

Childhood nutrition in Mexico: A diagnosis study of indigenous children of the Totonacapan

Luis Roberto Canto Valdes^{1*}, Juan Antonio Cortés-Ruiz², César Reyes³, Edora Reyes Hernández⁴, Hebert Jair Barrales-Cureño³

^{1*}División de Procesos Sociales, Derecho con Enfoque Intercultural, Universidad Intercultural del Estado de Puebla. Calle Principal a Lipuntahuaca S/N; Lipuntahuaca, Huehuetla, Puebla, México, C.P. 73475.

²Ingeniería Bioquímica. Instituto Tecnológico de Mazatlán, Unidad II Anillo Periférico S/N Esq. Huacanaxtle. Fracc. Pradera Dorada, Mazatlán, Sinaloa, México.

³División de Procesos Naturales, Ingeniería Forestal Comunitaria, Universidad Intercultural del Estado de Puebla. Calle Principal a Lipuntahuaca S/N; Lipuntahuaca, Huehuetla, Puebla, México, C.P. 73475.

⁴División de Procesos Naturales, Licenciatura en Enfermería, Universidad Intercultural del Estado de Puebla. Calle Principal a Lipuntahuaca S/N; Lipuntahuaca, Huehuetla, Puebla, México, C.P. 73475.

Corresponding author: Luis Roberto Canto Valdes^{1} E-mail: luis.canto@uiep.edu.mx Tel. 52+233 59692

Abstract

In this work was made a diagnostic analysis about the nutritional quality of indigenous children of the community of Huehuetla, State of Puebla, Mexico is known as Totonacapan. The study was performed in the children's garden "Jardin de niños de Huehuetla" from 5 to 9th November 2015. In order to determine the nutritional quality in children from 3 to 5 years old was carried out anthropomorphic measurements through body mass index (BMI) and the amount of calorie ingested daily. The sample consists of 57 children, which were classified by age: 3, 4 and 5 years old. According to BMI, children of 3 years do not show symptoms of malnutrition; for children of four years old, only 7.1 % of female showed undernutrition signals. In the case of children of five years old, 30 % presented overweight and obesity (30 %). Totonaco children analyzed consumed between 800 to 1150 Kcal/day, indicating that there is not a direct relationship between daily calorie consumption against BMI. Finally, totonaco children have a low diet in fat, but rich in carbohydrates and 30 % of them could suffer some degree of malnutrition. The children sample analyzed in this study and in accord to anthropomorphic measurements, indicate that there is not apparent malnutrition on totonaco children between three and five years.

Keywords: Body mass index, daily diet, nutrition, totonaco children

Introduction

Mexico is a country located in North America, which has advanced in the control of nutritional deficiencies of their population and deal the second place in Latin America in childhood chronic malnutrition (FAO, 2017). Because of this, is important to establish a sustainable local food system, however, the actual Mexican policies have been achieved significantly decreased the childhood malnutrition, as a result, has been observed an increase of a prevalence of overweight (Shamah, Amaya & Cuevas, 2015) and childhood obesity, mainly due to the lack of well balanced and healthy diet that provide some minimal essential nutrients for the normal development of Mexican children. In Mexico, 1.5 million of children suffering malnutrition and their prevalence is higher in the south of the country (19.2 %), as well as in the zones with a predominant indigenous population (Gutierrez *et al.* 2012). Despite the improvement of the nutrition in the last decades, Mexico has not had a significant reduction of childhood malnutrition, therefore, the prevalence of low height remains as a public health problem mostly in children under age 5.

The indigenous populations in Mexico present the next characteristics: have one of the highest rates of margination, are widely dispersed in the country, have inhabited particular regions with important mineral, touristic, biological, water, forest and eolic resources, in addition to a high diversity of medicinal and domestic plants, in the last years this group population has suffered an intense regional, national and international migration (Zolla, 2007). On the other hand, the inhabited areas by indigenous people are characterized by their educational underdevelopment, life expectancy seven less years than the rest of the population, high chronic malnutrition rates, the predominance of infectious diseases, influenza, pneumonia, pulmonary tuberculosis, child mortality above average of the country population, presence of diseases such as cholera, malaria, dengue, leprosy, between others (Zolla, 2007).

