Artículo Original

Food insecurity in homes of mothers of premature newborns with anthropometric alterations at birth

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ABSTRACT

Introduction: Preterm newborns are physiologically immature and have special nutritional needs for growing and developing adequately. There are not enough studies that show a relationship between food insecurity in households with premature infants.

Objective: To analyze food insecurity in the homes of preterm infants and identify its association with variables like family status and newborn anthropometry (weight, length, and head circumference).

Methods: A Cross sectional study was conducte in 45 mothers who were applied the Latin American and Caribbean Household Food Security Scale, with preterm newborns from 30 to 37 weeks of gestation (WG) in a public hospital.

Results: A 49% households had food security while 51% had food insecutiry (28.8%, 8.8%, 13.3% had mild, moderate, and severe food insecurity respectively). There were differences between the groups more than 1 day of hospital stay (72% households with food security vs 95% households with food insecurity, p = 0.044). The anthropomethric variables showed significant differences for the weight (p = 0.015), length (p = 0.027) and head circumference (p = 0.002) for the newborns with and without food security.

Conclusions: It is not only important to control nutrition during pregnancy, but also food security, especially severe food insecurity that the anthropometric variables of preterm newborns can have an impact.

KEYWORDS

Premature infant; food insecurity; anthropometric; breastfeeding

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INTRODUCTION

According to the *World Health Organization*, preterm is defined as born before 37 weeks of pregnancy, regardless of birthweight[1]. Worldwide, there are 15 million preterm births a year; 20% of these infants have some degree of malnutrition. In Mexico, the prevalence of preterm births is 7.3%, where 135,820 pretern infants born between 32 to 37 weeks gestational age (WGA) (2011)[2]. In the state of Guanajuato, the Ministry of Health recently reported an increase in preterm births, from 6 to 10%[3].

The etiology of preterm birth is multifactorial: placentary, maternal, socioeconomic and nutritional factors condition fetal and postnatal development. Some cause of prematurity are weight gain during pregnancy, teenage pregnancy, urinary tract infections, malnutrition, poverty, smoking and alcohol consumption[4].

Birthweight is an indirect marker of a mother's nutritional status and general wellbeing. Preterm infants make up a high-risk population, particularly vulnerable to developmental delay[5]. On the other hand, the rate of preterm births is an indicator of a population's overall health, and it is related to socioeconomic status, maternal health, access to adequate health care, and public policies concerning maternal and perinatal care. Nutritional problems in both children and adults are telling of the deprivation that socially, economically and

culturally vulnerable populations experience[6]. They are also a reflection of a population's living conditions, their social status and the State's investment in the health.

According to the Food and Agriculture Organization of the United Nations[7] and the United Nations Committee on Food Security consider that "*food security exists when all people, at all times, have physical and economic access to sufficient safety and healthy foods that cover their nutritional needs and food preferences for an active and healthy life*"[8].

Socioeconomic aspects, access to public services, allow achieving food security in households[9]. A study in Mexican preterm infants by Monroy Torres et al., Showed inadequate dietary practices (Deficience in quantity and quality in the foods) in the homes where the preterm infants would live. Many households not had access to water and electricity in their homes (public services) in addition to have a low income. All these conditions have a negative impact on the growth and development of preterm infants[4].

It has been demonstrated that poor nutrition during the first years impact in neurocognitive development, resulting in poor performance at school and subsequent low productivity in adulthood[5]. The prognosis for these children worse when is considered that most families with preterm infants already face economic and sociodemographic disadvantages that hinder optimal development[10].

Un estudio en Argentina encontró que cualquier niño o adulto en un 69.5% había experimentado un episodio de hambre, además de verse obligado a reducir la ingesta de alimentos debido a la falta de alimentos; para los niños esto tendrá un impacto en su crecimiento[11,12].

These evidence let us consider as main objective of our study to analyze food insecurity in mothers with a preterm born with variability in weight, length and head circumference at birth as consider the food security a perinatal risk variable. These would allow us to identify and describe indicators that validate the need for food and nutrition monitoring programs designed for households during pregnancy.

