

# Comparative Antimicrobial Studies between Commercial Deodorants, Alum, Sodium Bicarbonate and Lemon Against Sweat Odor Bacteria

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## Abstract

Deodorant products forestall the development and action of the debasing apocrine organ microbes living in the armpit. Normal antibacterial specialists in the market like triclosan and aluminum salts, regardless of their reasonable antibacterial impacts, increment the danger of Alzheimer's malady, bosom and prostate malignancies or actuate contact dermatitis. Notwithstanding spreading of bacterial opposition against anti-infection agents, so one of the most significant strides in microbiological explores is to locate another antimicrobial compound with negligible reactions. In this manner, normal antiperspirants like lemon juice having antibacterial impacts are of intrigue. The aim of the present study was to verify the *in vitro* comparative antimicrobial effects of different deodorants, alum, sodium bicarbonate and lemonjuice suspensions against two major bacteria responsible for axillary odor (*Staphylococcus epidermidis* and *corynebacterium*) by agar well diffusion method. The results acquired explained that all analyzed normal substances and commercial deodorants have a noteworthy antibacterial impact against the axillary related scent bacteria with various inhibitory zone measures recommended that the natural deodorants were much better in addition to that extracting the ingredients of commercial deodorants with hot aqueous extract lead, to increase the significant of its antibacterial effect so it is the main advice for the manufacturers.

## Introduction

Sweat glands emission is without anyone else unscented, and armpit rottenness is brought about by the microbial biotransformation of the scentless discharge into unpredictable musty molecules [1]. Therefore, a good antiperspirant item could forestall the development and action of the debasing apocrine organ discharge bacteria like *Staphylococcus epidermidis* and *Corynebacterium* species [2]. Nowadays, in most antiperspirant items, antibacterial specialists, for example, quaternary ammonium mixes like triclosan, aluminum salts, and sweet-smelling scent covering operators are used. Aluminum salts, notwithstanding their appropriate antibacterial impact, increment the danger of Alzheimer's ailment and bosom and prostate cancers [3-6]. Many of other antibacterial specialists saw as successful against skin microorganisms are aggravating or sensitizing [6]. There is additionally the danger of protection from standard anti-microbials. In this manner, herbal medicine having antibacterial impacts against *Staphylococci* and vigorous are on the other hand accessible for the treatment of armpit odor [7-9]. The antibacterial action of heating pop (sodium bicarbonate) was surveyed utilizing diverse test draws near. Momentary presentation tests demonstrated huge antibacterial effect. Sodium bicarbonate (SB) hindered the development of microorganisms and yeasts in agar media model frameworks under specific conditions. *Escherichia coli*, *Lactobacillus plantarum*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* [10]. Alums are utilizable for a scope of modern procedures. They are solvent in dihydrogen monoxide; have an astringent, corrosive, and sweetish taste; The compound material as alum has numerous

advantages as it has antibacterial impact on microbes, likewise, it has against yeast impact that represses the development of *Candida albicans* in which its impact on the maturing procedure [11]. Potash alum when added to water reports bactericidal effect, against different plague causing enteric pathogens like *Vibrio cholerae* and *Shigella dysenteriae* by bringing down the pH of water (from 6.0 to 4.0) [12]. Lemon is a significant restorative plant of the family *Rutaceae*. It is developed for the most part for its alkaloids, which are having anticancer exercises and the antibacterial potential in unrefined concentrates of various parts (viz., leaves, stem, root and blossom) of Lemon against clinically significant bacterial strains has been reported [13]. Citrus flavonoids have a large spectrum of organic action including antibacterial, antifungal, antidiabetic, anticancer and antiviral activities [14]. So, this study aimed to verify the *in vitro* comparative antimicrobial effects of different deodorants, alum, sodium bicarbonate and lemon juice suspensions against two major bacteria responsible for axillary odor (*Staphylococcus epidermidis* and *corynebacterium*) by agar well diffusion method.

## Materials and Methods

### Collection of examined samples

Five types of deodorants in addition to baking soda (sodium bicarbonate), alum and lemon were purchased from markets in Quiyeia /KSA.

