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GIVING OF NIGELLA SATIVA OIL INCREASES BREAST MILK PRODUCTION IN MOTHERS POST CAESAREA SECTIO

Pemberian Nigella Sativa Oil Meningkatkan Produksi ASI pada Ibu Post Sectio Caesarea

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ABSTRAK

Sectio caesarea merupakan metode persalinan melalui pembedahan dinding abdomen. Salah satu efek samping dari luka sectio caesarea adalah nyeri persisten. Nyeri yang dirasakan oleh ibu akan membuat ibu merasa tidak nyaman sehingga akan mempengaruhi produksi ASI. Produksi Asi yang tidak lancar dapat ditingkatkan dengan konsumsi nigella sativa. Nigella sativa mengandung galaktagog dan polifenol yang merangsang hipotalamus menghasilkan hormon prolaktin, mengaktifkan alveoli dan menurunkan beberapa refleks sehingga produksi ASI lancar. Kandungan ekstrak jinten hitam baik dalam bentuk minyak maupun kapsul, selain untuk memperlancar ASI juga dapat digunakan sebagai kekebalan tubuh dan anti infeksi. Desain penelitian ini menggunakan kuasi eksperimen dengan pretest posttest control group design. Sampel yang digunakan 32 responden kelompok intervensi di Rumah Sakit Kabupaten Kediri dan 32 responden kelompok kontrol di Rumah Sakit Aura Syifa. Teknik sampling yang digunakan yaitu purposive sampling dan uji statistik yang digunakan adalah Wilcoxon signed rank test dan Mann-Whitney test. Pada kelompok intervensi terjadi peningkatan produksi ASI sebesar 68,12 dari 14,38 ml menjadi 82,50 ml. Sedangkan pada kelompok kontrol peningkatan produksi ASI lebih kecil hanya sebesar 50,63 ml dari 14,06 ml menjadi 64,69 ml. Nilai rata-rata rank dari kelompok intervensi sebesar 48,06 dan pada kelompok kontrol sebesar 16,94, hal ini menunjukkan jika produksi ASI pada kelompok intervensi lebih unggul dibandingkan dengan kelompok kontrol. Sehingga dapat disimpulkan terdapat pengaruh pemberian nigella sativa oil terhadap produksi ASI pada ibu post sectio caesarea.

***Kata kunci**: galaktagog, jintan hitam, nigella sativa, produksi ASI, sectio caesarea*

ABSTRACT

Sectio caesarea is a method of delivery through dissection of the abdominal wall. One of the side effects of sectio caesarea wound is persistent pain.The pain felt by the mother will make the mother feel uncomfortable it will affect breast milk production.Poor milk production can be improved by consuming nigella sativa.Nigella sativa contains galactagogues and polyphenols that stimulate the hypothalamus to produce prolactin hormone, activate alveoli, and reduce some reflexes so that breast milk production is smooth.The content of black cumin extract both in the form of oil and capsules, in addition to facilitating breast milk can also be used for immunity and anti-infection.This research design uses a quasi-experiment with a pretest-posttest control group design.The sample used 32 intervention group respondents at Kediri Regency Hospital and 32 control group respondents at Aura Syifa Hospital.The sampling technique used was purposive sampling and the statistical tests used are Wilcoxon signed rank test and Mann-Whitney test.In the intervention group,there was an increase in breast milk production by 68.12 from 14.38 ml to 82.50 ml.While in the control group, the increase in breast milk

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production was smaller only by 50.63 ml from 14.06 ml to 64.69 ml.The mean rank value of the intervention group was 48.06 and that of the control group was 16.94, indicating that the breast milk production in the intervention group was superior compared to the control group.So it can be concluded that there is an effect of nigella sativa oil administration on breast milk production in post sectio caesarea mothers.

