

## ARTÍCULOS ORIGINALES

### Efecto del etiquetado calórico sobre la elección de un menú: estudio preliminar en Santiago de Chile

### Effect of calorie labeling on menu selection: a preliminary study in Santiago, Chile

#### ABSTRACT

Folate is an essential nutrient because mammals lack biological activity to synthesize. It different factors generate folate deficiency. Recent studies have identified that the C677T variant of the enzyme methylene tetrahydrofolate reductase (MTHFR), can play a role in serum folate concentrations (SFC) and red cell folate (RCF). The aim of this review was to actualice some generalities of folate metabolism, factors related to its deficiency, biochemical indicators used to assess the nutritional status of folate and role of the C677T polymorphism of the MTHFR enzyme on the cycle of folate and methionine. It is necessary to design studies with representative samples corroborating the effect of polymorphisms on biochemical indicators of nutritional status of folate and determine the dose-response effect and contribute to modify the nutritional recommendations with the necessary scientific evidence.

**Keywords:** Methylene tetrahydrofolate reductase, serum folate, red cell folate, folate blood.

Claudia Pérez (1)  
Javier Enrione (1,2)  
Paulo Díaz-Calderón (2)  
Isidora Vicente (1)  
María C. Rossi (1)

(1) Escuela de Administración de Servicios.  
Universidad de los Andes.  
(2) Biopolymer Research and Engineering Lab (BiopREL),  
Escuela de Nutrición y Dietética, Facultad de Medicina.  
Universidad de los Andes.

Dirigir la correspondencia a:  
María Cecilia Rossi Monseñor  
Escuela de Administración de Servicios.  
Universidad de los Andes,  
Alvaro del Portillo 12.455,  
Las Condes, Santiago,  
Chile  
Email: mrossi@uandes.cl

Este trabajo fue recibido el 18 de Enero de 2016  
y aceptado para ser publicado el 30 de Noviembre de 2016.

#### INTRODUCTION

The increase in diseases related to obesity such as diabetes mellitus and arterial hypertension, due to changes in consumer habits and modern lifestyle, are currently an important public health issue in developed countries and emerging economies. One key aspect related to changes in lifestyle, is the increase in demand for eating away from home in food premises (e.g. a la carte restaurants, fast food restaurants, etc.). The latter has led to a significant growth in restaurant offering during the last decade (1). For example in the United States, the eating away from home item has significantly increased in importance in the adult market segment and nowadays it corresponds to about 50% of total food expenditures (2-4). As expected, this behavior has been associated to an increase in intake of high calorie foods, fats and sugar content (5).

Recent literature indicates that consumers' menu selection may be modified if nutrition facts or caloric information are disclosed (6,7). Tandon et al (8) studied the effect of caloric information disclosure in menus offered by McDonalds at a primary care pediatric clinic in Seattle (USA). This study reported that parental choice (99 persons) was significantly influenced by this information, reducing the children's menu calorie intake by 109 kcal. Dumanovsky et al (9) in an extensive research aimed to study the effect of adding the caloric labeling to menus on individual purchases in fast food restaurant chains, observed that 15% of costumers considered the use of caloric information in their purchase decision, which produced a decrease in the calorie intake of 105 kcal in comparison with those customers who did not use the caloric information. A more recent study carried out by Morley et al (10) reported

a significant decrease in mean calorie intake of 120 kcal after the caloric information was disclosed in fast foods restaurants in Victoria (Australia).

Interestingly this behavior was observed regardless of the economic and demographic group tested. Similar behavior was previously observed by Bassett et al (11) who found a difference of 52 calories between customers who saw caloric information with respect to those who did not see the information. In the same line, Harnack et al (12) studied the effect of nutritional facts on menus including caloric load with fat/saturated fats and sodium levels in various restaurants. The results showed that purchase intention for a hamburger decreased when calorie and nutrients information was available. Interestingly, a significant reduction was also observed for salad offerings when the calorie and nutrition information was disclosed, indicating that although the calorie intake seemed appropriate, the excess in fat and saturated fats content informed could modify customer's choice.

