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INHIBITORY ACTIVITY OF ANTI-ACNE SERUM ETHANOL EXTRACT FROM NATURAL MATERIALS: A LITERATURE REVIEW

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ABSTRACT

Acne is a condition where the oil gland accumulates in clogged pores causing inflammation. Acne can be treated using anti acne products such as serum. Acne treatment using natural ingredients is considered safer than products with synthetic chemicals. Writing uses the literature review article (LRA) method which the sources are derived from databases and grouped due to the similarity in the scope of the discussion. Anti acne serum from ethanol extract of various natural ingredients shows anti bacterial activity of acne bacterias such as *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis* which can be identified from the larges area of the inhibition zone.

Review Paper

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Keywords: Ethanol Extract, Anti Acne, Serum, Anti Bacterial from Natural Ingredient.

INTRODUCTION

Acne is a condition where the oil gland accumulates in clogged pores causing inflammation. Acne can take the form of papules, pustules and nodules. Acne in general is caused by hormones during puberty. The production of androgen hormones has increased drastically and resulted in excess sebum secretion (Sifatullah & Zulkarnain, 2021). Besides follicular and hormonal blockages, bacterial activity is also a factor that can exacerbate acne. Bacterias that often infect the skin are *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis* which might be causing pustules (Cunliffe et al., 2001).

Treatment of acne can be done by reducing excess sebum production, repairing follicles and reducing bacterial colonies on the skin (Hafsari et al., 2015). The treatment must be adjusted according to the severity. Based on Aqsha et al., (2016) if acne is already at moderate to severe severity, it needed a consultation with the expert. However, if the severity of acne is still low, one can use anti-acne products or other medicines widely sold. Anti acne products act as anti bacterial, anti inflammatory, help reduce oil production and speed up cell turnover (Lee et al., 2017).

Anti acne products usually use antibiotics which can cause side effects such as skin irritation. In addition, improper use can also cause bacterial resistance problems (Lood & Collin, 2011). Therefore, an alternative is needed from natural ingredients as antibacterials that can works optimally to solve acne problems and minimizes the side effects. Several studies have been conducted on natural ingredients as antibacterial agents such as sweet orange peel (Handayani, 2013), starfruit (Juniasti et al., 2015), basil leave (Angelina et al., 2015), beluntas leave (Hafsari et al., 2015), papaya leave (Tuntun, 2016) and papaya seed (Torar, 2017).

Various natural ingredients that have antibacterial activity have been widely applied to anti acne products. One of the anti acne products that have been developing

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lately is serum. Serum is an emulsion preparation that has a low viscosity so it can deliver active substances through the surface of the skin by forming a thin film layer. Serum has a small amount of solvent so it tends to be concentrated and contains more active substances. The advantage of serum products is absorbed more quickly by the skin due to their high active ingredients content (Farmawati, 2014). This can make anti acne serum easier to spread on the surface of the skin so it might be more efficient. The purpose of this literature review is to identify and examine the inhibitory activity of serum with ethanol extract formulations from natural ingredients against acne bacterias.

METHOD

Writing uses the literature review article (LRA) method which the sources are derived from databases and grouped due to the similarity in the scope of the discussion. The topic is anti acne serum made from ethanol extract of various natural ingredients (plants) as an anti bacterial based on the inhibition activity of acne bacteria, such as *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. The inhibitory activity of serum tested with diffusion methods such as discs and wells by measuring the diameter of the inhibition zone using a vernier caliper. The keywords used in the search included ethanol extract, anti acne, serum and anti bacterial from natural ingredients. After the filtering process based on topic keywords, 5 journals that obtained the criteria have found

RESULT AND DISCUSSION

Acne is caused by internal and external factors which can be exacerbated by a bacterial infection. Bacterias that often infect the skin are *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. (Marliana et al., 2018). *P. acnes* is a gram positive bacterium known as the main organism causes acne. Inflammation can occur because the P. *acnes* bacteria produces hyaluronidase, lecithinase, lipase, neurimidase and protease. In addition, these bacteria also produce hydrolytic enzymes causing damage to polysebaceous follicles. P. *acnes* activities convert unsaturated fatty acids into saturated fatty acids which causes sebum to become solid. Anytime sebum production increases, more P. acnes will also come out of the sebaceous glands (Aida et al., 2016).

Staphylococcus sp. are normal flora bacteria found in abundance on the skin and mucous membranes. These bacteria effected skin infections not only in humans but also in animals. *Staphylococcus aureus* and *Staphylococcus epidermidis* are gram positive bacteria that can also cause acne. Acne inflammation is thought to be due to the release of oleic acid by bacteria and produces lipase from the hydrolysis process (Meilina & Hasanah, 2018). Acne is usually treated with antibiotics, but long term use can cause bacterial resistance to result in immuno hypersensitivity and organ damage. Therefore, natural ingredients can be used to treat acne (Dewi et al., 2018).

