

Antibacterial Activity of Aqueous Extract of Green Tea on Bacteria Isolated From Children With Impetigo

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Abstract

Background: Impetigo is a contagious superficial pyogenic infection of the skin, caused by *Staphylococcus aureus* or *Streptococcus pyogenes* and some times *proteus mirabilis*, different antibiotics was used for the treatment of impetigo, given topically or systemically.

Objectives: The aim of the present work is to estimate the effectiveness of aqueous extract of green tea on different types of bacteria which was isolated from children suffering from impetigo skin infection.

Methods: The study was done in the College of Medicine / Diyala University. Forty two samples with positive bacterial cultures, were obtained from the skin lesions of children with impetigo infection, they were tested by doing antibiotic sensitivity test of different antibiotics and the resistant cultures of different types of bacteria, which was isolated from infected patients were tested by 10% aqueous extract of green tea.

Results: The study revealed that 10% aqueous extract green tea was effective as antibacterial agents, against antibiotic's resistant strains of *Staph. aureus*, *Strep. Pyogenes* and *Proteus mirabilis*.

Keyword: Impetigo, *Staph. aureus*, *Strep. pyogenes*, *Protus mirabilis*.

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Introduction

Impetigo is a contagious superficial pyogenic infection of the skin, it is of two main clinical forms: non-bullous impetigo (Impetigo Contagiosa of Tilbury Fox) and bullous impetigo [1]. Contagiosa Bullous impetigo is accepted as a Staphylococcal disease, although Streptococcal bullous impetigo has been reported [2]. The non-bullous form may be caused by *Staphylococcus aureus*, *Streptococci*, or by both organisms together it accounts for more

than 70% of all cases, rarely caused by *Proteus mirabilis* [1-4].

Clinical features :- Non-bullous impetigo occurs more commonly in preschool age children, the initial lesion is a very thin-walled vesicle or pustule on an erythematous

base, that ruptures quickly and evolve to yellowish-brown (honey-comb) crusted

plaque. The crust dry and separate to leave erythema, which fades and complete spontaneous healing can occur within 2-3 weeks without scarring. The face, especially

around the nose and mouth and the limbs are the sites most commonly affected [1,3,5].

Bullous impetigo occur more commonly in the new born and in older infants, and is characterized by the rapid progression of vesicle to flaccid bulla, which are less rapidly ruptured and become much larger, up to 1-2 cm in diameter and may persist for 2 or 3 days, the content are at first clear, later become cloudy, and after rupture thin, flat, light brownish to golden – yellow crust are formed, central healing and peripheral extension may give rise to circinate lesions. Although the face is often affected the lesions may occur any where on the skin, and buccal mucous membrane may be involved [1,3,5].

Diagnosis is made by clinical criteria and confirmed by Gram stain and culture of exudates from lesion [3].

Treatment: in mild and localized infection, a topical antibiotic alone may suffice e.g. mupirocin, fusidic acid, bacitracin for both Staphylococcal and Streptococcal impetigo, if the infection is wide – spread or severe or is accompanied by lymphadenopathy or if there is reason to suspect a nephritogenic Streptococcus, an oral antibiotic such as flucloxacillin, or erythromycin is indicated also azithromycin, cephalexin, cefalexin, cefprozil and clindamycin are alternative therapies [1,3].

Black tea (as 2% topical [7] ointment) also give a good result in treatment [6].

Tea is the second most common beverage consumed by humans. Although this beverage has little nutritional value per se, tea is refreshing mildly stimulating, and produces a feeling of well-being. Current extensive studies indicate that tea has some beneficial health effects besides being refreshing. The antitumour as well as antimicrobial activity of tea extracts and tea

components have some beneficial health effects demonstrated by in vitro studies [7].

The active components of tea responsible for such biological activities are now recognized to be catechins (also known as polyphenols), which constitute catechin (C), epicatechin (EC), gallic catechin (GC), epigallocatechin (EGC), epicatechin gallate (ECg), and epigallocatechin gallate EGCg [7].

