

## Microbiological Quality Assessment of Some Brands of Cosmetic Hair Care Preparations Sold Within Alkhoms City, Libya

Gamal M. A. B<sup>(1)</sup>, Abo Azza M. M.<sup>(2)</sup>, Al Gayeed A. O. A<sup>(3)</sup> And shakurfow F. A. A.<sup>(4)</sup>

(1) Faculty of Pharmacy, Alazhar Univ., Egypt,

(2) Faculty of Medicine, Al Margeb Univ., Libya

(3) Faculty of Science and Arts, Al Margeb Univ., Libya.

(4) Faculty of medical technology., Al Margeb Univ., Libya.

### Abstract

From the moment of shampoo product is opened until the consumer discards it, it is subject to constant and variable microbial contamination from the domestic environment and the consumers' hands and body fluids. **Materials:** A total of 18 representative samples were purchased at retail outlets in AlKhoms, Libya. These samples were hair shampoo and kohl, which are currently available in the local markets. **Media used:** Nutrient agar, blood agar, mannitol salt agar, peptone water and tryptone yeast extract agar were used in the isolation and determination of the bacterial load of the sample. Sabouraud dextrose agar was used for the isolation and enumeration of yeasts and molds. **Method:** Bacteriological counts of the cosmetic shampoo, fungal isolates were identified based on their macroscopic and microscopic appearance. **Results:** The two brands include Dove and Pantene shampoos, From 22.2% of Dove shampoo *S. epidermidis* was isolated at rate of less than 1000 cfu/g. and 11.1% contain *Rhizopus spp.* The two brands include Parachute and Good life hair oils. From 22.2% of Parachute hair oil *B. subtilis* was isolated at rate of 100 cfu/g. No other bacteria, molds or yeasts detected in the tested samples. Also the same results observed with Good life hair oil but *B. subtilis* was isolated from 11.1% of the examined samples. **Summary:** Two brands of hair shampoos were tested for their total aerobic bacterial, coliform and fungal counts. Only *Staphylococcus epidermidis* and *Rhizopus spp.* were detected. However *Bacillus subtilis* was isolated from 11.1% of the tested hair oil samples. All tested samples of cosmetic hair preparations including hair shampoos and oils were free from anaerobic bacterial contamination.

**Keywords:** shampoo, oil, contamination

### الملخص:

من لحظة فتح منتج الشامبو حتى يتخلص منه المستهلك، فإنه يخضع لتلوث جرثومي مستمر ومتغير من البيئة المحلية وأيدي المستهلكين وسوائل أجسامهم. **المواد:** تم شراء ما مجموعه 18 عينة تمثيلية في أماكن البيع بالتجزئة بمدينة الخمس، ليبيا. وكانت هذه العينات عبارة عن شامبو للشعر وكحل متوفر حاليا في الأسواق المحلية. **الوسائط المستخدمة:** أجار المغذيات، أجار الدم، أجار ملح المانيتول، ماء البيبتون، أجار مستخلص خميرة التريبتون تم استخدامها في عزل وتحديد الحمل البكتيري للعينة. تم استخدام Sabouraud dextrose agar

لعزل وتعداد الخمائر. الطريقة: تم تحديد التعداد البكتيريولوجي لشامبو مستحضرات التجميل والعزلات الفطرية بناءً على مظهرها المجهرى. النتائج: العلامتان التجاريتان هما Dove و Pantene، من 22.2٪ من Dove shampoo S. تم عزل البشرة بمعدل أقل من 1000 cfu / g و 11.1٪ تحتوي على Rhizopus spp. تشمل العلامتان التجاريتان زيوت الشعر Parachute و Good Life. من 22.2٪ من زيت شعر المظلة B. subtilis تم عزلها بمعدل 100 cfu / g. لم يتم اكتشاف بكتيريا أو عفن أو خمائر أخرى في العينات المختبرة. كما لوحظت نفس النتائج مع زيت الشعر Good life ولكن تم عزل B. subtilis من 11.1٪ من العينات التي تم فحصها. الإستنتاج: كانت جميع العينات المختبرة لمستحضرات التجميل للشعر بما في ذلك الشامبو والزيوت خالية من التلوث البكتيري اللاهوائي.

## Introduction

Cosmetics and toiletries are in daily use to cleanse, perfume, beautify or decorate the human body. They are mainly applied to the hair. But, cosmetics are not intended to permanently alter the physiology of the target organ, although some 'healthcare' products may contain an active substance or make medicinal claims. These include cosmetics that help with conditions such as dandruff. The microbiology of cosmetics is therefore complex due to the wide range of formulations, manufacturing procedures and conditions of consumer use (Gunn, 1974).