Table 1. Inhibitory Activities of Anti Acne Serum Ethanol Extract from Natural Ingredients

Researchers	Nature Ingredients	Tested Bacterias	Inhibitory Activities	Descriptions
(Hasrawati et al., 2020)	Papaya seed (*Carica papaya* L.)	*Propionibacterium acnes*	The best concentration for the inhibition of bacteria is 15%, which is 10.49 mm.	The positive control (tetracycline) has an inhibition zone area of 10.64 mm
(Nuraeni & Farhamzah, 2021)	Beluntas leave (*Pluchea indica* L.)	*Propionibacterium acnes*	The best concentration on the inhibition of bacteria is 1%, about 20.73 mm with a very strong category.	The positive control has an inhibition zone area of 15.74 mm with a strong category.

(Fikayuniar et al., 2021)	Basil leave (*Ocimum x africanum* Lour.)	*Staphylococcus aureus*	The best concentration on the inhibition of bacteria is 5% about 17.4 mm, which is in the very strong category.	The positive control has an inhibition zone area of 34.2 mm with a very strong category.
(Cahyanta et al., 2022)	California papaya leave (*Carica papaya* L) and sweet orange peel (*Citrus sinensis* L)	*Propionibacterium acnes*	The best inhibition is a combination formula of California papaya leave and sweet orange peel with 1:3 ratio, about 7.36 mm in the medium category.	The total concentration used is 20% for all formulas. The combination formula has a larger inhibition zone than the single formula.
(Firmansyah et al., 2022)	Starfruit	*Propionibacterium acnes*	The best concentration on the inhibition of bacteria is 20%, about 18.10 mm with the medium category.	The positive control (clindamycin) has an inhibition zone area of 23.80 mm in the strong category.
		Staphylococcus aureus	The best concentration on the inhibition of bacteria is 20%, about 17.03 mm with the medium category.	The positive control (clindamycin) has an inhibition zone area of 22.07 mm in the strong category.
		Staphylococcus epidermidis	The best concentration on the inhibition of bacteria is 20%, about 17.00 mm with the medium category.	The positive control (clindamycin) has an inhibition zone area of 23.37 mm in the strong category.

*Source: personal doc.

Ethanol extracts from various natural ingredients are known to have antibacterial activity based on it inhibition of bacteria (Tabel 1). Ethanol solvent is a type of universal solvent used to attract compounds that are soluble in polar and non-polar solvents. This is because the ethanol solvent consists of a polar -OH group and a non-polar CH2CH3 group. Ethanol solvent has a low boiling point so it is non-toxic and harmless also considered safe for use as a food solvent. In addition, ethanol solvents are also economical and easy to obtain (Azis et al., 2014).

Papaya (*Carica papaya* L.)

Papaya (*Carica papaya* L.) is a plant from the Caricaceae family commonly found in tropical areas. Almost all parts of papaya can be used for medication. Mangalanayaki & Nirosha (2013) reported in their research that the ethanol extract of papaya leaves had antibacterial activities against the bacteria *Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus pneumonia* and *Salmonella typhi*. Another study by Peter et al., (2014) using papaya seed extract showed antibacterial activities against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Salmonella typhi* bacteria. Papaya is known to contain papain enzymes and carpine alkaloids as antimicrobial and antibacterial through proteolytic activity by digesting proteins from microorganisms and then turning them into peptones (Yani & Putri, 2019).

Serum with a combination formula research by Cahyanta, et al. (2022) the ethanol extracts of papaya leaves and sweet orange peels had a larger inhibition zone against P. *acnes* bacteria than the single formula of each extract. Research on the inhibition of serum against P. *acnes* bacteria by Hasrawati et al. (2020) showed that the best concentration of papaya seed ethanol extract is 15% with an area of inhibition zone of 10.49 mm. The zone of inhibition is known to be wider at the higher concentration of papaya seed ethanol extract in anti acne serum formulations. This is in line with the results of a study by Pertiwi et al., (2019) on the P. *acnes* antibacterial activities of papaya leaf ethanol extract gel which the higher concentration, the wider inhibition zone with the best concentration of 15%.

Beluntas (*Pluchea indica* L.)

Beluntas (*Pluchea indica* L.) is a plant from the Asteraceae family which has a wide distribution in Indonesia, Malaysia, Thailand, Taiwan, India and Mexico (Suriyaphan, 2014). Phytochemical screening of the ethanol extract of beluntas leaves by Wijaya et al., (2017) showed that beluntas leaves contain alkaloids, flavonoids, quinones, tannins, saponins, steroids and terpenoids. Beluntas are expected to have antibacterial activity through the mechanism of inhibiting bacterial growth and synthesis of cell membranes by alkaloid compounds. Alkaloids can interfere with the composition of the components that drew up the cell wall (peptidoglycan) in bacteria which causes the cell wall not to form completely which will result in cell death. In addition, the nitrogen content in the alkaloid base groups can react to affect bacterial DNA resulting in structural changes and arrangement of amino acids causing lysis cells (Nahak, 2013).

