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Boosting Infant Growth: Exploring the Influence of Baby Massage on Weight Gain in 1-6 Month-Olds

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Abstract−Massage therapy is one of the oldest healing methods worldwide, encompassing both healthcare and treatment. Baby massage offers numerous benefits, including the enhancement of infant weight gain. In Kediri, East Java, child growth and development issues persist, with a prevalence of underweight children at 17.5% and wasted children at 9.0%. This research aims to analyze the impact of baby massage classes on infant weight gain. This study adopts a quasi-experimental design with a Two Group Pretest-Posttest format. The research subjects were divided into two groups: control and treatment. Pretest and posttest measurements were conducted. Statistical analysis using paired t-tests yielded a significance level of p=0.000 (p<0.05), indicating a significant influence of baby massage classes on weight gain in infants aged 1-6 months. The average weight gain after intervention was 5200 grams.Of the total respondents, 19 infants (63.3%) experienced weight gain, with 13 from the intervention group and 6 from the control group. However, 9 infants (30%) maintained their weight, with 2 from the intervention group and 7 from the control group, while 2 infants (6.7%) experienced weight loss, all from the control group.Baby massage classes have a positive impact on infant weight gain at the Ibu Hawa Clinic in Kediri Regency.

Keywords: Baby Massage; Infants Aged 1-6 Months; Weight Gain

1. INTRODUCTION

Evaluating a child's nutritional status involves comparing measurements of weight and height. This assessment is crucial for identifying potential health issues and ensuring that the child is growing properly. Typically, there are three physical growth indicators measured in infants: height, weight, and head circumference. Each of these indicators provides essential information about different aspects of an infant's development.Height (or length, for infants) is a fundamental measure of skeletal growth and development. Weight, on the other hand, reflects the overall growth and nutritional status of the child, indicating whether they are receiving adequate nutrition for healthy development. Head circumference is an important measure of brain growth and development, as rapid brain growth occurs during the first years of life.In the first three months, infants generally experience a weight gain of 600-1000 grams. This rapid weight gain is indicative of proper feeding practices and the infant's ability to assimilate nutrients effectively. This period is critical as it sets the foundation for future growth and development.By the end of the first year, a baby's weight typically triples their birth weight. This significant increase highlights the infant's growth milestones and the effectiveness of the nutritional and caregiving environment provided by the parents or caregivers. Monitoring these growth parameters helps in the early detection of growth abnormalities, which can then be addressed promptly through medical or nutritional interventions.It is essential for healthcare providers to regularly measure and record these growth indicators during routine check-ups. This practice enables the identification of any deviations from the expected growth patterns, allowing for timely interventions. Moreover, educating parents about the importance of these growth indicators can empower them to seek medical advice when they notice irregularities in their child's growth.(Sutomo & Anggraini, 2010).

Based on data from the Indonesian Nutritional Status Study, it is reported that the national prevalence of underweight toddlers, characterized by weight-for-age below -2SD, reaches 17%, while the prevalence of wasted toddlers (weight-for-length/height below -2SD) is 7.1%. In East Kalimantan Province, the prevalence of underweight toddlers is 16.2%, while the prevalence of wasted toddlers is 8.1%. In the Kutai Kartanegara Regency area, these figures are slightly higher, with the prevalence of underweight toddlers reaching 17.5% and the prevalence of wasted toddlers reaching 9.0% (Ministry of Health of the Republic of Indonesia, 2021). This indicates that malnutrition among toddlers is a serious issue that requires serious attention from authorities, especially in designing and implementing effective nutrition programs at both national and regional levels.

Massage is one of the oldest healing methods globally. It encompasses healthcare and treatment by loosening stiff muscles and integrating body organs through strong rubbing. Massage therapy is not only used in salons and spas but is also applied in various hospitals and healthcare centers for infants.Massage therapy stands as one of the ancient forms of treatment worldwide, offering both healthcare and therapeutic benefits. Its techniques, capable of relaxing rigid muscles and harmonizing bodily organs through vigorous strokes, extend beyond luxurious salon and spa settings. Indeed, massage therapy finds its application in numerous hospitals and healthcare facilities, even for infants (Syaukani, 2015).

Engaging in baby massage offers numerous benefits, one of which is aiding the development of brain cells. A child who receives regular stimulation and stimuli tends to develop faster compared to those who lack stimulation. The quality of a baby's sleep significantly influences the growth and development of their brain; hence, it is crucial to maintain both the quality and quantity of a baby's sleep (Wahyuni et al., 2020).

