



# MUSHROOM PRICES AND THEIR EFFECT ON CONSUMPTION: THE CASE OF MEXICO

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## ABSTRACT

Edible mushrooms show increasing importance as a food in many regions worldwide. However, their accessibility to different social levels is a matter of major consideration, and mushroom prices are a critical factor. In this study, primary and secondary data on mushroom species, mushroom products, current and inflation-free prices, trade marks, and incomes were analyzed during 2002-2011 in Mexico, particularly in the central region. Interview and observation protocols, as well as national and international databases, were used to record data at diverse points of sale. The Mexican mushroom market expanded recently in terms of species cultivated, as well as the variety of products and presentations available at the point of sale. There were eight mushroom species in the commercial market, including 16 different presentations and 20 trade marks available to the consumer. Inflation-free consumer prices of most mushrooms and presentations in the period 2010-2011 were more expensive than those of the period 2008-2009, ranging from 6.3-114.4%. Current consumer price of edible mushrooms varied from USD \$ 4.00/kg to \$ 59.32/kg. Mushroom prices were more expensive than other foods widely consumed, and were also highly variable between regions. Maximum and minimum mushroom prices showed wider ranges than those from mature markets. The prices of most fresh mushrooms were cheaper in Mexico than in other countries, indicating that production costs and the general purchasing power of Mexican consumers are lesser. Mushroom products require specific regulations to attain

**high quality standards. All these circumstances drastically affect the access to mushrooms as a food by different social levels. They are also limiting factors for increasing mushroom consumption, and for further development of this emergent agri-food chain.**

**Key words: Consumer mushroom prices, developing countries, edible mushrooms, Mexico, mushroom products, wholesale mushroom prices.**

## INTRODUCTION

The utilization, availability, stability, and accessibility of foods are fundamental to understand their social and economic importance. Edible mushrooms show increasing significance as a food in many regions worldwide. The controlled production of several species strengthens their availability and utilization throughout the year. A stable supply of mushrooms in the market is associated to high levels of local production and/or imports. The balance between supply and demand, as well as some other factors, determine the price of mushrooms and thus their accessibility to different social levels.

In Mexico, mushroom cultivation was introduced in 1933 and now it has developed into an emergent agri-food chain<sup>3</sup>. This chain has expanded rapidly during the last decade. The characterization of such expansion is relevant for further organization, development, and competitiveness of the agri-food chain. The marketing channels, structure of the emergent agri-food chain, and consumption trends of edible mushrooms in Mexico have already been described by the authors<sup>2,3,4</sup>. In this study, we analyzed main trends of wholesale and consumer prices of edible mushrooms and mushroom products available in the Mexican market, during 2002-2011. Mushroom prices were also compared with those from other countries and the

impact of this factor on the social access to mushrooms, particularly in developing countries, is discussed.

## MATERIALS AND METHODS

*Region of study.* The central region of Mexico shows the highest level of consumption of edible mushrooms and mushroom products<sup>4</sup>. The States of Mexico, Michoacan, Puebla, Tlaxcala, and Veracruz, located in this region, were selected for this study during 2002-2011. Studies included large, medium and small cities, namely (million people): Mexico, D.F. (8.8), Morelia (0.729), Puebla (1.5), Senguio (0.018), Tecamalucan (*ca.* 0.010), Tlaxcala (0.089), and Toluca (0.819) [www.inegi.org.mx].

*General methodology.* Main variables were mushroom species, mushroom products, prices, trade marks, and incomes. Primary and secondary data were analysed in this research. Interview and observation protocols, as well as national and international databases, were used to record all data. The points of sale in cities studied were selected considering a sample size determined by the following formula:  $n = \sigma^2 pq / e^2$  [ $\sigma^2 = 1.962$ ;  $p =$  probability that the event occurs (0.50);  $q =$  probability that the event does not occur (0.50);  $e =$  maximum acceptability of error (0.05)]<sup>7</sup>. As mushrooms and their products are not homogeneously available to the consumer, we selected representative public markets,

“tianguis” (popular market days), and supermarkets, where they are sold within the cities studied, as a sampling frame. We used the systematic sampling technique selecting differing days of the week and schedules as starting points, as well as a sample interval of about 30 min between interviews during 4 h in a day. Data were checked, edited, and processed using cross-tabulations.

*Consumer prices in Mexico.* Current prices (USD/kg) to the consumer of fresh, dried, and canned edible mushrooms available at the point of sale (2 “tianguis”, 8 public markets, 8 supermarkets) were recorded in the cities of Mexico, Puebla, Tlaxcala, and Toluca during the period 2002-2011. A structured observation protocol was used to record prices. At least three records per product in 18 points of sale selected randomly were taken in different months of the year.

*Consumer prices in other countries.* Several countries were selected for comparison, including Australia, France, Great Britain, and U.S.A. Data were recorded directly at supermarkets randomly selected or at the supermarket website: Group Carrefour (France, [www.ooshop.com](http://www.ooshop.com)); Group Géant Casino (France, [www.mescoursescasino.fr](http://www.mescoursescasino.fr); <http://courses.monoprix.fr/magasin-en-ligne>); Aldi Supermercados (Great Britain; <http://aldi.com>); J. Sainsbury Corporate (Great Britain; [www.sainsburys.co.uk/groceries](http://www.sainsburys.co.uk/groceries)); Coles Store (Australia; [www.coles.com.au](http://www.coles.com.au)); Drake Supermarkets (Australia; [www.drakes.com.au/home](http://www.drakes.com.au/home)). All data were converted to USD/kg, classified by species and presentation.

*Average prices.* The average price from other foods widely consumed (per kg, per liter, per box) were based on official governmental databases. Monthly prices for every product were taken from PROFECO-

Mexico ([www.profeco.gob.mx](http://www.profeco.gob.mx); from May to June), which keeps track of the retail price index (monthly) for basic products. We included *Agaricus* mushrooms and diverse foods, such as meat (popular or milled beef), chicken (thighs), egg (12 per box), milk (whole, liter), avocado (medium piece= ca. 300 g), black bean (packed), brown sugar (packed), fresh nopal, fresh tomato (“bola” or “saladette”), and rice (packed).

*Wholesale prices.* The evolution of current wholesale prices (USD/kg) of “champiñones” (*Agaricus*: fresh white champignon mushrooms) per year was based on databases from the National System of Information and Market Integration (SNIIM, [www.economia-sniim.gob.mx](http://www.economia-sniim.gob.mx)). The SNIIM monitors wholesale prices daily in main cities across the country. Average minimum and maximum mushroom prices per month were generated for each State, and then by region. The average minimum and maximum price from all regions represented the national average. Current wholesale prices for *Agaricus* mushrooms in the U.S.A. were based on databases from the United States Department of Agriculture ([www.ams.usda.gov](http://www.ams.usda.gov)).

