

A STUDY ON INVITRO ANTIMICROBIAL ACTIVITY OF COCONUT WATER AND COCONUT OIL ON GRAM POSITIVE AND GRAM NEGATIVE BACTERIA.

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ABSTRACT

The indiscriminate use of synthetic products has led us to the state of resistance and also provoked the need for natural products. The products from coconut were known to have antibacterial, antiviral, antitumor activity from time immemorial. Hence this study is undertaken to find out the antibacterial activity of coconut oil and coconut water against gram positive and gram negative bacteria isolated from clinical samples. Isolates numbering 100 (25 each of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*) isolates were included in our study. Varied zone of inhibition were observed by coconut water at different concentrations and also by undiluted coconut oil against the pathogens. But none of them show any inhibitory effect against *Pseudomonas aeruginosa*. The limitations in our study can further be overcome by using various extracts and with larger number of samples.

KEYWORDS: Coconut oil, coconut water, antibacterial activity.

INTRODUCTION

Cocos nucifera L. (family *Arecaceae*), commonly known as coconut, is considered as an important fruit crop in tropical countries. Coconut is the most extensively grown and used nut

in the world, playing a significant role in the economic, cultural, and social life of over 80 tropical countries. Coconut is mainly an oil crop; rich in lauric acid, with a variety of other uses in addition to commercial oil production. The fruit, flower and root of this plant are used as ingredients for many ayurvedic preparations and it is also used in Malay traditional medicine to treat ailments such as fever, headaches, stomach upset and diarrhea^[1]. The products from coconut were known to have antibacterial, antiviral, antitumor activity and as an alternative for oral rehydration and intravenous hydration of patients particularly in remote regions^[2]. It's also effective in the treatment of kidney and urethral stones, urinary infections and mineral poisonings. It offers protection against myocardial infarction and control of hypertension^[3]. Hence we intended to do a study to find out the antibacterial activity of coconut oil and coconut water against gram positive and gram negative bacteria isolated from clinical specimens.

METHODOLOGY

Institutional ethical committee clearance was obtained. This prospective observational study was conducted in the microbiology lab at the Sri Muthukumaran Medical College from November 2015 to April 2016 (6months). The study consists of 100 isolates of gram positive and gram negative bacteria from urine samples of patients.. Pure coconut oil was extracted, purified by filtration method and stored in a sterile container at 4 °C. Coconut water is collected, purified by filtration method and stored at 4 °C. Coconut water is diluted to three different concentrations – 100%, 50% and 25%. Before testing they were brought to the room temperature^[5].

Urine samples from the patients were processed using Nutrient agar, Blood agar and MacConkey agar. The isolated organisms were identified by gram stain, colony morphology and by standard biochemical tests – catalase, coagulase, Oxidase, indole, citrate, urease, and also agar triple sugar iron and motility. In our study 25 strains of each of the bacteria were included – *Staphylococcus aureus*, (gram positive and gram negative) *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Antimicrobial sensitivity test was done on Mueller Hinton agar. Control antibiotics for gram positive organism were Nitrofurantoin (300 U), and Norfloxacin (30µg). Control antibiotics used for gram negative organisms were Amikacin (30µg), and Gentamicin (10µg)^[6].

Isolated organisms were processed in Mueller Hinton agar with control antibiotics. And 10 µl of coconut oil, coconut water with three different concentrations (100%, 50% and 25%). The plates were incubated at 37 ° C for 24 hours. The results were recorded.

RESULTS

100 isolates from urine samples including with 25 each of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were used this study. The bacteria included in our study were found to be sensitive to control antibiotics used (Table 1). The zone of inhibition shown by bacteria for coconut water with different concentrations are shown in Table 2.

Table1. Range of sensitivity pattern of study organisms to control antibiotics

Bacteria	Zone range in mm for control antibiotics with concentration			
	Norfloxacine (10µg)	Nitrofurantoin (300)	Gentamicin (10 µg)	Amikacin (30 µg)
<i>Staphylococcus aureus</i> (25)	17 – 23mm	17 to 26 mm	-	-
<i>Escherichia coli</i> (25)	-	-	15 to 19 mm	17 to 21mm
<i>Klebsiella pneumoniae</i> (25)	-	-	15 to 17 mm	17 to 21 mm
<i>Pseudomonas aeruginosa</i> (25)	-	-	15 to 23 mm	17 to 20mm

