

## Full Length Research Article

# SLEEP DISORDERS IN LEBANESE CHILDREN: PREVALENCE, RELATION WITH DIETARY HABITS, AND IMPACT ON CHILDREN'S BEHAVIORS

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**Introduction:** Sleep is a vital physiological function for the maintenance of health and quality of life. Physicians and psychologists estimate that as many as 30% of children may have a sleep disorder at some point during childhood. Poor diet can negatively impact sleep patterns in children. Sleep disorders may lead to daytime moodiness, irritability, lack of focus in class, sleepiness in school, inability to get up in time for school and significant behavioral and learning problems.

**Objectives:** 1. To study the prevalence of sleep disorder in Lebanese children. 2. To determine the associations between quality of sleep and harmful diet in Lebanese children. 3. To evaluate the impact of sleep disorders on quality of life in Lebanese children.

**Material and Methods:** This study was conducted at Makassed schools with children aged 3-8 years. This was a two-step study, the first step was a questionnaire distributed to school children to be answered by their parents. This questionnaire included questions concerning child diet, child quality of sleep and child behavior. In this first step of the study, these questionnaires were analyzed and only the individuals with severe sleep disorders were included in the second part of the study. The second step was to organize an individual meeting with every child, who met the inclusion criteria, and the child underwent complete physical exam.

**Results:** The prevalence of unhealthy dietary habits in Lebanese children is 70.7% with a mean age of 6.03 years and 52.1% of these children were males. The prevalence of severe sleep disorders was found to be 5.6%. The mean age is 6.3 years with gradual increase from 14.3% between 3 and 5 years of age to 49.2% between 6 and 8 years of age. A significant relation was found between severe sleep disorders and unhealthy dietary habits. Concerning sleep disorders and behavior disorders, only 1.3% of children with no sleep disorders had behavior disorders while 22.2% of children with severe sleep disorders had behavior problems. The result is highly significant (P-Value < 0.0001).

**Discussion:** Sleep behaviors are among the most common concerns that parents of young children bring to their physicians. A child who goes to bed unwillingly or wakes frequently during the night can be highly disruptive to a family. The prevalence of sleep disorders in Lebanon is 67.2%, much higher than other studies. Our study showed no gender difference in children with severe sleep disorders. Diet has a significant impact on the sleep habits of school children as proved by our study. Our study indicates the impact of sleep disorders on children's quality of life.

**Conclusion:** To our knowledge, this is the first study in Lebanon discussing sleep disorders and its relation with nutrition and its impact on children behavior. We demonstrated that there is a significant relationship between unhealthy diet and sleep disorders. Inadequate sleep in children has been shown to be associated with poor academic performance, behavioral problems, poor mental and physical health.

**Key words:** ECBI, Eyberg Child Behavior Inventor, ADHD, Attention Deficit Hyperactivity Disorder.

## INTRODUCTION

Sleep is a vital physiological function for the maintenance of health and quality of life. Sleep rests the body and restores its energy levels. However, sleep is an active state that affects both the physical and mental well-being. In fact, in infancy and early childhood, the developing brain seems to need more time asleep than it does awake (Hunt, 2003). According to the National Sleep Foundation's recommendations, children between 3 and 5 years of age should get 11 to 13 hours of sleep per day, children between 5 and 12 years old age should get 10 to 11 hours of sleep every 24 hours (National sleep foundation, 2013). However, the most recent scientific study of sleep duration among children reveals a tremendous amount of variation between individuals especially during early childhood (Iglowstein *et al.*, 2003).

According to 'Jenni *et al.*', there is no optimal number of sleep hours that applies to all kids (Jenni *et al.*, 2007). Sleep requirements are probably influenced by growth rates, stress, disease, and other aspects of the physical condition. They may also be influenced by genes (Gottlieb *et al.*, 2007). Physicians and psychologists estimate that as many as 30% of children may have a sleep disorder at some point during childhood. Sleep disorders can include somnambulism, 'PavorNocturnus' or night terrors, nocturnal enuresis, obstructive sleep apnea syndrome, narcolepsy, insomnia and snoring (Bruni *et al.*, 2010). A good night's sleep is often the best way to help coping with stress, solving problems, or recovering from illness. For this reason it is important for both parents and educators to understand how sleep works and how disruptions in normal sleep patterns can affect children. Sleep disorders have implications both for social-emotional adjustment and for school performance. Sleep disorders in children may lead to daytime moodiness, irritability, lack of focus in class, sleepiness in school, inability to get up in time for school and significant behavioral and learning problems.

