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RESEARCH

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The Effect of Black Cumin (*Nigella Sativa*) on Breastfeeding Mothers

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Abstract

Breast milk is the best nutrient to reduce the pain in nursing mothers and death in infants. However, for nursing mothers, too little milk volume is the cause of problems occurring during the breastfeeding process. Thus, mothers who breastfeed should consume foods that can increase the breast milk volume. One food frequently consumed by mothers to increase breast milk is honey. In fact, natural honey is challenging to discover, and the price is also high which makes it as an obstacle. A more economical alternative is required, one of which is black cumin. It is easy to obtain and the price is also affordable. Black cumin also contains galactagogue to increase prolactin that influences breast milk production. The objective of this study is to identify the effect of black cumin on the volume of breast milk. The study was a randomized controlled trial involving 60 breastfeeding mothers divided into intervention groups and control groups. The intervention group was provided 15 grams of black cumin brewed with 1000C boiling water as much as 200 ml, and the control group was assigned 15 grams of pure honey brewed boiling 1000C as much as 200 ml. Intervention and control were administered on the second day to the day of completion after giving birth. They were measuring instruments which accustomed to measure breast milk pumps. Bivariate analysis employing the Wilcoxon and Mann Whitney tests presented a significant difference between the volume of breast milk ($p = 0.001$) of the control and intervention groups. This study recommends the application of black cumin as a strategy to increase the volume of breast milk in nursing mothers.

Keywords: Black cumin, Breastfeeding, *Nigella Sativa*.

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1. INTRODUCTION

Newborns need breast milk because it is the best source of nutrients for growth and it is able to increase their health status of newborns (Abbass-Dick et al., 2019). Global data displays that breast milk can save more than 800,000 lives each year, and the majority are children under the age of 6 months (Abd-elkareem et al., 2022). Breast milk is essential for babies in maintaining health and survival because babies who are breastfed own better endurance than those who are not (Adiyaman et al., 2022). Hence, babies who are provided with breast milk rarely suffer from diseases, and it is able to avoid nutritional problems (Alkhalaf et al., 2020). Lack of breast milk intake may unbalance the baby's dietary needs, thus, the volume of breast milk which does not meet the baby's needs will become a problem (Alkis et al., 2021). The imbalance of nutritional fulfilment in infants negatively impacts the quality of human resources identified from the inhibition of baby growth and development (Arbour et al., 2019).

Breast milk is beneficial for both baby and mothers who breastfeed their babies (Segura, 2022). Breastfeeding reduces a mother's risk of developing breast cancer, ovarian cancer, diabetes and heart disease, thus, it can be estimated that breastfeeding is one way to prevent 20.000 deaths each year from breast cancer (Beyene et al., 2022). In breastfeeding, there are many factors affecting the volume of breast milk, one of which is the food consumed by mothers (Branger et al., 2019).

One food that has been proven to increase the volume of breast milk is by consuming honey (Bucher & Spatz, 2019). The research results in Japan and several other drugs demonstrate that honey is able to ease the release of breast milk and the number of antibodies in breast milk (Buckingham et al., 2022). Furthermore, the baby's immunity to the disease also increases (Budiati & Setyowati, 2019). The efficacy of honey is also effective in dealing with swelling of the fungus in the baby's mouth (Ciesielska-figlon et al., 2021). Moreover, honey is also good for the stomach and blood (Cohen et al., 2018). Honey is frequently applied immediately after the mother gives birth, hence, when breastfeeding her baby, the amount of breast milk volume increases (Davra et al., 2022). However, pure honey is now complicated to discover, and the price is also hard to afford (Deniz, 2022). Recently, there are many processed honey which is able to reduce the efficacy and content required from the honey (Douglas & Geddes, 2018). As the matter of fact, moreover, many manufacturers add water of brown sugar as a mixture of honey. Therefore, a study is required to conduct in increasing the volume of breast milk by employing natural ingredients that are easy to obtain, affordable and cannot be faked.

Studies on the content of black cumin have been extensively performed. Moreover, black cumin is also easy to find at an affordable price (Esharkawy et al., 2022). Black cumin is also generally traded in an unprocessed form which influences on reducing the content and efficacy of black cumin. In previous studies, black cumin was employed as an antidiabetic by utilizing the scope of its compound in the form of thymoquinone (Esmail et al., 2021). In this study, innovation was conducted by utilizing the compound content of black cumin in the form of galactagogue. Thus, the objective of this study is to analyze the effect of black cumin on the breast milk volume of nursing mothers. The findings of this study are expected to increase the breastfeeding volume of the mothers.