*Trade mark position.* The number of trade marks associated to fresh or processed mushrooms was recorded in public markets (8), tianguis (2), and supermarkets (2) from the cities of Mexico, Puebla, Tlaxcala, and Toluca. Interviews to mushroom consumers were carried out at the point of sale, asking them to identify one or more from all trademarks recorded. Interviews were made during May-July in 2007 (n=465) and 2011 (n= 537). An observation protocol was used to record trade marks available at the point of sale.

*Mushroom products.* The price and the variety of mushroom products was assessed

by interviews with personnel of companies involved. Data were confirmed at the company web sites and at the point of sale. Companies were established in the States of Mexico, Michoacan, and Veracruz.

*Inflation-free analysis.* Current consumer prices (CP) and minimum wages (MW; [www.conasami.gob.mx](http://www.conasami.gob.mx)) were subjected to deflation using the consumer price index (CPI), and calculated in U.S. dollars (USD) according to the following exchange rate established by the Bank of Mexico ([www.banxico.org.mx](http://www.banxico.org.mx)): from 1940 to 2002, USD \$ 1.00= \$ 9.66 Mexican pesos (MN); from 2003 to 2011 were as follows: 2003= \$ 10.82, 2004= \$ 11.33, 2005= \$ 10.90, 2006= \$ 10.92, 2007= \$ 11.08, 2008= \$ 13.81, 2009= \$ 13.52, 2010= \$ 12.34, and 2011= \$ 11.80. Data were subjected to deflation through the following formula: Inflation-free CP or MW (year)= (CP or MW/CPI) 100<sup>6</sup>. At present, mushrooms are not yet considered as a generic product in databases, so only fresh *Agaricus* is included (*i.e.*, a generic product is the basic unit to calculate the CPI-Mexico, according to the methodology from the Bank of Mexico, which consists of a group of specific products having similar characteristics). According to this study, we considered all mushrooms commercially available in Mexico as the generic product called “mushrooms”, whose price is the average consumer price of all mushroom species and product lines.

*Social accessibility.* A comparative analysis between the minimum wage ([www.conasami.gob.mx](http://www.conasami.gob.mx)) and the consumer price of “champiñones” (*Agaricus*: fresh white champignon mushrooms), as well as that from other foods widely consumed, was carried from 1940 to 2011. Inflation-free data were used, so the minimum wage was divided by the consumer price per kg

of *Agaricus* mushrooms and other foods in order to get the amount of the product that could be bought in a specific year. This analysis provided an approach to the purchasing power of the minimum wage over time.

*Databases.* National and international official databases on mushroom prices were analyzed. In Mexico, fundamental databases were: 1) INEGI (National Institute of Statistics, Geography and Informatics; [www.inegi.org.mx](http://www.inegi.org.mx)) through the national survey of household incomes and expenses carried out every two years; 2) The Bank of Mexico ([www.banxico.org.mx](http://www.banxico.org.mx)) through the consumer price index (CPI-Mexico) recorded biweekly and the daily exchange rate; and 3) CONASAMI (National Commission of Minimum Wages; Secretary of Labour and Social Prevision; [www.conasami.gob.mx](http://www.conasami.gob.mx)) through the minimum wages recorded yearly. Other secondary databases from the Secretary of Economy were: 1) SNIIM (National System of Information and Market Integration; [www.economia-sniim.gob.mx](http://www.economia-sniim.gob.mx)), which provides monthly wholesale prices for *Agaricus* at several cities across and outside the country; 2) PROFECO (Federal Procuracy of the Consumer; [www.profeco.gob.mx](http://www.profeco.gob.mx)) keeps track of the retail price index (monthly) for basic products; and 3) SEDECO (Secretary of Economic Development from the Federal District Government; [www.sedeeco.df.gob.mx](http://www.sedeeco.df.gob.mx)). International databases were those available electronically. This is the case of the National Agricultural Statistics Service from the United States Department of Agriculture ([www.nass.usda.gov](http://www.nass.usda.gov)), whose data were used to make a comparison of wholesale prices of fresh mushrooms between Mexico and the U.S.A. Data were available at the section of “*Agaricus* mushrooms: sales, price and

value by utilization (States, Regions, and United States), price per pound for the fresh market". Current prices from 1996-2011 were converted to kg and analyzed. Average maximum and minimum prices were generated by region and the same periods were compared in both countries.

## RESULTS AND DISCUSSION

There were eight mushroom species in the commercial market of central Mexico, as well as a variety of presentations (16) available to the consumer (**Table 1**). By contrast, in 2005, there were basically four mushroom species recorded in the Mexican market<sup>2</sup>. Mushroom species available were: *Agaricus bisporus* (J.E. Lange) Pilát, *Pleurotus ostreatus* (Jacq.) P. Kumm., *P. pulmonarius* (Fr.) Quél., *P. eryngii* (DC.) Quél., *Lentinula edodes* (Berk.) Pegler, *Hypsizygus tessulatus* (Bull.) Singer, *Flammulina velutipes* (Curtis) Singer, and *Ustilago maydis* (DC.) Corda. All species were identified at the molecular level (data not shown). At least, twenty different trade marks were also recorded: Biopremium, Campbell's, Chedraui, Del Fuerte, Del Monte, El Dorado, Golden Hills, GPL, Great Value, Herdez, Hongos Leben, Hongos Selectos Doña Petrita, Knorr, La Costeña, Los Aztecas, Monteblando, Monte Rey, San Marcos, San Miguel, and Via Verde. It is important to note that most packages had traditional recipes on the back about how to cook mushrooms, which motivate new consumers and promote consumption. One company added the term "gourmet" on the labels of mushroom packages in order to bring it to the attention of the consumer. Although a high proportion (46.6-76.9%) of mushroom consumers did not identify specific trade marks associated to fresh or

processed products, Monte Blanco showed the highest frequency of records in the interviews (2007: 20.3%; 2011: 27.2%), followed by Monte Rey (2007: 1.6%; 2011: 3.8%), Hongos Leben (2007: 1.2%; 2011: 2.9%), Biopremium (2011: 1.9%), and others (**Table 2**). Monte Blanco is part of Hongos de México, S.A., a large company having significant market power<sup>2</sup>.

Supermarkets had the largest variety of presentations to the consumer: fresh (in bulk, packaged) and processed (dried or canned, in pickle, brine, or oil) mushrooms (*Agaricus*, *Pleurotus*, *Lentinula*, *Hypsizygus*, *Flammulina*, *Ustilago*). In public markets, there were predominantly fresh and dried mushrooms, in bulk or packaged (white *Agaricus*, *Pleurotus*, *Lentinula*, *Ustilago*). In "Tianguis" (popular market days), there was a lesser variety of mushroom species and presentations, basically fresh white *Agaricus* in bulk and fresh *Pleurotus* in bulk.