There are several medical methods reported in the literature that are used normally to assess the malnutrition degree in patients, among the most common is the medical history, physical examination, anthropomorphic measures, immunological probes and muscle status (De Legge, 2010). The anthropomorphic measures allow an indirect determination of chemical composition of the human body and their ability to store energy by using tools relatively inexpensive such as calipers and measuring tape. For example, can be determined triceps diameter (TSF), which is an indirect indicator of fat storage and proteins (De Legge, 2010). This measures are compared with standardized tables in order to obtain percentages of normal values. Anthropometric measurements in childrens and adolescents are commonly used as health indicators. The quotient between weight/mass body and height is determined the body mass index (BMI) and with this values patients can be classified as mild, moderate or serious malnutrition, as well as overweight and obese (USAID, 2012).

The main purpose of this investigation is to perform a general diagnosis of the nutrition status of indigenous children from 3 to 5 years old in the rural community of Huehutla Puebla Mexico; this survey was performed by using the body mass index (BMI) and compared with the average values of the country and then find the causes of these results, proposing some solutions.

Methods

The present study was carried out on the children garden “Jardin de niños Huehuetla” on the community of Huehuetla, Puebla from 5 to 9 November 2015. It was decided performed the study in the garden, due to the fact that is a representative sample ($n = 57$) and the analysis included children between 3 to 5 years old and all of them come from all the geographical points of the study area which contains 1764 inhabitants (INEGI, 2010), and 97.98% of them are natives. The anthropomorphic indicators determined in this work were weight (kg) or body mass and height (m) with the objective of obtaining the body mass index (BMI). In order to classify the BMI values, we used the tables reported by World Health Organization (WHO, 2007) which can be consulted at Food and nutrition technical assistance (Fanta II) from 2012.

To complement this diagnosis study were included two questionnaires which address a) food risk identification (data collection about food safety) and b) intake nutritional assessment and included the number of daily meals by mean of estimation of food calories and the amount of fats and proteins ingested in their daily diet. Subjects was informed that their participation in the study was voluntary. Written informed consent was obtained from all mother of the children.

Results

The data on body mass index (BMI) for children from 3 to 5 years old indicates that is not a evidence of malnutrition in children analyzed, according to World Health Organization (WHO, 2007). Figure 1-a shows the distribution of BMI in male and female, almost all are between the normal range values, except for 14% of children whom showed overweight. For children of four years old, only 7.1% of female showed undernutrition, the upper BMI values indicate obesity (7.1 %) and the rest fall into the normal range, it means there is not evidence of malnutrition. On the other hand, 14 % of male showed symptoms of obesity and 86 % are in the normal values (Figure 1-b). These results contrast with the previous report made by Romo *et al.* (2006) whom reported that the undernutrition index of totonaco children was higher than those showed here. Finally, male under five years old (Figure 1-c), showed overweight (30 %), obesity (30 %) and normal (40%), whereas 12.5 % female of the sample analyzed showed obesity and the rest fall between normal values (87.5 %).

