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Comparison of the effectiveness of rocking and massage on infant sleep quality using a local wisdom approach in Barito Kuala Regency, South Kalimantan Province

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ABSTRACT

Background: *Infant sleep quality is an important determinant of growth, neurodevelopment, immune function, and family well-being. In South Kalimantan, traditional rocking practices such as bapukung remain culturally familiar, yet their effectiveness compared with infant massage has not been adequately examined.*
Objectives: *This study aimed to compare the effectiveness of rocking and infant massage in improving sleep quality among infants aged 0-12 months in the working area of Tamban Community Health Center, Barito Kuala Regency, South Kalimantan, Indonesia.*
Methods: *A quasi-experimental study with a non-equivalent control group design was conducted from March to June 2025. Seventy-six infants were selected through purposive sampling and allocated into two groups: rocking (n=38) and infant massage (n=38). Rocking was performed using a traditional/manual rhythmic swing three times daily for 5-25 minutes, adjusted to infant comfort, whereas infant massage was performed once daily before bedtime for 10-15 minutes using a structured gentle massage procedure. Sleep quality was measured before and after the 5-week intervention using the Brief Infant Sleep Questionnaire (BISQ). Changes in sleep quality categories were analyzed using the McNemar test with a significance level of $p<0.05$.*
Results: *The proportion of infants with good sleep quality in the rocking group increased from 39.5% before intervention to 60.5% after intervention, and the change was statistically significant ($p=0.008$). In the massage group, good sleep quality increased from 44.7% to 60.5%, but the change was not statistically significant ($p=0.180$).*
Conclusions: *Rocking was more effective than infant massage in improving infant sleep quality. Culturally relevant education on safe rocking techniques may be integrated into community-based infant health promotion programs.*

KEYWORD: *infant sleep quality; swinging; infant massage; BISQ*

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INTRODUCTION

More than 200 million children under the age of five worldwide, particularly in Asia and Africa, do not reach their optimal developmental potential. The prevalence of developmental delays in children in several countries is alarming, such as the United States (12-16%), Thailand (24%), Argentina (22%), and Indonesia (13-18%) (1). One important factor influencing infant development is sleep quality. Regular sleep contributes to infants' cognitive, social, and emotional abilities (2). Additionally, good sleep quality is crucial in supporting *neurodevelopment,* which refers to brain development and cognitive function in infants (3).

In Indonesia, data shows that 44.2% of infants experience sleep problems. Among them, 51.3% have sleep disorders, 42.2% sleep less than 9 hours per night, and many wake up more than three times during the night, with a duration of more than one hour (4) . This issue is common, with 16-38% of parents reporting sleep-related difficulties during the first 12 months (5). Sleep problems in infants include frequent nighttime awakenings, difficulty returning to sleep, and short sleep duration (6). If not properly addressed, sleep disturbances can impact an infant's long-term health, including increased risk of delayed psychomotor and cognitive development, impaired immune function, and endocrine system dysfunction (7)(8). Various interventions have been proposed to address sleep issues in infants, one of which is the use of baby swings. The rhythmic motion of a swing mimics the sensations in the womb and has been shown to help infants fall asleep faster, sleep longer, and reduce crying duration (Singh & Menahem, 2023).Research indicates that rocking movements can improve sleep quality by reducing the time it takes to fall asleep, maintaining deep sleep without disrupting the REM phase, and supporting bodily regeneration, including growth hormone production during the slow-wave sleep phase (9)(10).

In addition to rocking, baby massage is also an effective method for improving sleep patterns. Baby massage stimulates the release of endorphins and serotonin, which promote relaxation and calmness, and increases vagus nerve activity, which aids digestion and nutrient absorption (11). Babies who receive regular massage experience an increase in sleep duration of up to 1-2 hours per night (12). Studies show that 85.71% of babies experience an increase in sleep duration after receiving massage (13). Baby massage before bedtime also reduces the time it takes to fall asleep (*sleep latency)* and the frequency of waking up at night (14).

