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Association between food insecurity and perinatal risk factors with hearing problems in preterm birth

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ABSTRACT

Background: hearing disorders in the premature newborns impact on their development and language and therefore, on their quality of life. Several risk factors have been associated to these conditions, but little is known about socioeconomic, nutrition factors and food security.

Objective: to analyze the association between food security and prenatal risk factors in newborns with hearing disorders.

Methods: study of 35 cases and 105 controls in premature newborns from 30 to 37 weeks of gestation (WG) in a public hospital. The working tool was a

questionnaire to collect data about the maternal medical record and the anthropometry of the newborn, as well as the risk factors for the auditory function, sociodemographic aspects, and food security with its respective classification and food habits.

Results: the principal perinatal risk factor associated to hearing impairment was the use of gentamycin (ototoxic drug) in 18.1% of the total (OR: 5.61 [1.29-24.50]). Severe food insecurity was associated with auditory disfunctions in 27.2% of cases and in 2.8% of controls (OR: 12.75 [2.89-56.16]). 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%; Ji^2 = 0.008). The anthropomorphic variables showed differences in weight, length and cephalic perimeter for the newborns ($p < 0.000$).

Conclusion: severe food insecurity**,** exposure to gentamycin and low education level of the mother had a significant association with auditory impairments in preterm children. For these newborns, variables like weight, length and cephalic perimeter at the moment of birth were lower than in controls. These initial findings point to the important role that environmental risks, like food insecurity, have in auditory impairments in addition to those previously described.

Key words: Premature birth. Hearing loss. Risk factors. Nutritional status.

INTRODUCTION

The function and development of a newborn's hearing system is associated with maternal and newborn health status, so a comprehensive perinatal evaluation is important to identify the underlying causes when hearing impairment is detected (1). Physiological and anatomical alterations generate conductive and neurosensory hearing loss, however, there is not yet enough evidence to describe their etiological factors (2). In Mexico, around ten million people have some type of hearing impairment (WHO); from them, between 200,000 and 400,000 have total deafness.

Each year, between 2,000 and 6,000 children with congenital hearing loss are born. Three out of 1,000 newborns will suffer from hearing loss, if this condition is not detected and attended in a timely manner (3). Hearing impairment during childhood impacts on language skills and could cause neurocognitive underdevelopment. The cost of health care for a child with hearing loss exceeds more than three times that of a child with normal hearing. Genetic origin represents 25% of the total cases, 25% are non-genetic factors and the rest is unknown (50%) (4).

Preterm infants (those born before the 37th week of gestation) present immaturity in different organs and systems, including hearing, which could affect the neuromotor development (5). The nutritional aspects (food security) are within that 50% of risk factors still undescribed. The rate of premature births is an indicator of the health conditions of a population, and has been associated with socioeconomic status, maternal health, proper access to adequate health services, quality of care and public policies in maternal and perinatal health (6).

Worldwide, about 13 million preterm deliveries occur each year. Its frequency varies from 5 to 11% in developed countries and to 40% in underdeveloped countries, where 20% of these children present some type of malnutrition at birth (6,7). In 2002, Mexico had a prevalence of prematurity of 8.9%, 13.7% corresponding to third-level hospitals (2,8). In 2006, the Ministry of Health reported an increase in preterm deliveries from 6 to 10% (1,783 preterm births) in the State of Guanajuato, with an average of 17 births per week. Of the 1,783 preterm births, 266 did not survive due to extreme prematurity. In addition, the Ministry of Health of the State of Guanajuato, states that the first cause of perinatal morbidity for 2005 was prematurity, with 86.5% of the total causes (congenital, chromosomal abnormalities such as neural tube defects and acute respiratory infections) (9). The main causes of prematurity are related to maternal conditions as obesity during pregnancy, age, urinary tract infections, malnutrition, poverty, tobacco and alcohol consumption (10); also diabetes, hypertension, anemia, inadequate prenatal control and work stress play a role

in inducing premature deliveries (11). Exposure to environmental contaminants in water, air, food or at work are causal factors that have been previously described (10).

