

# Use and understanding of the nutrition information panel of pre-packaged foods in a sample of Mexican consumers

Vanessa De la Cruz-Góngora, MSc,<sup>(1)</sup> Salvador Villalpando, MD, PhD,<sup>(1)</sup>  
 Guadalupe Rodríguez-Oliveros, MBA, PhD,<sup>(1)</sup> Marcia Castillo-García, MPH,<sup>(1)</sup>  
 Verónica Mundo-Rosas, MSc,<sup>(1)</sup> Sergio Meneses-Navarro, MD, MA.<sup>(1)</sup>

De la Cruz-Góngora V, Villalpando S, Rodríguez-Oliveros G, Castillo-García M, Mundo-Rosas V, Meneses-Navarro S. Use and understanding of the nutrition information panel of pre-packaged foods in a sample of Mexican consumers. *Salud Publica Mex* 2012;54:158-166.

## Abstract

**Objective.** To assess the use and understanding of the Nutritional information Panel (NIP) of pre-packaged foods by Mexican consumers. **Materials and methods.** A questionnaire and an understanding test for NIP were applied to adult consumers in supermarkets of six cities in the Northern, Central, and Southern regions of Mexico. Data were analyzed by frequencies and Poisson regression models. **Results.** Interviewed 731 consumers; 71.5% were women, mean age  $33 \pm 9.7$  (range: 18-60), 70% completed high-school or a higher degree. In total, 17% of consumers use the NIP for making purchase decisions; 49% did not understand the NIP. Only 1.2% of consumers answered correctly the five questions of the NIP understanding test. **Conclusions.** The use and understanding of the NIP are low despite a high proportion self-reported reading and understanding. The lack of previous knowledge of the technical language prevents use and interpretation of NIP nutritional information for purchasing decisions.

Key words: consumers; food labeling; Mexico

De la Cruz-Góngora V, Villalpando S, Rodríguez-Oliveros G, Castillo-García M, Mundo-Rosas V, Meneses-Navarro S. Uso y comprensión del etiquetado nutrimental posterior de los alimentos pre-empaquetados en una muestra de consumidores mexicanos. *Salud Publica Mex* 2012;54:158-166.

## Resumen

**Objetivo.** Evaluar el uso y comprensión del etiquetado nutrimental posterior (NIP, por sus siglas en inglés) de alimentos preempacados por consumidores mexicanos. **Material y métodos.** Se aplicaron un cuestionario y una prueba de comprensión del NIP a consumidores adultos en supermercados de seis ciudades de las regiones Norte, Centro y Sur de México. **Resultados.** Se entrevistaron 731 consumidores; 71.5% eran mujeres, la media de edad  $33 \pm 9.7$  años (intervalo 18-60); 70% terminaron preparatoria o un nivel más alto. El 17% usa la etiqueta nutrimental para elegir sus alimentos; 49% no comprendía la NIP. Sólo 1.2% de los consumidores respondió correctamente las cinco preguntas de la prueba de comprensión del NIP. **Conclusiones.** El uso y comprensión del NIP fue bajo, a pesar de la gran proporción que autorreportó leerlo y comprenderlo. La falta de conocimiento previo del lenguaje técnico dificulta el uso e interpretación de la información nutrimental de NIP para las decisiones de compras de alimentos.

Palabras clave: consumidores; etiquetado de alimentos; México

(1) Instituto Nacional de Salud Pública. Cuernavaca, Morelos México.

The nutritional information panel (NIP) on the back of pre-packaged foods is an instrument to inform consumers about their nutritional content and values.<sup>1</sup> In some countries, the NIP has been used as an effective tool to inform and educate consumers about food advantages and health related risks, with the purpose of promoting healthy food choices,<sup>1,2</sup> and modifying dietary habits.<sup>3,4</sup> Several studies have documented that the NIP use by adult consumers reduces the dietary intake of total fat and cholesterol,<sup>5</sup> and increases the intake of fiber, iron, protein,<sup>6</sup> vitamin C,<sup>7</sup> fruit and vegetables.<sup>8</sup> Such dietary changes have been attributed mainly to changes in the purchasing behavior associated to the consumer perceptions about the correct use of the NIP.<sup>9</sup>

Sociodemographic characteristics associated with the use of the NIP are gender<sup>10</sup> (women more prone to use the NIP),<sup>5</sup> age,<sup>3</sup> higher education level, socioeconomic status (SES),<sup>11</sup> previously diagnosed chronic health conditions,<sup>12,13</sup> and personal concerns about nutrition and health.<sup>14</sup> However, a relevant proportion of consumers faces difficulties in understanding such information.<sup>10,15,16</sup> Reading the NIP does not imply understanding its content and consequently making an informed purchase decision. Consumers that read the NIP generally focus on specific information based on their personal needs and interests.<sup>10,14,17</sup> Studies in USA, New Zealand, and France<sup>16,18,19</sup> have found that the self-reported use of NIP for purchasing decisions is moderate to high.<sup>20</sup> In Mexico, there is no documented evidence on the use and understanding of the NIP by consumers and about the factors associated with the use and understanding of the NIP.

