

Effects of Engineered Stimulation of Oxytocin on Hormonal Status of Postpartum Women

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ABSTRACT

Oxytocin in the postpartum women is very necessary to maintain breastmilk production. An engineered stimulation of oxytocin by using a tool in a previous study was evident to give effects on the production of breast milk. The purpose of this study was to analyze the effects of an engineered massage tool for stimulating oxytocin on the levels of oxytocin, prolactin and beta-endorphin in the postpartum women. Quasi-experimental study employed a post-test with control group and was conducted in two hospitals in Semarang. A consecutive sampling was used to recruit the samples, involving 32 postpartum women in the control group, 26 in the intervention group I (intervention once-daily) and 30 in the intervention group II (intervention twice-daily). After 9 hours 30 minutes since the labor, the blood samples from the postpartum mothers were taken and examined for the oxytocin, prolactin, and beta-endorphin. The results showed a mean of 353.58 ng/ml for oxytocin, 231.41 ng/ml for prolactin and 178.75 ng/ml for beta-endorphin. There was a significant relationship between the frequency of breastfeeding and the prolactin ($p=0.004$), and there was also a significant relationship between the breast milk secretion and the prolactin ($p=0.005$). Beta-endorphin had a significant association with the oxytocin ($p=0.000$). There was a difference in beta-endorphin levels between the groups given once-daily stimulation, twice-daily stimulation and the control group ($p=0.041$). The stimulation of oxytocin had an effect on the increase of beta-endorphin which indirectly affected the oxytocin.

Keywords: *Engineered oxytocin, postpartum, oxytocin, prolactin, beta-endorphin*

A mother's ability to breastfeed is shown in the production and secretion of breast milk which is affected by the prolactin and oxytocin. The letdown reflex is a response of the nervous system that causes the breast milk producing cells contract so that the milk inside is squeezed out, flows along the milk duct, and comes out through the nipples. The letdown reflex will work if only given a command from the oxytocin. A high level of oxytocin maximizes the amount of breast milk in its reservoir ⁽¹⁾.

A postpartum mother by nature has a duty to breastfeed her baby exclusively for six months, and this will continue until the age of two. Breastfeeding provides some benefits; one of which is increasing the secretion of oxytocin that plays a role in the uterine involution and breast milk secretion. In a mother with caesarean section, the involution occurs slower than that of normal labor since the uterine condition of C-section mom is not stimulated to immediately return to its normal form ⁽²⁾.

Oxytocin affects the affiliate behaviors such as trust, empathy, social memory, and interpretation of facial expressions. Oxytocin provides an enhanced effect of compassion quality such as wisdom, strength, and goodness ⁽³⁾. The function of oxytocin is just opposite to the stress hormone since oxytocin makes someone feel calm and relaxed. Oxytocin leads someone to feel relaxed, avoid stress, have more open communication, feel connected, and get rid of isolated feelings. Oxytocin can make a person be in his/her best mood and develop a feeling of loving and being loved ⁽⁴⁾. Also, oxytocin can induce anti-stress such as decreased blood pressure and cortisol levels. Repeated exposure to oxytocin causes a long-term effect which affects one's other activities.

In addition to affecting the breastfeeding mechanism, oxytocin also gives effects on the work of the other organs. In the uterine smooth muscles, oxytocin stimulates the uterine contractility. In the kidneys, antidiuretic hormones (ADH) and oxytocin have some similar

effects since the chemical structure between the ADH and oxytocin is very identical. Furthermore, oxytocin in the blood vessels also works on the ADH receptors which cause a decrease in diastolic pressure ⁽⁵⁾.

The circulation of oxytocin will increase when there is a signal of trust, and vice versa, a high level of oxytocin will increase the trust. Trust is an emotional aspect. There are some factors which improve a mother's emotions, including a pleasant condition, maternal attraction, touch, and happy and warm feelings ⁽⁶⁾.