Arsenic exposure during pregnancy generates alterations in prenatal growth and development, with intrauterine growth retardation, low weight, miscarriages and prematurity (10). A study conducted in Bangladesh showed that prenatal exposure to arsenic was associated with lower weight of the newborn at birth, and that it is dose dependent, when the exposure to arsenic in drinking water is chronic (12). Another aspect is the low birth weight and maternal health status, which have been associated with food insecurity (13).

According to the World Organization for Food and Agriculture (FAO Food Security), food security exists when individuals or families, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences, being the access permanent and constant to allow their development (14,15). To measure food security, four indicators are considered: availability, sufficiency, stability and access (16). According to the results of the National Health and Nutrition Survey (NHNS 2012), in Mexico, 70% of the population presented some level of food insecurity (17.7% moderate and 10.5% severe) (17). For Guanajuato, in 2010, food insecurity was 40.7% (10.2% of households had severe food insecurity) (18).

Other risk factors associated with hearing disorders are the length of stay in the neonatal Intensive Care Unit longer than five days and with assisted ventilation, as well as the administration of ototoxic antibiotics (gentamycin, tobramycin), and loop diuretics (furosemide). Furthermore, other risk factors are the presence of hyperbilirubinemia which requires exchange transfusion and the development of intrauterine infections such as cytomegalovirus, herpes, rubella, syphilis and toxoplasmosis (1,19).

Therefore, the objective of this study was to evaluate the main risk factors associated with hearing impairment in premature newborns and integrating others such as known exposure to arsenic, food insecurity and sociodemographic aspects.

MATERIAL AND METHODS

A case-control design was carried out, with a final sample size of 35 cases and 105 controls, from 2016 to 2017, in a public hospital in Leon, Guanajuato. For the calculation of the sample size, food insecurity was considered as the main risk factor, which for Guanajuato is 71.2%. Once the mothers of the premature newborns signed the letter of informed consent, the main variables of the study were collected. The inclusion criteria were: newborns with a prematurity of 30 to 37 weeks of gestation (WG), born in a public hospital and who had a complete hearing screening study, with positive (cases) or negative results (controls) and with complete data in the file.

The auditory screening was carried out with the Otoread device (Interacustics®, series 9039018), which has a sensitivity of 91% and a specificity of 85%. This equipment performs transient evoked otoacoustic emissions (TEOAE), with a frequency range from 500 Hz to 4,000 Hz and a stimulus intensity of 83dB SPL (± 3dB). This test evaluates the function of outer hair cells and was performed in a noise isolated environment. To test de TEOAEs, the equipment's olive was inserted in the external auditory canal of the newborn, preferably asleep and in the supine decubitus position. The duration of the auditory test was four minutes (two minutes for each ear).

To evaluate the arsenic exposure, a database with arsenic levels in water of the municipalities of the State of Guanajuato was consulted. The database was created by researchers from the Environmental Nutrition and Food Security Laboratory of the University of Guanajuato, who analyzed the samples with the Arsenator® equipment. With this database, the place of residence of each mother was located and identified as exposed or not exposed (< 0.025 mg/l according to NOM-127-SSA-1996).

To measure food security, the Latin American Food Security Classification (ELCSA) was applied. This tool estimates the last three months of pregnancy 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, eight referring to adults in the home and seven related to children under 18 years of age in the home.

The frequency of food consumption was evaluated and a questionnaire about the food intake in the last 24 hours was applied within 24-hour postpartum, through a direct interview with the mothers. From the clinical record of the mother and the newborn, biochemical data, drugs prescribed for premature babies and other variables (mother's age, mother's age at first pregnancy, WG, weight, length and cephalic perimeter) were collected.

Statistical analysis

Percentages and measures of central tendency were applied, and for the comparison of mother's age, first pregnancy age, WG, weight, length and cephalic perimeter, a Mann-Whitney U test was applied. To measure the association of the main risk factors to the hearing impairment, a Ji^2 test and the odds ratio calculation (95% confidence intervals) were applied. Multivariate analysis and logistic regression were applied with the variables corresponding to the auditory risk. All analyses were made considering a significant difference of $p < 0.05$ and a power of 80%.

