

ORIGINAL ARTICLE

## Relationship Between Maternal Sleep Quality and Child Nutritional Status

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Highlights:

1. There is no relationship between poor maternal sleep quality and child nutritional status.
2. Pittsburg sleep quality index as an assistive technology.

ABSTRACT

**Objective:** To analyze the relationship between maternal sleep quality and child nutritional status. **Methodology:** Cross-sectional study carried out with mothers and children in a private pediatric institution in a municipality in Maranhão between March and December 2020. The mothers who participated were aged between 17 and 42 years old, while the children were aged between 6 and 24 months. The data collected included children's weight, height and body mass index, in addition to sociodemographic, perinatal and maternal sleep quality issues. The analysis used descriptive statistics and logistic regression models for associations between perinatal characteristics and child nutritional status in terms of maternal sleep quality. **Results:** It was found that 54.5% of the children were females, 80.6% aged between 6 and 24 months; 62.4% of mothers were married, with an average age of 29 years ( $SD \pm 5.7287$ ). There was no significant association between child nutritional status and poor sleep quality ( $p > 0.05$ ). **Conclusion:** In this study, we were unable to identify relationships between sleep and child nutrition. In other words, poor sleepers do not represent an increased risk of influencing inadequate infant nutritional status. **Implications for practice:** The use of the Pittsburg Sleep Quality Index, as an assistance technology, helps to improve health care for mothers and their children, expanding the possibilities of resources for nursing work.

**Keywords:** Sleep. Women. Nutritional Status. Child. Nursing.

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## INTRODUCTION

Nutritional status is an important indicator of health conditions and is mainly determined by the socio-economic situation of families<sup>1</sup>. In recent years, Brazil has been undergoing a nutritional change, with the number of overweight and obese children increasing and child malnutrition decreasing<sup>2</sup>.

Children do not usually eat the recommended daily amount of essential nutrients, and this is a worrying situation, since the quality and quantity of food consumed by children affects their health throughout their lives. Childhood is seen as a stage of vulnerability to nutritional deficiencies and problems<sup>3</sup>.

Depleted nutritional status is reflected in the immune system; therefore, when faced with an infection, malnutrition is a facilitator of the spread of infections. An appropriate diet, rich in specific nutrients, can delay this degradation of immunity, reduce the occurrence of secondary infections and improve the therapeutic response<sup>4-5</sup>.

Between 2011 and 2013, there was a worldwide nutritional transition from 101 million underweight children under the age of five to 42 million overweight children in the same age group. Among the various causes of child mortality, one third is associated with malnutrition and the other portion with obesity<sup>1,6</sup>.

In the last 16 years, the number of overweight children and adolescents aged between 5 and 19 has practically doubled, from one in ten to almost one in five<sup>7</sup>. Specifically in the state of Maranhão, a survey carried out in 2006 showed that 3.9% of children were diagnosed with malnutrition and 6.7% were diagnosed as overweight<sup>8</sup>.

Some studies show that contemporary society has suffered a reduction in the quality and quantity of sleep, due to the fact that people need to work or have leisure time<sup>9</sup>.

The daily activities carried out by women can suffer losses due to the poor use of their sleep, which generates unsatisfactory performance at work and quality of life, in addition to causing a strong social and economic impact<sup>10</sup>. Sleep is essential for maintaining human life, as it has a restorative function. Its deprivation can cause damage to the immune system, healing processes, as well as physical and/or mental health<sup>11-12</sup>.

Other aspects related to poor sleep quality in women, such as maternal demands, extra work at night, excessive daytime sleepiness, snoring, sleep apnea and insomnia also seem to increase the vulnerability of people who depend on their care, namely children<sup>13</sup>. Nevertheless, there are still no studies on the relationship between maternal sleep quality and child nutritional status<sup>14</sup>. This fact is worrying, as the modulation of maternal sleep may have repercussions on children's health in the future.

