD for their participation. Participation took approximately 1 hour including processing time for the HbA<sub>1c</sub> test.

### Demographic and Physical Health Information

Demographic variables included self-reported ethnicity, age, gender, and education. Physical health measures included weight, height, and HbA<sub>1c</sub>. BMI was calculated using

measured height and weight. Participants were classified as overweight based on a BMI of 25–29.99 and obese based on a BMI  $\geq 30$ .

### Binge Eating

Three diagnostic items from the Spanish version of the Questionnaire on Eating and Weight Patterns-Revised (QEWPR; [23]) were administered to assess binge eating. Participants were asked, (1) “In a 2-hour period, have you ever eaten what most people would regard as an unusually large amount of food?”, (2) “During the period in which you ate too much, did you feel you could not stop eating or control what or how much you were eating?”, and (3) “During the past 6 months, how often, on average, did you have times when you ate this way (that is, large amounts of food plus the feeling that your eating was out of control)?” The first two questions were based on a dichotomous yes/no response, whereas the third question was based on a five-point scale (less than 1 day a week, 1 day per week, 2 or 3 days a week, 4 or 5 days a week, nearly every day). Consistent with the frequency of binge eating required for a diagnosis of BED based on the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; [24])*, participants were categorized as binge eaters if they responded “yes” to the first two questions (overeating and loss of control) and had engaged in one or more episodes of binge eating per week. A binge eating frequency score was calculated based on how often participants engaged in binge eating per week, on average, and assigning a value of 0 to participants who indicated no binge eating episodes. The binge eating frequency score ranged from *never* (0) to *nearly every day* (5).

### Dietary Adherence

Three items from the Spanish version of the Summary of Diabetes Self-Care Activity (SDSCA) scale [25] were used to assess dietary adherence. Participants were asked, “On average, over the past month, how many days per week have you followed your eating plan?”. Participants were also asked to indicate how many of the last 7 days that they ate “5 or more servings of fruit and vegetables” and “high-fat foods such as red meat or full-fat dairy products.” The SDSCA uses an eight-point scale ranging from 0 to 7 days.

### Dietary Self-Efficacy

Five items from the Spanish diabetes self-efficacy scale [26], which was developed based on Bandura’s social cognitive theory [27] and validated with a sample of type 2 diabetes patients in Mexico, were used to measure diet self-efficacy. The items assess how capable diabetes patients feel about performing behaviors relevant to eating a healthy diet. A

sample item includes, “How capable do you feel about avoiding foods that are not part of your diet?” Participants responded to the items based on a four-point Likert scale from *not capable* (1) to *very capable* (4). Internal consistency was good for the total ( $\alpha=0.88$ ), Mapuche ( $\alpha=0.88$ ), and non-Mapuche ( $\alpha=0.88$ ) samples. A diet self-efficacy score was calculated by averaging the five items.

### Body Image Dissatisfaction

Two items from the weight and shape concern subscales of the Spanish version of the Eating Disorders Examination—Questionnaire (EDE-Q; [28]) were used to assess body image dissatisfaction. Participants were asked, (1) “During the past 28 days, how dissatisfied have you been with your weight?” and (2) “During the past 28 days, how dissatisfied have you been with your shape?” The items were based on a seven-point Likert scale ranging from *not at all* (0) to *markedly* (6). The EDE-Q items demonstrated good internal consistency for the total ( $\alpha=0.85$ ), Mapuche ( $\alpha=0.81$ ), and non-Mapuche ( $\alpha=0.87$ ) samples. Scores from the weight and shape concern items were totaled and averaged to provide an overall body image dissatisfaction score.

### Emotional Well-Being

The Spanish version of the Five Well-Being Index of the World Health Organization (WHO-5; [29]) was used to assess emotional well-being. Participants were asked about positive affect and level of energy based on a six-point Likert scale ranging from *at no time* (0) to *all of the time* (5). This subscale showed good internal consistency for the total ( $\alpha=0.89$ ), Mapuche ( $\alpha=0.85$ ), and non-Mapuche ( $\alpha=0.90$ ) samples. Consistent with previous use of the WHO-5, item scores were summed and transformed to a 0–100 scale with lower scores representing poorer emotional well-being. A WHO-5 cutoff of  $<50$  is recommended as the threshold for further testing of depression and suggests mild–severe depression [30].