Based on Indonesia's 2018 health profile data, the exclusive breastfeeding coverage for infants is, on average, nationally at 65.16%. Gorontalo province is the fourth-lowest complete breastfeeding coverage based on 46.91%. Data from the Gorontalo Provincial Health Office presented that of the 11,975 breastfed babies, only 5,018 babies (46.9%). The lowest breast milk coverage in Gorontalo Province in 2018 was Bone Bolango Regency which was out of 675 infants, only 258 babies were breastfed (38.2%). This exposure clearly displays that breastfeeding achievement is still far from the national

target of 80%. The results of a survey conducted by researchers at the Puskesmas (Primary Health Center) in Bone Bolango Regency obtained the results that there were 3 Primary Health Centers with the lowest breast milk achievement in Puskesmas Tapa out of 68 babies who received breast milk only 2 (3.0%), in Puskesmas Bulawa from 46 babies who got breast milk only 2 (4.0%) and in Puskesmas Toto Utara from 81 babies who got breast milk only 4 (5.0%).

2. RESEARCH METHOD

This Randomized Controlled Trial (RCT) was conducted from July to November 2020 at the Puskesmas in the working area of Bone Bolango Regency of Gorontalo Province, Indonesia. Breastfeeding mothers were randomly divided into intervention and control groups. The process of randomizing nursing mothers with odd numbers was included in the intervention group, and breastfeeding mothers with even numbers were classified in the control group. After obtaining approval from the mothers, they were blinded by the intervention. The inclusion criteria for this study are mothers who gave birth to vaginal babies, did not suffer from severe infectious diseases (HIV, sepsis, and herpes simplex virus type 1 in their breasts), did not have breast disease (blistered nipples, mastitis, breast tumors, and breast cancer) and did not experience post-breast surgery. The exclusion criteria involve mothers not following the rules presented during the study. The number of samples administered by each group was 30 nursing mothers. This study has obtained ethical permission from research ethic committee (LB.01.01/KEPK/58/2020).

Before the researcher intervened, the researcher provided informed consent to the nursing mother, then was teaching on how to apply the breast milk pump and distributed a notebook of the breast milk volume. The procedure gave 15 grams of black cumin brewed with 2000C boiling water for 20 minutes, then filtered and placed in a bottle in the intervention group. In the control group, 15 grams of pure honey was brewed with 1000C boiling water for 200 minutes and then placed in a bottle. Six enumerators assisted researchers from the Puskesmas where the study was performed. The task of the enumerator in the survey was to distribute black cumin steeping water and honey-steeping water from researchers to nursing mothers. Furthermore, the enumerator's duty is also to ensure that nursing mothers drink steeping water. After confirming that the nursing mother drinks the enumerator, soaking water is required to check the milk volume notebook.

Breastfeeding mothers involved in the study were required to pump breast milk once a day for 30 minutes for each breast. The time to pump breast milk is between 01.00 to 06.00 because the time is the best moment to perform power pumping, and the baby is in a deep sleep. Thus, there is no breastfeeding activity on demand. After pumping breast milk, the mother writes the volume of breast milk pumped from the second day to the next day in the record book. The research instrument consisted of a questionnaire sheet characteristic of nursing mothers, a volume notebook and a breast milk pump.

Homogeneity tests were performed on the characteristic variables of respondents. Bivariate analysis is conducted on the second and the seventh day. Breast milk production data is not normally distributed. Therefore, nonparametric tests are implemented. After treatment, follow-up tests between the intervention and control groups displayed significant differences between breast milk production ($p = 0.0001$) in the intervention and control groups.

3. RESULTS AND DISCUSSION

Table 1. Respondent Characteristics (n=60).

| Characteristics | Intervention | | Control | | p-value |
|------------------------------|--------------|----|---------|----|---------|
| | N | % | N | % | |
| Age | | | | | |
| Healthy Reproduction (20-35) | 26 | 87 | 24 | 80 | 1,000 |
| High Risk (<20/>35) | 4 | 13 | 6 | 20 | |
| Education | | | | | |
| Primary School | 4 | 13 | 5 | 16 | 0,608 |
| High School | 26 | 87 | 25 | 84 | |
| Parity | | | | | |
| Primipara | 3 | 10 | 2 | 6 | 0,856 |
| Multipara | 27 | 90 | 28 | 94 | |

Table 1 displays that the homogeneity test presented no significant difference in the control and intervention groups ($p > 0.05$).