METHODS

Study area

Guanajuato is a Mexican state located in the middle area of the country and according to the 2015 intercensal National Population Census, Guanajuato has 5 853 677 inhabitants, representig the 4.9% of the total of the country[13]. Guanajuato is divided into 6 socioeconomic and geographic regions[13]. with 46 municipalities. Guanajuato State has a hight prevalence in preterm births, from 6 to 10%, with an average 17 deliveries a week, acording with the Ministry of Health recently[3]. The study protocol was reviewed and approved by the Research and Ethics Committee at the Mother and Child Hospital with number 22-12/001-13.

Study population

A cross-sectional analytical study was conducted with 45 mothers (households) of preterm infant, recruited from the Ministry of Health Mother and Child Hospital in León, Guanajuato. Sampling was carried out in consecutive cases over the course of one year. Inclusion criteria were mothers from the state of Guanajuato with preterm infants (<37 WGA) whose medical records included birthweight, length, and head circumference data.

The hospital's gynecology and neonatology specialists were asked to refer patients in accordance with inclusion criteria. The mothers signed an informed consent before taking part in the study. Anthropometric indicators obtained from infants' medical records were birthweight, length, head circumference and gestational age.

The Latin American and Caribbean Household Food Security measurement scale[14] addpated for México was applied to mothers for measuring food security. This scale estimates the last three months and classifies the household in the following categories: secure household, household with mild insecurity, household with moderate insecurity, household with severe insecurity. It consists of 15 questions, 8 referring to adults in the home and 7 related to children under 18 years of age in the home and has four answer options: YES, NO, NS: not sure, NA: no answer.

For each household, we analyzed socioeconomic status, education, income, number of family members and family situation. We considered as family situation the mother's marital status or the presence of a partner or other family member. These data were complementary to the food security diagnosis. Other features and variables were supplemented with data from the newborns' medical records.

The study protocol was reviewed and approved by the Research and Ethics Committee at the Mother and Child Hospital. As to statistical analysis parametric and nonparametric descriptive analyses as well as percentages. The *chi-squared test* was used for analyzing association with food security and main anthropometric variable in preterm infants, an Odds Ratio was calculating too. *With p <0.05, an 80% power*. Data were analyzed using STATA® version 2.0, 2006 statistical software package.

RESULTS

The mothers' average (median) age was 25±6.8 years (15 to 42 years). A 18% of mothers had incomplete primary education; 29% had completed elementary school, a 32% had attended middle school and 12% had some high school studies (Table 1).

The birthweight average was 2042 g ± 0.690g (Range= 0.600 to 3000 g); the length was 43±4 cm (26 to 50 cm

range); the head circumference was 32 cm, and average length was 42.5 cm; the gestational age was 33±3 WGA (27 to 36 WGA range); a 68% of the babies were delivered by cesarean and 32% by vaginal delivery. The food insecurity was associated with the hospital stay greater than one day *(p<0.05)* (Table 1)

Table 1. Analysis of food insecure households versus Food security and its comparison with some variables of mothers and newborns.