The variety of mushroom species and presentations at the point of sale increased through time, showing that mushroom consumption improved during the period of study. In 2002, there was a small variety of mushroom presentations available in the market (**Table 1**). In the case of the champignon or "champiñones", there were white and brown *Agaricus bisporus*, including fresh mushrooms in bulk or packaged in conventional or biodegradable containers (whole, sliced, mature and young fruit bodies), as well as canned mushrooms. Vacuum packaging of mushrooms was available using plastic bags, and modified atmosphere packaging using plastic films. The brown *A. bisporus* included mature mushrooms, marketed as "portobello" or "portabella", and young mushrooms at early stages of development, known as "cremini", "crimini", "portobellini", or "portabellini".

**Table 1.** Average current and inflation-free prices (2002-2011) of edible mushrooms to the consumer at the point of sale [“tianguis”, public markets, supermarkets] in central Mexico (States: Mexico, Puebla, Tlaxcala). Prices are shown in Mexican pesos (MN) and inflation-free prices (IFP) have also been converted to USD.

| Commercial name<br>Species                       | 2002 <sup>a</sup> |                 | 2008-2009 <sup>b</sup> (A) |                |                 | 2010-2011 (B) |                |                 | Variation (A/B, %) |         |
|--|-------------------|-----------------|----------------------------|----------------|-----------------|---------------|----------------|-----------------|--------------------|---------|
|  | IFP<br>(MN/kg)    | IFP<br>(USD/kg) | CP<br>(MN/kg)              | IFP<br>(MN/kg) | IFP<br>(USD/kg) | CP<br>(MN/kg) | IFP<br>(MN/kg) | IFP<br>(USD/kg) | IFP-MN             | IFP-USD |
| “Champiñones” or Champignon ( <i>Agaricus</i> ): |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh (databasis) <sup>c</sup>                   | 32.84             | 3.40            | 29.49                      | 21.59          | 1.60            | 47.30         | 32.42          | 2.75            | 50.17              | 71.71   |
| <i>A. bisporus</i> (white)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh (this study)                               | 29.88             | 3.09            | 44.42                      | 32.52          | 2.41            | 55.86         | 38.29          | 3.24            | 17.74              | 34.44   |
| <i>A. bisporus</i> (white)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Canned <sup>c,d</sup>                            | 37.41             | 3.87            | 43.90                      | 32.14          | 2.38            | 71.53         | 49.03          | 4.16            | 52.55              | 74.58   |
| <i>A. bisporus</i> (white)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh, “portobello”                              | 55.82             | 5.78            | 59.29                      | 43.40          | 3.21            | 66.09         | 45.30          | 3.84            | 4.38               | 19.63   |
| <i>A. bisporus</i> (brown)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh, “C/P”                                     | 56.11             | 5.81            | 68.40                      | 50.07          | 3.70            | 71.09         | 48.73          | 4.13            | -2.68              | 11.62   |
| <i>A. bisporus</i> (brown)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh, organic                                   | -                 | -               | 83.39                      | 61.04          | 4.51            | 124.50        | 85.34          | 7.23            | 39.81              | 60.34   |
| <i>A. bisporus</i> (white)                       |                   |                 |                            |                |                 |               |                |                 |                    |         |
| “Setas” ( <i>Pleurotus</i> spp.):                |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh, white, gray, brown<br>oyster mushrooms    | 42.13             | 4.36            | 54.71                      | 40.05          | 2.96            | 66.66         | 45.69          | 3.87            | 14.08              | 30.74   |
| Canned <sup>e</sup>                              | -                 | -               | 126.65                     | 92.71          | 6.86            | -             | -              | -               | -                  | -       |
| Fresh, “Trompeta real”<br>“King” oyster mushroom | -                 | -               | 208.00                     | 158.60         | 11.81           | -             | -              | -               | -                  | -       |
| <i>P. eryngii</i>                                |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Shiitake ( <i>Lentinula edodes</i> ):            |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh  | 92.26             | 9.55            | 125.00                     | 91.50          | 6.77            | 250.00        | 171.36         | 14.52           | 87.28              | 114.49  |
| Dried  | -                 | -               | 599.00                     | 438.47         | 32.43           | 500.00        | 342.73         | 29.04           | -21.84             | -10.45  |
| Shimeji ( <i>Hypsizygus tessulatus</i> ):        |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh  | -                 | -               | 650.00                     | 475.81         | 35.19           | -             | -              | -               | -                  | -       |
| Enoki ( <i>Flammulina velutipes</i> ):           |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh  | -                 | -               | 364.00                     | 266.45         | 19.71           | 700.00        | 479.82         | 40.66           | 80.08              | 106.29  |
| “Cuitlacoche” ( <i>Ustilago maydis</i> ):        |                   |                 |                            |                |                 |               |                |                 |                    |         |
| Fresh  | -                 | -               | 66.60                      | 48.75          | 3.61            | 66.11         | 45.31          | 3.84            | -7.06              | 6.37    |
| Canned   | -                 | -               | -                          | -              | -               | 124.46        | 85.31          | 7.23            | -                  | -       |

USD= American dollars. Exchange rate, 2011: USD \$ 1.00= MN \$ 11.80. CP= Then current prices. IFP-MN= Variation of inflation-free prices in Mexican pesos (MN). IFP-USD= Variation of inflation-free prices in USD. C/P= cremini/portobellini.

<sup>a</sup> Mayett *et al.*<sup>4</sup>. <sup>b</sup> Mayett and Martínez-Carrera<sup>5</sup>. <sup>c</sup> Federal District Government, Secretary of Economic Development ([www.sedeco.df.gob.mx](http://www.sedeco.df.gob.mx)) and PROFECO ([www.profeco.gob.mx](http://www.profeco.gob.mx)). <sup>d</sup> Sliced, whole mushroom in pickle (380 g). <sup>e</sup> Whole “setas” in brine (290 g).

**Table 2.** Position of trade marks from fresh and processed mushrooms in consumer's preferences at the point of sale in the central region of Mexico, during the period 2007-2011. Data show the frequency a trade mark was recorded in the interviews (n= 1,002).

| Trade mark          | Period                           |   |                              |
|---------------------|----------------------------------|---|------------------------------|
|                     | 2007<br>Supermarkets<br>(n= 465) | 2011<br>Public markets, tianguis, supermarkets<br>(n=537) | 2007-2011<br>Increase<br>(%) |
|                     | Frequency<br>(%)                 | Frequency<br>(%)  |                              |
| Monte Rey           | 1.6                              | 3.8   | 137.5                        |
| Monte Blanco        | 20.3                             | 27.2  | 34.0                         |
| Hongos Leben        | 1.2                              | 2.9   | 141.7                        |
| Biopremium          | -                                | 1.9   | -                            |
| Others <sup>a</sup> | -                                | 17.6  | -                            |
| None                | 76.9                             | 46.6  | - 39.4                       |

<sup>a</sup>Chedraui, Gourmet, GPL, Hongos Selectos Doña Petrita, Los Aztecas, Vía Verde.

