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The use of *Commiphora myrrh* extract as disinfectant agent against pathogenic microbes isolated from beauty salons

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Abstract

The main aim of this study was using of *Commiphora myrrh* extract as a sterilizer against pathogenic microbes isolated from beauty salons. The efficiency of *C. myrrh* extract was tested against each type of bacteria and fungi that were obtained from the previous study and compared with the efficiency of the chemical reagent used in salons. There were no significant differences in the efficiency of similar efficiency *C. myrrh* and barbicide solution on the tested microorganisms. The result also revealed that *C. myrrh* extract had higher antibacterial activity against bacterial isolates than fungal isolates.

Keywords: *Commiphora myrrh, Antimicrobial activity, Pathogenic microbes, Salons' tools, Beauty salon*

1. Introduction

Several studies reported the presence of diverse microbes isolated from tools used in salons (Bashir and Lambert, 2020; Ebuara *et al*., 2020; Alswedi and Jaber, 2019; Stanley *et al*., 2019; Evbuomwan *et al*., 2018; Edward *et al*., 2015; Baqer *et al*., 2014 ; Enemuor *et al*., 2013; and Naz *et al*., 2012). The most dominant pathogenic bacteria were, *Streptococcus, Staphylococcus epidermidis, Klebsiella pneumonia, Pseudomonas aeruginosa, Enterococcus, E. coli* and *Micrococcus*, while fungi species were *Penicillium spp, Aspergillus, Candida albicans,. ; Trichophyton, Malassezia, Mucor*, *Microsporum Alternaria spp., Trichophyton spp, Cladosporium* spp., *Geotrichum candidum, Rhizopus nigricans, R. arrhizus,., Mucor* spp., *Gliocaldium*, and *Fonsecaea* (Alswedi and Jaber, 2019; Evbuomwan *et al*., 2018; and Edward *et al*., 2015).

Studies found that not all microorganisms isolated from cosmetics essentially pathogenic but might pose a threat to the entire microbiome (Bashir and Lambert, 2020; and Janmohammadi *et al*., 2016). It has been found that the higher the moisture content in cosmetics, the higher the number of microbes (Ebuara *et al*., 2020). In addition, if beauty equipment or products are left open, they will be exposed to air, dust, and microorganisms in the air, which will increase microbial contamination (Evbuomwan *et al*., 2018).

Salon hygiene: The most common methods used in salons to sterilize tools and equipment in beauty salons are autoclaving, chemical reagents, UV radiation, boiling water, , and quartz bead sterilization (Esther

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Bolkin, 2016, Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization). The hot water sterilizing process is immersing the instruments in boiling water for at least 3-5 min. While this procedure is quick, it is ineffective in eliminating all bacteria (Battersby, 2016). Although autoclaving is the most reliable method for removing all microorganisms, it is not suitable for sterilizing electrical equipment, and the sterilization process takes a long time. Chemical disinfectants are excellent at killing or slowing the growth of microorganisms; however, the majority of these compounds are dangerous and should be handled with caution (Tracy Morin, 2019, Sources of Proper Sanitation Protocols Can Make or Break Your Salon). Barbicide solution, which is highly hazardous to humans, is currently used as disinfection in most salons, and some others use a quartz sterilizer or UV radiation. (Esther Bolkin, 2016, Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization).

Commiphora myrrh is a widespread plant among the many species that belong to the Burseraceae family. Its homeland is the Arabian Peninsula and some African countries. It has been used since ancient times in the treatment of many diseases, where it was used as an astringent, anti-parasite, antiseptic, anti-cough, for spasm and menstruation (Wanner *et al*., 2010; and Singh *et al*., 2013). Myrrh is an Olea resin obtained from the stem of different species of plant *Commiphora*. It is a brown mass and with water, it forms an emulsion. It has a taste and a balsam smell (Evans, 2009) (Figure 1). Many different species of myrrh located in diverse states as shown in Table 1.

Figure 1 : The plant *commiphora myrrh*

Table 1: The different species of plant Commiphora (El Ashry *et al.* , 2003)

Species	**Country**
C. molmol Engler	Ethiopia, Somalia, Arabia
C. mukul Engler	Somalia, India
C. guidotti Chiov.	Somalia
C. Abyssinian Engler	China, East Africa, Ethiopia
C. incise Chiov.	India, East Africa, Ethiopia
C. pyracanthoides Engler	East Africa
C. rostrate Diels	Arabia
C. gileadensis Engler	Djibouti, Ethiopia, Kenya, Somalia, Sudan
C. wightii Engler Pakistan, India	
C. guillauminiperr Engler	Sudan, Kenya
C. erythraea (Var.) Engler	India, Somalia
C. opobalsamum Engler	Near Cairo “at Mataria”