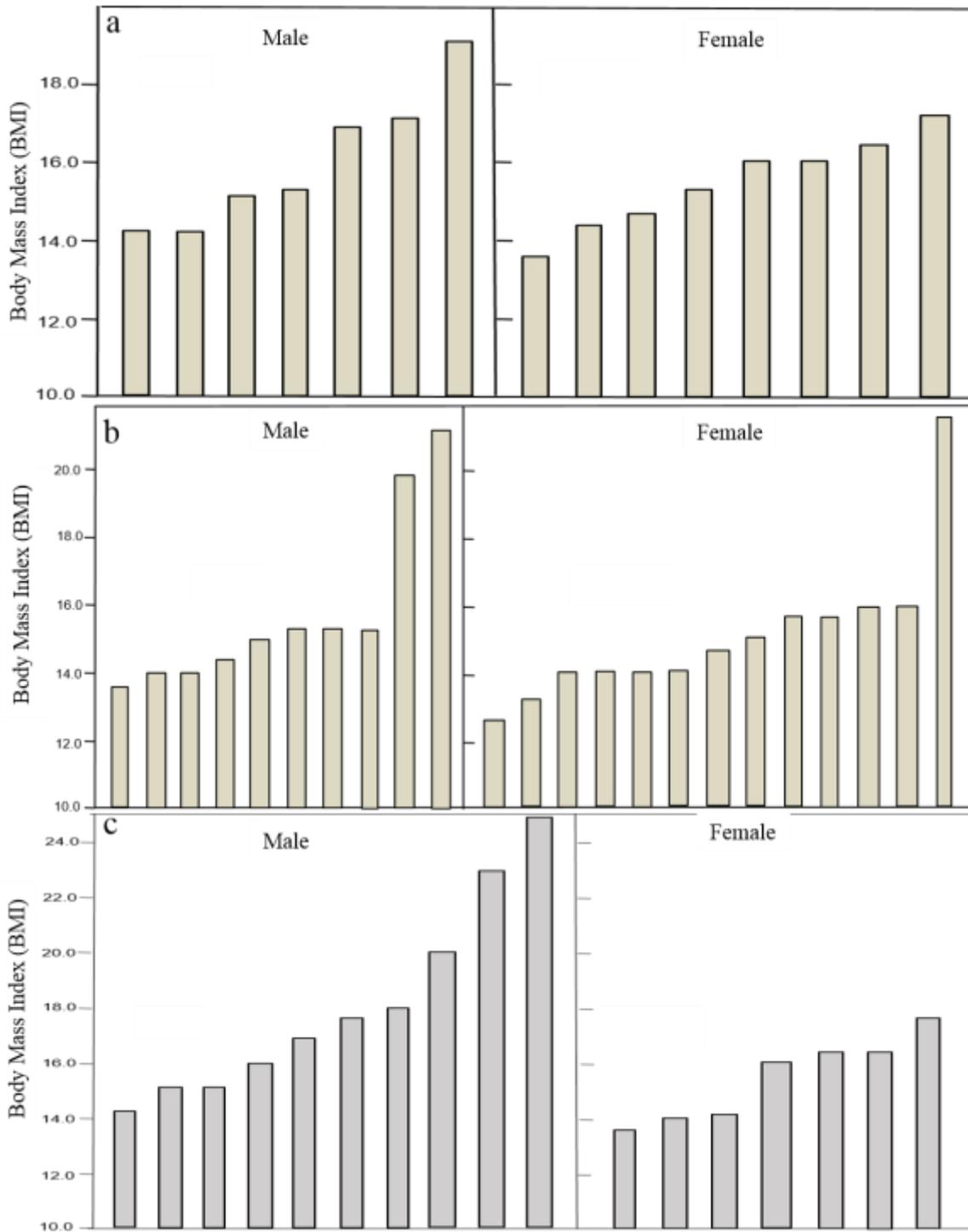


Figure 1. Body Mass Index. a) BMI distribution of three years old children; b) BMI distribution of four years old children and c) BMI distribution of five years old children.

The results showed above indicates that there is not an apparent evidence of malnutrition in the children (between 3 to 5 years old) on Huehuetla, Puebla, however, in order to corroborate these results was analyzed the quality and amount of food daily consumption by children through the application of questionnaires. The data obtained are observed in Table 1, allowing us a diet classification: low, average and rich diet in calories, the amount of calorie consumption was estimated from the tables reported by the Mexican Institute of Social Security (IMSS, 2017). The amount of Kcal/day consumed by children varies from 830-1150 Kcal/day.

We must mention that children consume the same amount of food during the day (breakfast, meal time and dinner) and therefore, the same amount of Kcal/day. Furthermore, is also important to maintain that children have direct access to a local, seasonal fruit diversity such as orange, mandarin orange, lemon, lime, guava, watermelon, papaya, mamey, sapota, vanilla, coffee, chili, banana and peanut; through the year has always been available, some of these fruits are collected by children directly. Most of the data collected from questionnaires are according to the previous report made by Romo *et al.* (2006) whom reported that totonaca family including in their daily diet beans, corn, green chile, soup, egg, chicken and pork meat, rice, sweet potato, sugar, bread, seasonal fruit and animal fat. In this study, we noticed that around 20% of totonaca children have access to a varied rich food (Table 1).

Table 1. Diet of indigenous children of the Totonacapan. a) Low calories diet; b) Average diet in calories and c) Rich diet in calories.

