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Kohl Al-Ethmed

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Abstract. To find Kohl Al-Ethmed, which Prophet Mohammed (Peace be upon him) was using and recommended to use. 16 samples of commonly used Kohl were analyzed. Atomic Absorption Spectrometer was used to detect minerals presence and its concentrations. Plasma IL-200, Emission spectrometer was used to detect Antimony. Samples, which found to match the description of Kohl Al-Ethmed tested for microbial contamination. If this is negative, its effect on growth of various types of common organisms to the eye is tested. One sample found to match some of the literature description of Kohl Al-Ethmed; it is reddish-brownish-black in color, and had Antimony (Sb = 0.01%) in it, which is claimed to be the effective gradient of Al-Ethmed. It has no bacterial contamination, and no inhibitory effect on microbial growth in vitro. It contains very low concentration of lead (Pb = 0.01%), which is claimed to be the most hazardous component of commonly used brands of Kohl. It contains iron, copper, magnesium, manganese and zinc, which function as cofactors for various enzymes in the tears film. Our sample is safe and matches some of the description of Kohl Al-Ethmed. Further studies are recommended to fully understand its effect on eyes and microorganisms *in vivo*.

Keywords: Kohl, Antimony, Ethmed.

Introduction

Kohl is a traditional powder-like mixture, such as powdered antimony sulfide, used as cosmetic eyeliner and to treat eye diseases in many Middle and Far East countries[1].

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Jabir narrated that the Prophet Mohammed (peace be upon him) recommended Al-Ethmed before sleeping, for it enhances vision and makes hair grow. Al-Tabarani narrated that the Prophet Mohammed (peace be upon him) advised the use of Kohl Al-Ethmed for it makes hair grow, removes foreign bodies from the eyes and sharpens vision[2].

Al-Asgalani said that Kohl Al-Ethmed is a known black reddish rock found in Al-Hijaz district, and the best types which come from Asfahan[3].

It is believed that Kohl Al-Ethmed benefit is due to the Antimony (Sb) present in it. Antimony's sulfide compound, antimony (III) trisulfide (Sb_2S_3) was recognized at least as early as 3000 BC. Pastes of Sb_2S_3 powder in fat, or in other materials have been used since those days as eye cosmetics in the Middle East. In this use, Sb_2S_3 is called kohl. It was used to darken the brows and eye lashes[1,4,5].

Over the last 20 years, kohl has gained a bad repetition, either due to its high content of lead[6,7], or contamination with microorganisms[5,8].

This study is aimed to analyze and find Kohl Al-Ethmed, which supposes to be safe cosmetic eyeliner and a remedy to some ocular conditions.

Materials and Methods

Samples of the claimed Kohl Al-Ethmed produced by some regions of Saudi Arabia and other countries are analyzed in the Chemistry lab at the Faculty of Science at King Abdulaziz University (KAU), Jeddah, Saudi Arabia. A gross examination of samples is performed. Perkin Elmer, model 5000, Atomic Absorption Spectrometer (AAS) (flame system) was used to detect minerals presence and its concentrations in the samples. Plasma IL-200, Emission spectrometer is used to detect Sb in the samples.

The sample that we believe it has Kohl Al-Ethmed characteristics is tested independently in two microbiology labs at King Abdulaziz University Hospital and Alkadra. It is tested first for microbial contamination, and if that is negative, then different concentrations were used to test its inhibitory effect on the growth of *Staphylococcus* and *Streptococcus* organisms in culture plates.

Results

Table 1 shows the origin of the sixteen samples of claimed Kohl Al-Ethmed.

Table 1. Origin of the 16 samples.

No. of samples	Origin
3	Saudi Arabia (Makkah)
3	Saudi Arabia (Madina)
1	Saudi Arabia (Jeddah)
1	India
7	Pakistan
1	Al-Yemen

Grossly, the collected samples were tested against the well documented description of Kohl Al-Ethmed in literature. The color of Kohl Al-Ethmed is claimed to be reddish black. Only one sample closely matches this description; sample No. 16 (Table 2).

Table 2. Color of samples.

Sample no.	Color
1	Dark grey
2	Dark grey
3	Dark grey
4	Black
5	Dark grey
6	Dark grey
7	Dark grey
8	Black
9	Black brown
10	Dark brown
11	Dark grey
12	Dark grey
13	Black
14	Dark grey
15	Brown
16	Reddish-brownish-black

During the Chemistry lab test, it was noticed that sample No.13 was pure charcoal mixed with greasy material. Meanwhile, sample No. 4 had charcoal as a main component of its mixture. These samples are obviously not Kohl Al-Ethmed that we are looking for, so we did not apply any further analysis on it.