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A mother is the closest person to a child and provides care for th. Mothers need to be equipped with sufficient knowledge and skills to provide appropriate stimulation for their child's growth and development. The quality of a child's growth and development is determined by family care, primarily by parents, especially mothers. Mothers play a crucial role in providing stimulation and detecting potential developmental deviations (Legiati et al., 2019).

The Toddler's Mother Class serves as a forum for mothers with children aged 0 to 5 years to engage in collaborative discussions, share insights, and exchange experiences related to healthcare, nutrition, and fostering optimal growth and development. These sessions are guided by facilitators, often healthcare providers such as nurses, who provide expert guidance and support. Among the various topics covered during these sessions, one notable subject is the technique of infant massage, which is taught to mothers with the goal of promoting healthy weight gain in their babies (Legiati et al., 2019).

The first year of motherhood marks a period of adaptation in a woman's life, involving vario asks such as identifying the needs of the baby and finding appropriate solutions to ensure mutual understanding and the format of a strong bond between mother and child. Infant massage serves as one approach that significantly contributes to the psychological and physiological well-being of both the baby and the mother, aiding in the development of a harmonious relationship characterized by bonding attachment (Yavaş et al., 2021). Through this practice, mothers learn to understand and respond to their baby's cues, fostering a nurturing environment that prom s emotional closeness and physical health.

The importance of diss inating knowledge about infant massage care practices and their effects is crucial for mother education. Altho infant massage is a traditional practice, knowledge about it remains limited. A study conducted to explore the prevalence and pe ptions of infant massage practices in two Indian states involved 1497 caregivers of children under 18 months old. The results of this cross-sectional study indicate that the use of baby oil in infant massage is a commonly practiced traditional method. However, clear guidelines on infant massage modules, appropriate oil choices, and application techniques are needed to maximize the benefits and minimize the risks associated with this popular traditional practice (Chaturvedi et al., 2020). Therefore, more intensive and informative educational efforts are needed to improve understanding a safe and effective practices related to infant care.

An experimental study w s conducted on 120 mothers with neonates hospitalized (60 in the experimental group, in the control group). Infant massage training was provided to the intervention group for 3 days by trained midwives. Before education, the mean scores of awareness, stress perception, and breastfeeding self-efficacy in the intervention group were 6.47±2.23, 33.42±6.85, 131.50±19.34, respectively. After education, the average scores above changed to 8.33±1.28, 39.10±1.85, 145.77±15.80, and this change was statistically significant with ($P < 0.01$). It can be concluded that infant massage training is effective in increasing maternal awareness, breastfeeding self-efficacy, and reducing matern stress perception (Didarloo et al., 2018).

A meta-analysis study aimed to evaluate the effecti ss of massage therapy in treating anorexia (long-term loss of appetite) in children with decreased appetite sensations. In addition to pharmacotherapy, in China, massage therapy is also used by many traditional Chinese medicine pra itioners to treat anorexia in children. The analysis results suggest that massage therapy is significantly more effective than pharmacotherapy in treating anorexia in children. However, the quality of evidence for this finding is low due to the high risk of bias in the included studies. Well-designed randomized controlled trials are still needed to further evaluate the effectiveness of massage therapy (Gao et al., 2018). This study sheds light on the potential of massage therapy as an alternative or complementary treatment for pediatric anorexia, but more rigorous research is necessary to confirm its efficacy and safety.

The initial data collection results showed that in 2023, there were a total of 649 toddlers in the working area of the Mojo Kediri Community Health Center. Out of these toddlers, 329, or 50.69%, were weighed. Among the weighed toddlers, 302 experienced weight gain, while 27 did not. Based on this data, it is evident that almost 50%, or approximately 320 toddlers, did not undergo weighing, indicating a lack of growth monitoring or weight monitoring for these children. This suggests a potential gap in healthcare services for monitoring the growth and weight of toddlers in the community. It underscores the importance of implementing comprehensive monitoring programs to ensure the well-being and healthy development of all children in the area served by the health center.As for the results of interviews conducted with mothers who have toddlers and those who visited the Mojo Kediri Maternity Clinic, several mothers expressed that they were unaware of how to provide healthcare for their infants, particularly through promoting infant growth stimulation by infant massage. This suggests a need for increased education and awareness among mothers regarding the importance and techniques of infant massage as part of infant healthcare practices. Implementing educational programs and workshops could help empower mothers with the knowledge and skills needed to promote the health and development of their infants effectively.

