

## The power of natural products against bacteria causing acne

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### Abstract

**Objective:** To determine the inhibitory effect of lemon, green tea and Shea butter on the bacteria isolated from patients with acne.

**Method:** This Experimental study was conducted at the Microbiology laboratory of the Department of Veterinary Medicine, Kerbala University, Iraq. From February-March/2022. Simple random sampling was used to collect the samples. The culture media was incubated aerobically for 24 hours at 37°C. Lemon, green tea and Shea butter was used to test antimicrobial activity against the isolated bacteria. Antibiotics disks of tetracyclin, methicillin, azithromycin and clarithromycin were used to compare the effect of natural products. Data was analysed using SPSS.

**Results:** There were 50 subjects (35 males and 15 females) included, with mean age 21±3 years (range: 19-24 years). Among the 50 swabs, 26(52%) different microorganisms were isolated. All the isolates show 100% sensitivity against lemon, and 83.3% against green tea, while all the isolates were resistant to Shea butter. The sensitivity of isolates towards the antibiotics used ranged 16.6-83.3%.

**Conclusion:** While lemon and green tea could play a crucial role against different types of bacteria that caused acne, Shea butter had no role to play in this regard.

**Key Words:** Clarithromycin, Azithromycin, Methicillin, Tea, Bacteria, Acne Vulgaris

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### Introduction

Acne disease is a chronic inflammation of hair follicles and pilosebaceous units in the skin, resulting from increased androgen-induced production of sebum, alteration of keratinization, colonisation of bacteria in hair follicles and inflammation, and the distribution of acne depends on the density of sebaceous glands on the face, neck, back and chest<sup>1</sup>. The clinical features of the disease include seborrhoea, lesions with no inflammation, and lesions with inflammation as well as scarring<sup>2</sup>. About 20% teenagers suffer from the condition which can persist into adulthood, and the causative agents of acne include gene and hormonal disturbances, microbial infections, diet, smoking and stress<sup>3</sup>.

Antibiotics are not the perfect way of acne treatment, although they reduce the lesions in most patients. Benzoyl peroxide, retinoids and antibiotics as independent topical therapies, and when used together, may cure moderate and mild acne<sup>4</sup>. Severe acne usually needs oral antibiotics with topical benzoyl peroxide. Oral intake of isotretinoin is determined as the most effective

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treatment in severe cases, but the use is limited due to teratogenicity and side effects<sup>5</sup>.

Adverse effects as well as availability and cost may limit the use of treatment for acne, and there is a need for a new safe and effective treatment comprising natural products<sup>4</sup>. The biggest problem with oral antibiotics is that they cause long-term disturbances in micro-flora of the gut. The antibiotics prescribed by dermatologists for curing acne are broad spectrum, killing both probiotic and harmful bacteria<sup>6</sup>. The damage to probiotics also depends on the treatment duration<sup>5</sup>.

The biologically active components found in medicinal plants have been of great interest to scientists. The peel of citrus lemons is a rich source of flavanones and polyethoxylated flavones<sup>6</sup>. These components play an important ecological and physiological role, and they also have commercial value because of multitude applications in pharmaceutical and food industries. The oils of citrus peel show strong antimicrobial activity. Lemon is a member of rutaceous family, and it is cultivated for its alkaloids mainly, because they have antibacterial and anticancer activities, and the crude extracts has potential benefits<sup>7</sup>.

The Chinese used green tea as a medical treatment to many diseases, including acne, and is believed to improve human wellbeing in general. It is also believed to be of

help in reducing hormonal disturbances and inflammation, while it also assists detoxification<sup>8</sup>.

Shea butter is a pure and natural vitamin A cream, and it has shown to be a superb moisturiser for the skin with exceptional healing properties. It has a lot of useful properties and is traditionally used as an anti-inflammatory agent, as decongestant for arthritis and sprains, as a healing salve for umbilical cords of babies, and as a lotion for skin and hair care. However, the emollient and protective roles of Shea butter are most appreciated with respect to skin care. Vitamin A is an important compound in Shea Butter for treating a number of skins conditions, including wrinkles, blemishes, dermatitis and eczema<sup>9</sup>. The moisturisers in Shea butter cream are the same as those produced by sebaceous glands in the skin having biochemical effects that make the cream ideal for wound-healing<sup>7</sup>.