1.1. Medicinal uses of plant Commiphora myrrh

Commiphora myrrha is the most important species of myrrh which has been used as an antimicrobial agent (Alhussaini *et al*., 2015). It is the most effective medical plant for sore throats, canker sores, gingivitis, pharyngitis, sinusitis, acne, boils, and arthritis (rheumatism) (Vander Zanden,1980). It is one of the outstanding cures in established Chinese medication to reduce soreness and swelling as a result of traumatic injury (Vander Zanden, 1980). The extract of myrrh is useful in the treatment of indigestion and diabetes mellitus (Al-Awadi, 1987). Also, it is used in perfumes and cosmetics for the treatment of skin, hair, and scalp (Selim, 1988). It is also widely used in the treatment of many diseases such as fevers, anemia, hepatitis, ulcers, asthma, paralysis, stomach problems, chest, and kidney diseases (Al-Ghazal, 2007; and Shent *et al*., 2008). There are also many reports in Saudi Arabia Kingdome alone on the use of *C. myrrh* as an anti-fungicide and anti-bacterial (Saadabi *et al*., 2006; Omer *et al*., 2011; Abdallah and Khalid, 2012; and Mohammed and Samy, 2013).

The components of *C. myrrh* such as sesquiterpene lactones, one of, are used in the synthesis of some anti-inflammatory and anti-allergen medications (Neerman, 2003; and Gadir and Ahmed, 2014). In addition, sesquiterpenes and sesquiterpene lactones compounds play an effective role against the activity of fungi, bacteria, and viruses (Kokate *et al*., 2007; Gadir and Ahmed, 2014; Vishakha and Ramyasree, 2015; and Omer and Al-Dogmi, 2018).

In our study, we investigated the efficacy of *C. myrrh* extract as a natural disinfectant. This method is effective, safe, widely available, and affordable (Al-Harbi *et al*., 1994; Mohamed *et al*., 2014; and Vishakha and Ramyasree, 2015).

2. Materials and methods

2.1. Preparation of plant extracts of C. myrrh

Olea resin of *Commiphora myrrh*, which belongs to the Burseraceae family, was obtained from the local market of Jeddah city, KSA. Samples were collected and authenticated by the Department of Botany, University of King Abdulaziz, Jeddah.

To prepare 10% of *C. myrrh* extract; the samples were dried and broken into small pieces inside bags, and 10 g was measured. Then a 100 ml of ethanol was added to the ten gm of myrrh and mixed using a shaker at 200 x g for 4 h. The mix was then centrifuged at 3000 rpm for 30 min and the supernatant was collected in Eppendorf tubes. Finally, the plant extract was preserved at 4°C until used. The same method was used to prepare 15% and 20% of *C. myrrh* extract: 15 gm and 20 gm of myrrh powder were dissolved in 100 ml of ethanol separately (Shuaib *et al*., 2013; Al-Sabri *et al*.,2015; Vishakha and Ramyasree, 2015, and Omer *et al*. 2011).

2.2. Pathogenic microbes growth condition

Stock cultures of all bacteria isolated from salons product and tool from previous study (Alharbi and Alhashim, 2021) were sub-cultured three times using nutrient agar and incubated at 37°C for 18 h for bacteria and 96 h for fungi at 25°C. Cultures were prepared for downstream experiments by subcultures into the nutrient broth. Then diluted according to 0.5 McFarland turbidity standards to be $1.5X10^{8}$ CFU mL^{-1} at OD ~660nm.

2.3. Commiphora myrrh efficiency

First, three concentrations of *Commiphora myrrh* extract (10%, 15%, and 20%) were tested against each type of bacteria and fungi that we obtained from salon samples using the agar well diffusion method (Omer *et al*., 2011; Al-Sabri *et al*., 2015; Mohammed and Samy, 2013; and Groove and Randall,1955). Each agar plate's surface was inoculated completely with the microbe using a sterile cotton loop and the name of the microbe was written on each plate.

Then, a hole with a diameter of 8 mm was punched with a sterile cork borer in each plate, and a volume of 50 μL of *Commiphora myrrh* extract was pipetted into the well. Each concentration of the *C. myrrh* extract was written on each plate. The plates were put in an incubator at 37°C for 18 h for bacteria and 5-7 days for fungi at 25°C. After that, the inhibition zones were measured in mm and recorded. Corresponding numbers of positive and negative control plates were used for comparison.