From the moment of shampoo product is opened until the consumer discards it, it is subject to constant and variable microbial contamination from the domestic environment and the consumers' hands and body fluids. For example, micro-organisms are readily introduced when fingers are dipped into shampoo products, spillage of water into shampoos or shower preparations are unfortunately common sources of potential contamination. A family-size shampoo can be over 80 % water and may be used by several different people over a prolonged period. In a warm, moist environment such as a shower where it is easily contaminated, micro-organisms are very likely to enter the product (Tang, 1998).

Shampoos, which necessarily contain surfactants, are particularly susceptible to contamination by water-borne Gram-negative bacteria. Active ingredients may also be rendered ineffective. Other contamination effects may be unpleasant aromas or tastes (yeasts, actinomycetes) and change of tactile effects (Brannan and Dille, 1990).

Specific organisms in cosmetic shampoo products isolated from poorly preserved water-based products include Klebsiella, Enterobacter, Staphylococcus and Bacillus species, Pseudomonas, (including *P. aeruginosa*, *Burkholderia cepacia*), Penicillium and *Candida albicans*. Gram-negatives are most common and have very various metabolic capabilities, can survive in a

wide range of environments, they are often introduced through water supplies (Warwick, 1993).

Micro-organisms in the home are adapted to a wide range of environments and can degrade a host of product ingredients. Moldiness, color change, frothing, and packaging that bulges, leaks or explodes as a result of gas production are obvious effects of gross contamination, more subtle changes can occur ( Durant and Higdon, 1987).

A Japanese study of professional shampoo products in hair dressers found that over 60% of samples were contaminated with Gram negative, including *P.aeruginosa*. This may reflect multiple use, poorly preserved products or the consequences of dilution after purchase (Gray and McNamee, 2000).

## 1-MATERIALS:

### 1.1- Cosmetic products:

A total of 18 representative samples were purchased at retail outlets in AlKhoms, Libya. These samples were hair shampoo and kohl, which are currently available in the local markets. Three different batches, were selected. Table (1) illustrates different classes and trade names of all cosmetic samples investigated.

**Table (1).** Class, type and trade names of cosmetic preparation under investigation.

Class	Type	Trade name <sup>®</sup>
Hair care preparation	Shampoo	Dove and Pantene
	Oil	Parachute and Good life

**1.2. Media used:** Nutrient agar, blood agar, mannitol salt agar, peptone water and tryptone yeast extract agar were used in the isolation and of determination of the bacterial load of the sample. Sabouraud dextrose agar was used for the isolation and enumeration of yeasts and molds. The media were reconstituted and sterilized according to the direction of the manufacturer. (all obtained from Oxoid). Bacteriological counts of the cosmetic shampoo: In order to assess the degree of contamination, 1g of material was dispersed in 4 ml sterile ringer solution containing 0.25% tween 80. Appropriate dilutions were made in the same dispersing vehicle and 0.5 ml was plated out on the appropriate solid medium using the surface viable method. All the plates were incubated at 37 °C for 24-48 hours. Emergent colonies were counted after the necessary incubation. All operations were carried out in duplicates. Results were expressed as colony forming unit per gram (CFU/g). Yeasts and Molds Count of the Cosmetic Powders: One ml of the last two dilutions mentioned in prepared above were inoculated on Sabouraud dextrose agar plates using spread plate method. The plates were then incubated at 25 °C for 2-3 days. Colonies were counted after three days. Results of colony count was expressed as yeasts and molds counts per

gram. Identification of bacterial isolates: All bacterial isolates were identified based on their Gram reaction and biochemical tests, as described by U.S.FDA manual online. Identification of fungal isolates: All fungal isolates were identified based on their macroscopic and microscopic appearance with reference to standard manual

## Results and discussion

### Microbial Contents Of Different Batches And Containers Of Hair Care Cosmetic Preparations.

#### 1- Microbial Content of Hair Shampoos:

A total of 18 samples representing two brands of hair shampoos were tested for their total aerobic bacterial, coliform and fungal counts. The samples were also qualitatively examined for the presence of some potential pathogens. The results are summarized in Tables (2 and 3).

The two brands include Dove and Pantene shampoos. From 22.2% of Dove shampoo *S. epidermidis* was isolated at rate of less than 1000 cfu/g. and 11.1% contain *Rhizopus spp.* In another study done by Gray and McNamee, 2000, where found 60% of shampoo products had been contaminated.

#### 2- Microbial Content of hair oils:

A total of 18 samples representing two brands of hair oils were tested for their total aerobic bacterial, coliform and fungal counts. The samples were also qualitatively examined for the presence of some potential pathogens. The results are summarized in Tables (4 and 5).

