



**Breastfeeding and complementary feeding association with childhood obesity****Lactancia materna y alimentación complementaria en relación con la obesidad infantil****Aleitamento materno e alimentação complementar em relação à obesidade infantil**Edisson Javier Fiallos-Brito<sup>1\*</sup> , Silvia Carolina Villacrés-Gavilanes<sup>1</sup> <sup>1</sup> Hospital General Docente Ambato, Tungurahua, Ecuador.\*Corresponding author: [xv04@hotmail.com](mailto:xv04@hotmail.com)

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**ABSTRACT**

**Introduction:** childhood obesity globally is an unresolved health problem, becoming increasingly present in all countries with not appropriate standard treatment strategies. **Objective:** to describe the relationship between breastfeeding, complementary feeding and formula milk in childhood obesity. **Method:** an observational cross-sectional study was conducted in 126 children, aged of 6 months to 2 years, treated at the Hospital General Docente Ambato, Ecuador, in 2019. The variables studied were as follow: age, sex, nutritional status, exclusive breastfeeding duration, time of initiation in complementary feeding and duration providing formula milk. Descriptive statistics and the nonparametric Mann-Whitney U test were applied. **Results:** infants between the age of 6 to 12 months (50.8%) and female sex (55.2%) predominated. Of the total of children, 62.1% apply in obese profile, 70.6 % were exclusively breastfed in their early 6 months (2 months less than obese patients). The same behavior was observed in

those who received complementary feeding and in those who consumed formula milk for 2.5 months. **Conclusions:** most children in the study were classified as obese. Obese children had a short frequency of exclusive breastfeeding and consumed complementary feeding and formula milk for a longer period of time rather than children with normal weight.

Keywords: childhood obesity; breastfeeding; complementary feeding; formula foods

**RESUMEN**

**Introducción:** la obesidad infantil es un problema de salud mundial, no resuelto, con incremento en todos los países. Para ello no existen estrategias de tratamiento estandarizadas. **Objetivo:** describir la relación entre la lactancia materna, la alimentación complementaria y leche de fórmula con el riesgo de obesidad infantil. **Método:** se realizó un estudio observacional, de corte transversal, en 126 niños comprendidos entre 6 meses a 2 años de edad, atendidos en el Hospital General Docente Ambato en el año 2019. Las variables estudiadas fueron edad, sexo, estado nutricional, el tiempo de lactancia exclusiva, el inicio de alimentación complementaria y el tiempo de consumo de la leche de fórmula. Se aplicó la estadística descriptiva y la prueba no paramétrica de U de Mann-Whitney. **Resultados:** predominaron en este estudio los infantes entre 6y12mesesdeedad que representaron el 50,8%, se destacó el sexo femenino con el 55,2%. De los 126 niños estudiados se observó que el 62,1% estaban dentro del perfil de obesos, el 70,6% recibió lactancia exclusiva en los primeros 6 meses de vida, siendo 2 meses menor por los clasificados en el perfil de obesos. Igual comportamiento se observó en los que recibieron alimentación complementaria y en 2,5 meses los que consumieron leche de fórmula. **Conclusiones:** la mayoría de los niños en el estudio estaban clasificados como obesos. Los niños obesos tuvieron un tiempo de lactancia exclusiva más corto y consumieron alimentación suplementaria y leche de fórmula por un período de tiempo más largo que los niños con un peso normal.