Table 2. The Breastmilk Volume of Control Group (n=60).

| Breastmilk Volume | Control | | | p-value |
|-------------------|---------|---------|-------------|---------|
| | Median | Min-Max | 95% CI | |
| Day 2 (Pre) | 20 | 0-50 | 9,1-35,7 | 0,001 |
| Day 3 | 48 | 10-80 | 70,4-123,1 | |
| Day 4 | 65 | 25-325 | 84,2-156,3 | |
| Day 5 | 72 | 38-368 | 92,7-168,2 | |
| Day 6 | 94 | 45-375 | 102,3-175,6 | |
| Day 7 (Post) | 183 | 50-380 | 128,4-184,2 | |

Table 2 presents that the primary findings of this study displayed a significant volume of breastmilk in the control group by applying honey sobbed with hot water ($p=0.001$).

Table 3. The Breastmilk Volume of Intervention Group (n=60).

| Breastmilk Volume | Intervention | | | p-value |
|-------------------|--------------|---------|-------------|---------|
| | Median | Min-Max | 95% CI | |
| Day 2 (Pre) | 60 | 0-100 | 12,1-43,9 | 0,001 |
| Day 3 | 122 | 10-220 | 90,4-132,4 | |
| Day 4 | 187 | 25-325 | 114,2-163,2 | |
| Day 5 | 192 | 38-368 | 172,6-184,5 | |
| Day 6 | 211 | 45-375 | 192,1-215,3 | |
| Day 7 (Post) | 218 | 50-380 | 218,4-284,9 | |

Table 3 presents that the primary findings of this study displayed a significant volume of breastmilk in the intervention group by applying black cumin (*Nigella sativa*) sobbed with hot water ($p=0.001$).

Table 4. The difference in mean of breastmilk volume in the control group and intervention group.

| Breastmilk Volume | Intervention | Control | p-value |
|-------------------|--------------|---------|---------|
| Day 2 (Pre) | 24 | 46 | 0,001 |
| Day 7 (Post) | 172 | 216 | |

Table 4 presents that the primary findings of this study revealed a significant difference in the volume of breastmilk between the intervention group (black cumin) and the control group (honey) ($p = 0.001$).

The most extensively distributed total respondents in this study were in the 20-35 age group which were 50 respondents (83%). Age is a very decisive maternal health and conditions associated with pregnancy, childbirth and postpartum, and how to care for and breastfeed the baby. Mothers less than 20 years old are still immature and unprepared in terms of physical and social skills in dealing with pregnancy and childbirth.

The highest education level of the respondents was at the higher education level, as much as 85% and other primary education was as much as 15% of the total respondents. The education of respondents is one of the essential elements which determines the nutritional situation of the family. People possessing higher education are easier to understand the information compared to people who are less educated (Essa et al., 2018). Maternal education is one reinforcing factors influencing a person's behavior (Fan et al., 2019). The determining educational factor is easy for a person to absorb and understand the knowledge they have gained (Fatimah et al., 2021). The level of respondents' education is one of the social aspects which generally affects human attitudes and behaviors (Flood et al., 2019). Respondents with a group of education also tend to own better and broader knowledge than respondents with low-level education.

Based on these results, the total number of respondents in multipara is as much as 92% of the total number of respondents. Parity refers to the number of live births a woman owns. Parity is also considered as the direction of information seeking about the respondent's knowledge. It is associated with the influence of one's or others' experience on the understanding that can affect current or later behavior (Forster et al., 2019). Parity is allegedly associated with search information about breastfeeding. The number of deliveries provides experience in breastfeeding for mothers and understands how to increase breast milk production. Hence, there will be no obstacles for the mother in breastfeeding. The first time mothers who give birth more than twice frequently find problems in breastfeeding (Gnanasekaran et al., 2021). Problems which generally arise are nipple blisters due to inexperience they possess or unreadiness for breastfeeding in psychological matter, and the changing of the shape and condition of the nipple which is not well (Habibi et al., 2018). More children born affects the productivity of breast milk because it is closely associated with the mother's health status, fatigue, and nutritional intake (Hamze et al., 2019). For mothers who give birth more than once, breast milk production is much higher than for mothers who give birth for the first time. The number of deliveries that the mother has undergone affects their baby experience (Hikmah et al., 2022).