N=45	Food safety n=22	Food insecurity n=23	*p value*	*OR* (CI**)*
Mothers				
Mother's level of education, n (%)				
No schooling	0	2 (8.6)	*7.302*	*4.00 (0.17 – 94.05)*
Primary education	4 (18.1)	4 (17.3)		
Incomplete primary education	0	3 (13)		
Secondary education	7 (31.8)	6 (26)		
Incomplete secondary education	4 (18.1)	5 (21.7)		
High school	4 (18.1)	1 (4.3)		
Incomplete high school	2 (9)	1 (4.3)		
University	1 (4.5)	1 (4.3)		
Maternal age (years), mean ± SD	25 ± 6.5	24 ± 7.1	*0.509*	———-
Mother's weight gain (kg), mean ± SD	10 ± 6.7	12 ± 7.9	*0.483*	———-
Pregestational weight (kg), mean ± SD	60.5 ± 13	55.3 ± 12.5	*0.155*	———-
Labor birth, n (%)Caesarean operation, n (%)	6 (27.2)	4 (17.3)	*0.635*	1.78 (0.83 – 1.56)
Caesarean operation, n (%)	16 (72.7)	19 (82.6)		
Gestational Diabetes Mellitus (DMG), n (%)	1 (4.5)	2 (8.6)	*0.311*	2.00 (0.17 – 23.78)
Preeclampsy, n (%)	5 (22.7)	6 (26)	*0.069*	1.20 (0.31 – 4.69)
Newborn				
Weight (g), mean ± SD	2.3 ± 0.4	1.9 ± 0.62	*0.015****	———-
Head circumference (cm), mean ± SD	32.7 ± 2.2	30 ± 3	*0.002****	———
Length (cm), mean ± SD	45.9 ± 2.5	41.6 ± 6.4	*0.027****	———
More than 1 day of hospital stay, n (%)	16 (72)	22 (95)	*0.044****	———
Gestational weeks (GW), mean ± SD	34 ± 2.3	33 ± 3.6	*0.435*	———-
Apgar, mean ± SD	8.4 ± 0.7	8.5 ± 0.5	*0.496*	———
Steroid, n (%)	13 (59)	17 (74)	*1.112*	1.96 (0.56 – 6.92)

The values of the quantitative variables are expressed in medians and ranges. Qualitative variables are reported in frequencies and percentages. The comparison analysis was performed with the chi square test. Odds Ratio (OR)* was calculated to measure associated risk factors, with their respective Confidence Interval (CI)**. Variables without normality were analyzed with the Mann-Whitney U test. *** Values with statistical significance.

According to socioeconomic situation, 24% of the family income was destined for foods. The average energy intake (median) per family was 1675 Kcal, with a macronutrient distribution of 17% protein, 27% fats and 55% carbohydrates. The average number of family members was 3 (from 2 to 8); 57% of mothers were single, living with a relative, while the rest lived with their partners.

As to the main occupation of the infants' mothers, 86.6% were homemakers, 6.6% were students and the remaining 6.6% had other activities.

Food insecurity analysis

A 49% of households had food security and 51% food insecurity (28.8%, 8.8%, 13.3% had mild, moderate, and severe food insecurity respectively). It found statistical significance to compare weight (p= 0.015), length (p= 0.027) and head circumference (p= 0.002) of preterm newborn with the food insecurity (Figure 1 and table 1). Respect to some specific questions of the validate scale we found that a 65% of the mothers had worry about not having access to foods in the last three months while a 28% of these percent said that not had foods in reallity. Other variables that we meassument were that a 51% of mothers reported not feel healthy, neither had a good diet where only a 40% had a variety diet.

A 39.9% mentioned that an adult in their homes had skipped a meal due a to lack or economic or other foods resources and a 48% mentioned that an adult in their homes had eaten less than they should; a 19% reported that, in the last three months, some adult in their homes felt hungry but did not eat due to a lack of economic or other resources.

DISCUSSION

Food security is a population's right to be guaranteed a nutritional status that allows for healthy living. A lack of economic resources directly obstructs the achievement of food security. In the case of preterm newborns, vulnerabilities inherent to their physiological immaturity increase the cost of care and nutrition. The situation is further complicated by the problems detected in our study, such as the mothers' low levels of education; this is especially significant in Mexico, where mothers are still mainly responsible for child rearing and nutrition[15].

We observed that 87% of mothers were homemakers. This could be beneficial for their families, because mothers are usually attentive to the management of home finances and distribution of food among family members. However, this fact alone does not guarantee a lower risk of food insecurity, as the distribution of resources, decisions and intrafamilial dynamics vary among homes and even among family members.