The mother's perception of her child's nutritional status is essential for early intervention and thus preventing possible nutritional disorders<sup>15-16</sup>. The difficulty in terms of recognizing nutritional status contributes to the increase in overweight children<sup>17</sup>.

Based on these considerations, we can see the importance of carrying out studies that investigate this relationship between the quality of mothers' sleep and the nutritional status of their children, since existing publications highlight associations focused on the presence of health problems or diseases specifically in the woman; therefore, it is believed that progress can be made in the investigative approach regarding the effects on children. Thus, the objective of this research is to analyze the relationship between maternal sleep quality and child nutritional status.

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## METHODOLOGY

This is a cross-sectional and descriptive-analytical study, carried out in a private pediatric institution in a city in the state of Maranhão.

Data collection started in March 2020, being interrupted in the same month, due to the new Coronavirus (COVID-19) pandemic. However, with the gradual opening of health establishments, the research carried out at the pediatric clinic was resumed in July and completed in December of the same year.

The target population involved the dyad (mother-child). In order to determine the sample size, a calculation was performed in the G\* Power 3.1<sup>18</sup> software, using a chi-square analysis, with 20% medium effect size, 0.85 or 85% power and significance level ( $\alpha$ ) equal to 0.05 or 5%. Accordingly, the calculation revealed that 225 children and 225 mothers should be studied, resulting in 450 participants.

To this end, convenience sampling was used, consecutively, where all mothers of eligible children were invited to participate in the research until the proposed size was reached. However, the final sample was not reached, due to the reduction in the flow of services in the field of study, caused by the health measures in force during the COVID-19 pandemic. Accordingly, the final sample consisted of 165 children and 165 mothers, totaling 330 participants.

The following sample eligibility criteria were used: mothers aged in the reproductive phase (10 to 49 years old), biological or adopted and who were accompanying their children at the time of the research; children aged between 6 months and 5 years, males and females, were included. Mothers who underwent psychotherapeutic monitoring and/or used sleep-inducing medications during the research period were excluded; the exclusion of children involved those with congenital malformations, genetic syndromes, endocrinopathies, cardiopathies, neuropathies, pneumopathies or nephropathies.

All steps of data collection were carried out by a single researcher, previously trained to familiarize herself with the instrument and ensure adequate quality in terms of verifying the measures. It should be noted that, due to the pandemic scenario, participants were informed about the need to respond to the questionnaire online, through the WhatsApp® application.

A single electronic instrument was used, which consisted of a closed questionnaire with objective questions, prepared using the Google forms tool, in order to obtain information from the mother-child binomial, namely: sociodemographic and anthropometric data and sleep quality. The mothers responded to the questions on the same day as the children's anthropometric assessment.

In the first part of the instrument, the sociodemographic and perinatal assessment involved: child's information (name, age, sex, origin); mother's information (name, age, profession/occupation, education, marital status, family income); perinatal information (gestational age, weight and length of the baby at birth, risk during pregnancy).

The second part of the instrument included information about the child's current diet and anthropometric data (weight, length/height and BMI). Regarding anthropometry, Welmy® anthropometric scale/Balmak® pediatric scale and infantometer/stadiometer were used; in order to calculate BMI, an Elgin® calculator was used. When checking their weight, children under two years of age were accompanied by their mothers and were placed on the pediatric scale in the supine position, undressed. When measuring the weight of children over two years of age, they were dressed but barefoot. These children remained in an orthostatic position in the middle of the anthropometric scale platform.

The length of children under two years of age was checked by placing them in the supine position on a flat horizontal surface, with the head resting firmly on the end of the infantometer, neck

straight, chin away from the chest, shoulders and back fully in contact with the surface, arms extended along the body or held over the belly, and the feet forming a 90° angle with the infantometer.