The current study was planned to determine the inhibitory effect of lemon, green tea and Shea butter on the bacteria isolated from patients with acne.

## Materials and Methods

This Experimental study was conducted at the Microbiology laboratory of the Department of Veterinary Medicine, Kerbala University, Iraq, From February-March/2022, and comprised swabs obtained from chronic acne patients. The samples were collected after taking approval from the institutional ethics review committee and obtaining informed consent from the participants.

Simple random sampling was used to collect the samples from the students of the college who represented the young community and more likely to experience acne.

Disposable swabs were used to collect the specimens from the exudates and pus of the pimples on the skin of patients under the advisory of the relevant physician to avoid any possible contamination. For culturing, the swabs were placed inside tubes containing normal saline to keep the swab as moist as possible until it reached the laboratory, or they were placed in the tube with a cover and was transferred to the laboratory within 30 minutes of the collection. Each specimen was inoculated on the blood, nutrient, chocolate and MacConkey's agar plates (Himedia, India) The culture media was incubated aerobically for 24 hours at 37°C.

Lemon, green tea and Shea butter were used to test their antimicrobial activity against the isolated bacteria. For comparison of their effect, antibiotics disks or tetracyclin, methicillin, azithromycin and clarithromycin (Bioanalyze, Turkey) were used.

Squeezed and crushed lemon 100g was dissolved in 100ml distilled water, and was used after filtration. Also, 100g of green tea leaves were boiled in 100ml water, and the solution was used after filtration. Shea butter was kept at room temperature for use<sup>10</sup>.

Natural products assay was performed by using a pure culture of bacteria (107CFU). The inoculum was prepared by adding growth of 5 isolated colonies of blood agar to 5ml of nutrient broth. This culture was then incubated for 2 hours to produce a suspension of bacteria with moderate turbidity using the McFarland tube standard (0.5) (Mastgroup, England). By a sterile swab, an inoculum from the standardised culture was taken, and swapped on Müeller-Hinton plate and left to dry. Cork poorer was used to make pores on the agar plates, and then the supernatants of the natural products were kept in them, and incubated overnight at 37°C. The zones of inhibition were measured by a ruler, and the inhibition zone was compared to the standard, as described by the Clinical and Laboratory Standards Institute (CLSI)<sup>10</sup>, to determine the susceptible and resistant organism to each product.

## Results

There were 50 subjects (35 males and 15 females) included, with mean age 21±3 years (range: 19-24 years). From among the 50 swabs, 26(52%) different microorganisms were isolated; 18(36%) gram-positive, 6(12%) gram-negative and 2(4%) candida (Table 1).

**Table-1:** Prevalence of microorganisms associated with acne (n=50).

NO. of swabs	Number of isolates			
	Gram-positive bacteria	Gram-negative bacteria	Candida	Negative growth
50	18(36%)	6(12%)	2(4%)	24(48%)

For the 24(%) gram-positive or gram-negative swabs, the types of bacteria were identified (Table 2).

**Table-2:** Gram-positive and gram-negative bacteria isolated (n=24).

Type of bacteria	Number	%
<i>Staphylococcus epidermidis</i>	11	45.8%
<i>Staphylococcus aureus</i>	5	20.8%
<i>Streptococcus pyogenes</i>	2	8.4%
<i>Acinetobacter</i>	2	8.4%
<i>Klebsiella pneumonia</i>	4	16.6%
<b>Total</b>	<b>24</b>	<b>100%</b>

All the isolates show 100% sensitivity against lemon, and 83.3% against green tea, while all the isolates were resistant to Shea butter. The sensitivity of isolates towards the antibiotics used ranged 16.6-83.3% (Table 3).

## Discussion

The current findings were similar to those reported earlier<sup>11</sup>. The bacteria isolated from the skin surface were *streptococcus* (S.) *pyogenes*, *staphylococcus* (S.) *aureus*, *staphylococcus* (S.) *epidermidis* and *Fungi*. The findings these correlated with those of a previous study<sup>12</sup>. In a study, gram-positive *staphylococcus* was determined as the largest group of microorganisms found on normal human skin<sup>13</sup>.

The role of *staphylococcus* found on the skin is mainly to prevent colonisation by other pathogenic bacteria and to maintain the balance among various micro-flora of the skins. These gram-positive bacteria can produce highly active antimicrobial substances against *Pseudomonas* (P.) *acnes* and other gram-positive bacteria. *P. acnes* may ferment the lactic acid that is produced by *S. epidermidis*, and convert it to propionic acid and acetic acid<sup>14</sup>.