In the study (15) baby massage was even found to be more effective in prolonging sleep duration and reducing the severity of crying. Traditional practices such as "Ayun Bapukung" from the Dayak tribe in Central Kalimantan also show positive

results in improving the quality of sleep in infants. Research in the Mendawai region found that 79.41% of infants who used this method had good quality sleep compared to 25.81% of infants who used regular swings (16). Swings are an important element in the performance of the Bapalas midwife ceremony in South Kalimantan. Typically, these swings are made using a long piece of cloth called *tapih bahalai* and yellow-colored fabric. The swing serves as a place to lay the baby, who is then rocked. Various types of cakes and other accessories are often hung on the swing, indicating the potential for culture-based interventions to support infant sleep health.

In The working area of the Tamban Community Health Center in Barito Kuala District, most infants (7 out of 10 infants) were reported to have poor sleep quality, while the remaining 3 infants had good sleep quality. Given the significant prevalence of sleep disorders in South Kalimantan and the importance of sleep patterns for infant growth and development, further research is needed to evaluate the effectiveness of intervention methods such as baby swinging and massage. This study focuses on infants in South Kalimantan, particularly in the Tamban Health Center's service area in Barito Kuala District, which has not yet been explored in depth. Given the important role of the government and community in supporting infant development as stipulated in Law No. 17 of 2023, Article 41, this study is expected to provide scientific evidence to develop culturally appropriate intervention recommendations to improve infant sleep quality in the region.

MATERIAL AND METHOD

This study employed a quasi-experimental non-equivalent control group design to compare the effects of swinging and infant massage on infant sleep quality. The study population included infants aged 0–12 months who resided in the service area of the Tamban Community Health Center, Barito Kuala District, South Kalimantan Province. A total of 76 infants were selected through purposive sampling and divided equally into two groups: rocking (38 infants) and massage (38 infants).

This study was conducted in the working area of the Tamban Health Center in Barito Kuala District, South Kalimantan, Indonesia, during a four-month period from March to June 2025. The independent variable was the intervention method (swinging or infant massage), and the dependent variable was infant sleep quality. Swinging: rhythmic motion using a traditional/manual swing, three times a day for 5–25 minutes, adjusted to the infant's comfort. Infant massage: structured gentle stroking and pressure following the standard baby massage procedure, once daily before bedtime for 10–15 minutes.

Data collection was conducted in three stages: pre-test, intervention implementation, and post-test. In the pre-test stage, mothers or primary caregivers

were asked to complete the Brief Infant Sleep Questionnaire (BISQ) based on the infant's sleep condition before the intervention. The questionnaire assessed total sleep duration, frequency of nighttime awakenings, and duration of nocturnal wakefulness. Baseline demographic data of mothers and infants were also collected at this stage.

During the intervention stage, infants in the rocking group received rocking using a traditional/manual rhythmic swing three times daily for 5–25 minutes, adjusted to the infant's comfort and condition. Meanwhile, infants in the infant massage group received structured gentle massage once daily before bedtime for 10–15 minutes. Mothers or caregivers were first given instructions regarding the intervention procedure. The implementation of the intervention was monitored using observation sheets to record adherence, frequency, duration, and infant comfort during the 5-week intervention period.

In the post-test stage, sleep quality was reassessed after the 5-week intervention using the same BISQ instrument. The post-test data were then compared with the pre-test data to determine changes in infant sleep quality before and after the intervention in each group. Good sleep quality was defined as total sleep of ≥ 9 hours, ≤ 3 nighttime awakenings, and ≤ 1 hour of wakefulness during the night. Data were collected using the Brief Infant Sleep Questionnaire (BISQ) and observation sheets for protocol adherence. The procedure included a pre-test to assess baseline sleep quality, a 5-week intervention (swinging or massage), and a post-test using the BISQ. The data were analyzed using the Wilcoxon Signed Rank Test to assess differences between pre- and post-intervention outcomes within each group, with statistical significance set at $p < 0.05$.

This study received ethical approval from the Ethics Committee of Universitas 'Aisyiyah Yogyakarta, with approval number 4299/KEP-UNISA/III/2025, and was also registered with the Indonesia Clinical Research Registry (INA-CRR) under registry number INA-5FF9535. Informed consent was obtained from all mothers, and the principles of beneficence, non-maleficence, confidentiality, and voluntary participation were upheld throughout the study.

