

Antibacterial Activity of Some Disinfectants and Detergents on some pathogenic bacteria

* Siham Sh. AL-Salihi/Northern Technical University, Iraq
** Israa A. Mohammed jumaah /Northern Technical University, Iraq
*** Assist.prof, Sayran S. Saleh /Kirkuk University, Iraq

Abstract

The fulminate of microorganism with reduced susceptibility to antibacterial agent is a major health problem. The study evaluated the antibacterial effect of seven disinfectants and detergents hydrogen peroxide, apple cider vinegar, sodium hypochlorite, iodine, detol, sodium chloride solution and tite altunsa detergent at five different concentration was used and five types of plant oils included castor oil, olive oil, clove oil, sweet almond oil and pumpkin seed oil to determine their efficacy on selected gram positive and negative bacteria. Agar diffusion well method was applied for each bacterial isolate then incubate at 37 for 24 hrs then inhibition zone were recorded. Hydrogen peroxide with (1-5%) exhibit high activity into *Shigella flexeneri*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Acinetobacter baumani* with inhibition zone (40mm) while (4-5%) showed activity into *Streptococcus agalactiae*, *Pseudomonas aeruginosa* and (1-3%) of it showed activity into *Escherichia coli* and *Proteus mirabilis* whereas *Enterobacter sakazaki* recorded inhibition zone 40 mm at (2-3%). Sodium chloride solution appeared activity only on *Enterococcus faecalis* at (5,10,15,20%) and *Acinetobacter baumani* at 20%. Tite detergent exhibit activity into *Staphylococcus aureus* and *Streptococcus agalactiae*. Detol was found activity into *Enterococcus faecalis* and *Staphylococcus aureus* at (3-5%) and *Streptococcus agalactiae* with concentration (2-5%). Iodine showed considerable activity with inhibition zone (20-3mm) for all selected bacteria at (3-5%). Apple cider vinegar appeared activity into *Shigella flexeneri*, *Acinetobacter baumani*, *Streptococcus agalactiae* whereas at (80-100%) concentration into *Staphylococcus aureus*, *E. coli* and inhibit growth of *Pseudomonas aeruginosa* and *Proteus mirabilis*. Plant oil didn't appear antibacterial activity into chosen bacteria except clove oil affected on *Proteus mirabilis* and *Staphylococcus aureus*. Sodium hypochlorite appeared higher activity to *Staphylococcus aureus* with moderate activity against *Shigella flexeneri*, *Acinetobacter baumani*, *Streptococcus agalactiae* whereas did not appear any activity against *Proteus mirabilis* and has lower activity to others.

Conclusions: Hydrogen peroxide at 3% had potent activity followed absolute Apple cider vinegar and 5% Iodine had suitable activity against all selected bacteria .

Key words: disinfectant , antibacterial, Hydrogen peroxide .

INTRODUCTION

Liquid antiseptics and disinfectants are widely used in homes and hospitals to control the growth or remove pathogenic microbes potentially on both living tissue and inanimate objects which are important aspect of infection control practices and prevention of hospital acquired infection[1]. In last decade, gram negative bacteria become more prevalent instead of *Staphylococcus aureus* in infection acquired from hospitals [2]. morbidity and mortality with high rate caused by resistant pathogen ,and participate to increased healthcare costs worldwide despite the availability of newer antibiotics, emerging bacterial resistance to antibiotic has become a major problem in the world [3]. Hand washing with soap (soaps can remove 65 to 85% bacteria from human skin) and water been considered a measure of personal hygiene. Bacteria are numerous and exist in environment and even in human body. Bacteria's that cause human diseases has great importance with reference to health [4]. Although fats and oils are general soaps component but some and to enhance the antibacterial activities of soaps some detergents were added [5]. Transient bacteria such us *Staphylococcus aureus* and *Pseudomonas aeruginosa* are deposited on the skin surface from environmental sources and may causes skin infections[6].

