BACK MASSAGE USING FRANGIPANI AROMATHERAPY OIL TO REDUCE THE LEVEL OF TUMOR NECROSIS FACTOR ALPHA AND THE INTENSITY OF LABOR PAIN

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ABSTRACT

Spontaneous labor is characterized by simultaneous uterine contractions that can cause labor pain complaint as an inflammatory reaction that triggers the release of cytokines. The more severe labor pain, the more stress that can reduce immunity, so that the increasingly heavy inflammatory reaction is characterized by increase in expression of TNFα. The purpose of this study was to prove that back massage using frangipani aromatherapy oil reduced levels of tumor necrosis factor alpha (TNFα) and labor pain intensity. Method: *True Experiment (Randomized Clinical Trial/RCT)* with *Pretest Posttest Control Group* design. The research was carried out in inpatient public health centers in Badung Regency and Denpasar City. The *research subject is nulliparous,* cervical dilatation is 6-8 cm. The sample sizes are 40 people, the number of samples are 2 group, namely control (C) and intervention (I). Sample selected with simple random sampling technique. The pain intensity observed using numeric rating scale (NRS). Data analysis includes Univariate, Bivariate (Paired T Test and Independent T Test), and Multivariate (Manova). Data analysis with the help of the SPSS program. Ethical clearance from the Ethic Commission of the Sanglah Central General Hospital. Results: the average pain intensity and TNFα levels before treatment in both groups were $p>0.05$. After had been given the intervention, the mean difference between the two groups were $p<0.05$. The contribution of the intervention to pain intensity was 16.3%; TNFα levels 23%. Conclusion: there is an effect of back massage using Frangipani aromatherapy oil on decreasing labor pain intensity and TNFα levels

Keywords: Back massage, Frangipani aromatherapy oil, labor pain, TNFα

INTRODUCTION

Spontaneous labor is characterized by simultaneous uterine contractions. Contractions cause stretching of the lower uterine segment, resulting in flattening, effacement and dilatation of the cervix. This event causes complaints of labor pain as an inflammatory reaction that triggers the release of cytokines. Labor pain consists of two patterns, namely visceral and somatic pain. Visceral pain is caused by the cervix stretching and opening, which triggers the activity of nociceptive afferents that innervate the endocervix and lower segments from Thoracis 10 to lumbar I. The natures of this pain are dull and difficult to localize. The more the lower part of the fetus is descending because of adequate uterine contractions, can cause stretching and distension of the pelvic floor, vaginal, and perineal muscles. This event causes ischemia and tissue injury that triggers the inflammatory process and stimulates the nerves in sacral 2 to sacral 4 (S2-S4), resulting in somatic pain. This pain occurs at the end of the I to the II stage, the nature of the pain, sharp and easily localized (Bonapace, J., *et al.*, 2018).

Study on 70 nulliparous people was conducted by Sriasih, et al (2019). It was found that almost all respondents (95.72%) experienced moderate pain (score 4-6). Small portion of respondents (4.28%) experienced mild pain (score 0-3). Cevik and Karaduman (2020) described the average labor pain intensity in the active phase (cervical dilatation 5-7 cm) is 8.43 ± 1.17, while in the transition phase (cervical dilatation 8-10 cm) is 9.7 ± 0.53.

Labor pain tends to be more severe in Nulliparas because they do not have experience in childbirth. Labor pain felt by parturient can trigger stress that can affect the hypothalamic-pituitary-adrenal (HPA) axis. Cortisol secretion causes increased gluconeogenesis and decreased immunity. Cortisol release can trigger cytokine activity. In normal conditions, cytokines are almost not produced. The lower of the body's immunity, the more TNF α is expressed (Cierny *et al.*, 2014). TNFα can increase the sensitivity of sensorics neurons to excitation produced by

capsaicin and this increase is probably mediated by the production of prostaglandin neurons. Prostaglandins can increase the sensitivity of nociceptors, which can reduce the threshold for receptor activation so that the sensation of pain is felt to be greater (Neal, J.L. *et al.*, 2015).