Tea extracts, including EGCg, have already shown a strong antimicrobial activity at "cup of tea" concentration against a wide variety of microorganism, such as methicillin resistant Staphylococcus aureus (MRSA), many enteropathogenic bacteria, and other microorganisms, even fungi.

A study of the mechanism of the antibacterial activity of tea catechins showed that the primary target site of catechins is phospholipids of bacterial membrane. There for, even though much is not clear about antibacterial mechanism, bacterial membrane perturbation may be at least one of the reasons why catechins show strong direct antimicrobial activity [7].

The aim of the present study is to evaluate the antibacterial effects of aqueous extract of

green tea on different types of bacteria which were isolated from children with impetigo.

Methods

The study was done in College of Medicine / Diyala University. Forty six samples of cultured bacteria, which were isolated from children with impetigo were tested by antibiotic sensitivity test by using Kirby-bauer disk method, which include: methicillin, cefotaxime, cefalexin, piperacillin, gentamicin, erythromycin and ciprofloxacin [8].

The cultures which were resistant to the preceding antibiotics (selected according to

the diameter of inhibition zone) ,were selected ,and sensitivity testing to aqueous extract of green tea (10mg/ml stock solution=10% concentration) , by using agar-well diffusion [9,10].

Different concentrations of aqueous extract of green tea (1,2,3,4and5 ml) were obtained from the original stock solution of green tea and diluted by using distill water (to obtain a total 10ml for each concentration) , and were tested on the resistant cultures of isolated bacteria , by measuring the diameter of inhibition zone .

Also the MIC and MBC of different concentration (1,2,3,4and5 ml) of green tea extract were measured by using Agar – dilution method [11] .

MIC (minimum inhibition concentration) which is the minimum concentration of the compound that inhibit the bacterial growth . MBC(minimum bactericidal concentration) is minimum concentration of compound which decrease the number of bacterial colonies by 99.9% of culture .

Results

Table-1 shows the antibiotic sensitivity tests of different types of antibiotic on different types of bacteria . The percentage of resistance of Staph. aureus to cephalexin , methicillin and erythromycin was (50 , 71.4 and 50%) respectively, Strep. pyogenes resistance was (50 , 71.4 and 70.8%) respectively and proteus mirabilis resistance

was (75 , 78.6 and 62.5%) respectively , while resistance of Staph. aureus to cefotaxim and gentamicin was (37.5 and 33.3%) , Strep . pyogenes resistance was 42.9% for both and Proteus mirabilis resistance was (25% for both antibiotics) . The resistance of Staph .aureus to ciprofloxacin and piperacillin was (33.3 and 41.7%) , Strep. pyogenes resistance was 35.7% for both and Proteus mirabilis has no resistance to both antibiotics .

The study shows that the aqueous extract of green tea was effective against different types of resistant bacteria (Staph aureus , Strep. pyogenes and Proteus mirabilis) as in table-2 . For Staph aureus (picture-1) the inhibition diameters was (8.25 , 10.14 , 11.20 , 13. 40 , and15.00)mm for different concentrations of aqueous extract of green tea , to Strep pyogenes (picture-2) was (0.00 , 2.75 , 4.42 , 6.75 , 8.85) mm and for Proteus mirabilis (picture-3) was (1.00 , 5.32 , 7.12 , 9.25 , 12.25)mm .

Its antibacterial effect was directly proportional with its concentration According to the values of MIC & MBC as in table-3 , the results reveled that the aqueous extract of green tea were more effective as antibacterial agent against Staph. aureus , Proteus mirabilis than Strep. pyogenes, which was due to the bactericidal effects of catechins of green tea , which is related to the Gallic acid moiety and the hydroxyl group member , which cause damage of bacterial membranes[12] .

Table 1 : Percentage of resistant bacteria to different antibiotics .