The project was approved by the Institutional Bioethics Committee of the University of Guanajuato (CIBIUG) CIBIUG-P24-2016. As well as the Ethics Committee of the Hospital de Especialidades Materno Infantil de Leon (HEMIL) register 094.

RESULTS

A total of 127 preterm (30 to 36 WG) infants were studied (33.4 ± 1.9 cases and 35.1 ± 1.5 control), 22 belonged to the case group and 105 to the control group. Nine preterm infants in the case group and 66 in the control group were males and the rest were females. For the group of cases, 50% of the mothers completed primary education, while 48.5% of the mothers of the control group completed secondary education ($p = 0.008$). The median age of the mothers in the group of cases was 26 years old (range of 17 to 40 years) and 22 years old

for the controls (range of 14 to 40 years). Regarding the number of gestations, 72.7% of the cases and 49.5% of the controls presented ≥ 2 gestations, of which 27.2% of cases and 16.1% of controls presented a history of prematurity for one or more previous pregnancies. The administration of vitamin supplements consisted mostly of folic acid for cases (90.9%) and controls (92.3%) (Table I). The place of residence was Leon, Guanajuato, for 77.2% of the cases group and 79% of the control group (Table II).

Among the main perinatal risk factors, 18.1% of premature infants were prescribed gentamycin for more than five days for cases group, and for the control group in 3.8% of newborns with prematurity (OR = 5.61; CI = 1.29-24.50). Only in the control group, the mothers of the premature infants presented intrauterine infection by cytomegalovirus (0.9%) and administration of loop diuretics (furosemide) for more than five days (0.9%) (Table III).

Urinary tract infection (UTI) was present in 50% of cases and 45.7% of controls and 9% of the group of cases had smoking and alcohol habits. The consumption of drugs during pregnancy was 72.7% for the case group and 61.9% for the control group (p ≥ 0.05) (Table III).

In the evaluation of food security, 18.1% of households in the case group and 45.7% of households in the control group were classified as households with food security. Severe food insecurity was 27.2% for the case group and 2.8% for the control group. Severe food insecurity was a risk factor (OR = 12.75, CI = 2.89-56.16) for hearing disorders, while household food security had a protective effect (OR = 0.26, CI = 0.08-0.83) (Table III).

In relation to mothers' exposure to different prenatal risk factors, 100% of the cases group and in 97.1% of the control group lived in areas that presented arsenic levels in water above the norm and 36.3% of the group of cases and 24.7% of the mothers of the control group reported drinking tap water without treatment (Table III).

Children of the group of cases had an average weight at birth of 1,640 g (935-3,450 g), a length of 41.3 ± 4.7 cm and a cephalic perimeter of 29.4 ± 3.0 cm. On the other hand, the control group presented a weight of 2,355 g (790-3,600 g), a length of 45.5 ± 3.7 cm and a cephalic perimeter of 32.2 ± 2.3 cm. Both

groups differ significantly in terms of WG (p = 0.000), weight (p = 0.000), length (p = 0.000) and cephalic perimeter (p = 0.000) (Table IV).

The caloric intake for the case group was 1,277 (with a range of 128-1,536 kcal) and 1,155 (with a range of 513-2,575 kcal) for the control group. For the nutrients, the cases had less than 80% of the recommended daily intake (RDI) of protein in 37.5%, fiber in 100%, iron in 87.5% and vitamin B6 in 87.5%. For the control group, nutrient intake less than 80% of the RDI was 30.4% for proteins, 84.75% for fiber, 69.5% for iron and 69.5% for vitamin B6. Statistical significance was shown for sugar consumption (p = 0.043) (Table V).

