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Tummy Time and Development of 6- to 12-Month-Old Infants

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Abstract

Early childhood development, particularly within the first 1,000 days of life, is a critical period. Globally, 5–16% of children experience developmental delays. This figure is higher in Indonesia with approximately 13–18% of children under five are facing growth and developmental issues. Adequate stimulation, including activities like tummy time, plays a vital role in a child's growth and development. This study aimed to investigate the correlation between tummy time and the developmental outcomes of infants aged 6–12 months. An analytical descriptive design with a cross-sectional approach was employed in this study that was conducted at Public Health Centers in North Sulawesi Province, Indonesia. Data collection involved questionnaires assessing the onset, frequency, and duration of tummy time, alongside the use of the Child Development Pre-Screening Questionnaire. With a minimum sample size of 96 respondents, data were analyzed using Spearman's correlation. Findings indicated that performing tummy time more than 1–2 times per week, with each session lasting 6–20 minutes, was significantly associated with better developmental outcomes. However, no significant relationship was observed between early initiation of tummy time or the number of daily sessions with infant development. The study concluded that engaging in tummy time more than 1-2 times per week for 6-20 minutes per session can promote optimal infant development.

Keywords: Infant development, sensory stimulation, tummy time

Introduction

Early childhood development during the first 1,000 days of life is a critical period, beginning from fetal development in the womb through the child's second year of life.[1] During this stage, rapid brain development takes place, encompassing the growth of the sensory system, hippocampus, myelination, and the neurotransmitter system.[2]

Global estimates suggest that the prevalence of developmental delays in infants and preschoolers ranges from 5-16%.[3] According to the Indonesian Pediatrician Association (IDAI), 5 to 10% of children are believed to encounter developmental delays. In 2014,[4] national data from the Indonesian Ministry of Health indicated that approximately 13–18% of Indonesian infants suffered from growth and developmental problems.[5]

Interruptions in an infant's growth and development can jeopardize their future stages of life. Maximizing Development during this critical period is essential. Stimulation is a significant factor influencing infant growth and Development. Offering appropriate and positive stimuli from the environment can contribute to achieving optimal growth and developmental outcomes. One effective form of stimulation for growth and Development is engaging infants in tummy time activities.[6]

Tummy time is an important activity that supports the growth and development of infants, when a baby is placed on their stomach, they are encouraged to lift their head and push with their arms, which helps strengthen the neck, back, and shoulder muscles. It also enhances gross motor skills such as rolling over, crawling, and eventually walking.

Acknowledging the significance of infant development during the First 1,000 days of life

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and its implications for future developmental stages, along with the existing research gap regarding tummy time and infant development, this study seeks to explore the correlation between tummy time and the growth and development of infants aged 6–12 months.

Methods

This cross-sectional analytical study was conducted at Paniki Bawah, Tuminting, and Tagulandang Health Centers in North Sulawesi Province from July 2023 to September 2024. The study utilized a questionnaire to gather information on variables such as the initiation age of tummy time, weekly frequency, daily sessions, and duration per session, which were treated as independent variables. The Child Development Pre-Screening Questionnaire (KPSP) was used to evaluate infant development as the dependent variable. KPSP is a tool to detect the development of children aged 0–72 months, consisting of 9–10 age-appropriate questions, using aids such as pencils, paper, a tennis ball, rattle, blocks, raisins, peanuts, or small biscuits. The interpretation of results is as follows: 9–10 "Yes" answers indicate appropriate development, 7–8 "Yes" answers indicate doubtful development, and fewer than 6 "Yes" answers suggest potential developmental delays.

Inclusion criteria were infants aged 6–12 months who had received tummy time stimulation from birth until 6 months, with parental or caregiver consent. Exclusion criteria included prematurity or post-term, congenital abnormalities, neuromuscular diseases, central nervous system disorders, hearing impairments, speech disorders, vision impairments, incomplete vaccination records, mothers with infectious diseases during childbirth, improper tummy time positioning, and infants engaging in tummy time for more than six months.

The minimum required sample size was 96. Data were analyzed using univariate and bivariate methods. Spearman's correlation was used due to non-normally distributed data. Ethical approval was obtained from the Atma Jaya Catholic University Ethics Committee (No: 18/07/KEP-FKIKUAJ/2023).

Results

Of 109 respondents, nine were excluded (two post-term births, six who began tummy time after six months, and one with Down syndrome), leaving 100 eligible participants. Table 1 presents the demographic characteristics of the study population. Table 2 summarizes tummy time practices, including age of initiation, weekly frequency, daily sessions, and session duration. Developmental outcomes were classified as normal, borderline, or abnormal. The data revealed that most infants (82%) showed normal Development, with the largest group (22 infants) starting tummy time at four months of age.