(a) Low calories diet			(b) Average diet in calories			(c) Rich diet in calories		
Brekfast	Meal	Dinner	Breakfast	Meal	Dinner	Breakfast	Meal	Dinner
Soap	Soap	Soap	Beans	Beans	Beans	Beans	Beans	Beans
Rice	Rice	Rice	Egg	Egg	Egg	Egg	Chicken meat	Egg
Potatoes	Potatoes	Potatoes	Chicken meat	Chicken meat	Chicken meat	Chicken meat	Pork meat	Chicken meat
Beans	Beans	Beans	Pork meat	Pork meat	Pork meat	Pork meat	Beef	Pork meat
Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin sprouts	Pumpkin sprouts	Beef	Fish meat (once a month)	Beef
Sprouts	Sprouts	Sprouts	Sprouts	Potatoes	Potatoes	Fish meat (once a month)	Tuna fish (once a month)	Fish meat (once a month)
Egg	Egg	Egg	Potatoes	Seasonal fruit	Seasonal fruit	Tuna fish (once a month)	Pumpkin sprouts	Tuna fish (once a month)
Seasonal fruit	Seasonal fruit	Seasonal fruit	Seasonal fruit	-	-	Pumpkin sprouts	Potatoes	Pumpkin sprouts
-	-	-	-	-	-	Potatoes	Seasonal fruits	Potatoes
-	-	-	-	-	-	Seasonal fruits	Snacks	-
Kcal/day (830-890)			Kcal/day (900-1000)			Kcal/day (1000-1150)		

Is important to remember that an individual person obtain energy from carbohydrates (50-60 %), fats (30-35 %), proteins (10-15 %), as well as vitamins and minerals. In this study, we realized that children have a diet relatively low content in fats. The feed children analysis in this study indicates that carbohydrate consumption is high and is obtained from cereals and tuber, where corn is the predominant and include tortillas, tamales and other preparations, additionally rice, potato and sweet potato which are consumed by around 60 % of children and it is consumed between two or three days a week. The main source of proteins is obtained from meats and beans, where 70 % of children consumed from 3 to 7 days a week. Beans are the leguminous most consumed (95 %) and is consumed daily, between vegetables, chili, onions and pigweed. It's important to mention that children have three meals by day, but the same variety and amount is repeated.

The relationship between the amount of calorie intake and BMI of totonaco children are shown in Figure 2. For children three years, 40 % of them consume less Kcal/day than those recommended (900 Kcal/day) (Figure 2-a). In the case of children of 4 and 5 years old, 30 % suffer malnutrition (Figure 2-b and Figure 2-c). These data indicate that there are not a direct relationship between BMI and daily calorie consumption, although existed a $R^2 > 0.80$ in all correlations.