### Statistical Analyses

All statistical analyses were performed using SPSS software version 22.0. A missing variable analysis was conducted to identify individuals with missing data on one or more of the key study variables. Individuals excluded from the study due to missing data were compared to the retained sample on demographic variables using *t* tests for continuous and chi-square tests for categorical variables which indicated no significant differences between the eliminated and retained cases. The prevalence of binge eating was determined for the total sample as well as based on ethnicity and gender. Differences were evaluated using the chi-square test. The binge eating and non-binge eating groups were then compared on dietary

**Table 1** Comparison of dietary adherence, psychological factors, and glycemic control by binge eating status

	Binge eaters ( <i>n</i> =31)	Non-binge eaters ( <i>n</i> =356)	Significance	Effect size
	<i>n</i> (%)	<i>n</i> (%)	<i>p</i> value	Phi
Overweight	7 (22.6)	114 (32.0)	0.277	0.110
Obese	23 (74.2)	202 (56.7)	0.059	0.193
Depressed symptoms*	10 (32.3)	57 (16.0)	0.022	0.236
Dietary adherence	<i>M</i> (SD)	<i>M</i> (SD)	<i>p</i> value	Cohen's <i>d</i>
High-fat foods*	3.48 (1.76)	2.05 (1.70)	<0.001	0.839
>5 fruits and vegetables	4.61 (2.17)	4.70 (2.09)	0.823	0.040
Eating plan adherence*	3.48 (2.28)	4.56 (1.90)	0.003	0.557
Diet self-efficacy	2.36 (.73)	2.63 (.66)	0.031	0.407
Body image dissatisfaction*	5.61 (1.65)	3.71 (2.21)	<0.001	0.874
Emotional well-being*	63.12 (28.27)	74.72 (23.60)	0.010	0.484
Body mass index*	34.78 (7.94)	31.44 (5.54)	0.002	0.580
HbA <sub>1c</sub>	7.26 (1.80)	7.26 (2.02)	0.998	0.000
Age at diabetes diagnosis*	43.98 (12.27)	51.87 (12.70)	0.001	0.613

Depressive symptoms based on WHO-5 index cutoff of <50

\*Significant at the  $p < 0.05$  level for chi-square tests and after Holm's Sequential Bonferroni correction for *t*-tests

adherence, glycemic control, and psychological variables. Dichotomous study variables were examined using the chi-square test, and continuous study variables were examined with a *t* test using Holm's Sequential Bonferroni procedure to correct for multiple comparisons [31]. Cohen's *d* and the Phi coefficient were also calculated to examine effect sizes. Pearson's *r* coefficient was used to test the strength of association between binge eating frequency and the dietary adherence, glycemic control, and psychological variables for each ethnic group.

## Results

### Prevalence of Binge Eating

Approximately 8 % ( $n=31$ ) of the total sample reported binge eating, on average, at least once a week for 6 months. The prevalence of binge eating for Mapuche patients was 4.9 % ( $n=7$ ), and for non-Mapuche patients, it was 9.9 % ( $n=24$ ) [ $\chi^2(1, n=387)=3.09, p=0.079, phi=0.089$ ].

### Differences Between Binge Eaters and Non-Binge Eaters on Dietary Adherence, Psychological Factors, and Glycemic Control

Table 1 shows the descriptive statistics and mean differences between the binge and non-binge eating groups after correcting for multiple comparisons using Holm's Sequential Bonferroni procedure [31]. The binge eating group had greater BMI values than the non-binge eating group. In terms of dietary adherence, the binge eating group was more likely to eat foods high in fat and less likely to adhere to the prescribed eating plan compared

to the non-binge eating group. Furthermore, the binge eating group reported poorer body image and lower emotional well-being. Based on the WHO-5 index cutoff of <50, the binge eating group was more likely to report depressive symptoms. There were no differences in HbA<sub>1c</sub> levels; however, the binge eating group reported a younger age at diabetes diagnosis compared to the non-binge eating group.