Keywords: breastmilk production**,** black cumin, caesarea section, galactagogue, nigella sativa

INTRODUCTION

Sectio caesarea is delivered through an incision in the abdominal wall and uterus and ends with heacting or suturing the incision to deliver one or more babies.[1] WHO (World Health Organization) sets the standard for delivery by sectio caesarea (SC) method at 5-15% per 1000 births in the world. Sectio caesarean deliveries worldwide have reached 21% and are expected to continue to increase globally over the next decade with nearly one third (29%) likely by 2030.[2]

Cesarean section delivery is performed due to several factors originating from the mother and baby such as narrow pelvis, fetal position, prolonged partus,[3] placenta previa, premature rupture of membranes, macrosomia,[4] cephalopelvic disproportion and fetal distress.[5] In addition, age and parity also affect the type of maternal delivery.[6]

Sectio caesarean delivery has a 20 times greater risk of postpartum complications and longer recovery time than vaginal delivery.[7,8] The sectio caesarean scar makes women vulnerable to gynecological problems such as pelvic adhesions, chronic pain, bleeding, and infertility due to the niche, as well as its influence on subsequent pregnancies.[9,10] Pain in the postpartum wound is a problem that must be controlled despite the technology of childbirth technology has developed. SC wounds that do not heal cause pain and can interfere with breastfeeding, resulting in insufficient breastfeeding for the baby.[11]

In 2022 UNICEF reported that globally the average exclusive breastfeeding rate in the world was only 67%. Data sourced from the Central Bureau of Statistics in 2022 explained that exclusive breastfeeding coverage in Indonesia reached 72.04% and in East Java alone in 2022 exclusive breastfeeding coverage of infants less than 6 months was 69.72%. In 2022 exclusive breastfeeding in Kediri District reached 58.6%. Exclusive breastfeeding coverage in Indonesia, East Java, and Kediri District has shown a good prevalence, even so the achievement of this indicator still needs to be improved, and attention to the distribution of exclusive breastfeeding.

Non-exclusive breastfeeding is influenced by several factors including pain that does not originate from the breast, attachment errors, working mothers, postpartum fatigue, and maternal knowledge of children's nutritional needs.[12] Failure to breastfeed in the first 1 hour or early initiation of breastfeeding (EIBF) based on the method of delivery can also affect the failure of exclusive breastfeeding.[13]

The impact of infants who are not exclusively breastfed is associated with a low immune system that is susceptible to gastrointestinal infections, respiratory infections, and other infections.[14] Mothers who do not breastfeed are at risk for ovarian cancer and breast cancer.[15]

To improve breastfeeding, there are two main approaches: pharmacological and nonpharmacological therapies. Among the non-pharmacological methods, Nigella sativa or black cumin is emerging as a promising option. Although Nigella sativa is better known as a traditional remedy for various diseases and as a health supplement, its potential as a breast milk facilitator is not widely known. However,

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cumin has an advantage over other breast milk enhancers. Besides its ability to increase breastmilk production, black cumin extracts both in oil and capsule form also offer additional benefits. The plant is known to boost the immune system and has anti-infective properties. Diversity benefits these benefits make black cumin interesting in supporting the health of breastfeeding mothers and their babies.[16]

Nigella sativa, commonly referred to as black cumin, black seed, or black seed, is a flowering plant belonging to the Ranunculaceae family in the Plantae kingdom. These seeds are native to a wide geographical area, including parts of Asia, Western Asia, the Mediterranean region, and portions of Western and Southern Europe.[17] Throughout history, various civilizations have utilized Nigella sativa, recognizing its potential as a remarkable medicinal plant. It has earned a reputation as a "miracle remedy" due to its purported ability to address multiple health issues and support the body's natural healing mechanisms.[18] Nigella sativa holds a significant place in Islamic medical tradition, with its healing properties highlighted in various Prophetic teachings. Furthermore, the renowned physician Ibn Sina (also known as Avicenna) documented the therapeutic benefits of Nigella sativa in his influential medical treatise, "The Canon of Medicine" (Al-Qanoon fi el-Tibb).[19] The U.S. Food and Drug Administration Food and Drug Administration (FDA) has granted Nigella sativa its official seal of approval for human consumption, confirming its safety. This endorsement indicates that black cumin can be consumed without major health concerns. The FDA's recognition marks a significant milestone in validating Nigella sativa's use as a dietary supplement or food component, potentially expanding its applications in health and nutritional products.[20]