This study aims to describe the use and understanding of the NIP in a sample of Mexican consumers with high SES and educational level and to identify the factors associated with its use and understanding. The design to explore such an association, was based on the theoretical framework (TF) proposed by Grunert *et al.*<sup>15</sup> Such TF implies that "only labels to which consumers are exposed can be expected to have any effects". For this to happen, consumers go through an internal information processing which comprises search, exposure, perception, liking and "understanding" of the label information (LI). LI may alter the overall pattern of food purchases; so the expected effect in this context, is the use of LI in making food purchasing decisions.<sup>15</sup>

The evidence generated by this study represents the optimal understanding capacity for the information provided in the NIP, assuming that population with lower educational experience will have a similar or lower understanding capacity. This objective information will help decision makers and academics to design public

strategies to promote the use of NIP as an instrument for consumers to make informed food choices.

## Materials and methods

### Survey design

We selected six stores from the total list of one chain of supermarkets, using stratified convenience sampling to represent three regions of Mexico. The selected cities were Monterrey, Nuevo León and Cd. Obregón, Sonora (Northern region), Mexico City and San Luis Potosí, SLP (Central region), and Mérida, Yucatán and Tuxtla Gutiérrez, Chiapas (Southern region) from November-December 2008. This particular chain of stores was selected because it offered the opportunity to recruit a sample with better socioeconomic and educational status. Every 13<sup>th</sup> consumer entering the supermarket was invited to participate in the study. Selection criteria included to be male or female, 18-55 y old, living in the city for at least two years, and giving their consent to participate. Individual surveys were applied during two 7 h-shifts (morning and afternoon) for six consecutive days in each store. The total duration of the interview was 15 minutes.

### Sample size

We had a sample of 731 consumers, distributed in six cities, calculated with a confidence of 95% and  $\beta=0.8$ , considering an estimated design effect of 1.5, to estimate proportions with a maximum variance ( $p=0.5$ ) of consumers that report to use the NIP and estimated error maximum of 9%.

### Definition of variables

For the purpose of this study, "NIP" refers to the nutrition information panel on the back of the pack. "Any nutritional information" refers to nutritional claims, nutritional labeling or any nutritional information referring to the content of calories, fat, carbohydrates, minerals, or vitamins in the food packaging. "Subjective understanding" refers to self-reported understanding of NIP. "Objective understanding" refers to results of the minipractical test of NIP understanding (described below).

### Questionnaire to evaluate the use and understanding of NIP

A 50 items questionnaire including two sections was designed: Section 1) Sociodemographic characteristics,

health and nutrition interests, habitual routine when reading the NIP, and self-reported abilities to use and understand the NIP (closed questions); reasons for not understanding or using the NIP (open questions); and 2) A practical test for NIP understanding (closed questions), registering the answering time.

A pilot test was carried out with consumers from supermarkets not included in this sample, in order to

verify consumers' understanding of the items in the above mentioned questionnaire.

For the practical test of NIP understanding, the NIP of two products of different brands (Product A and B) were reproduced, separated from the original packages to avoid the influence of the type of food or commercial brand (figure 1). Both products differed in weight content, number of portions, and appearance. Product

Anverse

Product A



Product B

Información Nutricional	
Tamaño de la Porción: 25 g (2 galletas)	Cholesterol 2.3 mg
Porciones por Paquete: 2	Ácidos Grasos Trans 0 g
	Sodio 100 mg
	Carbohidratos Totales 18 g
<b>Cantidad por Porción:</b>	del cual:
<b>Contenido Energético 466 kJ (112 kcal)</b>	Fibra Dietética 1.5 g
<b>Grasas (lípidos) 3.5 g</b>	Fibra Soluble 0.7 g
del cual:	Fibra Insoluble 0.7 g
Grasa Saturada 1.4 g	Almidones 7.6 g
Grasa Monoinsaturada 1.2 g	Proteína 2 g
Grasa Poliinsaturada 0.6 g	