Table 1 Demographic Characteristics of the Study Population

Variable	n=100	%
Age		
6 Month	14	14
7 Month	7	7
8 Month	7	7
9 Month	20	20
10 Month	12	12
11 Month	13	13
12 Month	27	27
Gender		
Male	56	56
Female	44	44

Interestingly, no abnormal cases were observed among infants who began tummy time at 1, 2, or 5 months. The study included 100 infants, ranging in tummy time initiation from less than one month to 6 months. The study reports a p-value of 0.106 and a correlation coefficient of -0.163, indicating the statistical analysis of the relationship between the age of tummy time initiation and developmental outcomes. However, further context is needed to interpret these findings accurately.

Table 3 shows the association between the number of tummy time sessions per day and developmental outcomes in infants aged 6–12 months. Among those who engaged in 1–2 sessions per day, 7% demonstrated appropriate development, 5% were questionable, and 2% were deviant. In the 2–3 sessions group, 25% achieved appropriate development, 4% were questionable, and no deviant cases were recorded. For infants performing 3–4 sessions per day, 22% were appropriate and 1% deviant, with no questionable outcomes. The largest group, those practicing tummy time more than four times daily, included 28% appropriate, 4%

Table 2 Tummy Time Assessment

Variable	n	%
Age to Start Tummy Time		
<1 Month	5	5
1 Month	3	3
2 Month	8	8
3 Month	24	24
4 Month	28	28
5 Month	18	18
6 Month	14	14
Intensity (1 weeks)		
1–2x	9	9
3–4x	15	15
5–6x	3	3
Every day	73	73
Session (per day)		
1–2x	14	14
2–3x	29	29
3–4x	23	23
>4x	34	34
Duration (per session)		
<1–5 min	40	40
6–20 min	47	47
>20 mmin	13	13
Developmental		
Appropriate	82	82
Questionable	13	13
Deviant	5	5

questionable, and 2% deviant cases.

Statistical analysis revealed a p-value of 0.098 and a correlation coefficient of 0.167, indicating a weak, nonsignificant positive correlation between the number of daily tummy time sessions and developmental outcomes.

Table 4 presents the relationship between the number of daily tummy time sessions and developmental outcomes in infants aged 6–12 months. The study categorizes daily tummy time sessions into four groups: 1-2 times, 2-3 times, 3-4 times, and more than four times. For each group, the table presents the count and percentage of infants categorized as showing normal, borderline, or abnormal Development. Among the 100 infants studied, 82 (82%) demonstrated normal Development, 13 (13%) were classified as borderline, and 5 (5%) as abnormal. Significantly, infants who underwent more than four tummy time sessions per day exhibited the highest incidence of normal Development, with 28 cases (28%). The group with 2-3 tummy time sessions showed no abnormal cases, while the 3-4 group had no borderline cases. Additionally, Table 4 includes a p-value of 0.098 and a coefficient of 0.167, indicating a potential weak positive correlation between tummy time frequency and developmental outcomes. However, interpreting these findings accurately would necessitate additional statistical context.

Table 5 presents the association between tummy time session duration and developmental outcomes in infants aged 6–12 months. Of the 100 infants, 82% demonstrated appropriate development, 13% were borderline, and 5% were deviant. The highest proportion of appropriate outcomes was observed among infants who engaged in sessions lasting 6–20 minutes (42%). No abnormal cases occurred in the group with sessions longer than 20 minutes. Statistical analysis showed a p-value of 0.014 and a correlation coefficient of 0.244, indicating a statistically significant positive correlation between session duration and developmental outcomes. These findings suggest that sessions of 6–20 minutes are particularly beneficial, and longer durations may also support favorable developmental progress.

Table 6 illustrates the association between weekly tummy time frequency and developmental outcomes in infants aged 6–12 months. Tummy

Table 3 Correlation Between the Session Frequency of Tummy Time per Day and Developmental Outcomes in Toddlers Aged 6–12 Months

Tummy Time Sessions/Day	Appropiate n (%)	Questionable n (%)	Deviant n (%)	p-value	Correlation (r)
1-2x	7 (7.0)	5 (5.0)	2 (2.0)	0.098	0.167
2-3x	25(25.0)	4 (4.0)	0(0.0)		
3-4x	22 (12.0)	0 (0.0)	1(1.0)		
>4x	28 (28.0)	4 (4.0)	2(2.0)		

Table 4 Correlation Between the Age to Start Tummy Time and Developmental Outcomes in Infants Aged 6–12 Months

Age to Start Tummy Time	Toodlers Age 6 to 12 Months Development			p-value	Correlation
	Appropiate n (%)	Questionable n (%)	Deviant n (%)		
<1 Month	3 (3.0)	1 (1.0)	1 (1.0)	0.106	-0.163
1 Month	2 (2.0)	1(1.0)	0 (0.0)		
2 Month	8(8.0)	0 (0.0)	0 (0.0)		
3 Month	21 (21.0)	2 (2.0)	1 (1.0)		
4 Month	22 (22.0)	4 (4.0)	2 (2.0)		
5 Month	15 (15.0)	3 (3.0)	0 (0.0)		
6 Month	11 (11.0)	2 (2.0)	1 (1.0)		
TOTAL	82 (61)	13 (13.0)	5 (5.0)		

Table 5 Correlation Between the Duration of Tummy Time Sessions and Developmental Outcomes in Infants Aged 6–12 Months