Nigella sativa seeds have a fairly high oil content, ranging from 26% to 34% of their total composition. The fatty acid profile in this oil is dominated by two main components: linoleic acid which accounts for about 64.6% and palmitic acid which accounts for about 20.4% of the total fatty acids. In addition, Nigella sativa seeds also contain smaller but significant amounts of essential oils, ranging from 0.4% to 2.5%. This diversity in composition demonstrates the potential nutritional and health benefits possessed by this plant.[21] Phenolic acids and flavonoids, alkaloids, saponins, and fatty acids are also found in nigella sativa seeds.[22] Flavonoids comprise a varied class of polyphenols, with over 5000 distinct compounds found in plants. These substances are key components in many fruits and vegetables. Scientists have taken a keen interest in flavonoids due to their wide-ranging health benefits. Among their notable properties, flavonoids function as antioxidants, safeguarding cells from harm. Furthermore, these compounds show promise in reducing inflammation and controlling excessive cell proliferation. This multifaceted nature of flavonoids makes them crucial elements in maintaining a nutritious diet.[23]

Nigella sativa contains specific phytochemical compounds that possess galactagogue properties, which means they have the potential to promote and enhance the production of breast milk.[24] Galactogogue in nigella sativa stimulates breast milk by increasing dopamine secretion in the anterior pituitary which inhibits the inhibitory effect of prolactin secretion so that the prolactin content in the body increases.[25] The polyphenol-rich extract from black cumin has been found to stimulate the hypothalamus, leading to increased production of the prolactin hormone. This, in turn, activates the alveoli in the breast tissue. Additionally, it appears to reduce certain reflexes, collectively resulting in improved milk production and flow.[26] Galactagogues affect the prolactin reflex to stimulate the alveoli

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and influence the increase of oxytocin resulting in the formation of breast milk. [27]

This study aims to analyze the effect of giving black cumin oil (Nigella sativa oil) to accelerate breast milk production in post-cesarean section mothers.

METHODS

This study employs a quasi-experimental design with a non-randomized pretest-posttest control group approach. The quasi-experimental method is used to assess the effect of an intervention without subject randomization. In this design, measurements are taken on both groups (treatment and control) before and after the intervention. This method allows researchers to evaluate the impact of the intervention despite the lack of full randomization.[28]

This study was conducted from February 23 to May 30, 2024, by recruiting mothers who had undergone cesarean sections based on inclusion and exclusion criteria. The inclusion criteria included: mothers who were willing to participate and follow the study rules, had a post-cesarean section wound on day 2, experienced difficulties in breast milk production, and did not consume breast milk enhancers. The exclusion criteria included: mothers taking medication for high blood pressure or blood sugar reduction, as well as those experiencing post-cesarean section complications (uterine atony).

The method used involved supplementing Nigella sativa oil in the form of a soft gel at a dose of 500mg once daily, which was taken orally. The study procedure with an initial measurement of milk production using a breast pump. After that, the intervention was carried out with the administration of Nigella sativa oil, followed by a re-measurement to assess changes in milk production. The supplement was recommended to be taken before bedtime. This timing is based on the fact that levels of prolactin, a hormone that plays an important role in milk production, generally increase at night.[29] By taking Nigella sativa oil at this time, it is expected to maximize its effect on increasing prolactin levels and in turn, increase milk production.

The study population is drawn from two locations in Kediri Regency: Kediri Regional Hospital and Aura Syifa Hospital. Research subjects are mothers who have recently undergone cesarean sections at these hospitals. To determine a representative sample size, researchers use the calculation method formulated by Lemeshow in 1990. The sample size calculation uses an x1 − x2 value of 3.2 and a standard deviation of 2.3, derived from previous similar studies.[30] This method ensures that the sample is sufficiently large and representative of the post-cesarean section mother population in both hospitals, enhancing the reliability and validity of the research findings.[31]

In experimental studies, researchers must consider potential participant attrition during the study. This can occur due to dropouts, loss of follow-up, or non-compliance with the research protocol. To anticipate this, researchers adjust the initial sample size using a predicted dropout rate of 10%. Consequently, this study uses 32 samples in the intervention group and 32 samples in the control group.

Data collection methods in this study involve 2 instruments: patient identity forms and breast pumps. Data collection is carried out in collaboration with midwives and nurses in the maternity wards of both hospitals to identify suitable respondents. After identifying respondents meeting the inclusion and exclusion criteria, they are provided with explanations of the study's objectives, benefits, and procedures, and allowed to ask questions. Willing respondents are given informed consent forms and asked to fill out identity data sheets.

Breast milk production is measured on day 2 post-cesarean section using breast pumps, with results recorded.