Reverse

Información nutricional

Tamaño de la porción:	2 piezas 21,25 g
Porciones por paquete:	9,6
<b>Cantidad por porción</b>	
<b>Contenido energético:</b>	<b>109 kcal (464 kj)</b>
<b>Grasas (Lípidos):</b>	<b>4,3 g</b>
del cual	
Grasa Saturada	2,9 g
Grasa Trans	0 g
Grasa Monoinsaturada	0,9 g
Grasa Poliinsaturada	0,2 g
Cholesterol	4,40 mg
Sodio	66,1 mg
Carbohidratos (hidratos de carbono)	15,9 g
Del cual:	
Fibra dietética	0,8 g
Proteína	1,8 g
	%IDR
Yodo	17%
Ácido Fólico (vitamina B9)	15%
Vitamina A	11%
Vitamina B6	11%
Vitamina B12	10%
Vitamina B2	8%
Vitamina B12	7%
Niacina (Vitamina B6)	7%
Zinc	7%
Hierro	8%

Información nutricional

Tamaño de la porción:	25 g (2 galletas)
Porciones por paquete:	2
<b>Cantidad por porción</b>	
<b>Contenido energético:</b>	<b>469 KJ (112 kcal)</b>
<b>Grasas (Lípidos):</b>	<b>3,5 g</b>
del cual	
Grasa Saturada	1,4 g
Grasa Monoinsaturada	1,2 g
Grasa Poliinsaturada	0,6 g
Cholesterol	2,3 mg
Ácidos grasos Trans	0 g
<b>Sodio</b>	<b>100 mg</b>
<b>Carbohidratos totales</b>	<b>18 g</b>
del cual:	
Fibra dietética	1,5 g
Fibra soluble	0,7 g
Fibra insoluble	0,7 g
Azúcares	7,6 g
<b>Proteína</b>	<b>2 g</b>

FIGURE 1. BACK OF PACK NUTRITION PANEL INFORMATION EXPOSED TO CONSUMERS IN SIX CITIES IN THE NORTHERN, CENTRAL AND SOUTHERN REGIONS OF MEXICO. ANVERSE: ORIGINAL STAMPS EXPOSED TO CONSUMERS. REVERSE: TRANSCRIBED VERSION OF THE NIP EXPOSED TO CONSUMERS IF THEY HAD VISUAL DIFFICULTIES BECAUSE OF THE FONT SIZE. SURVEY PERIOD: NOVEMBER-DECEMBER 2008

B had a lower content of saturated fat, cholesterol, and total fat, slightly more calories, sodium and fiber than Product A. If participants had visual difficulties because of the font size, they were presented with a transcribed version of the NIPs in Arial 12 pt. font.

After examining and reading the NIPs, participants were asked to answer the following questions: 1) total amount of carbohydrates contained in the product A, 2) Amount of saturated fat in one portion of product A, 3) total amount of calories in the product B, 4) How many portions are in product B, and 5) If you eat the whole content of product B, how many cookies will you be eating? Some of the questions required reading carefully the NIP and others performing simple arithmetic calculations.

### Ethical aspects

The research protocol was reviewed and approved by the Ethics, Biosecurity and Research Committees of the National Institute of Public Health, Cuernavaca, Mexico. Verbal consent was obtained after explaining the nature and objectives of the study to participants.

### Statistical analysis

Separate logit regression models were used to test the association between self-reported NIP reading, use, or understanding alternately, and sex, education, age, food expenditure, obesity, chronic diseases, and having children under 18 y of age. Obesity and chronic diseases were self-reported if the subject had a previously diagnosed by a physician. Marginal effects for each of the associations were estimated. A marginal effect is considered as the change in the probability resulting from a unit change of an independent variable.<sup>21,22</sup>

All analysis were adjusted for the grouping variable (geographic region) and performing bootstrap estimations based on empirical distribution. A code matrix was used to analyze open questions. The number of correct answers attained in the NIP practical test for NIP understanding and the time invested to response was modeled using a Poisson regression model adjusted by sex, education, age, food expenditure, obesity, chronic diseases, and having children under 18 y of age; model assumptions were verified. Data are shown as proportions, geometric means and 95% confidence intervals. Differences were considered significant if  $p < 0.05$ . Data were analyzed using STATA software, version 11.0 (Stata Corp, USA).

## Results

A total of 731 adult consumers, distributed proportionally into the three geographic regions, were surveyed. Most of the consumers were women (70%); 20% of the employed population ( $n=320$ ) had a health related profession; 70% of the sample had completed high-school education or a higher level (table I). Approximately 30% of invited consumers rejected participation; no information on these consumers was collected. This rejection rate is frequent in surveys carried-out in public places.