Based on the data normality test, the significance value of black cumin is 0.006, and the significance value for pure honey is 0.011. As the significance value of both variables is <0.05 , it is implied that the volume of breast milk-fed with black cumin and pure honey is not distributed normally. Hence, the type of test administered to examine hypotheses is a nonparametric statistical test, the *Mann Whitney Test*. Based on the significance value (p -value) of 0.001 (<0.05), it is identified that there is a difference in the volume of breast milk in nursing mothers who consume black cumin and pure honey in which the average value of the importance of breast milk administered black cumin is higher than that provided with pure honey.

This randomized study revealed that black cumin (*Nigella sativa*) was better at increasing breast milk volume than honey, as was conducted in previous studies. It is because the volume of milk produced equals the amount of breast milk pumped or removed. Thus, it is implied that the more volume of breast milk released with the breast

pump, the more critical milk is produced by the breast. However, some explain that the volume of breast milk produced with a breast milk pump does not display a meaningful difference on the first day of postpartum motherhood (Zhang et al., 2022).

Black cumin contains galactagogue phytochemical compounds which are useful for increasing breast milk with the provision that nursing mothers should consume it regularly. Black cumin also unveiled an increase in the volume of breast milk more than the volume of breast milk in mothers consuming honey (Hossain et al., 2021). The average percentage of breast milk increasing in the control group or nursing mothers consuming pure honey from the second day to the seventh day was 28.98% and 80.6%, in the intervention group or who consumed black cumin.

Food consumed by nursing mothers affects the production of breast milk dramatically. When the food consumed by mothers contains adequate nutrients and a regular diet, the production of breast milk will run smoothly (Jefferson & Bibb, 2019). The quality and presentation of breast milk are significantly influenced by the food consumed by mother on a daily basis. During breastfeeding, the mother must certainly consume a balanced and diverse diet (Kabir et al., 2020). There are various developments in society regarding certain types of food which makes mother lose the natural nutrients required by mother's body during breastfeeding (Khazdair et al., 2021). Smooth milk production will be guaranteed if the routine food consumption is sufficient nutrition accompanied by a regular diet (Khodabakhsh et al., 2017).

The production and release of breast milk occur after the baby is born, followed by a decrease in levels of the estrogen hormone, which increases prolactin levels for breast milk production (Leisegang et al., 2021). Even on the first day, although there is only a tiny amount of breast milk coming out; the mother must continue breastfeeding. This action is intended to provide nutrition to the baby, so that the baby learns to breastfeed or get used to sucking the mother's nipples and enhancing the production of breast milk (Lojander et al., 2022). Honey has been examined to increase the volume of breast milk within ten days of postpartum (Mandey et al., 2015).

Black cumin increases the amount of breast milk due to the combination of lipid elements and the structure of hormones (Mehlsen et al., 2022). Furthermore, the content of polyphenols in black cumin, which is also discovered in katuk leaves, plays a significant role in increasing prolactin levels (Mir et al., 2022). Black cumin administration was examined in mice, with increases in milk production by 31.1% and 37.6% compared to the control group that was not provided with black cumin (Walsh et al., 2019). This study also corroborated previous studies that proved black cumin contains estrogenic constituents as anethole, increases milk secretion, promotes menstruation, and facilitates birth (Nielsen et al., 2022). Structurally, anetholes are similar to dopamine and spread competitive antagonism at dopamine receptor sites. Therefore, it is able to stimulate the release of prolactin and increase milk production (Nomura et al., 2019). Black cumin also contains saponins and alkaloids which produces the prolactin hormone through dopamine inhibition mechanisms (Amelina, 2019). Other benefits of applying black cumin are an immune system, anti-allergy, anti-tumor, anti-inflammatory, anti-bacterial, and breast milk promoter because it contains polyphenols that increase the prolactin hormone, that causes the mother's milk production smoothly. The mechanism of black cumin extract action containing polyphenols which stimulates the hypothalamus produces the hormone prolactin, enables the alveoli and some reflexes are let down which makes milk production smooth (Ohlendorf et al., 2019). After conducting the study for one week, the researchers concluded that there was an effect of black cumin extract on refined milk production. Another phytochemical content in black cumin galactagogue is

a nutrient which is able to accelerate breast milk production, particularly in mothers who experience problems with breast milk production (Ritonga et al., 2017).