RESULTS AND DISCUSSION

Univariate analysis was conducted to describe the distribution of infant sleep quality categories before and after the intervention. The results showed a significant change in the distribution of sleep quality categories following treatment.

Table 1. Demographic characteristics of respondents in the rocking and massage groups

Variable	Category	Swing	Massage	Homogeneity Test
Mother's Education	Elementary/Junior High School	1 (0.29%)	1 (0.29%)	Homogeneous (p=0.996)
	High School	9 (2.63%)	11 (3.22%)	Homogeneous (p=0.996)
	Bachelor	7 (2.05%)	8 (2.34%)	Homogeneous (p=0.996)
	Graduate	21 (6.14%)	18 (5.26%)	Homogeneous (p=0.996)
Mother's age	Teen	0 (0.0%)	1 (0.29%)	Homogeneous (p=0.996)
	Adult	38 (11.11%)	37 (10.82%)	Homogeneous (p=0.996)
Employment Status	Full-time	3 (0.88%)	3 (0.88%)	Homogeneous (p=0.996)
	Part-time	3 (0.88%)	4 (1.17%)	Homogeneous (p=0.996)
	Not working	32 (9.36%)	31 (9.06%)	Homogeneous (p=0.996)
Number of Children	One Child	10 (2.92%)	15 (4.39%)	Homogeneous (p=0.996)
	Two Children	16 (4.68%)	12 (3.51%)	Homogeneous (p=0.996)
	Three Children/More	12 (3.51%)	11 (3.22%)	Homogeneous (p=0.996)
Housing Status	With husband	17 (4.97%)	20 (5.85%)	Homogeneous (p=0.996)
	With Husband and Family	15 (4.39%)	14 (4.09%)	Homogeneous (p=0.996)
	Living Alone	6 (1.75%)	4 (1.17%)	Homogeneous (p=0.996)
Infant Age	>3 months	8 (2.34%)	5 (1.46%)	Homogeneous (p=0.996)
	≥ 3 months – < 6 months	11 (3.22%)	11 (3.22%)	Homogeneous (p=0.996)
	≥ 6 months – < 9 months	10 (2.92%)	10 (2.92%)	Homogeneous (p=0.996)
	≥ 9 months – ≤ 12 months	9 (2.63%)	12 (3.51%)	Homogeneous (p=0.996)
Birth History of the Baby	Full Term	36 (10.53%)	35 (10.23%)	Homogeneous (p=0.996)
	Premature	2 (0.58%)	3 (0.88%)	Homogeneous (p=0.996)
Baby's Gender	Male	18 (5.26%)	23 (6.73%)	Homogeneous (p=0.996)
	Female	20 (5.85%)	15 (4.39%)	Homogeneous (p=0.996)
Breastfeeding History	Exclusive breastfeeding	24 (7.02%)	17 (4.97%)	Homogeneous (p=0.996)
	Non-Exclusive Breastfeeding	14 (4.09%)	21 (6.14%)	Homogeneous (p=0.996)

Table 1 on the characteristics of respondents in the swing and massage intervention shows the distribution of demographic characteristics of respondents in the swing and massage treatment groups. Most mothers had a high school to postgraduate level of education, were adults, and the majority did not work full time. Respondents generally had 1–2 children, lived in villages, and most babies were born at full term. The distribution of baby gender was relatively balanced, and most babies were exclusively breastfed. The Chi-Square homogeneity test showed

$\chi^2 = 8.999$, df = 23, and p = 0.996. Since p > 0.05, the respondent characteristics in the rocking and massage groups were considered homogeneous, indicating no significant differences in demographic characteristic distribution between the two groups.