### Factors associated with purchasing decisions

The consumers declared taking their purchasing decisions mainly considering the product expiration date (57%), the trade mark (27%), and the price (23%). A 17% of consumers reported consulting the NIP and 16% basing their food choices on perceived product healthiness. Frequencies are not mutually exclusive (figure 2).

### NIP reading

About 79% of consumers reported reading the NIP; 50% of consumers out of those who declared to read NIP, did it rarely, 39% sometimes or frequently, 11% only the first time buying the product.

After adjusting for confounding variables, women were 6% more likely to read the NIP than men ( $p < 0.001$ ). Consumers with a higher level of education (12.4%,  $p = 0.022$ ) and those having children under 18 y old (6.4%,  $p = 0.001$ ) were also more likely to report reading the NIP than their respective counterparts. The association between consumers previously diagnosed with chronic diseases and NIP reading was marginally significant ( $p = 0.06$ ) (table II).

### Use of NIP and “Any Nutritional Information”

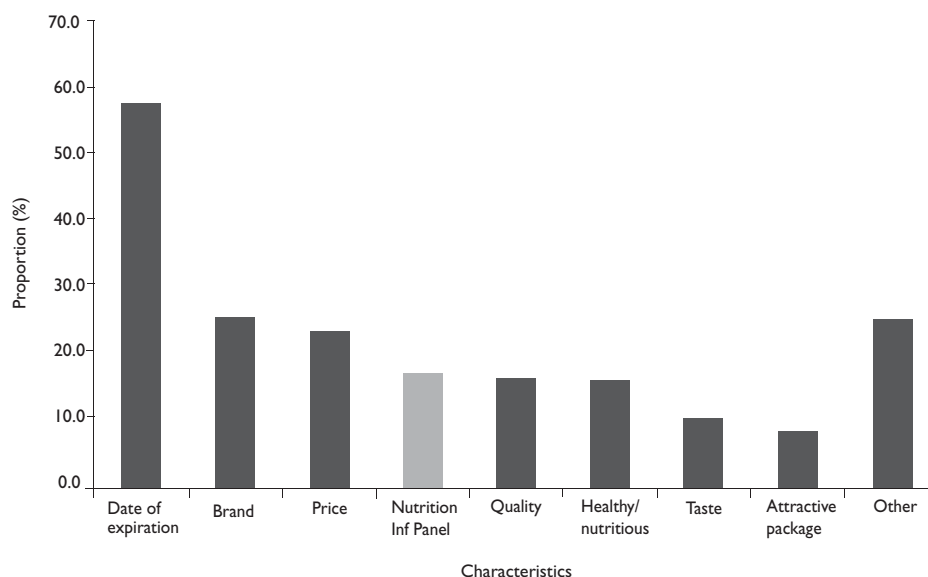
A total of 17% of consumers reported using the NIP as the main information at least for one food purchasing event. A total of 59% mentioned to use “any other nutritional information” to make food purchase decisions, in addition to other purchasing criteria. In both cases, 40% reported using this information rarely, 22.2% and 29.6% reported using it sometimes or very frequently, respectively and 8.1% reported using it the first time they bought a new product.

**Table I**  
**GENERAL CHARACTERISTICS IN THE SAMPLE OF CONSUMERS RECRUITED IN SUPERMARKETS IN SIX CITIES IN THE NORTHERN, CENTRAL AND SOUTHERN REGIONS OF MEXICO (N=731). SURVEY PERIOD: NOVEMBER-DECEMBER 2008**