Similarly, Tang, 1998, reported that products are often water in oil emulsions with high concentrations of solutes and lowered water activity. These conditions are favorable for fungal growth.

The two brands include Parachute and Good life hair oils. From 22.2% of Parachute hair oil *B. subtilis* was isolated at rate of 100 cfu/g. No other bacteria, molds or yeasts detected in the tested samples. Also the same results observed with Good life hair oil but *B. subtilis* was isolated from 11.1% of the examined samples.

#### 3-Anaerobic Microbial Content of Cosmetic Hair Preparations:

All tested samples of cosmetic hair preparations including hair shampoos and oils were free from anaerobic bacterial contamination.

**Table (2)** Aerobic microbial contents of different batches and containers of Dove hair shampoo

Batch	Serial No.	Aerobic bacteria		Fungi		
		Total count/g.	Isolated microorganism	Total count/g.	Yeasts	Moulds
A	1	5.0 X 10 <sup>2</sup>	<i>S. epidermidis</i>	1.0 X 10 <sup>5</sup>	—	<i>Rhizopus spp.</i>
	2	3.0 X 10 <sup>2</sup>	<i>S. epidermidis</i>	0	—	
	3	10 <sup>2</sup>	—	0	—	
		0			—	

B	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—
C	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—

**Table (3)** Aerobic microbial contents of different batches and containers of Pantene hair shampoo

Batch	Serial No.	Aerobic bacteria		Fungi		
		Total count/g.	Isolated microorganism	Total count/g.	Yeasts	Moulds
A	1	2.0 X 102	<i>Sarcina lutea</i>	0	—	—
	2	3.0 X 102	<i>Sarcina lutea</i>	0	—	—
	3	102 0	—	0	—	—
B	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—
C	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—

**Table (4)** Aerobic microbial contents of different batches and containers of Parachute hair oil

Batch	Serial No.	Aerobic bacteria	Fungi			
		Total count/g.	Isolated microorganism	Total count/g.	Yeasts	Moulds
A	1	1.0 X 102	<i>B. subtilis</i>	0	—	—
	2	1.0 X 102	<i>B. subtilis</i>	0	—	—
	3	102 0	—	0	—	—
B	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—
C	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—

**Table (5)** Aerobic microbial contents of different batches and containers of cood life hair oil

Batch	Serial No.	Aerobic bacteria		Fungi		
		Total count/g.	Isolated microorganism	Total count/g.	Yeasts	Moulds
A	1	1.0 X	<i>B. subtilis</i>	0	—	—
	2	102	—	0	—	—
	3	0	—	0	—	—
B	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—
C	1	0	—	0	—	—
	2	0	—	0	—	—
	3	0	—	0	—	—

The presence of hazardous bacteria such as *S. epidermidis*, *P.aeruginosa*, *E. coli* and *C. perfringens* in cosmetics preparations is unacceptable in health authorities all over the world. In addition, it would give the consumer more than strong worry when using such products (Parker, 1982).

The frequency of such reports has declined in recent years as manufacturing processes have improved and there is better understanding of preservation. Nevertheless, there is still a need for vigilance and good practice (Hitchins, 1993).

Contamination controller is more of an alarm in a non-sterile facility than in sterile creation production services. The sterile production facility distinguishes there is a difficult with contamination and cross-contamination of lots, the non-sterile capability has a great offer to trust they are not gratified by these issues. This can lead to a very cavalier defiance about contamination control by the workers and managements. The non-sterile manufactory is responsible for all aspects of his product, counting any offensive organisms present (Sutton,2006).

### Summary

18 items representing 2 brands of hair shampoos, 18 items representing 2 brands of hair oils.

The microbiological examination included the determination of total aerobic bacterial and fungal counts, as well as, qualitative tests for potential pathogen microorganisms, namely *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Micrococcus spp.*, *Pseudomonas aeruginosa*, other *Pseudomonas spp.*, *Escherichia coli*, *Salmonella spp.* and other Enterobacteriaceae. In addition, anaerobic bacterial count and qualitative tests for the presence of *Clostridia spp.* in powders were also carried out.

The results obtained could be summarized as follows: Two brands of hair shampoos were tested for their total aerobic bacterial, coliform and fungal counts. Only *Staphylococcus epidermidis* and *Rhizopus spp.* were detected. However *Bacillus subtilis* was isolated from 11.1% of the tested hair oil samples. All tested samples of cosmetic hair preparations including hair shampoos and oils were free of anaerobic bacterial contamination.

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