Oyster mushrooms or “setas” (*Pleurotus* spp.: white, gray, brown) and shiitake (*Lentinula edodes*) mushrooms were sold fresh. New products were introduced to the market in the following periods (2008-2009, 2010-2011): organic champignon (white), canned “setas”, “trompeta real” (“King” oyster mushroom, *P. eryngii*), dried shiitake, fresh shimeji (*Hypsizygus tessulatus*), fresh enoki (*Flammulina velutipes*), and Mexican “Huitlacoche” or “Cuitlacoche” (*Ustilago maydis*). Dried shiitake was basically imported from China, while “trompeta real”, shimeji and enoki were imported by Grupo San Miguel, S.A., from the U.S.A. “Huitlacoche”, either wild or cultivated, is sold in bulk as whole infected corn cobs or as packaged independent galls (fresh or processed). Interesting was the case of mixed mushrooms introduced

by the company Hongos Leben, in which fresh *Agaricus*, *Pleurotus* and *Lentinula* fruit bodies, either whole or sliced, are sold within the same package. Development of a local market for canned “setas”, “trompeta real”, and shimeji in 2008-2009 was not successful, as they were not recorded again in the following period 2010-2011. The idea was good in order to develop a market for new species, but their prices were more expensive than those of the other mushrooms or similar products, and they were introduced untimely during a world economic crisis (2008-2009), a difficult situation for most local people. In fact, inflation-free mushroom prices to the consumer during 2008-2009 were less than those of the other periods studied (2002, 2010-2011). The only exception was dried shiitake, whose inflation-free price was

reduced by 10.4% from 2008-2009 to 2010-2011. It is possible that imports of this product increased, which are mainly sold at the public market called Mercado San Juan in Mexico city.

The evolution of mushroom prices to the consumer at the point of sale during 2002-2011 is shown in **Table 1**. Inflation-free consumer prices (USD) of most mushrooms and presentations in the period 2010-2011 were more expensive than those of the period 2008-2009, ranging from 6.3-114.4%. In 2011, mushrooms were more expensive than other foods widely consumed (**Table 3**). Their current consumer price varied from USD \$ 4.00/kg to \$ 59.32/kg. Only avocado and meat were equivalent to the current consumer price of fresh white champignon recorded in this study (USD \$ 4.73/kg), as well as that from databases at national level (USD \$ 4.00/kg). Mushrooms were more expensive than chicken, black bean, egg, brown sugar, rice, milk, tomato, and nopal. These data confirm previous research work showing perceptions of Mexican consumers, who consider edible mushrooms as very or regularly expensive<sup>4,5</sup>. High prices for long periods will lead to restricted mushroom consumption, and mushroom and non-mushroom consumers may look for substitute goods affecting the development of the emergent agri-food chain.

Current wholesale prices of fresh mushrooms varied per region of the country during 1996-2011 (**Table 4**). Four major areas can be clearly identified: southeast, central east, western, and northern regions. There were no records of wholesale prices for fresh “champiñones” (*Agaricus*, white champignon mushrooms) before 1996. Daily wholesale prices per kg have been available on-line since 1998, and now the SNIIM covers the most important cities

in the country allowing comparisons between regions. Data for only fresh white champignon mushrooms are available, and no other species is yet recorded. In general, average wholesale prices of fresh “champiñones” decreased from 1996 to 2011 in all regions: from USD \$ 4.39 to \$ 3.44 in the region A; \$ 2.65 to \$ 2.19 in the region B; \$ 2.75 to \$ 2.36 in the region C; and \$ 3.74 to \$ 2.16 in the region D. The region A (Southeast), which included the States of Oaxaca, Quintana Roo, Tabasco and Yucatan, consistently showed the highest average wholesale prices for “champiñones” during the periods analyzed (1996-2002, 2003-2008, 2009-2011), as well as a high level of variation between minimum and maximum prices (1996-2011: USD \$ 2.08-6.69). These States have warm climates and relatively lesser mushroom consumption, since fresh mushrooms require special care. The region B (Central east), including the States of Guanajuato, Hidalgo, Mexico, Morelos, Puebla, Queretaro, and Veracruz, had low average wholesale prices for “champiñones”. Most commercial farms are established in this a region of greater mushroom consumption, as well as efficient transportation infrastructure and logistics. The interesting case of region D (Northern), including the States of Baja California, Durango, Nuevo Leon, and San Luis Potosi, is shown by the lowest average wholesale price for “champiñones” (USD \$ 2.16), as well as the lowest level of variation between minimum and maximum price (\$ 3.30). This trend can be due to greater mushroom imports from the U.S.A., affecting the supply and demand interaction in this region.

A comparative analysis indicated that the U.S. mushroom industry had completely opposite trends. Average current wholesale prices of fresh *Agaricus*



**Table 3.** Current consumer prices of edible mushrooms in central Mexico, in comparison with those of other foods widely consumed. Average prices for 2011. Exchange rate, 2011: USD \$ 1.00= MN \$ 11.80.

| Species                                     | Commercial presentation available in 2011                  | Average consumer price (USD/kg) |
|---|--|---------------------------------|
| <b>Mushrooms</b>                            |  |                                 |
| <i>Flammulina velutipes</i> (Curtis) Singer | Fresh enoki  | 59.32                           |
| <i>Lentinula edodes</i> (Berk.) Pegler      | Dried shiitake   | 42.37                           |
|   | Fresh shiitake   | 21.19                           |
| <i>Agaricus bisporus</i> (J.E. Lange) Pilát | “Champiñones”, marketed products:                          |                                 |
|   | Fresh organic white champignon                             | 10.55                           |
|   | Canned white champignon in pickle                          | 6.06                            |
|   | Fresh “cremini/portobellini” (young brown champignon)      | 6.02                            |
|   | Fresh “portobello” (mature brown champignon)               | 5.60                            |
|   | Fresh white champignon                                     | 4.73                            |
|   | Fresh white champignon (price from databasis) <sup>a</sup> | 4.00                            |
| <i>Pleurotus ostreatus</i> (Jacq.) P. Kumm. | Fresh “setas” (oyster mushrooms)                           | 5.65                            |
| <i>P. pulmonarius</i> (Fr.) Quéf.           |  |                                 |
| <i>Ustilago maydis</i> (DC.) Corda          | Fresh “Huitlacoche” or “Cuitlacoche”                       | 5.60                            |
|   | Canned “Huitlacoche” or “Cuitlacoche”                      | 10.54                           |
| <b>Other foods</b>                          |  |                                 |
| <i>Persea americana</i> P. Mill.            | Avocado  | 4.70                            |
| -   | Meat   | 4.23                            |
| -   | Chicken  | 3.49                            |
| <i>Phaseolus vulgaris</i> L.                | Black bean   | 1.97                            |
| -   | Egg  | 1.60                            |
| <i>Saccharum officinarum</i> L.             | Sugar  | 1.38                            |
| <i>Oryza sativa</i> L.                      | Rice   | 1.36                            |
| -   | Milk (liter)   | 1.03                            |
| <i>Solanum lycopersicon</i> L.              | Tomato   | 0.90                            |
| <i>Opuntia</i> spp.                         | Nopal  | 0.82                            |