Neal,J.L., et al (2015) found that TNF α levels were higher until near the end of the pre-active phase, while the active phase showed the opposite. TNF α levels were lower until the end of the active phase. TNFα activates coagulation, stimulates the expression or release of adhesion molecules, PGE2, platelet activating factor, glucocorticoids and eicosanoids, and affects apoptosis (Neal *et al.*, 2015; Rejeki *et al.*, 2014).

Pain stimulates afferent pain fibers to secrete P substance which activates ascending pathways that transmit nociceptive signals to the thalamus and reticular formation. The interconnection of these two organs leads to the hypothalamus and limbic system which elicits behavioral and emotional responses to pain. Mothers in labor respond to pain by crying and screaming (Sherwood, 2010). Maternal mothers who are unable to tolerate the pain, tend to propose termination of pregnancy by cesarean section. To anticipate this problem, labor pain management is needed.

The goal of labor pain management is to maintain the balance of body functions, reduce or eliminate labor pain, and parturient discomfort with minimal side effects. Non-pharmacological pain management has been chosen recently because it has almost no side effects. Some alternatives that can be chosen include hypnobirthing, acupuncture, water birth, massage (Czech *et al.*, 2018).

Back massage is a touch or stroke by applying light pressure using the fingers. The massage aims to reduce or eliminate pain and facilitate relaxation. Back massage is useful in reducing labor pain (Mehdi,R.,et.al, 2017; Zaghloul and Mossad, 2018; Smith, C.H., et.al., 2018; Imron, R., 2019), as well as reducing anxiety (Mansour, L, 2016; Cevik and Karaduman, 2020; Tabatabaeichehr and Mortazavi, 2020). Essential oil containing Frangipani aromatherapy, absorbed through smell can inhibit cortisol secretion and increase serotonin secretion. During massage, aromatherapy is absorbed through the skin, it can help reduce parturient anxiety (Karlina, et.al, 2014; Kaviani *et al.*, 2014; Raju, 2014; Makvandi, 2016; Mansour, L, 2016; Yazdkhasti and Pirak, 2016; Tabatabaeichehr and Mortazavi, 2020). Linalool found in frangipani are able to inhibit the release of acetylcholine and make changes in the function of ion channels at the neuromuscular junction. Linalool also functions as a sedative (Shinde, et.al, 2014; Goswani,et.al, 2016; Nurcahyo and Purgiyanti, 2017).

Although several studies have proven the benefits of frangipani aromatherapy, there is no standard on the duration of the intervention carried out yet. The duration of the intervention still varies, so that further research still needs to be done to determine the efficacy of back massage using Frangipani aromatherapy oil on parturient. This study aims to prove the efficacy of back massage using frangipani aromatherapy oil on pain intensity and TNFα levels in the active phase of labor.

METHODS

This research is a *True Experiment (Randomized Clinical Trial / RCT)* with a *Pretest Posttest Control Group* design. This research was conducted for eight months. The research locations are in Denpasar City and Badung Regency, each of which is four public health centers that have inpatient facilities. The sample of this study was normal parturient, nulliparous, cervical dilatation 6-8 cm, cooperative, and never or currently suffering from allergies. The sample size is 40 people, divided into 2 groups, namely the control group (C) and the intervention group (I), selected by *simple random sampling* technique.

Pain intensity was measured using a numerical rating scale (NRS). The number 0 indicates no pain; the number 10 indicates severe (very severe) pain. The NRS instrument has a validity value of r = 0.941 and a reliability of 0.95 (Alghadir *et al.*, 2018). The measurement results are recorded on the observation sheet.