Despite that several studies have showed that population segments are interested in menu labeling and its effect on purchase decision (11), only few of them have focused on the complexity and factors that could influence food preference. Shindler et al (13) identified factors at individual and environmental levels. Regarding to individual factors these researchers mentioned personal preferences for specific items in menus, hunger level and misunderstanding related to meaning of the concept of calorie. Environmental factors include the higher cost of healthier foods and wellness perception of the restaurants among others. Droms (14) and Moorman (15) mentioned factors like individual food preferences and customer's individual characteristics such as motivation for a healthy diet, health awareness, nutritional knowledge and health status. These findings highlight the complex nature of the decision process associated to food purchase, which help to explain some conflicting information observed in the literature questioning the importance of calorie and nutritional information disclosure. Indeed Harnack & French (3) reported

that the effect of calorie labeling would be limited due to the lack of importance that many consumers give to nutrition when eating out. Tandon et al (16) showed that menu labeling increased nutrition awareness of parents but did not decrease the calorie load purchased for either children or the parents. Moreover ongoing research has highlighted the relevance of determining whether calorie labeling has a meaningful and beneficial impact on consumers purchasing decisions (1, 17).

The aim of this work was to evaluate the potential usefulness of menu labeling (caloric information) on food selection by customers. The surveyed people were selected from intermediate income employees from different organizations in Santiago, Chile. This preliminary study is the first attempt in this country in order to systematically assess the effect of caloric information on menu selection.

#### MATERIAL AND METHODS

A quantitative approach was used following a cross-sectional survey design. Data was collected online by a structured survey with closed and open-ended questions using a Likert-type scale (18, 19). The survey was sent online using a web survey hosting service to 1000 employed people with different positions, from managers to administrative workers at each organization. It is important to indicate that this group in general corresponds to people with tertiary education. 444 replied (44% of surveys sent). 227 surveys (51% of surveys replied) were selected (based on the frequency of eating out lunch at non-a-la-carte restaurants (at least once per week) during working days. Also people eating food brought from home were also excluded in the study. The people were contacted by email addresses obtained from a database provided by the School of Service Management at Universidad de los Andes.

Hence only this subgroup was considered for further analysis. It is important to remark that the targeted group at which the survey was aimed was not statistically sampled from the general population. The scope of this work was to preliminarily evaluate the potential of menu labeling (caloric

TABLE 1

Calorie count of menu alternatives considered in this study.

	Item	Calorie count (kcal/portion)
Drinks	Mineral water	0
	Light soft drink	5
	Soft drink	67
	Fruit juice	72
Main course	Cesar salad	231
	Roasted chicken and salad	352
	Mashed corn pie	490
	Tomato-avocado hamburger	591
	Fried fish and mashed potatoes	629
	Beef and french fries	724
Desserts	Canned peaches	89
	Fruit salad	93
	Caramel pudding	160
	Ice cream	196
	Milk caramel cake	395
	Suspiro limeño	670

information) on food selection by customers, who could be described as intermediate income employees from different organizations in Chile. The questionnaire was designed by the research team and validated by a group of academic peers (20).

The survey included three sections. The first section was used to filter the respondents as employees who had lunch at least once a week in restaurant offering predefined menus. The second section of survey was designed to determine whether the caloric information in menus could have a significant effect on customer choice for drinks, main courses and desserts. This section included different menu options normally available at different restaurants in Santiago. The calorie count varied from 0 to 72 kcal in the case of drinks, 231 to 724 kcal for main courses and 89 to 670 kcal for desserts (table 1). The surveyed participants had the option to select a three-course menu as normally presented on standard boards, and later with the calorie count information disclosed on the same board.

Finally, the third section of the questionnaire collected demographic data of each person surveyed. The reported height and weight values, allowed the calculation of the Body mass index (BMI) classifying the 227 people as "underweight" (BMI<18), "normal" (18<BMI<25), or "overweight" (BMI>25). Despite the limitations of BMI values as an objective indicator for obesity, it is still used as an important tool in health policy planning (21, 22). In this work, BMI values were used as possible factor that could influence the menu selection with the calorie count information.

Additional questions related to metabolic diseases and current job description was also recorded together with people's awareness of nutritional facts (e.g. caloric count and salt content).

The overall menu calorie count that was observed after the calorie information was disclosed, were grouped in terms of the number of people that reduced the calorie count, a group that maintained it and those who reduced it. Further analysis on the change of calorie count by gender was also evaluated.

The accuracy and statistical significance of the study were tested by Analysis of Variance (ANOVA) using the software SPSS (version 20, IBM, USA).

As the analysis done in this work was based only in customer preferences information collected through an online survey, an Institutional Review Board (IRB) approval was not required.