<sup>a</sup> Average price at national level, according to the Federal District Government, Secretary of Economic Development ([www.sedeco.df.gob.mx](http://www.sedeco.df.gob.mx)) and PROFECO ([www.profeco.gob.mx](http://www.profeco.gob.mx)).

mushrooms increased from 1996 to 2011 in all regions: from USD \$ 1.88 to \$ 2.06 in the east region; \$ 2.76 to \$ 3.79 in the

central region; and \$ 2.62 to \$ 3.02 in the west region (**Table 5**). Furthermore, the level of variation between minimum and

maximum wholesale prices per period analyzed was less than that observed in Mexico, showing remarkable stability of a mature market (1996-2011, USD: east region, \$ 0.03-0.30; central region, \$ 0.08-0.59; west region, \$ 0.44-1.06).

**Table 6** shows the social accessibility of fresh “champiñones” in Mexico during the period 1940-2011, if the minimum wage is used as a reference for buying the product. Although the general purchasing power of inflation-free minimum wage has decreased 71.1% during that period,

*Agaricus* mushrooms now require even a smaller fraction of the minimum wage-earner’s income. The average inflation-free consumer price of *Agaricus* mushrooms decreased from USD \$ 24.78 to \$ 2.75. In 1940, 0.46 kg of “champiñones” could be bought by the minimum wage, while 1.20 kg in 2011, *i.e.* 160% greater amount of mushrooms. Therefore, in general, *Agaricus* mushrooms are now more accessible to the Mexican society than 71 years ago. However, the impact of buying mushrooms on social levels is

**Table 4.** Variation of fresh “champiñones” (*Agaricus*, white champignon mushrooms) current wholesale prices in Mexico during 1996-2011, between several periods and regions. Data selected from official databases, the number of States by region may vary each year.

| Region (States)  | Mushroom prices per period (USD/kg) <sup>a,b</sup> |   |   |
|--|--|---|---|
|  | 1996-2002<br>Minimum-Maximum<br>(Average)          | 2003-2008<br>Minimum-Maximum<br>(Average) | 2009-2011<br>Minimum-Maximum<br>(Average) |
| Region A<br>(Southeast: Oaxaca, Quintana Roo,<br>Tabasco, Yucatan)                                   | 3.35-5.43 (4.39)                                   | 1.31-5.24 (3.27)                          | 0.09-6.78 (3.44)                          |
| Region B<br>(Central east : Guanajuato, Hidalgo,<br>Mexico, Morelos, Puebla, Queretaro,<br>Veracruz) | 2.33-2.97 (2.65)                                   | 0.46-3.04 (2.23)                          | 0.47-3.90 (2.19)                          |
| Region C<br>(Western: Guerrero, Jalisco,<br>Michoacan, Nayarit)                                      | 2.34-3.16 (2.75)                                   | 1.89-3.04 (2.41)                          | 0.64-4.07 (2.36)                          |
| Region D<br>(Northern: Baja California, Durango,<br>Nuevo Leon, San Luis Potosi)                     | 2.40-5.08 (3.74)                                   | 1.68-4.08 (2.88)                          | 0.51-3.81 (2.16)                          |

<sup>a</sup> Average from SNIIM databases ([www.economia-sniim.gob.mx](http://www.economia-sniim.gob.mx)).

<sup>b</sup> Exchange rate: from 1940 to 2002, USD \$ 1.00= \$ 9.66 Mexican pesos; from 2003 to 2011: 2003= \$ 10.82; 2004= \$ 11.33; 2005= \$ 10.90; 2006= \$ 10.92; 2007= \$ 11.08; 2008= \$ 13.81; 2009= \$ 13.52; 2010= \$ 12.34; 2011= \$ 11.80.

**Table 5.** Variation of fresh *Agaricus* current wholesale prices in the U.S.A. during 1996-2011, between several periods and regions.

| Region (States)   | Mushroom prices per period (USD/kg) <sup>a</sup> |   |   |
|---|--|---|---|
|   | 1996-2002<br>Minimum-Maximum<br>(Average)        | 2003-2008<br>Minimum-Maximum<br>(Average) | 2009-2011<br>Minimum-Maximum<br>(Average) |
| East<br>(Delaware, Florida, Maryland,<br>New York, Pennsylvania, Tennessee) | 1.78-1.99 (1.88)                                 | 1.84-2.14 (1.99)                          | 2.04-2.07 (2.06)                          |
| Central<br>(Illinois, Missouri, Oklahoma, Texas,<br>Wisconsin)              | 2.47-3.06 (2.76)                                 | 3.11-3.62 (3.37)                          | 3.75-3.83 (3.79)                          |
| West<br>(California, Colorado, Montana,<br>Oregon, Utah, Washington)        | 2.40-2.84 (2.62)                                 | 2.84-3.51 (3.18)                          | 2.49-3.55 (3.02)                          |

<sup>a</sup> Data from the United States Department of Agriculture (USDA; [www.ams.usda.gov](http://www.ams.usda.gov)).

different, because the number of minimum wages earned daily by each level vary as follows: low (1-5), medium (5.01-8.00), and high (>8.01)<sup>5</sup>. By contrast, other foods consumed widely showed the opposite trend, *i.e.* lesser amounts can now be bought through the minimum wage. This was the case of meat (1940: 2.53 kg, 2011: 0.73 kg), milk (1940: 9.50 L, 2011: 4.66 L), rice (1940: 7.45 kg, 2011: 3.54 kg), sugar (1940: 7.86 kg, 2011: 3.48 kg), and tomato (1940: 7.26 kg, 2011: 3.05 kg).