**Palabras clave:** obesidad infantil; lactancia materna; alimentos complementarios; alimentos formulados

**RESUMO**

**Introdução:** a obesidade infantil é um problema de saúde global não resolvido, com aumento em todos os países. Não há estratégias de tratamento padronizadas para isso. **Objetivo:** descrever a relação entre aleitamento materno, alimentação complementar e fórmula láctea com o risco de obesidade infantil. **Método:** estudo observacional, transversal, realizado em 126 crianças entre 6 meses e 2 anos de idade, atendidas no Hospital Geral de Ambato em 2019. As variáveis estudadas foram idade, sexo, estado nutricional, tempo de amamentação exclusiva, o início da alimentação complementar e o tempo de consumo da fórmula láctea. Aplicou-se estatística descritiva e o teste não paramétrico Mann-Whitney U. **Resultados:** lactentes entre 6 e 12 meses de idade predominaram neste estudo, representando 50,8%, o sexo feminino se destacou com 55,2%. Das 126 crianças estudadas, observou-se que 62,1% estavam dentro do perfil obeso, 70,6% receberam aleitamento materno exclusivo nos primeiros 6 meses de vida, sendo 2 meses mais jovem para aquelas classificadas no perfil obeso. O mesmo comportamento foi observado naqueles que receberam alimentação complementar e em 2,5 meses os que consumiram leite de fórmula. **Conclusões:** a maioria das crianças do estudo foi classificada como obesa. As crianças obesas apresentaram menor tempo de aleitamento materno exclusivo e consumiram alimentação complementar e fórmula láctea por mais tempo do que as crianças com peso normal.

**Palavras-chave:** obesidade infantil; aleitamento materno; alimentos complementares; alimentos formulados

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## INTRODUCTION

The development and prevalence of childhood obesity has increased alarmingly in recent years, which constitutes a major health risk for children; therefore the World Health Organization (WHO) has called it the epidemic of the 21st century.<sup>(1)</sup> It belongs to one of the current health problems affecting children worldwide, regardless of their ethnicity, race or social class, corresponds with it in developed and developing countries.<sup>(2)</sup>

Compared to children who are not obese, children with obesity between the ages of 6 months and 2 years are three times more likely to maintain these parameters at age 4 years.<sup>(3,4)</sup> The onset of obesity in infants is related to the nutrition they receive during the first months of life. The introduction of complementary foods and formulas can have a negative impact on the health of infants in the short, medium and long term, which can increase their risk of disease and mortality. Therefore, it is important to pay attention to the proper nutrition of infants from the beginning to promote healthy growth and development.<sup>(1,3,5)</sup>

Several authors have identified limitations in the nutritional process in the childhood population, but so far no effective community strategies have been implemented to address this problem.<sup>(3)</sup> Most studies on the management and prevention of obesity focus on adults and older children, but it is crucial to identify the factors associated with obesity during the first years of life in order to implement early prevention strategies. In this way, it is more effective to prevent obesity than to treat it in the future.<sup>(6)</sup>

Several studies have been developed with the aim of determining the factors that contribute to the obesity epidemic, which has an evident genetic component.<sup>(7)</sup> However, in recent decades it has been observed that there are modifiable factors that also play an important role, such as: family habits, availability of high-calorie foods, lack of time to eat as a family, the influence of advertising and parenting styles. These factors have been related to a higher incidence of nutrition-related morbidity and mortality in the first year of life. Therefore, weight development in infancy becomes a critical and potentially important time for obesity prevention.<sup>(1,6,8)</sup>

The WHO has identified obesity as a very serious global health problem, with levels of overweight and obesity reaching alarming proportions worldwide and affecting people of all ages. This has led to a significant increase in metabolic diseases and their consequences: a cause for great concern.<sup>(9)</sup>

If left untreated, childhood overweight and obesity tend to persist into adolescence and adulthood<sup>(4)</sup>, predisposing people to develop diseases such as diabetes, heart disease, musculoskeletal disorders and other health problems.<sup>(6)</sup> These nutrition-related diseases are a leading cause of disability and death, and represent high costs for health systems worldwide.



In Ecuador, according to the National Health and Nutrition Survey conducted by the Ministry of Health, it is estimated that approximately 148 000 children under 5 years of age are overweight or obese, representing an increase of 10.4% from 1986 to 2016.<sup>(10)</sup> In addition, it has been observed that mothers provide foods other than breast milk to their babies from the first month of life, which led to the conduct of this research, for which the objective is to describe the relationship between breastfeeding, complementary feeding and formula milk with the risk of childhood obesity.

## METHOD

A cross-sectional observational research was developed through the review of medical records of the Health Care Registry Platform (PRAS), Hospital General Docente Ambato, Ecuador, during 2019, under previous authorization.

The study universe consisted of 234 children (N=234), aged 6 months to 2 years, who received care at the hospital. The final sample consisted of 126 children (n=126), who met the inclusion criteria of having complete information to carry out the study. The exclusion criteria were based on: having experienced previous episodes of malnutrition, metabolic, oncological and immunological conditions.