Table 2. Frequency distribution of pre- and post-intervention infant sleep questionnaire findings

Variable	Category	Pre-swing	Post Swing	Pre-massage	Post Massage
Wake-up Frequency	1 time	2 (0.25%)	10 (1.25%)	4 (0.5%)	5 (0.63%)
	2-3 times	20 (2.51%)	22 (2.76%)	19 (2.37%)	24 (3.01%)
	4-5 times	15 (1.88%)	4 (0.5%)	14 (1.74%)	8 (1.0%)
	>5 times	1 (0.13%)	2 (0.25%)	1 (0.12%)	1 (0.13%)
Duration of Wakefulness	< 15 Minutes	15 (1.88%)	16 (2.01%)	19 (2.37%)	23 (2.88%)
	15-30 Minutes	14 (1.75%)	19 (2.38%)	16 (1.99%)	13 (1.63%)
	31-60 Minutes	6 (0.75%)	3 (0.38%)	3 (0.37%)	0 (0.0%)
	>60 Minutes	3 (0.38%)	0 (0.0%)	0 (0.0%)	2 (0.25%)
Total Sleep	>10 Hours	4 (0.5%)	5 (0.63%)	6 (0.75%)	7 (0.88%)
	9-10 hours	26 (3.26%)	27 (3.38%)	22 (2.74%)	24 (3.01%)
	7-8 hours	7 (0.88%)	4 (0.5%)	8 (1.0%)	7 (0.88%)
	<7 hours	1 (0.13%)	2 (0.25%)	2 (0.25%)	0 (0.0%)
Consistent Sleep Patterns	Yes	16 (2.01%)	19 (2.38%)	22 (2.74%)	25 (3.13%)
	No	22 (2.76%)	19 (2.38%)	16 (1.99%)	13 (1.63%)
Sleep Quality According to Mothers	Very Good	3 (0.38%)	6 (0.75%)	4 (0.5%)	9 (1.13%)
	Good	22 (2.76%)	23 (2.88%)	26 (3.24%)	25 (3.13%)
	Fair	13 (1.63%)	9 (1.13%)	8 (1.0%)	4 (0.5%)
Waking Up During Sleep	Yes	13 (1.63%)	14 (1.75%)	6 (0.75%)	6 (0.75%)
	No	25 (3.13%)	24 (3.01%)	32 (3.99%)	32 (4.01%)
Sleep Aid	Always	24 (3.01%)	17 (2.13%)	16 (1.99%)	13 (1.63%)
	Sometimes	10 (1.25%)	18 (2.26%)	20 (2.49%)	24 (3.01%)
	No	4 (0.5%)	3 (0.38%)	2 (0.25%)	1 (0.13%)
Sleep Time	Very Early	14 (1.75%)	7 (0.88%)	1 (0.12%)	4 (0.5%)
	Early	8 (1.0%)	10 (1.25%)	10 (1.25%)	15 (1.88%)
	Fairly Ideal	13 (1.63%)	17 (2.13%)	20 (2.49%)	17 (2.13%)
	Slightly Late	3 (0.38%)	4 (0.5%)	6 (0.75%)	2 (0.25%)
	Late	0 (0.0%)	0 (0.0%)	1 (0.12%)	0 (0.0%)
Electronic Sleep Aid Devices	Yes	13 (1.63%)	15 (1.88%)	16 (1.99%)	16 (2.01%)
	No	25 (3.13%)	23 (2.88%)	22 (2.74%)	22 (2.76%)
Sleeps Soundly According to Mother	Very sound	16 (2.01%)	14 (1.75%)	21 (2.62%)	21 (2.63%)
	Fairly Restful	22 (2.76%)	24 (3.01%)	16 (1.99%)	16 (2.01%)
	Not Restful	0 (0.0%)	0 (0.0%)	1 (0.12%)	1 (0.13%)
Baby Snoring	Yes	2 (0.25%)	0 (0.0%)	0	1 (0.13%)
	No	36 (4.51%)	38 (4.76%)	38 (4.73%)	37 (4.64%)