A comparative analysis of average consumer prices of edible mushrooms between Mexico and other countries is shown in **Table 7**. Fresh, white *Agaricus* mushrooms are cheaper in Mexico (USD \$ 4.73/kg) than in the U.S.A. (\$ 8.09/kg), Great Britain (\$ 8.15/kg), France

(\$ 8.73/kg), and Australia (\$ 10.55/kg). The opposite trend is observed in canned white *Agaricus* mushrooms, because this processed product is cheaper than the fresh product in the U.S.A. (\$ 7.04/kg), Great Britain (\$ 4.28/kg), France (\$ 8.97/kg), and Australia (\$ 4.49/kg). However, in Mexico, canned *Agaricus* mushrooms are more expensive (\$ 6.06/kg) than the fresh product (\$ 4.73/kg). Fresh, young and mature brown *Agaricus* mushrooms (“portobello”, “portobellini”, “cremini”) are also cheaper in Mexico than in the rest of the countries, although young stages were not available in Australia and France. Fresh organic white *Agaricus* mushrooms had equivalent price in Mexico and the U.S.A. (\$ 10.40-10.55/kg), but they were very expensive in France (\$ 18.32/kg).

Fresh oyster mushrooms are cheaper in Mexico (\$ 5.65/kg) than in the rest of the countries studied (\$ 8.67-17.08/kg). This was also the case for fresh shiitake, whose

price varied from \$ 21.19/kg to 29.36/kg. The consumer price of fresh shimeji ranged from \$ 21.76/kg to 48.07/kg, which was only recorded in Mexico and Great Britain.

**Table 6.** Amount of fresh white champignon mushrooms (*Agaricus*; inflation-free consumer price<sup>a,b</sup>) purchased by the minimum wage in Mexico during 1940-2011, in comparison with other foods widely consumed.

| Year | Inflation-free<br>minimum wage <sup>c</sup><br>(USD) | Amount bought (kg)           |                   |                           |                   |                    |                     |
|------|--|------------------------------|-------------------|---------------------------|-------------------|--------------------|---------------------|
|      |  | <i>Agaricus</i> <sup>d</sup> | Meat <sup>d</sup> | Milk (Liter) <sup>d</sup> | Rice <sup>d</sup> | Sugar <sup>d</sup> | Tomato <sup>d</sup> |
| 1940 | 11.40  | 0.46                         | 2.53              | 9.50                      | 7.45              | 7.86               | 7.26                |
| 1950 | 6.24   | 0.29                         | 1.21              | 7.34                      | 4.24              | 6.12               | 5.16                |
| 1960 | 7.45   | 0.41                         | 1.03              | 7.76                      | 5.14              | 8.98               | 8.98                |
| 1970 | 12.07  | 0.68                         | 1.46              | 11.83                     | 7.40              | 16.09              | 10.23               |
| 1980 | 12.98  | 0.80                         | 1.31              | 18.81                     | 8.60              | 19.37              | 8.89                |
| 1990 | 6.14   | 1.89                         | 1.26              | 9.45                      | 4.35              | 9.75               | 4.48                |
| 2000 | 4.05   | 0.80                         | 1.22              | 5.00                      | 4.88              | 5.26               | 3.49                |
| 2001 | 4.10   | 1.12                         | 1.26              | 5.13                      | 5.69              | 5.39               | 3.98                |
| 2002 | 4.11   | 1.21                         | 1.29              | 5.41                      | 5.87              | 5.87               | 3.29                |
| 2003 | 3.57   | 1.35                         | 1.44              | 6.01                      | 6.09              | 5.69               | 5.04                |
| 2004 | 3.41   | 0.86                         | 1.47              | 5.85                      | 4.01              | 5.31               | 4.59                |
| 2005 | 3.55   | 1.20                         | 1.24              | 5.49                      | 4.23              | 5.42               | 4.79                |
| 2006 | 3.57   | 1.36                         | 1.35              | 5.39                      | 5.57              | 4.58               | 5.50                |
| 2007 | 3.51   | 1.21                         | 1.18              | 5.88                      | 4.29              | 6.93               | 6.58                |
| 2008 | 2.68   | 1.31                         | 1.15              | 4.85                      | 2.75              | 6.44               | 3.25                |
| 2009 | 2.87   | 1.17                         | 1.00              | 4.60                      | 2.73              | 2.73               | 2.17                |
| 2010 | 3.05   | 1.09                         | 0.74              | 4.36                      | 3.21              | 2.39               | 3.21                |
| 2011 | 3.29   | 1.20                         | 0.73              | 4.66                      | 3.54              | 3.48               | 3.05                |

USD= American dollars.

<sup>a</sup> CPI= Consumer price index according to the Bank of Mexico ([www.banxico.org.mx](http://www.banxico.org.mx)).

<sup>b</sup> Exchange rate: from 1940 to 2002, USD \$ 1.00= \$ 9.66 Mexican pesos; from 2003 to 2011: 2003= \$ 10.82; 2004= \$ 11.33; 2005= \$ 10.90; 2006= \$ 10.92; 2007= \$ 11.08; 2008= \$ 13.81; 2009= \$ 13.52; 2010= \$ 12.34; 2011= \$ 11.80.

<sup>c</sup> Minimum wage according to CONASAMI ([www.conasami.gob.mx](http://www.conasami.gob.mx)).

<sup>d</sup> Amounts purchased are based on mushroom (*Agaricus*) and food prices taken from diverse references, databases, and this study. All prices were subjected to deflation according to Martínez-Carrera *et al.*<sup>2</sup>; Mayett *et al.*<sup>4</sup>; Mayett and Martínez-Carrera<sup>5</sup>; Secretary of Economic Development from the Federal District Government; [www.sedeco.df.gob.mx](http://www.sedeco.df.gob.mx)).

**Table 7.** Average current consumer prices of edible mushrooms and other foods widely consumed in Mexico, in comparison with those recorded in other countries. Prices per kg in 2011 (except where indicated).

