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The Relationship between Sleep Quality and Growth and Development in Toddler-Aged Children

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ABSTRACT

Sleep is an essential need in children's health, but sleep disorders can negatively impact children's health and growth and development. This study aims to assess the relationship between sleep quality and the growth and development of toddler-age children in the Karangdadap Pekalongan, Central Java. A correlative descriptive study with a cross-sectional approach was conducted on 267 children aged 1-3 years. Data collection from October to December 2023 used scales, microtoise, KMS GRAPHS, DDST II, and BISQ questionnaires. Data were analyzed using descriptive statistics and the Chi-Square test. The majority of respondents (82.4%) had good sleep quality. The study showed that there was a significant relationship between sleep quality and child growth; children with sleep disorders had a higher risk of undernutrition and overnutrition (p = 0.0001; OR = 5.260). Sleep quality was significantly associated with child development; children with sleep disorders were at a higher risk of suspected developmental issues (p = 0.0001; OR = 37.217). Sleep quality is highly related to the growth and development of preschool children. Sleep disorders have the potential to reduce the quality of child growth and development, making it important to manage and address sleep disorders to support children's health.

INTRODUCTION

One of the most important needs of a person in life is sleep, which is just as important as the nutritional needs of a child. Children's sleep needs will decrease as they age. Babies spend most of their time sleeping early in their lives. Their sleep duration at night is almost the same as their sleep duration in the morning and afternoon. Children between the ages of two and five spend the same amount of time between waking and sleeping. During childhood and older adolescence, sleep accounts for an average of 40% of the time needed to fall asleep each day. If the amount of time needed to sleep is insufficient, then sleep disturbances can occur. Children who are fussy or try to sleep all night will be disturbed and complained about as a child's sleep problem in the family [(1)].

The prevalence of sleep-related disorders is estimated to be between 57.35% and 46% [(2)]. Overall sleep disturbances may occur in 20%-30% of children. In 2006, the incidence of sleep problems in children under 3 years old in five cities in Indonesia was reported to be 44.2% [(1)]. However, almost 72% of parents do not consider infant sleep problems as part of their child's development. Sleep

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disorders can interfere with the baby's development, immune function, and endocrine system regulation [3]. Sleep disorders that are not treated early will tend to settle down over time [2].

If not handled properly, growth and development problems in toddlers will have a bad impact on the future. Poor sleep quality in children can affect a child's physical growth, cognitive, emotional, social, and behavioral development. Because of these growth and development disorders, they will later have low education due to inability to think, low income, low productivity, having many children, and not being able to take good care of children[4].

In additional research, it was found that 32% of mothers said that their children often had trouble sleeping. Children with poor sleep quality can experience negative impacts on their physical and cognitive growth. At the same time, the brain is developing synapses, important connections that allow humans to learn, move, and acquire many new skills. The child's body produces three times as much growth hormone when sleeping as it does when waking up. Therefore, sleep disorders are a problem that will affect children's development [5].

Disruptions in the cycle of basic life habits related to sleep and wakefulness can lead to a decline in memory and cognitive development. Habits and environments that are not supportive for the formation of sleep patterns can also cause this problem[6]. Due to the habits of adults who are active when they prepare for children's sleep, especially with the development of communication and entertainment technology through digital devices, the ability of children to enter the sleep and wake phases is greatly disturbed7. A sleep environment with high light and loud noise is a pollution for children to be able to start their sleep process [7].

This is supported by research from Miller et al in the United States in 2015 that lack of naps produced a moderate to large effect on self-regulation strategies, with decreased skepticism, negative self-assessment, and increased physical self-assessment. soothing, focusing on the pieces of the puzzle that don't match, and the urge to solve the puzzle that can't be solved. The results suggest that sleep plays an important role in the way toddlers respond to challenging events in their daily lives[8].

