



Efficiency of Some Gel hand sanitizers Obtained From Iraqi local Markets.

Nibras Mohammed
alsaffar

Sudad jasim
Mohammed

Mohammed A. Al-
soufi

Center for market research and consumer protection/
University of Baghdad

تأريخ قبول النشر: 2014/3/26

تأريخ استلام البحث: 2014/1/28

Abstract

The research aims to investigate the efficiency of waterless hand cleaners used by different sectors of society and in particular women and children as hygiene for hands to reduce the spread of infection. This is the first study was carried out in our Center for Market Research and Consumer Protection during the year (2013). Eleven samples of waterless hand cleaner were obtained from Iraqi local markets which subjected to the following studies: first the chemical analyses using Atomic absorption to estimate the concentration of (Cd, Pb, Co, Cu), second the Bacteriological examination which include to study the effect of these samples against bacteria including (*E.coli*, *Bacillus spp.*). The results showed that Kelobatra, Dettol contain high concentration of Copper (0.4398, 0.2768 $\mu\text{g/g}$) and lead (0.2033, 0.2287 $\mu\text{g/g}$), while the rest of tested brands contained lower concentration of Copper and lead. Beauty and Dettol showed high concentration of Cobalt (0.0817, 0.0886 $\mu\text{g/g}$) respectively. Bacteriological examination reveals that 4wet and Cleaner samples had high efficiency against *E.coli* while Vanilla and Kelobatra showed no antibacterial activities against *E.coli*. 4 wet and Dettol had high efficiency against *Bacillus spp.* .

Key words: hygiene, waterless hand, Baghdad markets.

تقييم فعالية بعض أنواع مطهرات اليد الهلامية المتوافرة في الاسواق المحلية.

نبراس محمد الصفار سداد جاسم محمد محمد عبد الرزاق الصوفي
مركز بحوث السوق وحماية المستهلك/ جامعة بغداد

الخلاصة

يهدف البحث إلى التحري عن فعالية غسول اليد الهلامية المستخدمة من قبل مختلف فئات المجتمع وبخاصة النساء والأطفال باعتبار نظافة الأيدي مهمة للحد من انتشار العدوى، وتم اجراء هذه الدراسة في مركز بحوث السوق وحماية المستهلك خلال سنه (2013). سحب احد عشر عينة من غسول اليد الهلامية من الأسواق المحلية وتم اجراء الفحص الكيميائي باستخدام جهاز الامتصاص الذي لتقدير تراكيز (الكاديوم، الرصاص، كوبالت، النحاس). أما الفحص الثاني ويشمل الفحص البكتريولوجي والتي تشمل دراسة تأثير هذه العينات بما في ذلك تأثيرها ضد بكتريا (*Esherichia spp. Bacillus*) أظهرت النتيجة أن غسول اليد Kelobatra، Dettol تحتوي على تراكيز من النحاس (0.4398، 0.2768 ميكروغرام/ غرام) والرصاص (0.2033، 0.2287 ميكروغرام/ غرام) في حين أن العينات المختبرة الأخرى احتوت على تراكيز واطئه من النحاس والرصاص. اما غسول علامة Beauty, Dettol تظهر احتواءها على تراكيز عالية من الكوبالت (0.0817، 0.0886 ميكروغرام/ غرام) على التوالي. أما الفحص البكتريولوجي اظهر أن غسول 4wet و Cleaner blue colour كانت ذات كفاءة مطابقة لما كتب على بطاقة الدلالة ولها كفاءة عالية ناهضت (*E.coli*) بينما Vanilla Kelobatra لم تظهر أي منطقة تثبيط لبكتريا القولون (*E.coli*). غسول 4wet و Dettol اظهرت كفاءته عالية لمناهضة *Bacillus spp*.

الكلمات المفتاحية: التعقيم، غسول اليد، أسواق بغداد.



Introduction

Thousands of people die every day around the world from infections acquired While receiving health care. Hands are the main pathways of germ transmission during health care, hand hygiene is therefore the most important measure to avoid the transmission of harmful germs and prevent health care-associated infections (35).

