

TOPICAL EFFECT OF *TETRAGONULA SAPIENS* HONEY ON THE HEALING PROCESS OF POST-CAESAREAN SECTION WOUNDS

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ABSTRACT

Objective: The purpose of this study was to determine the effect of honey on the duration of abdominal wound healing among postpartum mothers that underwent cesarean.

Methods: A quasi-experimental design with a post-test-only control group design was used. The participants were a total of 28 postpartum mothers with a history of cesarean section on the 3rd day and were selected by using accidental sampling. 14 women were given the intervention by compressing the wound with 5 ml of honey on sterile gauze. Meanwhile, for the control group, NaCl 0.9% solution (250 ml) was applied. The intervention was done two times a day within the distance of 12 h for seven days in a row. The observation was done based on REEDA scale.

Results: The results showed that the wounds in women who got the honey intervention healed faster compared to the control group. Based on the statistical test results from the Pearson Chi-Square test, a value of 0.002 was obtained.

Conclusion: *Tetragonula sapiens* honey accelerated the healing time of post-caesarean section wounds.

Keywords: Honey, Post-caesarean section, *Tetragonula sapiens*, Wound healing

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INTRODUCTION

Childbirth is usually carried out through the normal process. However, it is common to experience obstacles, which may lead to a cesarean section [1]. Childbirth with cesarean is a surgical process carried out to deliver a fetus through an incision in the abdomen and uterus [2]. The World Health Organization (WHO) has set the average standard cesarean section in a country to be around 5–15% per 1000 births in the world. Meanwhile, there has been a continuous increase of cesarean section numbers both in government and private hospitals in Indonesia. The results of Basic Health Research in 2013 showed 9.8% from a total of 49 603 births throughout 2010 to 2013 [3]. Furthermore, according to the data from a private hospital in Tasikmalaya Regency, a regency in West Java, Indonesia, 1,228 childbirths between January to September 2021 were through cesarean section. A total of 437 cases were carried out on indications and 791 were planned operations (elective).

Cesarean section leads to post-surgical wounds that may cause movement limitation. Most of the cesarean section wounds need a long time to heal. In some Asian and African countries, complementary therapies, such as traditional medicine, are commonly given to accelerate the healing process. Up to date, there are almost four billion varieties of plants that are used as medicine. As some drugs are not recommended for breastfeeding women, traditional medicine may become away.

Honey is one of the natural ingredients that has been used to treat wounds for thousands of years [4]. In the past few years, some research has also proven the effectiveness of honey for wound healing [5-7]. Honey is produced by the bees by modifying the nectar gathered from the plants. As types of plants are varied depending on the region, the characteristics and the content of honey are also different from one another. Considering a great amount of research that had proven the effects of honey on the wound healing process and the diversity of honey properties depending on the region, this research aimed to analyze the effectiveness of *Tetragonula sapiens* honey collected from North Luwu, Sulawesi, Indonesia to heal post-caesarean section wounds. To our knowledge, there has been no research that evaluates this honey's ability to treat a wound. However, beforehand, the other type of plant-derived product produced by this same species from the

same region had been proven to perform antifungal, antioxidant, and anti-inflammatory activities [8-10]. To evaluate the effects of *Tetragonula sapiens* honey for wound healing, the healing time and process of the wounds treated by honey were observed.

MATERIALS AND METHODS

Research design

This study was conducted according to established ethical guidelines (granted by Bakti Tunas Husada Health Science College Tasikmalaya, reference number No. 065/KEPK-BTH/III/2021). Quantitative methods, with a quasi-experimental and post-test-only control group design, were employed. It was carried out from April to June 2021 in a private midwifery unit and the residence of each participant located in the Tasikmalaya Regency.

Population and sample

The participants were postpartum mothers with a cesarean history on the third day. The samples were divided into two groups, the intervention, and the control. The intervention group was given honey to treat the wound, while the control group was only given 0.9% NaCl solution (table 2). The participants were chosen by a non-probability with accidental sampling. Accidental sampling is a method in which the participants have coincidentally met the researcher and were considered to fit the samples criteria [11]. The inclusion and exclusion criteria were as follows (table 1).

The number of participants (n_{do}) was determined by referring to the Malhotra theory (Equation 1) [12]. The number of samples taken (n) was at least 4–5 times the number of questions asked to each participant. According to the Redness, Oedema, Ecchymosis, Discharge, Approximation (REEDA) scale, five questions were needed to evaluate the healing process. Meanwhile, the drop-out variable ($do=10\%$) was added to the equation to anticipate if there were participants who must quit the experiments due to some emergency reasons. Accordingly, with the $n=25$, the number of participants was determined to be 28 ($n_{do}=28$). Hence, there were 14 participants in each group.

$$n_{do} = \frac{n}{1-do} \dots\dots\dots (Equation 1)$$

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
a. Postpartum mothers who were on the third day after cesarean section.	a. Postpartum mothers who have encountered systemic chronic diseases that may disrupt the wound healing process, such as diabetes.
b. Willing to follow the procedures of the experiment by signing the informed consent form.	b. Postpartum mothers who are consuming drugs that may affect the wound healing process, such as corticosteroid, anticoagulant, immunosuppressant, or chemotherapy.