Common use of these agents enhance development of bacterial resistance[7]. Development of resistance to biocides and antimicrobial agents and is particularly warning problem which is associated by cross-resistances mechanisms (between antibiotic and between antibiotic and biocide) that may appear in certain bacteria such as

pathogenic gram-negative bacteria which are less susceptible to biocides because of their complex cell wall [8, 9] of gram- negative bacteria in which the outer membrane act as permeability barrier in limiting or prevention the entry of many chemically unrelated types[10]. It will be continuing needed for novel and potent antimicrobial for control and elimination of microbial pathogens[11]. Combining antimicrobials could encourage their activities (via additive effects or synergism) and could help to overcome acquired microbial resistance to single chemicals [12].

The iodine antiseptics advantage is their wide scope of antimicrobial activity, killing all principal pathogens and spores which are consider to be the most difficult form of microorganisms during given enough time that inactivated by disinfectants and antiseptics in hospitals[13]. Hydrogen peroxide is a peroxygen demonstrates broad-spectrum efficacy against viruses, bacteria, yeasts, and bacterial spores In general, greater activity is seen against gram-positive than gram-negative bacteria; More commonly, 3% solutions of hydrogen peroxide have been used in household first aid for scrapes [14]. Peracetic acid (PAA) (CH_3COOOH) is considered a more potent biocide than hydrogen peroxide, being sporicidal, bactericidal, virucidal, and fungicidal at low concentrations (<0.3%) [15]. Essential oils are aromatic oily liquids obtained from plant materials (flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots) and can be prepared by expression, fermentation or extraction but the method of steam distillation have been shown to possess antibacterial, antifungal, antiviral insecticidal and antioxidant properties

and is most commonly used for commercial production [16]. Some problems associated with acquired microbial resistance and side effects to single antimicrobials could be minimized by using them at lower concentrations in combination. Prerequisites for decreasing concentrations of biocides should be their synergistic or additive effects in mixtures. Increased antimicrobial activities of hydrogen peroxide were shown in combinations with other compounds [17] and few studies were reported with Iodine [18]. Gibson *et al.* (1998) have suggested the need to test antiseptics, like antibiotics in order to determine their activity against a range of organisms [19]. Therefore, the study aimed to determine inhibitory effect of detergents, essential oils and disinfectants and the potential use of combination between these compounds on growth on some nosocomial pathogenic bacteria.

MATERIALS AND METHODS

Bacterial isolates and media

The clinical isolates of nine bacteria were collected and identified in Azadi teaching hospital and re-identified in the medical laboratory techniques department. Blood agar base and MacConky agar from [Bury, Lancashire United Kingdom], Mannitol salt agar, and Brain-Heart infusion agar and broth, Muller-Hinton agar prepared according manufactured company (Himedia India). Heated to boiling to dissolve the medium completely, sterilized by autoclaving at 15 lbs. pressure. (121 °C) for 15 minutes. Any solutions which used in this study were sterilized by filtration by Millipore filter with diameter 0.22µm.

Agar diffusion well assay

Suspension of bacteria prepared by transferred an inoculums from the bacteria to a test tube contained 5 ml sterilized normal saline compare and adjusted with the tube No. (0.5) of McFarland standard which gives a cell density 1.5×10^8 cell/ml. A sterile cotton swab is dipped into the suspension and then swabbed evenly across the surface of a Muller-Hinton agar plate; the plates were incubated at 37 °C for 30 minutes. After that 100 µL from each prepared diluted concentration (Table 1) (detergent, disinfectant) and essential oil (not diluted) were added to each of the wells (7 mm diameter holes cut in the agar gel, 20 mm apart from one another). Except the plates of *Streptococcus agalactiae* and *Enterococcus faecalis* incubated under anaerobic condition in candle jar, all other plates were incubated (not converted) for 24 h at $36^\circ \text{C} \pm 1^\circ \text{C}$, under aerobic conditions. After incubation, Inhibition of the growth was measured in mm. Tests were performed in duplicate [21].

Detergent and disinfectant solutions concentrations

Five concentration (1% ,2% ,3% ,4% ,5%) were selected from each of detol, Hydrogen peroxide, Apple cider vinegar ,Lugol's Iodine and Sodium chloride while Sodium hypochlorite is so strong we used low concentrations (0.25% ,0.5%,0.75%,1% ,1,25%) and detergent (Altunsa) used selected 0.05%, 0.15%, 0.25%, 0.35%, 0.45% concentrations.