2.4. Antimicrobial Assay

To investigate the sensitivity of microbes isolated in this study against the *C. myrrh,* the concentration of the highest inhibition zone obtained for each microbe was repeated three times and the inhibition percentage of each organism was recorded compared to the control. Then, the inhibition percent was calculated using the following formula (Derbalah *et al*., 2012):

Inhibition percent =[(size of the colony on the control plate – size of the colony on test plate) ÷ size of the colony on control plate] x 100

2.5. Comparing the efficiency of C. myrrh with a chemical reagent used in a salon

The concentration that causes the highest inhibition zone of *C. myrrh* extract for each microbe was compared with the most common chemical reagent used in salons named barbicade solution (diluted to 2 oz:32 oz a sterile distilled water) by evaluating antimicrobial activity using the agar well diffusion method (Groove and Randall, 1955).

Two agar plates surface were inoculated completely with the microbe using a sterile cotton loop and the name of the microbe was written on each plate. Then, a hole with a diameter of 8 mm was punched with a sterile cork borer in each plate.

In the first plate, a 50 μL of *Commiphora myrrh* extract was introduced into the well using a sterile pipette, and in the other plate, a 50 μL of chemical reagent was introduced into the well using a sterile pipette. The concentration of the *C. myrrh* extract and the name of the chemical reagent were written on each plate. The inhibition zones were measured in mm and recorded. The inhibition percentage of the concentration that causes the highest inhibition zone of *Commiphora myrrh* extract for each microbe was compared with the inhibition percentage of chemical reagent used in a salon (barbicade solution) for each organism tested. The previously mentioned formula was used to calculate the inhibition percentage comparing to the controls.

2.6. Statistical analysis

Data was analyzed statically using three types of statistical tests. Firstly, tests of Normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests to know if the data sampling followed a normal distribution or not. Then, Mann-Whitney test to compare the efficiency of *C. myrrh* with a chemical reagent used in a Salon. Finally, Kendal's w test for the three concentrations of *C.myrrh* extract (10%, 15%, and 20%) to find out which was the most effective concentration on inhibiting the growth of bacteria and fungi (Statistics, 2009).

3. Results

3.1. Commiphora myrrh efficiency

Table 2 showed the efficiency of three concentrations of *C. myrrh* extract on microbial isolates by the agar well diffusion method.

For fungi, it can be seen that the use of 20% of *C. myrrh* extract did not affect fungal isolates Also, while the concentration of 10%of *C. myrrh* was the most effective concentration on fungal isolates.

For bacteria, it can be seen that the concentration of 15% and 10% of *C. myrrh* extract were more effective on bacteria growth compared to 20 %. The concentration of 15%of *C. myrrh* extract had the highest efficiency only on three types of bacteria *Macrococcus* spp, *Microbacterium oxydans, Brachybacterium* spp. While the concentration of 10%of *C. myrrh* extract had the highest efficiency on the rest of the bacterial isolates.

From Table 2, isolates were divided into three categories high, moderate, and low susceptibility to myrrh extract; it revealed that *Microbacterium oxydans* is the most bacterial isolates sensitive to *C. myrrh.* Generally, the bacterial isolates were more sensitive for *C. myrrh* extract than fungal isolates.

3.2. Statistical analysis

The significance of the three concentrations of myrrh extracts (20% / 15% / 10%) was evaluated to find which of these was more affected by the growth of the bacteria and fungi. Firstly, the normality by using the Kolmogorov-Smirnov and Shapiro-Wilk tests was investigated.

Table 2: Effect of *C. myrrh* different concentrations on the growth of tested organisms using inhibition percentage formula

Tested organism	10% of *C. myrrh* extract	15% of *C. myrrh* extract	20% of *C. myrrh* extract extract	Microbial sensitivity
Microbacterium oxydans	39.5	52.5	36	H
Brachybacterium nesterenkovii	47.9	42.9	39.5	
***Brachybacterium* spp**	34.2	46.2	26.8	
***Macrococcus* spp**	36.0	39.5	30.6	
***Microbacterium* spp**	39.5	36	28.7	
Sphingomonas aeria	39.5	34.2	30.6	
Micrococcus luteus	37.8	28.7	26.8	
Staphylococcus equorum	36.0	30.5	28.7	
Bacillus subtilis	36.0	30.5	28.7	
Staphylococcus epidermidis	33.5	24.9	22.9	M
Staphylococcus aureus	32.4	24.9	28.7	
Bacillus siamensis	28.7	24.9	22.9	
Purpureocillium lilacium	21.0	10.8	No effect	L
Aspergillus flavus	21.0	10.8		
***Penicillium* spp.**	12.9	6.6		
Aspergillus niger	8.7	2.2		

Note: H= highly sensitive; M= moderately sensitive; L=low sensitive.

