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THE EFFECT OF GIVING PROPOLIS EXTRACT TO PREGNANT WOMEN WITH BACTERIAL VAGINOSIS

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Abstract

Background: Bacterial Vaginosis (BV) in pregnancy is caused by several physiological changes that disrupt the vaginal ecosystem, namely hormonal changes and vaginal flora. Treatment with antibiotics for Bacterial Vaginosis (BV) cases has a risk of resistance, so alternative therapies are needed, one of which is propolis extract. This study aims to prove the effect of giving propolis extract to pregnant women with bacterial vaginosis. **Methods:** This study used a quasi-experimental type of clinical trial research with The Pretest-Posttest Control Group Design. The population in this study were 100 pregnant women who experienced flour albus at Anugrah Pratama Clinic Surabaya in September-December 2021. The sample of pregnant women with BV was 44 people who were divided into control and intervention groups. Independent variable is giving propolis extract and dependent variable is infection of bacterial vaginosis. The sampling technique in this study was consecutive sampling. Data analysis using Chi Square Test. **Results:** The control group did not reduce bacterial vaginosis infection, which remained with BV (+) infection by 54.5% and BV infection (-) by 45.5%, while the intervention group was proven to reduce bacterial vaginosis infection to BV infection (+) by 18 .2% and BV infection (-) of 81.8%. Analysis: The results of the Chi-Square test showed that the p-value of BV infection was 0.012 and bacterial vaginosis infection α (0.05). **Conclusion:** There is a significant difference between the control group and the group given propolis extract. It can be concluded that there is an effect of propolis extract administration on reducing infection in pregnant women with bacterial vaginosis.

Keywords: Bacterial vaginosis, pregnancy, propolis

INTRODUCTION

Bacterial vaginosis is an imbalance in the vaginal flora due to the replacement of Lactobacillus sp species by anaerobic bacteria and an increase in vaginal pH. Bacterial vaginosis is one of the most common causes of complaints in the vaginal area in reproductive women (Thoma et al., 2011). As many as 75% of cases of bacterial vaginosis are asymptomatic, although some women have typical symptoms and most patients come with complaints of abnormal vaginal discharge that is grayish white, watery, accompanied by malodor vaginitis, and there are also

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complaints of itching and pain (Center for Disease Control and Prevention, 2015; Menaldi SLSW, 2015).

The prevalence of bacterial vaginosis differs in each country, estimated to be in the range of 8% to 75% (Bitew et al., 2017). The incidence rate of bacterial vaginosis in women from Southeast Asia including Indonesia is greater than 30% (Bautista et al., 2016; Brookheart et al., 2019). Based on data from the Gynecology Polyclinic at RSUD Dr. Soetomo Surabaya showed that during the 2018 period, bacterial vaginosis was included in the top 10 most common diseases, namely 198 patients with bacterial vaginosis of all age ranges.

During pregnancy there are several physiological changes, namely the disruption of the vaginal ecosystem due to hormonal changes and changes in the vaginal flora which results in increased vaginal acidity and has an impact on increasing vaginal mucus in pregnant women so that pregnant women have the potential to experience vaginal discharge. In addition, the genital mucosa becomes thinner and has a larger surface area making pregnant women more susceptible to infection (Lima et al., 2013; Datcu, 2014; Lamont et al., 2011; Lima et al., 2013).

A survey conducted in 8 cities in Indonesia showed that 82.3% of 1000 pregnant women were affected by fluor albus. Based on research by Masyitha (2017) at Dr. Soetomo showed that fluor albus in pregnant women was 52.2% caused by bacterial vaginosis, 56.52% in third-trimester pregnant women, and 52.2% in primigravidas. Pregnant women at the Pratama Anugrah Clinic Surabaya experienced bacterial vaginosis in as much as 48%. In the literature it is said that the prevalence of BV ranges from 9-23% in public hospitals and in pregnancy ranges from 6.4-38% (Mengistie et al., 2014).