When measuring children over two years of age, they were positioned standing, with heels together, the back of the head (nape), back, buttocks and heels touching the vertical rod of the stadiometer, arms loose along the body with the palms of the hands facing the thighs and head positioned in the Frankfurt plane, which is an imaginary horizontal line that joins the lower outer part of the eye socket with the ear opening, forming a 90° angle with the cursor of the measuring device. In the case of children with hairstyles, headbands or barrettes in their hair, they were advised to remove them and try to leave their hair as loose as possible<sup>19</sup>.

In order to calculate BMI, the formula that divides weight (in kilograms) by height (in meters) squared was used. BMI was used as a reference for assessing children's nutritional status. The possible scores obtained when analyzing BMI x AGE are: (> +3 z scores: obesity); (≤ +3 and ≥ +2 z-scores: overweight); (≤ +2 and > +1 z-scores: risk of overweight); (≤ +1 and ≥ -2 z-scores: adequate BMI); (< -2 and ≥ -3 z-scores: thinness); and (< -3 z scores: marked thinness)<sup>19</sup>. During the procedure for verifying the components of nutritional status and detecting them among children, the guidelines of the Brazilian Ministry of Health were adopted, which are described in the Child Health Handbook<sup>20</sup>.

The last part of the instrument was composed of the Pittsburgh Sleep Quality Index (PSQI), in order to assess the quality of maternal sleep in the last month, a version validated, translated and adapted to Brazilian standards as the *Índice de Qualidade do Sono de Pittsburgh*<sup>21</sup>.

The PSQI contains 19 self-report questions and five questions directed to the spouse or roommate. The last five questions are aimed only at clinical practice; therefore, they do not contribute to the total index score, which is why they were removed from the research. The 19 self-report questions are categorized into seven components, graded into scores from zero (no difficulty) to three (severe difficulty).

The components present in the PSQI are: C1 subjective sleep quality, C2 sleep latency, C3 sleep duration, C4 habitual sleep efficiency, C5 sleep changes, C6 use of sleep medications and C7 daytime sleep dysfunction.

The sum of the values attributed to the seven components varies from zero to twenty-one in the total questionnaire score, indicating that the higher the number, the worse the sleep quality. A total score greater than five indicates that the individual is experiencing major dysfunction in at least two components, or moderate dysfunction in at least three components. Mothers with scores higher than five points were classified as poor sleepers.

After verifying errors and inconsistencies, a descriptive analysis was carried out using absolute and relative frequencies for all sociodemographic variables, maternal sleep quality and child nutritional status.

In order to assess possible associations between perinatal characteristics and child nutritional status in relation to maternal sleep quality, binary logistic regression models were used<sup>22</sup>. Odds ratios (OR) were also estimated with 95% confidence intervals. All tests were performed using the IBM SPSS 24<sup>23</sup> program with 5% significance.

The research was approved by the Human Research Ethics Committee of the Federal University of Maranhão/UFMA, obtaining approval under Opinion nº 4.544.192.

## RESULTS

The study sample consisted of 330 participants, distributed among 165 children and 165 mothers, who filled out the instrument and/or participated in all stages of the research. Among the

children, there was a predominance of females (54.5%), aged between 6 and 24 months (80.6%), without siblings (58.8%), born in the municipality where the study took place (65.5%) and who did not attend daycare or nursery (87.3%). Regarding the type of birth and duration of breastfeeding, 84.2% were born via cesarean section and were breastfed for less than a year (88.5%). Of the breastfed children, 34.5% were supplemented with breastfeeding and 93.9% were not using food supplements.

Most mothers were married (62.4%), had higher education (69.7%), owned their own home (81.2%) and lived in urban areas (98.2%). The average age of these mothers was 29 years old ( $SD \pm 5.7287$ ). In terms of help with children, 90.9% of mothers said they had some type of support network. Most participants had a monthly family income between five and nine minimum wages (32.1%), considered average purchasing power in Brazil. It should be noted that the value of the minimum wage in 2020 was R\$1,045.00.