Bed	Room	17 (2.13%)	14 (1.75%)	7 (0.87%)	9 (1.13%)
	Parents' Room	13 (1.63%)	18 (2.26%)	17 (2.12%)	23 (2.88%)
	Siblings' Room	3 (0.38%)	3 (0.38%)	8 (1.0%)	1 (0.13%)
	Other Rooms in the House	5 (0.63%)	3 (0.38%)	6 (0.75%)	5 (0.63%)
Sleeping Media	Baby Crib	3 (0.38%)	7 (0.88%)	2 (0.25%)	4 (0.5%)
	Parent Bed	17 (2.13%)	12 (1.5%)	16 (1.99%)	19 (2.38%)
	Stroller	18 (2.26%)	19 (2.38%)	20 (2.49%)	15 (1.88%)
Sleeping Position	Stomach	9 (1.13%)	9 (1.13%)	17 (2.12%)	13 (1.63%)
	Sideways	14 (1.75%)	20 (2.51%)	20 (2.49%)	22 (2.76%)
	Flat	15 (1.88%)	9 (1.13%)	1 (0.12%)	3 (0.38%)
Children's Sleep Routines	Bathing	1 (0.13%)	4 (0.5%)	28 (3.49%)	4 (0.5%)
	Drinking Milk	34 (4.26%)	30 (3.76%)	1 (0.12%)	33 (4.14%)
	Hugging	0 (0.0%)	2 (0.25%)	0 (0.0%)	1 (0.13%)
	Listening to Music	3 (0.38%)	2 (0.25%)	3 (0.37%)	0 (0.0%)
's Weekly Sleep Routine Frequency	Once	0 (0.0%)	1 (0.13%)	0	0 (0.0%)
	2 times	1 (0.13%)	6 (0.75%)	3 (0.37%)	3 (0.38%)
	3 times	28 (3.51%)	27 (3.38%)	23 (2.86%)	27 (3.38%)
	4 times	9 (1.13%)	4 (0.5%)	12 (1.49%)	8 (1.0%)
Bedtime Preparation Time	6:00 p.m.	14 (1.75%)	7 (0.88%)	6 (0.75%)	4 (0.5%)
	7 p.m.	8 (1.0%)	10 (1.25%)	10 (1.25%)	15 (1.88%)
	8 p.m.	13 (1.63%)	17 (2.13%)	20 (2.49%)	17 (2.13%)
	9:00 p.m.	3 (0.38%)	4 (0.5%)	6 (0.75%)	2 (0.25%)
	10 p.m.	0 (0.0%)	0 (0.0%)	1 (0.12%)	0 (0.0%)
Baby Sleeping Methods	Accompanied by an adult	30 (3.76%)	25 (3.13%)	17 (2.12%)	15 (1.88%)
	Alone	8 (1.0%)	13 (1.63%)	21 (2.62%)	23 (2.88%)
Difficulty Putting the Baby to Sleep	Very Easy	7 (0.88%)	5 (0.63%)	5 (0.62%)	1 (0.13%)
	Fairly Easy	17 (2.13%)	11 (1.38%)	16 (1.99%)	15 (1.88%)
	Neither Easy Nor Difficult	7 (0.88%)	12 (1.5%)	9 (1.12%)	10 (1.25%)
	Quite Difficult	4 (0.5%)	8 (1.0%)	9 (1.12%)	9 (1.13%)
	Very Difficult	3 (0.38%)	2 (0.25%)	5 (0.62%)	3 (0.38%)
Baby Sleep Duration	< 8 Hours	2 (0.25%)	0 (0.0%)	3 (0.37%)	1 (0.13%)
	>12 hours	36 (4.51%)	38 (4.76%)	35 (4.36%)	37 (4.64%)
Baby Sleep Issues	Not at all	29 (3.63%)	37 (4.64%)	27 (3.36%)	32 (4.01%)
	Slightly Problematic	9 (1.13%)	1 (0.13%)	11 (1.37%)	6 (0.75%)

Based on **Table 2** on the frequency distribution of the pre- and post-treatment infant sleep questionnaires, the frequency distribution of respondents on 21 variables measured before (pre) and after (post) the swing and massage treatment is shown. It can be seen that for most variables, the number in the post condition shows improvement or change towards a better category compared to the pre condition.

For example, in the "Frequency of Awakening" variable, there was a decrease in the number of frequent awakenings, while in the "Sleep Quality According to Mother" and "Sound Sleep According to Mother" variables, there was an increase in the categories of better sleep quality. The total number of respondents in each condition remained the same (n = 38), allowing for a balanced comparison.