Infections of the reproductive tract such as bacterial vaginosis in pregnancy can predispose to prematurity, low birth weight, etc. which can increase perinatal morbidity and mortality (Stanford and Kaambo, 2018). The therapy given to bacterial vaginosis patients, whether they are pregnant or not, is in the form of antibiotics. Improper use of antibiotics can trigger resistance and the risk of recurring bacterial vaginosis infections. The risk of recurrent BV infection is 40-50% with metronidazole and clindamycin as first-line therapy for BV (Schuyler JA, 2015; Algburi A, 2017). Low long-term cure rate.

During pregnancy, efforts are made to minimize consumption of drugs including types of antibiotics (Wardaniati & Pratiwi, 2017). Therefore, to prevent the occurrence of bacterial resistance to antibacterial, recurrence and reduce the risk of complications due to bacterial vaginosis, it is necessary to develop research on the discovery of alternative or new drugs derived from nature. One of the natural ingredients that can be used as an alternative is propolis. Propolis is a bee product. It consists of a resinous substance collected by bees from flowers, buds, and exudates of various plant sources (Cristina Toreti et al., 2013a; Kurek-Górecka et al., 2014a; Margaretha, 2012).

The benefits of propolis for human health have been known for a long time and many studies have been carried out on this matter. Propolis and a number of its compounds show a variety of biological effects and pharmacological activities, namely as high antibacterial, antiviral, anti-inflammatory, antioxidant, antifungal, and antiatherogenic, as well as antiproliferative and proapoptotic activity (da Silva Frozza et al., 2013; Huang et al., 2014; Kurek-Górecka et al., 2014; Machado et al., 2012; Rabelo Coelho et al., 2015).

Propolis also has anti-inflammatory activity. Propolis has a significant effect on the arachidonic acid metabolic pathway so that inflammatory mediators are not formed (Armutcu et al., 2015). In previous experimental studies, it was reported that the inhibitory activity of propolis extracts against cyclooxygenase (COX-1 and COX-2) and its activity against lipoxygenase. The effect of propolis activity is a change in the concentration of prostaglandin E2 and leukotrienes (Kurek-Górecka et al., 2014b). The benefits of using propolis extract as alternative drug therapy for bacterial vaginosis patients, especially in pregnant women, are still limited in testing. So based on the above background, this study aims to examine and prove the effect of giving propolis extract to pregnant women with bacterial vaginosis.

METHOD

This study used a quasi-experimental type of clinical trial research with The Pretest-Posttest Control Group Design. The purpose of this study was to analyze the effect of giving propolis extract to pregnant women with bacterial vaginosis.

The population in this study were all pregnant women who experienced flour albus at the Pratama Anugrah Clinic Surabaya a total of 100 pregnant women. The sampling technique in this study was consecutive sampling. The sample size was calculated using the research sample size formula, namely 44. Data collection was carried out in May-December 2021 starting with determining the research sample.

The sample is divided into two groups, namely the control group and the intervention group. The independent variable of the research is propolis extract administration. The dependent variable of the study was bacterial vaginosis infection in vaginal secretions found in pregnant women who had complaints of vaginal discharge obtained by examining samples with Giemsa staining. Samples included in the control group were given metronidazole 2x500 mg if the gestational age was <20 weeks or clindamycin 2x300 mg if the gestational age was ≥20 weeks for 7 days, while those in the intervention group were given metronidazole 2x500 mg if the gestational age was <20 weeks or clindamycin 2x300 mg at gestational age ≥20 weeks and propolis extract for 7 days. After 7 days there will be a re-examination bacterial vaginosis infection. Diagnosis of Bacterial Vaginosis based on Nugent score (0-10) was analyzed and calculated included in normal (score 0-6) and BV (score ≥7).

The study instrument in this study was the researcher himself. In addition, the subjects in the study and computers with SPSS software. Data processing is done by editing, coding, entering, cleaning, and tabulating data. The data that has been collected and processed is then analyzed using the Chi-Square test with the help of the SPSS computer program. Researchers need to explain the aims and objectives of the research on the subject to be studied. Provide understanding in a friendly and polite manner. Researchers manage their research honestly and fairly based on the Health Research Ethics Committee of the Faculty of Medicine, Universitas Airlangga has passed the ethical test with ethical number 174/EC/KEPK/FKUA/2021.based on health research ethics committee Airlangga Univercity School of medicine with nomor ethic 174/EC/KEPK/FKUA/2021