The variables studied were: age, gender, nutritional status, exclusive breastfeeding, initiation of supplementary feeding and infant formula.

The descriptive statistical methods used were frequencies and percentages; the mean and median were used for the age variable.

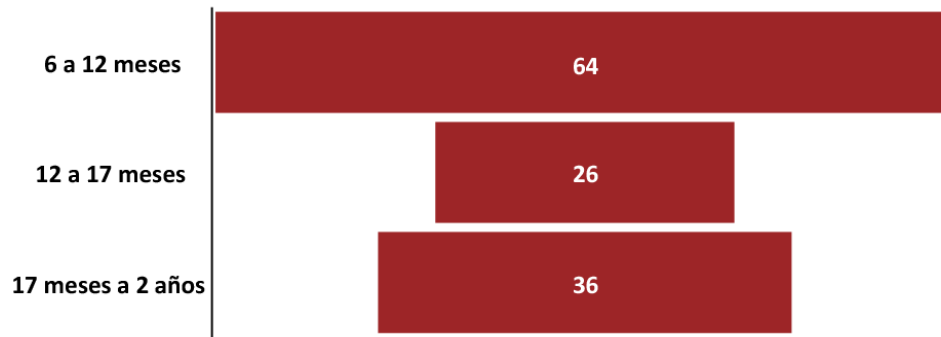
For the analysis of feeding characteristics and nutritional status, the Mann-Whitney U statistical methods were used and, to calculate nutritional status, the Z score of the body mass index for age (BMI/E) was used, which was determined with reference to the tables of the World Health Organization (WHO).<sup>(11)</sup>

In the context of this research, the data were entered into Microsoft Excel tables and graphs and then processed and analyzed using the SPSS version 25.0 statistical software. The results obtained were represented in the form of graphs and tables to facilitate their understanding.



## RESULTS

Children between 6 and 12 months of age predominated, representing 50.8% and corresponding to the characteristics of the study population (Figure 1).



**Fig. 1** Age groups

Source: PRAS, 2019.

The descriptive analysis of the variables gender, nutritional status and exclusive breastfeeding are shown in Table 1.

There was a predominance of the female gender with 55.2 % (69); the male gender was represented by 44.8 % (57). Of the 126 children studied, 62.1% (77) were found to be obese and only 37.9% (49) were normal. Of the sample studied, 70.6 % (89) were exclusively breastfed in the first 3 months of life, while 29.4 % (37) were not.

**Table 1** Behavior of the variables gender, nutritional status, breastfeeding and lactation

Variables	Indicators	Frequency	%
Gender	Male	57	44,8
	Female	69	55,2
	<b>Total</b>	<b>126</b>	<b>100,0</b>
Nutritional status	Normal	49	37,9
	Obese	77	62,1
	<b>Total</b>	<b>126</b>	<b>100,0</b>
Breastfeeding up to three months	Yes	89	70,6
	No	37	29,4
	<b>Total</b>	<b>126</b>	<b>100,0</b>

Source: PRAS, 2019.

Descriptive statistics and the nonparametric Mann-Whitney U test were applied to contrast the time of exclusive breastfeeding, the initialization of complementary feeding and the formulated milk with the weight variable (BMI). Because the data for most of the categories did not have a behavior adjusted to a normal distribution, statistical validity was placed at  $p \leq 0.05$  (Table 2).

It was observed that those who presented obesity had an exclusive breastfeeding intake 2 months lower on average. Moreover, this difference was even greater in males: about 3.5 months. The data analyzed showed a significant difference ( $p=0.008$ ) in relation to the male gender.

**Table 2** Comparison between dietary characteristics and nutritional status

	Median values		U of Mann-Whitney
	Normal (months)	Obese (months)	p
Exclusive breastfeeding time	3	1	0,004
Male	4,5	1	0,008
Female	3,3	1	0,059
Introduction of complementary feeding	4,7	6,3	0,001
Male	6,2	4	0,003
Female	6,2	4	0,002
Consumption time of formulated milk	8,4	10,3	0,006
Male	7,9	10,1	0,024
Female	9,1	10,5	0,079

Source: PRAS, 2019.

