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Scale for assessing the quality of Mexican adults' mealtime habits

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Abstract

Objective. To construct a scale for assessing the quality of mealtime habits in a sample of urban Mexican adults, computing the contribution of a set of advisable and unadvisable mealtime habits. **Material and Methods**. We performed an exploratory factor analysis among 7 472 adults participating in the baseline assessment of the Health Workers Cohort Study, to assess the mealtime habits quality. Likelihood ratio test for difference of two probabilities and test for the difference of two means were used to identify differences between low and high categories of the Mealtime Habits Quality Scale (MHQS) across variables of interest. **Results**. Participants with the top quality of mealtime habits showed lower rates of overweight, obesity, abdominal obesity, and elevated body fat. They were also more adherent to a prudent dietary pattern than a western dietary pattern, and consumed more fruits and vegetables. **Conclusions**. Anthropometric and dietary variables differed across MHQS categories. However, further validation of the scale, and assessment of their ability to predict weight gain or related diseases are needed, using prospective and intervention studies.

Key words: eating behavior; assessment; evaluation; scale; indicator; adults; Mexico

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Resumen

Objetivo. Construir una escala para evaluar la calidad de los hábitos al comer, calculando la contribución de un grupo de hábitos recomendables y no recomendables, en población adulta urbana de México. **Material y métodos**. Realizamos un análisis exploratorio de factores en 7 472 adultos participantes en el Estudio de Cohorte de Trabajadores de la Salud para evaluar la calidad de los hábitos al comer. Para identificar diferencias entre la baja y alta calidad de los hábitos al comer a través de las variables de interés, utilizamos la prueba de razón de probabilidades a fin de evaluar la diferencia entre dos proporciones y la prueba de comparación de medias. **Resultados**. Los participantes clasificados en la categoría de alta calidad de los hábitos al comer presentaron prevalencias más bajas de sobrepeso, obesidad, obesidad abdominal y porcentaje de grasa corporal elevado. Además, mostraron mayor adherencia al patrón dietario prudente que al patrón dietario occidental, así como mayor consumo de frutas y verduras. **Conclusiones**. Las variables antropométricas y de dieta muestran diferencias a través de las categorías de la escala de la calidad de hábitos al comer. Sin embargo, será necesario validar la escala y evaluar su capacidad para predecir ganancia de peso o enfermedades relacionadas, mediante estudios prospectivos o de intervención.

Palabras clave: conducta alimentaria; escala; indicador; evaluación; adultos; México

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Nutrition is one of the most important predictors of population health, making nutrition factors such as diet quality,[1] dietary patterns,[2] food-related behaviors,[3,4] food consumption customs,[5] and mealtimes[5] key health issues. Some studies have shown that what people do while eating can influence their health as well as what they eat. For instance, distractions from eating such as watching TV or working can reduce the ability to monitor consumption, which may lead to unintentional overconsumption of food.[6,7] Furthermore, people have been found to consume less fruits and vegetables when they watch television during dinner.[8] Particular work activities or long commutes can also negatively affect mealtime habits. These constraints reduce the availability of time to eat, provide incentives to eat out and make individuals more vulnerable to hunger and less able to select healthy foods.[9] Lack of time to eat is associated with skipping meals (frequently breakfast or lunch) and shifting mealtimes to later in the day.[10,11] It is likewise associated with rushed eating, which decreases satiety at meal completion and thus encourages overeating.[12] By contrast, having ample time to eat makes it easier to plan meals in advance and has been linked to higher intakes of fruits and vegetables.[13]

Family factors can also influence the ways that people eat and the quantity of food that is seen as acceptable to consume.[14] For instance, family members may encourage an individual to finish a meal despite fullness, to rush meals, or to eat in front of the television; these learned eating habits might contribute to overeating.[15] Said mealtime behaviors have been assessed individually, but not as an interrelated whole. Thus, we sought to construct a scale for assessing the quality of mealtime habits in a sample of urban Mexican adults, computing the contribution of a set of advisable and unadvisable mealtime habits. Finally, we characterized the scale in relation to other variables, such as anthropometric indicators, dietary patterns and intake of particular foods.