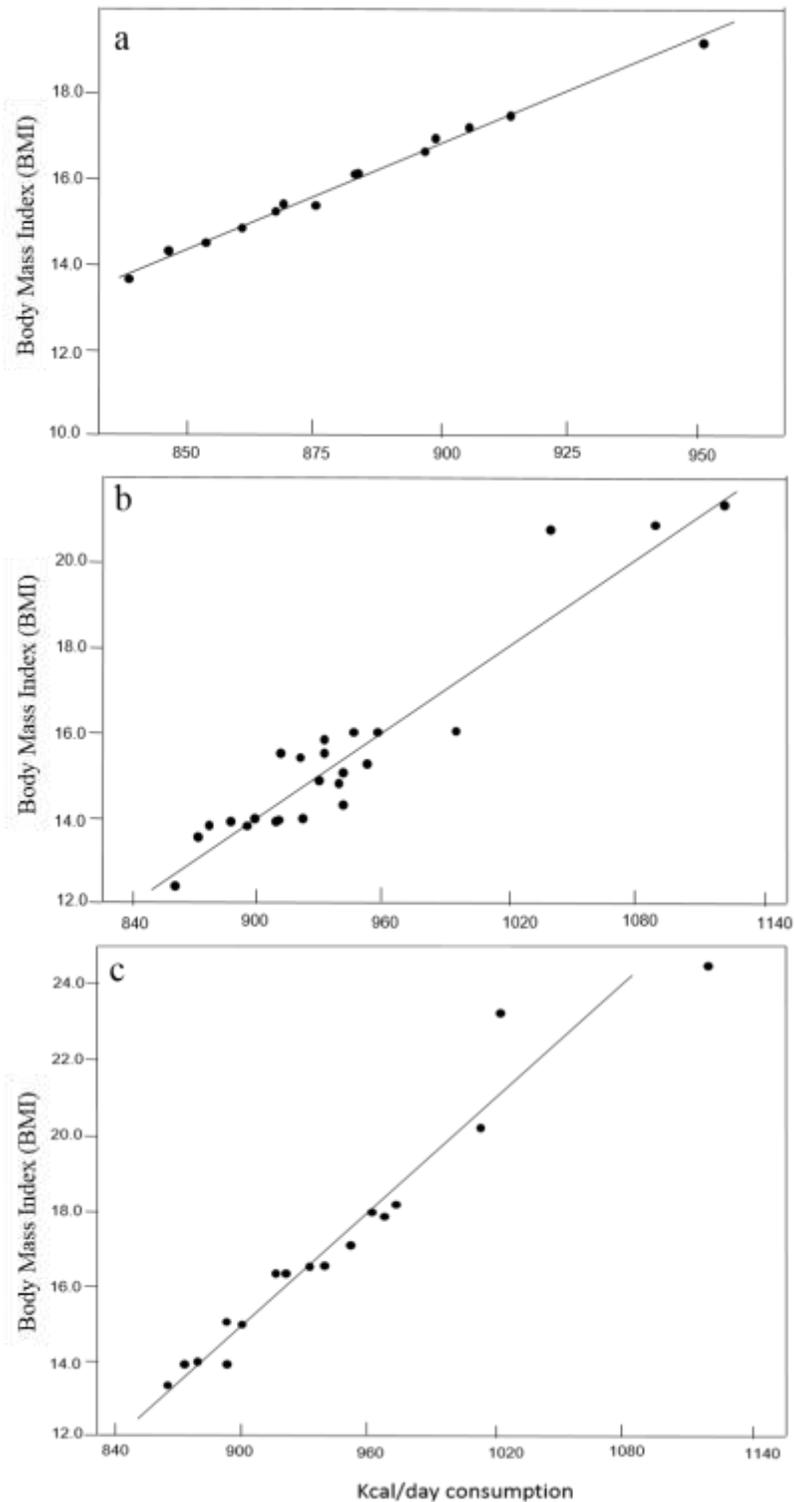


Figure 2. Relationship between Body Mass Index distribution and calorie intake. a) Relationship between BMI distribution and calorie intake by male and female of tree years old; b) Relationship between BMI distribution and calorie intake by male and female of four years old and c) Relationship between BMI distribution and calorie intake by male and female of five years old.

According to our results, it is concluded that totonaco family children with low incomes consumed in average 860 Kcal/day (Table 1, a), average incomes (950 Kcal/day; Table 1, b) and high incomes (1125 Kcal/day; Table 1, c). This contrast drastically with a previous report (Romo *et al.* 2006) whom reported 604.2 Kcal/day average consumption and in that report, children consumed between 20 to 30 protein grams daily (25 % of total required), 50 % of total fat recommended and a general deficit of caloric intake (47 %). In this work, these deficiencies have been reduced drastically, although was not quantified, the amount of carbohydrates, fats and proteins were higher than these reports. Other foods that are not included in the tables and nor commented, is the chayote fruit and mushroom were not considered in this work because their consumption is sporadic and have low content of carbohydrates.

On the other hand, daily calorie consumption by totonaco children, according their age indicated that the amount of calorie intake is almost minimal to recommend, for example for three years old children is around 850-950 Kcal/day (Figure 2-a) where the minimal recommended is 900 Kcal/day. For four year old children, calories consumption ranging from 850 to 1150 Kcal/day (Figure 2-b) and finally, five old year children the food caloric content was 860 to 1140 Kcal/day (Figure 2-c). According to the American Heart Association, children between 2 to 3 years old need around 900-1000 Kcal/day; based on a sedentary lifestyle, but when children is moderately physically active, he needs additionally 0-200 Kcal/day, when is very physically active, they need 200-400 Kcal/day. However, making the same analysis for children between 4 to 8 years old is widely recommended that female must intake 1200 Kcal/day and the diet must be include 25-35 % fats and for male is necessary 1400 Kcal/day and must contain almost the same fat amount.