Transmission of infectious diseases can occur by indirect contact from hands and articles freshly soiled with discharges of the nose and throat. Most bacteria/viruses are readily inactivated by soap and water. Waterless alcohol-based hand sanitizers, can be used as an alternative to hand washing and are especially useful when access to sinks or warm running water is limited. When hands are visibly dirty we can wash hands with soap and water, Washing with soap and water is the preferred method of hand washing, However, if hands are not visible dirty, and soap and water are not readily available, a waterless hand cleaner with at least 60% alcohol should be used (19).

Contaminated hands play a key role in transferring fecal particles from one host to another (11). A person who practices inadequate hand hygiene after defecation can transfer pathogens to other persons through direct interpersonal contact, contact with inanimate objects and surfaces, and food preparation (7; 10; 12). In developing countries, where many households store the water they use for cooking and drinking in the home, dipping contaminated hands and cups into storage containers can also transfer pathogens to other family members (30).

Hand- based transmission of pathogens is so ubiquitous that hand washing with soap has been argued to be the best intervention to prevent diarrhea (9), and the most cost-effective option for preventing the death of a child (22). Evidence from several meta-analyses suggest that hand washing education and promotion can reduce diarrhea incidence as much or more than improvements in water supply (16; 17).

A recent review of randomized controlled trials of hand washing interventions in developing countries found that hand washing can reduce diarrheal episodes by an average of 31% (15). Hand washing interventions have also been found to significantly reduce incidence of respiratory illness in community settings around the world by an average of 21% (1). However, the problem remains that most



people do not wash their hands with soap at important times, such as after using the toilet, before preparing food, before eating, after cleaning up a child who has defecated, and before feeding a child.

A review of hand washing behavior research from 11 countries found that only 17% of child caretakers wash their hands with soap after using the toilet (14). The quantity and proximity of water available to households have been demonstrated to correlate with frequency of hand washing (13; 18; 24). For example, households in east Africa that have individual piped water connections use more than twice the volume of water for personal hygiene compared with households that do not have piped supply (31). Globally, more than three billion persons do not have household-level access to piped water, which presents a formidable challenge to increasing rates of hand washing with soap and water (31). Identifying alternative hand hygiene methods for populations with limited water availability may be a critical step for reducing global child mortality. Alcohol-based hand sanitizers are waterless hand hygiene agents that have been widely accepted for use in hospitals and health care facilities in the United States and Europe, but have received little attention for their use in the developing world. Hand sanitizer formulations consist of ethanol, isopropanol, and/or n-propan. Those sanitizers that contain 60–80% alcohol act as a skin disinfectant by denaturing proteins of pathogens (6).

It is noted that hand sanitizer is not effective against bacterial spores or protozoan acolytes and has poor antimicrobial activity against certain non-enveloped viruses (19). The correct use of hand sanitizer does not require water, takes less time than hand washing, and does not require drying hands with potentially contaminated surfaces (27). Arrange of efficacy tests for hand sanitizer have been performed on hands artificially contaminated with bacteria and viruses.

Benefits of waterless hand sanitizer:

- 1- Require less time than hand washing.
- 2- Act quickly to kill microorganisms on hands.
- 3- More accessible than sinks.
- 4- Reduce bacterial counts on hands.
- 5- Do not promote antimicrobial resistance.
- 6- Less irritating to skin than soap and water.
- 7- Some can even improve condition of skin (1).



Materials and Methods

1- Sampling: Eleven samples from different brand of gel hands sanitizer were obtained from local markets of Baghdad City (Table. 1), were conducted for estimation the proportion of some mineral element (Cu, Co, Cd, Pb) by using atomic Absorption, and bacteriological testing by measuring the anti-bacteriological activities using agar- well diffusion(20; 25).

Table (1): The collected samples from Baghdad markets.