## RESULTS AND DISCUSSION

The number of valid responses was ~51% (227 out of 444). In terms of gender, 94 were men (41%) and 133 were women (59%) (table 2). The average age for each group was 44.6 years old for men and 40.3 years old for women. BMI va-

lues for each gender were in average 26.6 kg/m<sup>2</sup> and 23.3 kg/m<sup>2</sup> for men and women respectively. These results indicated values in the overweight range but near the normal limit (BMI > 25 kg/m<sup>2</sup>) in case of the men. In the case of the women, the BMI values were in the normal range (BMI 18.5-24.9 kg/m<sup>2</sup>). In addition to this information, ~20% of the surveyed informed to have a diagnosed metabolic disease (table 2). The resulting BMI values and reported percentage of people who informed a metabolic disease, could be explained by the age group of the participants and their educational level.

The global analysis of the 227 valid responses showed three subgroups observed when the caloric information was disclosed: i) 112 people (~49%, group A) who decided to reduce the overall calories of the menu, ii) 108 people (~47%, group B) maintained the calorie load and iii) 9 people (~4%, group C) increased their calorie intake. The latter was considered in the discussion.

Group A initially chose a menu calorie load of 744 kcal changing to 452 kcal in average ( $p<0.05$ ), accounting a difference in 292 kcal (~39.2%). Similar behavior has been observed in Netherlands, where a comparable study showed that 54% of customers chose a healthier menu option when nutrition labeling was included in a la carte restaurant (23, 24). Figure 1 shows the distribution of the overall calorie load reduction when caloric information was available to the surveyed. It is clear that the calorie load shifted towards a lower range.

Our study showed that group A was formed by 70% of women (table 3), with an age of ~38 years old and a BMI of 23.6 kg/m<sup>2</sup>, both in average. As expected, the greater proportion of women in this group reflects a higher interest in healthier diet, which has been reported in similar studies (25, 26). Additionally, 21.4% of women informed a diagnosed metabolic disease. In the case of men (30% of this group), they were ~41 years old in average, with a reported BMI of 26.9 kg/m<sup>2</sup>. In the case of this group, 24.3% reported to have a diagnosed metabolic disease. It is important to outline that BMI values observed for men were in the "overweight" range but near the normal values, whereas in the case of the women, the average BMI was in the "normal" range (table 3). Further analysis on the decrease of calorie count by gender indicated a significant reduction of 315 kcal ( $p<0.05$ ) in the case of men and 278 kcal ( $p<0.05$ ) in the case of women, supporting previous findings that report greater preference for low calorie foods when calorie information was available (25-28). Indeed Pulos and Leng (27) observed in a pilot research project in Washington (USA), a reduction of about 75 calories after the calorie information was disclosed. Moreover, Hwang and Lorenzen (28) demonstrated that customers were willing to pay a higher price for those foods courses that included

TABLE 2

Subset of people selected to this study.

	Men	Women
Number of people (n)	94	133
Age	44.6 (12.0)	40.3 (10.6)
BMI	26.6 (3.5)	23.3 (4.5)
Diagnosed metabolic disease (%)	20	21

Values in brackets correspond to standard deviation

BMI: Body Mass Index measured as the ratio between body mass and the square of height.

nutritional information.

Regarding the group of 108 people who did not modify the calorie intake (group B), it was formed by 52% of men and 48% of women with an average age of 41 and 39 years old respectively. As observed previously, the values of BMI were higher in men (table 3). In terms of metabolic disease informed, 21.1% of women and 17.8% of men reported this condition. It is interesting to highlight that 47% of people belonging to this group chose a hypocaloric menu ( $\leq 450$  kcal)

prior the calorie information was disclosed. As expected, this group did not further reduce the total calorie count as it did the remaining fraction of this group (53%), who selected menus with high calorie load (774 kcal in average) prior caloric information disclosure.

In an attempt to correlate BMI values with overall calorie count of the menus selected, 70% of women with a BMI value of  $23.6 \pm 6.6$  kg/m<sup>2</sup> reduced the calorie load. In the case of the women that maintained the calorie count, 48% reported

FIGURE 1

Variation of calorie intake when caloric information is available to consumers.