Duration of Tummy Time/Session	Appropriate n (%)	Questionable n (%)	Deviant n (%)	p-value	Correlation
<1–5 min	28 (28.0)	9 (9.0)	3 (3.0)	0.014	0.244
6–20 min	42 (42.0)	3 (3.0)	2 (2.0)		
>20 min	12 (12.0)	1 (1.0)	0 (0.0)		
TOTAL	82 (61.0)	13 (13.0)	5 (5.0)		

time intensity was categorized into four groups: 1–2 times, 3–4 times, 5–6 times, and daily. Among the 100 infants, 82 (82%) demonstrated normal development, 13 (13%) were classified as borderline, and 5 (5%) as abnormal. Infants who engaged in daily tummy time had the highest proportion of normal development, totaling 64 (64%). Notably, no abnormal cases were observed among infants practicing tummy time 3–4 times or 5–6 times per week.

Furthermore, Table 6 reports a p-value of 0.002 and a correlation coefficient of 0.300, indicating a statistically significant positive correlation between the frequency of tummy time per week and developmental outcomes. This suggests that increasing the frequency of tummy time sessions throughout the week may correlate with better developmental outcomes in infants of this age group. The robust statistical significance ($p<0.01$) and moderate positive correlation further underscore the beneficial impact of consistent tummy time on infant development.

The Kruskal-Wallis test results indicate a significant difference in tummy time intensity per week concerning developmental outcomes (Asymp. Sig.<0.05). Pairwise comparisons demonstrate that tummy time performed

Table 6 Correlation Between the Frequency of Intensity Tummy Time Per Week and Developmental Outcomes in Infants Aged 6 To 12 Months

Intensity of Tummy Time / Week	Appropiate n (%)	Questionable n (%)	Deviant n (%)	p-value	Correlation (r)
1–2x	2 (2.0)	5 (5.0)	2 (2.0)	0.002	0.300
3–4x	13 (13.0)	2 (2.0)	0 (0.0)		
5–6x	3 (3.0)	0 (0.0)	0 (0.0)		
Everyday	64 (64.0)	6 (6.0)	3 (3.0)		

1–2 times per week significantly differs from intensities exceeding 1–2 times per week (3-4 times per week, 5–6 times per week, and daily). This indicates that performing tummy time more than 1–2 times per week is more beneficial for development.

The results of the Kruskal-Wallis test indicate a significant difference in tummy time duration concerning developmental outcomes (Asymp. Sig<0.05). Pairwise comparisons show that durations of less than 1–5 minutes significantly differ from durations of 6–20 minutes. Therefore, it can be concluded that the duration of tummy time per session that impacts Development is 6–20 minutes.

Discussion

There is a notable correlation between tummy time and infant development, particularly regarding the frequency of tummy time sessions per week and the duration of each session. These findings are consistent with Hewitt et al., who reported that regular tummy time is associated with improved locomotor skills such as rolling, crawling, and sitting, as well as earlier achievement of milestones. Moreover, among six observational studies, it was observed that infants who engage in longer durations of tummy time tend to reach developmental milestones earlier. Additionally, significant correlations were identified between tummy time and cognitive development, as well as social communication skills.[6]

Koren et al.,[6] investigated the association of tummy time with growth and development in infants aged 2 and 4 months. The authors reported that infants who engaged in longer durations of tummy time achieved developmental milestones earlier, including lifting the head, turning the head, making eye contact, bringing hands to the mouth, and kicking. Similarly, a study by Sabang and Yuliati demonstrated significant improvements in psychomotor development among infants aged 6–9 months before and after tummy time, with a Z value of –4.231 and p<0.0001.[7]

These findings are consistent with previous studies, supporting the association between tummy time and developmental progress.[6,7] This study shows age-appropriate developmental outcomes in infants aged 6–12 months who engage in tummy time, as assessed using the pre-screening developmental questionnaire, in line with previous studies. No studies to date have reported an absence of association between tummy time and development. This study further evaluated the timing of initiation, weekly frequency, daily sessions, and session duration to identify criteria for optimal tummy time. The results obtained that an ideal frequency of tummy time for optimal development is more than 1-2 times per week, as there was a significant difference observed between frequencies of 1–2 times per week and those exceeding 1–2 times per week in terms of developmental outcomes (Asymp. Sig.<0.05). Similarly, the study identified the optimal duration of tummy time to be 6-20 minutes, with a notable difference noted between durations of less than 1–5 minutes and 6-20 minutes in relation to development(Asymp. Sig. <0.05).

No significant correlation was found between the initiation age of tummy time or the number of daily sessions and developmental outcomes in infants aged 6–12 months. This may be explained by the study's sample selection, which included only infants who began tummy time early (before 6 months of age, consistent with WHO guidelines) and excluded those who started later. The lack of variation in initiation age likely contributed to the nonsignificant findings. In summary, infants who performed tummy time more than 1–2 times per week, with sessions lasting 6–20 minutes, were more likely to achieve age-appropriate developmental milestones.

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