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Some sleep disorders are serious enough to cause adverse cardiovascular and metabolic effects (diabetes, heart disease) as well as failure to thrive (Heussler, 2005). Sleep as the National Center on Sleep Disorders Research has noted, we need new, large-scale, controlled studies that measure both sleep and biological outcomes (Hunt, 2003). Unfortunately, such studies are uncommon. In a study of 297 Finnish families with children aged 5-6 years, researchers found that kids who slept less than 9 hours each day had 3-5 times the odds of developing attention problems, behavior problems, and other psychiatric symptoms (Paavonen *et al.*, 2009). Bell JF and Zimmerman F, in their study published in 2010, recorded the body weights and sleep habits of kids less than five years of age. Then, five years later, they examined the kids again. The study revealed a link between sleep loss and obesity. Kids who had gotten less than 10 hours of nighttime sleep at the beginning of the study were twice as likely to become overweight or obese later on (Bell and Zimmerman, 2010). There are many ways in which dietary habits and nutritional requirements may correlate.

Although foods have not been found to trigger sleep disorders, eating certain kinds of foods, overeating and under-eating can either worsen or augment sleep disorders risks (Nauert, 2014). Risk for sleep apnea is increased by carrying extra body weight and high blood pressure. Eating small quantities of food or eating too much can make falling or remaining asleep difficult - insomnia's primary characteristics (Leung *et al.*, 2013). According to the National Sleep Foundation, an improvement in sleep habits can result in healthy eating habits and better health generally. It is very interesting that it has been noted that the reverse has the same effect. Enhancing nutrient intake and eating behavior result in a more peaceful sleep (Tauman *et al.*, 2011).

Imbibing caffeine in the evening, overeating or eating certain kinds of foods can disrupt the sleep (Pollak and Bright, 2003). Fatty foods including whole milk products, red meat, fried foods and refined carbohydrate sources like enriched pasta, sweets, white bread and salty snack foods can contribute to weight gain and high blood pressure (Leung *et al.*, 2013). For insomnia relief, as recommended by the Mayo Clinic website, large meals, soft drinks, chocolate, coffee and caffeine should be avoided at all costs during night times. More peaceful sleep may be enhanced by consuming balanced meals and snacks at the proper time intervals and selecting largely healthy foods. These foods include vegetables, whole grains and fruits as they help in stabilizing body energy levels in the course of the day (Leung *et al.*, 2013). Bad diet and sleep disorders could be related and can end up with social behavioral problems. The negative effect of sleep disorders on Lebanese children school performance and social-emotional status is worth to be studied in order to establish a new guideline about diet in children and hours of sleep needed.

## Objectives

The objectives of this study are

- To study the prevalence of sleep disorder in Lebanese children.
- To determine associations between quality of sleep and harmful diet in Lebanese children.

- To evaluate the impact of sleep disorders on quality of life in Lebanese children.

## MATERIALS AND METHODS

This study was conducted on Makassed schools with children aged 3-8 years. A total of 37 schools spread across Lebanon were included and divided into 4 regions: Beirut (the capital), North, South with Mount Lebanon, and Bekaa. This was a two-step study, the first step was a questionnaire distributed to school children to be answered by their parents. This questionnaire included questions concerning the child's age, sex, area, questions about child diet, child quality of sleep and child behavior. The Eyberg Child Behavior Inventory (ECBI) was the questionnaire of choice since it has been validated and used by several studies as a tool to assess behavioral problems in children (Eyberg and Ross, 1978; Burns and Patterson, 1990 and Axberg *et al.*, 2008). It was shown to be concise measure of childhood behavioral problem (Boggs *et al.*, 1990).