No	Sample	Origin	Date of production	Date of expired	Volume /ml	The ability to kill germs	Notes
1	Kelobatra	Syria	2009	2013	130 ml	%99	Sterile Gel for hands
2	Dettol	Turkey	2009/11/18	2012/11/18	85 ml	%99.99	Sterile Gel for hands
3	Germix	Turkey	2009/11/16	2012/11/16	85 ml	%99.99	Warning signs/away from sun light and Narwalaan
4	VANILLA	Turkey	2009/6/11	2013/6/11	88ml	%99.99	Anti-Bacterial deep cleaner
5	FRESH	Syria	2009/11	2012/11	200ml	%99.99	Cleaner and effective sterile and (full recovery to the hands)
6	Dottol	Turkey	2012/3	2014/3	250 ml	%99	Liquid gel the best protection from germs
7	Beauty	Syria	2009	2012	85ml	%99.99	Sterile Gel for hands
8	Cleaner (blue colour)	China	2010/1/18	2013/1/18	60 ml	%99.99	Gel hand sanitizer apple-flavored
9	Cleaner (red colour)	China	2010/1/18	2013/1/18	60 ml	%99.99	Gel hand sanitizer strawberry flavored
10	4 Wet	Turkey	2009/11/16	2012/11/16	85 ml	%99.99	Sterile Gel for hands
11	HiGeen	Turkey	2010	2013	85ml	%99	Sterile Gel for hands

2- Estimation the mineral elements:

Ten ml of samples were taken from each tested gels, mixed with acid mix-(2:1 V/V) HNO₃ + HCL center. The mixtures was heated at 37C until clear solutions were obtained. Solutions were diluted with 100ml D.W., cooled and subjected to analyses. The metals of (lead, cadmium, copper and Cobalt) were measured by using Atomic Absorption (34; 35; 36).

3- Bacteriological study:

Antibacterial activity of tested sanitizer gels against two candidate bacteria (*E.coli* and *Bacillus spp.*) was performed by using agar- well diffusion assay, briefly (3; 4; 5).

4- Bacterial isolates:

These were obtained from the Market Research and Consumer Protection Center namely *E.coli* and *Bacillus spp.*

5- Estimation of pH:

Hydrogen ion concentration of samples were estimated using pH-meter (36).

Results and Discussion:**Chemical finding:**

The results of metal analyses of hand lotion gels are presented in (table, 2). As is clear in the table, tested lotion gels showed higher concentration of copper- recorded in lotion sign Kelobatra (0.4398 µg/g) and the lower concentration of Copper recorded in lotion sign Cleaner (red color)(0.0393µg/g), These results appeared consistent with the study(29) for the types of hand lotion, as the concentration of hand lotion(0.4398 µg /g) in the current study, while the concentration of lead currently had several types (32). This indicates the existence of an element Lead less than normal limits permitted by the World Health Organization. Copper is important element and key in hand lotion gels where important philological Although the element copper toxic, but his exposure Tangier Security gel Hand, where the Copper is used in concentrations of certain part of the standard specifications of Iraq and that's where the quality of the hand lotion does not cause adverse reactions due to skin contact, but its importance lies in the cycle in the killing of neighborhoods deemed pesticide effective as a result of mechanical this element is based on the change oxidative stress and the serve as a catalyst to generate the type of oxygen (such as hydroxyl radicals) and thus cause damage to proteins and nucleic acids by



damaging the cytoplasm enzymes and cause branched- chain security the effects on the bacterial DNA and thus damage the protein and then cell death (33).

The tested lotion gels showed higher concentration of Cadmium were recorded in lotion sign Fresh ($0.0096 \mu\text{g} / \text{g}$) and the lower concentration of Cadmium recorded in lotion sign Dettol. The result of element cadmium are consistent with the study (28; 23) which determines the presence of cadmium in lye hand in small portions and the reason for the presence of Cadmium contamination is the result of tea cans, plastic and that's where the Acute exposure to cadmiums a result of presence of Cadmium in the hand lotion gels may cause symptom sing including kills, fever, muscle aches and sometimes referred to as "the Cadmium blues." Symptom may resolve after a week if there is any damage in the respiratory tract. Exposure to Cadmium can cause more severe symptoms like pneumonia, and pulmonary edema. Symptoms of dermatitis sand rash may begin hours after exposure to hand lotion, dryness and irritation of the nose and throat, headaches, dizziness, weakness, fever, chills, and chest pain, which quickly lead to respiratory problems and kidney, which can be kill.