In the cases group, the products that provided macronutrients and micronutrients (ingested five to seven days a week by the mothers) were: milk (59%), fruits (50%), vegetables (31.8%); proteins were ingested two to four times a week and intake consisted of eggs (45.4%), fish (9%), chicken (36.6%), beef (36.3%) and pork (22.7%). In the control group, the foods that contributed nutrients were milk (70.4%), fruits (67.6%) and vegetables (45.7%), which were consumed five to seven days a week; for proteins, a consumption of two to four times per week of egg (52.3%), fish (4.7%), chicken (52.3%), beef (38%) and pork (20%) was evidenced. For the comparison, statistical significance was present for the consumption of fruits (p = 0.028), seasonal vegetables (0.002) and cookies, bars and pastries (0.019).

Ingestion of processed foods as cold cuts was observed in 36.3% and 46.6% of the case and control group, respectively (p = 0.304).

For multiple regression, 16 dependent variables were analyzed. For newborns: hyperbilirubinemia, WG at birth, weight, length, cephalic perimeter, Apgar score, Apgar score at five minutes, number of days hospitalized and birth route. For mothers: marital status, education level, occupation, current age, weight gain, preeclampsia, and gestational diabetes mellitus (GDM), taking as independent variable food security against food insecurity in the case and control group, finding an R^2 = 0.5502, p = 0.3978. The difference, therefore, is not statistically significant as a risk factor in the hearing variable. Individually, only one correlation was found with the education level (R^2 = 0.5557851, p = 0.0158); the rest did not have a significant difference.

DISCUSSION

The auditory disfunctions at birth generate long-term impacts on learning and a more pronounced lag in education. Therefore, sensory problems should be detected early in life, or possibly even at the prenatal stage (20).

There are several studies that have described risk factors associated with the etiology of hearing loss. Severe food insecurity was associated with hearing impairment (21). The period that the questionnaire tests spans the last three months, which corresponds to the third trimester of pregnancy, where the growth and development of the newborn must be completed.

It is known that the presence of severe food insecurity in a household, affects the quantity and quality of the key nutrients of food for the development of children (14). In this study, both for the control group and for the cases, the consumption of nutrients was found to be 80% below the RDI for fiber, calcium, vitamin B6, B12 and C. This was also true for the consumption of iron, which is an enzymatic cofactor involved in oxidation-reduction reactions, fundamental in cellular metabolism, and in the formation of hemoglobin (20). A nutrient intake of less than 80% may explain the lower weight in newborns compared to controls. Nutritional and energy deficiencies also affected the development and growth in utero. This nutritional status will depend on the duration of food insecurity, which may be transitory or could be perpetuated intergenerationally (14). In a study in which the correlation between hearing loss and low birth weight was measured, there was an incidence of sensorineural hearing loss of 0.3% and conductive hearing loss of 2.7% in newborns with low weight in the period from 1998 to 2000 (22). In our study, a similar result was obtained, although our group of cases presented a lower mean weight compared to the control group.

The key nutrients in embryonic development are: proteins, fat, lipids, folates, calcium, iron and zinc (23), which are found in the food groups corresponding to fruits, vegetables and food of animal origin (fish, meat, egg, cheese). Their low consumption reflects the insufficient intake of these nutrients, which is confirmed by the diagnosis of food insecurity in the households of the newborns

of the case group, with differences between cases and controls in the consumption of fruits (p = 0.028) and vegetables (p = 0.002). According to Bolzán A and Mercer R (2009), nutritional problems reflect situations of deprivation faced by population groups that present high social, economic and cultural vulnerability.

The scale used (ELCSA) measures the last three months, which reflects the last trimester of pregnancy, a period considered to be critical for fetal growth. Although the last three months were measured, there is evidence that an adequate diet from the beginning of pregnancy is key for good growth and fetal development (23). The correlation between deficiency of nutrients and hearing loss is still under study, however, some publications have associated these impairments with deficiencies of vitamin A and iron (24).

Food insecurity has a relationship with household poverty and is associated with limited economic access to food (25). Even though one of the limitations of our study was that the economic income of the families was not evaluated, other social conditions such as the education level were considered, finding that 50% of the mothers in the case group attended primary school, with a statistically significant difference (p = 0.008) with the control group. In Mexico, 20.6% of the population has educational backwardness (26), which means that such percentage of people do not attend school or they have not finished primary or secondary studies. In our study, this percentage is higher, since 81.8% of our case population has primary and secondary education, that is, their age does not correspond to their education level.