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The intervention group is then given Nigella sativa oil in 500mg soft gel form, to be consumed daily for 14 days before bedtime. After the 14-day intervention, a posttest measurement of breast milk production is conducted using questionnaires and breast pumps, with results recorded. In the control group, respondents were not given nigella sativa oil, and only pre-test measurements of breast milk production were conducted on day two, with post-test measurements taken on day fourteen. Once all data is collected, data processing begins.

Data processing was carried out through several systematic stages. Starting with editing to ensure data completeness, followed by coding to classify the information. Next, data entry or input into the system was carried out and ended with cleaning to verify data accuracy. Analysis data approach multilevel approach. First, a test normality test is used to determine the distribution of the data. Then, the univariate analysis was used to describe the characteristics of each variable. Finally, analysis bivariate analysis was conducted using the Wilcoxon signed rank test to compare paired data, and Mann-Whitney to compare two independent groups. The choice of these nonparametric tests indicates that the data may not be normally distributed or the measurement scale is ordinal.

This study has undergone rigorous ethical evaluation and received approval from two authoritative bodies: The Health Research Ethics Commission (KEPK) of the Health Polytechnic of the Ministry of Health Malang, providing ethical approval with reference number DP.04.03/F.XXI.31/0566/2024. Kediri Regional Hospital, as one of the research locations, also issued ethical clearance for this study, document number 000.9/5775/418/100/2024. Obtaining both ethical approvals demonstrates that the research has met the necessary ethical standards and is deemed suitable for implementation, considering participant safety and well-being.

RESULT

This study's analysis aimed to evaluate the efficacy of black cumin oil (Nigella sativa oil) in enhancing breast milk production. The research focused on mothers who had recently undergone cesarean sections at two healthcare facilities in Kediri District: Kediri District Hospital and Aura Syifa Hospital. Through careful examination of the collected data, the study sought to determine whether there was a significant correlation between black cumin oil supplementation and increased breast milk volume in mothers who had delivered via cesarean section. The findings of this analysis are expected to offer new insights into the potential of Nigella sativa oil as a natural intervention to support lactation in mothers who have undergone cesarean deliveries.

a. Respondent Characteristics

Table 1. Respondent Characteristics (n=64)

Characteristics	(n=32) Intervention Group		(n=32) Control Group		*p-value*
	Frequency/Mean	%/SD	Frequency/Mean	%/SD	
Age	27.03	5.997	28.00	5.507	0.490[a]
Parity					0.900[a]
Primiparous	15	46.9%	11	34.4%	
Multiparous	17	53.1%	21	65.6%	
Education					0.594[a]
Basic	1	3.1%	2	6.3%	
Medium	27	84.4%	27	84.4%	
High	4	12.5%	3	9.4%	
Occupation					1.000[a]

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Characteristics	(n=32) Intervention Group		(n=32) Control Group		*p-value*
	Frequency/Mean	%/SD	Frequency/Mean	%/SD	
Work	7	21.9%	7	21.9%	
Not working	25	78.1%	25	78.1%	
Nipple condition					0.000[a]
Prominent nipple	21	65.6%	29	90.6%	
Inverted nipple	11	34.4%	3	9.4%	
Pain					0.161[a]
Moderate pain	18	56.3%	21	65.5%	
Severe pain	14	43.8%	11	34.4%	
Breast milk volume (breastpump)	14.84	17.014	14.06	16.236	0.000[b]

(Description: a. Levene test b.normality test)

Analysis of Table 1. parity characteristics showed that most participants in this study had given birth more than once (multipara) In the intervention group and control group. Education level was dominated by secondary education in both groups. Employment status showed a balance, with 78.1% (25 respondents) not working in both groups.

An assessment of nipple shape revealed differences between the intervention and control groups. In the intervention group, 21 respondents had prominent nipples. In contrast, the control group showed a higher number of respondents with protruding nipples, totaling 29 individuals.

Assessment of post-cesarean section pain levels revealed that most respondents experienced moderate pain In the intervention group and control group. Assessment of breast milk production was conducted using a breast pump. The intervention group showed an average production of 14.84 ml, while the control group averaged 14.06 ml.

The normality test of breast milk production measurements in breast pumps indicated that the data were not normally distributed. Therefore, the Wilcoxon signed-rank test was used to analyze the significance of the difference in the mean rank value of breast milk production before and after the administration of nigella sativa oil in the intervention group and to analyze the significance of the difference in the mean rank value of breast milk production before and after no treatment in the control group. and the Mann-Whitney test was used to see the significance of the difference in the rank value of breast milk production between the intervention group and the control group.