- The null hypothesis H_0: the data sampling is normally distributed.
- The alternative hypothesis H_1: the data sampling is not normally distributed.

As we noticed from Table 3 below. We found that the Sig for two of three concentrations was not significant (higher than 5%) so, the null hypothesis was rejected, and the alternative hypothesis was accepted that the data was not normally distributed. Thus, we used a nonparametric test to investigate which was the best concentration.

Table 3: Test the normality for three concentrations of *C. myrrh* extracts (20%/15%/10%)

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
20% of *C. myrrh* extract	0.209	13	.125	0.885	13	0.083
15% of *C. myrrh* extract	0.197	13	.179	0.905	13	0.155
10% of *C. myrrh* extract	0.204	13	.142	0.834	13	0.018

Note: [a] Lilliefors Significance Correction

Nonparametric Kendal's w test for k related samples.

Table 4: Ranks for three concentration of *C. myrrh* extracts

Ranks	
	Mean Rank
20% of *C. myrrh* extract	1.50
15% of *C. myrrh* extract	1.96
10% of *C. myrrh* extract	2.54

Table 5: Test statistic

Test Statistics	
N	13
Kendall's W[a]	0.276
Chi-square	7.176
df	2
Asymp. Sig.	0.028

Note: [a] Kendall's Coefficient of Concordance.

- **The null hypothesis H_0:** All concentrations of *C. myrrh* had the same efficiency.
- **The alternative hypothesis H_1:** All concentrations of *C. myrrh* had different efficiency.
- The sig 0.028 was lower than 5% so the null hypothesis was rejected, and the alternative was accepted that the efficiency of different concentrations of *C. myrrh* was different.

Additionally, the means of the three concentrations were compared (Table 4, Figure 2) below. It indicated that the mean of 10% concentration for *C. myrrh* was mostly the highest one. This statistically means that the efficiency of three concentrations of myrrh extracts was not equal and the best concentration on the growth of most fungi and bacteria was 10%.

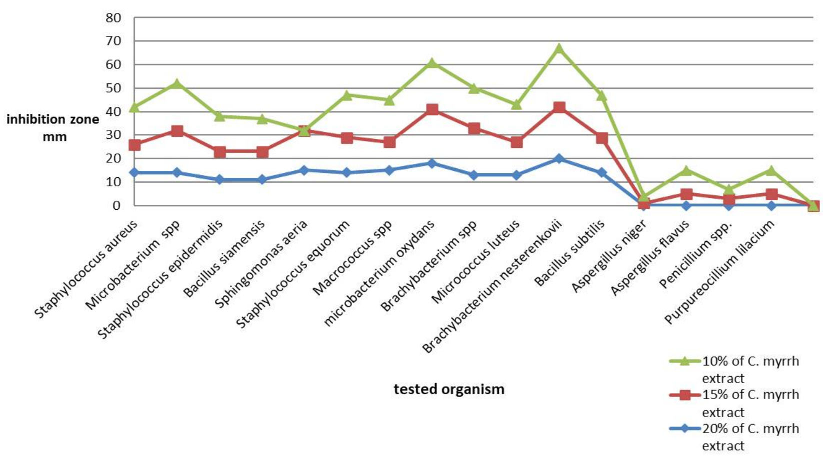

Figure 2: The means of the three concentrations of *C. myrrh* extracts

3.3. Antimicrobial assay

The concentration of the extract which caused the highest inhibition zone (10% or 15%) for most microbe was repeated three times to assure the effectiveness of the *C. myrrh* (in Tables 6 and 7). It can be seen that the results of the three experiments were close in each microbe tested.

Table 6: The antimicrobial effect of 15% of *C. myrrh* extract against microbial isolates. Zone of inhibition measured in mm.

Tested organism	First experiment for 15% *C.myrrh*	Second experiment for 15% *C.myrrh*	Third experiment for 15% *C.myrrh*	Average
***Macrococcus* spp**	**20mm**	**21mm**	**16mm**	**19mm**
microbacterium oxydans	**23mm**	**25mm**	**28mm**	**25mm**
***Brachybacterium* spp**	**20mm**	**18mm**	**24mm**	**20mm**