Discussion

In Mexico, in the years 1999 to 2006, there were about 1.5 million children under the age of 5 years old that suffering chronicle undernutrition (González de Cossio *et al.* 2009). The reduction of malnutrition in the Mexican children have been reduced at higher rates between poorest populations, indicating the success of the Mexican government policies to reduce the poverty (Rivera *et al.* 2009). The prevalence of childhood chronicle malnutrition in Mexico could be analyzed since four main regions: north, center, south and Mexico City; for 2012, the southern region showed the highest index of chronicle undernutrition (25 %) in children younger than 3 years old (Gutierrez *et al.* 2012), in meantime in urban areas still remains much lower.

In the case of indigenous children, chronicle malnutrition diminished around 39.8 % between the years 1988 and 2012, although at a lower rate than non indigenous children (52.4 %), this was possible thanks to the implemented government programs, where the chronicle undernutrition was diminished at higher rates between years 1999 to 2006. The causes of malnutrition of children of Totonapacan community may be the result of the following factors: high incidence of infectious diseases, inadequate hygiene of children and deficient health services. These risk factors are consequence of the inequity resource distribution, services, wealth and opportunities. Actually, the main actions performed in order to reduce the infantile undernutrition in indigenous regions of Mexico is through the reinforcement of health programs and social development and including food supplied subsidies, but extra effort is still needed to implement services of primary health care such as breast feeding, supplementation and adequate feeding and well balance diet. However, is necessary personal operative training on these programs and create a supervision with the purpose of revising food distribution and revise and adequate implementation of health services (Gutierrez *et al.* 2012).

The early childhood cover since birth to 5 years old and is a decisive stage in the development of specific physical and intellectual capabilities in each child. This stage is considered the most vulnerable due to the formation of competences and essential conditions of the rest of life. In Mexico, 25.8 % of children are exposed a serious failings in the availability of food (UNICEF Mexico, 2016). This percentage varies considerably by region, for example, for the year 2002, Chiapas reported that 40 % of children experienced undernourishment in 2nd and 3rd degree, in meantime for 2015 was reported that 36% of Mexican children suffered malnutrition. On the other hand, in 2010 the development of the indigenous people in Mexico reported that 38 % of native children suffered chronicle malnutrition, where the adverse effects of undernutrition in the long term is irreversible, between them cognitive and physical development.

Mexico is undergoing a nutritional transition which is characterized by the prevalence of different types of undernutrition (Rivera *et al.* 2013) and anemia (de la Cruz-Góngora *et al.* 2013) in children under five years old. Depart from diminishing the stunting and anemia in the last 25 years in the general population in Mexico, this problem is still high in rural and indigenous populations. The existing national programs and policies such as the Human Development Program, namely oportunidades (Rivera *et al.* 2004), offer a subsidy in milk distribution (Licons) (Rivera *et al.* 2010) and more recently, the National Crusade against Hunger (Social Development Secretariat, 2010) have tried to decrease malnutrition and anemia, but on the hand, certain sectors of the population have increased the obesity index. In the last national survey (2012), Mexico faces a dilemma or dual problem, because the infantile population has been experimented overweight and obesity (Cepeda-López *et al.* 2011), on the other hand, anemia (12-23 %) and stunting (14 %) persisting.

According to Kroker-Lobos *et al.* (2014), anemia and obesity prevalence may be due to food consumption of low calorie content instead of food with high calories in terms of proteins and nutrients (Hernández *et al.* 2012). The southern region is the poorest region in Mexico with the highest rural and indigenous areas. In this area, child malnutrition begins since pregnancy and through the first years of life (Kroker-Lobos *et al.* 2014), there are several factors that promote this phenomenon between them food insecurity, which play a key role in stunting children, including the fast food demand of energy and nutrients in order to achieve a fast development. But, there are other physiological factors which could be also considered such as grastical capacity diminished, where is necessary a frequent food intake as a consequence of the immaturity of the gastrointestinal system, and a persistent tradition of eating foods considered as “adequate” for children; furthermore, these children probably have an immature immune system, which may lead to infections and diseases in unhealthy environments (Kroker-Lobos *et al.* 2014). All these factors can lead to malnutrition, despite having food security, but with the peculiarity of consuming unhealthy food. An anemic and stunting children can begin to gain weight after about two years old and then developing overweight, although remains anemic.