	Mean $\pm$ SD [range]	
Age (years)	32.8 $\pm$ 9.7 [18-60]	
Gender (female)	Frequency (%) 71.50	CI 95% (68.26, 74.82)
Residence zone		
Southern	33.60	(30.22, 37.09)
Central	33.10	(29.69, 36.52)
Northern	33.20	(29.82, 36.67)
Education level		
No studies	0.14	
Elementary school	6.02	(4.29, 7.75)
Secondary school	16.69	(13.98, 19.40)
High school / Technician	33.11	(37.87, 45.03)
Graduate degree	31.87	(28.49, 35.26)
Postgraduate degree	3.83	(2.44, 5.22)
Marital status		
Single	38.85	(35.31, 42.40)
Married	52.67	(49.04, 56.30)
Divorced	2.46	(1.34, 3.59)
Widower	0.41	(-0.05, 0.87)
Civil marriage	4.79	(3.24, 6.40)
Separated	0.82	(0.17, 1.48)
Practicing a health related profession	20.8 (of n=320)	(16.35, 25.26)
Occupation		
Housewife	23.94	(20.84, 27.04)
Student	9.44	(7.31, 11.56)
Work and studying	2.87	(1.66, 4.09)
Employed	59.64	(56.08, 63.21)
Unemployed	2.74	(1.55, 03.92)
Retired	1.23	(0.43, 2.03)
Other	0.14	(-0.13, 0.41)
Have children younger than 18 years	53.49	(49.86, 57.11)
Estimated monthly food expenditure (Mexican pesos)		
< 1000	10.3	(8.06, 12.46)
1000 - 2500	45.4	(41.80, 49.04)
2500 - 5000	35.0	(31.55, 38.49)
> 5000	6.6	(4.77, 8.37)
Does not know	2.7	(1.55, 3.92)
Frequency of attendance to supermarket		
Twice or three times per week	25.3	(22.15, 28.47)
Once a week	34.5	(31.02, 37.93)
Every two weeks	32.6	(29.15, 35.96)
Once a month	7.7	(5.73, 9.59)
Health condition		
Previously diagnosed chronic disease*	12.9	(9.80, 14.55)
Obesity <sup>‡</sup>	12.2	(9.80, 14.55)
Other	10.8	(8.55, 13.06)

\* Chronic diseases previously diagnosed by a physician were: diabetes mellitus, dyslipidemia, and hypertension

‡ Previously diagnosed by a physician



**FIGURE 2. MAIN CAUSES FOR FOOD PURCHASING DECISIONS OF INDUSTRIALIZED FOODS SELECTED BY MEXICAN CONSUMERS IN SIX CITIES IN THE NORTHERN, CENTRAL AND SOUTHERN REGIONS OF MEXICO. DATA ARE NOT MUTUALLY EXCLUSIVE. SURVEY PERIOD: NOVEMBER –DECEMBER 2008. FREQUENCIES ARE ADJUSTED BY SEX, AGE, FOOD EXPENSES AND EDUCATION, CLUSTERED BY GEOGRAPHIC ZONE**

**Table II**

**LOGIT REGRESSION MODELS HAVING THE VARIABLES READING, USE AND UNDERSTANDING OF THE NUTRITION PANEL INFORMATION AS DEPENDENT VARIABLES IN CONSUMERS FROM SIX CITIES IN THE NORTHERN, CENTRAL AND SOUTHERN REGIONS OF MEXICO, AS DEPENDENT VARIABLES, ADJUSTED BY GEOGRAPHIC REGION. SURVEY PERIOD: NOVEMBER-DECEMBER 2008**

Covariates	Reading			Use			Understanding		
	Coefficient	P value	Marginal effect	Coefficient	P value	Marginal effect	Coefficient	P value	Marginal effect
Age (years)	-0.002	0.749	0.000	0.003	0.419	0.001	0.002	0.155	0.001
Sex (females)	0.225	0.001	0.064	0.058	0.726	0.014	0.087	<0.001	0.034
Education level*									
Secondary school	-0.387	0.001	-0.117	0.196	0.921	0.051	0.222	0.001	0.085
High school / Technician	-0.220	0.005	-0.061	0.488	0.808	0.124	0.185	0.388	0.072
Graduate degree	0.033	0.668	0.009	0.814	0.685	0.226	0.170	0.263	0.066
Postgraduate degree	0.593	0.022	0.124	0.972	0.606	0.326	0.636	0.192	0.223
Monthly home food expenses‡									
1000 - 2500	-0.040	0.843	-0.011	-0.183	0.438	-0.044	0.228	0.232	0.089
2500 - 5000	0.097	0.730	0.026	0.021	0.957	0.005	0.233	0.273	0.091
> 5000	0.387	0.164	0.091	0.073	0.821	0.018	0.644	0.001	0.227
Obesity§	0.179	0.135	0.046	0.179	0.432	0.047	-0.103	0.272	-0.041
Chronic disease§	0.177	0.065	0.046	0.004	0.966	0.001	0.232	<0.001	0.089
Have children younger than 18 years	0.222	0.001	0.061	0.001	0.987	0.000	-0.065	0.496	-0.026
Intercept	0.677	0.001		-1.612	0.464		-0.348	0.004	

\* Elementary school is the reference

‡ Less than 1000 Mexican pesos of monthly food expense is the reference

§ Health conditions previously diagnosed



**Table III**  
**POISSON REGRESSION MODEL TO EVALUATE THE NUMBER OF CORRECT ITEMS IN THE MINI-TEST FOR NIP OBJECTIVE UNDERSTANDING IN CONSUMERS FROM SIX CITIES IN THE NORTHERN, CENTRAL AND SOUTHERN REGIONS OF MEXICO; ADJUSTED BY GEOGRAPHIC REGION. SURVEY PERIOD: NOVEMBER-DECEMBER 2008**