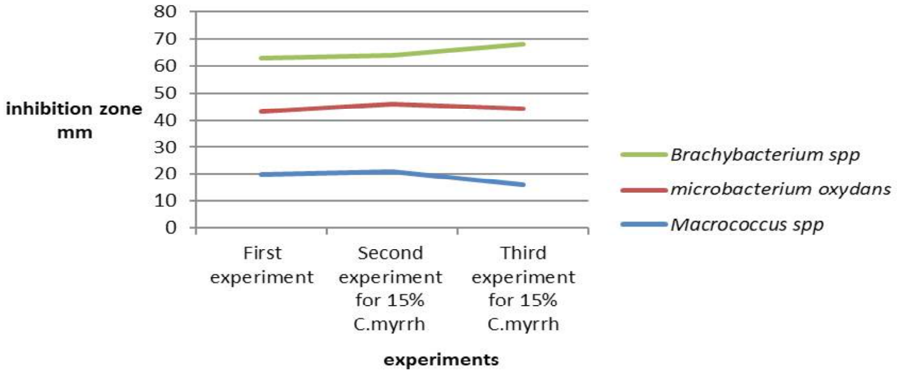

Figure 3 The effect of 15% of *C. myrrh* extract against microbial isolates

Table 7: The antimicrobial effect of 10% of *Commiphora myrrh* extract against microbial isolates. Zone of inhibition measured in mm

Tested organism	First experiment for 15% *C.myrrh*	Second experiment for 15% *C.myrrh*	Third experiment for 15% *C.myrrh*	Average
Staphylococcus aureus	16mm	15mm	17mm	16mm
Microbacterium spp	20mm	16mm	18mm	18mm
Staphylococcus epidermidis	15mm	13mm	14mm	14mm
Bacillus siamensis	14mm	11mm	12mm	12mm
Sphingomonas aeria	20mm	17mm	19mm	18mm
Staphylococcus equorum	18mm	20mm	19mm	19mm
Micrococcus luteus	16mm	18mm	19mm	18mm
Brachybacterium nesterenkovii	25mm	20mm	21mm	22mm
Bacillus subtilis	18mm	16mm	17mm	17mm
Aspergillus niger	3mm	2mm	4mm	3mm
Aspergillus flavus	10mm	5mm	7mm	7mm
Penicillium spp.	4mm	5mm	6mm	5mm
Purpureocillium lilacium	10mm	6mm	8mm	8mm

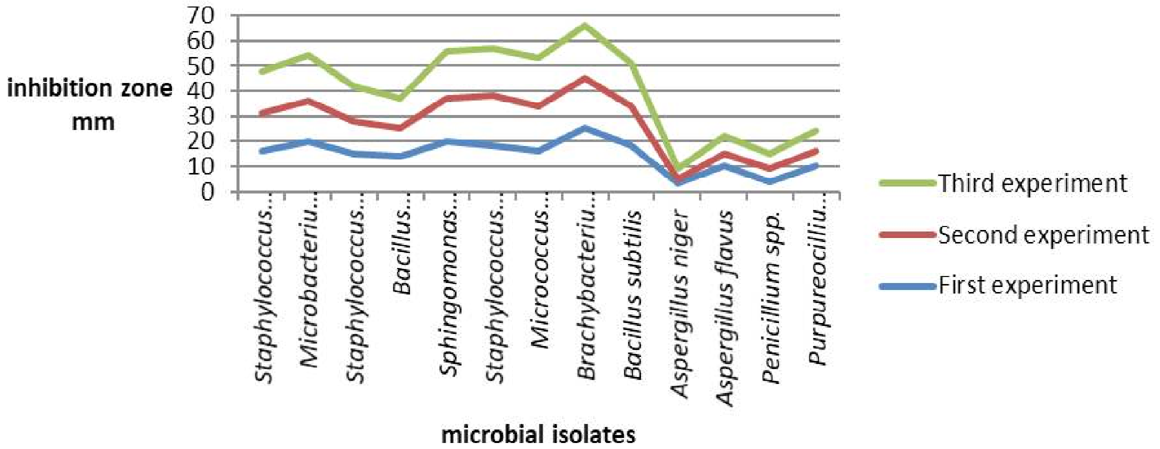

Figure 4: The effect of 10% of *C. myrrh* extract against microbial isolates

3.4. Compared the efficiency of Commiphora myrrh with a chemical reagent used in a salon

Table 8 showed the comparison of antimicrobial activity of *C. myrrh* extract on each microbe with a chemical reagent used in the salon (barbicade solution). For bacterial isolates, *Commiphora myrrh* extract showed a high effect against three bacterial isolates: *Brachybacterium* spp, *Microbacterium* spp, and *Brachybacterium nesterenkovii* compared to the chemical reagent, and *Brachybacterium nesterenkovii* was the most sensitive bacteria against *C. myrrh* extract. While *C. myrrh* extract showed a similar effect on *Sphingomonas aeria* to the chemical reagent. Chemical reagent showed a higher effect on the rest of bacterial isolates, especially on *Microbacterium oxydans*.