2. RESEARCH METHODS

This study adopts a quasi-experimental or experimental research type with the aim of gathering predictive data and information regarding the actual experiment's outcomes. Employing a Two Group Pretest-Posttest design, subjects are divided into control and treatment groups, and pretests and posttests are conducted to measure the effectiveness of the intervention.The research was conducted in 2024 at theIbu Hawa Clinic in Kediri Regency. The study population consists of mothers with one-year-old infants in the working area of the Mojo Community Health Center, while the sample

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includes mothers with infants aged 1-6 months in the same area. Sampling was done purposively based on specific criteria.Infant massage is the independent variable, while body weight is the dependent variable. Operational definitions are provided to clarify the variables' meanings and measurements. Research instruments include the Infant Massage Module, baby scale, and infant weight observation sheet.Data collection involves both primary and secondary methods. Primary data are gathered through pre-tests and post-tests, directly from respondents, to assess body weight using a baby weight scale. Secondary data are obtained from the annual reports ofIbu Hawa Clinic in Kediri Regency.Data analysis comprises univariate and bivariate analyses. Univariate analysis summarizes measurement data for each research variable, while bivariate analysis tests causality and relationship hypotheses. The Parametric T-Test or T-Test is used to determine the significance of sample groupings, with a T-statistic value greater than 1.96 indicating significance.

3. RESULT AND DISCUSSION

The study on the impact of infant massage classes for 1-6 month old infants on weight gain at the Ibu Hawa Clinic in Kediri, conducted from January to March 2024. This research used a Two Group Pretest-Posttest design, with 15 samples in the control group and 15 samples in the treatment group. Both groups underwent pretests and posttests. The table below presents the characteristics of respondents in both the experimental and control groups. It includes detailed information on the age and gender distribution of the babies, as well as their birth weight. The data is organized to show both the frequency and percentage for each category within the groups, providing a clear comparison of the two groups. The data distribution can be seen in the table 1.

Table 1. Characteristics of Respondents

Characteristics		Experimental Group		Control Group	
		Frequency	%	Frequency	%
Baby Age	1 Month	1	6.67	0	0
	2 Month	2	13.33	9	60
	3 Month	5	33.33	3	20
	4 Month	4	26.67	2	13.33
	5 Month	3	20	1	6.67
Gender	Male	7	46.67	7	46.67
	Female	8	53.33	8	53.33
Birth Weight (grams)	2500-2900	8	53.33	8	53.33
	3000-3400	3	20	7	46.67
	3500-3800	4	22.67	0	0
Total		6	100	6	100

Source: Primary Data 2024

Based on table 1, it is evident that the most common age of respondents in the intervention group is 3 months, with 5 infants (33.33%), and the least common age is 1 month, with 1 infant (6.67%). In the control group, the most common age is 2 months, with 9 infants (60%), and the least common age is 5 months, with 1 infant (6.67%). The infants' ages are calculated from birth until the infant massage intervention is conducted.The gender distribution of respondents is balanced in both the intervention and control groups. In the control group, there are 7 male infants (46.67%) and 7 male infants (46.67%) in the intervention group. Similarly, there are 8 female infants (53.33%) in both the control and intervention groups.Regarding birth weight, in the intervention group, the most common birth weight is 2500-2900 grams, with 8 infants (53.33%), and the least common is 3000-3400 grams, with 3 infants (20%). In the control group, the most common birth weight is also 2500-2900 grams, with 8 infants (53.33%), while the least common birth weight is 3000-3400 grams, with 7 infants (46.67%).

The research presented provides a detailed demographic analysis of infants involved in a massage intervention, highlighting age, gender, and birth weight distributions. The findings align with established theories and previous research on the benefits of infant massage, suggesting that such interventions can significantly enhance infant development. One of the primary theoretical frameworks supporting the benefits of infant massage is attachment theory. According to Bowlby (1969), physical touch is crucial for developing secure attachments between infants and their caregivers. Infant massage promotes bonding, which can lead to improved emotional and social outcomes for the child. Secure attachment is foundational for healthy psychological development, influencing a child's ability to form relationships and manage stress later in life.Another supporting theory is the psychoneuroimmunology framework, which posits that psychological processes can influence the immune system. Studies have shown that infant massage can reduce cortisol levels (a stress hormone) and increase serotonin levels (a neurotransmitter associated with well-being) (Field, 2014). This hormonal balance can enhance immune function, leading to better overall health outcomes for infants.Furthermore, the tactile stimulation provided by massage has been linked to improved physical growth. Research by Underdown et al. (2006) indicates that massage can stimulate the vagus nerve, which plays a role in gastrointestinal function and nutrient absorption. This can result in better weight gain and growth, particularly important for infants with low birth weight.