With these outcomes we can infer that the mothers in our study did not have a healthy diet during pregnancy. Considering that evidence has as main risk factors for to have a preterm born a maternal undernutrition, we can analize that was a causal factor in our study in particular[16]. As to the an-

Figure 1. Variables for the newborns with and without food security.
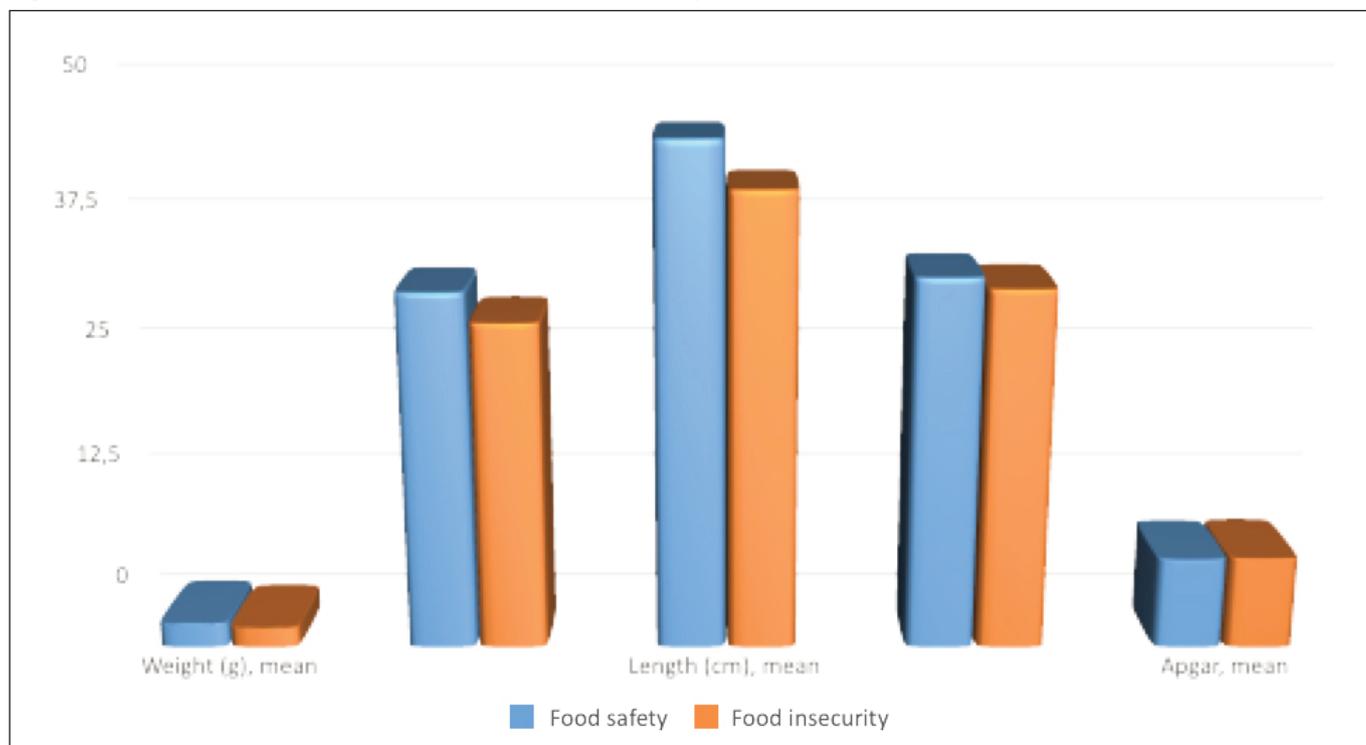
thropometric variables, our results show the infants' average birthweight, length and head circumference were low, in agreement with other studies conducted in this age group[17].

Preventing malnutrition and its long-term complications should be a priority for many countries and governments, especially those with high rates of preterm deliveries, because of the seriousness of the health and nutrition risks associated with these conditions. Reducing malnutrition demands not only a medical intervention, but economic and social measures as well[18]. The causes of malnutrition (undernutrition or obesity) are very complex and involve biological, socioeconomic, and cultural determinants. These factors are rooted in insufficient access to nutritious foods, deficient health services, inadequate sanitation, and poor practices in the home. The ultimate underlying cause is social inequality in the distribution of resources, knowledge, and opportunities[19]. Families with low incomes lack the economic resources for securing their access to food, regardless of its availability in local or regional markets. This kind of food insecurity usually fluctuates, it can be temporary or variable, and is subject to the influences of taboos and other customs[20,21]. Nutritional counseling is a crucial strategy for disease prevention in both adults and Food security is a population's right to be guaranteed a nutritional status that allows for healthy living. A lack of economic resources directly obstructs the achievement of food security. In the case of preterm newborns, vulnerabilities inherent to their physiological immaturity increase the cost of care and nutrition. The situation is further complicated by the problems detected in our study, such as the mothers' low levels of education; this is especially significant in Mexico, where mothers are still mainly responsible for child rearing and nutrition.

