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AROMATHERAPY MASSAGE IS EFFECTIVE ON INCREASING BODY WEIGHT AND IGF-1 (INSULINE-LIKE GROWTH FACTOR-1) LEVELS IN MALNOURISHED TODDLERS

Aromatherapy Massage Efektif terhadap Peningkatan Berat Badan dan Kadar IGF-1 (Insuline-Like Growth Factor-1) Balita Gizi Kurang

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ABSTRAK

Gizi kurang pada balita memiliki dampak jangka panjang dan jangka pendek, seperti menyebabkan infeksi yang berulang, rendahnya prestasi akademik, dan produktivitas yang rendah dibandingkan anak dengan gizi normal, Metode non farmakologi aromatherapy massage adalah metode yang membantu meningkatkan nafsu makan sehingga berat badan, tinggi badan dan kadar IGF-1 meningkat. Penelitian ini bertujuan untuk menguji efektivitas aromatherapy massage terhadap kenaikan berat badan, tinggi badan, dan kadar IGF-1 pada balita gizi kurang. Populasi jumlah seluruh balita gizi di 20 Puskesmas Kota Bengkulu kurang di Wilayah Kerja Dinas Kesehatan Kota Bengkulu. Teknik sampling dengan simple random sampling, 20 balita gizi kurang bayi kelompok intervensi, 20 bayi kelompok kontrol, sehingga total sampel 40 balita. Uji analisis dengan menggunakan uji paired t-test dan uji Idenpendent t-test. Terdapat perbedaan antara sebelum dan sesudah diberikan aromatherapy massage pada kelompok intervensi berat badan p-value = 0,000, tinggi badan p-value = 0,062, dan kadar IGF-1 p-value = 0,011. Kesimpulan: aromatherapy massage yang digunakan 3 kali seminggu durasi 15 menit selama 4 minggu dapat meningkatkan berat badan, dan kadar IGF-1 balita gizi kurang.

***Kata kunci**: aromatherapy massage, berat badan, gizi kurang, kadar IGF-1*

ABSTRACT

Malnutrition in toddlers has long-term and short-term impacts, such as causing repeated infections, low academic achievement, and low productivity compared to children with normal nutrition. The non-pharmacological aromatherapy massage method is a method that helps increase appetite so that weight, height and IGF-1 levels increase. This study aims to test the effectiveness of aromatherapy massage on weight gain, height, and IGF-1 levels in malnourished toddlers. The population is the total number of malnourished toddlers in 20 Bengkulu City Health Centers in the Bengkulu City Health Office Work Area. The sampling technique was simple random sampling, 20 malnourished toddlers in the intervention group, 20 babies in the control group, so that the total sample was 40 toddlers. The analysis test used the paired t test and the Idenpendent t-test. There was a difference between before and after being given aromatherapy massage in the intervention group, weight p-value = 0.000, height p-value = 0.062, and IGF-1 levels p-value = 0.011. The conclusion was that aromatherapy massage used 3 times a week for 15 minutes for 4 weeks can increase body weight and IGF-1 levels in malnourished toddlers.

Keywords: aromatherapy massage, body weight, IGF-1 levels, malnutrition

INTRODUCTION

Toddlerhood is a very important period for the growth and development of children. The World Health Organization (WHO) explained that nutritional problems are very vulnerable in toddlers aged 1-5 years and estimate that 159 million children experience

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stunted growth and nearly 20 million children experience stunting.[1]

The prevalence of nutritional status in Bengkulu Province based on the latest SKI 2023 data is 7.2%. Meanwhile, data from the Bengkulu City Health Office in 2023 shows that *the trend of* nutritional status problems in toddlers is still high. Malnourished children under five in 2023 will be 60 under five while malnourished children in 2024 as of February will decrease to 55 children under five.[2]

Malnutrition is a nutritional state characterized by a thin condition, weight according to height less than -2 to -3 standard deviations in children aged 6-59 months. Children will become thin due to weight loss that occurs twice for 6 months or no weight gain in children every month. There is a weight loss of about 20%-30% of the weight loss from the ideal weight. Weight loss can be caused by poor eating habits, food rejection and decreased appetite at the age of 24-59 months. [3,4]