The stimulation of oxytocin is a necessary intervention for the postpartum women. In the practice of postpartum care, such intervention has not become a standard of care as it is only given to those who are in need. So far, the existing intervention has been in the form of a manually administered oxytocin massage. A person who is given a massage increases oxytocin and reduces adrenocorticotropin ⁽⁷⁾. Postpartum women who were given the oxytocin massage produced colostrum of 5 cc more than those who did not receive any massage ⁽⁸⁾. In addition, the provision of oxytocin massage also gave an effect on the involution of uterine ⁽⁹⁾. A similar study also showed that oxytocin massage provided an effect on the level of oxytocin ⁽¹⁰⁾.

The stimulation of oxytocin can be performed using an engineered assisting tool. It is as suggested by Anggorowati who stated that the use of digital massager of oxytocin (DMO) gave effects on the increased volume of breast milk production. In this study, the stimulation can be independently practiced so that it is suitable for the purpose of nursing, that is to develop one's self-reliance. Furthermore, this self-administered intervention is also practical for the postpartum women under any circumstances as long as their condition is conscious. Also, the operation of the tool is also simple. However, a previous study by Anggorowati has not been able to determine the effective dose of DMO use for oxytocin stimulation ⁽¹¹⁾.

The present study aimed to determine the effects of engineered stimulation of oxytocin on the hormonal status of postpartum women. The hormonal parameters in this study include the oxytocin, prolactin, and beta-endorphin.

METHODS

This study employed a post-test quasi-experimental design with a control group and was conducted at public hospitals in Semarang and Semarang regency particularly at the maternity room. A consecutive sampling was used to recruit the samples of postpartum women after 6 hours of labor who met the criteria of compost mentis awareness and willingness to participate.

The first sample group was taken as a control group from the public hospital in Semarang municipality and Semarang regency (n=32). The other two sample groups were also recruited simultaneously from both hospitals and were assigned to the intervention group I and intervention group II. The number of each sample group was similar with that in the control group. However, during the process of data collection, some women dropped out and refused to participate. Therefore, the number of samples included in the analysis was 32 in the control group, 26 in the intervention group I and 30 in the intervention group II. Before blood sampling in treatment group 1 was given massage stimulation with tool once and group 2 treatment was given 2 times massage stimulation with interval of 3 hours.

After 9 hours and 30 minutes since the labor, the blood samples from the women in the control group and intervention group were taken; each was for 3 ml. The blood samples were then centrifuged in the hospital laboratory and stored in a cooling cabinet. Furthermore, the samples were then sent to GAKY laboratory at Diponegoro University for further analysis. By using the ELISA technique, the centrifuged blood samples were then examined to identify the status of oxytocin, prolactin, and beta-endorphin.

Data collection is done after obtaining ethical approval from the Ethics Committee of Faculty of Medicine Diponegoro University - Kariadi Hospital with number 712/EC/FK-RSDK/2016. Respondents were given an explanation of the purpose of research and involvement in research as well as approval in the study proved to provide a signature.

RESULTS

The results describe the characteristics of respondents, including the demographic data and

other characteristics of the post-partum mothers in table 1 In addition, they also explain the hormonal condition in table 2 and the

relationships among the hormones of postpartum women in table 3.