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The researchers observe that the balanced distribution of gender and birth weight between the intervention and control groups enhances the validity of their findings. The minor differences in age distribution are not deemed significant enough to affect the overall outcomes of the massage intervention. This observation is crucial as it suggests that the benefits of infant massage are likely consistent across different demographic profiles.The researchers also highlight the importance of considering demographic factors when designing and interpreting future studies on infant massage. They suggest that ensuring balanced demographic characteristics can help isolate the effects of the interventi more effectively, leading to more reliable and generalizable results.In their opinion, the findings reinforce the potential of infant massage as a beneficial intervention for infant development. The researchers argue that the balanced demographic distribution in their study provides a robust basis for their conclusions, suggesting that the positive effects of infant massage are not confounded by gender or birth weight differences.Moreover, the researchers emphasize the need for further research to explore the long-term benefits of infant massage, particularly in diverse populations. They advocate for more extensive studies that include various demographic groups to confirm the generalizability of the results. This would help in understanding how different factors such as cultural practices and socioeconomic status might influence the effectiveness of infant massage.

In conclusion, this research supports the theoretical foundations of infant massage's benefits, demonstrating positive outcomes in a well-balanced demographic sample. The findings underscore the potential of infant massage to improve physical and emotional development in infants, reinforcing the need for its inclusion in early childhood care practices. The researchers' insights call for continued exploration of this intervention to maximize its benefits across diverse infant populations.

The e below illustrates the distribution of infant weight prior to the infant massage intervention. The data is categorized into two groups: the intervention group and the control group. Each group shows the frequency and percentage of infants falling within specific weight ranges. This provides a comprehensive overview of the initial weight distribution of infants before the intervention was applied.

Table 2. Distribution of Infant Weight Before the Infant Massage Intervention

Respondents	Infant Weight Before Intervention	Frequency	Percentage (%)
Intervention Group	3400 gram	1	3.3
	3500 gram	2	6.78
	3600 gram	1	3.3
	3610 gram	1	3.3
	3800 gram	1	3.3
	4100 gram	1	3.3
	4300 gram	2	6.78
	4400 gram	1	3.3
	5000 gram	1	3.3
	5300 gram	1	3.3
	5500 gram	1	3.3
	6000 gram	1	3.3
	6600 gram	1	3.3
Control Group	2500 gram	2	6.78
	2600 gram	3	10
	2700 gram	1	3.3
	2800 gram	1	3.3
	2900 gram	1	3.3
	3000 gram	2	6.78
	3100 gram	2	6.78
	3200 gram	1	3.3
	3300 gram	1	3.3
	356 gram	1	3.3
	Total	30	100

Source: Primary Data 2024

Based on Table 2, the most common infant weights before the massage intervention in the intervention group are 3500 grams and 4300 grams, each represented by 2 infants, accounting for 6.78%. In the control group, the most frequent infant weight is 2600 grams, accounting for 10% of the infants.Expanding the analysis, it is clear that the intervention group shows a relatively even distribution of infant weights before the massage intervention. The two most frequent weights, 3500 grams and 4300 grams, each have a small but equal representation. This suggests a diverse range of initial weights within the intervention group. In contrast, the control group has a more pronounced concentration at the 2600 grams weight mark, indicating a more uniform starting point for many of the infants in this group. Understanding these weight distributions is crucial for evaluating the effectiveness of the infant massage intervention on weight gain.

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The analysis of infant weights before the massage intervention, as presented in Table 2, provides a foundational understanding of the baseline characteristics of the study groups. The diversity in initial weights within the intervention group and the concentration at 2600 grams in the control group offer significant insights into how initial weight distributions might impact the outcomes of the intervention.One of the primary theoretical frameworks supporting this analysis is the principle of developmental plasticity. According to this theory, infants have a high degree of developmental adaptability, which allows them to respond positively to beneficial interventions such as massage therapy (Shonkoff & Phillips, 2020). This adaptability is particularly relevant in the context of infant weight gain and physical development. Massage therapy, by stimulating the vagus nerve, enhances gastric motility and nutrient absorption, thus promoting weight gain and overall growth (Field, 2018).Another relevant theory is the biopsychosocial model, which integrates biological, psychological, and social factors in understanding health and development (Engel, 1977). The physical touch involved in massage not only stimulates physiological growth but also provides psychological comfort, reducing stress and promoting a sense of well-being in infants. This holistic approach underscores the multifaceted benefits of infant massage, making it an effective intervention for diverse infant populations, as reflected in the varied weight distribution of the intervention group.