At the age of 24 months, the child enters the transition stage from breastfeeding to family food. At this age, children begin to adapt to consuming a variety of foods that are in accordance with nutritional needs. After the age of 24 months, the child's ability to consume adult food is developing, so food intake should be able to increase. [4]

Handling malnutrition can be done by pharmacological means or by administering medical drugs and non-pharmacological means or by providing additional food for toddlers. Treatment by pharmacological means, namely by administering multivitamins and other micronutrients,[5] While handling non-pharmacological methods, one of them is by applying massage/mass and aromatherapy to stimulate hormones in the body.[6] With massage, it will stimulate appetite in malnourished toddlers so that it can increase weight. With massage stimulation, growth and development in children will be optimal. One of the measures of growth and development in children is the child's weight or height. Massage is a massage that is done with fine rubs on the surface of the skin. Massage performed on babies and toddlers is a therapy of direct contact with the body that can provide a sense of security and comfort. If mass is done regularly, it will increase catecholamine *hormones* (epinephrine and norepinephrine) which can trigger stimulation of growth and development because it can increase appetite, increase weight, and stimulate the development and structure of brain functions. Massage can also stimulate Vagal activity. With increased vagal activity, there is a release of the hormones Insulin and Gastrin so that food absorption becomes more efficient. This causes children to feel hungry faster, appetite increases, and weight gain.[7,8]

Massage therapy can also lead to weight gain by increasing insulin and growth factors such as insulin-1 IGF-1 (Insuline-Like Growth Factor-1) because insulin promotes the conversion of glucose into short-term storage (glucogen) and long-term storage (lipids), and IGF-1 plays an important role in promoting growth by stimulating cell growth and multiplication and inhibiting apoptosis.[9] Insulin-like Growth Factor-1 (IGF-1) is a GH (Growth Hormone) transporting protein, its structure and function are similar to insulin but the growth-promoting effect is much stronger. IGF levels do not fluctuate throughout the day, but the average daily GH level is seen at IGF-1 levels. The hormones GH and IGF-1 are often associated with growth and developmental disorders because growth delays occur at a time when these hormones play an important role in growth. [10]

Aromatherapy is a therapy in the field of health that uses the scent of a certain ingredient to improve physical and psychological conditions by providing certain stimuli, including increasing appetite. Aromatherapy can be given by inhaling, compressing, applying to the

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skin, spraying, or mixing it with water to soak the entire body. Aromatherapy has a positive effect due to its ability to stimulate sensory receptors with a fresh and fragrant scent. This stimulation can have a strong impact on emotions and ultimately affect other organs of the body. Receptors in the nose pick up scents and transmit information to different areas of the brain. This area controls emotions and memories, as well as providing information to the hypothalamus. Through the activation of the limbic system, aromatherapy provides psychological and physical effects by sending odor signals to olfactory areas in the lateral cerebral cortex. These signals are then passed on to the limbic system, processed by the hypothalamus, and sent to the amygdala to produce an emotional response to the smell being inhaled. In addition, this stimulus also strengthens the activity of the parasympathetic nervous system and suppresses the activity of the sympathetic nervous system.[10–12]

Aromatherapy massage is a combination of massage and aromatherapy that is used to produce maximum results compared to using only one therapy. The combination of massage and aromatherapy is done because both work through complementary mechanisms. Massage provides physical stimulation that improves circulation and stimulates digestive hormones, while aromatherapy stimulates the limbic system through smell to increase appetite. This combination is more effective in increasing weight and growth than if given separately.[13]

Aromatherapy is used as a combination of *lemongrass, fenner,* and *fennel* oil aromatherapy. Giving aromatherapy massage will increase the appetite and growth of children in body length or height and weight in children under five. This study aims to analyze the effectiveness of *aromatherapy massage* on weight gain, height, and IGF-1 levels in malnourished toddlers.

METHODS

The design of this study is *a pretest-posttest with control group design*, which is included in the *quasi-experimental* type. This study involved two groups, namely the intervention group that was given *aromatherapy massage* three times a week for 15 minutes for four weeks, and the control group that received only Supplemental Feeding (PMT). The sampling technique in the study is *simple random sampling.* And has received *an ethical clearance permit* from the Research Ethics Commission of the Ministry of Health of the Ministry of Health No.1200/EA/F.XXIII.38/2024.