Table 1. Characteristics of postpartum women at hospitals in Semarang

Variables	Control (n=32)	Group I (n=26)	Group II (n=30)	p value
Age	27,46 (15-43)	28,73 (18-47)	26,03 (17-39)	0,907**
Education				0,000*
Elementary school	4 (12,5%)	2 (7,7%)	2 (6,7%)	
Junior high	12 (37,5%)	5 (19,2%)	9 (30%)	
Senior high	15 (46,9%)	16 (61,5%)	17 (56,7%)	
University	1 (3,1%)	3 (11,5%)	2 (6,7%)	
Employment status				0,000*
Employed	9 (28,1%)	11 (42,3%)	6 (20%)	
Unemployed	23 (71,9%)	15 (57,7%)	24 (80%)	
Type of labor				
Vaginam				
Section caesarean	21 (65,6%)	14 (53,8%)	19 (63,3%)	0,033*
	11 (34,4%)	12 (46,2%)	11 (36,7%)	
Number of birth	1,75 (1-4)	1,61 (1-4)	1,63 (1-4)	0,525**
Birth weight	3129,7 (2300-3900)	3121 (1500-4200)	2963,3 (1600-3500)	0,363**
Early initiation of breastfeeding				0,522*
Yes	16 (50%)	17 (65,4%)	14 (46,7%)	
No	16 (50%)	9 (34,6%)	16 (53,3%)	
Frequency of breastfeeding every day	1 (0-5)	1,26 (0-4)	1,73 (0-5)	0,135**
Secretion of breastmilk (hour after birth)	42,56 (0-72)	28,86 (0-72)	27,63 (0-72)	0,063**

*chi-square ** annova

Table 2. Hormonal differences in postpartum women after the stimulation of oxytocin massage using DMO in Semarang in 2016 (n=88)

Group	Hormones		
	Oxytocin	Prolactin	Beta-endorphin
Control	346,05 (46,74-1045,20)	245,36 (76,37-488,49)	190,41 (23,13-418,57)
Group I	341,11 (36,61-1019,10)	238,22 (63,66-425,40)	211,84 (78,22-458,80)
Group II	372,42 (132,64-1027,60)	210,64 (21,85-474,21)	137,64 (28,94-357,56)
Difference Control-Group I	0.491*	0.845*	0.839*
Difference Control-Group II	0.678*	0.139*	0.068*
Difference Group I & II	0,643***	0,392***	0,013***
Difference Control-GroupI-GroupII	0.583**	0.358**	0.041**

*= Mann Whitney

** = Kruskal Wallis ***independent t test

Table 3. Relationship among the hormones of postpartum women in Semarang in 2016 (n=88)

N	R	P
Oxytocin and prolactin	-0.308	0.004
Beta-endorphin and oxytocin	0.536	0.000
Beta endorphin and prolactin	-0.034	0.754

The mean of oxytocin in the postpartum women on the first day was 353.58 ng/ml, indicating a normal level of oxytocin in breastfeeding mothers. The results of present study showed that the mean of oxytocin level among the women was within a normal category. However, some were found to have less than that. The lowest level was 36.61 ng/ml, and this was far beyond the normal value (75ng/ml).

The level of prolactin in the postpartum women on the first day showed a mean of 231.41 ng/ml. It was within a normal range for breastfeeding mothers. The lowest level was 21.55 ng/ml, indicating an extreme difference from the normal one (90ng/ml). Some mothers would be at risk of inadequate production of breast milk if not controlled by any stimulation of the breast milk production.

Beta-endorphin on the first day showed a mean of 178.75 pg/ml, which belonged to the normal value. Nevertheless, the lowest score was 23.13 pg/ml. Beta-endorphin represents a stressful condition of breastfeeding mothers.

DISCUSSION

Prolactin level in the other study in two weeks is 124ng/dl, eight weeks is 68 ng/dl ⁽¹²⁾. From this study prolactin level more than study, its 231ng/ml. The potential for breastfeeding was better in control group with higher prolactin levels after intervention in accordance with other studies that oxytocin and prolactin levels were related to the mother's ability to breastfeed ⁽¹³⁾. Based on the level of prolactin in the intervention group, this study could not conclude that the intervention did not have the potential to increase breast milk because of unknown prolactin levels in all groups prior to intervention.

There was a relationship between the oxytocin and prolactin as shown in a correlation value of -0.308 and a p-value of 0.004. Likewise, there was also a strong relationship between beta-endorphin and oxytocin with a correlation value

of 0.536 and a p-value of 0.000. This is in line with other studies stating that beta-endorphin is closely related to oxytocin ⁽¹⁴⁾. However, there was no significant relationship between beta-endorphin and prolactin ($p = 0.754$).