The ECBI consists of 36 items rated by parents. It has two scales; intensity and problem scales. The intensity scale assesses the frequency of the behavioral problem. Parents were asked to rate each problem addressed in the 36 items from 1 to 7. The problem scale evaluates the parent's perception of the particular behavior as a problem. Parents are asked to rate the 36 behaviors as "yes" or "no". The subscale of the sleep-50 questionnaire is used to assess sleep disorders in children. It includes sleep apnea, insomnia, narcolepsy, restless leg/periodic limb movement disorders, circadian rhythm sleep disorders, sleep walking, nightmares, and impact of sleep disorders on daily functioning. Each item is scored on a four-point scale of the intensity, 1 (not at all), 2 (somewhat), 3 (rather much), 4 (very much) (Sporer *et al.*, 2005). No standard parental questionnaire uniformly used in the research of feeding disorders is currently available, and the existing instruments have not been nor used with samples at the age range of the current study.

Therefore, we invented a parental questionnaire for children diet, with a pediatric dietician. This questionnaire is a pilot questionnaire, and it consists of 7 items including the quality of food, number of meals and frequency of junk food. The questionnaire also served as a written consent form, by which the parents were informed about the study and required their signature for their approval. Wording of questions was very critical and should take into consideration; appropriateness of the content, level of sophistication of language, type and form, sequence and how are data sought from the respondents. During questionnaire development, mode of administration was kept in mind, whether it will be self-administered or interview based and its design and flow was planned accordingly. This questionnaire was distributed to a 20 random mothers and fathers at first to assess the clarity of its questions. In this first step of the study, these questionnaires were analyzed and only the individuals with severe sleep disorders were included in the second part of the study. The second step was to organize, with the help of pediatric nurse, an individual meeting with every child, who met the inclusion criteria, and the child was physically examined by the physician, his weight and height and BP were taken by the pediatric nurse.

**We included in the first step of the study**

- Every child whose age between 3 years and 8 years after getting consent from his parents or legal guardians. We included in the second step of the study:
- Every child having severe sleep disorders (somnambulism, night terrors, nocturnal enuresis, obstructive sleep apnea syndrome, and narcolepsy). We excluded from this study:
- Every child whose parents or legal guardians refused to sign the consent and to be enrolled in the study.
- Every child with diet restricted condition (hepatic, renal or cardiac, severe asthma, epilepsy...) or psychiatric disorders such as ADHD, autism...

**Statistical Analysis**

Data were analyzed using SPSS version 19. Chi-square test was used to assess any significant differences among the studied variables. Multivariate analysis was performed to determine the risk factors that influence behavioral disorders. The results were expressed as odds ratio and their 95% confidence intervals. P-Value<0.05 was considered significant.

**RESULTS**

6045 questionnaires were distributed to school children aged 3-8 years, to be answered by their parents. 5152 questionnaires were back, and 4516 were filled. Distribution of responders by region was: Beirut 1214 (26.9%), North 1538 (34.1%), South 435 (9.6%), Bekaa 1329 (29.4%) (Table 1).

**Table 1. Distribution of Responders by Region**

Region	Beirut	North	South	Bekaa
Numbers	1214	1538	435	1329
Percentage	26.9%	34.1%	9.6%	29.4%

**Table 2. Numbers and Percentage of Unhealthy Dietary Habits by Region**

Region	Beirut	North	South	Bekaa
Numbers	699	1213	327	954
Percentage	57.6%	78.9%	75.2%	71.8%

The prevalence of unhealthy dietary habits in Lebanese children is 70.7% with a mean age of 6.03 years and 78.9% of these children were males. North had the majority of cases with a percentage of 78.9% (1213), Beirut had the lowest percentage 57.6% (699), Bekaa 71.8% (954), and South 75.2% (327) (Table 2).

**Table 3. Numbers and Percentage of Behavioral Disorders by Region**

Region	Beirut	North	South	Bekaa
Numbers	53	97	23	76
Percentage	4.4%	6.3%	5.3%	5.7%

**Table 4. Relation between Behavioral Disorders and Dietary Habits**

	Unhealthy Dietary Habits (n=3193)	Healthy Dietary Habits (n=1323)	P-Value
Behavioral Disorders	206(6.5%)	43(3.3%)	< 0.0001

The prevalence of behavioral disorders is 5.5% with a mean age of 5.93 years and 70.7% were males. North had the majority of cases with 6.3% (97) of children, followed by Bekaa with 5.7% (76), South 5.3% (23) and Beirut 4.4% (53) (Table 3).