According to the aspects evaluated by the Joint Committee on Childhood Hearing (JCIH) (1,19), the data of our study show a weak association between the administration of gentamycin for more than five days and the presence of auditory alterations. This finding can be attributed to improvements in health care, since the presence of hyperbilirubinemia that requires blood transfusion, intrauterine infections and the administration of ototoxic drugs and loop diuretics is rare and strictly controlled in the hospital environment, since these

are recognized as risk factors that can lead to the presence of hearing loss in a newborn.

Although most of the participants to this research work belonged to the municipality of León, it should be noted that the municipalities of Silao, San Francisco del Rincón, Ocampo, San Luis Potosí, San Felipe and Purisima del Rincón share characteristics of environmental exposure to arsenic, similar to that of the municipality of Leon. In all of them the economic activities are mainly the mining industry, agriculture, oil industry and micro-industry (brick kilns, leather tanning, battery recyclers, small foundries, etc.). These economic activities generate metallic waste, pesticides pollution, uncontrolled deposits of industrial waste and hazardous organic compounds (27). Therefore, even though in our study the arsenic exposure was analyzed according to the place of residence, it is also necessary to evaluate the levels of exposure in the population for other pollutants.

A study conducted in Guanajuato found that the exposure to arsenic could be due to the direct consumption of contaminated water, but also to the use of this water in the cooking of food, preparation of beverages, irrigation of crops and consumption of milk from animals fed with water containing arsenic (28). In our study, water consumption was evaluated, showing that 36.3% of the mothers in the case group and 24.7% of the mothers in the control group reported consuming water from the tap or without treatment. However, the arsenic exposure according to the area of residence was also evaluated, finding that 100% of the cases group and 97.1% of the control group resided in areas that presented arsenic levels above the norm. Considering the aspects mentioned above, the levels of exposure to arsenic for our population could be higher than estimated, which means that further studies are necessary.

It is important to mention that one of the limitations of our study was the sample size for the case group, which was not completed, due to the low prevalence of premature infants with hearing impairment and the moderate coverage of the hearing screening in the place of recruitment due to circumstantial situations in the period in which the study was conducted, thus

generating a power of 40.4% of the study. In order to continue elucidating the findings and integrating the factors for decision making, additional work with a larger sample size and a higher periodicity should be performed.

CONCLUSION

This study allowed identifying the association between severe food insecurity and auditory alterations; as well as the association between exposure to gentamycin (perinatal risk factor according to the Joint Committee on Infant Hearing, JCIH) with the presence of auditory impairment. The mothers of the group of cases attended primary school as the maximum education level, with a statistically significant difference ($p = 0.008$) when compared with the control group. Likewise, the children of the group of cases presented lower values for weight, length and cephalic perimeter compared to the control group. Also, differences were found in the consumption of fruits ($p = 0.028$) and vegetables ($p = 0.002$) between the mothers of both groups. In summary, these initial findings give an overview of the main risk factors associated with hearing impairment and related to nutritional and environmental socioeconomic aspects. This information will allow to integrate timely interventions and achieve food security for pregnant women and their households. Finally, we propose to consider food security in the parameters of the JCIH for a more comprehensive evaluation of the hearing loss.