Galactagogues affect the prolactin reflex to stimulate the alveoli active in the breast milk formation. The hormone oxytocin also stimulates the milk production. The increased oxytocin hormone is affected by galactagogue (Pattison et al., 2019). Black cumin makes breast milk flow faster. Oxytocin is the hormone contained in black cumin which is responsible for stimulating milk secretion (milk is let down) (Safi et al., 2021). The role of oxytocin in the mammary glands is to promote the contraction of myoepithelial cells surrounding the alveoli of the mammary glands so that by contracting the contents of the myoepithelium cells, the alveolus is triggered into the milk ducts as the alveoli become empty and can stimulate the subsequent synthesis of milk (Schindler-Ruwisch et al., 2019).

Maintaining the volume of breast milk requires significant effort until the achievement of lactogenesis (Shlafer et al., 2018). The successful procedure of lactogenesis begins from postpartum to 72 hours after delivery. To achieve lactogenesis function, it is necessary to conduct early breastfeeding incineration as soon as the baby is born for one hour (Susiloretni et al., 2019). This initiation of early breastfeeding is also closely associated with the success of breastfeeding (Thorley, 2019). The study results explained that if the process of lactogenesis is not achieved, the mother will experience difficulties in breastfeeding even though the breast feels full. If mothers are not able to initiate early breastfeeding, lactogenesis cannot be achieved. Obstacles frequently occur during lactogenesis because there is no stimulation of milk, thus, oxytocin and prolactin decrease (Tiwari et al., 2022).

Breastfeeding mothers in the intervention group and control group received information that drinks provided to mothers every morning increase the volume of breast milk without knowing whether the mother is getting a drink containing black cumin or honey. Moreover, nursing mothers involved in the study were also taught how to employ breast milk pumps and how to record in the milk volume book. Every day, the enumerators involved in the study ensure that nursing mothers consume the given drink every morning by making a home visit. The process of pumping breast milk is conducted between 1 to 6 a.m. Mothers are required to pump each breast for 30 minutes every day. The selection of pumping time in the morning is the right time to perform power pumping (Triansyah et al., 2021). It is also an effective time because the baby is in a sleep state, so the breastfeeding process is not ongoing. The results of the breast milk pump performed after breastfeeding cannot interpret the volume of breast milk produced by the nursing mother.

The study revealed a significant increase in breast milk volume between the control and intervention groups. Another survey involving nursing mothers also presented an increase in the importance of breast milk in mothers who pumped breast milk in the morning. However, the limitation of the researchers in this study is the researchers did not investigate the quality of breast milk in each group. The volume of breast milk in postpartum mothers consuming black cumin is more compared to postpartum mothers who consume pure honey.

The study unveiled that the average volume of breast milk will increase every day if postpartum mothers regularly consume black cumin. This finding reveals new results from previous research which discovered the benefits of black cumin to lower blood sugar levels in people with diabetes (Wagner et al., 2019). In this study, researchers also revealed the benefit of black cumin to increase the volume of breast milk. Therefore, further validation of the findings of this study may be required to look at the quality of

breast milk in mothers who consume black cumin frequently and regularly after giving birth.

The best time to have abundant milk production in the future starts from the first day to the seventh day because it is expected that the mother immediately breastfeeds her baby after giving birth and resumes regular breastfeeding activities on the second day. However, many mothers are unable to maintain it due to physical fatigue.

4. CONCLUSION

The use of black cumin (*Nigella sativa*) has been revealed to increase the volume of breast milk in nursing mothers. Based on our research, we advise nursing mothers to consume black cumin as an effort to increase the volume of breast milk, and for midwives, to be able to introduce black cumin to nursing mothers so that the inhibitory factor in providing exclusive breast milk due to the amount of milk volume which is too little can be overcome. The application of black cumin to increase the volume of breast milk is more efficient and effective because the price of black cumin is affordable and easy to obtain.

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