Higher concentration of pH value recorded in lotion sign Fresh (8.48) and the lower concentration of pH recorded in lotion sign HiGeen (5.97). This study showed the current matching gel hand to the standard specifications of Iraq and the world, the fact that the borders of the bases pH was between (6-9%) and this indicates the existence of a relationship between the fundamentals pH and killed neighborhoods and agreed to study the case with the study(36) and the reason indicates the strength of the product and the nature of the currency in Alqzaeneighborhoods and not contaminate hands and this shows the production, which has the correctpaths.

As for lead, higher concentration were recorded in lotion sign Dettol($0.2287 \mu\text{g} / \text{g}$) and lower concentration of lead recorded in equal of two lotion sign Vanilla, Cleaner (red color) ($0.0000 \mu\text{g} / \text{g}$), That this current study, agreed with the study(2), where the ratios of lead were high($0.2033 \mu\text{g/g}$)and also hand lotion because they contain lead and has sparked a result of which the accumulation of the concentration of the element lead body and feel the skin and to instead many but the large number of brands with out quality controlled to the entry of poor Buzau of unknown origin(8).



As for Cobalt, higher concentration recorded in lotion sign Dettol ($0.0886 \mu\text{g/g}$), and lower concentration of the Copper recorded in lotion sign Kelobatra ($0.000\mu\text{g/g}$). Has agreed out come with the current study(36; 26) include hand lotion on the mineral elements cobalt and proportions are few and thus meet international standards and health conditions to protect consumers from the dangers of poisoning, has caused presence of cadmium in high quantities because of the rapid industrialization of hand lotion or serious repercussions such as contamination of accidental components such as hand lotion or because the cans and pollution of the atmosphere and not sterilized and cleaned before packing or due to poor storage, and are leading this pollution, which presence in small quantities prevent.

Table (2): The estimation of the Ph, of samples and the concentration of elements.

No.	sample	PH	Cu	Co	Pb	Cd
1	kelobatra	6.79	0.4398	0.0000	0.2033	0.0033
2	Dettol	7.29	0.1139	0.0681	0.0254	0.0011
3	germaix	6.24	0.0697	0.0749	0.0635	0.0074
4	VANILLA	6.10	0.0510	0.0545	0.0000	0.0022
5	FRESH	8.84	0.1109	0.0272	0.1016	0.0096
6	Dettol	6.82	0.2768	0.0886	0.2287	0.0030
7	Beauty	7.66	0.2238	0.0817	0.0127	0.0041
8	Cleaner (red colour)	7.36	0.0393	0.0477	0.0000	0.0037
9	Cleaner(blue colour)	7.05	0.1031	0.0068	0.0127	0.0015
10	4 Wet	6.34	0.1207	0.0545	0.0508	0.0089
11	HiGeen	5.97	0.2444	0.0341	0.0889	0.0026

Bacteriological study:

In this study, results showed that 4wet and Cleaner (blue color) are potent antibacterial agent against *E.coli* and *Bacillus spp.* (20mm, 15mm) inhibition zone receptivity followed by 4wet which also revealed antibacterial activity(18 mm,18mm)inhibition zone against both of tested bacteria *E.coli* and *Bacillus spp.* while Vanilla and



Kelobatra brands didn't show any inhibitory activity against *E.coli* and *Bacillus spp.* (table, 3). To our Knowledge this is the first study to assess the effects of waterless hand cleaner samples against tested organism was carried out at (market research and consumer protection center). Several studies have confirmed the efficiency of alcohol based products reporting microbial effects of alcohol as good or superior to those other antiseptic (21; 37).

Table (3): The antibacterial activity of tested lotion were measured by agar- well diffusion assay and results was assessed by diameters of inhibition zones.