RESULT AND DISCUSSION

Based on Table 1 shows that the most age is in the age group 20-35 years, namely productive age as many as 36 samples (81.8%). The type of flour albus in this pregnancy is physiological as many as 24 samples (54.5%). The gestational age when examined and positive for bacterial vaginosis was the most in trimester 2 as many as 22 samples (50%), and in the 2-4th pregnancy group as many as 23 samples (52.3%). Samples of pregnant women who suffer from bacterial vaginosis have experienced flour albus as many as 38 samples (86.4%) with physiological types as many as 30 samples (78.9%).

Univariate analysis

Tabel 1. Sample Characteristics of Pregnant Women

Characteristics	Amount (n)	Percentage (%)
Age		
<20 years old	4	9.1
21-35 years old	36	81.8
≥35 years old	4	9.1
Flour albus type in this gravida		
Physiological	24	54,5
Physiological	20	45,5
Gestational age of the mother when experiencing flour albus		
1st trimester	19	43,2
2nd trimester	22	50
3rd trimester	3	6,8
Gravida		
1	21	47,7
2-4	23	52,3
> 4	0	0
Pregnant women with flour albus have experienced Flour albus		
a. Before pregnancy		
1) No	6	13,6
2) Yes	38	86,4
a) Physiological	30	78,9
b) Pathological	8	21,1
b. In Previous Pregnancy		
1) Gravida 1 (Not yet)	21	47,7
2) No	9	20,5
3) Yes	14	31,8

a)	Physiological	8	57,1
b)	Pathological	6	42,9

Pregnant women experience a two-fold increase in the prevalence of vaginal microorganism colonization compared to non-pregnant women. Increased circulating estrogen levels and deposition of glycogen and other substrates in the vagina during pregnancy influence this association (Choi et al., 2012; Yang et al., 2015). Bacterial vaginosis is associated with a variety of serious obstetric complications such as premature rupture of membranes, spontaneous abortion, under-term labor and postpartum endometritis, chorioamnionitis and cesarean section wound infection, abortion, chorioamnionitis and intrauterine infection, low birth weight and high fetal mortality (Center for Disease Control and Prevention, 2015).

The age range of pregnant women diagnosed with bacterial vaginosis based on Nugent's criteria is mostly in the range of 21-35 years as many as 36 samples (81.8%). According to Lokken (2019) age affects changes in microbiota in the vagina, especially those who are classified as sexually active. In accordance with the research of Abdul Karim and Jusuf Barakbah (2016) which states that the highest prevalence of the age of women who experience bacterial vaginosis is 25-44 years. This is because at that age, women have sexual intercourse with a more frequent frequency, thus triggering bacterial vaginosis.

The type of flour albus during pregnancy with bacterial vaginosis is mostly physiological as many as 24 samples (54.5%). This is in line with the opinion of Andi Selastri and Rizalinda Sjahril (2014) that determining the prevalence of bacterial vaginosis is categorized as difficult because ⅓ - ⅗ of infected women are asymptomatic. As many as 75% of BV cases are asymptomatic although some women have characteristic symptoms and most patients present with complaints of vaginal discharge (Menaldi SLSW, 2015).

Gestational age when examined and positive for bacterial vaginosis was the most in trimester 2 as many as 22 samples (50%). According to Khoman (2020) based on the trimester of pregnancy, in the 2nd trimester the incidence of bacterial vaginosis is most often found at (52.2%). Meanwhile, according to (Abdelaziz et al., 2014) a higher infection rate was recorded among subjects in the third trimester

(71.6%) than in the second trimester of pregnancy (28.4%). Bacterial vaginosis infection is a risk factor for preterm birth (Kamga et al., 2019). Infection is associated with preterm birth, with a higher risk if before 16 weeks of gestation. (Kiran et al., 2017; Nadeau et al., 2016).