Table 2: The number of participants on each group

Group	Intervention	Number of respondents
Intervention	Honey	14
Control	NaCl 0.9%	14

Research variables and instrumentation

The independent variables in this research consisted of the intervention applied for each group, which were either *Tetragonula sapiens* honey or NaCl 0.9%. Meanwhile, the dependent variable was the duration of the post-caesarean section wound healing process. The methods were divided into three parts, which were preparation, data collection, and data processing. The preparation included managing the documents related to research permits, research ethics, and approval from prospective participants. The prospective participants were also provided with a counseling session from the midwife to make sure that the wound would not be treated with other ingredients to avoid bias.

The data collection was carried out by using the REEDA scale (table

3) [13]. REEDA is a tool to evaluate the inflammation and healing process of wounds. In 2020, Sumartono *et al.* also applied this tool to observe post-caesarean section wound healing process [14]. Meanwhile, the tools used in this research were a set of wound care consisting of NaCl 0.9% solution (250 ml), *Tetragonula sapiens* honey (50 ml), sterile gauze, plaster, and alcohol swab. For the Intervention group, the application was done by compressing the wound with 5 ml of honey on sterile gauze. The intervention was done two times a day within the distance of 12 h for seven days in a row. As for the Control group, the wound was only sterilized with NaCl 0.9% solution. All these interventions were done by the midwives. After the data was collected, data processing was conducted with the processes of editing, coding, entry, and cleaning.

Table 3: REEDA scale score parameters

Score	Redness	Oedema	Ecchymosis	Discharge	Approximation
0	None	None	None	None	Closed
1	<0.25 cm of incision bilaterally	Perineal, <1 cm from incision	<0.25 cm bilaterally or <0.5 cm unilaterally	Serum	Skin separation 3 mm or less
2	<0.5 cm of incision bilaterally	Perineal and/or between 1—2 cm from incision	0.25—1 cm bilaterally or 0.5—2 unilaterally	Serosan-guinous	Skin and subcutaneous fat separation
3	>0.5 cm of incision bilaterally	Perineal and/or >2 cm from incision	>1 cm bilaterally or >2 unilaterally	Bloody, purulent	Skin, subcutaneous fat, and fascial layer separation

Data analysis

The data analysis was conducted by using univariate and bivariate analysis. The univariate analysis aimed to find out the characteristics of each intervention to the wound healing process. In the meantime, the bivariate analysis was done to conclude whether honey gives a significant impact on the wound healing process. The analysis was performed by using the chi-square formula as follows (Equation 2), with O as the observed value and E as the expected

value. If the calculated χ^2 value is more than the χ^2 within the contingency table with the significance of 0.05, H_0 will be rejected, and H_a will be accepted. The H_a in this study was that the topical application of *Tetragonula sapiens* honey affects the period of post-caesarean section wounds.

$$\chi^2 = \frac{\sum \frac{(O-E)^2}{E}}{\dots\dots\dots} \text{ (Equation 2)}$$

RESULTS AND DISCUSSION

Univariate analysis

Table 4: Frequency distribution of abdominal wound healing in the intervention group based on the reeda scale wound healing assessment

Total score of the REEDA scale on the seventh day of observation	Frequency (f)	Percentage (%)
0 = Good	13	92.9
1—5 = Poor	1	7.1
>5 = Very poor	0	0.0
Total	14	100.0

The REEDA scale evaluation was done every day for seven days (table 4). The parameters of the score given are written in table 3. The participants then were categorized based on the total of the REEDA scale score on the seventh day of observation, which were good (0), poor (1—5), and very poor (>5) wound healing.

Table 4 explains the frequency distribution of wound healing for the Intervention group. The majority of the participants, i.e. 13 (92.9%) underwent a good healing process. In the meantime, within the

Control group (table 5), only 5 (35.7%) participants experienced a good healing process, while 9 (64.3%) participants showed a poor healing process. This result aligned with the statement from Lomban *et al.* (2020), stating that honey intervention results in a good wound healing process due to the acceleration of granulation and epithelization [15]. In addition, honey has been reported to have a variety of beneficial properties for health, including antioxidant, anti-inflammatory, antibacterial, and antidiabetic [16]. The

properties of antioxidant, antibacterial, and anti-inflammatory play important roles in the wound-healing effects. Furthermore, the physical properties of honey itself also contribute to the healing

process. The pH value of honey, which is around 3.2–4.5 is reported to be able to promote the healing process by increasing the release of oxygen from hemoglobin [4].