Dietary habits and behavioral disorders were related as shown by our data with highly significant P-Value < 0.0001 (Table 4). Out of 4516 children, 3034 children were found to have sleep disorders, with a prevalence of 67.2%, severe 287 (6.4%), moderate 672 (14.2%), and mild 2075 (45.9%). 287 children were found to have severe sleep disorders. Parents of children with severe sleep disorders were then contacted and a meeting was arranged with their children.

These children were physically examined, their weight, height and blood pressure were checked accurately and the body mass index (BMI) was calculated. Out of 287 children, 35 were excluded, 27 had adenoid faces, 2 had adenoid hypertrophy, 3 were obese, 1 had severe asthma, 1 cardiac disease and 1 with nasal septum deviation. The remaining 252 patients were fulfilling all inclusion criteria and were included in the study. (Figure 1). The prevalence of severe sleep disorders in Lebanon was found to be 5.6%. The mean age of children with severe sleep disorders is 6.3 years with gradual increase from 14.3% between 3 and 5 years of age to 49.2% between 6 and 8 years of age with a significant P-Value < 0.007 (Table 5).

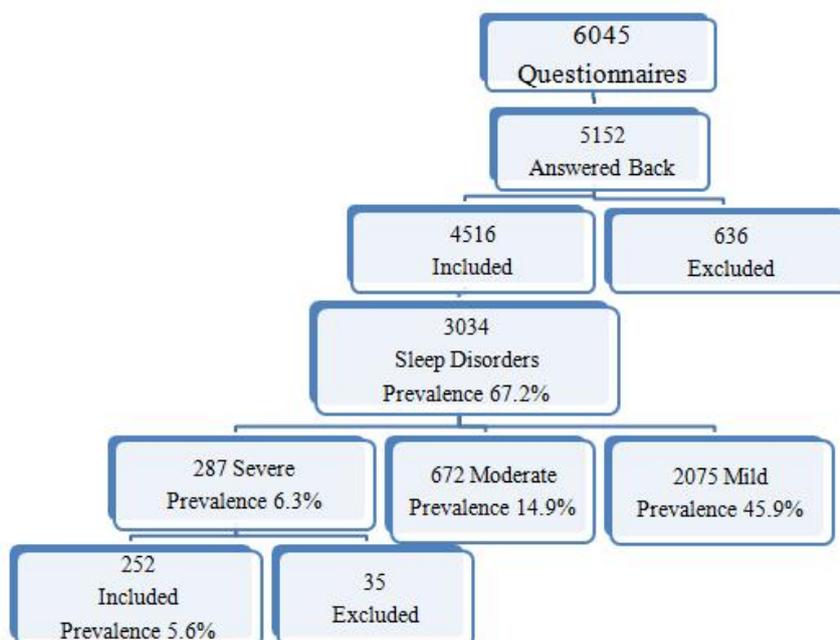
**Table 5. Comparison between Age Category and Sleeping Disorders**

Region	Beirut	North	South	Bekaa
Numbers	17	141	26	68
Prevalence	1.4%	9.3%	6%	5.1%

Males with severe sleep disorders were 53.8%. According to different geographic areas, the results have shown that the North had the majority of cases with a percentage of 9.3%, south 6%, Bekaa had 5.1%, and Beirut 1.4% (Table 6).

A significant relation was found between severe sleep disorders and unhealthy dietary habit with a P-Value less than 0.0001. 6.6% of children with unhealthy dietary habits had severe sleep disorders where only 3.3% in children with healthy dietary habits (Table 7).

Regarding the effect of sleep disorders on children behaviors, comparison was done and showed gradual increase in behavior problems from 1.3% children with no sleep disorders to 22.2% in children with severe sleep disorders. The result is highly significant (P-Value<0.0001) (Table 8).