The remaining 14 samples were chemically analyzed. Table 3 summarizes the concentration of isolated elements in one gram of Kohl.

Table 3. Concentrations of elements in one gram of Kohl.

Sample no.	Percentage (%)									
	Pb	Fe	Zn	Cu	Mg	Mn	Bi	Sb	Ni	Ca
1	55.79	0.04	0.04	–	0.01	–	0.08	–		
2	73.10	0.01	0.001	–	0.01	–	0.25	–		
3	77.25	0.31	0.06	–	0.02	–	0.59	–		
4*										
5	70.54	0.16	0.12	–	0.02	–	0.95	–		
6	77.59	0.31	0.016	–	0.01	0.04	1.53	–		
7	78.32	0.08	0.01	–	0.01	0.03	0.13	–		
8	29.25	1.03	0.02	0.1	0.06	0.02	0.08	–		
9	–	16.20	2.47	–	0.13	0.23	–	–		
10	22.6	1.37	0.06	5.7	0.15	0.03	–	–		
11	72.93	0.06	0.15	–	0.05	–	0.1	–		
12	76.41	0.04	0.62	–	0.01	–	1.0	–		
13*										
14	75.52	0.32	1.03	–	0.01	–	0.15	–		
15	12.34	15.12	0.03	–	1.0	0.05	0.42	–		
16	0.01	27.79	0.03	<0.01	0.03	0.04	0.01	0.01	0.01	–

**Samples did not have chemical analysis, Fe = iron, Cu = copper, Mg = magnesium, Mn = manganese, Zn = zinc, Pb = lead, Bi = bismuth, Ca = calcium, Sb = antimony, Ni = nikon*

Only sample number 16 matched the physical appearance and color documented before for Kohl Al-Ethmed. It is the only sample that contains Sb and very low concentration of lead and other elements, except iron. As a result, we subject this sample to further microbiological analysis. The sample was not contaminated with any organism, and has no effect on bacterial growth.

Discussion

Over the last decades Kohl has gained bad reputation, either due to its high content of lead[6,7], or contamination with microorganisms[5,8]. We believe that Prophet Mohammed (Peace be upon him) will not recommend something to use if it is harmful to us. He himself used to use Kohl Al-Ethmed three repetitions every night in each eye as narrated by Ibn Abbas[9]. This is a humble trial from us to defend Prophet Mohammed (Peace be upon him) sunnah, by finding Kohl Al-Ethmed.

To our surprise most of the kohl available in the market, which we tested over the years contains harmful level of lead ranging from 12.34-78.32%. The Food and Drug Administration (FDA) has estimated that the tolerable daily intake level of lead from all sources is 750 micrograms (mcg) per day for most adults, and 250 mcg per day for pregnant women. Our proposed sample of Kohl Al-Ethmed (PSKAE) contains 0.01% (1 mg Pb / 1 g of sample) of lead. So if we applied 10-70 mg of Kohl to the eye per day on average it will contain 100-700 mcg of lead. So our PSKAE has trace of lead that we do not think it will cause lead poisoning and toxicity.

Our PSKAE contains iron, copper, magnesium, manganese and zinc, which function as cofactors for various enzymes in the tears film[10]. Metal-carrying proteins, which are almost always found in human tears, include copper-carrying ceruloplasmin and iron-carrying transferrin. Ceruloplasmin is a potent oxidizing agent. It may play an important role in certain detoxification activities[11]. Lactoferrin, a member of the transferrin family, is an important player in the defense against pathogenic microorganisms and has also been shown to have activity against several viruses[12-13].

Iron was noticed to be the most abundant component in our PSKAE with (Conc. 27. 79%). Al-Hazzaa and Krahn[14] reported high level of iron (Fe) (mean 46%) in 5 western made eyeliner pencil. McGahan[15] reported that the intraocular fluid (aqueous and vitreous humour) and lens concentration of Fe increased significantly after ocular inflammation. Iron (Fe) is being use in high concentration in modern kohl preparations and its increase level in the ocular fluids and tissue in response to inflammation, and is being part of Lactoferrin. This creates an assumption, that iron may be highly beneficial to human eyes when applied topically (Kohl) to it.