The researchers observe that the relatively even distribution of infant weights in the intervention group is indicative of a diverse sample, which enhances the generalizability of the findings. The presence of multiple weight categories (e.g., 3500 grams and 4300 grams) in equal representation suggests that the intervention's effectiveness can be assessed across a broader range of initial conditions. This diversity is crucial for understanding how massage therapy impacts infants with different starting weights, potentially leading to more nuanced and targeted recommendations for infant care.In contrast, the control group's concentration around the 2600 grams weight mark highlights a more uniform baseline. While this uniformity could simplify the analysis of weight gain within this group, it also suggests that the findings might be less applicable to infants with higher or more varied initial weights. The researchers note that this limitation needs to be considered when interpreting the results and applying them to the general infant population.The researchers emphasize the importance of considering initial weight distributions when evaluating the effectiveness of interventions like infant massage. They argue that understanding the baseline characteristics of study participants is crucial for accurately measuring the intervention's impact. In this study, the diverse weight distribution in the intervention group allows for a more comprehensive evaluation of the massage's effects, potentially leading to broader and more inclusive conclusions.Moreover, the researchers suggest that future studies should continue to examine the impact of initial weight variations on the effectiveness of massage therapy. They recommend designing studies that include a wide range of initial weights to ensure that the findings are applicable to all infants, regardless of their starting weight. This approach would enhance the validity and applicability of the research, providing stronger evidence for the benefits of infant massage.

In conclusion, the analysis of initial weight distributions provides valuable insights into the effectiveness of infant massage interventions. The supporting theories of developmental plasticity and the biopsychosocial model highlight the multifaceted benefits of massage therapy. The researchers' observations and recommendations underscore the importance of considering baseline characteristics in evaluating and applying health interventions, ensuring that the benefits of infant massage can be maximized across diverse infant populations.

The table below presents the frequency distribution of respondents based on weight gain observed during the study. The data is categorized into three sections: weight increase, weight stability, and weight decrease, with further division between the intervention group and the control group. This table aims to highlight the variations in weight changes among infants in both groups, providing a clear comparison of the outcomes between those who received the intervention and those who did not.

Table 3. Frequency Distribution of Respondents Based on Weight Gain

Weight Gain	Frequency	Percentage (%)
Increase:		
Intervention Group	13	43.3
Control Group	6	20
Stable:		
Intervention Group	2	6.7
Control Group	7	23.3
Decrease:		
Intervention Group	0	0
Control Group	2	6,7
Total	30	100

Source: Primary Data 2024

Based on Table 3, weight gain was observed in 19 individuals, comprising 13 individuals (43.3%) in the intervention group and 6 individuals (20%) in the control group. There were 9 respondents who did not experience weight gain (stable), with 2 individuals (6.7%) from the intervention group and 7 individuals (23.3%) from the control group.

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Additionally, 2 individuals from the control group (6.7%) experienced weight loss, while there were no respondents in the intervention group who experienced weight loss.

The data presented in Table 3 show a significant difference in weight gain between the intervention and control groups. Weight gain was observed in 19 individuals, comprising 13 individuals (43.3%) in the intervention group and 6 individuals (20%) in the control group. Additionally, there were 9 respondents who did not experience weight gain (stable weight), with 2 individuals (6.7%) in the intervention group and 7 individuals (23.3%) from the control group. Furthermore, 2 individuals (6.7%) from the control group experienced weight loss, while no respondents in the intervention group experienced weight loss. These findings suggest that infant massage significantly contributes to weight gain in infants.

Infant massage increases the activity of the neurotransmitter serotonin, which enhances the capacity of cell receptors to increase glucocorticoid (adrenaline, a stress hormone). This process leads to a reduction in adrenaline levels, thereby reducing stress hormone levels. Lower stress hormone levels improve immune function, particularly by increasing levels of immunoglobulins IgM and IgG, which are critical for the immune system's ability to fight infections (Field, 2014).Furthermore, the reduction in stress hormones and the increase in serotonin levels result in improved overall well-being for infants. Serotonin is known to regulate mood and social behavior, appetite and digestion, sleep, memory, and sexual desire and function. By increasing serotonin levels, infant massage not only promotes weight gain but also enhances emotional and psychological development (Field, 2014).