In the 2-4th pregnancy group, there were 23 samples (52.3%). Previous pregnancy can be a risk factor related to flour albus in the current pregnancy (Abdelaziz et al., 2014). Pregnant women who suffer from bacterial vaginosis in this study have experienced flour albus as many as 38 samples (86.4%) with physiological types as many as 30 samples (78.9%). This is in accordance with the research of Fonseca et al., (2013) around 43% of women experience flour albus and it was found that around 32% experienced pathological flour albus in women aged around 30 years and the remaining 68% experienced physiological flour albus.

Pregnant women with complaints of flour albus before pregnancy were 38 samples (86.4%) with physiological types as many as 30 samples (78.9%) and pathological types as many as 8 samples (21.1). This is in accordance with research by Işik G, Demirezen S, Dönmez GH (2016) which says that bacterial vaginosis infection is found in 40% of women who experience spontaneous abortion where bacterial vaginosis that is asymptomatic and untreated since the first trimester or before pregnancy can cause abortion during the second trimester.

Bivariate analysis

Table 2. Cross tabulation of propolis extract administration on reducing infection in pregnant women with bacterial vaginosis

Treatment		Nugent Skor Bakterial Vaginosis		Amount	P-value
		0-6 (BV-)	≥7 (BV+)		
Not given propolis extract	n	10	12	22	0.012
	%	45.5	54.5	100.0	
Given propolis extract	n	18	4	22	
	%	81.8	18.2	100.0	
Total	N	28	16	44	
	%	63.6	36.4	100.0	

Based on the results of research conducted at the Pratama Anugrah Surabaya Clinic, it was found that using Chi Square analysis, the p-value was 0.012. This shows that the p value is smaller than the α value (0.05), which means that there is an effect of giving propolis extract to pregnant women with bacterial

vaginosis on reducing infection. In the control group only giving antibiotics and not giving propolis extract can cure pregnant women with bacterial vaginosis by 45.5%, while in the intervention group giving antibiotics and propolis extract can cure pregnant women with bacterial vaginosis by 81.8%.

In this study, it was found that pregnant women who were infected with bacterial vaginosis were 50%, namely out of 100 pregnant women with complaints of flour albus. Abdelaziz et al, in the study stated that out of 200 registered pregnant women, BV was detected in 49.8%, followed by several other infections. Pregnant women with vaginal complaints revealed various positive microbiological results (Abdelaziz et al., 2014).

Propolis has several nutritional compounds in it such as vitamins (A, B, and C), minerals (Ca, Mg, Na, Fe, Mn, Cu, and Zn), succinate dehydrogenase enzyme, polyphenols (flavonoids, phenolic acids, and their esters), terpenoids, steroids, and amino acids (Halim et al., 2012; Popova et al., 2011). Propolis has a main bioactive substance, namely Caffeic Acid Phenethyl Ester (CAPE), a phenolic derivative that has an important task because it has antifungal, antioxidant, antibacterial, anticancer, anti-inflammatory, and immunomodulatory activities.

Propolis extract has antibacterial activity to treat flour albus due to bacterial vaginosis. The antibacterial activity of propolis is broad-spectrum against gram-positive and gram-negative rod-shaped and cocci bacteria and can also cause toxic effects on pathogenic microbes (Yuliana et al., 2015). Flavonoids in propolis are able to inhibit the growth of microbial activity by working as a reservoir for hydroxyl radicals and peroxides so as to protect the human body from bacterial attacks and increase the body's immunity by stimulating antibody production (Huang et al., 2014).

Based on research by Yuliana et al. (2015), propolis extract has potential as a natural antimicrobial. The active compounds that play a role in inhibiting the growth of pathogenic microbes are hydroxyl groups that cause changes in organic components and nutrient transport resulting in toxic effects on pathogenic microbes.

Propolis can inhibit bacterial growth by inhibiting the process of cell division, changing the permeability of the cell wall membrane and inhibiting

protein synthesis, causing bacteriolysis (Mitra Nofembri Y, Netti Suharti, 2017). Propolis is bactericidal (kills bacteria), bacteriostatic (inhibits bacterial growth) and has antibiotic properties. Propolis can inhibit bacterial growth by inhibiting the process of cell division, changing the permeability of the cell wall membrane and inhibiting protein synthesis, causing bacteriolysis (Mitra Nofembri Y, Netti Suharti, 2017). In addition, propolis as an antibiotic has high selectivity. Propolis only kills the cause of the disease, while useful microbes are not disturbed (Kurniawati, 2011).