Material and methods

Study population

We analyzed the baseline data from adults participating in the Health Workers Cohort Study (HWCS). The HWCS is an ongoing longitudinal cohort study assessing relationships between lifestyle and health. Briefly, this study began in 1998-2000, carried out with active retired health workers from the Instituto Mexicano del Seguro Social (Mexican Social Security Institute) in the state of Morelos.[16] From March 2004 to April 2006, the study enrolled 10 460 workers and their relatives at the

Instituto Mexicano del Seguro Social and the Instituto Nacional de Salud Pública (Mexico National Institute of Public Health), both located in Cuernavaca Morelos, and workers at the Universidad Autónoma del Estado de México (Mexico State Autonomous University) in Toluca [17,18] For the present study, we performed a cross sectional analysis of data from 8 490 participants aged 18 to 70. We excluded participants with diseases that may have led them to significantly modify their mealtime habits: diabetes (n=508), cardiovascular diseases (n=74), kidney diseases (n=48), depression (n=279) and cancer (n=109). The remaining 7 472 participants were included in our analysis. The study was performed according to the Helsinki declaration on human studies[19]; each subject signed an approved informed consent form prior to entering the study. The ethics committees of all the participating institutions approved the study protocol.

Assessment of individual mealtime habits

The HWCS questionnaire included data on mealtime behaviors. Participants were asked: "When you eat, generally, what do you do?" (¿Cuando come generalmente qué hace?). They responded by answering yes or no to eight specific questions: I choose what I eat (Selecciono qué comer); I eat slowly (Como lentamente); I take my time to finish my meal (Tomo el tiempo que sea necesario para terminar); I take advantage of mealtimes to accomplish work activities (Aprovecho para arreglar pendientes); I am distracted -I talk, watch TV or read - so I do not realize how much I eat, (Me distraigo -platico, veo tele o leo- sin darme cuenta de cuánto como); I rush my meals to avoid exceeding the available time to eat (Me apuro para no exceder el tiempo que tengo para comer); I eat in huge mouthfuls (Como a grandes bocados); and I eat all my food, without leaving anything on the plate (Como todo sin dejar comida en el plato). These items were categorized into two groups –advisable and unadvisable for good health– on the basis of published studies. Items included in the unadvisable category were: eating while doing another activity (such as watching television, working at a computer, reading, driving or playing video games) since it increases the probability of overeating and being overweight or obese[20]; eating on the run, since this increases intake of soft drinks, fast food, total fat and saturated fat[13] and the probability of being overweight[21,22]; eating large bites of food, since this increases one's initial ingestion rate[23] and has been related to greater total caloric intake[24]; and eating all the food served, since this increases the probability

of finishing one's meal even when one is full.[25] Items included in the advisable category were: food choice, since dietary restraint and selecting healthy food is associated with weight control;[26-28] eating slowly, since this may help to maximize satiation and reduce energy intake within meals,[12] and; taking time to finish meals, since greater time spent preparing and eating food is linked to a higher intake of healthful foods such as fruit and vegetables and a lower intake of snacks.[13]