Table2. Susceptibility pattern to coconut water at different concentrations

Bacteria included in our study	Susceptibility at given concentration		
	(100%)	(50%)	(25%)
<i>Staphylococcus aureus</i> (25)	6mm – 12mm	< 6mm	< 6mm
<i>Escherichia coli</i> (25)	6mm – 8mm	< 6mm	< 6mm
<i>Klebsiella pneumoniae</i> (25)	6mm – 8mm	< 6mm	< 6mm
<i>Pseudomonas aeruginosa</i> (25)	< 6mm	< 6mm	< 6mm

Table3. Susceptibility pattern to undiluted coconut oil

Bacteria	Concentration (100%)
<i>Staphylococcus aureus</i> (25)	6mm -12mm
<i>Escherichia coli</i> (25)	6 -10mm
<i>Klebsiella pneumoniae</i> (25)	<6mm
<i>Pseudomonas aeruginosa</i> (25)	<6mm

The coconut water shows zone of inhibition for *Staphylococcus aureus* in the range from 6mm to 12mm, for *Escherichia coli* and *Klebsiella pneumoniae* from 6mm to 8mm when testing at 100% concentration (Figure 1). No inhibition or <6mm is noted at other two concentrations (50% and 25%). In case of *Pseudomonas aeruginosa* <6mm zone of inhibition is noted at all three concentrations (100%, 50% and 25%).

The isolates were tested against undiluted coconut oil and the results are shown in table 3. The filtered, undiluted coconut oil shows the zone of inhibition in the range of 6mm to 12mm for *Staphylococcus aureus*, 6mm to 10mm for *Escherichia coli* and < 6mm for *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*.

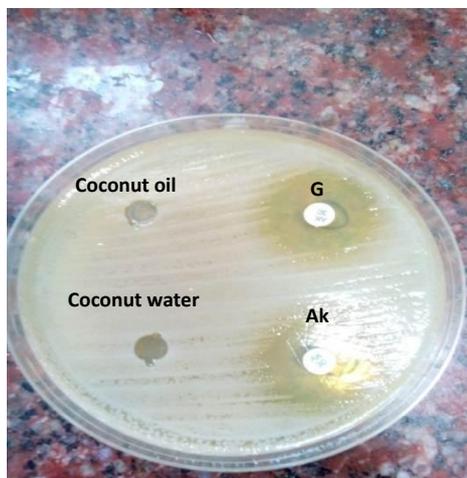


Figure 1: Gram negative bacilli with Amikacin(Ak) and Gentamicin(G) as control antibiotics along with Coconut water & Coconut oil.

DISCUSSION AND CONCLUSION

Various antibiotics had been used successfully in treating the infections that once devastated the humans, but their indiscriminate use has led to the development of multidrug-resistant pathogens. Hence, we are in the need to utilize natural extracts in place of synthetics to combat the pathogens. One such commonly available product in our country is coconut oil and coconut water. Studies were done to establish the antimicrobial activity of coconut products clinically and invitro. We also intended to study the effect of coconut oil and coconut water with 100 isolates of most common urinary pathogens.

A prospective observational study with a sample size of 100 (25 each of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*) to know the antimicrobial property of Coconut oil and coconut water was conducted. The coconut water shows zone of inhibition for *Staphylococcus aureus* in the range from 6mm to 12mm, for *Escherichia coli* and *Klebsiella pneumoniae* from 6mm to 8mm when testing at 100% concentration. No inhibition or <6mm is noted at other two concentrations (50% and 25%). In case of *Pseudomonas aeruginosa* <6mm zone of inhibition is noted at all three concentrations (100%, 50% and 25%). When tested against undiluted coconut oil, the zone of inhibition in

the range of 6mm to 12mm for *Staphylococcus aureus*, 6mm to 10mm for *Escherichia coli* and < 6mm for *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were noted.

Studies done by Rajeev K Singla et al shows different zone of inhibitor for coconut extracts^[6]. (Ogbalu et al showed the effect of coconut oil was comparable to the sensitivity of fluconazole in candida species^[7]). Our study was done with the crude extract of coconut oil and three different concentrations of coconut water. We observed various zone of inhibition for coconut water at 100% concentration. Coconut oil is also found to show some zone of inhibition to the pathogens in our study. But none of them was found to be effective against *Pseudomonas aeruginosa*.

Since the study was done with the pure filtered extracts and with a small sample size, our study has got limitations. Further research can be extended with various extracts of the coconut and with a larger sample size which might help in giving more positive results.

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