Essential oil preparation

Essential oil either tested solely (not diluted neither mixed as provided by manufacture company) or combination

made by mixing equal volume of each type (v/v) in tubes then added to wells.

RESULTS

In this study six types of gram negative bacteria and three types of gram positive bacteria were selected and the following results were obtained:

E. coli showed sensitivity to hydrogen peroxide at 1-3% and absolute vinegar with inhibition zone 40mm and considerable effect to 4-5% of iodine with inhibition zone 15-20mm respectively.

Pseudomonas aeruginosa exhibit susceptibility to all selected concentration with high inhibition zone 40mm at (4-5%) while apple cider vinegar showed bacteriostatic effect at 60-80% whereas iodine had low activity to *P. aeruginosa* with 12+3 mm at 2-5% .

Shigella flexneri had sensitivity to hydrogen peroxide at all selected concentration with inhibition zone 40mm followed apple cider vinegar with high susceptibility at 60-100% than 20-40% which got 10-20mm respectively followed to iodine that appeared suitable activity at 3-5% with inhibition zone 20,20,30mm respectively.

Acinetobacter baumani showed sensitivity to hydrogen peroxide at five selected concentration followed to apple cider vinegar and iodine while sodium hypochlorite recorded (20,25)mm at 1%,1,25% .

Proteus mirabilis was effected to hydrogen peroxide at 1-3% while exhibit bacteriostatic effect to apple cider vinegar and iodine.

Enterobacter sakazaki appeared resistance each of detol ,tite detergent and sodium chloride solution whereas effected to hydrogen peroxide with high sensitivity at 2-3% and absolute apple cider vinegar recorded 25mm .Iodine and Sodium hypochlorite has less activity to *E. sakazaki*.

Regarding gram positive bacteria *Staphylococcus aureus* appeared sensitivity to hydrogen peroxide at five chosen concentration with inhibition zone 40mm and same inhibition zone recorded at 3-5% of detol .Iodine showed resistance at 1% then was susceptible with increase concentration which recorded 40mm at 5%. This showed impact of tite detergent on gram positive bacteria especially *Staph. aureus* which effected at all concentrations. Sodium hypochlorite exhibit potent activity to *Staph. aureus* which recorded 45mm at 1.25%.

Streptococcus agalactiae were effected to hydrogen peroxide at 3-5% followed iodine and tite detergent at all selected conc. Apple cider vinegar, detol and Sodium hypochlorite had low activity to *S. agalactiae*.

Enterococcus faecalis showed sensitivity to hydrogen peroxide, detol in all selected conc. and 5% of iodine with inhibition zone 40mm . *E. faecalis* is the only bacteria showed sensitivity to sodium chloride solution at 5%,10%,15%,20% .

All selected bacteria were resistant to the plant oil except clove oil was effective against of *Staph. aureus* and *Proteus mirabilis*. When combine hydrogen peroxide with either iodine or apple vinegar showed antagonism effect except in *S. agalactiae* the inhibition zone recorded 15mm which is better than use hydrogen peroxide or apple vinegar alone.

Table1: Disinfectants, detergents and whole plant oil used in this study

Source	Company name/product
Hydrogen peroxide (absolute) PH=4.9	Schailau company/Indian
Sodium hypochlorite 6% PH=14	FAS/Iraqi
Sodium chloride (Nacl) powder	Zer /Turkish
Apple cider vinegar PH=2	Zer /Turkish
Lugol's Iodine 5%	Eisen-Golden/Laboratories/ USA
Detol (Lenol) hlroxylenol, pine oil, unknown conc. PH=8	Spartan /Jordan
Detergent (Altunsa)	Altunsa company/Turkish product
Coconut oil	Hemani International/Keps/ Pakistan
Clove oil	Hemani International/ Keps/ Pakistan
Pumpkin oil	Emad factory for herbs plant oil/Iraqi
Castor oil	Emad factory for herbs plant oil/Iraqi
Olive oil , first cold press)	Al-Wazir –company /Lebanon
Sweet almond oil	Hemani International/Keps/ Pakistan

Table 2: Antibacterial activity of apple cider vinegar against tested bacteria.