According to the Ministry of Health (2023), a child's ability to sleep and get enough rest according to their needs is a way to measure the quality of children's sleep. Another opinion states that if a child sleeps less than nine hours a night, wakes up three times or wakes up for more than an hour, or if the baby seems fussy, cries often, and has trouble falling back asleep[9]. Data shows that 20-30% of children have sleep disorders[10].

Sleep-wake time and circadian rhythm appear to play an important role in obesity risk, as variations in sleep schedules have been shown to have a stronger influence on metabolism compared to sleep duration. total sleep duration. Later bedtimes and greater variability in sleep schedules are predictors of greater weight changes that are also associated with negative metabolic outcomes. Infant growth is also affected by sleep patterns. An increase in nap frequency and overall longer sleep duration among infants was found to have a temporal correspondence with their length growth. In contrast, longer sleep times in infancy and longer nap duration in toddlerhood are associated with increased adiposity[11].

This is supported by a study from Petrov et al in Mexico in 2021 At 6 months of age, 35.7% (n = 45) of infants experienced RWG (Rapid Weight Gain), and at 36 months of age, 42.3% (n = 41) of toddlers experienced OW. A nap of ≥5x/day in 1 month was significantly associated with a decrease in RWG odds compared to a nap of <5x (OR = 0.11, 95% CI:0.02, 0.63). Each increase of 1 hour of sleep at night versus diurnal was associated with a greater likelihood of OW at 36 months (OR = 1.51, 95% CI: 1.13, 2.03)[11].

The growth and development of toddler children has a considerable impact on the quality of adulthood because this period is the most important and vulnerable to the success of children's growth and development. Child development consists of gross motor, fine motor, socialization, cognitive, and language [12].

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Data from BPS (Census Management Agency, 2022) states that the age of children under five (1-4 years) recorded in Indonesia is 10.063.094 people, in Pekalongan Regency there are 57.528 children under five, while data from the Pekalongan Regency Health Office that for September 2023 the highest incidence of stunting in children under five is in the work area of the Karangdadap Health Center with a prevalence of 11.7%, namely 340 children[13].

Therefore, this study aimed to determine the relationship between sleep quality and the growth and development of toddlers in the working area of the Karangdadap Health Center, Pekalongan Regency.

METHOD

This study is a correlative descriptive research with a cross-sectional approach that aims to assess the relationship between sleep quality and growth and development in toddler children. The study population includes all children aged 1-3 years in the Working Area of the Karangdadap Health Center, Pekalongan Regency, with a total of 1582 children as of September 2023. The research sample was taken using cluster random sampling from two villages, namely Karangdadap and Kalilembu Village, involving 291 children. Using Isaac and Michael's table, the number of samples required was 286 children, but after excluding 24 children who met the exclusion criteria, the number of respondents obtained was 267 children. This study used tools and materials to measure growth, namely a microtoise and a scale, as well as an instrument using the KMS chart containing the weight-for-age chart. The instrument to measure development was the DDST II. Sleep quality was assessed using the Brief Infant Screening Questionnaire (BISQ), supported by objective data (actigraphy) and subjective data (sleep diary), and a test-retest reliability analysis with reliable results ($r>0.82$).

The research was conducted in Karangdadap Village and Kalilembu Village from October to December 2023. This research complies with research ethics which include informed consent, anonymity, and data confidentiality, and has obtained ethical approval with registration number: KEPK/UMP/33/XII/2023. Growth was measured using weight scales, microtoise, and KMS graphs; development was assessed using DDST II; and sleep quality was evaluated with the Brief Infant Sleep Questionnaire (BISQ).