### Associations Between Frequency of Binge Eating and Dietary Adherence, Psychological Factors, and Glycemic Control Based on Ethnicity

Table 2 presents the correlations between binge eating frequency and study variables based on ethnicity. For the

**Table 2** Correlations between frequency of binge eating and study variables by ethnicity

	Ethnicity	
	Mapuche	Non-Mapuche
High-fat foods	0.183*	0.225***
>5 fruits and vegetables	-0.113	-0.013
Eating plan adherence	-0.095	-0.232***
Diet self-efficacy	-0.144	-0.137*
Body image dissatisfaction	0.154	0.306***
Emotional well-being	-0.037	-0.144*
Body mass index	0.093	0.305***
HbA <sub>1c</sub>	0.162	-0.010
Age at diabetes diagnosis	-0.126	-0.185**

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

Mapuche sample, binge eating frequency was positively associated with consuming high-fat foods. Among the non-Mapuche sample, binge eating frequency was positively associated with consuming high-fat foods and negatively associated with eating plan adherence. Binge frequency was also associated with lower diet self-efficacy, higher BMI, greater body image dissatisfaction, lower emotional well-being, and younger age at diabetes diagnosis.

## Conclusion

The co-occurrence of binge eating and type 2 diabetes in Chile was consistent with prevalence rates found in some studies [14, 32, 33] and lower than those reported in other studies [12]. On average, approximately 8 % of Mapuche and non-Mapuche type 2 diabetes patients engaged in one or more episodes of binge eating per week over the previous 6 months. Findings from this study may increase our understanding of the dietary adherence, glycemic control, and psychological issues associated with binge eating among type 2 diabetes patients in general, while highlighting important considerations that may be unique to indigenous and mainstream Latino patients in a Latin American country.

Dietary adherence and weight control are important components of diabetes management, which are influenced by binge eating status according to the study findings. The higher BMI among binge eaters may be the result of eating behaviors and lower adherence to the diabetes diet in patients with this co-morbid diagnosis. Interestingly, binge eaters and non-binge eaters were equally likely to eat five or more servings of fruits and vegetables. However, binge eaters consumed more high-fat foods such as meats and dairy than non-binge eaters which is consistent with behavioral patterns reported by women who binge eat [34–36].

Results from this study could be useful for the development of interventions aimed at improving dietary adherence and controlling weight among type 2 diabetes patients engaging in binge eating. For instance, addressing self-efficacy associated with avoiding high-fat foods and eating fruits and vegetables could be particularly effective given that binge eaters in this study reported lower diet self-efficacy compared to non-binge eaters. Enhancing perceptions of control may also be an important factor to consider in intervention efforts based on recent research indicating that dietary adherence and the consumption of high-fat foods were associated with perceived control over developing diabetes complications [37]. Additionally, cognitive behavioral guided self-help (CBTgsh) may be an effective means for helping binge eaters establish a regular pattern of eating. Recent research revealed that binge eaters who received ten sessions of CBTgsh had better dietary adherence and fewer binge episodes [38].

Findings also indicated important psychological aspects concerning the co-occurrence of binge eating and type 2 diabetes. Results suggest that engaging in binge eating contributes to greater body image dissatisfaction and poorer emotional well-being. These findings are consistent with a study of youth with type 2 diabetes, which indicated that patients engaging in binge eating had greater depressive symptoms and impairment in quality of life than those without binge eating [13]. In the current study, twice as many binge eaters (32 %) than non-binge eaters (16 %) were identified as potentially depressed. Depressive symptoms have been linked with inadequate diabetes management such as poor self-care, medication adherence [39], and glycemic control [40]. Such findings have highlighted the need to consider developing more comprehensive interventions for diabetes that address depression [41]. With regard to binge eating, future research could explore the potential indirect effect of binge eating on measures of diabetes control, such as HbA<sub>1c</sub>, through depression and other mediating psychological factors, which may further inform interventions specifically for type 2 diabetes patients with binge eating.