The advantages of propolis as a natural antibiotic compared to synthetic materials are safer and less side effects. The only side effect that occurs and that is rare is the onset of allergic reactions used orally and does not cause resistance. Propolis can inhibit bacterial growth by inhibiting the process of cell division, changing the permeability of the cell wall membrane and inhibiting protein synthesis, causing bacteriolysis (Mitra Nofembri Y, Netti Suharti, 2017).

Propolis extract has an antibacterial activity to treat flour albus complaints due to bacterial vaginosis. The antibacterial activity of propolis is broad-spectrum against gram-positive and gram-negative bacteria in the form of rods and cocci which can also cause toxic effects on pathogenic microbes (Yuliana et al., 2015). Flavonoids in propolis can inhibit the growth of microbial activity by acting as a reservoir for hydroxyl radicals and peroxides so that they can protect the human body from bacterial attacks and increase the body's immunity by stimulating antibody production (Huang et al., 2014).

Propolis is bactericidal (kills bacteria), bacteriostatic (inhibits bacterial growth), and has antibiotic properties. Propolis can inhibit bacterial growth by inhibiting the process of cell division, changing the permeability of the cell wall membrane, and inhibiting protein synthesis, causing bacteriolysis (Mitra Nofembri Y, Netti Suharti, 2017). In addition, propolis as an antibiotic has high selectivity. Propolis only kills the cause of the disease, while the beneficial microbes are not disturbed (Kurniawati, 2011).

CONCLUSION AND SUGGESTION

There was a significant difference between the control group that was not given propolis extract and the intervention group that was given propolis extract

against bacterial vaginosis infection. It can be concluded that there is an effect of propolis extract administration on reducing infection in pregnant women with bacterial vaginosis. Midwives are expected to increase screening for infections of the reproductive organs during pregnancy and increase awareness of complaints of vaginal discharge in pregnancy.

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REFERENCE

Armutcu F, Akyol S, Ustunsoy S, Turan FF. (2015). Therapeutic Potential Of Caffeic Acid Phenethyl Ester And Its Anti-Inflammatory And Immunomodulatory Effects (Review). J Exp Med, 9(5): 1582–1588. doi: 10.3892/etm.2015.2346.

Bautista CT, Wurapa E, Sateren WB, Morris S, Hollingsworth B, Sanchez J. (2016) Bacterial Vaginosis: A Synthesis of The Literature on Etiology, Prevalence, Risk Factors, and Relationship with Chlamydia and Gonorrhea Infections. Mil Med Res. doi: 10.1186/s40779-016-0074-5.

Bitew A, Abebaw Y, Bekele D, Mihret A.(2017). Prevalence of Bacterial Vaginosis and Associated Risk Factors among Women Complaining of Genital Tract Infection. Int J Microbiol. (ID 4919404), p. 8. doi: s10.1155/2017/4919404.

Brookheart RT, Lewis WG, Peipert JF, Lewis AL, Allsworth JE.(2019). Association Between Obesity And Bacterial Vaginosis As Assessed By Nugent Score. Am J Obstet Gynecol, 220(5) : 476. doi: 10.1016/j.ajog.2019.01.229.

Coelho GR. Mendonça RZ, Vilar KDS, Figueiredo CA, Badari JC, Taniwaki N, Negri G, *et al.*(2015). Antiviral Action of Hydromethanolic Extract of Geopropolis from Scaptotrigona postica against Antiherpes Simplex Virus (HSV-1). eCAM, (ID 296086), pp. 1–10. doi: 10.1155/2015/296086.

da Silva FCO, Garcia CSC, GambatoG, de Souza MDO., Salvador M, Moura S, Roesch-Ely M, et al. (2013). Chemical Characterization, Antioxidant and Cytotoxic Activities of Brazilian Red Propolis. FCT, 52: 137–142. doi: 10.1016/j.fct.2012.11.013.

Datcu R. (2014). Characterization of The Vaginal Microflora in Health and Disease. Dan Med J, 61(4): 1–24.