Bacterial isolate	Type of samples										
	Kelatobra	Dettol	germix	Vanilla	FRES H	Dottol	Beauty	Cleaner blue color	Cleaner red color	4wet	Higeen
	Zone of inhibition (mm) in diameter										
Escherich icoli	---	13	14	---	2	13	11	20	15	18	2
Bacillus spp.	---	11	---	---	---	12	---	15	13	18	9

(--) = NO inhibitory activity against *E.coli* and *Bacillus spp.*

References

1. Aiello A. E.; Coulborn R. M.; Perez V. and Larson E. L. (2008). Effect of hand hygiene on infectious disease risk in the community setting: a meta- analysis. *Am J Public Health* 98: 1372– 1381.
2. Agency for Toxic Substances and Disease Registry. Toxicological profile for lead. Atlanta, GA: US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry; (2007). Available at <http://www.atsdr.cdc.gov/toxprofiles/tp13.pdf>. Accessed June 5,
3. AOAC. (1998). U. S. Food and Drug Administration Bacteriological Analytical Manual. 8thd. AOAC International. USA.
4. APHA. (1998). American Public Health Association. Compendium of methods for the Microbiological Examination of hygiene. 3ed Washington. D. C.
5. Boyce J. Pittet D. (2001). Hand Hygiene Task Force, Committee HICPA. Draft guideline for Hand Hygiene in Healthcare settings. Atlanta: Centers for Disease Control and Prevention,
6. Boyce J. M. and Pittet D. (2002). Guideline for hand hygiene in healthcare settings. Recommendations of the healthcare Infection



- control practices advisory committee and the HICPAC/ SHEA/ APIC/ IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/ Association for Professionals in Infection Control/ Infectious Diseases Society of America. *MMWR Recomm Rep* 51: 1–45.
7. Brahimpour, M., H. Alipour, and S. Rakhshah. (2010). Influence of water hardness on acute toxicity of copper and zinc on skin. *Toxicol. Ind. Health*.
 8. CDC. Preventing lead poisoning in young children. Atlanta, GA: CDC. (2012). Available at: <http://www.cdc.gov/nceh/lead/publications/prevleadpoisoning.pdf>. Accessed June 5.
 9. Curtis V. (2003). Talking dirty: how to save a million lives. *Int J Environ Health Res* 13 (Suppl 1) : S73–S79.
 10. Curtis V.; Biran A.; Deverell K.; Hughes C.; Bellamy K. and Drasar B. (2003). Hygiene in the home: relating bugs and behavior. *SocSci Med* 57: 657–672.
 11. Curtis V. and Cairncross S. (2003). Effect of washing hands with soap on diarrhea risk in the community: a systematic review. *Lancet Infect Dis* 3: 275–281.
 12. Curtis V.; Cairncross S.; Yonli R. (2000). Review: domestic hygiene and diarrhea- pinpointing the problem. *Trop Med Int Health* 5:22–32.
 13. Curtis V.; Kanki B.; Mertens T.; Traore E.; Diallo I.; Tall F. and Cousens S. (1995). Potties, pits and pipes: Explaining hygiene behavior in Burkina Faso. *SocSci Med* 41: 383–393.
 14. Curtis V. A.; Danquah L. O. and Aunger RV. (2009). Planned, motivated and habitual hygiene behavior: an eleven country review. *Health Educ Res* 24: 655–673.
 15. Ejemot R.; Ehiri J.; Meremikwu M. and Critchley J. (2008). Hand washing for preventing diarrhea. *Cochrane Database Syst Rev* 23: CD004265.
 16. Esrey S. A.; Feachem R.G. and Hughes J. M. (1985). Interventions for the control of diarrheal diseases among young children: improving water supplies and excreta disposal facilities. *Bull World Health Organ* 63: 757–772.
 17. Fewtrell L.; Kaufmann R. B.; Kay D.; Enanoria W.; Haller L. and Colford J. M. (2005). Water, sanitation, and hygiene interventions