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Table I. General characteristics of mothers

General condition of mothers	Cases n = 22	Controls n = 105	p value	OR (CI)
Current age (years), median (range)	26 (17-40)	22 (14-40)	0.064	-
Years old 1st pregnancy (years), mean (range)	18 (15-35)	19 (14-34)	0.493	-
Number of gestations, n (%)				
1	6 (27.2)	53 (50.4)	0.047*	0.37 (0.13-1.01)
2 ≥	16 (72.7)	52 (49.5)	-	2.72 (0.99-7.49)
History of prematurity for 1 ≥ previous pregnancies, n (%)	6 (27.2)	17 (16.1)	0.219	1.94 (0.66-5.67)
Presence of anemia, n (%)	5 (22.7)	31 (26.6)	0.520	0.70 (0.24-2.07)
Consumption of vitamin supplements, n (%)				
Folic acid	20 (90.9)	97 (92.3)	0.815	0.82 (0.16-4.18)
Ferrous sulfate	16 (72.7)	74 (70.4)	0.832	1.12 (0.40-3.12)
Calcium	10 (45.4)	35 (33.3)	0.279	1.67 (0.66-4.23)

The values of the quantitative variables are expressed in medians and ranges. Qualitative variables are reported in frequencies and percentages. Variables without normality were analyzed with the Mann-Whitney U test. *Values with statistical significance.

Table II. Sociodemographic variables

Sociodemographic variables	Cases n = 22	Controls n = 105	p value
Mother educational level, n (%)			
Primary education	11 (50)	20 (19)	0.008*
Secondary education	7 (31.8)	51 (48.5)	
High school	3 (13.6)	24 (22.8)	
Technique	0	2 (1.9)	
Undergraduate	1 (4.5)	7 (6.6)	
Postgraduate	0	1 (0.9)	
No report	0	0	
Father educational level, n (%)			
Primary education	8 (36.3)	19 (18)	0.057
Secondary education	7 (31.8)	49 (46.6)	
High school	6 (27.2)	21 (20)	
Technique	0	1 (0.9)	
Undergraduate	1 (4.5)	7 (6.6)	
Postgraduate	0	0	
No report	0	8 (7.6)	
Place of residence, n (%)			
León	17 (77.2)	83 (79)	0.853
Another residence†	5 (22.7)	22 (20.9)	
Mother occupation, n (%)			
Housewife	16 (72.7)	73 (69.5)	0.875
Saleswoman	2 (9)	8 (7.6)	
Leather and footwear industry	2 (9)	8 (7.6)	
Other‡	2 (9)	16 (15.2)	
Father occupation, n (%)			
Building	3 (13.6)	11 (10.4)	0.4124
Leather and footwear industry	4 (18.1)	29 (27.6)	
Metal and textile industry	2 (9)	10 (9.5)	
Seller	0	7 (6.6)	
Merchant	1 (4.5)	8 (7.6)	
Driver	4 (18.1)	3 (2.8)	
Others§	7 (31.8)	35 (33.3)	
No report	1 (4.5)		

	2 (1.9)

The values are reported in frequencies and percentages. The comparison analysis was performed with the Chi-square test. *Values with statistical significance. †Other origin: Ocampo (n = 3), San Felipe (n = 2), San Francisco del Rincón (n = 12), Purísima del Rincón (n = 13), San Luis Potosí (n = 1), Silao (n = 1). ‡Student, nurse, graphic designer, lawyer, babysitter, secretary, radio operator, dispatcher, daycare teacher, maid. §Engineer, nurse, lawyer, graphic designer, school coordinator, waterproofing, loader, field work, parking valet, locksmith, carpenter, waiter, mechanic, plumber, assistant driver, public toilet, butcher.