The prevalence of poor maternal sleep quality was 74.5%, which made the event under study a common outcome. The nutritional status of most children presented adequate percentages, that is, weight, height and ideal BMI for their age, with z scores  $\leq +1$  and  $\geq -2$ , assessed through the children's health records (Table 1).

**Table 1.** Descriptive analysis of the variables “maternal sleep quality” (n=165) and “child nutritional status” (n=165). Imperatriz-MA, Brazil, 2021.

Variable	n	%
<b>Mother's sleep quality</b>		
Good sleeper	42	25.5
Poor sleeper	123	74.5
<b>Child's nutritional status</b>		
<b>Weight</b>		
Adequate	152	92.1
High	12	7.3
Low	1	0.6
<b>Height</b>		
Adequate	127	77.0
High	26	15.8
Low	11	6.7
Very low	1	0.6
<b>BMI</b>		
Eutrophy	97	58.8
Thinness	25	15.2
Marked thinness	16	9.7
Risk of overweight	12	7.3
Overweight	10	6.1
Obesity	5	3.0

**Source:** own elaboration.

With regard to the quality of maternal sleep, the analysis between the groups revealed that children born to poor sleepers had a higher percentage of normal weight than those born to good sleepers. The differences between good and poor sleepers and components of nutritional status do not represent clinically relevant proportional changes. It should be noted that most mothers who sleep poorly have children within the high height classification (Table 2).

**Table 2.** Characteristics of the components of child nutritional status (n=165) regarding maternal sleep quality (n=165). Imperatriz-MA, Brazil, 2021.

	GOOD SLEEPER		POOR SLEEPER	
	N	%	N	%
<b>WEIGHT</b>				
Adequate	37	24.3	115	75.7
High	4	33.3	8	66.7
Low	1	100.0	0	0.0
<b>HEIGHT</b>				
Adequate	37	29.1	90	70.9
High	3	11.5	23	88.5
Low	2	18.2	9	81.8
Very low	0	0.0	1	100.0
<b>CURRENT BMI</b>				
Eutrophy	23	23.7	74	76.3
Thinness	1	20.0	4	80.0
Marked thinness	3	30.0	7	70.0
Risk of overweight	10	40.0	15	60.0
Overweight	3	18.8	13	81.3
Obesity	2	16.7	10	83.3

Source: own elaboration.

Table 3 presents the magnitude of the associations found between the components of nutritional status and poor sleep quality. A binary logistic regression was performed to verify whether the independent variables referring to the children's nutritional characteristics (weight, height, BMI) were related in any way to the poor quality of maternal sleep. Thus, it was found that there was no gross and statistically significant association between child nutritional status and poor sleep quality. In other words, poor sleepers do not represent an increased risk of influencing inadequate child nutritional status.

**Table 3.** Logistic regression analysis between components of child nutritional status and poor maternal sleep quality (n=123). Imperatriz-MA, Brazil, 2021.

	POOR SLEEPER n (%)	Odds ratio (95% CI)	p-value*
<b>Breastfeeding time</b>			
< 1 year	110 (75.3)	1.41 (0.50 – 3.98)	0.52
> 1 year	13 (68.4)	1.00	
<b>Child's main caregiver</b>			
Mother with help	114 (76.0)	1,00	
Mother without help	9 (60.0)	2.11 (0.70 – 6.33)	0.18
<b>Child's diet</b>			
EBF <sup>+</sup>	4 (80.0%)	1.5 (0.69 – 3.29)	0.29
BF <sup>++</sup> + formula milk	5 (83.3%)	1.6 (0.17 – 15.08)	0.67
Exclusive formula milk	2 (66.7%)	2.0 (0.22 – 18.05)	0.53