Infant massage has been shown to improve sleep quality and quantity, which are essential for healthy growth and development. Siti Noorbaya and Rr Nindya's study in the Malaysian Journal of Medical Research demonstrated that infant massage significantly increases sleep duration. The study used a pre-experimental design with a one-group pretest and posttest, measuring sleep quantity in infants aged 3-6 months. The results showed that after massage, infants slept an average of 13.77 hours per day compared to 12.48 hours per day before the massage, with an average increase of 1.29 hours per day. The statistical analysis indicated a significant effect of massage on sleep quantity (p=0.000) (Noorbaya & Nindya, 2020).Improved sleep contributes to better weight gain because growth hormone, essential for physical development, is primarily secreted during deep sleep. Adequate sleep also supports cognitive and emotional development, providing infants with the necessary rest to process their experiences and develop optimally.

Research by Lastriati and Ita in the Journal of Comprehensive Nursing highlighted the therapeutic benefits of infant massage in preventing upper respiratory tract infections. Their study involved 70 infants and found that massage had a positive impact on the recovery from colds and coughs. The quantitative research, conducted using a cross-sectional design, suggested that infant massage enhances immune function, thereby helping prevent and recover from respiratory infections (Lastriati & Ita, 2022).This finding is consistent with the theory that reduced stress hormone levels improve immune function. By lowering stress and boosting immune system markers such as IgM and IgG, infant massage helps protect infants from infections, contributing to overall health and well-being.

Infant massage stimulates the release of digestive hormones like insulin and gastrin, which improve food absorption. Better food absorption leads to more efficient nutrient uptake, which is crucial for weight gain. Infants who receive regular massage tend to feel hungrier more often, leading to more frequent feeding and, consequently, increased weight (Fatmawati et al., 2021).Nurul Fatmawati and colleagues conducted a literature review published in the Journal for Quality in Public Health, which explored how infant massage influences weight gain. The review concluded that regular massage, involving massaging the legs, abdomen, chest, arms, and back, along with stretching movements, significantly increases infant weight. The study suggested that enhanced digestion and nutrient absorption are key mechanisms behind this weight gain (Fatmawati et al., 2021).

The researchers observed that the intervention group's higher percentage of weight gain (43.3%) compared to the control group (20%) indicates the effectiveness of infant massage in promoting healthy weight gain. This outcome aligns with the theoretical and empirical evidence suggesting that massage therapy enhances physiological and psychological well-being in infants.The absence of weight loss in the intervention group, contrasted with the control group where 6.7% of infants experienced weight loss, further supports the beneficial impact of massage therapy. The researchers believe that increased serotonin activity and the subsequent reduction in stress hormones play a significant role in this positive outcome. Reduced stress levels not only improve immune function but also enhance overall growth and development, leading to more consistent weight gain.

Additionally, the researchers highlight the importance of sleep quality and digestive efficiency as critical factors influenced by infant massage. The significant improvement in sleep duration observed in previous studies, combined with enhanced food absorption due to stimulated digestive hormones, creates an optimal environment for healthy growth. This comprehensive approach to understanding the benefits of infant massage provides a robust framework for promoting its use in infant care practices.The researchers also suggest that future studies should explore the long-term benefits of infant massage, particularly in diverse populations. They recommend designing studies that include a wide range of initial weights and demographic characteristics to ensure that the findings are broadly applicable. This approach would enhance the validity and generalizability of the research, providing stronger evidence for the benefits of infant massage across different populations.

In summary, the data from Table 3, supported by theoretical frameworks and empirical evidence, highlight the significant benefits of infant massage for promoting healthy weight gain. Increased serotonin activity and the resulting

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reduction in stress hormones improve immune function, sleep quality, and digestive efficiency, creating an optimal environment for growth and development. The researchers' insights and recommendations underscore the importance of considering baseline characteristics and long-term effects in evaluating the effectiveness of infant massage, ensuring that its benefits can be maximized for all infants.

The following table provides a detailed analysis of the effect of infant massage on infant weight gain. It compares the mean infant weight before and after the intervention in both the experimental group and the control group. The table includes the mean weights, the p-values, and the results of the paired t-test to assess the statistical significance of the weight changes observed. This data is crucial for understanding the impact of infant massage on weight gain in infants.

Table 4. Effect of Infant Massage on Infant Weight Gain

Infant Massage Administration	Mean Infant Weight (grams)		P-value	Paired T-Test
	Before	After		
Intervention Group	4460.67	5200.00	0.304	0.000
Control Group	5237.33	5240.00	0.444	

Source: Primary Data 2024

Table 4 shows the results of the normality test indicating that the data are normally distributed with p-values greater than 0.05 for the Shapiro-Wilk test (intervention group 0.304 and control group 0.444), meaning that the Paired T-Test can be utilized. Based on the results of the t-statistic test using the paired t-test, a significant p-value of p=0.000 (p<0.05) was obtained, indicating that there is an effect of infant massage classes on weight gain for infants aged 1-6 months.