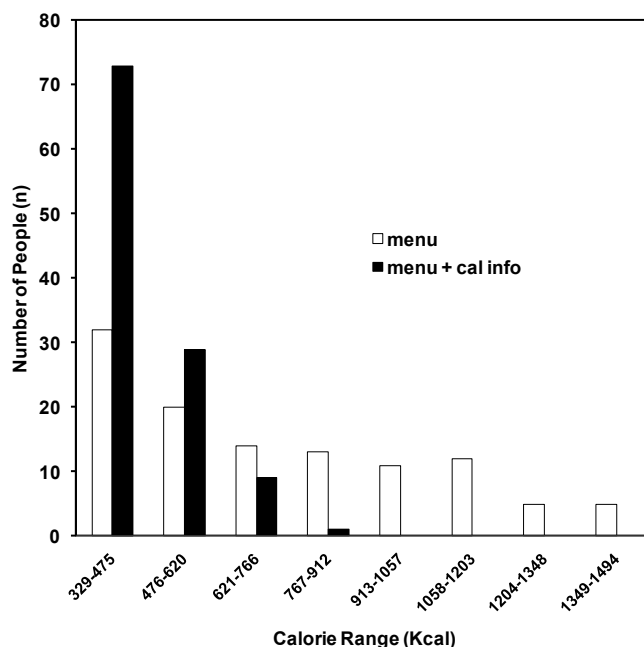


TABLE 3

Statistics data related with the two main populations observed in this study.

		Men	Women
People that reduced caloric load in menu (112 people)	Gender (%)	30	70
	Age (years, average)	40.5 (9.8)	37.3 (10.7)
	BMI	26.9 (3.3)*	23.6 (6.6)*
	Diagnosed metabolic disease (%)	24.3	21.4
People that maintained caloric load in menu (108 people)	Gender (%)	52	48
	Age (years)	41.0 (10.3)	39.3 (10.4)
	BMI	26.4 (3.7)*	22.2 (2.5)*
	Diagnosed metabolic disease (%)	17.8	21.1

Values in brackets correspond to standard deviation

\*Significant differences between genders:  $p < 0.05$

BMI: Body Mass Index measured as the ratio between body mass and the square of height.

a BMI of  $22.2 \pm 2.5 \text{ kg/m}^2$ . The higher amount of women who reduced the calorie intake (70%) may be explained because that women group shows BMI values highly disperse (with high standard deviation). This fact could imply that a fraction of women belonging to this group was in the "overweight" range and for that the decision to reduce the calorie intake was taken. Whereas in the female group that maintained the calorie load, the dispersion observed in BMI values was lower. Thus, as a high proportion of women belonging to this group should be in the "normal" range, the caloric information is not an incentive for reducing the calorie intake (table 3).

In the case of the male group, no correlation was observed between BMI values and calorie count. Indeed our results suggest that this group was less interested in the concept of calorie labelling, accounting 30% of the surveyed (table 3). The behavior of this group was observed with a BMI described as "overweight". Unlike the group of women, a correlation between the reduction in calorie count and reported metabolic diseases was not observed.

Another group analyzed in this study corresponded to the 89 persons who initially chose a hypocaloric menu ( $\leq 450$  kcal). This group was formed mainly by women (67%), out of which 36% (32 people) further reduced their calorie intake after the caloric information was disclosed. From this group (32 people), 84% (27 people) were women, which confirms women's interest in healthy lifestyle as observed in the literature (25, 26). The overall reduction in calorie load for each gender in this group was in average  $\sim 16\%$  (72 kcal) in men and  $\sim 19\%$  (87 kcal) in women.

In terms of how helpful the surveyed customers considered the nutritional information in menus, 82.5% indicated to appreciate this information, but only 54.5% were willing to change their menu preference for a lower calorie option. This value is similar to the percentage of people who actually did prefer a lower calorie menu (49%) as discussed before.

This study offers indicative data related to the effect of disclosing nutritional information to a well-educated segment of customers accustomed for predefined menus in restaurants on daily basis service. Indeed is important to stress the fact that the target group surveyed belongs to an educated population segment, which is usually highly aware of healthy eating and its effect on overall wellness. Also it is important to note that weight control following a reduction in daily calorie intake can reduce significantly the body weight (29). This suggests that a systematic approach towards nutritional information provision to consumers can potentially have a significant effect on overweight and obese conditions. However, it is necessary to consider that this approach needs to be complemented by other strategies such as increase in nutrition awareness at community level, adequate pricing and control of fast food advertising to children (30). Since the multifactorial nature of the decision making process during food purchase, further research is necessary towards the understanding of the effect of environment conditions and the context at the moment of food buy and consumption. Indeed some findings reported in the literature indicate that the inherent complexity and influence of several external and potentially modifiable factors may act as deterrents to the regular use of menu labels (13). Additionally, studies have shown that the nutritional information display layout can play an important role in whether the information is noticed, understood and used (31, 27).