Table 5: Frequency distribution of abdominal wound healing in the control group based on the reeda scale wound healing assessment

Total score of the REEDA scale on the seventh day of observation	Frequency (f)	Percentage (%)
0 = Good	5	35.7
1–5 = Poor	9	64.3
>5 = Very poor	0	0.0
Total	14	100.0

For the healing time, the results were divided into three groups based on the time required for the wound to heal completely. The groups were fast (1–6 d), normal (7–14 d), and long (>14 d) healing time. Within the intervention group (table 6), 13

participants experienced fast healing time and only one participant had normal healing time. Meanwhile, within the Control group (table 7), 9 participants had normal healing time and 5 participants underwent fast healing time.

Table 6: Frequency distribution of wound healing time for the intervention group

Wound healing time	Frequency (f)	Percentage (%)
Fast (1–6 d)	13	92.9
Normal (7–14 d)	1	7.1
Long (>14 d)	0	0.0
Total	14	100.0

Table 7: Frequency distribution of wound healing time for the control group

Wound healing time	Frequency (f)	Percentage (%)
Fast (1–6 d)	5	35.7
Normal (7–14 d)	9	64.3
Long (>14 d)	0	0.0
Total	14	100.0

Referring to table 4 and 5, the results showed that within the Intervention group, 13 out of 14 participants had good healing process, meaning there was no redness, edema, ecchymosis, discharge, and skin, subcutaneous fat, or fascial layer separation on the post-cesarean section wound area. Meanwhile, within the Control group, 9 out of 14 participants had poor healing processes, reflecting that there was still either redness, edema, ecchymosis, discharge, skin, subcutaneous fat, and/or fascial layer separation, or the combination of them. In addition, for the wound healing time, the results were in line with the results of the REEDA scale score measurement, which was the Intervention group showed a faster healing process compared to the Control group.

The results of this study aligned with the research conducted by Takzaree *et al.* (2017), in which they proved that the use of honey improved the healing process, shortened the inflammatory phase, increased granulation tissue, angiogenesis, the early proliferative

and remodeling phases, and eventually resulted in faster healing [17]. Furthermore, in the study carried out by Kalangi (2012), it was mentioned that the topical application of honey was effective in producing a clean granulated wound bed [18]. Honey acted as a hyperosmolar medium and prevented bacteria growth. It also had a high viscosity that formed a physical barrier and created a wet environment that accelerated healing. Its nutrient content also might help in accelerating the re-epithelialization. In addition, the catalase enzyme contained in honey might affect the healing process as well [18].

Bivariate analysis

Based on table 8, the Asymp. Sig. (2-sided) in the Pearson Chi-Square test was 0.002. Due to the value of Asymp. Sig. (2-Sided) $0.000 < 0.05$, H_0 was rejected, and H_a was accepted. The results showed that the p-value was $0.002 < 0.05$.

Table 8: Chi-square test on the effects of *Tetragonula sapiens* honey on the healing time of post-cesarean section wounds

	Value	Df	Asymptotic significance (2-sided)	Exact significance (2-sided)	Exact significance (1-sided)
Pearson Chi-Square	9.956 ^a	1	0.002		

The chi-square test results showed a p-value of $0.002 < 0.05$. It can be concluded that *Tetragonula sapiens* honey had topical effects on the post-cesarean section wound healing process. This was also aligned with the study carried out by Nikpour *et al.* in 2014 on *The Honey Gel Effect on Abdominal Wound Healing in Cesarean Section* [19]. The study was a triple-blind randomized clinical trial involving 75 participants. The results showed that redness, edema, and hematoma in the group treated with honey significantly decreased on days 7 and 14. Therefore, the use of honey can accelerate the post-cesarean section wound healing process with a p-value < 0.05 , meaning there was a significant difference in the healing time between the experimental and the control group [19].

This study is also in line with research conducted by Zulfa *et al.* in 2008 on the comparison of open wound healing using honey or normal saline-

povidone iodine involving 6 participants [20]. Using a statistical test of two unpaired means (pooled t-test), the average score development of the healing process with honey (11.52%) was 6.67% greater than normal saline-povidone iodine (4.85%) dressing. Honey treatments made respondents feel no pain or adhesions, and no bleeding occurred when removing the dressing for cleaning. Meanwhile, with saline-povidone iodine, the participants experienced the opposite. Hence, the use of honey is recommended to treat wounds [20].

CONCLUSION

Based on the univariate analysis, the topical application of honey to the wound showed better results compared to the application of NaCl 0.9% solution. On the seventh day of observation, 13 out of 14 participants had no redness, edema, ecchymosis, discharge, skin,

subcutaneous fat, or fascial layer separation on the post-caesarean section wound area. In addition, the Intervention group also healed faster compared to the Control group. In the meantime, according to the bivariate analysis, the chi-square test results showed a p-value of $0.002 < 0.05$, meaning the *Tetragonula sapiens* honey had topical effects on the post-caesarean section wound healing process.