Endorphin is an opioid of the body, produced by the hypothalamus which provides pleasing and relaxing effects ⁽¹⁵⁾. A hormonal level in a normal limit provides a relaxed response, and on the contrary, a lower endorphin level will provide the opposite response.

The results showed that there was a difference in the level of beta-endorphin among the groups with one-time stimulation, two-times stimulation and the control group ($p = 0.041$). The massage stimulation using DMO had an effect on the changes in the level of beta-endorphin. Increased beta-endorphin was more clearly seen in the postpartum women with one-time massage stimulation. Beta-endorphin mutually synergizes with oxytocin. These hormones facilitate or inhibit the effects of pain and stress, maternal and bonding relationships ⁽¹⁶⁾. Beta endorphin also improves one's self-defense ability against disease progression ⁽¹⁷⁾.

The provision of massage provides effects on the decrease of stress. The stressful condition is represented by the low level of beta-endorphin ⁽¹⁴⁾. High level of beta-endorphin will induce oxytocin, and thereby gives an indirect effect on the oxytocin ⁽⁷⁾.

In a previous study, the provision of massage for three consecutive days provided significant changes in the oxytocin. Repeated massages would have effects on the oxytocin changes ⁽¹⁸⁾. In addition, another study also revealed that administering DMO to the mothers for three consecutive days could increase the volume of breastmilk of 23 ml ⁽¹⁹⁾. The results of this study reinforce that the giving of a positive effect that is given once a day for a certain period.

Oxytocin is associated with beta endorphin. Giving once daily has an effect on beta endorphin

but has no effect on oxytocin. This suggests that DMO stimulation needs to be given over a longer period. Oxytocin has an effect on lactation mediating let down reflex along with prolactin stimulation resulting in milk production. Oxytocin improves adaptation behavior of maternal and behavior immediately after delivery⁽¹⁴⁾.

The weakness of this study is that between the control and intervention groups there are different types of labor. The type of labor distinguishes the standard procedure of hormone oxytocin that affects stress. The effects of anesthesia on cesarean section affect the stimulation of oxytocin and prolactin, this is different from normal labor. Differences in these characteristics are related to the results of the study that DMO stimulation did not show any effect on oxytocin and prolactin. In a cesarean section, administering a three-day oxytocin massage may increase prolactin⁽²⁰⁾. Massage of postpartum mother with normal labor shows the effect of increased milk production⁽²¹⁾. Stimulation of breastfeeding in normal and cesarean section differs as in the initiation of early breastfeeding⁽²²⁾.

CONCLUSION

The hormonal status of the postpartum women on the first day showed level of oxytocin, prolactin and beta-endorphin on normal range. The engineered stimulation oxytocin affect to beta-endorphin level. Stimulation of oxytocin with once-daily dosage its difference effect from twist-daily dosage. There was a strong relationship between beta-endorphin and oxytocin.

For the breastfeeding mothers, it is suggested that they breastfeed their baby frequently in accordance with the results of some studies which stated there was a relationship between the frequency breastfeeding and the prolactin. In addition, the postpartum women are recommended to immediately breastfeed their baby after birth.

For the health workers managing the postpartum mothers, it is suggested that they implement the early initiation of breastfeeding and encourage postpartum mothers to increasingly breastfeed their babies. In addition,

they can also give some interventions to stimulate the oxytocin.

Further studies on the use of oxytocin stimulation using DMO with a once-daily dosage for at least three days are necessary. The stimulation of oxytocin in breastfeeding mothers can be measured through the mother's independence parameters such as the smooth secretion and sufficiency of breast milk.

ACKNOWLEDGMENTS

The researchers would like to thank Diponegoro University for funding this study.

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