On the other side, the chemical reagent showed a higher effect on all fungal isolates than *C. myrrh* extract, especially on *Penicillium* spp. In general, it can be said that the effect of *C. myrrh* extract was close to that of the chemical reagent used in the salon (barbicade solution) in most bacterial isolates. The zone of inhibition obtained for some isolates are presented in Figures 5, 6, 7, 8, 9, and 10.

Table 8: Comparison of the effect of *C. myrrh* extract and barbicade solution on the inhibition of microbial

Tested organism	Inhibition % of *C. myrrh* extract	Inhibition % of barbicade solution
Microbacterium oxydans	44.6	74.9
Brachybacterium nesterenkovii	47.8	39.5
Brachybacterium spp	39.5	32.3
Macrococcus spp	41.2	50.9
Microbacterium spp	39.5	37.8
Sphingomonas aeria	39.5	39.5
Micrococcus luteus	32.4	50.9
Staphylococcus equorum	36	39.5
Bacillus subtilis	36	47.8
Staphylococcus epidermidis	30.6	39.5
Staphylococcus aureus	34.2	50.9
Bacillus siamensis	28.7	39.5
Purpureocillium lilacium	21	24.9

Table 8 (Cont.)

Tested organism	Inhibition % of *C. myrrh* extract	Inhibition % of barbicade solution
Aspergillus flavus	21	30.6
Penicillium spp	12.9	36
Aspergillus niger	8.7	26.8

Figure 5: The antibacterial activity of (A) *C. myrrh* extract and (B) barbicide solution against *Macrococcus* spp

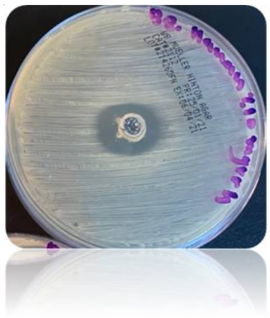

Figure 6: The antibacterial activity of(A) *C. myrrh* extract and (B) barbicide solution against *Brachybacterium nesterenkovii*

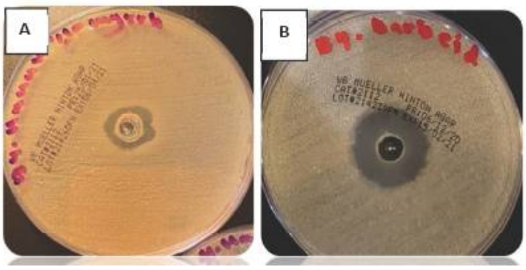

Figure 7: The antibacterial activity of (A) *C. myrrh* extract and (B) barbicide solution against *Bacillus subtilis*

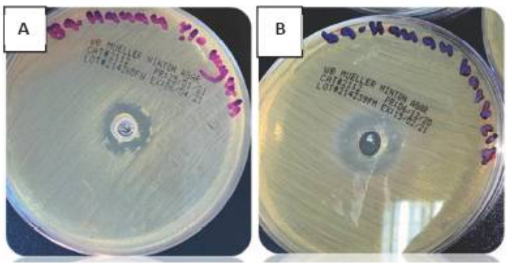

Figure 8: The antibacterial activity of(A) *C. myrrh* extract and (B) barbicide solution against *Microbacterium* spp

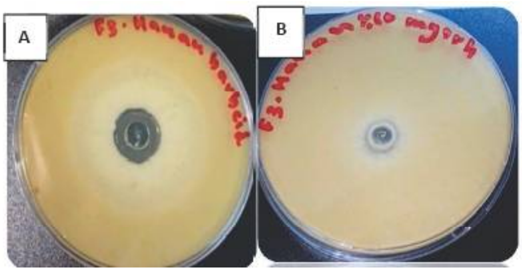

Figure 9: The antibacterial activity of (A) barbicide solution and (B) *C. myrrh* extract against *Penicillium* spp

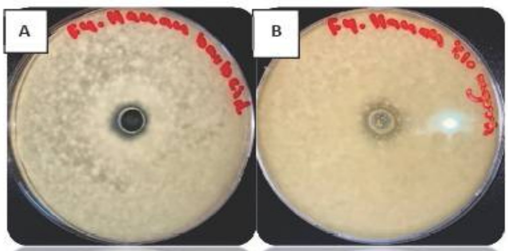

Figure 10: The antibacterial activity of (A) barbicide solution and (B) *C. myrrh* extract against *Aspergillus flavus*

3.5. Statistical analysis

To compare the efficiency of *Commiphora myrrh* with a chemical reagent used in a salon statistically. Firstly, the normality was investigated by using the Kolmogorov-Smirnov and Shapiro-Wilk tests.