Table III. Main perinatal risk factors

Perinatal risk factors	Cases n = 22	Controls n = 105	OR (CI)	p*
Prenatal for the mother				
Presence of intrauterine infection by cytomegalovirus, n (%)	0	1 (0.9)	-	-
Postnatal for the newborn				
Use of mechanical ventilation, n (%)	0	0	-	-
Administration of ototoxic antibiotics, n (%)	4 (18.1)	4 (3.8)	5.6 (1.3-24.5)†	-
Gentamicin	0	0	-	-
Tobramycin	0	1 (0.9)	-	-
Administration of loop diuretics (furosemide), n (%)				
Hyperbilirubinemia requiring exanguinotransfusion, n (%)	0	0	-	-
State of food security in the family				
Food safety, n (%)	4 (18.1)	48 (45.7)	0.26 (0.08-0.83)†	0.023†
Mild food insecurity, n (%)	9 (40.9)	44 (41.9)	0.96 (0.38-2.44)	0.339
Moderate food insecurity, n (%)	3 (13.6)	10 (9.5)	1.50 (0.38-5.97)	0.943
Severe food insecurity, n (%)	6 (27.2)	3 (2.8)	12.75 (2.89-56.16)†	0.0001
Exposure to arsenic by area of residence, n (%)	22 (100)	102 (97.1)	-	-
Consumption of tap water with arsenic, n (%)	8 (36.3)	26 (24.7)	1.74 (0.65-4.60)	-
Comorbidity, n (%)				
Preclamsia	3 (13.6)	17 (16.1)	0.82 (0.22-3.07)	-
Eclampsia	0	1 (0.9)	-	-
DMG	4 (18.1)	7 (6.6)	3.11 (0.83-11.73)	-
IVU	11 (50)	48 (45.7)	1.19 (0.47-2.98)	-
Consumption of alcohol and/or tobacco, n (%)	2 (9)	7 (6.6)	1.40 (0.27-7.24)	-

Medications received during pregnancy, n (%)	16 (72.7)	65 (61.9)	1.64 (0.59-4.54)	-
Occupation during pregnancy, n (%)	6 (27.2)	32 (30.4)	0.86 (0.31-2.39)	-

DMG: gestational diabetes mellitus; UTI: urinary tract infection. The variables are reported in frequencies and percentages. Odds ratio (OR) was calculated to measure associated risk factors, with their respective confidence interval (CI). *Values with statistical significance. †Calculation by proportions for the different classifications of the SAN and IA (< 0.05).

Table IV. Comparison with the anthropometric variables for both groups

Weeks of gestation and anthropometric values	Casos n = 22	Controles n = 105	p valor
Weeks of gestation (WG)	33.4 ± 1.9	35.1 ± 1.5	0.0001
Anthropometric values			*
Weight (g)	640 (935-3,450)	2,355 (790-3,600)	0.001*
Length (cm)	41.3 ± 4.7	45.5 ± 3.7	0.001*
Head circumference (cm)	29.4 ± 3.0	32.2 ± 2.3	0.001*

The values of the variables are expressed as means and standard deviations (±). Variables without normality were analyzed with the Mann-Whitney U test. *Values with statistical significance.

Table V. Maternal postpartum energy and nutrient consumption

Nutrients	RDI	Cases n = 8		Controls n = 46
		Energy consumption	% adequacy lower than 80, n%	Energy consumption
Energy (kcal)	2,000 (1,800-2,200)	1,277 (128-1,536)	8 (100)	1,155 (513-2,575)
Proteins (g)	51 (45-60)	45 (8-57)	3 (37.5)	55 (17-170)
Lipids (g)	57 (50-67)	35 (7-50)	7 (87.5)	29 (7-118)
Carbohydrates (g)	246 (217-290)	184 (9-271)	6 (75)	176 (11-530)
Sugar (g)	25	1 (0-63)	2 (25)	14 (0-108)
Fiber (g)	28	6 (3-16)	8 (100)	10 (0-69)
Cholesterol (mg)	< 300	237 (81-319)	4 (50)	150 (0-3,060)
Sodium (mg)	2,000-4,000	1,186 (192-2,473)	6 (75)	1,296 (284-4,146)
Iron (mg)	18 (15-20)	11 (2-15)	7 (87.5)	9 (2-55)
Calcium (mg)	1,000 (900-1,100)	788 (271-991)	4 (50)	654 (48-1,786)
Vitamin B6 (mcg)	1.8 (1.6-2)	0.4 (0-2)	7 (87.5)	0.8 (0-3)
Vitamin B12 (mcg)	2.0 (1.8-2)	1.3 (0-4)	4 (50)	1.6 (0-94)
Vitamin C (mcg)	60 (54-64)	16 (0-117)	5 (62.5)	30 (1-332)

RDI: Recommended daily intake. The values of the variables are expressed in medians and ranges. The variables were analyzed with the Mann-Whitney U test. *Values with statistical significance.