Table 3. Frequency distribution and percentage of sleep quality before and after rocking

Category	Swing Frequency (Pre)	Percentage (Pre)	Frequency (Post)	Percentage (Post)
Good	15	39.5	23	60.5
Poor	23	60.5	15	39.5
Total	38	100.0	38	100.0

Based on **Table 3** on the Distribution of Frequency and Percentage of Sleep Quality Before and After Rocking, it is evident that before the rocking treatment, the majority of infants (60.5%) had poor sleep quality, while only 39.5% of infants were in the good category.

After the swing treatment, the proportion of infants with good sleep quality increased to 60.5%, while those with 'poor' sleep quality decreased to 39.5%. This indicates that the swing treatment has a positive effect on improving infants' sleep quality.

Table 4. Frequency distribution and percentage of sleep quality before and after massage

Category	Massage Frequency (Pre)	Percentage (Pre)	Frequency (Post)	Percentage (Post)
Good	17	44.7	23	60.5
Poor	21	55.3	15	39.5
Total	38	100.0	38	100.0

Based on **Table 4** on the distribution of frequency and percentage of sleep quality before and after massage, 55.3% of infants were in the poor category, while 44.7% were in the good category. After massage treatment, the percentage of good sleep quality increased to 60.5%, while 39.5% of infants remained in the poor category. Although there was an improvement, this change was not as significant as the change observed after swing treatment.

Table 5. Results of the kolmogorov-smirnov normality test

Sleep Quality	K-S Statistics	df	Sig. (p)	Description
Pre- Rocking	0.393	38	< 0.001	Not normal
Post- Rocking	0.393	38	< 0.001	Not normal
Pre- Infant Massage	0.365	38	< 0.001	Not normal
Post- Infant Massage	0.393	38	< 0.001	Not normal

The normality test results presented in **Table 5** showed that all variables had significance values below 0.05, indicating that the data were not normally distributed. Therefore, the analysis was continued using a non-parametric test. Prior to conducting further analysis, assumption testing was performed. A normality test was applied to assess whether the data were distributed normally.

Table 6. Results of homogeneity test (Levene's Test)

Variable	Calculation Basis	Levene Statistic	df1	Sig. (p-value)
Post Massage Rocking	Mean	0.00	1	1.000
Post Massage Rocking	Median	0	1	1
Post Massage Rocking	Median (adj df)	0	1	1
Post Massage Rocking	Trimmed Mean	0	1	1

The homogeneity of variance test was conducted to determine whether the variances of two or more groups being compared were similar. This test is important before performing parametric analyses such as t-tests or ANOVA, which require equal variances between groups. In this study, Levene's Test was used based on the mean, median, and trimmed mean.

As shown in **Table 6**, Levene's Test based on the mean yielded a significance value of 1.000. Since p > 0.05, the variances between groups were considered homogeneous, indicating that the homogeneity assumption was met. However, the previous normality test showed that the data were not normally distributed; therefore, parametric tests such as the t-test or ANOVA were not applied. Accordingly, the analysis was continued using non-parametric tests that were more appropriate for the data distribution. To test the significance of changes in sleep quality categories before and after treatment, the McNemar test was conducted. This test is used to analyze differences in category proportions that occurred before and after treatment, with the following results.

Table 7. McNemar test results

Sleep Quality	Exact Sig (2-tailed)	Conclusion
Pre-Swing & Post-Swing	0.008	Significant
Pre Massage & Post Massage	0.180	Not Significant

Based on **Table 7** on the results of the McNemar test, it shows that the swing treatment has a significant impact on changes in the quality of sleep categories in infants (p = 0.008), while the massage treatment does not cause significant changes (p = 0.180).

The Effect of Swinging on Infant Sleep Quality

Based on the results of the analysis conducted, the rocking treatment showed a significant positive effect on improving the quality of infants' sleep. Before the rocking treatment, the majority of infants (60.5%) had poor sleep quality; however, after the treatment, the proportion of infants with good sleep quality increased to 60.5%, while those with poor sleep quality decreased to 39.5%. This indicates that baby swinging is effective in improving their sleep quality. These results are consistent with the local wisdom of the Banjar community, which has long practiced the traditional method of baby swinging known as "bapukung." Bapukung is one of the cultural heritages of the Banjar tribe, widely recognized in South Kalimantan, including Barito Kuala.