- The null hypothesis H_0: the data sampling follows the normal distribution.
- The alternative hypothesis H_1: the data sampling does not follow the normal distribution.

It can be noticed from Table 9 below that the sig for *C. myrrh* extract concentrations was not significant (higher than 5%) and the sig for barbicide solution was significant so we rejected the null hypothesis and accepted the alternative hypothesis that the data was not normally distributed. So, the decision was to apply a nonparametric test. A nonparametric test was applied to investigate which is the best concentration (Mann-Whitney).

- The null hypothesis H_0: the mean of Inhibition % of *C. myrrh* extract and barbicide solution are equal.

The alternative hypothesis (H_1): the mean of Inhibition % of *C. myrrh* extract and barbicide solution are not equal.

The significance for Mann Whitney 0.073 (Table 11) was higher than 5%, so we accepted the null hypothesis that the mean of Inhibition % of C. myrrh extract and barbicide solution were equal.

Table 9: Test the normality for the Inhibition % of *C. myrrh* extract and the Inhibition % of barbicide solution

Tests of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistics	**df**	**Sig.**	**Statistics**	**df**	**Sig.**
Inhibition % of *C. myrrh* extract	.137	16	.200*	.929	16	.237
Inhibition % of barbicide solution	.248	16	.010	.881	16	.040

Note: a. Lilliefors Significance Correction; *. This is a lower bound of the true significance.

Table 10: Ranks for the *C. myrrh* extract (code 1.00) and the barbicide solution(code 2.00).

Ranks				
	Codes	**N**	**Mean Rank**	**Sum of Ranks**
samples	1.00	16	13.53	216.50
	2.00	16	19.47	311.50
	Total	32		

Table 11: Test statistics

Test Statistics[b]	
	Samples
Mann-Whitney U	80.500
Wilcoxon W	216.500
Z	-1.806
Asymp. Sig. (2-tailed)	.071
Exact Sig. [2*(1-tailed Sig.)]	.073[a]

Note: a. Not corrected for ties; b. Grouping Variable: codes.

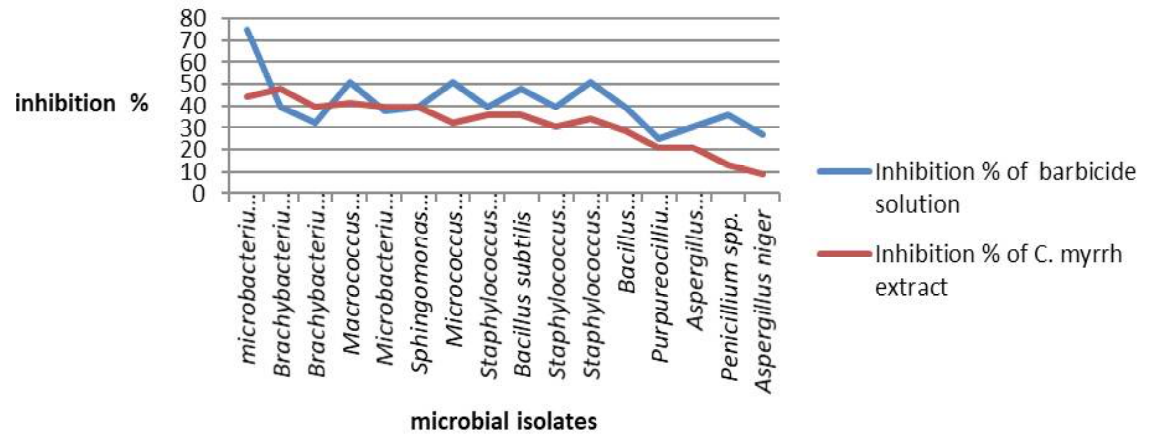

Figure 11: Comparison of the Inhibition % of *C. myrrh* extract with the Inhibition % of barbicide solution

4. Discussion

As a safe substitute for chemical reagents to sterilize salons, the extract of *Commiphora myrrha* was the focus of our study. Previous investigations have explored the antimicrobial activity of *C. myrrh* (Abdallah *et al*., 2009; Gadir and Ahmed, 2014; and Saadabi *et al*., 2006). An *in vitro* study of sesquiterpenes derived from myrrh discovered antibacterial activity against *Pseudomonas aeruginosa*, *S. aureus*, *Escherichia coli*, and *Candida albicans*, all clinically relevant bacterial species (Omer and Al-Dogmi, 2018; and Saadabi *et al*., 2006). From a medical perspective, myrrh has been used since ancient times for the treatment of several diseases, as an astringent, antiparasitic, antiseptic, and anticough agent, as well as to manage spasms and menstruation pain (Shuaib *et al*., 2013; Singh *et al*., 2013; and Wanner *et al*., 2010). Furthermore, myrrh is commonly used in traditional Chinese medicine to reduce pain and swelling due to traumatic injury (Vander Zanden, 1980), and its extract has been shown useful for the treatment of indigestion and diabetes mellitus (Al-Awadi, 1987).