Breastmilk Production at Intervention Group

Table 2. Volume of Breast Milk Production in The Intervention Group Before and After the Intervention Nigella Sativa Oil

Variabel of breastmilk volume	Intervention Group n=32		*P-value*
	Pre-test	Post-test	
	Mean ±SD	Mean ±SD	
Breast pump (ml)	14.38 ± 17.215	82.50 ± 31.109	0.000

(Description: *Wilcoxon signed rank test*)

Statistical analysis presented in Table 2 revealed significant changes in breast milk production of post-cesarean section mothers following Nigella sativa oil administration. Before the intervention, average milk production was recorded at 14.38 ml. After supplementation, this average increased dramatically to 82.50 ml, representing a 68.12 ml increase. The Wilcoxon signed-rank test yielded a p-value of 0.000, which is substantially below the 0.05 significance threshold. This result leads to the rejection of the null hypothesis, indicating that the observed changes are statistically significant. Based on these findings, it can be concluded that Nigella sativa oil administration is positively correlated

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with increased milk production in post-cesarean section mothers. The data demonstrated substantial improvement in lactation capacity following intervention with this supplement.

Breastmilk Production at Control Group

Table 3. Breastmilk Volume at Control Group

Variabel of breastmilk volume	Control Group n=32		*P-value*
	Pre-test	Post-test	
	Mean ±SD	Mean ±SD	
Breast pump (ml)	14.06 ± 16.236	64.69 ± 39.491	0.000

(Description: *Wilcoxon signed rank test*)

Statistical analysis presented in Table 3 showed significant changes in breast milk production of post-cesarean section mothers who received standardized care. Before care provision, average milk production was recorded at 14.06 ml. After the standardized care period, this average increased to 64.69 ml, representing a 50.63 ml increase. The Wilcoxon test, used for data analysis, yielded a p-value of 0.000. This value is significantly below the 0.05 significance threshold, leading to the null hypothesis rejection. This result indicates that the observed changes have strong statistical significance.

Results of analysis of breast milk production in the intervention group and control group

Table 4. The Effect of Nigella Sativa Oil Consumption on Increasing Breast Milk Production in Sectio Caesarea Mothers

Group	N	Mean rank	Sum of ranks	*P-value*
Intervention Group	32	48.06	1538.00	0.000
Control Group	32	16.94	542.00	

(Description: *Mann-Whitney test*)

Based on Table 4 of 64 samples consisting of 32 people in the control group and 30 people in the intervention group. Using the Mann-Whitney test, the mean ranks in the control group were 16.94 with a sum of ranks of 542.00, increasing in the intervention group with mean ranks of 48.06 and the sum of ranks of 1538.00 with a P-value of (0.000 < α 0.05), so null hypothesis is rejected and alternative hypothesis is accepted, which means that there is an effect of nigella sativa oil consumption to increase breast milk production in post sectio caesarea mothers.

DISCUSSION

The normal physiology of breastfeeding is a process that begins long before the newborn begins to nurse. Female breast development undergoes significant changes in composition, size, and shape during various stages of life. These critical stages include puberty, pregnancy, and lactation, each of which is characterized by important physiological changes to support breastfeeding function. This process involves three main aspects: the formation of mammary glands, the development of the ability of the glands to milk, and eventually the production of milk itself. [32] During puberty, fluctuations in the hormones estrogen and progesterone in the menstrual cycle promote the development of a more mature breast structure. After puberty, the breasts are relatively stable until pregnancy occurs. During pregnancy, mainly due to increased progesterone levels, there is proliferation of secretory tissue leading to an increase in breast volume. Breast development continues during labor and lactation, with further growth and differentiation of the lobules and the start of active milk production.[33]

Breast milk production is initiated by hormonal changes occurring after the placenta is delivered. There is a significant decrease in progesterone levels, followed by increases in prolactin,

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cortisol, and insulin levels. Prolactin plays a crucial role, particularly in response to breast emptying during infant suckling. Stimulation of nipple nerve endings during suckling prompts a rapid rise in prolactin concentration. Additionally, the oxytocin hormone contributes to the milk ejection reflex. Nipple stimulation through suction signals the hypothalamus, triggering oxytocin release. Consequently, myoepithelial cells contract, expelling milk from the alveoli into the milk ducts and through the nipple. Oxytocin also exerts psychological effects, inducing calmness and reducing maternal stress. Moreover, this hormone fosters emotional bonding between mother and child, crucial in the bonding process.[33]