Assessment of dietary patterns

A semi-quantitative food frequency questionnaire (FFQ) validated in a Mexican population[29] was used to assess diet. This questionnaire included data on the frequency of consumption of 116 food items commonly consumed over the past year, ranging from never to ≥ 6 times per day. Dietary patterns were derived from an exploratory factor analysis with previously defined food groups.[30] Briefly, food items were classified into 28 food groups based on similarity in nutrients, content lipid profile, content of sugar, proportion of dietary fiber and commonly consumed foods. Three dietary patterns were derived: the first, identified as the prudent diet is typified by a greater intake of processed vegetable juices, potatoes, fresh fruits, fresh vegetables and legumes, and a lower intake of pastries. The second, identified as a western diet, is characterized by a higher intake of pastries, refined cereals, corn tortillas and soft drinks, and a lower intake of whole cereals, sea food and full-fat dairy products. The third, identified as a high protein/fat diet, is typified by a greater intake of red meat, processed meat, margarine and eggs, and a lower intake of fruits and whole grain cereals. The factor score for each dietary pattern was constructed by summing the standardized percentage of energy intake of food groups, weighted by their factor loading. Finally, we defined tertile categories for each dietary pattern, the highest tertile reflecting greatest adherence to dietary pattern.

Anthropometric assessment

Weight was measured with a previously calibrated electronic scale, while participants were wearing minimal clothing. Height was measured with a conventional stadiometer. Body mass index (BMI) was calculated as a ratio of weight (Kg) to height squared (m²). Waist circumference was measured at the high point of the iliac crest at the end of normal expiration, to the nearest 0.1 cm, with a steel measuring tape. Body composition was assessed as body fat proportion (BFP) determined

by dual-energy X-ray absorptiometry with a Lunar DPX-GE (software version 1.35, fast scan mode).

Other variables

Leisure physical activity was assessed using a validated physical activity questionnaire, a detailed description of which appears elsewhere.[17,31] We defined two categories: <30 minutes per day and ≥30 minutes per day, based on the minimum amount of physical activity recommended for Mexican adults.[32] Further, regular self-monitored body weight assessment was defined as present when participants reported weighing themselves at least once every 4-6 months. Demographic data were collected via self-administered questionnaires assessing age, sex and educational attainment.

Statistical analysis

We performed exploratory factor analysis of a set of eight mealtime items using the principal factor method to uncover underlying factors and factor loading of each item.[33,34] First, since all mealtime practices were binary variables, a tetrachoric matrix correlation was obtained. When participants performed a mealtime habit we entered a value of 1 into the analysis. Unrotated and rotated factor analyses were conducted to achieve greater interpretability. The criteria for determining the factors to retain were: factors with eigen values of 1 or greater; those factors that concentrate at least 4 relevant items on the factor axis with factor loadings of 0.3 or greater, and; the interpretability of the factors[35] in terms of their representativeness of mealtime habits in our study population.

After conducting the oblique rotation factor analysis, the scree plot test showed that the last substantial decline in the magnitude of the eigenvalues was in factor 1, which had an eigenvalue of 2.1 and the solution explained 26.2% of the variance. Five items had factor loadings of 0.3 and greater, and advisable mealtime items were correlated positively and unadvisable mealtime items were correlated negatively (Table I). We assessed the internal consistency of the scale using the Kuder-Richardson coefficient test[33] and found the coefficient to be 0.84.

The Mealtime Habit Quality Scale (MHQS) was constructed by summing the contribution of each item weighted by its factor loading.[35] Since the indicator had negative values, we added 5 to the total summarized score to obtain a positive scale. Each participant received an individual score representing the quality of their mealtime habits, with higher scores reflecting better quality.

Table I
Factor loading of mealtime habits by factor analysis method in an urban Mexican adult population, March 2004 to April 2006

	Factor loading
Advisable mealtime habits	
I take my time to finish my meal	0.72
I eat slowly	0.53
I choose what I eat	0.24
Unadvisable mealtime habits	
I rush my meals to avoid exceeding the available time to eat	-0.71
I eat in huge mouthfuls	-0.68
I take advantage of mealtimes to accomplish work activities	-0.37
I eat all my food, without leaving anything on the plate	-0.26
I am distracted (I talk, watch TV or read) so I do not realize how much I eat	-0.23
Explained variance (%)	26.2

We performed a descriptive analysis of the main characteristics of interest by sex because anthropometric measures and mealtime items are likely to be gender specific.