RESULT AND DISCUSSION

Characteristic of Respondents

Table 1.
Characteristics of respondents by parental education, age, and sex

Characteristics	N	%	Min	Max
Education				
Elementary School	35	13.1		
Middle School	45	16.9		
High School	165	61.8		
Bachelor	22	8.2		
Age			12 month	36 months
12-23 months	131	49.1		
24-36 months	136	50.9		
Sex				
Male	138	51.7		
Female	129	48.3		

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Based on table 1, it shows that the characteristics based on parental education are the largest of the respondents in this study have high school education of 165 respondents (61.8%). Based on the age of the respondents, more than some were 24-36 months old, 136 respondents (50.9%). Based on gender, most of the respondents were male with 138 respondents (51.7%).

Distribution of Respondents by Sleep Quality, Nutritional Status (Growth), and Developmental Status

Table 2.
Distribution of respondents by sleep quality

Sleep Quality	N	%
No Interruptions	220	82.4
Disturbances	47	17.6
Total	267	100

Table 2 shows that there are more respondents without sleep disorders compared to 47 respondents (17.6%) who have sleep disorders. The results of this study showed that most of the respondents had good sleep quality, which was 220 respondents (82.4%). Good sleep quality if the length of sleep is balanced between night and day sleep. Sleep quality is a person's satisfaction with sleep where a person can easily start sleeping and maintain sleep, the quality of sleep itself can be described by looking at the length of sleep, soundness during sleep, and feeling refreshed when waking up and sleep quality can also affect overall health and quality of life [(14)].

According to table 1, it can be seen that more than half of the children's age, namely 24-36 months, is 156 children (50.9%). The age of the child will greatly influence the determination or regulation of the child's health pattern, including the need for sleep because the older the child, the less the total time of sleep needs[(1)].

The age of the child will be very influential in determining or regulating the child's health pattern, including sleep patterns, because the older the human being, the less time the total time needed for sleep decreases. It is influenced by the growth and physiology of the cells and organs in the child[(15)]. At the age of toddler, a child is more active in doing activities and exploring himself so that the child will sleep less often and affects his sleep patterns. When children are 18 – 24 months old, children enter the stage of autonomous development in children at this age, centered on increasing the child's ability to control their body, self and environment [(16)].

Table 3.
Distribution of respondents by nutritional status (growth)

Growth	N	%
Malnutrition	0	0
Undernourshed	21	7.9
Ideal	234	87.6
Overnutrition	12	4.5
Total	267	100

Table 3 shows that a small percentage of respondents who are undernourished are 21 respondents (7.9%) and 12 respondents (4.5%) are undernourished. It can be seen that a small number of children have undernourished growth and overnutrition by 33 children (12.4%). Children who experience malnutrition affect children's growth and development in the future. Undernutrition and

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malnutrition in toddlers result in disruption of physical growth and health. Indirectly, malnutrition and malnutrition can cause children under five to experience nutritional deficiencies that can have long-term consequences, namely related to children's health, child growth, infectious diseases and children's intelligence as well as due to the attack of certain diseases[17].

Based on the results of research in the field of neurology conducted by Benjamin S. Bloom, an education expert from the University of Chicago, United States, it was stated that the growth of brain tissue cells in children aged 0-4 years reached 50%, until the age of 8 years reached 80%.3 The rapid development of the brain is along with the physical growth of children. For this reason, parents must provide stimulation so that children can grow and develop optimally [18].

Undernutrition problems in toddlers are caused by various things, both direct and indirect causative factors. The direct causative factor is an unqualified diet. This is in accordance with research from [16]. When entering the age of 1 year, toddlers tend to have difficulty eating and consuming small portions of food. Toddlers tend to have a frequency of eating more than three times a day, this is due to the small size of the toddler's stomach, so feeding five to six times a day is better than three times a day, but this frequency of eating does not seem to be related to nutrient intake. Children usually refuse food with large portions, it is better to give food in small portions which are then added if the child wants.

Table 4.
Distribution of respondents by developmental status

Development	N	%
Normal	237	88.8
Suspect	30	11.2
Untestable	0	0
Total	267	100

Table 4 shows that most of the children have normal development of 237 children (88.8%). Child development consists of gross motor, fine motor, socialization, cognitive and language[12].