Each group consisted of 20 malnourished toddlers, so that the total sample was 40 respondents. Sample selection was carried out using *a simple random sampling* technique. Measurements were taken before and after the intervention to assess changes in weight, height, and IGF-1 levels.

The aromatherapy oil used in this study is a combination of lemongrass, fennel, and fennel. Of the 100 ml *of aromatherapy oil* used, 2 ml are a combination of lemongrass, fennel, fennel, fennel, and 98 ml of sunflower essential oil as a solvent. The *aromatherapy oil* blend of emongrass, fennel, and fennel is 1:1:1 (0.66 + 0.66 + 0.66).

The subjects in this study were 40 malnourished toddlers who were divided into two groups, namely 20 toddlers with an intervention group given *aromatherapy massage* using *increased appetite oil massage* 3 times a week with a duration of 15 minutes for 4 weeks and 20 toddlers in the control group were given Supplementary Feeding.

The researcher began by collecting data according to the inclusion and exclusion criteria. The inclusion criteria included toddlers aged 24–48 months with poor nutritional status based on anthropometric assessment, no history of genetic diseases, having a KIA book,

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being in good health, and not taking pharmacological drugs. Exclusion criteria include toddlers who have a history of infections such as diarrhea, ISPA, worms, or tuberculosis, have wounds on the area of the body where the massage is located, have a history of allergy to *aromatherapy oil*, and toddlers whose parents are not willing to be respondents. The drop-out criteria were set for toddlers who had diarrhea for more than four days or had flu and cough for more than seven days during the intervention period.

The researcher grouped the subjects into the intervention group and the Control group. The intervention and control groups were randomly assigned from 40 malnourished toddlers who met the inclusion criteria. A total of 20 toddlers were included in the intervention group and given *aromatherapy massage*, while 20 other toddlers were in the control group and given Supplementary Feeding (PMT). This division is carried out after sampling.

The intervention group and control group were pretested for weight, height, and IGF-1 levels. Furthermore, the posttest will be carried out after being given aromatherapy massage using *increased appetite oil massage* 3 times a week with a duration of 15 minutes for 4 weeks while the control group is given PMT for 4 weeks. PMT is given daily for 4 weeks in the form of additional foods containing about 300–400 kcal of energy and 10–15 grams of protein per serving, in accordance with the Ministry of Health's guidelines for malnourished toddlers.

Toddler weight measurement was carried out using a digital scale with an accuracy of 0.1 kg, so that it was able to accurately show weight changes up to one number after the comma. Meanwhile, height was measured using a stadiometer with an accuracy of 0.1 cm, which allowed height measurements to be carried out precisely. IGF-1 levels were measured through blood samples using an ELISA Kit, which was analyzed at the GAKI UNDIP Laboratory.

The intervention was in the form of aromatherapy massage which was carried out three times a week for 15 minutes for four weeks, using a mixture of essential oils from lemongrass (*Cymbopogon citratus*), fennel *(Foeniculum vulgare*), and nutmeg (*Myristica fragrans*). The massage technique involves gentle strokes and circular movements on the back, legs, and arms of the toddler to provide a relaxing effect as well as physiological stimulation. The massage was carried out by researchers who had received previous *training in aromatherapy massage* techniques . This is done to ensure consistency of treatment and minimize bias between intervention actors during the study.

Outcome measurements were conducted before and after the intervention in both groups, including weight, height, and IGF-1 levels. Weight was measured using a digital scale, height was measured with a stadiometer, and IGF-1 levels were measured. Data analysis was conducted using SPSS software, with paired t-tests to evaluate differences in pre- and post-intervention groups, as well as independent t-tests to compare differences between intervention and control groups. The $p<0.05$ value was considered statistically significant.

RESULT

The results of data analysis in Table 1 showed the characteristics of respondents based on infectious diseases of most infants in the intervention group with the never category (95%) and also in the control group with the never category (75%). Respondent characteristics based on breast milk history in the intervention group were mostly with exclusive breastfeeding history (80%) and also in the exclusive breastfeeding history control group (70%).

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The characteristics of toddlers in table 1 in both the intervention group and the control group after being tested using chi square showed that there was no significant difference in p-value ≥0.05 or homogeneous intervention and control groups based on infectious disease characteristics, and history of breastfeeding.