Bacterial name apple cider vinegar concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
20%	0	10	11*	0	12	12	0	8	0
40%	10	20	20 *	0	12	*20	0	10	0
60%	0	40	24 *	10	18	24* 13	10	14	0
80%	15	40	26 *	10	23	28* 18	20	15	0
100%	40	40	32 *	25	24	24* 16	20	15	14

*Bacteriostatic

Table 3: Antibacterial activity of NaCl solution against tested bacteria.

Bacterial name NaCl concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
1%	R	R	R	R	R	R	R	R	R
2%	R	R	R	R	R	R	R	R	R
3%	R	R	R	R	R	R	R	R	R
4%	R	R	R	R	R	R	R	R	R
5%	R	R	R	R	R	R	R	R	40
10%	R	R	R	R	R	R	R	R	40
15%	R	R	R	R	R	R	R	R	40
20%	R	R	R	R	30	R	R	R	40

Table 4:Antibacterial activity of sodium hypochlorite against tested bacteria.

Bacterial name Sodium hypochlorite concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
0.25%	10	9	R	5	8	R	30	10	R
0.5%	10	11	R	10	R	5	32	10	12
0.75%	10	13	R	15	R	10	33	18	10
1%	15	17	R	10	20	15	40	20	11
1.25%	15	22	R	15	25	15	45	18	13

Table5: Antibacterial activity of hydrogen peroxide against tested bacteria.

Bacterial name Hydrogen peroxide concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
1%	40	40	32	20	34	26	40	R	40
2%	40	40	20	40	42	24	40	R	40
3%	40	40	40	40	40	28	40	17	40
4%	R	40	R	30	40	40	40	40	40
5%	R	40	R	20	40	40	40	40	40

Table 6: Antibacterial activity of iodine against tested bacteria.

Bacterial name Iodine concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
1%	R	R	R	R	R	R	R	14	R
2%	R	15	14*	10	13	8	10	16	R
3%	10	20	28*	15	20	12	15	17	12
4%	15	20	12*	15	20	12	20	20	12
5%	20	30	18	20	26	15	40	40	22

*Bacteriostatic

Table 7: Antibacterial activity of detol against tested bacteria

Bacterial name Detol concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
Detol 1%	R	R	R	R	R	R	5	R	40
Detol 2%	R	R	R	R	R	R	5	15	40
Detol 3%	R	R	R	R	10	R	40	15	40
Detol 4%	R	R	R	R	10	R	40	20	40
Detol 5%	R	R	R	R	10	R	40	20	40

Table 8: Antibacterial activity of detergent(tite) against tested bacteria

Bacterial name Tite concentrations	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
0.05%	R	R	R	R	R	R	20	15	R
0.15%	R	R	R	R	R	R	26	20	R
0.25%	R	R	R	R	R	R	30	22	13
0.35%	R	R	R	R	R	R	38	25	R
0.45%	R	R	R	R	R	R	40	30	10

Table 9: Antibacterial activity of some plant oil against tested bacteria.

Bacterial name Types of plant oil	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
Clove oil	R	R	20	R	R	R	20	R	R
Olive oil	10	R	R	R	R	R	R	R	R
Castor oil	R	R	R	R	R	R	R	R	R
Sweet almond oil	R	R	R	R	R	R	R	R	R
Pumpkin seed oil	R	R	R	R	R	R	R	R	R
Clove oil+ pumpkin seed oil	R	R	R	R	R	R	R	R	R

Table 10: Effect of combination between disinfectants against tested bacteria

Bacterial name Type of combination	<i>Escherichia coli</i>	<i>Shigella flexeneri</i>	<i>Proteus mirabilis</i>	<i>Enterobacter sakazaki</i>	<i>Acinetobacter baumani</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Streptococcus agalactiae</i>	<i>Enterococcus faecalis</i>
	Zone of inhibition in millimeter								
H ₂ O ₂ 1% +20% vinegar	20	23	R	20	40	25	40	15	40
H ₂ O ₂ 1% + 3% iodine	5	12	R	10	15	10	40	R	40
Vinegar 3% + 3% iodine	10	15	R	5	20	20	20	R	40
H ₂ O ₂ 5% + 5% vinegar	30	40	R	20	40	45	40	30	40
H ₂ O ₂ 5% + +5% iodine	40	40	R	40	40	40	30	24	20

DISCUSSION

Environmental contamination has been demonstrated to play an important role in the transmission of certain nosocomial pathogens and the emergence of resistant microorganisms in hospitals and the community is causing problems for both the treatment of patients and infection control including methicillin-resistant *Staphylococcus aureus*, glycopeptide resistant enterococci [22]. Therefore the study intend to found the efficacy of different disinfectants on nosocomial pathogens.