The improvement in infant sleep quality in this study can be seen as a modern manifestation of the bapukung practice. Although the intervention did not entirely use traditional methods (e.g., using a tapih or traditional bindings), the underlying principle remains the same: providing a sense of safety and comfort to infants through constant rhythmic rocking movements. The rhythmic motion of a swing mimics the sensations in the womb, which are known to provide a sense of safety and comfort to babies. This phenomenon helps accelerate the transition of babies from a wakeful state to deeper sleep. Previous studies support these findings, showing that swinging can shorten the time it takes for babies to fall asleep and extend the duration of deep sleep (NREM), a critical phase for the baby's physical regeneration (17).

According to (18), the vestibular stimulation produced by rocking also helps reduce arousal density, which can disrupt a baby's sleep. As a result, babies sleep more soundly and wake up less frequently at night. Rocking works by stimulating the baby's vestibular system, located in the inner ear and consisting of semicircular canals and otolith organs. This stimulation activates the reticular activating system (RAS) in the brainstem, which facilitates the transition between wakefulness and sleep. The repetitive rhythmic activity triggers a brain response characterized by increased *slow-wave activity* and *sleep spindles,* which are hallmarks of stage 3 NREM sleep (18)(19).

Furthermore, during NREM sleep, there is an increase in the release of *growth* hormone (GH), which is important for tissue regeneration and brain development in infants. Therefore, sleep prolonged by

rocking is not only restorative but also supports the overall growth and development of infants (10). Additionally, rocking has a significant impact on prolonging the deep sleep phase, which is part of non-rapid eye movement (NREM) sleep. This phase plays a crucial role in physical recovery and infant growth, including optimal growth hormone production during sleep (10). Research also shows that rocking not only accelerates the time it takes to fall asleep but also supports deep sleep quality, which contributes to the long-term health of infants (17).

Research further supports these findings, showing that both mechanical methods (such as rocking) and parental caregiving methods significantly reduce fussiness and heart rate in infants, contributing to calmer sleep conditions (20). Overall, the results of this study confirm that rocking not only helps babies fall asleep faster but also significantly improves their sleep quality. This is consistent with the theory that rhythmic movement can naturally regulate babies' sleep patterns in a way that supports their physical and cognitive development.

The Effect of Infant Massage on Sleep Quality Compared to Swinging

Although massage treatment also showed an improvement in the quality of infants' sleep, this change was not as significant as that seen with rocking treatment. Before massage treatment, 55.3% of infants had poor sleep quality, but after treatment, only 39.5% were in the poor sleep category. Infant massage, which stimulates the release of endorphins and serotonin, has been proven to enhance relaxation, reduce stress, and support infant sleep quality.

Although there was an improvement, the effect of massage in improving sleep quality was not as significant as that of rocking. In this study intervention, infant massage was performed using olive oil. In the study (21) , the oils used for baby massage were virgin coconut oil (*Virgin Coconut Oil)* and olive oil (*Olive Oil)*, both of which have benefits for improving infant sleep quality. Virgin coconut oil is known for its ability to maintain skin moisture and contains antibacterial and antifungal properties that prevent skin rashes in babies, while olive oil helps protect and moisturize the baby's skin. However, despite these significant benefits in enhancing relaxation in babies.

Previous studies have also shown that regular infant massage can increase sleep duration by up to 1–2 hours per night and reduce the frequency of nighttime awakenings (22). Infant massage influences the parasympathetic nervous system, which is responsible for promoting relaxation and reducing nervous activity that can disrupt infant sleep (12). Massage can also improve blood flow and increase serotonin levels, which have a calming effect and can lead to longer sleep duration.

Physiologically, massage touch activates mechanoreceptors in the skin that send signals to the central nervous system, particularly the brainstem and limbic system. This activation reduces stress hormone levels (cortisol) and increases serotonin and melatonin, two key hormones in regulating the sleep cycle.(2021)(2024) Stimulation of the vagus nerve during massage slows heart rate and deepens breathing, facilitating systemic relaxation that helps babies fall asleep more easily (23)(24).