Table 1. Characteristics of Research Respondents

Variable	Category	Aromatherapy Massage		Control		p-value
		n=20	%	n=20	%	
Infectious Diseases	Ever	1	5,00	5	25,0	0,077
	Never	19	95,0	15	75,0	
History of Breast Milk	Non-Exclusive	4	20,0	6	30,0	0,465
	Exclusive	16	80,0	14	70,0	

Table 2. Weight, Height and IGF-1 Levels in the Control Group

Control Group	n	Mean±SD	Mean Difference	p-value
Weight				
Pre test	20	9,88±1,154	0,32	0,000
Post test	20	10,20±1,239		
Height				
Pre test	20	86,91±6,698	0,06	0,107
Post test	20	86,97±6,710		
IGF-1 Level				
Pre test	20	43,35±32,258	2,05	0,736
Post test	20	45,40±30,983		

* Uji Paired Sampel T-test

In the paired sample t-test table 2, it was seen that there was a difference in the average pre-test and post-test weight in the control group of 0.32 with p-value = 0.000, meaning that there was a difference in the average weight before and after in the control group. In the height variable, there was a difference in the average pre-test and post-test height in the control group of 0.06 with p-value = 0.107, meaning that there was no difference in average height before and after in the control group. And in the IGF-1 level variable, there was no difference in the average pre-test and post-test IGF-1 levels in the control group with p-value = 0.736, meaning that there was no difference in the average IGF-1 level before and after in the control group.

Table 3. Weight, Height and IGF-1 Levels in the Intervention Group

Intervention Groups	n	Mean±SD	Mean Difference	p-value
Weight				
Pre test	20	9,51±1,061	0,90	0,000
Post test	20	10,41±1,047		
Height				
Pre test	20	85,36±6,229	0,15	0,062
Post test	20	85,51±6,246		
IGF-1 Level				
Pre test	20	93,55±96,789	43,65	0,011
Post test	20	137,20±120,47		

The results of the paired sample t-test in table 3 showed that there was a significant difference between the average weight before and after the intervention in the intervention group, with a difference of 0.90 kg and a p-

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value = 0.000. This suggests that the intervention has an effect on weight gain. Meanwhile, in the height variable, no significant difference was found between the mean before and after the intervention, with a difference of 0.15 cm and a p-value = 0.062. This means that the intervention has no significant effect on height changes. In the IGF-1 level variable, there was a significant mean difference of 43.65 ng/mL with a p-value = 0.011, which suggests that aromatherapy massage interventions have an effect on increasing IGF-1 levels.

Table 4. Analysis of Differences in Mean Weight, Height and IGF-1 Levels in the Intervention and Control Group

Variabel	Group				p-value
	Aromatheraphy Massage		Control		
	Mean±SD		Mean±SD		
Weight					
Post test	10,41	1,047	10,20	1,239	0,003
Height					
Post test	85,51	6,246	86,97	6,710	0,474
IGF-1 Level					
Post test	137,20	120,470	45,40	30,983	0,002

* Independent T-test

Based on the results of the independent sample t-test, it was found that there was a significant difference in the average body weight and IGF-1 levels of post-test results between the intervention group and the control group, with a p-value of ≤ 0.05. This suggests that there is a marked difference between the two groups, so it can be concluded that aromatherapy massage is effective in increasing weight and IGF-1 levels compared to the control group. On the other hand, in the height variable, a p-value of > 0.05 was obtained, indicating that there was no significant difference between the intervention group and the control group. Thus, it can be concluded that aromatherapy massage is not effective in increasing height.

DISCUSSION

Good nutritional adequacy in children will increase resistance to disease, children who are malnourished will be susceptible to diseases, especially infectious diseases. In this study, 95% were found in the intervention group that did not have infectious diseases. In the control group, 75% did not have infectious diseases. In the results of interviews that have been conducted with the respondents' parents, most of the infectious diseases experienced by toddlers occurred in the past 1-2 months. Parents immediately bring toddlers to health services, hospitals, health centers, doctors and local midwives. Diseases that are often suffered by toddlers are ISPA or diarrhea.