- to reduce diarrhea in less developed countries: a systematic review and meta-analysis. *Lancet Infect Dis* 5: 42–52.
18. Gilman R. H.; Marquis G. S.; Ventura G.; Campos M.; Spira W. and Diaz F. (1993). Water cost and availability: key determinants of family hygiene in a Peruvian shantytown. *Am J Public Health* 83: 1554–1558.
 19. Green Cleaning Standards, Yale University. (2012). Developed by the Facilities Services Department, February.
 20. Hussain, I.; Khan, F.; Iqbal, Y. and Khalil, S. (2006). Investigation of Heavy Metals in commercial tea Brands .. *Jour. Chem. Soc. Pak.* 28:246 – 251.
 21. Kampf G. and Kramer A. (2004). Epidemiologic background of hand hygiene and evaluation of the most important agents for scrubs and rubs. *Clin. Microbiol. Rev* 17: 863–893.
 22. Larsen, J. (2003). Hygiene and health in developing countries: defining priorities through cost-benefit assessments. *Int J Environ Health Res* 13: 37–46.
 23. Lasheen Y. F.; Awwad N. S.; EL- Khalafawy A, Abdel- Rassoul A. A. (2008). Annual effective dose and concentration levels of heavy metals in different types of hygiene in Egypt. *International Journal of Physical Sciences*, 3:112-119.
 24. Oswald W. E.; Hunter G. C.; Lescano A. G.; Cabrera L.; Leontsini E. Pan W. K.; Soldan V. P. and Gilman R. H. (2008). Direct observation of hygiene in a Peruvian shantytown: not enough handwashing and too little water. *Trop Med Int Health* 13: 1421.
 25. Pedro L. F.; Martin M. J.; Pablos F. and Gonzalez A. G. (2001). Differentiation of waterless hand cleaner (*Camellia sinensis*) varieties and their geographical origin according to their metal content. *J Agric Food Chem* 49: 4775–4779 (VL).
 26. Picheansanthian, w. (2004). A systematic review on the effectiveness of Alcohol based solutions for hand hygiene. *Int.J. Nurs .Pract*; 10: 3-9
 27. Pittet D. (2001). Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerg Infect. Dis.* 7: 234–240.
 28. Safety and Health Topics Cadmium- Health Effects. Osha.gov. Retrieved. (2013).
 29. Sivin I. Utility and drawbacks of continuous use of a copper T IUD for 20 years. (2007). *Contraception*; 75(6 Suppl.):S70eS75.



30. Trevett A. F.; Carter R. C. and Tyrrel S. F. (2004). Water quality deterioration: a study of household drinking water quality in rural Honduras. *Int J Environ Health Res* 14: 273–283.
31. Tumwine J. K.; Katui- Katua M. and Munguti K. K. (2002). *Drawers of Water. II: 30 Years of Change in Domestic Use and Environmental Health in East Africa*. London: International Institute for Environment and Development.
32. Warnes S. L.; Caves V.; Keevil C. W. (2011). Mechanism of copper surface toxicity in *Escherichia coli* 0157:H7 and *Salmonella* involves immediate membrane depolarization followed by slower rate of DNA destruction which differs from that observed for Gram-positive bacteria. *Environ Microbiol*. Dec 19.
<http://dx.doi.org/.1462-2920.2011.02677.x> [Epub ahead of print].(VL)
33. Warnes S. L.; Keevil C. W. Mechanism of copper surface toxicity in vancomycin. (2011). resistant enterococci following wet or dry surface contact. *Appl Environ Microbiol*; 77:6049e 6059 (VL).
34. World Health Organization. (1998). *Quality Control Methods for Medical plant Materials*. Geneva, Switzerland.
35. World Health Organization. (2009). *Hand Hygiene: Why, How and When*
36. World Health Organization. (2010). *Progress on sanitation and PH effect; update*. Geneva: WorldHealth Organization, .55 p.
37. World Health Organization. (2009). *Guidelines on hand hygiene in healthcare*. <http>.