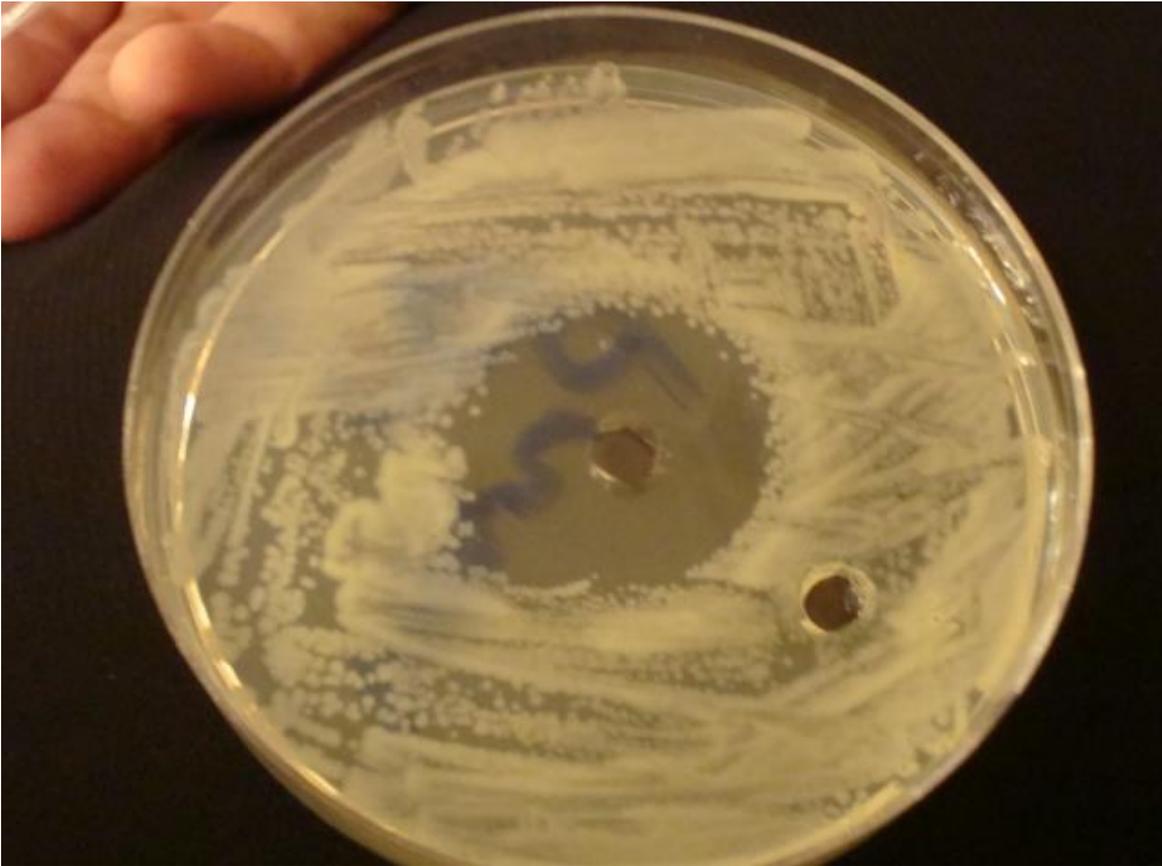
Antibiotics	Staph. aureus-tota 24samples	Strep. pyogenes – tot 14samples	Proteus mirabilis-to 4samples
Cephalexin	Resestant-12 50%	10 71.4 %	2 50%
Cefotaxime	Restant-9 37.5%	6 42.9%	1 25%
Methicillin	Restant-17 70.8%	1 71.4%	2 50.%
Erythromycin	Restant-15 62.5%	11 78.6%	3 75%
Gentamicin	Restant-8 33.3%	6 42.9%	1 25%
Piperacillin	Restant-10 41.7%	5 35.7%	0 0%
Ciprofloxacin	Restant-8 33.3%	5 35.7%	0 0%

Table 2 : Inhibition zone (mm) of aqueous extract of green tea on bacteria .