|  | Consumer price (USD/kg) |                     |                            |                     |                        |
|--|-------------------------|---------------------|----------------------------|---------------------|------------------------|
|  | Mexico <sup>a</sup>     | U.S.A. <sup>b</sup> | Great Britain <sup>c</sup> | France <sup>d</sup> | Australia <sup>e</sup> |
| “Champiñones” or Champignon ( <i>Agaricus</i> ):                       |                         |                     |                            |                     |                        |
| Champignon, fresh ( <i>A. bisporus</i> , white)                        | 4.73                    | 8.09                | 8.15                       | 8.73                | 10.55                  |
| Champignon, canned in pickle ( <i>A. bisporus</i> , white)             | 6.06                    | 7.04                | 4.28                       | 8.97                | 4.49                   |
| Champignon, fresh “portobello” ( <i>A. bisporus</i> , brown)           | 5.60                    | 16.94               | 9.78                       | 14.17               | 10.55                  |
| Champignon, fresh “cremini/portobellini” ( <i>A. bisporus</i> , brown) | 6.02                    | 7.23                | 9.29                       | na                  | na                     |
| Champignon, fresh, organic ( <i>A. bisporus</i> , white)               | 10.55                   | 10.40               | 11.10                      | 18.32               | na                     |
| “Setas”, fresh ( <i>Pleurotus</i> spp.):                               |                         |                     |                            |                     |                        |
| white, gray, brown oyster mushrooms                                    | 5.65                    | 8.67                | 17.08                      | 10.58               | na                     |
| Shiitake, fresh ( <i>Lentinula edodes</i> )                            | 21.19                   | 29.36               | 25.07                      | 28.01               | na                     |
| Shimeji, fresh ( <i>Hypsizygus tessulatus</i> )                        | 48.07 <sup>f</sup>      | na                  | 21.76                      | na                  | na                     |
| Other foods:   |                         |                     |                            |                     |                        |
| Avocado  | 1.41                    | 1.49                | 1.63                       | 1.79                | 1.59                   |
| Meat   | 4.23                    | 6.61                | 11.71                      | 15.80               | 12.67                  |
| Chicken  | 3.49                    | 5.51                | 8.87                       | 7.23                | 9.51                   |
| Black bean   | 1.97                    | 1.53                | 4.24                       | 7.73                | na                     |
| Egg  | 1.60                    | 3.99                | 2.59                       | 2.37                | 3.90                   |
| Sugar  | 1.38                    | 3.51                | 3.25                       | 2.47                | 2.74                   |
| Rice   | 1.36                    | 1.71                | 1.95                       | 1.41                | 3.16                   |
| Milk (Liter)   | 1.03                    | 1.08                | 1.28                       | 1.52                | 1.14                   |
| Tomato   | 0.90                    | 2.93                | 3.28                       | 1.74                | 7.40                   |
| Nopal  | 0.82                    | 5.51                | na                         | na                  | na                     |

<sup>a</sup> PROFECO ([www.profeco.gob.mx](http://www.profeco.gob.mx)) and this study.

<sup>b</sup> Data recorded at random supermarkets in California, U.S.A.

<sup>c</sup> J. Sainsbury Corporate ([www.sainsburys.co.uk/groceries](http://www.sainsburys.co.uk/groceries)). Aldi Supermercados (<http://aldi.com>).

<sup>d</sup> Group Carrefour (<http://www.ooshop.com>). Group Géant Casino ([www.mescoursescasino.fr](http://www.mescoursescasino.fr)). Group Casino Monoprix (<http://courses.monoprix.fr/magasin-en-ligne>).

<sup>e</sup> Coles Store ([www.coles.com.au](http://www.coles.com.au)). Drake Supermarkets ([www.drakes.com.au/home](http://www.drakes.com.au/home)).

<sup>f</sup> Data from 2009.

na= Not available.

In general, the average consumer price of edible mushrooms was more expensive

than most foods widely consumed in all countries studied, although proportions

were different. It is possible that greater labor, distribution, and marketing costs are responsible for expensive mushroom consumer prices in countries studied. Conversely, high levels of cheap mushroom imports are common in many of these countries. In any case, further analyses are required to determine how expensive mushroom prices are generated.

The mushroom market in Mexico has recently been characterized by an increasing demand and supply of mushroom products, basically promoted by internet popularization of their functional or medicinal properties. First records of some of these products were made in 2005. At present, a variety of products are available, including processed (powder, capsules), beverage (alcoholic extracts, syrup, coffee, tea, chocolate, wine), and personal care (cream, soap) products (**Table 8**). There are now three Mexican companies established, while another one is of international origin. They mainly operate following an electronic direct marketing strategy (business to consumer), direct selling, or selling in a variety of shops offering of natural produces. Current consumer prices for powders (60 g) ranged from USD \$ 26.75 to \$ 29.11, capsules (50) from \$ 15.74 to \$ 99.00, alcoholic extracts (60 ml) from \$ 9.44 to \$ 19.67, coffee (30 bags) from \$ 25.50 to \$ 141.00, and cream (50 g) for the skin from \$ 11.80 to \$ 21.00 (tooth paste). The consumer price for other products were: syrup, \$ 6.29 (120 ml); tea, \$ 33.00 (25 bags); chocolate, \$ 30.00 (15 bags); wine, \$ 14.16 (750 ml); and soap, \$ 12.00 (135 g). Mushroom species used to prepare the products were shiitake, maitake, reishi, and matsutake, or combinations of shiitake and maitake. Value-added mushroom products represent a good marketing strategy in terms of profitability and it is

expected to grow rapidly. However, it is now being carefully controlled by the Federal Commission of Protection against Sanitary Risks. Although further timely efforts are needed, this national authority is establishing specific regulations about the category, labelling, contents, quality standards, safety, marketing, and scientific evidences supporting health claims of mushroom products. Experiences in other countries are of interest. In the U.S.A, claims advertised in newspapers and supermarkets, including a Ling-zhi (*Ganoderma*) tea mix that “restore the body, slow the process of aging, prolong life, cure cancer and other serious ailments”, were stopped by government authorities protecting the public from fraud<sup>1</sup>.

In general, it can be established that, during the period of study, the Mexican mushroom market has expanded in terms of species cultivated, as well as the variety of products and presentations available at the point of sale. Mushroom prices are more expensive than other foods widely consumed, although the same situation is also recorded in countries studied from differing regions. Maximum and minimum mushroom prices show wider ranges than those from mature markets in other countries (*e.g.*, U.S.A.). Mushroom prices are also highly variable between regions. Furthermore, the prices of most fresh mushrooms are cheaper in Mexico than in other countries, indicating that production costs and the general purchasing power of Mexican consumers are lesser. In fact, Mexico has the lowest level of income in terms of salary/hour within the OECD countries (Organisation for Economic Co-operation and Development; [www.oecd.org](http://www.oecd.org)). The increasing demand and supply of mushroom products requires specific regulations to attain high quality standards,

**Table 8.** Diverse mushroom products from shiitake (*Lentinula edodes*), maitake (*Grifola frondosa*), reishi (*Ganoderma lucidum*), and matsutake (*Tricholoma magnivelare*), which have been recently introduced to the Mexican market. They are produced locally or imported, and their current consumer prices were recorded in during 2011 (Exchange rate: USD \$ 1.00= \$ 12.71 Mexican pesos).