The sensitivity of microbial isolates obtained from salons to alcohol extract of *C. myrrh*, at three concentrations (10%, 15%, and 20%), was tested by the agar well diffusion method. The concentration of 10% *C. myrrh* extract had a high effect on most bacterial isolates. This result was similar to a previous study by Al-Hussaini *et al*. (2015), who reported that the alcohol extract of *C. myrrh* at a concentration of 10% was effective against all of the microbial groups tested, either fungi or bacteria, compared with an aqueous extract of *C. myrrh*. The microbes tested in their study were *C. albicans*, *Epidermophyton floccosum*, *Microsporum audouinii*, *Trichophyton concentricum*, *Trichophyton tonsurans*, *Trichophyton rubrum*, *B. subtilis*, *P. aeruginosa*, *S. aureus*, and *E. coli.* Another study by Vishakha and Ramyasree (2015) on five bacterial strains (*Enterococcus*, *P. aeruginosa, Klebsiella pneumonae*, and *S. aureus*) reported that 100 mg / mL alcohol extract of *C. myrrh* was the best compared to 50 and 25 mg / mL lower concentrations. Moreover, *Enterococci* were the most sensitive to *C. myrrh* in all organisms tested in the study, whereas *S. aureus* was the least sensitive (Vishakha and Ramyasree, 2015).

The concentration of the *C. myrrh* extract showing the highest inhibitory activity against each microbe was compared with that of a chemical reagent used in the salon (barbicide solution). It was observed that the *C. myrrh* extract had an antimicrobial effect on most bacterial isolates similar to that of the barbicide solution. In contrast, in the case of fungi, the barbicide solution was more effective than *C. myrrh* on preventing the growth of all fungal isolates. Nevertheless, a previous study on 20 fungi (*Acremonium strictum*, *A. flavus*, *Aspergillus sydowii*, *Chaetomium globosum*, *Cladosporium cladosporioides*, *Cladosporium sphaerospermium*, *Cladosporium verrucocladosprioides*, *Cochliobolus spicifer*, *Drechslera biseptata*, *Embellisia chlamydospora*, *Eurotium amstlodami*, *Fusarium semitectium*, *Myceliophthora lutea*, *Penicillium chrysogenum*, *Penicillium fellutanum*, *Penicillium reticulosum* ,*Phoma tropica*, *Torula caligans*, *Trichoderma psudokoningii,* and *Ulocladium consortiale*) revealed that the best efficacy of *C. myrrh* extract was at a concentration of 20% (Al-Sabri *et al*., 2015). Moreover, the highest efficacy was against *Trichoderma psuedokoningii* and *A. strictum*, whereas the lowest efficacy was against *U. consortiale*. Altogether, these results indicate that *C. myrrh* extract may be used in beauty salons as a safe and natural sterilization method.

5. Conclusion

It was observed that the *C. myrrh* extract showed an effect close to barbicide solution on most bacterial isolates, while in the case of fungi, barbicide solution was a high and clear effect on all fungal isolates; Because of its active substance alkyl dimethyl benzyl ammonium chloride which is killing the fungi and their spores. All the results found indicate that *C. myrrh* extract may be used in salon tools sterilization methods as a safe and natural method. The findings of these studies may have been limited by the variable types of microorganisms present in the collected samples. Besides, the approaches used may not have been conducive to isolating all types of contaminating organisms; some organisms may require special conditions to grow on agar plates or tissue culture propagation in the case of viruses and other parasites.

We aim to heighten salon standards of care used in sterilizing beauty tools and products and storing them properly. Besides, we highly recommend the use of individual cosmetic kits. All of these recommendations, if employed, should contribute significantly to a reduction in the spread of infection and disease through beauty salons. Here, a little try has been made to investigate the efficacy of *C. myrrh* extract; so, more examination is required for the efficacy of *C. myrrh* extract or other natural extracts which could be used as a safe and reliable method for sterilizing beauty tools.

Recommendation

To date, limited information is available on the antimicrobial efficacy of *C. myrrh* extract in the field of cosmetics; therefore, further investigations are warranted to further explore the potential of *C. myrrh* or other natural extracts that could be used as a safe and reliable method for sterilizing beauty tools.

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