Most of the respondents in the intervention group, namely 16 out of 20 toddlers (80%), had a daily food intake that was classified as adequate based on the comparison with the Nutritional Adequacy Rate (AKG). This adequate food intake can support the success of interventions in improving the nutritional status of toddlers. Food intake is one way to find out the nutritional state of children. Malnutrition is caused by inadequate food intake, indigestion or absorption, and overeating. The food intake consumed will then produce an impact on the growth and development of the child which can be seen from his nutritional status. Food is the most important part in the process of growing and developing children considering that it was the golden age or golden age.

The results of data analysis showed that in the intervention group there was an increase in average body weight

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before and after treatment. This corroborates the theory that massage can increase weight in children. *Massage* is a tactile stimulus that can stimulate the muscles, bones and organ systems of the body so that they can function optimally.

Massage with moderate pressure will cause nerve endings on the surface of the skin to act on touch, thus sending signals to the central nerves (hypothalamus and spinal cord). It will then cause stimulation in the peripheral nerves, especially in the pressure receptors that will activate the parasympathetic nerves. The parasympathetic nerve is responsible for rest and digestion. The vagus nerve will be activated and will stimulate the hormones insulin and gastrin which play a role in metabolism, where these two hormones are digestive hormones. The presence of the hormones insulin and gastrin will increase the absorption of food juices to be more effective, children are more likely to feel hungry appetite will increase so that weight will also increase.[14]

Therefore, it can be concluded that massage is effective in increasing appetite in malnourished children under five so that weight also increases. Weight gain after giving massage is caused by the production of beta endorphin hormones that affect the growth mechanism in children. The tone of the vagus nerve (the 10th nerve) also increases so that the rate of absorption of the enzyme gastrin and insulin secretion increases, the absorption of feeding becomes better.[15]

Aromatherapy oils contain many fragrance compounds, and the sedative effects can be enhanced by synergistic interactions between these compounds. Thus, the combination of several essential oils may exhibit a stronger appetite-enhancing effect than the active compounds administered separately, and the synergistic effects of fragrance compounds may be useful for treating appetite loss. In this study, 3 *aromatherapy oils* (lemongrass, fennel, fennel) are used as aromatherapy to increase appetite in malnourished toddlers who can increase weight.

Lemongrass produces *aromatherapy oil* from young lemongrass leaves, the main components of lemogras essential oils are neral, isoneral, geranial, isogeranial, geraniol, geranyl acetate, citronelal, citronelol, germacrene-D, and elemol which make up about 60–80% *aromatherapy oil.* Lemongrass *aromatherapy oil* is well-known for its soothing and refreshing properties, making it a popular choice in massage therapy. It is often used to relieve muscle tension, stress, and discomfort. Lemongrass *aromatherapy oil* contains citra-like compounds, which are believed to have anti-inflammatory, analgesic (pain reliever), and antimicrobial effects. When used for massage, Lemongrass aromatherapy oil can help improve blood circulation, reduce pain, and promote relaxation.[16]

Fennel aromatherapy oil is an oil obtained from the Foeniculum vulgaris plant, known by the name fennel. The main ingredient in Fennel aromatherapy oil that increases appetite is trans-Anethole. Other phenylpropanoids contained in the oil are estragol, cis-anethole, p-anisaldehyde, and p-anisketone, which account for 92.23% of the total peak area of fennel essential oil. [17] Next is nutmeg aromatherapy oil or often known as nutmeg. Nutmeg (*Myristica fragrans*) is widely used to flavor sweet and savory foods and has been used as an herbal remedy to increase appetite in Asian countries. Nutmeg aromatherapy oil contains phenylpropanoids such as myristicine and methyl eugenol. From previous studies, phenylpropanoid compounds showed an increase in appetite after inhaling nutmeg essential oil. Trans-cinnamal dehyde is a compound in nutmeg oil that functions to increase appetite. This compound has a volatile aroma with an appetite-boosting effect, So it can be concluded that

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aromatherapy by combining 3 *aromatherapy oils* can stimulate increased appetite.[18]

Inhaling the combined aromatherapy oils used in this study stimulates the olfactory receptors, sending electrical impulses to the limbic system and hypothalamus via the olfactory bulb and upper olfactory cortex. These signals are further projected to higher brain regions such as the amygdala, hippocampus, and prefrontal cortex, which play key roles in mood regulation, emotional processing, and appetite control. Aromatherapy also activates the parasympathetic nervous system, enhancing vagal stimulation of the stomach, which improves digestion, increases appetite, and consequently promotes weight gain.