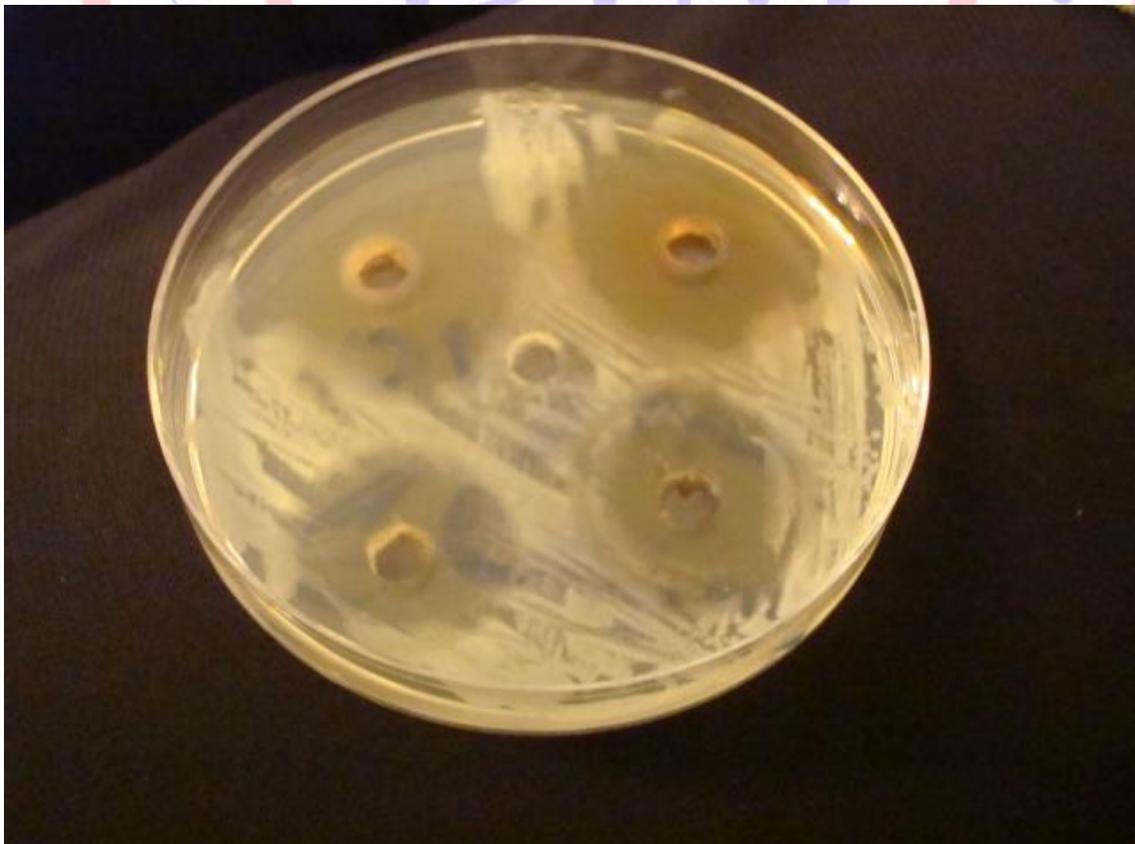
Bacteria	Inhibition zone in different concentrations (mm)				
	1mg/ml	2mg/ml	3mg/ml	4mg/ml	5mg/ml
Staph. aureus	8.25	10.14	11.20	13.40	15.00
Strep. pyogenes	0.00	2.75	4.42	6.75	8.85
Proteus mirabilis	1.00	5.32	7.12	9.25	12.25

Table 3 : Values of MIC and MBC of aqueous extract of green tea .