Hydrogen peroxide showed potent activity into gram positive and gram negative bacteria at different concentration . This study disagree with another study that recorded MRSA isolates exhibited considerable resistance to hydrogen peroxide (H₂O₂) at concentration below 1000 µg/disc but it was sensitive at higher concentrations. *E. coli* was resistant to the concentration of H₂O₂ (1000µg/disc) but it was sensitive at concentrations 3000, 5000 and 8000 µg/disc with inhibition zone 6, 7 and 11 mm, while *P. aeruginosa* exhibited resistance to most concentrations but it was sensitive to H₂O₂ only at concentrations 3000,5000 and 8000 µg/disc with inhibition zone 7,11 and 15mm [23]. Fakhriddeen, (2001) found in his study that *S. aureus*, *E. coli* and *P. aeruginosa* were resistant to lower concentrations 600 µg/disc of H₂O₂ who pointed out that MIC values of H₂O₂ for *P. aeruginosa*, *E. coli*, *S. aureus* were 1024 ,512 and 512µg/ml respectively He arranged the disinfectants according to their potency as chlorohexidine cetrimide, CHX, PVP-I, chloroxylenol, formaldehyde and H₂O₂ [24]. while Penna *et.al.*, (2001) mentioned that MIC values of (H₂O₂) for *E. coli* ranged between 1250-3700µg/ml and for *S.aureus* it ranged 625-938µg/ml[25].

Altunsa tite detergent appeared activity into gram positive bacteria and resisrance into gram negative bacteria this may be due to gram-negative bacteria are generally less susceptible to biocides than gram-positive species. Such resistance is likely to be intrinsic, due to outer membrane that acts as a protective barrier. Due to the capacity of surviving in unfavorable environmental conditions and to the high resistance to antibiotic agents, antiseptics and disinfectants, bacteria species continues to bean important pathogen in hospital acquired infections, mainly respiratory and urinary infections [26].

Sodium hypochlorite appeared higher activity to *Staphylococcus aureus* with lower activity to *E. coli* and moderate activity into *Shigella flexeneri* , *Acinetobacter baumani* , *Streptococcus agalactiae* whereas resistance to *Proteus mirabilis* . Another study showed that MRSA was resistant to all concentration of sodium hypochlorite below 3000µg/disc while it was sensitive to the concentrations of 3000,5000 and 8000 µg/disc with inhibition zone 4,7 and 11 mm respectively while *E. coli* and *P. aeruginosa* were resistant to all sodium hypochlorite concentrations. MRSA was inhibited only at concentration ≥1000 µg/ disc [23]. Penna *et.al.*, (2001) found that MIC values of sodium hypochlorite for *E. coli* and *S. aureus* which ranged between (1109-1497) µg/ml[25], while the Penna *et.al.*,(2002) found that MIC values of sodium hypochlorite for *P. aeruginosa* was 2500µg/ml[27]. (Lee *et al*, 2009) concluded from their study that the optimum washing and

sanitizing conditions for lettuce containing *S. aureus* using sodium hypochlorite are depending on concentration, period of immersion and temperature [35].

Iodine had activity at 3-5% for all selected bacteria with bacteriostatic effect into *Proteus mirabilis* at 2-4% . The present study incompatible with [28] which exhibited Iodine resistance to *E. coli*, *Staph. aureus*, *P. aeruginosa* and sensitivity to *Proteus sp.* The unsusceptible of *Proteus mirabilis* to iodine may be due to the capacity of surviving in unfavorable environmental conditions and its high resistance to antibiotic agents, antiseptics and disinfectants.