The research material consisted of original (non-scented) virgin coconut oil (VCO) and VCO with the aroma of Frangipani (Plumeria) 10%. Original VCO and VCO with aromatherapy frangipani produced by Bali Usada. Frangipani contains 3.86% Tannins; Total phenol 18.94 mg GAE/g; vitamin C 2.28 mg/100 g (Wrasiati and Hartati, 2011). Frangipani of which contain Linalool 8% (India) and 20.7% (China)(Goswani, et.al, 2016)

The taking of TNFα examination materials, are using blood taken from the median cubital vein using a disposable 3 mL syringe. Examination of Human TNF-α using ELISA Kit, catalog number: cat.E00082Hu, BT-Lab. The TNFα examination, according to the factory inspection procedure, was carried out at the Clinical Pathology Laboratory, Sanglah Central General Hospital, Denpasar. Data analysis includes univariate, bivariate (Paired T test and Independent T Test), and multivariate (Manova) analysis. Paired T Test for test the pretest with posttest data in both group. Independent T Test for test Pretest and posttest data between control (C) with intervention group (I). Data analysis with SPSS program.

Back massage was done by rubbing and pressing gently on the back starting from the thoracic X region to the sacral II for 10 minutes (four cycles of uterine contractions) in both groups. The treatment in the intervention group (I) was using frangipani aromatherapy, while the control group was using original VCO. Massage technique was according to standard operating procedures.

Ethical considerations

Data collection was carried out after obtaining approval from the Ethic Commission of the Sanglah Central General Hospital and obtaining research permits from the Bali Province One Stop Licensing and Investment Service, Denpasar City Health Office and Badung District Health Office.

RESULTS

Characteristics of Subjects

The study was conducted in eight public health centers. Characteristics of the research subjects are described below.

Table 1 Characteristics of Research Subjects

Characteristics		Group				*p*
		Control (C) n = 20		Intervention n = 20		
		f	%	f	%	
Age						0,404
	20-25 years	16	80	15	75	
	26-30 years	4	20	5	25	
Amount		**20**	**100**	**20**	**100**	
Education						0,567
	Basic	1	5	1	5	
	Middle	14	70	13	65	
	Higher	5	25	6	30	
Amount		**20**	**100**	**20**	**100**	
Childbirth companion						0,643
	Husband	18	90	17	85	
	Parents	2	10	3	15	
Amount		**20**	**100**	**20**	**100**	

Description: Control group (C) = back massage using original VCO; Intervention group (I) = back massage using VCO with Frangipani aromatherapy

Table 1 shows that the data on age, education level, and birth attendants in the two groups were not different ($p > 0.05$). This confirms that the characteristics of the research subjects of the two groups are equivalent. The effect of the intervention on the dependent variable was tested with Independent t test, Paired T test, and Manova. Prerequisite analysis carried out for the analysis of data normality and homogeneity of variance. Data on labor pain intensity and TNFα levels pretest and posttest in both groups were normally distributed ($p > 0.05$) and all variances were homogeneous ($p > 0.05$).

Labor Pain Intensity

Table 2 Differences in Pain Intensity Before and after Intervention

Group	Pain LaborIntensity		*p*
	Mean ± SD Pretest	Mean ± SD Posttest	
Control (C)	7,10 ± 1,25	6,75 ± 1,29	0,232
Intervention (I)	6 ,90 ± 1.44	5.75 ± 1.02	0.000
p	0.643	0.01	

Table 2 illustrates, the intensity of pain before being given treatment (pretest) was the same in both groups ($P > 0.05$). Pain intensity in the two groups was significantly different ($p < 0.05$) after the intervention (posttest). The average intensity of labor pain before and after treatment, it appears that in the control group there is a decrease in

the intensity of labor pain, but not significantly different (p> 0.05). In the intervention group, it appeared that there was a significant decrease in pain intensity (p < 0.01). This shows that back massage with Frangipani aromatherapy oil is able to reduce the intensity of pain in the active phase of the first stage of labor.

Tumor Necrosis Factor Alpha (TNFα)

Table 3 shows that the levels of TNFα before being given treatment (pretest) in the two groups were not different (P > 0.05). After being given treatment (posttest), the levels of TNFα in the two groups were significantly different (p < 0.01).