Prolactin is involved in numerous physiological functions, with its primary roles being milk production and the development of mammary glands in breast tissue. In women, basal prolactin levels typically average around 13 ng/ml, while in men, they average around 5 ng/ml. Most laboratories set the upper normal limit for serum prolactin levels between 15 and 20 ng/ml. When serum prolactin levels exceed this upper limit, it is termed hyperprolactinemia. Causes of hyperprolactinemia can include physiological factors like pregnancy and lactation, as well as pathological conditions or medication-induced effects. During pregnancy, serum prolactin levels can increase significantly, often reaching 35 to 600 ng/ml at term, which is approximately 10 times higher than normal. Prolactin levels in amniotic fluid are even higher, being about 100 times greater than those in maternal and fetal blood. Stimulation of the breast nipple through infant suckling triggers prolactin secretion via neural pathways during breastfeeding. Prolactin secretion temporarily spikes during breastfeeding, potentially rising to levels up to 300 ng/ml above normal. Initially, prolactin levels rise about 10 ng/ml above normal during the first week postpartum and continue to increase over several months after delivery. Generally, prolactin is secreted during sleep. Insufficient levels can impair milk production, while excessively high levels can lead to galactorrhea in non-breastfeeding women or men. In women, excessive prolactin levels can cause amenorrhea due to its suppression of GnRH release.[34]

The statistical analysis presented showed a significant change in breast milk production after Nigella sativa oil administration. The data showed an average increase in breast milk volume of 68.12 ml between pre-and post-test measurements in the intervention group. Table 3 illustrates that there was an average increase of 50.63 ml of breast milk production volume between the pretest and post-test in the control group that was not given nigella sativa oil. The difference in rank mean values showed that there was a difference between the intervention group and the control group with a significance value of 0.000. This finding indicated a positive correlation between Nigella sativa oil administration and increased milk production.

This substantial change in volume illustrates the potential effectiveness of Nigella sativa oil in stimulating and increasing milk production in postpartum mothers, particularly in cases of caesarean section. These results highlight the possible benefits of Nigella sativa oil as a natural intervention to support lactation, although further research is needed to confirm the mechanism and consistency of this effect.

Nigella sativa, or black cumin, has a rich and diverse chemical composition. Its main contents include vegetable fats and oils (35%), carbohydrates (32%), and proteins (21%).[35] In addition, the seeds also contain water, saponins, and various fatty acids. In terms of micronutrients, Nigella sativa provides various minerals such as calcium, sodium, potassium, magnesium, and iron. The seeds are also rich in vitamins,

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including A, B complex (B1, B2, B6), C, and E. This high nutrient composition makes Nigella sativa a potential source of energy and provides galactagogue effects, i.e. the ability to increase milk production. The lipids, fats, hormonal compounds, and polyphenols in these seeds play a role in stimulating the prolactin reflex and the hormone oxytocin, which are important for milk production and ejection. Nigella sativa's galactagogue mechanism involves stimulation of the hypothalamus and anterior pituitary, resulting in increased levels of prolactin in the blood. Prolactin then stimulates the acinus cells in the breast alveoli to produce milk. Simultaneously, myoepithelial cell contractions push the milk out of the alveolus through the lactoferential ducts towards the lactopharyngeal sinuses, facilitating breastfeeding.[36]

The results of this study demonstrated that milk production in the intervention group was superior to the control group. This study aligns with previous research conducted in Iran, which employed a triple-blind randomized controlled clinical trial involving 117 breastfeeding mothers divided into three groups: black cumin, nettle, and placebo. All three groups received 15 drops three times daily for four weeks. The infant's weight, breastfeeding frequency, number of wet diapers, diaper weight, and defecation frequency were evaluated before and after the intervention. At the trial's outset, there were no statistically significant differences among the three groups regarding infant weight (P=0.891), breastfeeding frequency (P=0.921), number of wet diapers (P=0.783), diaper weight (P=0.841), and infant defecation frequency (P=0.898). However, post-intervention, the mean scores of all indicators were significantly higher in the experimental groups than in the placebo group (P<0.001). Furthermore, all indicators in the black cumin group showed significant improvement compared to the nettle group (P<0.001).[37]