**Figure 1. Total Number Included with Prevalence**

**Table 6. Percentage of Severe Sleep Disorders by Region**

Age category (years)	No problem (n=1482)	Mild (n=2075)	Moderate (n=672)	Severe (n=252)	P-Value
[3-4]	251(16.9%)	423(20.4%)	145(21.6%)	36(14.3%)	0.007
[5-6]	619(41.8%)	807(38.9%)	260(38.7%)	92(36.5%)	
[7-8]	612(41.3%)	845(40.7%)	267(39.7%)	124(49.2%)	

**Table 7. Relation between Severe Sleep Disorders and Unhealthy Dietary Habits**

	Unhealthy Dietary Habits n=3162	Healthy Dietary Habits n=1319	P-Value
Severe Sleep Disorders	209 6.6%	43 3.3%	< 0.0001

**Table 8. Relation between Severity of Sleeping Disorders and Behavioral Disorders**

	Unhealthy Dietary Habits (n=3162)	Healthy dietary Habits (n=1319)	P-Value
Sleeping Disorders			
No problem	917(29%)	565(42.8%)	< 0.0001
Mild	1518(48%)	557(42.2%)	
Moderate	518(16.4%)	154(11.7%)	
Severe	209(6.6%)	43(3.3%)	

**Table 9. Relation between Severity of Sleeping Disorders and Dietary Habits**

	No Sleeping Disorders (n=1482)	Mild Sleeping Disorders (n=2075)	Moderate Sleeping Disorders (n=672)	Severe Sleeping Disorders (n=252)	P-Value
Behavioral Disorders	19(1.3%)	97(4.7%)	74(11%)	56(22.2%)	< 0.0001

**Table 10. Multiple Regressions Showing the Variables that Influence Behavioral Disorders**

	Odds Ratio	95% CI	P-Value
Age	0.93	[0.85-1.02]	0.125
Gender	0.42	[0.32-0.56]	< 0.0001
Area	1.07	[0.95-1.20]	0.284
Sleeping Disorder	2.51	[2.18-2.89]	< 0.0001
Dietary Habits	0.66	[0.47-0.93]	0.019

Relation between severity of sleeping disorders (mild, moderate and severe) and dietary habits was studied and showed a significant-Value  $< 0.0001$  (Table 9). Performing multiple regressions showed that sex, dietary habits and sleeping disorders significantly influence behavior in children. Therefore, diet is a factor which can directly influence behaviors and sleep (Table 10).

As Seo *et al.* (2010), our study showed no gender difference in children with severe sleep disorders, while Van Litsenburg *et al.* (2010) reported that girls experienced more sleep problems than boys. As suggested by Owens *et al.* (2000), economic factors may contribute to an increased rate of sleep deprivation, and other sleep problems. These finding can explain the highest percentage of children with sleep disorders found in our study in North region.

**Table 11. Prevalence of Sleep Disorders in Comparison with other Studies**

Our Study in Lebanon	Oxford by Ali et al	Blunden et al in Australia	Washington by Marc et al
67.2%	20.7%	40%	10.8%

## DISCUSSION

Sleep behaviors are among the most common concerns that parents of young children bring to their physicians. A child who goes to bed unwillingly or wakes frequently during the night can be highly disruptive to a family. To make the definition of sleep problems even more difficult, families vary greatly in their tolerance of their children's sleeping habits. Helping a family resolve a child's sleep problem is satisfying for a family physician and worth the time spent taking a careful history. Sleep disorders and its relation to diet have been discussed in some studies, and its psychological impact on the children and their families have been considered a burden on the community (Thiedke, 2001). The prevalence of sleep disorders in Lebanon is 67.2%, much higher than the study conducted in Oxford by Ali *et al.* (20.7%) (Ali *et al.*, 1994; Amintehran *et al.*, 2013), and study conducted by Blunden *et al.* in Australia (40%) (Blunden and Chervin, 2010), and in Washington by Marc *et al.* (10.8%) (Blunden and Chervin, 2010) (Table 11).