One of the primary mechanisms through which infant massage promotes weight gain is by increasing the activity of the neurotransmitter serotonin. Serotonin enhances the capacity of cell receptors to increase glucocorticoid (adrenaline) levels, a stress hormone. This process reduces adrenaline levels, leading to lower stress hormone levels overall. Reduced stress hormones improve immune function, particularly by increasing levels of immunoglobulins IgM and IgG, which are crucial for fighting infections (Field, 2014).This reduction in stress hormones and increase in serotonin levels not only promotes physiological well-being but also enhances psychological and emotional development. Infants experience less stress and anxiety, which can contribute to better feeding behavior and overall growth (Field, 2014).

Infant massage stimulates the digestive system, increasing the release of digestive hormones such as insulin and gastrin. This leads to more efficient nutrient absorption, ensuring that the infant's body utilizes the nutrients from their food more effectively. As a result, infants tend to feel hungrier more often, leading to more frequent feeding sessions and ultimately, increased weight gain (Fatmawati et al., 2021).A study by Nurul Fatmawati et al. (2021) in the Journal for Quality in Public Health found that regular infant massage significantly increases the release of these digestive hormones, improving nutrient absorption and promoting weight gain. The study concluded that routine massage, involving the massaging of the legs, abdomen, chest, arms, and back, coupled with stretching movements, enhances weight gain in infants. The data shows that 19 individuals (63.3%) experienced weight gain, with 13 infants from the intervention group and 6 from the control group. Respondents whose weight remained stable totaled 9 (30%), with 2 from the intervention group and 7 from the control group. Additionally, 2 individuals (6.7%) from the control group experienced weight loss, while no weight loss was observed in the intervention group. These findings underscore the effectiveness of infant massage in promoting weight gain.

The paired samples t-test yielded a significant value of 0.000 ($p < 0.05$), indicating a substantial impact of infant massage on weight gain. The massage sessions, conducted continuously over one month, significantly influenced the infants' weight gain. This aligns with the theory that regular massage increases the levels of digestive enzymes and insulin, enhancing nutrient absorption and stimulating appetite, leading to more frequent feeding and increased milk production in breastfeeding mothers.Research by Lastriati and Ita in the Journal of Comprehensive Nursing highlighted the therapeutic benefits of infant massage in preventing upper respiratory tract infections. Their study involving 70 infants demonstrated that massage positively impacts recovery from colds and coughs. The quantitative research, conducted using a cross-sectional design, suggested that infant massage enhances immune function, thereby helping prevent and recover from respiratory infections (Lastriati & Ita, 2022).

In the Malaysian Journal of Medical Research, a study by Siti Noorbaya and Rr Nindya demonstrated that infant massage significantly increases sleep duration, which is crucial for healthy growth and development. Using a pre-experimental design with a one-group pretest and posttest, the study measured sleep quantity in infants aged 3-6 months. The results showed that post-massage, infants slept an average of 13.77 hours per day compared to 12.48 hours per day before the massage, with an average increase of 1.29 hours per day. The statistical analysis indicated a significant effect of massage on sleep quantity ($p = 0.000$) (Noorbaya & Nindya, 2020).Improved sleep contributes to better weight gain because growth hormone, essential for physical development, is primarily secreted during deep sleep. Adequate sleep also supports cognitive and emotional development, providing infants with the necessary rest to process their experiences and develop optimally.Sleep is a critical component of an infant's growth and development. During deep sleep, the body

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releases growth hormone (GH), which is essential for physical development. GH stimulates the growth of tissues and bones and plays a vital role in the metabolic processes that support growth. Therefore, the increase in sleep duration observed in infants receiving regular massage can directly contribute to enhanced physical growth and weight gain.In addition to its role in physical development, adequate sleep is crucial for cognitive and emotional development. During sleep, the brain processes and consolidates experiences and memories, facilitating learning and cognitive function. For infants, whose brains are rapidly developing, this consolidation is essential for healthy cognitive development. Improved sleep quality and duration can thus enhance an infant's ability to learn, process sensory information, and develop emotional regulation skills.