Dependant variable: Number of correct items (0 to 5).  
*n*=705

Covariate	Coefficient	P value	Marginal effect	CI95%
Time (minutes)	0.039	<0.001	0.06	(0.03, 0.09)
Sex (female)	0.048	0.35	0.08	(-0.08, 0.23)
Age	-0.007	<0.001	-0.01	(-0.01, -0.008)
Education level (Reference category: elementary school)				
Secondary school	0.190	0.16	0.33	(-0.13, 0.79)
High school	0.388	<0.001	0.67	(0.47, 0.85)
Graduate degree	0.572	<0.001	1.06	(0.8, 1.32)
Postgraduate degree	0.728	<0.001	1.72	(0.81, 2.63)
Monthly home food expenses (Reference category: <1000 pesos)				
\$1 000 - \$2 500 pesos	0.015	0.76	0.02	(-0.13, 0.18)
\$2 500 - <\$5 000 pesos	0.102	<0.001	0.17	(0.09, 0.25)
> \$5 000 pesos	-0.062	0.00	0.39	(0.1, 0.68)
Obesity diagnosed	0.053	0.13	0.09	(-0.03, 0.21)
Chronic disease	-0.006	0.85	-0.01	(-0.11, 0.09)
Have children <18 yrs of age	0.939	<0.001	-0.10	(-0.14, -0.06)
Intercept	0.150	0.03		

The main barriers for consumers not using the NIP or any other nutritional information were: lack of interest, time constraints, and null understanding of nutritional information. No statistical associations were found between the use of NIP or any other nutritional information (data not shown) and sex, education level, SES, obesity or previously diagnosed chronic disease (table II).

### Subjective understanding of NIP

Fifty seven percent of consumers reported to understand the NIP. The reasons for not understanding the NIP (43%) were: not knowing the technical terms, confusion when interpreting the information and lack of trust on the truthfulness of the information.

Women were 3.5% more likely to report understanding NIP than men ( $p<0.001$ ). Consumers graduated from high-school ( $p=0.001$ ), spending more than \$5 000 pesos/month in food ( $p=0.001$ ), or previously diagnosed with chronic diseases ( $p<0.001$ ) were more likely to report understanding NIP than their counterparts (table II).

### Objective understanding of NIP

The font size of the NIP was too small to be read by 33.7% of consumers, thus, they were provided with a larger font size version. For this section 1.24, 4.5, 9.7, 42.3, 30.8 and 11.7% of consumers answered correctly 5, 4, 3, 2, 1 and 0 questions, respectively; no differences by sex were found. The median of time employed to answer this section was three minutes (range: 0.66, 14). In a Poisson regression model, the time spent was positively associated with answering correctly: for each additional minute, consumers had 6% more probabilities for a better score ( $p<0.001$ ); similarly, higher SES and education level had higher probabilities for a better score. Older consumers and consumers having children under 18 y old, had a lower probability for a better score ( $p<0.001$ ). No differences by sex or health status were found (table III).

### Choosing the “healthiest” product

A total of 44.9% consumers chose product A based on vitamin content (44.5%), colorful label format (15.9%),

calories (11.6%), or fat content (9.2%). The consumers choosing product B (49.5%) because of its lower fat content (36.6%), higher fiber content (19%), and the label format (13.1%). A total of 1.8% of consumers mentioned that both products were healthy, while 2.5% indicated that none of them was healthy.

## Discussion

### The use of NIP

Only a small proportion of the sample reported to use the NIP for purchasing decisions, contrasting with a high proportion of consumers using the NIP in New Zealand (66-87%)<sup>16</sup> and USA (80%).<sup>5</sup> A recent survey in USA, showed that 68% of Americans use the NIP, however taste was the main influence on purchasing decisions (86%), followed by price, healthfulness (58%), and convenience (56%).<sup>18</sup> The difference of our results with those reports may be explained by differences in culture and a higher level of consumers awareness in those countries.

On the contrary, two thirds of Mexican consumers mentioned to use "any nutritional information" as a secondary food purchasing criterion. This difference might be due to the influence of nutritional and health claims, included in the food package, known to influence purchasing decisions.<sup>23</sup> The reasons expressed by our consumers for not using the NIP were lack of time and/or interest and poor understanding of the nutritional information, also identified by others.<sup>15</sup> Purchasing decisions were led by brand name, freshness, and price in our sample.