Apple cider vinegar exhibit activity into *Shigella flexeneri*, *Acinetobacter baumani* ,*Streptococcus agalactiae* whereas at (80-100%) concentration into *Staphylococcus aureus* , *E. coli* and inhibit growth of *Pseudomonas aeruginosa* and *Proteus mirabilis* . Another study appeared the minimum dilution of Apple Cider Vinegar required for growth inhibition *S. aureus*, a 1/25 dilution ACV was required, whereas for *E-coli* cultures, a 1/50 ACV dilution was required [29]. ACV has multiple antimicrobial properties on different microbial species, affecting microbe growth, suppressing mononuclear cytokine and phagocytic responses. The tandem mass spectroscopy results are in cohesion with these observations. The microbes underwent significant impairment following ACV addition which damaged cell integrity, structural and metabolic proteins as well as nuclear material [30].

The study appeared Detol resistance to gram negative bacteria and susceptible to gram-positive bacteria. In addition, in gram-negative bacteria, the outer membrane acts as a selective permeability barrier in limiting or preventing the entry of many unnecessary or harmful chemical compounds into the bacterial cell [31]. The changes in permeability system may lead to acquire resistance to biocidal compounds [32].The outer membrane of *P. aeruginosa* is responsible for the high resistance in comparison with other organisms. This phenomenon is ascribed to some differences in Lipopolysaccharide (Lps) composition and in the cation content of the outer membrane, which aids in producing strong Lps-Lps links that selecting permit general diffusion through them [33]. Furthermore, *P. aeruginosa* possesses active efflux pump system acts as wide transporters for a whole range of biocides and antibiotics, that coupled with the narrow porin channels in the outer membrane of this organism, restrict diffusion of many antimicrobial agents into the cell[34]. Another study exhibited that relative sensitivity of MRSA to detol at concentrations of 100,200,300,400 and 500 µg/ml with inhibition zone of 8,14,18,21 and 25mm but it was not affected by concentrations below 100 µg/disc while *E. coli* and *P. aeruginosa* revealed full resistance to all concentration of chloroxylenol (50-500 µg/disc)[23].

[24] showed that *S. aureus* and *E. coli* were resistant to Detol in 10-100µg/disc ,but they were sensitive to this disinfectants at increased concentrations whereas *P. aeruginosa* was full resistant to all concentrations of chloroxylenol up to 500µg/disk . The effect of Detol was assessed also by [36] against some microorganisms associated with nosocomial infection including *S. aureus*, it

was highly effective like this study results, results of this study regarding Detol are similar to that obtained by [37] as the study recorded inhibition zones ranging from 28 to 17 mm for 100% to 5% concentration.

Combination of 1% Hydrogen peroxide with 3% iodine lead to antagonism except *Enterococcus faecalis*, *Staphylococcus aureus* the inhibition zone increase comparing than use iodine alone and showed static effect comparing to individual 1% Hydrogen peroxide. When mixed 1% Hydrogen peroxide with vinegar lead to synergism effect than use vinegar alone and showed antagonism effect except in *Streptococcus agalactiae*, *Acinetobacter baumani* the inhibition zone increased comparing than use 1% Hydrogen peroxide alone .when combine 5% Hydrogen peroxide with 5% iodine lead to synergism effect except *Enterococcus faecalis* and *Streptococcus agalactiae* the inhibition zone decrease from 40mm into 30mm . Another study showed Both Hydrogen peroxide and iodine were mostly cidal individually and in mixtures against *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Both compounds manifested static inhibitory effects individually, but their mixtures were synergistically cidal for *Saccharomyces cerevisiae* and *E. coli*[38]. From the present study we concluded use Hydrogen peroxide alone is better than combination .

The results concluded that the antibacterial effects of antiseptics and disinfectants are not only dependent on the types of antiseptics and disinfectant but also on their concentrations.