BF + other foods	45 (78.9%)	0.80 (0.07 – 9.26)	0.86
Other foods	67 (71.4%)	1.00	
<b>Attend daycare or nursery</b>			
Yes	15 (71.4%)	1.00	
No	108 (75.0%)	1.2 (0.43 – 3.32)	0.72
<b>Use food supplement</b>			
Yes	7 (70.0%)	1.00	
No	116 (74.8%)	1.2 ( 0.31 – 5.17)	0.73
<b>Weight</b>			
Adequate	115 (75.7%)	1.5 (0.44 – 5.45)	0.49
Low	0	**	**
High	8 (66.7%)	1.00	
<b>Height</b>			
Adequate	90 (70.9%)	1.00	
Low	9 (81.8%)	1.8 ( 0.38 – 8.97)	0.44
High	23 (88.5%)	3.1 (0.89 – 11.14)	0.075
Very low	1 (100.0%)	**	**
<b>BMI</b>			
Eutrophy	74 (76.3%)	1.00	
Thinness	4 (80.0%)	1.2 (0.39 – 5.98)	0.55
Marked thinness	7 (70.0%)	0.85 (0.24 – 2.94)	0.80
Obesity	10 (83.3%)	1.5 (0.31 – 7.61)	0.58
Risk of overweight	15 (60.0%)	0.46 (0.18 – 1.17)	0.10
Overweight	13 (81.3%)	1.3 (0.35 – 5.14)	0.66

\* Wald chi-square.

\*\* Presence of zero values that makes it impossible to calculate the odds ratio (OR). 95% CI: 95% confidence interval.

\* Exclusive breastfeeding.

\*\* Breastfeeding.

Source: own elaboration (2021).

## DISCUSSION

The prevalence of altered infant nutritional status was low, while poor sleep quality was a common event among mothers. Regarding the quality of sleep, it can differ due to the natural difference between biological and chronological age. Restful sleep (slow waves) reduces with advancing biological age, and this process is more harmful when it occurs in younger people<sup>15</sup>.

More than half of the mothers participating in this research were poor sleepers. Nonetheless, in this study, an increase in the risk of developing worse nutritional status in children born to these women who sleep poorly was not found. It should also be noted that no investigation was found that analyzed this relationship between the quality of maternal sleep and child nutritional status.

According to a bibliographic survey in databases, few publications were found that were close to the purpose of this article. The few studies identified and analyzed highlighted the relationship between socioeconomic and health factors and child nutritional status. Accordingly, this research is unprecedented in terms of the influence of maternal sleep on the child nutritional status.

Despite this, the consulted studies are unanimous in terms of showing that qualitative and quantitative changes in sleep have epidemiological associations with numerous health problems, such as metabolic syndrome, diabetes, cardiovascular diseases and psychological alterations<sup>24-25</sup>.

The cycle that goes from pregnancy to the postpartum period causes several biopsychosocial changes in women's lives, which causes their sleep pattern to change. Studies have estimated that these sleep-related disorders harm up to 86% of postpartum women<sup>26</sup>.

The results showed that most mothers who sleep poorly breastfed for less than a year. Breastfeeding is associated with decreased maternal sleep satisfaction, as many women stop breastfeeding due to the interference with sleep and the fact that they perform numerous tasks<sup>24</sup>.

Breastfeeding has to be reconciled with the woman's other tasks, and as it is a task that extends throughout the night, it involves greater difficulties, which creates overload and physical exhaustion, causing them to breastfeed for less time<sup>27</sup>.

The importance of the mother-child relationship, especially in the first years of life, is fundamental for the child to have a continuous emotional relationship to develop in a healthy way, including good nutrition. Harms in this relationship can trigger changes at cognitive, emotional and social levels with unprecedented repercussions for children's health<sup>13</sup>.

The need to return to work and the day-to-day routine makes mothers look for an alternative support network to care for their children, as it is a way for women to maintain a balance between family life and their professional career. The main caregivers involved in this process are close family members, maids or nannies and daycare workers<sup>28</sup>. However, mothers are not always able to delay their return to work and, consequently, need to opt for alternative care for their children, even if they are still very young<sup>29</sup>.

Because they do not have the support to look after their young children or even for financial reasons, many women end up being forced to quit their jobs or look for something that requires lower qualifications or reduced working hours, which can also have a direct impact on their children's nutritional status<sup>30</sup>.