Aromatherapy massage combines massage and aromatherapy to achieve more optimal results than either therapy alone. In this study, malnourished toddlers received massages while inhaling the aroma of lemongrass, fennel, and nutmeg, which promote relaxation. The essential oils of fennel and nutmeg contain phenylpropanoids, compounds known to stimulate appetite in malnourished children.

Research conducted by Nguyen *et al* (2023) in a systematic review study stated that essential oils of lavender, fennel, nutmeg, black pepper, vanilla, curry, cinnamon, and cloves can increase appetite. Based on the results of the research and theory above, it can be concluded that *aromatherapy massage* can increase appetite in malnourished toddlers so that weight increases.[19]

Based on the results of the analysis of the homogeneity test distribution data, the pretest measurement results obtained in the intervention group were 85.36 and for the posttest measurement had an average of 85.65 with a -value of 0.652. The results of data analysis showed that there was no increase in average height in the intervention group before and after treatment.

Based on the homogeneity test results, the intervention group's pretest mean IGF-1 level was 93.55, increasing to 137.20 in the posttest, with a p-value of 0.011. These findings indicate a significant increase in mean IGF-1 levels following treatment.

Insulin-like Growth Factor-1 (IGF-1) is a hormone produced by the liver and other tissues in response to Growth Hormone (GH) stimulation. It plays a crucial role in bone and skeletal muscle growth and development, with GH's effects on growth largely mediated through its interaction with IGF-1. This hormone is essential for regulating postnatal growth, particularly from late infancy onward.[10]

Insulin-like growth factor-1 is a hormone that mediates the effects of growth hormone and plays an important role in the regulation of somatic growth and organ development.[20] Children's growth and development are influenced by various factors, including genetic factors, the environment since prenatal, Christmas, postnatal, nutrition including macronutrients and micronutrients, hormonal (growth hormone and IGF-1), and there are stimulation factors. Massage stimulation can lead to weight gain by increasing insulin and growth factor such as insulin-1 (IGF-1) because insulin promotes the conversion of glucose into short-term storage (glucogen) and long-term storage (lipids). IGF-1 plays an important role in promoting growth by stimulating cell growth and multiplication and inhibiting apoptosis.[10]

Premature babies who received a massage of 15 minutes a day for 5 days showed weight gain in premature babies. Weight gain is also associated with increased serum insulin and IGF-1 levels after massage. Furthermore, research conducted by Hartanto (2015) on massage performed on full-term infants showed that there was a significant difference in the increase in IGF-1 levels between the intervention and control groups. With the results of a

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statistical test with p-value = 0.000.19 Therefore, it can be concluded that massage is effective in increasing IGF-1 levels in malnourished toddlers. [21]

The pretest–posttest control group design is a strength of this study, enabling control of external variables and yielding more valid results. This research innovatively examined the effectiveness of aromatherapy massage in improving weight, height, and IGF-1 levels among malnourished toddlers as a non-pharmacological approach to malnutrition. Moreover, the use of validated measurement instruments—scales for weight, stadiometers for height, and ELISA kits for IGF-1—ensures high data accuracy and reliability. Although this research has advantages, there are some limitations that need to be considered. One of the main limitations is the lack of control over the food intake of toddlers during the intervention period. This factor has the potential to affect the results of the study, given that nutritional status and IGF-1 levels can be affected by diet other than the intervention given.

Furthermore, the results of this study have broad implications in the health sector, especially in obstetric care and child nutrition. The findings that aromatherapy massage can increase body weight and IGF-1 levels suggest that this therapy can be used as an additional intervention in a program to improve the nutritional status of malnourished toddlers.

CONCLUSION

Based on the research that has been conducted, it can be concluded that *aromatherapy massage* lemongrass, fenner, and fennel are proven to have an effect on weight gain and increase in IGF-1 levels in the intervention group compared to the control group. However, it had no effect on height gain in the intervention group. This research is expected to be used as a reference in providing holistic midwifery care to malnourished toddlers.

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