Since 1997, when Oportunidades program started (namely Progres), México showed evidences based on malnutrition prevention, over all when was attended families with low income and in their members included children under age one, as well as pregnant women and nursing infants who received fortified foods or nutritional supplements (breastfeeding infants between 6 to 23 month age). The results were immediate because nutritional benefits of the program were positive and encourage the child's growth with the concomitant anemia index reduction (Rivera *et al.* 2004). In recent years, the program has been modified the distribution of food supplements with

the purpose to reduce the amount of calories and micronutrient composition in order to avoid undesirable effects, as well as overweight. Other programs, such as the program responsible for distributed fortified milk (Rivera *et al.* 2010) and nutritional program have been implemented in isolated communities without educational and health services, who showed encouraging results in the nutritional status of children (Leroy *et al.* 2010).

On the other hand, Mexican government launched a program denominated crusade against hunger with the intention of reduce food insecurity; which include plans of strengthening nutritional food components distributed by the program oportuidades (Social Development Secretarit, 2013). But, when this program was released, was not taking into account the notice that 70 % of adults and 33 % of children suffered overweight or obesity, benefiting only at low income population, which was the target of the program. In spite of these advances, there is a continuing need to integrate nutritional programs to resume the notion of “eat healthy” and therefore is also highly recommendable to include a program of physical activity through the different stages of life.

Malnutricion of totonaco children in the north mountains of Puebla, including 21 municipalities which was reported previously by Romo *et al.* (2006) where undernourishment was visible in all communities analyzed, but thanks to health and food security program known as Progresa, undernutrition index diminished drastically, especially in children. Romo *et al.* (2006) reported that totonaca families showed relatively low life quality and well-being indexes which are underneath of the basic living conditions that an individual requires for their normal development. At that time, Progresa program help to improve the nutritional level of totonaco children in Puebla since it was implemented in 1994, this program reduced drastically precarious conditions of totonaca families, including migration reduction in periods of food scarcity and employment; this allowed to the families have an a minimal income, however, does not solve the problem of poverty. In 2001, the living conditions of 16 from 21 totonaco municipalities of the State of Puebla (CONAPO, 2001) suffered very high marginalization and extreme poverty.

Actually, the program crusade against hunger, as well the National Comission for Development of indigenous Mexican people (CDI), PESA-FAO and Totonaco children (private association) programs have achieved considerable progress in order to demolish infantile malnutrition because these programs benefit more than 90 % of the local population, among them pregnant women as well as children under seven years old, who are the most vulnerable sector of the population. The totonaca families invest 97% of the money that they receive to purchase food and clothing. In the work published by Romo *et al.* (2006), the authors make explicit reference that undernutrition of totonaco children was chronicle, but in this work has been found that malnutrition has been diminished drastically, according to the index mass body (BMI) data collected and their relationship with the amount of calories ingested. Only one child of the sample studied suffer undernutrition, indicating that food supplies and health services implemented by the Mexican government have had a positive impact in the life quality of indigenous totonaca population, at least in the head municipality of Huehuetla. Furthermore, the vaccination program taken by the Secretary of Health has covered at 100% children under the age of 5 years in this indigenous population, administering vaccines against poliomyelitis, diphtheria, pertussis, tetanus, measles, rubella, parotiditis and tuberculosis.

Conclusion

The children sample analyzed in this study and in accord to anthropomorphic measurements (body mass index), indicate that there is not apparent malnutrition on totonaco children between three and five years. But, when was performed the daily calorie consumption, data indicate that there was undernutrition of approximately up 30% of the total children sample. However, the social programs undertaken by the Mexican government have been helped considerably in order to reduce malnutrition in totonaco children, especially on the head municipality of Huehuetla, Puebla.

Conflict of interest

The authors declare that there is no conflict of interest.

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