### Samples suspension

- 5g of each sodium bicarbonate and grinded alum were dissolved in about 10ml of hot and cold distilled water in sterile test tubes.
- 5ml of each type of deodorant was dissolved in about 10ml of hot and cold distilled water in sterile test tubes.
- 5ml of lemon juice was dissolved in about 10ml of hot and cold distilled water in sterile test tubes.
- The tubes were kept for 1 week at room temperature until use.

### Preparation of inoculums

The strains of bacteria (*Staphylococcus epidermidis*, *corynebacterium*) were inoculated in nutrient broth for overnight at 37 °C for bacteria.

### Antimicrobial screening

The preliminary investigation of antimicrobial effect of various extracts of various deodorants, alum, sodium bicarbonate and lemon juice were performed by utilizing agar well diffusion method [15]. The affectability of all extracts was tried against two significant bacteria liable for axillary smell (*Staphylococcus epidermidis* and *corynebacterium*). The anti-microbial activity was measured by the inhibition zones produced in millimeter. All trials were copied. Ciprofloxacin (10µg) utilized as positive control while

distilled water (100µg) utilized as negative control for antibacterial screening.

## Results

The results obtained from (Tables 1-4) clarified that all examined natural substances and synthetic deodorant possess a significant antibacterial effect against the axillary associated odor bacteria with different inhibitory zone measures. The most effective antibacterial against *Corynebacterium* from the commercial deodorant was the hot aqueous extract of D5 followed by D2 hot aqueous extract while D3 has no effect on it. Also, the most antibacterial effect against *Corynebacterium* from the examined natural substances was by cold aqueous extract of sodium bicarbonate followed by cold aqueous extract of alum and then lemon. the most effective antibacterial against *Staphylococcus epidermidis* from the commercial deodorant was hot aqueous extract of D5 followed by D2 hot aqueous extract while D4 and D6 has no effect on it. In addition to that the most antibacterial effect against *Staphylococcus epidermidis* from the examined natural substances was by cold aqueous extract of alum followed by cold aqueous extract of sodium bicarbonate and then lemon.

## Discussion

In general, it was found that an underlying negative impact of deodorants, yet not deodorants, on bacterial plenitude utilizing a customary culture-based methodology. Deodorants are able to do emphatically lessening the biomass of the armpit microbial network, to a great extent autonomous of the memorable item utilization of people. Numerous antiperspirants are ethanol-based and likely more water solvent and simpler to wash away than deodorants; and deodorants contain aluminum-based salts that diminish sweat by shaping hastens that truly square perspiration organs [16]. And along these lines may lessen assets important for the development of microbial networks. Dissimilar to numerous taxa on the body, these two taxa have been generally very much portrayed with respect to their biology. Types of *Corynebacterium* are related with the prevailing smells of the armpits and people with more *Corynebacterium* are probably going to have more grounded personal stench [17]. Stopping the utilization of antiperspirant and deodorants was related with lower levels of *Corynebacterium*, in accordance with desires, given that organizations that sell underarm items intend to decrease stench through decrease in generally speaking bacterial tallies. Despite the fact that it has for some time been perceived that skin bacterial piece fluctuates emphatically among people, representing such variety has been a test, one that has driven a few creators to recommend that the synthesis of the skin biome may basically be stochastic, a component of chance colonization's and capricious elements. The piece of the armpit microbiome is profoundly unsurprising, being ruled by *Staphylococcaceae* and *Corynebacterium*, and emphatically affected side-effect use. Types of the *Staphylococcaceae* incorporate helpful symbionts [18,19]. The more extensive wellbeing results of

antiperspirant and deodorants use are not all around examined. In spite of the fact that it has been proposed that antiperspirant as well as deodorants use is related with occurrence or period of bosom disease analysis [20], support for this affiliation is dubious, best case scenario [21,22]. Regardless of whether antiperspirant or deodorants will in general kindness less advantageous or even pathogenic bacteria species doesn't appear to have ever been thought of. Late work demonstrates that the microbial network structure of the skin, including its commensal/advantageous occupants, applies noteworthy impact on human wellbeing and illness, especially in the rise of pathogenic strains of *Staphylococcus aureus*, *S. epidermidis*, and *Propionibacterium acnes* [18,19,22].