We did not find differences by sex, age, education level, SES or health status in the use of the NIP found in previous reports from industrialized countries.<sup>7,9,10,15</sup> In an American study, obese consumers looked-out more frequently for information on calories and fat in the NIP than non-obese consumers. In our study, search for the NIP by consumers with a previously diagnosed with chronic diseases, which included obesity was marginally significant. This association might be underestimated since we did not include an objective measure of obesity. In general, this lack of association might be due to the homogeneity of our sample, characterized by a higher level of education and SES, compared with the Mexican population at large and their limited use of the NIP.

### Understanding of NIP

A large proportion of consumers declared to understand the NIP (subjective understanding), however only a very low proportion of consumers answered correctly

the practical test exploring the objective understanding of NIP. Such a difference may be due to the consumers believe that they are able to interpret the NIP, based on their basic understanding of a few nutritional terms,<sup>15</sup> since most of them had a high level of education (>12 completed school years). Studies in developed countries found that consumers are able to retrieve simple information and perform simple calculations and comparisons between products using numerical information, but their ability to interpret the nutrition label accurately reduces as the complexity of the task increases.<sup>10</sup>

The present sample had 4 years of education experience (12.5 y) more than the mean Mexican adults (8.7 completed years) in 2008.<sup>24</sup> In spite of this fact, only 1% of consumers were able extract and process numerical information to answer correctly the items in the NIP understanding practical test. The high proportion of incorrect answers might be due to unfamiliarity with the label format, or to a low exposure to the NIP. Other reasons might relate to nervousness generated by the test, time pressure; the mean time invested to solve the test (3 min) might not be enough for interpreting the NIP.

Our results contrast with those from New Zealand, where two thirds of consumers estimated correctly the amount of total fat per 100 g or sugar per serving.<sup>16</sup> Based on our results, probably less than 1% of Mexican consumers would be able to perform those calculations correctly. Perhaps, people with a lower level of education than our sample or with special dietary needs (e.g., pregnancy, breast feeding, and chronic diseases) would be more likely to have difficulties in understanding the NIP and use it correctly, as occurs in other countries.<sup>9</sup>

Consumers chose product B as healthier because its lower fat and higher fiber content. The majority of consumers chose product A as healthier because of its vitamin and mineral content and the label appearance, without considering the content of nutrients that might represent a risk for health.

Our results showed that the NIP appearance (colored format), the number of nutrients declared and the letter size used can confuse consumers when reviewing and comparing labels. Therefore, format improvements in the current nutrition labeling may help consumers to improve their understanding of the NIP.<sup>2</sup> A proportion of respondents able to understand the nutritional concepts in NIP may improve their abilities to extract information with a larger font size.

This is important considering that the food labeling Mexican regulation (NOM-051-2010) allows food industry to decide on the number of nutrients to declare and there in no specification for letter size or colors used.

The reasons found in this study for not using the NIP, i.e. not knowing the meaning of the technical terms,



lack of confidence in the truthfulness of the information are similar to those found in studies from other countries.<sup>9,15,19</sup>

We were not able to collect information of consumers who rejected to participate in the study and to assess whether our sample was biased. For the purpose of this study we selected a skewed sample of persons with higher SES and higher school experience. Based on the hypothesis that this sample will have the optimal capacity to interpret numerical data and, thus, to better process the information in the NIP. In consequence, the inferences from our result are applicable to such a layer of the population and are not representative the Mexican population at large. It can be assumed that population with lower educational experience will have a similar or lower understanding capacity.

One of the strengths of this study is providing some insights regarding the factors associated to reading, using and understanding the NIP in a sample of Mexican consumers.

In conclusion, the use and understanding of the NIP is low despite the high proportion of self-reported reading and understanding. The NIP does not seem to be an effective tool to communicate the nutritional information to consumers because requires previous understanding of the NIP technical terms, numerical abilities to interpret its information, and time to read it carefully during a purchasing event. In addition there is a lack of trust by the consumers in the truthfulness of the information. This results may help decision makers and academics to design public strategies to improve characteristics of the NIP as an instrument for consumers to make informed food choices.

### Acknowledgments

We thank the support provided by the Wal-Mart Foundation during the survey; the field personnel: Elena Carrillo-Cruz, Socorro Jaimes-Terán, Miguel Gaytan-Colin, Eréndira Marín-Mendoza, and Fabiola Pérez for their invaluable work.

*Declaration of conflict of interests:* The authors declare that they have no conflict of interests.