The relationship between maternal work and excess weight in children occurs mainly in people from developed countries; on the other hand, the relationship between maternal work and child nutritional deficit is more common in countries in South Asia and Africa<sup>8</sup>.

When analyzing the components of child nutritional status separately, none showed a statistically significant association with poor maternal sleep quality. It is worth noting that none of the consulted surveys investigated this specific influence on children. The results found from other studies refer to evidence related to women's health.

Currently, poor sleep quality in women is a global public health problem<sup>31</sup>. Thus, any care that promotes the maintenance of sleep will benefit health, preventing the emergence of diseases. Adequate sleep is, therefore, a primordial human need, as it prevents losses in cognitive performance, mood, daily activities, reduces fatigue and increases vigor. Poor sleep quality interferes with decision making, speed and accuracy of task performance and post-exercise recovery<sup>32</sup>.

With respect to child nutrition, offering food to children after six months of age has the function of complementing breast milk. From this period onwards, complementary feeding aims to meet children's nutritional needs<sup>33</sup>. Complementary feeding is essential, as the quantity and composition of breast milk can no longer meet the child's nutritional needs after six months of age<sup>34</sup>.

Thus, the data from the present investigation show that, despite the fact that mothers are sleeping poorly, the nutritional status of their children is developing well, with adequate weight, height and BMI. In view of this, there are numerous means that can influence the health and growth of children, among which healthy eating is the main factor that guarantees adequate growth, as it avoids excess weight and prevents possible nutritional deficiencies<sup>35</sup>.



Other investigations have shown that the increased prevalence of excess weight in childhood, as well as stunting, are public health problems and both are harmful to health, causing physical and cognitive damage that affects child development<sup>36</sup>. Thus, although the present investigation did not show the influence of maternal sleep on child nutritional status, it is important to consider that a well-rested mother is able to care for her child and all those around her more calmly, harmoniously and skillfully.

In practice, in health institutions, nurses usually deal with issues related to human sleep, as observed in the nursing diagnoses “Readiness for enhanced sleep and sleep deprivation”, especially in adults<sup>37</sup>. Accordingly, nurses can contribute to monitoring and assessing sleep quality, especially in the implementation of health education actions, aimed at improving sleep latency and duration, rest environment and substance use.

This work has limitations, as it is a single-center study, whose number of participants was relatively small, since the calculated sample was not included due to the COVID-19 pandemic. The results obtained from this investigation must be considered carefully, based on the findings of this research. Another issue is the fact that the study was carried out in a private health establishment, where it is possible to see that, even though mothers are declared poor sleepers, they have a support network, which can have a direct influence on how their babies are fed, who, consequently, have an adequate nutritional status.

Therefore, it is recommended that other investigations on the topic be implemented and in other contexts, replicated with mothers of children of other age groups, with a longitudinal or experimental design, in order to generate more robust evidence.

## CONCLUSION AND IMPLICATIONS FOR PRACTICE

The study concluded that there is no relationship between poor maternal sleep quality and child nutritional status. Due to the fact that this is a cross-sectional study, causal relationships cannot be established. The investigation used a psychometric scale to assess the quality of mothers’ sleep, which, although equivalent, is less accurate compared to other analytical methods, such as actigraphy and polysomnography.

The use of the Pittsburgh Sleep Quality Index, as an assistance technology, contributes to improving health care for mothers and their children, expanding the possibilities of resources for nursing activities in these populations, providing targeted attention, identifying distinct aspects that can influence nutritional status and align interventions that address the main changes in the quality components of maternal sleep, thus providing more responsive assistance to their needs.

The limitation of the study is the fact that, as the data were self-reported by the mothers, it is not possible to guarantee accuracy in filling out and/or memory. Furthermore, the COVID-19 pandemic made it impossible to expand the sample, which may have directly contributed to the weak associations between the variables.

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