To identify the differences between qualitative variables (education, BMI categories, central obesity, mealtime items) by sex with the two-sample proportion test, and evaluated quantitative variables (age, waist circumference) with the two-sample t-test.

In order to identify differences across participants' scores, we grouped scores in tertiles and compared the highest and lowest. The cut-off points for the MHQS scores were: 1.26 to 5.24 points for the first tertile, or "low quality"; 5.25 to 6.82 points for the second tertile, or "middle quality"; and 6.83 to 8.74 points for the third tertile, or "high quality".

To identify differences between high and low quality mealtime habit categories across qualitative variables (BMI categories, dietary patterns and leisure time physical activity), we used the likelihood ratio test for difference of two probabilities. For quantitative variables (age, BMI, waist circumference, energy intake, servings per day of some foods and food groups in the healthy eating pyramid[36]) we used the test for difference of two means. Proportions and means were adjusted by age and sex. Analyses were performed using STATA software, version 9.

Results

The factor solution of mealtime habits was composed of only the first factor; advisable mealtime items were correlated positively and unadvisable mealtime items were correlated negatively (Table I). Five items had a loading greater than 0.30; the exceptions were items: I chose what I eat; I eat all my food, without leaving anything on the plate and I am distracted (I talk, watch tv or read) so I do not realize how much I eat. The MHQS had a mean of 5.9 points, median 6.22, ranging from 1.26 to 8.74 (SD ±1.3)

The study population was composed of mainly middle-aged participants, most were women and had a bachelor's level education or higher. Close to 61% were overweight or obese, and a higher proportion of women than men were overweight, had central obesity and high proportions of body fat (Table II).

Our study population practiced mealtime habits differently by sex. A higher proportion of men performed the advisable habit of "taking their time to finish their meals" than women, while a higher proportion of women performed the advisable habits of "choosing what to eat" and "eating slowly." A higher proportion of men "eat all food without leaving anything on the plate" and "eat in huge mouthfuls," while a higher proportion of women were distracted at mealtime. In general, the mealtime habits most practiced in the study population were "I take time to finish my meal," "I eat all my food without leaving anything on the plate" and "I rush my meal to avoid exceeding the available time to eat" (Table II).

Table III shows differences in anthropometric, dietary and lifestyle variables between the low and high quality mealtime habits. Participants in the high quality category were mainly older aged, had lower prevalences of overweight, obesity, abdominal obesity and higher body fat proportion than those in the low category. They also adhered more to a prudent diet than to a western diet. In addition, participants in the high quality category spent 30 or more minutes a day doing leisure physical activity and weighed themselves more regularly than those in the low quality category. Further, participants in the high quality category consumed significantly less servings a day of jam and sausage, soft drinks, cookies, pastries and snacks than those in the low quality category. They also consumed significantly more servings a day of fruits and vegetables than those in the low quality category (Figure 1).

Table II

**CHARACTERISTICS OF THE URBAN MEXICAN ADULT POPULATION STUDY AND FREQUENCY
OF THEIR MEALTIME HABITS BY SEX, MARCH 2004 TO APRIL 2006**

	Men (n=2 319)	Women (n= 5 153)	p value
Demographic characteristics			
Age, mean years (*)	39.5 (12.3)	40.4(12.6)	0.004
Education			
Elementary and secondary education, %	27.7	30.8	< 0.001
High school, %	19.7	20.9	< 0.002
Bachelor's, Master's degree or higher, %	52.5	48.3	< 0.002
Anthropometric variables			
Normal‡, %	34.1	43.4	< 0.001
Overweight‡, %	47.9	37.9	< 0.001
Obesity‡, %	17.9	18.7	0.419
Waist circumference, cm (*)	90.5 (17.4)	87.7 (15.0)	< 0.001
Central obesity §, %	17.7	48.9	< 0.001
Higher body fat proportion#, %	26.2	58.1	< 0.001
Advisable mealtime habits, %			
I take time to finish my meal	40.8	36.2	< 0.001
I choose what I eat	9.4	12.4	< 0.001
I eat slowly	9.1	14.1	< 0.001
Unadvisable mealtime habits, %			
I eat all my food, without leaving anything on the plate	29.9	26.1	< 0.001
I rush my meals to avoid exceeding the available time to eat	18.0	19.5	0.111
I eat in huge mouthfuls	9.4	6.9	< 0.001
I am distracted (I talk, watch TV or read) so I do not realize how much I eat	8.7	12.0	< 0.001
I take advantage of mealtimes to accomplish work activities	1.2	1.8	0.046