The inhibitory activities of anti acne serum from the beluntas leaves (*Pluchea indica* L.) ethanol extract against P. *acnes* bacteria by Nuraeni and Farhamzah (2021) shows the higher concentration of beluntas leaf extract, the greater inhibition zone produced. The best concentration on the inhibition of bacteria is 1%, about 20.73 mm, which is in the very strong category. The inhibition zone is larger than the positive control which had an inhibition zone area of 15.74 mm in the strong category. This is in line with the results of a study by Komika et al., (2020) on the antibacterial activity of P. *acnes* in beluntas leaf extract facial soap. The best soap formula has almost the same inhibitory activities as the positive control clindamycin, but it makes the soap is considered not good for daily uses because it has the same activity as the antibiotic clindamycin.

Kemangi (*Ocimum x africanum* L.)

Basil (*Ocimum x africanum* Lour.) is a plant from the Lamiaceae family easies to find because besides being cultivated it also grows wild. In Indonesia there are several species of basil, namely O. *americanum* L., O. *basilicum* L., O *champechianum* Mill., O. *x citriodorum* Vis., O. *kilimandscharicum* and O. *sanctum* L. (Kusuma & Ningrum, 2021). Timotius et al., (2021) reported basil leaves contain of alkaloids, anthocyanins, cardio glycosides, coumarins, flavonoids, glycosides, phenolics, quinones, saponins, terpenoids and tannins. In addition, basil leaves also contain essential oils. Essential oils are a group of volatile compounds divided into two groups, hydrocarbons and oxygenated hydrocarbons. Oxygenated hydrocarbon derivatives (phenols) are known to have strong antibacterial activities (Angelina et al., 2015).

Inhibitory activities test of anti acne serum basil leaves ethanol extract by Fikayuniar et al. (2021) for S. *aureus* bacteria, the best concentration for bacterial inhibition is 5%, about 17.4 mm in the strong category. This study reported that the highest inhibition zone found at the highest extract concentration which the higher concentration of the extract given, the greater inhibition zone resulted. S. *aureus* is a gram positive bacteria, while gram positive bacterias known to be not resistant for phenolic compounds. Phenol is a fat soluble compound. The antibacterial activities of the phenol group occur through the mechanism of cell membrane damage, enzyme activation and protein denaturation. This causes a decrease in cell wall permeability and affects the process of transporting important organic ions in cells (purwantiningsih & Suranindyah, 2014).

Strarfruit (*Averrhoa bilimbi* L.)

Starfruit (*Averrhoa bilimbi* L.) is a plant from the Oxalidaceae family which found in tropical and subtropical regions. Starfruit widely used as medicine because it contains phytochemicals such as tannins, flavonoids, saponins, anthocyanins and terpenoids (Setyawan et al., 2021). According

to Afifi et al., (2018) the content of tannins and flavonoids in starfruit is a compound that works as an antibacterial. Tannins known to have spasmolytic effects (shrink cell walls) by binding proteins causes the permeability of cell walls disturbed and effects cell lysis. Tannins can also inhibit the reverse transcriptase and DNA topoisomerase enzymes which play a role in the multiplication process so that cells cannot form and multiply (Karlina et al., 2013). Flavonoids cause bacterial cell proteins to clump (coagulate) and denaturated. Flavonoids can also inhibit the action of the gyrase enzyme which unwinds DNA when it replicates causing DNA transcription hampered and results in cell damage (Mufti et al., 2017).

Anti acne serum ethanol extract starfruit by Firmansyah et al. (2022) showed an inhibitory effect on P. acnes, S. aureus and S. epidermidis bacteria. The largest inhibition zone was formed at the highest concentration of starfruit extract, about 20%, each inhibition zones are 18.10 mm, 17.03 mm and 17.00 mm in the moderate category. The zone of inhibition was not wider than the positive control clindamycin which had a strong category. Clindamycin is an antibiotic that works by inhibiting the 50s ribosome in tRNA translocation (Huda et al., 2019). The results of this study are in line with Sukandar et al., (2014) who reported ethanol extract of starfruit has antimicrobial activities against P. acnes, S. aureus and S. epidermidis.

CONCLUSSION

Based on a literature review of anti-acne serum from ethanol extract, it is known that various natural ingredients, including papaya seeds, basil leaves, papaya leaves, sweet orange peel and starfruit have antibacterial activity. These natural ingredients show good inhibition against acne causing bacteria such as *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermidis* based on the inhibition zones formed. Therefore, this serum can be used to help over acne problems.

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