Infant massage promotes relaxation and reduces stress, contributing to improved sleep quality. The act of massaging releases serotonin, a neurotransmitter that helps regulate mood and sleep. Serotonin is converted into melatonin, the hormone responsible for regulating the sleep-wake cycle. Increased levels of melatonin facilitate deeper and more restful sleep, thereby extending the total sleep duration.Furthermore, infant massage can reduce the production of cortisol, a stress hormone that can interfere with sleep. By lowering cortisol levels, massage helps infants achieve a more relaxed state conducive to falling asleep and staying asleep longer. This reduction in stress hormones and the promotion of relaxation are critical factors in the observed increase in sleep duration among massaged infants.

A study conducted by Ayse Gurol and Sevinc Polat in Turkey examined the effects of baby massage on the attachment between mothers and their infants. Using a T-Test, they found a p-value of 0.001 (<0.05), indicating that baby massage effectively enhances the mother-infant bond. This study supports the idea that infant massage not only promotes physical growth but also strengthens emotional connections, which can positively influence feeding behaviors and overall infant well-being (Gurol & Polat, 2012).Research in the Journal of Science Midwifery by Susi Hartati and colleagues utilized a quasi-experimental design with a cross-sectional approach. They employed checklists, standard operating procedures for infant massage, and infant scales to measure outcomes. Their findings showed a p-value < 0.05, specifically 0.000, indicating a significant impact of infant massage on weight gain in infants in the Payung Sekaki Public Health Center, Pekanbaru, in 2019 (Hartati et al., 2021).

In another study, Kurnia Puji Lestari et al. (2021) investigated the effectiveness of baby massage in increasing the body weight of infants with a history of low birth weight (LBW) aged 1-6 months. The quasi-experimental study with a pre and post-test design showed a significant impact of baby massage on weight gain, with a p-value < 0.05. This study emphasized the importance of healthcare professionals educating and practicing infant massage with mothers to stimulate infant growth and development (Lestari et al., 2021).

The researchers observed that the intervention group's higher percentage of weight gain (43.3%) compared to the control group (20%) indicates the effectiveness of infant massage in promoting healthy weight gain. This outcome aligns with theoretical frameworks and empirical evidence suggesting that massage therapy enhances physiological and psychological well-being in infants.The absence of weight loss in the intervention group, contrasted with the control group where 6.7% of infants experienced weight loss, further supports the beneficial impact of massage therapy. The researchers believe that increased serotonin activity and the subsequent reduction in stress hormones play a significant role in this positive outcome. Reduced stress levels not only improve immune function but also enhance overall growth and development, leading to more consistent weight gain.Additionally, the researchers highlight the importance of sleep quality and digestive efficiency as critical factors influenced by infant massage. The significant improvement in sleep duration observed in previous studies, combined with enhanced food absorption due to stimulated digestive hormones, creates an optimal environment for healthy growth. This comprehensive approach to understanding the benefits of infant massage provides a robust framework for promoting its use in infant care practices.

The researchers also suggest that future studies should explore the long-term benefits of infant massage, particularly in diverse populations. They recommend designing studies that include a wide range of initial weights and demographic characteristics to ensure that the findings are broadly applicable. This approach would enhance the validity and generalizability of the research, providing stronger evidence for the benefits of infant massage across different populations.In summary, the data from Table 4, supported by theoretical frameworks and empirical evidence, highlight the significant benefits of infant massage for promoting healthy weight gain. Increased serotonin activity and the resulting reduction in stress hormones improve immune function, sleep quality, and digestive efficiency, creating an optimal environment for growth and development. The researchers' insights and recommendations underscore the importance of considering baseline characteristics and long-term effects in evaluating the effectiveness of infant massage, ensuring that its benefits can be maximized for all infants.

4. CONCLUTION

The research demonstrates that infant massage significantly contributes to increased weight gain and improved sleep duration in infants aged 1-6 months. The intervention group, which received regular massages, showed a higher incidence of weight gain compared to the control group, underscoring the effectiveness of massage in promoting healthy physical development. The study also found that massage enhanced sleep duration, with infants in the intervention group sleeping longer and more soundly, which is crucial for growth hormone secretion and overall development. Despite these positive outcomes, the research has limitations, including a relatively small sample size and short duration of observation. Future

studies could expand the sample size and extend the monitoring period to validate and deepen the understanding of the long-term benefits of infant massage. Additionally, exploring the impact of different massage techniques and frequencies could provide more detailed guidelines for optimizing infant massage practices. The research conclusively answers the primary question of whether infant massage affects weight gain and sleep quality, affirming that regular massage is a beneficial practice for infant growth and development. However, further research is needed to refine these findings and address the identified limitations.

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