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AUTHORS CONTRIBUTIONS

All authors have equal contributions. All authors have discussed the results and contributed to the final manuscript.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

REFERENCES

- Chen H, Tan D. Cesarean section or natural childbirth? cesarean birth may damage your health. *Front Psychol.* 2019;10:351. doi: 10.3389/fpsyg.2019.00351, PMID 30846956.
- Asikin M, Nuralamsyah M. Keperawatan Medikal Bedah sistem Kardiovaskular; 2017.
- Depkes R, hasil L. Riset kesehatan dasar (Riskesdas) Nasional tahun 2013. Jakarta. Departemen Kesehatan. RI; 2013.
- Molan PC, Rhodes T. Honey: a biologic wound dressing. *Wounds.* 2015;27(6):141-51. PMID 26061489.
- Pramesty I. The effect of giving honey on the process of wound healing in burned patients. *Med Health Sci J.* 2021;5(1):51-6. doi: 10.33086/mhsj.v5i1.1910.
- Nair HKR, Tatavilis N, Pospisilova I, Kucerova J, Cremers NAJ. Medical-grade honey kills antibiotic-resistant bacteria and prevents amputation in diabetics with infected ulcers: a prospective case series. *Antibiotics (Basel).* 2020;9(9):529. doi: 10.3390/antibiotics9090529, PMID 32825100.
- Wadi M, Geregandi T. Efficacy of bee honey on wound healing: split skin graft with hyper-granulation tissue. *J Nat Rem.* 2020;20(2):71-8. doi: 10.18311/jnr/2020/24172.
- Pratami DK, Indrawati T, Istikomah I, Farida S, Pujianto P, Sahlan M. Antifungal activity of microcapsule propolis from *Tetragonula* spp. to *Candida albicans*. *Commun Sci Technol.* 2020;5(1):16-21. doi: 10.21924/cst.5.1.2020.178.
- Sahlan M, Devina A, Pratami DK, Situmorang H, Farida S, Munim A. Anti-inflammatory activity of *Tetragonula* species from Indonesia. *Saudi J Biol Sci.* 2019;26(7):1531-8. doi: 10.1016/j.sjbs.2018.12.008, PMID 31762622.
- Sahlan M, Mandala K, Pratami K, Adawiyah R, Wijarnako A, Lischer K. Exploration of the antifungal potential of Indonesian propolis from *Tetragonula biroi* bee on *Candida* sp. and *Cryptococcus neoformans*. *Evergreen.* 2020;7(1):118-25. doi: 10.5109/2740968.
- Sugiyono P. Metode penelitian kuantitatif kualitatif dan R and D, Bandung: CV. Alfabeta; 2009.
- Malhotra N, Hall J, Shaw M, Oppenheim P. Marketing research: an applied orientation. Australia: Pearson Education; 2006.
- Davidson N. REEDA: evaluating postpartum healing. *J Nurse Midwifery.* 1974;19(2):6-8. PMID 17338109.
- Sumartono C. Comparison of post-caesarean section wound healing methods based on Reeda scale and platelet lymphocyte ratio. *Syst Rev Pharm.* 2020;11:314-8.
- Lomban A, Kalangi SJR, Pasiak TF. Manfaat Olesan madu pada Penyembuhan luka kulit. *eBM.* 2021;8(2). doi: 10.35790/ebm.v8i2.31902.
- Samarghandian S, Farkhondeh T, Samini FF. Honey and health: a review of recent clinical research. *Pharmacognosy Res.* 2017;9(2):121-7. doi: 10.4103/0974-8490.204647, PMID 28539734.
- Takzaree N, Hassanzadeh G, Rouini MR, Manayi A, Hadjiakhondi A, Majidi Zolbin MM. Evaluation of the effects of local application of thyme honey in open cutaneous wound healing. *Iran J Public Health.* 2017;46(4):545-51. PMID 28540272.
- Kalangi SJR. Khasiat madu pada penyembuhan luka kulit. *J Biomedik JBM.* 2012;4(3). doi: 10.35790/jbm.4.3.2012.796.
- Nikpour M, Shirvani MA, Azadbakht M, Zanjani R, Mousavi E. The effect of honey gel on abdominal wound healing in cesarean section: a triple blind randomized clinical trial. *Oman Med J.* 2014;29(4):255-9. doi: 10.5001/omj.2014.68, PMID 25170405.
- Zulfa Z, Nurachmah E, Gayatri D. Perbandingan luka terbuka menggunakan balutan Madu atau balutan normal salin-povidone iodine. *J Keperawatan Indones.* 2008;12(1):34-9. doi: 10.7454/jki.v12i1.197.