* Standard deviation
‡ Body mass index defined as normal <25 kg/m^2, overweight 25 to 29 kg/m^2, obesity ≥ 30 kg /m^2
§ Central obesity defined as waist circumference for women ≥88 cm and for men ≥102 cm
# High proportion of body fat defined for women ≥33% and for men ≥25%

p value, two-sample t-test and two-sample proportions test for assessing difference, between men *versus* women

Discussion

In this study, we constructed a scale for assessing the quality of mealtime habits that accounted for the relationships between various habits. Variations in anthropometric indicators such as BMI, abdominal obesity and body fat proportion, as well as lifestyle variables such as dietary patterns, intake of servings of specific foods, leisure physical activity and self-monitoring body weight behavior were found across MHQS categories.

As expected, we found that low mealtime habit quality related to a higher BMI and greater overweight and abdominal obesity. These findings are consistent with the previously found association between individual mealtime habits –such as being distracted while eating by watching TV or working,[20] eating at fast

rate,[37] and skipping breakfast–[38] and higher body mass index.

Our results also show that mealtime habits are related to particular dietary pattern. We found a positive association between high quality and prudent dietary patterns, supporting previous studies' findings of a strong relationship between advisable mealtime habits –such as planning meals in advance and eating at home– and a higher intake of fruit and vegetables and a lower consumption of fat.[8-10]

In this study, we also found significant differences in mealtime practices by sex. For instance, the items "I take my time to finish my meal", "I eat slowly" and "I eat all my food, without leaving anything on the plate" showed relevant differences between men and women, as compared to the item "I take advantage of mealtimes

Table III
**ADJUSTED MEANS AND PROPORTIONS OF THE URBAN MEXICAN ADULT POPULATION, BETWEEN LOW
AND HIGH MEALTIME HABITS QUALITY, MARCH 2004 TO APRIL 2006**

	Mealtime Habits Quality Scale				
	Low quality (n=2856)		High quality (n=2461)		p value
Age, mean years (*)	39.2	(11.8)	40.7	(12.6)	<0.001
Anthropometric variables					
Body mass index, kg/m² (*)	27.2	(4.6)	25.9	(5.4)	<0.001
Normal,‡ %	32.2		45.4		<0.001
Overweight,‡ %	43.6		36.5		<0.001
Obesity,‡ %	22.6		13.4		<0.001
Waist circumference, cm (*)	91.4	(12.2)	88.4	(11.3)	<0.001
Central obesity,§ %	40.8		30.8		<0.001
Body fat proportion (BFP) (*)	32.0	(8.6)	29.9	(8.3)	<0.001
High BFP,# %	51.0		44.2		<0.001
Dietary patterns					
Prudent& T3, %	24.4		32.6		0.001
Western& T3, %	35.8		32.0		0.004
High fat/protein& T3, %	33.6		32.6		0.434
Leisure physical activity ≥30 min/day, %	31.2		36.3		<0.001
Regular self weighing assessment, %	66.3		70.9		<0.001
Energy intake, kcal (*)	2 285	(1 131)	2 222	(1 103)	0.0461

Mealtime Habits Quality Scale (range): tertile 1 labeled low quality: 1.26-5.24 points, and tertile 3 labeled high quality: 6.83-8.74 points
Mean and proportions were adjusted by sex and age