So, this study aimed to verify the *in vitro* comparative antimicrobial effects of different deodorants, alum, sodium bicarbonate and lemon juice suspensions against two major bacteria responsible for axillary odor (*Staphylococcus epidermidis* and *Corynebacterium*) by agar well diffusion method trying to find more effective natural antibacterial deodorants. In addition to demonstrate the effectiveness of some famous commercial deodorants against the bacteria responsible for sweat odor especially as some people use many and found the smell still present which may be due the low or no effect of these commercial deodorants in killing these bacteria so the odor is still present. From these examined natural deodorants was sodium bicarbonate which contains carbonate anions. Carbonate anions associate legitimately with the complex of transferrin-or lactoferrin-bound metals, for example, Fe and Cu [23]. Apo-transferrin is additionally known to interface with  $2\text{HCO}_3^-$  or  $\text{CO}_3^{2-}$ . These carbonic particles respond legitimately with arginine deposits of transferrin in restricting locales of 2 projections [24,25]. Sodium bicarbonate at 50mM expanded the antibacterial action of ovotransferrin against *E. coli* W1485, though ovotransferrin without  $\text{NaHCO}_3$  didn't show antibacterial action [26]. For the most part, Fe-restricting limit of ovotransferrin is known to diminish under acidic pH [27-29]. Little examinations were performed to explore  $\text{NaHCO}_3$  antibiofilm action and present outcomes couldn't help contradicting Cervantes who referenced that 5% SB could influence *Candida albicans* adherence [30].  $\text{NaHCO}_3$  influences on bacterial biofilm by causing impediment of bacterial development which concurred with that referenced by Silhacek and Taake who discovered incredible movement of SB on *Streptococcus mutans* development [31]. The antibacterial properties of sodium bicarbonate have been known for a considerable length of time, yet the atomic comprehension of its component of activity is as yet inadequate. Also, another natural examined deodorant were alum. Alum (sub-atomic equation:  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ ) is a lackluster, unscented crystalline strong that turns white in air [32]. The clinical employments of alum in mouth washes, immunizations improvement, haemostasis and hindrance of *V. cholerae* development in water have been portrayed [33,34]. Anti-toxin obstruction is a significant clinical and general medical issue which powers scientists to search for choices decisions. Characteristic synthetic mixes are among these other options. In this

examination, alum salt was tried against axillary ordinary bacterial vegetation which produces upsetting smell. Alum had strong inhibitory impacts against *M. luteus*, *S. epidermidis*, *C. xerosis* and *B. subtilis* at various concentrations based on the stock weakening tests, the MIC of 7.5mg/mL showed up as ideal centralization of alum against four significant microscopic organisms liable for axillary malodor. Previous examines have uncovered that alum is successful against a wide assortment of microbial pathogens [35,36] including *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumoniae* [37,38]. In 2014, additionally watched a critical bactericidal impact of alum against *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli* and *Klebsiella pneumoniae* [38]. In any case, the system of bactericidal impact of alum isn't notable [39]. A few suppositions characteristic the antibacterial impact of alum to decrease in sharpness or malicious consequences for bacterial cell divider. Moreover, histological examinations affirm the wellbeing of alum salt for mammalian utilization [40]. It can't be legitimately consumed because of its contrarily charged particle, which can't go through the cell films and thusly alum stay an innocuous substance [32]. Anyway, higher concentration of alum may cause nephrotoxicity and intestinal draining [38]. Alum salt is utilized in beauty care products as antiperspirant to diminish axillary smell by blocking sweat conduits and forestalling sweat discharge. Alum gems are profoundly solvent in water and when utilized under arm, they are broken up by the body's perspiration leaving a dry meager layer on the skin's surface which forestalls sweat to interact with scent causing microscopic organisms. One of the herbal plants regularly utilized as medication is the lemon organic product. Lemon organic product is an herbal plant that has the fundamental substance of alkaloid mixes which have the capacity as anticancer, antibacterial, antifungal, antiviral and antidiabetic. Alkaloid intensifies that liable for antibacterial is saponin. Lemon (*Citrus limon*) juice contains numerous bioactive mixes, for example, flavonoids, carotenoids, limonoid, tannin, and terpenoids. The bioactive mixes contained in lemon (*Citrus limon*) each have an antibacterial. Regarding to the above results, the results obtained from Tables 1-4 clarified that all examined natural substances and synthetic deodorant possess a significant antibacterial effect against the axillary associated odor bacteria with different inhibitory zone measures. The most effective antibacterial against *Corynebacterium* from the commercial deodorant was the hot aqueous extract of D5 followed by D2 hot aqueous extract while D3 has no effect on it. Also, the most antibacterial effect against *Corynebacterium* from the examined natural substances was by cold aqueous extract of sodium bicarbonate followed by cold aqueous extract of alum and then lemon. the most effective antibacterial against *Staphylococcus epidermidis* from the commercial deodorant was hot aqueous extract of D5 followed by D2 hot aqueous extract while D4 and D6 has no effect on it. In addition to that the most antibacterial effect against *Staphylococcus epidermidis* from the examined natural substances was by cold aqueous extract of alum followed by cold aqueous extract of sodium bicarbonate and then lemon.