| Name <sup>a</sup>             | Mushroom product presentation |   |  |                                |                                  |                               |                                     |                               |                                |                              |
|-------------------------------|-------------------------------|---|--|--------------------------------|----------------------------------|-------------------------------|-------------------------------------|-------------------------------|--------------------------------|------------------------------|
|                               | Processed                     |   | Beverages  |                                |                                  |                               |                                     | Personal care                 |                                |                              |
|                               | Powder <sup>b</sup><br>(60 g) | Capsules <sup>b</sup><br>(50<br>(60 ml) | Alcoholic<br>extract <sup>b,c,d</sup><br>(average) | Syrup <sup>b</sup><br>(120 ml) | Coffee <sup>e</sup><br>(30 bags) | Tea <sup>e</sup><br>(25 bags) | Chocolate <sup>e</sup><br>(15 bags) | Wine <sup>c</sup><br>(750 ml) | Cream <sup>b,e</sup><br>(50 g) | Soap <sup>e</sup><br>(135 g) |
| Shiitake (S)                  | 26.75                         | 15.74                                   | 9.44   | 6.29                           | -                                | -                             | -                                   | 14.16                         | 13.38                          | -                            |
| Maitake (M)                   | -                             | 17.31                                   | 14.56  | -                              | -                                | -                             | -                                   | -                             | 13.38                          | -                            |
| Reishi (R)                    | -                             | 61.50 <sup>f</sup> , 99.00 <sup>g</sup> | 14.16  | -                              | 25.50-141.00 <sup>h</sup>        | 33.00 <sup>i</sup>            | 30.00 <sup>j</sup>                  | -                             | 21.00 <sup>k</sup>             | 12.00 <sup>l</sup>           |
| Blend 1 (S+M)<br>"Redushima"  | 29.11                         | -                                       | -  | -                              | -                                | -                             | -                                   | -                             | -                              | -                            |
| Blend 2 (S+M)<br>"Toshima"    | -                             | -                                       | 9.44   | 6.29                           | -                                | -                             | -                                   | -                             | -                              | -                            |
| Blend 3 (S+M)<br>"Reumashima" | -                             | -                                       | 11.80  | -                              | -                                | -                             | -                                   | -                             | -                              | -                            |
| Blend 3 (S+M)<br>"Micoshima"  | -                             | -                                       | -  | -                              | -                                | -                             | -                                   | 11.80                         | -                              | -                            |
| Matsutake                     | -                             | -                                       | 19.67  | -                              | -                                | -                             | -                                   | -                             | -                              | -                            |

<sup>a</sup> Commercial names of the product are included.

<sup>b</sup> Laboratorios Fungicap (www.labfungimicel.com), Tecamalucan, Veracruz. The syrup may contain honey added. The cream refers to a preparation for the skin.

<sup>c</sup> Senguilhongo, S. de P.R. de R.L. (www.senguilhongo.com), Senguio, Michoacan, Mexico.

<sup>d</sup> Garcifer, S. A., Morelia, Michoacan, Mexico.

<sup>e</sup> Organo Gold International Mexico, S. de R.L. de C.V. (www.organogold.com), Mexico, D.F.

<sup>f</sup> 90 *Ganoderma lucidum* capsules from fruit bodies or mycelium, 100% organic certified.

<sup>g</sup> 90 capsules of powder from spores of *G. lucidum*, 100% organic certified.

<sup>h</sup> Consumer prices including different kinds of Organo Gold Gourmet coffee, namely: Black coffee (*Coffea arabica* mixed with organic *G. lucidum*, 30 bags, USD \$ 25.50); Supreme coffee (mixed with ginseng and organic *G. lucidum*, 20 bags, USD \$ 33.00); Latte coffee (mixed with organic *G. lucidum* extract, cream, and sugar, 20 bags, USD \$25.50); "King" of coffee (organic coffee mixed with *G. lucidum* spore powder, 25 bags, USD \$ 141.00); Royal brewed (Jamaica Blue Mountain coffee mixed with organic *G. lucidum* spore powder, 180 g, USD \$ 51.00). All organic products are certified.

<sup>i</sup> Green tea mixed with *G. lucidum*, 100% organic certified.

<sup>j</sup> Gourmet Mocha coffee or Gourmet Hot Chocolate mixed with *G. lucidum*, 100% organic certified.

<sup>k</sup> Tooth paste mixed with organic *G. lucidum* (150 g).

<sup>l</sup> Soap mixed with glutathione, grapeseed and *G. lucidum* extracts (135 g).

otherwise consumers may be greatly disappointed. All these circumstances drastically affect the access to mushrooms as a food by different social levels. They are also limiting factors for increasing mushroom consumption, and for further development of the emergent agri-food chain. Similar situations are common in many other developing countries where mushrooms are emerging as an important agri-food chain.

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### LITERATURE CITED

1. Coronado, R. 1985. Tea dealer to end cure-all claims. *Oakland (CA, U.S.A.) Tribune*. January 17: B1-B2.
2. Martínez-Carrera, D., D. Nava, M. Sobal, M. Bonilla and Y. Mayett. 2005. Marketing channels for wild and cultivated edible mushrooms in developing countries: the case of Mexico. *Micología Aplicada Internacional* 17: 9-20.
3. Martínez-Carrera, D., N. Curvetto, M. Sobal, P. Morales and V. M. Mora (Eds.). 2010. *Hacia un Desarrollo Sostenible del Sistema de Producción-Consumo de los Hongos Comestibles y Medicinales en Latinoamérica: Avances y Perspectivas en el Siglo XXI*. Red Latinoamericana de Hongos Comestibles y Medicinales-COLPOS-UNS-CONACYT-AMC-UAEM-UPAEP-IMINAP, Puebla. 648 pp.
4. Mayett, Y., D. Martínez-Carrera, M. Sánchez, A. Macías, S. Mora and A. Estrada-Torres. 2006. Consumption trends of edible mushrooms in developing countries: the case of Mexico. *Journal of International Food and Agribusiness Marketing* 18: 151-176.
5. Mayett, Y. and D. Martínez-Carrera. 2010. El consumo de los hongos comestibles y su relevancia en la seguridad alimentaria de México. Chapter 18. Pp. 293-329. *In: Hacia un Desarrollo Sostenible del Sistema de Producción-Consumo de los Hongos Comestibles y Medicinales en Latinoamérica: Avances y Perspectivas en el Siglo XXI*. Eds. D. Martínez-Carrera, N. Curvetto, M. Sobal, P. Morales and V. M. Mora. Red Latinoamericana de Hongos Comestibles y Medicinales-COLPOS-UNS-CONACYT-AMC-UAEM-UPAEP-IMINAP, Puebla.
6. Wonnacott, P. and R. Wonnacott. 1984. *Economía*. McGraw-Hill, México, D. F. 960 pp.
7. Zikmund, W. 1998. *Investigación de Mercados*. Prentice-Hall, Mexico, D. F. 739 pp.