This study revealed some interesting findings with regard to ethnicity. For instance, although the difference was not statistically significant, the prevalence of binge eating was 4.9 % for Mapuche and 9.9 % for non-Mapuche diabetes patients. Several Latin American countries, including Chile, have undergone rapid environmental and cultural changes due to globalization, economic growth, and urbanization resulting in a more westernized lifestyle [42]. Research suggests that the Anglo American cultural ideal of thinness plays an important role in the development of eating disorders [43]. In Chile, the indigenous Mapuche population has historically resided in traditional rural environments that may be more protected from the influence of westernization and the mass media. Unlike the Mapuches, non-Mapuches may be more exposed to and potentially internalize Anglo American portrayals of physical attractiveness, which may contribute to the occurrence of binge eating in this population. However, recent economic and social changes have resulted in the migration of greater numbers of Mapuches to urban areas [44], and such migration could potentially make this population more susceptible to disordered eating behaviors in the near future.

For Mapuche diabetes patients, as well as non-Mapuches, results indicated that binge eating frequency was associated with an increased consumption of high-fat foods such as meat and dairy products. The traditional Mapuche diet is scarce in meat and consists predominantly of vegetables [45], which is quite inconsistent with the high-caloric/high-fat foods that are typically consumed during binges. According to the “thrifty genotype” hypothesis, which has been used to explain the higher prevalence of obesity and diabetes among American Pima Indians, Australian Aborigines, and Pacific Islanders, hunter-gatherer societies adapted mechanisms that allowed

them to hoard calories to conserve energy and withstand times of famine [46]. Such beneficial mechanisms may be disadvantageous when high-calorie, high-fat diets are more frequently consumed such as during binge episodes. This is in line with recent research that revealed that adiposity and increased sedentary time influenced insulin resistance to a greater extent in Mapuches as compared to non-Mapuches [47].

Findings from this study may also contribute to a better understanding of the health challenges faced by indigenous populations in other countries such as Australia, Canada, and the United States where they experience higher rates of obesity, type 2 diabetes, and cardiovascular disease compared to non-indigenous populations [48–50]. Research in these countries suggests that disordered eating and body dissatisfaction are as prevalent among indigenous as non-indigenous populations [51, 52], which is contrary to findings in Chile [53]. Considering the prevalence of binge eating in these countries, the implications of co-morbid binge eating and diabetes may be even more far reaching for indigenous populations in such countries. Future research examining this co-morbid diagnosis among indigenous populations in other countries is warranted. Moreover, future research may also benefit from exploring differences in health behaviors and outcomes among indigenous-majority as compared to indigenous-minority countries. Berry and Kalin (1995) argue that the general orientation of society or a particular country toward cultural pluralism can support or hinder cultural diversity and the treatment of indigenous populations, particularly depending on whether the indigenous population is a dominant or non-dominant ethnic group [54]. As such, indigenous patients from indigenous-minority countries may experience more stress, discrimination, and hostility leading to worse health behaviors and outcomes.

The strengths of this study include the use of DSM-5 criteria to identify binge eating, the use of indigenous and non-indigenous type 2 diabetes patients, and the inclusion of a biological measure of diabetes control ( $HbA_{1c}$ ). One limitation of the study is the small sample of patients with binge eating, which may have affected the ability to detect significant relations with some of the study variables. Another limitation is the use of diagnostic items from the QEWP-R, a self-report questionnaire, rather than a diagnostic interview to assess binge eating. However, the QEWP-R has been identified as a useful tool for screening binge eating that can be easily utilized given its brevity [55].

Despite these limitations, the present study provides preliminary evidence concerning the prevalence of binge eating among type 2 diabetes patients and its implications for dietary adherence, glycemic control, and psychological well-being in a Latin American country, including mainstream Latino and indigenous populations. Research suggests that the prognosis of patients with this co-morbid diagnosis is poor in the absence of specialized treatment [56]. Health care professionals

treating diabetes patients could be encouraged to screen their patients for binge eating so they can make referrals for treatments that specifically address issues associated with binge eating. Such efforts could result in improved eating behaviors and disease management for diabetes patients with binge eating.

**Acknowledgments** This study was part of a larger research project supported by funding from the Government of Chile, through its National Council for Scientific and Technological Research (CONICYT), FONDECYT project 1090660 to the last author. The authors thank the FONDECYT project research team, particularly Tamara Hernandez Otzen, Gloria Muñoz, and Ligia Orellana, whose contribution made the data collection for this study possible.

**Conflict of Interest** Sylvia Herbozo, Patricia M. Flynn, Serena D. Stevens, and Hector Betancourt declare that they have no conflict of interest.

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