Table 3 Differences in TNFα Levels Before and after Intervention

Group	Levels of TNFα (ng/L)		*p*
	Mean ± SD Pretest	Mean ± SD Posttest	
Control (C)	32.12 ± 6.44	31.71 ± 5.62	0.225
Intervention (I)	30.29 ± 6.25	25.94 ± 5.18	0.000
p	0.366	0.002	

The average TNFα level of the control group after being given treatment was lower than before the treatment. However, it was not significantly different (p > 0.05). In the intervention group, it appeared that there was a significant decrease in pain intensity (p < 0.01) after being given treatment. This shows that back massage with Frangipani aromatherapy is able to reduce TNFα levels in active phase I labor.

The Effect of Back Massage with Frangipani Aromatherapy Oil on Pain Intensity and Levels of Tumor Necrosis Factor Alpha (TNFα**)**

Table 4 Results of Analysis of the Effect of Back Massage with Frangipani Aromatherapy Oil on Pain Intensity and Levels of Tumor Necrosis Factor Alpha (TNFα**)**

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Observed Power[c]
Intercept	Pillai's Trace	.983	1075.102[b]	2,000	37,0	.000	.983	1,000
	Wilks' Lambda	.017	1075.102[b]	2,000	37,0	.000	.983	1,000
	Hotelling's Trace	58.114	1075.102[b]	2,000	37,0	.000	114.983.983	1,000
	Roy's Largest RootRoy's	58.114	1075.102[b]	.000 .983	37,0		2,000	1,000
ID	Pillai's Trace	.322	8,801[b]	.959	37,0	.001	.322	2,000
	Wilks' Lambda	.678	8,801[b]	.959	37,0	.001	.322	2,000
	Hotelling's Trace	.476	8,801[b]	2,000	37,0	.001	322	.959
	Roy's Largest Root	.476	8.801[b]	2.000	37.0	.001	.322	.959

Table 4 provides information that back massage using Frangipani aromatherapy oil has an effect on decreasing TNFα levels and labor pain intensity (p<0,01).

To further explore the effect of treatment, an effect test was carried out between research subjects.

Table 5 Results of the analysis of Between-Subjects Effect

Source	**Dependent Variable**	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**	**Observed Power[c]**

Corrected Model	Pain Labor intensity	10,000[a]	1	10,000	7,379	0.010	163	.754
	TNFα level	331.949[b]	1	331.95	11,344	.002	.230	.907
Intercept	Pain Labor intensity	1562,500	1	1562,50	1152,913	.000	968	1,000
	TNFα level	33245,026	1	33245,03	1136,078	000	968	1,000
Interventions	Pain Labor intensity	10,000	1	10,000	7,379 ,	010	.163	754
	TNFα level	331,949	1	331,949	11,344	.002	.230	907
Error	Pain Labor intensity	51,500	38	1,355				
	TNFα level	1111,993	38	29,263				
Total	Pain Labor intensity	1624,000	40					
	TNFα level	34688,968	40					
Corrected Total	Pain Labor intensity	61,500	39					
	TNFα level	1443,942	39					

a. R Squared = ,163 (Adjusted R Squared = ,141)
b. R Squared = ,230 (Adjusted R Squared = ,210)
c. Computed using alpha = ,05

Table 5 shows that back massage using frangipani aromatherapy has an effect on reducing pain intensity and TNFα levels ($p<0.01$). The contribution of the intervention to pain intensity was 16.3%; while the level of TNFα as much as 23%. This shows that there are other factors that influence the decrease in labor pain intensity and TNFα levels.

DISCUSSION

Normal labor is labor at aterm pregnancy, without complications for both mother and baby. This labor is characterized by adequate uterine contractions, bloody show discharge, and cervical dilatation. Normal labor does not require special measures, Intervention is required when maternal and/or fetal well-being is at risk (Bonapace, at.al., 2018).