Development is an indicator of child quality assessment so that developmental obstacles in early childhood affect subsequent development. Development in children occurs throughout life and consists of several stages, one of which is the toddler age stage. The toddler period is 12 to 36 months old when children just start walking until they can walk on their own and run easily. At this stage, the child's development becomes the basis of the child's health, education, social skills, emotional development, and self-ability in the future. The process of child development involves interaction between parents and children because parents can find out about growth and development disorders as early as possible[19].

There are several factors, both internal and external, that affect children's development. The factors that affect child development delays are the family environment related to parental education due to the lack of knowledge about the stimulation that will be provided to support child development. As is known from general data in the form of parental education, high school education, This is in accordance with research from Tiara & Zakiyah, 2021 there is a relationship between maternal knowledge and the level of development of toddler-age children[19]. Good education affects a person's knowledge because it will be easy to receive information on how to take good care of children, maintain children's health and do proper stimulation. Good knowledge makes parents learn to provide stimulation so that it has an impact on optimal development in children. Parents with higher education tend to seek knowledge about the right stimulation materials and strategies and try to stimulate their children's development according to their age.

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Table 5.
Relationship between sleep quality and growth in toddler-aged children

Sleep Quality	Growth				Total		P value	OR
	Good Nutrition		Undenutrition & Overnutrition					
	n	%	N	%	n	%		
No Interruptions	202	91.8	18	8.2	220	100	0.0001	5.26
Disturbances	32	68.1	15	31.9	47	100		
Total	234	87.6	33	12.4	267	100		

Based on table 5, it can be seen that respondents who do not have sleep disorders tend to have good nutrition by 202 respondents (91.8%) and respondents who have sleep quality with disorders have poor and more nutritional growth by 15 respondents (31.9%).

The results of the chi-square test analysis obtained a p-value (Asymp. Sig. (2-sided) 0.0001 (<0.05) so that it can be concluded that H0 is rejected and Ha is accepted, which shows that there is a relationship between sleep quality and growth in Kalilembu Village and Village. From the OR value, it was obtained that children who had sleep quality disorders had a 5.260 times greater risk of having malnourished growth and more nutrition than children with undisturbed sleep quality.

This is in line with the research which revealed that there is a relationship between growth and children's sleep patterns[20]. During sleep, the body will produce a lot of growth hormone, or hormones produced by the adrenal glands, namely corticosteroids and aldosterone. By increasing the level of growth hormone, it will be able to spur body growth, tissue growth, accelerate healing, and can lower the amount of cholesterol in the blood. Because, during sleep, a lot of adrenaline hormones are released in waves, or wave after wave in the bloodstream, which will have a refreshing effect on a person's body. If you don't sleep for two or three nights, or reduce your sleep time for three nights in a row, it can cause a disturbance in a person's ability to perform their routine tasks[21].

There are many opinions from the general public and some clinicians or doctors who still say that sleep disorders are common in children who will later at a certain age and will improve on their own. In fact, this disorder, if not handled properly, can interfere with the growth and development of children. This is because about 75% of GH (Growth Hormone) is released when the child sleeps, where this GH is three times more during sleep than when he wakes up. The high level of GH is closely related to the physical condition of the child because this hormone has the task of stimulating the growth of bones and tissues, as well as regulating the body's metabolism, including the child's brain. In addition, GH also allows the child's body to repair and renew all cells in the body, ranging from skin cells, blood cells to brain nerve cells. In addition, sleep disorders in children can be primary sleep disorders or as a secondary consequence of medical or psychiatric disorders[4].

In the study Petrov et al., 2021 examined the relationship between infants' sleep-wake patterns and the incidence of overweight (OW)/obesity at the age of 36 months. The results of this study are showing the importance of the need for early sleep for obesity prevention in the context of other risk factors inherent in high-risk ethnic populations[11].