Copper was one of the elements isolated from our (PSKAE) in low concentration (< 0.01%). Siddiqui *et al.*[16] tested a special Indian traditional type of kohl called *Kohl-Chikni Dawa* (KCD), which is reputed for its beneficial effects in the treatment of premature cataracts. It was prepared by a ratio of (1:20:1) of copper sulfate, hard soap, and resin of *Shorea robusta.* Fresh solution (3%) (1 ml contain 45 mg) of KCD in distilled water was prepared before instillation and administered as eye drops once or twice a day for 90 days in naphthalene-induced cataracts in rats. Local application (twice daily) showed significant reduction in the lens opacification after 2 to 4 weeks of naphthalene administration. This suggests that copper is necessary for normal physiological function of the lens. Copper may inhibit the activity of lactate dehydrogenase, which thought to be a sensitive marker of cataract formation. Therefore, the presence of copper in our PSKAE may play a role in enhancing and sharpens vision.

Zinc (Zn), was found to increase the activity of the water channel of the lens in Xenopus oocytes[17], which offers the possibility of a pharmacological approach to manipulate the water permeability and transparency of the lens. Zn also enhances the molecular chaperone function and stability of Alpha-crystallin[18]. This resulted in the believed that it may have a role in the long-term maintenance of lens transparency and prevent cataract formation. Therefore, the presence of Zn in our PSKAE may also have an important role in maintaining clear and bright long term vision, but further studies are needed to support that idea.

Tabbara and Burd[8] studied 3 commercially prepared kohl imported from India. Bacillus species, Gram-negative bacilli, and number of fungi all heavily contaminated. Another study by Tabbara and Al Omar[19], noticed an increase rate of trachoma infection among kohl users. They suggested that this might be due to the contamination of the kohl samples themselves, or due to the bad habit of sharing the probe used for kohl application. Although our PSKAE did not show any contamination and inhibitory effect on organisms in culture plate (*in vitro*), but that does not rule out its possible effect on microorganism *in vivo*.

Sb was present in our PSKAE in small concentration (0.01%). Al-Hazzaa *et al.*[14] found a sample that contains 7.8% concentration of Sb. The Sb compounds are used to treat Schistosome species and Leishmaniasis[20], but we are not aware of any reports of using it against bacteria.

Kohl Al-Ethmed may improve vision, especially in sunny days or in bright light, as of their dark color on the lid margins will lead to decrease in the reflection of light from them, and decrease the glare resulted from that.

Conclusion

In conclusion, we believe that our sample, PSKAE, may be Kohl Al-Ethmed that Prophet Mohammed (peace be upon him) recommended to use. It is safe to apply to the eye. It contains minerals which are needed for some tear's film enzymes (responsible about fighting microorganisms). Further studies are needed to find its effect on eyelashes growth and microbial growth *in vivo*.

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كحل الأثمد

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المستخلص. تم تحليل ستة عشر عينة من الكحل المتداول في معمل كلية العلوم بجامعة الملك عبدالعزيز. تم فحص العينات ظاهريا. تم تقدير المعادن في العينات بإستخدام جهاز الامتصاص الذري، كما قدر الأنتموني بواسطة جهاز الانبعاث الذري. العينات التي وجد أنها تطابق وصف الكحل الموصى به (عينة واحدة)، تم اختبارها في معمل المايكروبيولوجي لمعرفة خلوها من التلوث، ومن ثم تأثيرها على مختلف أنواع البكتيريا التي تصيب العين. عينة واحدة فقط وجد أنها تطابق ما جاء في وصف كحل الأثمد. لونها بني مائل للحمرة والسواد، وتحتوي على معدن الأنتموني (٠,٠١٪) الذي يعتقد أنه المادة الفعالة في كحل الأثمد. تحتوي هذه العينة على كمية ضئيلة من الرصاص (٠,٠١٪)، والذي يعتقد أنه أخطر المواد المتواجدة في الكحل المتداول في الأسواق. عينة الكحل المتوافرة لدينا (رقم ١٦) هي آمنة، وتطابق بعض الأوصاف التي جاءت في كحل الأثمد الذي أوصي به سيدنا محمد (صلى الله عليه وسلم)، ونقترح المزيد من الأبحاث لنتمكن من معرفة تأثيرها على العين وعلى الجراثيم.