Finally, future work will be focused on the perspective of restaurants' managers regarding the possible operational barriers and potential benefits of including caloric information in menus.

## CONCLUSIONS

There are worrying indicators of overweight in the population of emerging economies such as in Chile. Moreover this has been quantified in a significant proportion of young children, implying the occurrence of potential costly metabolic conditions such as diabetes and hypertension. In addition to this situation, is the increasing food consumption away from home? Therefore, it would be important to inform customers about the caloric content of foods offered by restaurants. Despite limitations of this study in terms of the survey methodology described previously in the text, the present study demonstrated that caloric information in menus markedly reduced the overall caloric intake in meals, despite the fact that some customers had initially selected low caloric menus. This information could also help health professionals to promote caloric intake awareness, facilitating customers in making healthier choices when eating out.

Food caloric information, as indicated in this study, could help restaurant administrators to offer new food options towards healthier alternatives. Finally, this work and further research in this topic can contribute to public awareness that could provide guidelines for menu labeling in restaurants (chains) in similarly fashion as cities in the United States.

These findings will be complemented in the future by experimental work in other geographical areas of Santiago and various cities in Chile, in order to compare important factors such as customer age, education background and income. Moreover, a study towards the willingness of restaurant administrators towards the implementation of menu labeling is envisaged.

## RESUMEN

El 62% de la población chilena presenta sobrepeso (dato OMS). Publicar calorías en menús de restaurantes podría ayudar a controlar este problema. El objetivo fue estudiar el efecto de la entrega de información calórica en la elección de almuerzos típicos. La metodología tuvo un enfoque cuantitativo, con encuesta on line de diseño transversal, estructurada, con preguntas abiertas y cerradas, y con escala tipo Lykert. Se obtuvo 227 respuestas válidas. Los encuestados seleccionaron un almuerzo de 3 elementos, antes y después de exponer información calórica. Los resultados mostraron que el 49% de los encuestados reduce en promedio 292 kcal, (39,2% del total de calorías en menú) al considerar la información calórica. Nuestros resultados sugieren que aproximadamente para la mitad de los encuestados, la información fue útil en la selección de menú. Esta información podría ayudar a profesionales de la Salud a crear conciencia, facilitando a los consumidores elecciones más saludables.

Palabras clave: Servicio alimenticio; Etiquetado de menú; Divulgación de información sobre calorías; Elección de alimentos para el consumidor.

Acknowledgements: Financial support given by PAI Grant N° 79130039 from CONICYT-Chile is gratefully acknowledged.

## REFERENCES

1. Larson N, Story M. Menu labeling: does providing nutrition information at the point of purchase affect consumer behavior. *Healthy Eating Research - A National Program of the Robert Wood Johnson Foundation*; p 1-10, 2009.
2. Variyam JN. Nutrition labeling in the food-away-from-home sector. *Economic Research Service/USDA; Report N°4: 1-18; 2005.*