Huang, S., Zhang, C. -P., Wang, K., Li, GQ, & Hu, F. -L. (2014). Molecules Recent Advances In The Chemical Composition Of Propolis. Molecules, 19. https://Doi.Org/10.3390/Molecules191219610

Kaambo E, Africa C, Chambuso R, Passmore JAS.(2018). Vaginal Microbiomes Associated With Aerobic Vaginitis and Bacterial Vaginosis. Front Public Health, 6:1–6. doi: 10.3389/fpubh.2018.00078.

Kurek-Górecka A, Rzepecka-Stojko A, Górecki M, Stojko J, Sosada M, Świerczek-Zięba G.(2014). Molecules Structure and Antioxidant Activity of Polyphenols

Derived from Propolis. Molecules, 19(1): 78–101. doi: 10.3390/molecules19010078.

Kurniawati, D. (2011). Antibacterial Activity Test of Propolis Trigona Spp. Origin of High Hills in the Sprague-Dawle White Rat. Journal of Scientific Chemistry Progress, 1(1), 25–31.

Lamont RF, Sobel JD, Akins RA, Hassan SS, Chaiworapongsa T, Kusanovic JP, Romero R.(2011). The Vaginal Microbiome: New Information About Genital Tract Flora Using Molecular Based Techniques. Int J BJOG, 118(5): 533–549. doi: 10.1111/j.1471-0528.2010.02840.x.

Lima TM, Teles LMR, Oliveira ASD, Campos FC, Barbosa RDCC, Pinheiro AKB, Damasceno AKDC.(2013). Vaginal Discharge in Pregnant Women: Comparison Between Syndromic Approach and Examination of Clinical Nursing Practice. Rev Esc Enferm, 47(6): 1265–1271. doi: 10.1590/S0080-623420130000600002.

Machado JL, Assuncao AKM, da Silva MCP, Reis ASD, Costa GC, Arruda DS, Rocha BA, et al. (2012). Brazilian Green Propolis: Anti-Inflammatory Property by an Immunomodulatory Activity. eCAM, (ID 157652), p. 10. doi: 10.1155/2012/157652.

Margaretha I. (2012). Study of Propolis Bioactive Compounds. University of Indonesia.

Masyitha SZ. (2017). Pathological Flour Albus Overview Among Pregnant Women At RSUD Dr. Soetomo In 2015, Airlangga University Repository.

Mengistie Z, Woldeamanuel Y, Asrat D, Adera A.(2014). Prevalence Of Bacterial Vaginosis Among Pregnant Women Attending Antenatal Care in Tikur Anbessa University Hospital, Addis Ababa, Ethiopia. BMC Research Notes, 7(1): 1–5. doi: 10.1186/1756-0500-7-822.

Mitra Nofembri Y, Netti Suharti, MR (2017). Research Article Effects of Propolis and Lime on the Growth of Staphylococcus Aureus Ureus and Streptococcus Pyogenes In Vitro. Andalas Health Journal, 6(3), 581–585. Http://Jurnal.Fk.Unand.Ac.Id

Thoma ME, Klebanoff MA, Rovner AJ, Nansel TR, Neggers Y, Andrews WW, Schwebke JR.(2011). Bacterial Vaginosis Is Associated with Variations in Dietary Indices. J. Nutr, 141: 1698–1704. doi: 10.3945/jn.111.140541.

Toreti VC, Sato HH, Pastore GM, Park YK.(2013). Recent Progress of Propolis for Its Biological and Chemical Compositions and Its Botanical Origin. eCAm, pp. 13. doi: 10.1155/2013/697390.

Yuliana, R., Sutariningsih, E., Santoso, HB, & Riendrasaru, SD (2015). Antimicrobial Power of Trigona Spp Honey Bee Hives Against Microbial Pathogens. Bioeducation: Journal of Biology Education, 8(1), 67. Https://Doi.Org/10.20961/Bioedukasi-Uns.V8i1.3546

Wardaniati I, Pratiwi D. (2017). Antibacterial Activity Test of Trigona Bee Propolis Ethanol Extract (Trigona Spp) against Propionibacterium acnes that causes acne. JOPS, 1(1): 9–14. doi: https://doi.org/10.36341/jops.v1i1.369