REFERENCE

- Saha AK, Haque MF, Karmaker S. and Mohanta MK. Antibacterial effects of some antiseptics and Disinfectants. J. Life Earth Sci., Vols. 3-4: 19-21, 2009.
- Todar Kenneth. (2004) *Pseudomonas aeruginosa* Todar's Online Textbook of Bacteriology. Kenneth Todar University of Wisconsin-Madison, Department of Bacteriology.
- Moellering C, Graybill R, Corey L. (2007). Antimicrobial resistance prevention initiative-an update: proceedings of an expert panel on resistance. Am. J. Med.120:S4-S25
- Johnson SA, Goddard PA, Iliffe C, Timmins B, Rickard AH, Robson G. & Handley PS. (2002). Comparative susceptibility of resident and transient hand bacteria to para-chloro- meta xylenol and triclosan. J. Appl. Microbiol. 93: 336-344
- Friedman M. & Wolf R. (1996). Chemistry of soaps and detergents: various types of commercial products and their ingredients. Clin. Dermatol. 14: 7-13.
- Fluit AC, Schmitz FJ. & Verhoef J. (2001). Frequency and isolation of pathogens from Blood stream, nosocomial pneumonia, skin and soft tissue, and urinary tract infections occurring in European patients. Eur. J. Clin. Microbiol. Infect. 20: 188 - 191.
- Randall P, Cooles W, Piddock V, Woodward J (2004). Effect of triclosan or a phenolic farm disinfectant on the selection of antibiotic-resistant *Salmonella enteric*. J. Antimicrob. Chemother. 54:621-627.
- Braoudaki M. and Hitton AC. (2004). Adaptive resistance to biocides in *Salmonella enterica* and *Escherichia coli* O157 and cross-resistance to antimicrobial. J.Clin.Microbiol.,42 (1):73-78.
- Lotfipour F, Nahaei MR, Milani M, Javaherzadeh V, Omranic A, Attar N.(2006) Antibacterial activity of Germicide-P: A Persulfate based detergent/disinfectant on dome hospital isolates. *Iranian Journal of Pharmaceutical Sciences*. 2: 225-230.
- Sheldon AT. (2005). Antiseptic Resistance: What Do We Know and What Does It Mean.Clin.Lab.Sci.,18(3):181-188.
- Lambert PA. (2002). Cellular impermeability and uptake of biocides and antibiotic in gram-positive bacteria and mycobacteria. J.Appl.Microbiol. Symposium.,92:46-54.
- Drexler KE. (1994). Molecular nanomachines: physical principles and implementation strategies. Ann.Rev.Biophys.Biomol.Structure.,23: 377-405.
- McDonnell G, Russell AD. Antiseptics and disinfectants: activity, action, and resistance. Clin Microbiol Rev. 1999;12(1):147-179.
- "Antiseptics on Wounds: An Area of Controversy: Hydrogen Peroxide". Medscape.com. Retrieved (2014)-03-04.
- Wilgus TA, Bergdall VK, Dipietro LA, Oberyszyn TM (2005). "Hydrogen peroxide disrupts scarless fetal wound repair". *Wound Repair Regen*. 13 (5): 513-9
- Block S S.(1991) Peroxygen compounds. In: Block S S, editor. Disinfection, sterilization, and preservation. 4th ed. Philadelphia, Pa: Lea & Febiger. pp. 167-181.
- Van de Braak SAAJ, Leijten GCJJ.(1999). Essential Oils and Oleoresins: A Survey in the Netherlands and other Major Markets in the European Union. CBI, Centre for the Promotion of Imports from Developing Countries, Rotterdam. p. 116.
- Martin H, Maris P. (2012). Synergism between hydrogen peroxide and seven antibiotics against six bacterial strains. J Appl Microbiol. 113(3):578-590. doi: 10.1111/j.1365-2672.2012.05364.x.
- Voboril R, Weberova J.(2004). Successful treatment of infected vascular prosthetic grafts in the groin using conservative therapy with povidone-iodine solution. Ann Vasc Surg. ;18(3):372-375. doi: 10.1007/s10016-004-0024-7.
- Gibson SAW, Fraiese AP, Dure A, Bloomsfield SF. and Reancharen. (1998). Journal of the Nigerian Infection Control Association. 1: pp 8-10.
- Smânia A, Monache FD, Smânia EFA, Cuneo RS. (1999). Antibacterial activity of steroidal compounds isolated from *Ganoderma applanatum* (Pers.) Pat. (Aphyllophoro-mycetidae) Fruit body. *Int. J. Med. Mushrooms*, 1, 325-330.
- French GL, Phillips I. (1996). Antimicrobial resistance in hospital flora and nosocomial infection. *Hospital Epidemiology and Infection Control*. Williams, B. and Wilkins, B. (Eds.). May-Hall: 980-990.
- Rasha Hadi Saleh, Habeeb Sahib Naher , Saad A. Al-Jubory. (2012). A Study of Efficacy of Disinfectants and Bacterial Contamination in AL-Hilla Teaching Hospital. Medical Journal of Babylon-Vol. 9- No. 4.
- Fakhriddeen AJ. (2001). A bacteriological study of the pathogens causing nosocomial infections. M.SC. Thesis in Microbiology. College of Science, Kufa Univ.
- Penna TCV, Mazzola PG, and Martins AM..(2001).The efficacy of chemical agents in cleaning and disinfection programs.J.BMC.Infect.Dis.,1: 16-31.
- Lotfipour F, Nahaei MR, Milani M, Javaherzadeh V, Omranic A, Attar N.(2006). Antibacterial activity of Germicide-P: A Per sulfate based detergent/disinfectant on dome hospital isolates. *Iranian Journal of Pharmaceutical Sciences*; 2: 225-230.
- Penna VTC, Martins S.A.M. and Mazzola, P.G.(2002). Identification of bacteria in drinking and purified water during the monitoring of a typical water purification system. BMC Public Health.,2:13-28.
- Abdu M, Alkolaibea Gamal A, AL-Amerib Mawhoob N, Alkadasic Abdubaset A. Zaid. (2015). Study of the Efficacy of Disinfectant against Bacterial Contamination in Burns Unit- Alqumhory and International Yemen Hospitals in Taiz City *International Journal of Research Studies in Biosciences (IJRSB) Volume 3, Issue 3, March, PP 26-33*.
- Darshna Yagnik, Vlad Serafin, and Ajit J. Shah.(2018). Antimicrobial activity of apple cider vinegar against *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans*; downregulating cytokine and microbial protein expression . Sci Rep.; 8: 1732.
- Yagnik D, Serafin V J, Shah A. (2018). Antimicrobial activity of apple cider vinegar against *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans*; downregulating cytokine and microbial protein expression. *Sci Rep*. 29;8(1):1732. doi: 10.1038/s41598-017-18618-x.
- Russell AD, Tattawasart U. Maillard J. and Furr JR. (1998). Possible Link between Bacterial Resistance and Use of Antibiotics and Biocides.J. Antimicrob.Agents.Chemother., 42(8):2151-2155.
- Sheldon AT. (2005). Antiseptic Resistance: What Do We Know and What Does It Mean. Clin.Lab.Sci.,18(3):181-188.
- Schweizer HP.(1998). Intrinsic resistance to inhibitors of fatty acid biosynthesis in *Pseudomonas aeruginosa* is due to efflux: application of a novel technique for generation of unmarked