It is estimated that sleep problems are experienced by 25-30% of children regardless of age. Despite the magnitude and clinical importance of sleep issues, several studies have documented that there is a low level of recognition of sleep disorders by primary care physicians in children (Amintehran *et al.*, 2013). The prevalence estimates of sleep problems are very diverse in multiple old and new studies and in different parts of the world and it ranges from 20.7% in a 1989-90 survey in Headington, Oxford by Ali *et al.* (1994) to almost 40% in a 2010 study in Australian indigenous and children by (Blunden and Chervin, 2010).

Prevalence of sleep problems increased significantly over time (Singh and Kenney, 2003). Several studies found that sleep disorders may be under diagnosed in pediatric practices (Blunden and Chervin, 2010; Smedje *et al.*, 1999). If sleep disorders are not diagnosed and are left untreated, their negative impact on daytime functioning may be significant (Meltzer *et al.*, 2010). Most of the studies regarding sleep habits in children are from the West; however, a few Asian studies (Liu *et al.*, 2005) are available and these studies emphasize the effect of culture. To our knowledge, our study is the first one in our country and surrounding regions.

A study was conducted by researchers at the University of Copenhagen (Poor Diet Negatively Impacts Sleep Patterns in Middle-School Children, 2013), tracking the sleep and dietary behaviors of nearly 670 Danish children between the ages of 8 and 11. Each child was followed for a total of 8 days, during which time researchers monitored their sleep patterns and parents completed a food log and questionnaire on their children's sleep habits. After analysis, this Danish research team found that children consuming higher-calorie diets, high in sugar and sugar-sweetened beverages, were more likely to get less sleep than those with healthier diets. Based on these findings, diet has a significant impact on the sleep habits of school children as proved by our study.

Not only does a poor diet, high in calories and sugar, increase risk for obesity, it also may increase risk for sleep problems. If we can help children improve their diets, this lifestyle change may then improve sleep patterns and reduce risk for obesity and promote better health. According to David Gozala *et al.* (2007), Sleep disorders are accompanied by sizeable behavioral and neurocognitive dysfunction in children. Both sleep fragmentation/restriction and intermittent hypoxia are probably involved in the path physiology of neurobehavioral morbidity. Current evidence indicates that chronically disrupted sleep in children and adolescents can lead to problems in cognitive functioning, such as attention, learning, and memory (Moturi and Avis, 2010).

Primary sleep disorders, such as obstructive sleep apnea and restless legs syndrome, in children have been shown to be associated with excessive daytime sleepiness, cognitive deficits (e.g., lower intelligence quotient [IQ], impaired attentional capacity, and memory) and attention deficit hyperactivity disorder (ADHD) (Rhodes *et al.*, 1995; Cortese *et al.*, 2005 and Row *et al.*, 2003). Therefore, screening for daytime impairments (e.g., hyperactivity) and school related impairments (e.g., drop in academic grades) is important in children suspected of having sleep disorders. Few studies such as the one conducted by Kahn *et al.* (1989), have assessed the effect of poor sleeping on school performance and have found interesting results such as the point that among the "poor sleepers," 21% had failed 1 or more years at school. Our study indicates the same impact on children's quality of life. Our study showed a strong relation between dietary habits and severity of sleeping disorders from one hand and an impact of

severity of sleeping disorders on behavioral disorders from a second hand and a very strong relation between unhealthy dietary habits and behavioral disorders from a third hand with a very significant P-Value for all of these relations.

### Limitations

First, we didn't study the family socio-economic status, though the sociologic problems, economic status and parent's conflict can affect sleep in children.

Second, we didn't study all group of children with sleep disorders but only children with severe sleep disorders.

### Conclusion

To our knowledge, this is the first study in Lebanon discussing sleep disorders and its relation with nutrition and its impact on children behaviors. We used a pioneer questionnaire for dietary habits in children to assess its relation with sleep. The present study shows that the prevalence of sleep problems is relatively high in our country. We demonstrated that there is a significant relationship between unhealthy dietary habits and sleep disorders. Sleep problems in children have significant impacts on their health and well-being and inadequate sleep in children has been shown to be associated with poor academic performance, behavioral problems, and poor mental and physical health.

### Recommendation

Early intervention and increased awareness of clinicians to harmful diet and its impact on children well-being, health and sleep can procure a better quality of sleep and prevent behavior disorders.

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