Rodríguez Villamil et al., mentioned the household should facilitate the fulfillment of a series of specific functions for the individual and the family, among them acquisition, preparation, consumption, and food sanitation. However, diferents determinats affects directly and indirectly to the family lossing the control in had food security[22].

In this study the average number of members per family was low, but we must consider the range of members because most of the mothers were teenagers who planned to have more children, wich the age is a risk factor. Most mothers were living with relatives and had no support from their partners. It is important to consider respect we found more household with food insecurity.

A hospital stays more than one day for the premature was associated in premature with food insecurity which is an indicator of vulnerability in develop cardiometabolic risks factors as diabetes mellitus, cardiovascular disease. Higher preeclampsia in the mothers were observed. Therefore, food insecurity should be included in the list of risk factors to be avoided during pregnancy.

According to socioeconomic characteristics, most of the families had a low incomes wich difficult to do a food security. Considering the costs involved taje care a preterm infant the situation will be complicated cause for special baby formula for example. In the study by Monroy-Torres, et al., they analyzed the socioeconomic situation of households with preterm infants found that most dietary and nutritional practices were inadequate, both in quantity and quality of the food and nutrients, with lack to public services. In addition to give formula milk to their babies instead of exclusive breastfeeding that is de best food during the firs six months and more[5].

Health and education centers would have to be involved in this effort; other studies have investigated that education services should be involved in the management of prematurity as educational programs for children with special needs. A study by Chavez- Castillo et al., found that severe food insecurity was associated with auditory disfunctions in 27.2% of cases and in 2.8% of controls (OR: 12.75 CI=2.89-56.16) respect to education level for mother there were differences between the groups regarding the education level (cases: 50% of the mothers finished or interrupted primary education level vs controls *with 19%; Ji2 = 0.008*) and respect to the anthropomorphic variables showed differences in weight, length and head circumference (p < 0.000). (*p = 0.001*)[23,24].

These initial findings let to consider integrating to food insecurity as factor risk during pregnancy.

Strengths of the study: This first finding allows us to identify food insecurity as a probable variable of prenatal risk or during pregnancy. Although the Latin American validity scale to measure food security in households has been implemented for more than 10 years, it has not been integrated for clinical studies or periconceptional outcomes, especially in preterm births. These findings, although anthropometric variables are evaluated for everything that implies that a household has food security, this model could study a greater scope such as preventing or reducing premature birth.

Limitations of the data: One limitation was the sample size that could had improved an causality inference analysis.

INTERPRETATION

Exist an association with food insecurity in mothers of preterm born with variability in weight, length and head circumference and due to what preterm newborns are physiologically immature, to have special nutritional needs for growing and developing adequately. These findings show the importance of considering the measurement of food security in pregnant woman and not only the anthropometric variables, with the suggestion that it can be monitored as a prenatal risk variable to achieve adequate and homogeneous growth in prematures.

Currently we promote a program untitle "Follow of nutritional state in children born with preterm conditions" this program is in collaboration con Observatorio Universitario de Seguridad Alimentaria y Nutricional del Estado de Guanajuato (OUSANEG), University of Guanajuato and Ministry of Health.

CONCLUSIONS

Our findings indicate that most preterm infants will live in households with some level of food insecurity (mild to severe). It is not only important to monitor nutrition during pregnancy but food security, especially severe food in order to improve the anthropometric variables at the birth of the prematures and even the same prematurity. These findings show the urgent need to review and reform current feeding and nutrition programs to serve this population group studied before children return home, so that preterm newborns have the opportunity to grow up in an environment in which they can grow and develop their maximum human potential and prevent the known consequences of food insecurity in preterm infants from obesity and cardiometabolic diseases in adulthood.

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