There were 2 gram-negative *acinetobacter* isolates in the current study. These bacteria are widely distributed on various surfaces and universally inhabit the normal human skin<sup>15</sup>.

The most effective antibiotic in the current study was tetracycline. Fusidic acid, neomycin and gentamycin antibiotics also can be used in acne treatment<sup>14</sup>.

Antibiotics are generally taken as a first-line treatment of acne in moderate to severe forms, but antibiotics can actually cause long-term harm to the skin because the antibiotics kill both harmful bacteria and probiotics in the gut<sup>16</sup>.

The biggest problem of oral antibiotics is that they cause long-term disturbances in gut microbiota, and most antibiotics prescribed for acne treatment are not precision weapons<sup>17</sup>.

The current study found that all types of bacterial isolates showed 100% sensitivity against lemon, and 83% showed sensitivity against green tea. On the other hand, all the bacterial isolates were resistant to Shea butter.

Antibacterial potential of the crude extract's lemon against clinically significant strains of bacteria has been described<sup>18</sup>.

The function of flavonoids is direct as free radical scavengers and antioxidants, and they have the ability to modulate the activities of enzymes and inhibition of the cell proliferation. Besides, the antimicrobial activity of

lemon is directly related to the components that it contains<sup>19</sup>.

The natural antibacterial and astringent properties of lemon juice are very good for clearing up the skin. Vitamin C as well as other antioxidants help decrease blemishes and wrinkles. Vitamin C compound is vital for healthy glowing skin while its alkaline nature kills some bacterial types that are known to cause acne<sup>18</sup>.

Green tea has many benefits in the treatment of acne-prone skin, as it reduces the production of sebum, and protects the skin against inflammation<sup>20</sup>. It also reduces inflammatory reaction to bacteria that cause acne<sup>18</sup>.

Green tea is as effective both as benzoyl peroxide or antibiotic cream, but benzoyl peroxide can dry out the skin, leading to allergic reactions or itching. Green tea has great advantages as a natural antibacterial and antioxidant, just like epigallocatechin gallate that has a power 200 times more than with vitamin E for fighting free radicals<sup>20</sup>. These are used as drugs by dermatologists because it is effective in the clearance of pustules and papules in mild to moderate acne<sup>21</sup>. The comparison by other topical therapeutic agents, like topical erythromycin showed that the green tea lotion had a great and more rapid action than topical erythromycin<sup>12</sup>.

Studies have not reported any major side effect from creams with green tea extracts<sup>20</sup>. The extract of green tea is an extremely versatile supplement of herb<sup>19</sup>.

Not one of the bacterial isolates in the current study showed sensitivity against Shea butter. In Shea butter, vitamin A is important for treating a number of skin conditions, including wrinkles, blemishes, dermatitis and eczema. Additionally, the cream of Shea butter has more properties that provide relief against insect bites, allergies, sunburns, frostbites and other conditions. Vitamin E is also present in Shea butter, but the exact role of it is controversial even though it has been described as effective in a number of skin conditions or circumstances<sup>22,23</sup>. The quality of Shea butter may range from very poor to excellent. Shea butter of excellent quality may be prescribed to cure a number of skin conditions, and serve as a good moisturiser, while Shea butter of poor quality is good only as a moisturiser<sup>24</sup>.

For a long time, plants have played a valuable role as a source of natural products for maintaining human health. The use of extracts known to have antimicrobial properties can be of great significance in therapeutic improvement<sup>25</sup>.

**Limitation:** The current study has limitations as the

**Table-3:** The effect of natural products used and their comparison with various antibiotics in terms of effect on the bacterial isolates.

Natural products	Positive	Negative	Type of antibiotics	Sensitivity	Total NO.
Lemon	24 (100%)	0	Tetracyclin and Clarithromycin	20(83.3%)	24
Green Tea	20 (83.3%)	4	Methicillin	4(16.6%)	Bacterial
Shea Butter	0	24	Azithromycin	12(50%)	Isolates

sample size was not calculated which could have affected the power of the study.

## Conclusion

Natural products lemon and green tea played a crucial role against different types of bacteria, while Shea butter had no direct role in this regard.

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**Conflict of Interest:** None.

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