* Standard deviation
‡ Body mass index defined as normal < 25 kg/m², overweight 25 to 29, kg/m², obesity ≥ 30 kg/m²
§ Central obesity defined as waist circumference for women ≥88 cm and for men ≥102 cm
# High proportion of body fat defined for women ≥33% and for men ≥25%
& The tertile 3 of dietary patterns (T3) represent greater adherence to the pattern

p value, likelihood ratio test for difference of two probabilities, and test for difference of two means, between low *versus* high quality mealtime habit

to accomplish work activities," which was also statistically significant but insufficient; that is, this item may not be clinically relevant because the difference could be conditioned by the large number of observations. In addition, we found differences in servings a day for some food groups between low and high quality mealtime habits. The relevant differences were found in servings a day of fruits, vegetables and cookies; meanwhile, differences in jam and sausage, soft drinks, and snacks were significant but clinically irrelevant.

Our data posed some limitations due to scale construction. First, although multiple-choice responses are ideal in scale construction, the MHQS is composed of binary response items, from which participants identified the answer that best represented their usual mealtime

habits. Second, we had to account for the possibility that responses to particular items might vary by meal time, day of the week or the people present at a particular meal.[39] While we were unable to capture all this possible variation, we sought to generate a generally accurate picture of mealtime habits by asking participants to identify what they usually did at mealtimes. Thus, we consider the MHQS structure to be plausible, especially in light of the strong internal consistency and correlation among the majority of mealtime items. Third, the study's cross sectional nature means that the observed relationship between low quality mealtime habits and obesity does not necessarily indicate causality; thus the MHQS requires validation though prospective cohort and intervention studies that will further uncover as-

| | Mealtime habits quality scale | | |
| | Low quality (n=2856) | High quality (n=2461) | p value |
Servings a day			
Jam and sausage	0.41	0.37	0.003
Butter	0.11	0.12	0.365
Soft drinks	0.53	0.48	<0.001
Cookies	0.59	0.47	<0.001
Pastries	0.54	0.46	0.002
Snacks	0.12	0.09	<0.001
Dairy products	2.16	2.16	0.886
Nuts, seeds	0.21	0.22	0.702
Beans and lentils	0.54	0.57	0.101
Fish	0.21	0.23	0.249
Eggs	0.33	0.34	0.716
Poultry	0.37	0.36	0.507
Vegetables	1.80	1.97	0.016
Fruits	2.16	2.71	0.001
Whole grains	0.55	0.55	0.903

Figure modified from Willett WC. The healthy eating pyramid[36]
Mealtime Habits Quality Scale (range): tertile 1 labeled low quality: 1.26-5.24 points, and tertile 3 labeled high quality: 6.83-8.74 points.
Means were adjusted by sex and age
p value, test for difference of two means, between low quality *versus* high quality mealtime habits

FIGURE 1. SERVINGS A DAY OF SOME FOODS IN THE HEALTHY EATING PYRAMID, BETWEEN LOW AND HIGH QUALITY MEALTIME HABITS, IN AN URBAN MEXICAN ADULT POPULATION, MARCH 2004 TO APRIL 2006

sociations of mealtime habits with obesity indicators and dietary patterns. Another consideration is that our study population is limited to one specific group, which is urban working class Mexican adults who are mostly overweight or obese women. Nevertheless, we believe that these results can be applied to similar groups, such as Mexican Americans.[40]

Despite these limitations, we believe that the MHQS is a tool for understanding the relationships between mealtime habits and their physical consequences, as well as for providing outcome measurements for interventions intended to improve mealtime habits. Based on our findings, we argue that dietary advice should move beyond food recommendations to the promotion of advisable mealtime habits, such as eating leisurely, consciously and slowly at set and uninterrupted mealtimes. The beneficial influence of these advisable mealtime habits on diet and overweight should be further explored.

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