### References

1. Van den Wijngaart AW. Nutrition labelling: purpose, scientific issues and challenges. *Asia Pac J Clin Nutr* 2002; 11(2): S68-S71.
2. Cowburn G, Stockley L. A systematic review of the research on consumer understanding of nutrition labelling. Brussels: European Heart Network, 2003.

3. Satia JA, Galanko JA, Neuhauser ML. Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *J Am Diet Assoc* 2005; 105(3): 392-402.
4. Lin CT, Lee JY, Yen ST. Do dietary intakes affect search for nutrient information on food labels? *Soc Sci Med* 2004; 59(9): 1955-1967.
5. Neuhauser ML, Kristal AR, Patterson RE. Use of food nutrition labels is associated with lower fat intake. *J Am Diet Assoc* 1999; 99(1): 45-53.
6. Variyam JN. Do nutrition labels improve dietary outcomes? *Health Econ* 2008; 17(6): 695-708.
7. Guthrie J, Fox J, Cleveland L, Welsh S. Who uses nutrition labeling, and what effects does label use have on diet quality? *J Nutr Educ* 1995; 27 (4): 163-172.
8. Kreuter MW, Brennan LK, Scharff DP, Lukwago SN. Do nutrition label readers eat healthier diets? Behavioral correlates of adults' use of food labels. *Am J Prev Med* 1997; 13(4): 277-283.
9. Drichoutis AC, Panagiotis L, Rodolfo M, Nayga J. Consumers' Use of Nutritional Labels: A Review of Research Studies and Issues. *Academy of Marketing Science Review*, 2006. 9: p. [Accessed 2009 August] Available at: <http://www.amsreview.org/articles/drichoutis09-2006.pdf>
10. Cowburn G, Stockley L. Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutr* 2005; 8(1): 21-28.
11. Drichoutis AC, Lazaridis P, Nayga RM, Jr. An assessment of product class involvement in food purchasing behaviour. *Eur J Mark* 2007; 41:7/8: 888-914
12. Fitzgerald N, Damio G, Segura-Perez S, Perez-Escamilla R. Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *J Am Diet Assoc* 2008; 108(6): 960-967.
13. Boden M, Dadswell R, Hattersley S. Review of statutory and voluntary labelling of food allergens. *Proc Nutr Soc* 2005; 64(4): 475-480.
14. Hearty AP, McCarthy SN, Kearney JM, Gibney MJ. Relationship between attitudes towards healthy eating and dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. *Appetite* 2007; 48(1): 1-11.
15. Grunert K, Wills J. A review of European research on consumer response to nutrition information on food labels. *J Public Health* 2007; 15(5): 385-399.
16. Gorton D, Ni Mhurchu C, Chen MH, Dixon R. Nutrition labels: a survey of use, understanding and preferences among ethnically diverse shoppers in New Zealand. *Public Health Nutr* 2009; 12(9): 1359-1365.
17. Krukowski RA, Harvey-Berino J, Kolodinsky J, Narsana RT, Desisto TP. Consumers may not use or understand calorie labeling in restaurants. *J Am Diet Assoc* 2006; 106(6): 917-920.
18. International Food Information Council Foundation 2010 Food & Health Survey. Consumer Attitudes Toward Food Safety, Nutrition, & Health 2010. [Accessed March 3 2011]. Available at: <http://www.foodinsight.org/Content/3651/2010FinalFullReport.pdf>.
19. Mannell A, Brevard P, Nayga P, Combris P, Lee R, Gloeckner J. French consumers' use of nutrition labels. *Nutrition & Food Science* 2006; 36: 159-168.
20. Byrd-Bredbenner C, Alfieri L, Kiefer L. The nutrition label knowledge and usage behaviours of women in the US. *Nutr Bull* 2000; 25: 315-322.
21. Petersen T. A Comment on Presenting Results from Logit and Probit Models. *American Sociological Review* 1985(1): 130-131.
22. Zelter BA. Using simulation to interpret results from logit, probit, and other nonlinear models. *Strategic Management Journal* 2009; 30: 1335-1348.
23. Williams P. Consumer understanding and use of health claims for foods. *Nutr Rev* 2005; 63(7): 256-264.
24. Instituto Nacional de Estadística y Geografía (México). México de un vistazo 2009/Instituto Nacional de Estadística y Geografía.-México: INEGI 2009. [Accessed January 20 2010]. Available at: [http://www.inegi.gob.mx/prod\\_serv/contenidos/espanol/bvinegi/productos/integracion/pais/mexvista/2009/mexvis2009.pdf](http://www.inegi.gob.mx/prod_serv/contenidos/espanol/bvinegi/productos/integracion/pais/mexvista/2009/mexvis2009.pdf).