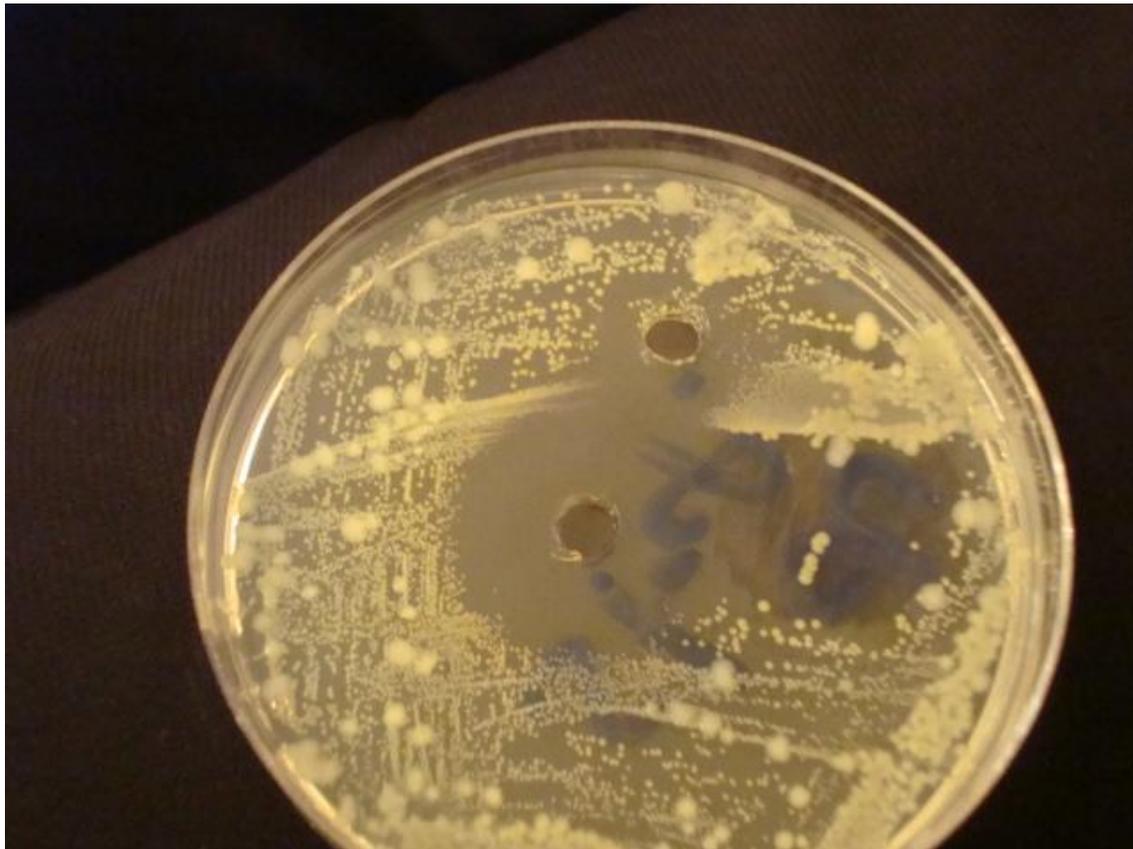
Bacteria	Green tea	
	MIC	MBC
Staph. aureus	2	4
Strep. pyogenes	4	5
Proteus mirabilis	3	5



Picture (1)



Picture (2)



Picture (3)

Discussion

The results of this study revealed that the aqueous extract of green tea was relatively effective as antibacterial agent, and *Protues mirabilis* was more sensitive than *Staph. aureus* and *Strep. pyogenes*. The antibacterial activity of green tea was due to the presence of catechin compound, which induce rapid leakage of small molecules entrapped in the intraliposomal space and aggregation of the liposomes which caused lyses, and kill the bacteria [12]. Also the study shows that the antibacterial activity of green tea was parallel to that of different types of antibiotics and black tea [1,3,6].

We concluded that the aqueous extract of green tea was relatively effective as antibacterial agent in vitro and its effect was directly proportional with its concentration.

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