**Table 1:** Collective table of antimicrobial effect of some natural substances and commercial deodorants against the axillary odor bacteria. (H=HOT/C=COLD/control+ve= Ciprofloxacin/control-ve=DW/ D=Deodrant)

Extract/Microbes	Sodium bicarbonate		Lemon		Alum		D1		D2		D3		D4		D5		D6		Control+ve	Control -ve
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C		
<i>Corynebacterium</i>	37	39	24	24	29	38	13	0	41	0	0	0	0	13	46	32	32	0	21	0
<i>Staphylococcus epidermidis</i>	32	35	25	20	30	37	12	0	17	0	15	0	0	0	35	30	0	0	25	0

**Table 2:** The antimicrobial activity of hot and cold aqueous Sodium bicarbonate extracts against axillary odor bacteria.

Isolates	Aqueous extracts	Sodium bicarbonate	Antibacterial control positive	Antimicrobial control negative
<i>Corynebacterium</i>	hot	37	ciprofloxacin	Distilled water
	cold	39	21	0
<i>Staphylococcus epidermidis</i>	hot	32	25	0
	cold	35		

**Table 3:** The antimicrobial activity of hot and cold aqueous alum extracts against axillary odor bacteria.

Isolates	Aqueous extracts	Alum	Antibacterial control positive	Antimicrobial control negative
<i>Corynebacterium</i>	hot	29	ciprofloxacin	Distilled water
	cold	38	21	0
<i>Staphylococcus epidermidis</i>	hot	30	25	0
	cold	37		

**Table 4:** The antimicrobial activity of hot and cold aqueous lemon extracts against axillary odor bacteria.

Isolates	Aqueous extracts	Lemon	Antibacterial control positive	Antimicrobial control negative
<i>Corynebacterium</i>	hot	24	ciprofloxacin	Distilled water
	cold	24	21	0

## Conclusion

From this study it can be concluded that all examined natural substances and synthetic deodorant possess a significant antibacterial effect against the axillary associated odor bacteria with different inhibitory zone measures but hot aqueous extract of D5, cold aqueous extract of sodium bicarbonate and alum has excellent antibacterial inhibitory effects on malodor producing skin bacteria. So cold aqueous extract of sodium bicarbonate and alum can therefore be used as either natural deodorants or as an alternative to other existing chemicals, currently used as active ingredients in deodorants. Also due to the excellent antibacterial inhibitory effects on malodor producing skin bacteria of hot aqueous extract of D5 and most of examined deodorants so it is recommended to the manufacturers that to heat the ingredients of deodorants because it could increase their antibacterial effect. However, the preparation of deodorant from natural examined substances is much better for its highly antibacterial effect except the lemon. Further examinations are required to explore the security, sensitivity, and viability of alum on human skin when utilized as antiperspirant.

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