Massage is known to have a greater effect on the light sleep phase (NREM stages 1–2) and to reduce sleep latency. However, compared to rocking, the effects of massage on prolonging deep sleep phases (NREM stage 3) and REM sleep remain limited (15). Nevertheless, massage continues to contribute to maintaining emotional stability in infants, improving short-term sleep quality, and supporting healthy nighttime routines (25)(26). Although massage has been proven to provide benefits for infant sleep, its effects are more limited compared to rocking. Often, massage only results in a short-term increase in sleep duration, while rocking plays a more significant role in improving the continuity of infant sleep. A study by Rezaei *et al.* (2023) found that massage is more effective in reducing fragmented sleep time, but the duration of deep sleep and REM sleep phases remains relatively short compared to rocking.

Research findings

indicate that while infant massage can help soothe babies and improve their sleep quality, the effects of massage are often more focused on the light sleep phase and not as strong as rocking in prolonging the deep sleep phase(15).

Massage also focuses on temporary relaxation, whereas rocking has a long-term impact on sleep continuity and the baby's physical well-being.(25) Also mention that infant massage can provide significant benefits in enhancing relaxation, but does not have the same impact on improving deep sleep quality when compared to rocking.

Comparative Effectiveness of Swinging and Massage

In a comparison between swinging and massage, the McNemar test results showed that swinging had a significant effect on changes in infant sleep quality ($p = 0.008$), while massage did not show significant changes ($p = 0.180$). These results confirm that swinging is more effective than massage in improving infant sleep quality.

Overall, both rocking and massage have significant benefits in improving infant sleep quality, but rocking has a stronger long-term impact. Rocking not only helps infants fall asleep faster but also extends the deep sleep phase (NREM), which plays a role in physical recovery and supports overall infant development (17). Although

massage can provide benefits such as increasing sleep duration in the short term, swinging remains a more effective option for improving overall sleep quality in infants, by improving sleep continuity and supporting optimal physical and cognitive development. Swinging is superior to massage in terms of sustainability and long-term effectiveness. Massage tends to be more limited to relaxation effects, while swinging improves overall sleep continuity in a way that supports the baby's sleep cycle (15). Although massage provides short-term benefits, swinging is more effective in creating consistent and deep sleep patterns for babies (25). This study is important and different from previous studies because it not only compares massage and rocking from a physiological perspective, but also links them to local cultural practices such as *bapukung*.

This has not been done in other studies, either domestically or internationally. Most previous studies have employed technology-based approaches, such as electric swings or automatic cradles, which do not account for the social, emotional, and cultural interactions between infants and caregivers (27)(28). Although emphasizing emotional connection through breath synchronization technology, it does not involve direct testing on infants. Meanwhile, this study was conducted directly on healthy infants in the local Indonesian context (29).

CONCLUSION AND RECOMMENDATION

This study concluded that rocking significantly improved infant sleep quality among infants aged 0-12 months in the working area of Tamban Community Health Center, Barito Kuala Regency, South Kalimantan.

The proportion of infants with good sleep quality increased from 39.5% before rocking to 60.5% after rocking, with a statistically significant result (p=0.008). Infant massage also showed an improvement in sleep quality, but the change was not statistically significant (p=0.180).

Therefore, rocking was more effective than massage in improving infant sleep quality in this study. It is recommended that community health centers integrate education on safe, culturally appropriate rocking techniques into infant health promotion programs. Mothers and caregivers should be guided on safe rocking duration, infant positioning, and the importance of supervision. Infant massage may still be used as a complementary bedtime routine to support relaxation and bonding.

Future studies are recommended to use randomized designs, larger samples, longer follow-up periods, and objective sleep measurements to strengthen evidence regarding the effectiveness and safety of culturally based infant sleep interventions.

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AUTHOR CONTRIBUTION

Eka Damayanti contributed to conceptualization, methodology, data collection, formal analysis, and writing the original draft. Mufdlilah contributed to conceptualization, supervision, validation, and review and editing of the manuscript. Asri Hidayat contributed to supervision, validation, and review and editing of the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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