Sleep disorders in children do not only result in growth problems, therefore children need enough water. Soetjiningsih, 2018 wrote in his book that as children get older, children have different sleep patterns. At about two years of age, children sleep about 10-13 hours. Approximately 30 percent of children will wake up in the middle of the night at least once a week and peak at 18 months to 2 years

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later the following ages decrease. At the age of 4-6 years, the child's sleep duration is about 10-11 hours. So in this pre-school period, in general, children still need a long amount of sleep[22].

Table 6.
Relationship between sleep quality and development in toddler-aged children

Sleep Quality	Development				Total		P value	OR
	Good Nutrition		Undenutrition & Overnutrition					
	n	%	N	%	n	%		
No Interruptions	214	97.3	6	2.7	220	100	0.0001	37.28
Disturbances	23	48.9	24	51.1	47	100		
Total	237	88.8	30	11.2	267	100		

The results of the chi-square test analysis shows that there is a relationship between sleep quality and development in Kalilembu Village and Karangdadap Village, Karangdadap Health Center working area. From the OR value, it was found that children who had sleep quality disorders had a 37.217 times greater risk of having suspect development than children with sleep quality without disturbances. Sleep is fundamental in regulating the hypothalamic-pituitaryadrenal axis, which is involved in growth hormone (GH) release. During deep (slow-wave) sleep, there is an increase in GH secretion. This peak of GH during sleep is essential for growth and muscle development, as well as tissue regeneration and repair. GH has a strong association with brain activity during deep sleep and plays a role in maintaining tissue homeostasis [23,24]. Furthermore, GH has been identified as being one of the potential mechanisms that link sleep to body composition[25]. Insufficient or poor quality of sleep can have a significant impact on the development, learning, behavior, and overall health of children[26,27] including a detrimental effect on their physical and mental well-being[28]. This research is in line with what was stated by Gracia et al., 2023. The quality of children's sleep affects memory and memory and the quality of children's sleep affects children's memory and grasp when learning. For this reason, it is very necessary to make an effort to manage our sleep time as well as possible[6].

Sleep is an activity that supports the maturation of nerves, processing sensory stimuli from the environment even when the baby is asleep. Tarullo et al., added that even in sleep conditions, babies continue to learn. The results of electroencephalogram (EEG) to identify brain activity, showed a response when given a tone/sound stimulus. This shows that during the sleep process, babies show adaptation of cognitive processes to stimuli from the environment[4].

Several studies have attempted to examine the link between children's sleep and development. Miller et al., 2015 conducted a study on the effect of acute sleep restriction (lack of naps) on self-regulation in toddlers. The results of the study showed that toddlers showed a decrease in skepticism in the condition of No Nap compared to the condition of Nap (7%). Skipping a nap also led to a 10% increase in calming down, a 9% increase in focus on the parts that didn't fit, and a 10% increase in the urge to get work done, compared to after a nap. Contrary to our expectations, we found a 4% decrease in negative self-assessments in children who did not nap compared to nap conditions[8].

There are several factors that affect a child's development. Based on the results of the research obtained, using the DDST II test, the results were obtained as many as 30 children (11.2%) were included in the suspect category. This is because there are factors that affect child developmental delays, namely the family environment related to parental education due to the lack of knowledge about the stimulation that will be provided to support child development. Good parental knowledge will improve the quality of child development. Good education affects a person's knowledge because it will be easy

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to receive information on how to take good care of children, maintain children's health and do proper stimulation. Good knowledge makes parents learn to provide stimulation so that it has an impact on optimal development in children. Parents with higher education tend to seek knowledge about the right stimulation materials and strategies and try to stimulate their children's development according to their age[18].

CONCLUSION

The results of this study show that there is a significant relationship between sleep quality and the growth and development of toddler-age children. This shows the importance of education to parents and teachers in toddler-age schools that it is necessary to consider the quality of sleep in achieving good growth and development of children.

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