Cytokines are produced by endometrial stromal cells, decidual cells, and macrophages in response to inflammation. TNFα stimulates the production of prostaglandins which trigger an increase in metalloprotease which further causes cervical ripening and effacement (Takayuki, et.al., 2019). The stretching of the lower uterine segment and compression of the sacral flexus trigger the secretion of the hormone oxytocin which causes the uterus to contract. This condition triggers the activity of nociceptive afferents that innervate the endocervical and lower segments from Thoracis 10 to lumbar I (T10-L1). The more frequent uterine contractions occur, the more the lower part of the fetus descends, resulting in stretching and distension of the pelvic floor, vagina, and perineum, which can trigger nerve fiber activity in sacral 2 to sacral 4 (S2-S4). These events cause ischemia and tissue injury that trigger the inflammatory process. As a result, pregnant women feel pain (Canavero *et al.*, 2018; Bonapace *et al.*, 2018). Stretching of the cervix triggers proinflammatory activity. There was a significant increase in pro-inflammatory cytokines, such as IL-6, IL-8, CCL-2 and TNF-α, compared to the inflammatory response observed in PTL human twins (Sivarajasingam, et.al., 2016)

Labor pain is an emotionally related experience. Pain perceived by parturient women can be measured using a numeric rating scale (NRS). The average intensity of labor pain in this study before the intervention was in the moderate to severe degree range (range 5-9). Similar results were found by Sriasih, et.al. (2019) most of the subjects experienced moderate pain. Azizah, et.al (2020) found an average labor pain of 6.33. Labor pain is unique and different from other pains. Pain intensity is influenced by several factors, including age, parity, education, and support from people around the mother (Maryuni, 2020). In this study, all subjects were nulliparous, with age of 20 - 30 years old, most of them were at the middle level of education, all subjects were accompanied by their families, especially their husbands. The results of the different test in the two groups showed that there

was no difference. Age, education, and delivery assistance were equal (p>0.05) in both groups, indicating that changes that occurred in one group were not fully influenced by the characteristics identified in this study.
TNFα levels and labor pain intensity in the intervention group after being given back massage with frangipani aromatherapy (posttest) were lower than pretest and lower than TNFα levels in the control group. The results of the independent t test and paired t test showed a significant difference (p <0.05). The results of the manova test also showed that back massage with frangipani aromatherapy had an effect on reducing TNFα levels and the intensity of labor pain. The older the gestational age, the greater the synthesis of CRH by the placenta. CRH triggers the formation of proinflammatory cytokines and chemokines in the myometrium. This condition triggers the synthesis of prostaglandins and suppresses the secretion of serotonin and endorphins. The impact is uterine contractions accompanied by pain (Sivarajasingam, et,al., 2016). Back massage using Frangipani aromatherapy provides efficacy through two pathways, namely skin and smell. Touch with gentle pressure on the skin provides a sense of comfort that triggers the secretion of endorphins, which is useful in reducing pain during the birth process of the baby (Wulandari, et.al., 2017; Fitriana and Antarsih, 2019; Darmawan and Waslia, 2019; Simpi and Sarkar, 2019; ' Gönenç and Terzioğlu, 2020; Azizi, M., 2020) as well, as reducing anxiety (Tabatabaeichehr and Mortazavi, 2020).
Frangipani aromatherapy oil contains Linalool which is able to inhibit the release of acetylcholine and make changes in the function of ion channels at the neuromuscular junction. Linalool also works as a sedative. When someone inhales the aromatherapy released by Frangipani, it will stimulate the olfactory nerve cilia receptors which are transmitted to the olfactory bulb via the olfactory nerve. The olfactory bulb is associated with the limbic system (Nurcahyo and Purgiyanti, 2017). When the mother gives birth calmly, it can increase anti-inflammatory activity, so that TNFα decrease, prostaglandins decrease and increase endorphin secretion so that pain decreases. This triggers the secretion of oxytocin (the love hormone) which is able to regulate uterine contractions and relaxation so as to facilitate the birth of a baby (Takayuki, et.al., 2019; Saha, et.al, 2017; Tabatabaeichehr and Mortazavi, 2020)

CONCLUSIONS

Back massage using Frangipani aromatherapy oil affects the intensity of labor pain and reduces TNFα levels. The intervention contribution was 16.3% to the decrease in pain intensity and 23% to the decrease in TNFα levels. Therefore, the recommendation for the next researcher is to find other factors that contribute to reducing pain intensity and TNFα

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