3. Harnack LJ, French SA. Effect of point-of-purchase calorie labeling on restaurant and cafeteria food choices: A review of the literature. *Int J Behav Nutr Phys.* 2008; 5:51-57.
4. Smith TA, Lin BH, Lee JY. Taxing caloric sweetened beverages: potential effects on beverage consumption, calorie intake and obesity. *Economic Research Service/ USDA; Report N°100: 1-23; 2010.*
5. Yoon HJ, George T. Nutritional information disclosure on the menu: focusing on the roles of menu context, nutritional knowledge and motivation. *Int J Hosp Manag* 2012; 31:1187-94.
6. Lowe DM. The effect of menu nutrition labels on consumers' dietary decision making. *Master of Science Thesis. Hospitality & Tourism Management, University of Massachusetts Amherst.* 2012.
7. Wei W, Miao L. Effects of calorie information disclosure on consumers' food choices at restaurants. *Int J Hosp Manag.* 2013; 33:106-17.
8. Tandon PS, Wright J, Zhou C, Rogers CB, Christakis DA. Nutrition menu labeling may lead to lower-calorie restaurant meal choices for children. *Pediatrics.* 2010; 125:244-8.
9. Dumanovsky T, Huang CY, Nonas CA, Matte TD, Bassett MT, Silver LD. Changes in energy content of lunchtime purchases from fast food restaurants after introduction of calorie labelling: cross sectional customer surveys. *BMJ.* 2011; 343:d4464.
10. Morley B, Scully M, Martin J, Niven P, Dixon H, Wakefield M. What type of nutrition menu labeling lead consumer to select less energy-dense fast food? An experimental study. *Appetite.* 2013; 67:8-15
11. Bassett MT, Dumanovsky T, Huang C, Silver L, Young C, Nonas C, Matte TD, Chideya S, Frieden TR. Purchasing behavior and calorie information at fast-food chains in New York City. *Am J Public Health.* 2007; 98:1457-9.
12. Harnack LJ, French SA, Oakes JM, Story MT, Jeffery R, Rydell SA. Effect of calorie labeling and value size pricing on fast food meal choices: results from an experimental trial. *Int J Behav Nutr Phys.* 2008; 5:63-76.
13. Jennifer Shindler, Kamila Kiszko, Courtney Abrams, Nadia Islam, Brian Elbel. Environmental and individual factors affecting menu labeling utilization: a qualitative research study. *J Acad Nutr Dietetics.* 2013; 113:667-72.
14. Droms C. When I go out to eat I want to enjoy myself: an investigation into consumers' use of nutrition information. *Adv Consum Res.* 2006; 33:282-3.
15. Moorman C. The effects of stimulus and consumer characteristics on the utilization of nutrition information. *J Consum Res.* 1990; 17:362-74.
16. Tandon PS, Zhou C, Chan N, Lozano P, Couch S, Glanz K, Krieger J, Saelens B. The impact of menu labeling on fast-food purchases for children and parents. *Am J Prev Med.* 2011; 41:434-8.
17. Swartz J, Braxton D, Viera AJ. Calorie menu labeling on quick-service restaurant menus: an updated systematic review of the literature. *Int J Behav Nutr Phys.* 2011; 8:135-43.
18. Maurer T, Pierce H. A comparison of Likert scale and traditional measures of self-efficacy. *J Appl Phys.* 1998; 83:324-9.
19. Blanco N, Alvarado ME. An attitudinal scale in relation to the scientific-social research process. *Rev Cs Sociales. (RCS)* 2005; 11:537-44.
20. Evergreen S, Gullickson A, Mann C, Weich W. Developing & Validating Survey Instruments. *Web seminar Evaluate. www.evaluate.org.* 269/387.5895. *Western Michigan University.* 2011.
21. Muralidhara DV. Body mass index and its adequacy in capturing body fat. *J Physiol Biomed Sci.* 2007; 20:97-100.
22. Daniels SR. The use of BMI in the clinical setting. *Pediatrics.* 2009;124:S35-S41.
23. Gallicano R, Reede AV. Consumer response to Healthy Choice® nutrition labelling in an a la carte restaurant setting: A matter of willpower or being empowered. *EuroCHRIE Conference, Amsterdam, Netherlands.* 2010.
24. Gallicano R, Rheede AV, Blomme RJ. Consumer response to Healthy Choice® nutrition labeling in a la carte restaurant setting: a matter of willpower or being empowered. *Adv Hospitality Leisure.* 2012; 8:109-27.
25. Albright C, Flora J, Fortmann S. Restaurant menu labeling: impact of nutrition information on entrée sales and patron attitudes. *Health Educ Quart.* 1990; 17:157-66.
26. Din N, Salehuddin M, Zahari M, Othman CN, Abas R. Restaurant operator's receptiveness towards providing nutritional information on menu. *Procedia Soc Behav Sci.* 2012; 50:699-709.
27. Pulos E, Leng K. Evaluation of a voluntary menu-labeling program in full-service restaurants. *Am J Public Health.* 2010; 100:1035-39.
28. Hwang J, Lorenzen C. Effective nutrition labeling of restaurant menu and pricing of healthy menu. *J Food Service.* 2008; 19:270-6.
29. Laska MN, Pelletier JE, Larson NI, Story M. Interventions for weight gain prevention during the transition to young adulthood: a review of the literature. *J Adolescent Health.* 2012; 50:324-33.
30. Kuo T, Jarosz CJ, Simon P, Fielding JE. Menu labeling as a potential strategy for combating the obesity epidemic: a health impact assessment. *Am J Public Health.* 2009; 99:1680-6.
31. Alexander M, O'Gorman KD, Woods K. Nutritional labeling in restaurants: whose responsibility is it anyway?. *Int J Contemp Hospitality Manag.* 2010; 22:572-9.