The research also analyzed the characteristics of complementary feeding and its relationship with nutritional status. It was observed that the age of initiation of complementary feeding in children with obesity was, on average, 2 months younger compared to those without obesity. Significant differences of  $p=0.003$  and  $p=0.002$  were shown in boys and girls, respectively.

The composition of complementary feeding was reflected in that 32.5 % (41) ingested fruits, 28.4 % (37) industrialized baby foods, 27.1 % (34) vegetables and 12 % (14) cereals.

The study also evaluated the time of consumption of formula milk and its relationship with nutritional status. It was found that children with obesity consumed on average 2.5 months more formula milk than those with a healthy weight. In addition, significant differences ( $p=0.024$ ) were observed in boys.

## DISCUSSION

The findings of this study are consistent with the literature reviewed, which suggests that children with obesity between 6 months and 2 years of age are three times more likely to maintain this condition at 4 years of age, compared to those without obesity.<sup>(3,4)</sup> Furthermore, feeding in the first months of life is a key factor in the development of obesity, where the age and timing of initiation of complementary feeding, as well as the duration, influence morbidity and mortality in the short, medium and long term.<sup>(1,3,12)</sup>

Obesity between 6 months and 2 years of age is due to genetic, epigenetic, behavioral and environmental factors. Some of these factors, such as behavioral and environmental factors, can be changed in childhood with clinical interventions by health specialists.<sup>(12)</sup>

Inadequate complementary feeding in infancy affects future body composition. For example, infants who drink high protein, low-fat milk formulas are at increased risk of overweight and obesity.<sup>(13)</sup>

Protein overfeeding in infancy, especially in formula-fed infants, can lead to accelerated growth and increased growth factors, increasing the risk of obesity.<sup>(14)</sup> Therefore, it is important that feeding strategies focus on providing adequate complementary feeding from six months of age, including a variety of foods from all food groups and combined with breastfeeding. Consistency and variety of foods should be gradually increased, and processed and ultra-processed foods should be avoided as much as possible.<sup>(15)</sup>

Research has shown that infants who are formula-fed may have higher blood levels of insulin compared to those who are exclusively breastfed. This may stimulate fat deposition and early adipocytes development in the infant body, which increases the risk of obesity and other associated complications. Therefore, it is important to encourage exclusive breastfeeding during the first 6 months of an infant's life to reduce formula consumption and minimize the risks of childhood obesity.<sup>(16)</sup>

Obesity can be influenced by sociodemographic factors, as several studies have shown. Certain ethnic groups, such as Aborigines, Hispanics and South Asians, have been found to have a higher propensity for obesity during childhood. In addition, children living in low-income countries with greater food security are more likely to develop obesity, as are those living in urban areas compared to those living in rural areas. In high-income countries, children from lower socioeconomic classes have a higher rate of obesity compared to children of higher socioeconomic status. It is important to take these factors into account in the prevention and treatment of childhood obesity.<sup>(17)</sup>

The analysis of the variables examined made it possible to identify the current weight conditions in the population studied and to point out how complementary feeding may represent an additional risk factor for overweight. Childhood obesity was found to be a major public health problem that can prematurely generate medical complications, psychological complications, comorbidities and mortality. It is crucial for health professionals to identify overweight and obese children and adolescents in order to offer them advice on adopting a healthy lifestyle and practicing physical activity.



Although this study provides information on the relationship between breastfeeding, complementary feeding and formula milk with the risk of childhood obesity, it is important to consider the limitations of the research study due to the sample size used and the observational design. It is recommended to complement new studies to confirm and extend these findings.

## CONCLUSIONS

Most of the children in the study were classified as obese. Obese children had a shorter exclusive breastfeeding time and consumed supplementary feeding and formula milk for a longer period of time than children with normal weight. Significant differences in the results were observed according to gender in some of the analyses performed. These findings suggest that effective strategies need to be implemented to prevent and address childhood obesity in this population, including encouraging breastfeeding and reviewing the introduction of supplemental foods and formula milk.

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**Conflict of interest:**

The authors declare that there were no conflicts of interest in the research.

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