This type of research was also conducted in Indonesia using an experimental design known as a non-randomized controlled trial with a pre-test-post-test control group. The sample consisted of 40 respondents divided into two groups: the intervention group received a 400 mg dose of cumin three times a day, while the observation group was administered twice a day for 30 minutes each time. The control group received daily attention and education over 14 days. The analysis results indicated a significant improvement in both the control and intervention groups with a p-value of 0.001. Administration of a combination of nigella sativa and lactation massage resulted in an average increase of 30.43 ng/ml oxytocin levels in the intervention group, compared to 6.72 ng/ml in the control group. This demonstrates a significant increase in oxytocin hormone levels among postpartum women.[36]

In a similar study involving a total of 60 participants, divided equally into an intervention group and a control group using a Randomized Controlled Trial (RCT) design, the intervention group received 15 grams of black cumin brewed with 200 ml of boiling water, while the control group received 15 grams of pure honey brewed similarly. The study utilized a breast pump as the instrument, requiring mothers to pump breast milk once daily for 30 minutes per breast between 1:00 AM and 6:00 AM. Results indicated that the average volume of breast milk increased significantly from 24 ml before the intervention to 172 ml afterward, with a p-value of 0.001, demonstrating the effectiveness of the breast milk enhancers.[38]

A similar study was conducted in Indonesia with a sample of 20 mothers selected randomly from a group of 60 mothers who were less than 40 days postpartum. The research utilized a pre- and post-test group design. The

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inclusion criteria included mothers who were willing participants, had recently given birth, were single mothers, were breastfeeding, were less than 40 days postpartum, and did not regularly consume black cumin. The intervention involved administering 100 grams of black cumin boiled in water until boiling, then consumed while warm. Milk production was assessed based on breastfeeding frequency. The results indicated that before consuming black cumin, the average breastfeeding frequency was 5.7 times, and there was a decrease in breastfeeding frequency. After consuming black cumin, there was an increase in breast milk production, particularly in breastfeeding duration, with a p-value of 0.000.[39]

In a previous study utilizing a pre-test and post-test design without a control group, 30 participants received a single dose of habatussauda capsules daily for 7 consecutive days, amounting to a total of 4 capsules per dose. During the study period, the results showed that 22 participants (74%) experienced regular breast milk production before and after consuming Nigella sativa extract, while 6 participants (26%) did not experience consistent breast milk production during breastfeeding. The paired t-test results were highly significant with a p-value of 0.000, indicating that Nigella sativa extract had a significant impact. This suggests that Nigella sativa extract may facilitate breast milk production.[40]

In earlier research, nigella sativa was administered as a decoction. The process of boiling has varied effects on the nutritional content of food. On one hand, this method decreases levels of ascorbic acid, reduces the quantity of total phenolic compounds, and diminishes antioxidant activity. The duration of boiling is critical in determining the efficacy of traditional herbal medicines. Varying heating times can significantly alter the properties and therapeutic benefits of the herb. Optimal boiling durations can enhance the extraction of active compounds, whereas excessively long or short boiling times may diminish the effectiveness of traditional medicine.[41]

During this study, the researcher encountered several limitations. These included not specifying the type of cesarean section method as an inclusion or exclusion criterion, and deviations from recommended breast milk pumping times among some respondents, potentially impacting the study's outcomes.

In this study, the intervention was given in the form of nigella sativa oil with a standardized content of 500mg in each soft gel and not nigella sativa seed broth as in previous studies so that the dose given to each respondent was the same so that it could control the same standard given. So that the dose given to each respondent is the same so that it can control the standard given the same. Also, the number of respondents in this study is greater than in previous studies, a larger sample than necessary will be more representative of the population and therefore will provide more accurate results.

CONCLUSION

The use of black cumin or nigella sativa has demonstrated an increase in breast milk production volume among breastfeeding mothers following cesarean section in the intervention group. Based on this and previous studies, it can be concluded that nigella sativa oil contains phytochemicals that offer a non-pharmacological alternative for enhancing breast milk production. We recommend that breastfeeding mothers consider consuming nigella sativa to boost milk volume. Additionally, hospitals and healthcare providers are encouraged to introduce nigella sativa to breastfeeding mothers to address challenges associated with insufficient breast milk volume, thus promoting exclusive breastfeeding. The use of black cumin for enhancing breast milk volume is deemed more efficient and effective due to its affordability and accessibility.

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