- chromosomal mutations for the study of efflux systems. *Antimicrob. Agents. Chemother.*, 42:394-398.
34. Russell AD. and Chopra I. (1996). Understanding antibacterial action and resistance, Ellis Horwood, Chichester, United Kingdom.
- 35- Lee Y, Jo S, Cho S, Kim G, Kim Y, Lee D, Park S, Bae D, Chung M, Bahk G and Ha D.(2009). Effects of chlorine concentrations and washing conditions on the reduction of microbiological contamination in lettuce. *Journal of the Korean Society for Applied Biological Chemistry*; Vol. 52, (3): 270-274.
- 36- Mohamed M. Jouda , Zuhair Dardona and Mohammed Albayoumi.(2016). The Antibacterial Effect of some Household Detergents against *Staphylococcus aureus* . *Int.J.Curr.Microbiol.App.Sci.* 5(2): 459-463.
- 37- Saha AK, Haque MF, Karmaker S and Mohanta MK. Antibacterial effects of some antiseptics and disinfectants. *Journal of Life and Earth Science.* 2009; Vol. 3: 19-21. **38-** Elena I Zubko and Mikhajlo K Zubko . Co-operative inhibitory effects of hydrogen peroxide and iodine against bacterial and yeast species . *BMC Res Notes.* 2013; 6: 272. Published online 2013 Jul 15. doi: 10.1186/1756-0500-6-272.