



BACTERIAL CONTAMINATION OF SMALL PAPER CURRENCIES IN THE CITY OF SAMARRA, IRAQ

Afrah Abdullah Jassim, Afrah Toama Khalaf and Ayat Muaffaq

Department of Biology, College of Education, University of Samarra, Iraq

Abstract

A total of 30 random samples were collected from paper currencies in the city of Samarra, from small groups (250, 1000, 5000 dinars), with 10 samples for each category and from different parts of the city, from different occupational segments (grocer, Butcher, Municipal, shoe shop, oven worker, food markets, beggars) for the period from 1/11/2018 to 1/12/2018. The results showed that paper currencies were polluted with 5 different bacterial species, *S. aureus* bacteria were highest. 33% (10 isolates) followed by *S. epidermidis* with 16.66% (5 isolates), *E. coli* with 16.66% (5 isolates) and *Enterobacter spp.* bacteria (20% (6 isolates) and *Klebsiella* bacteria by 13.33% (4 isolates).

Keywords: Bacterial contamination, small paper currencies, Samarra

Introduction

Money is one of the most frequently traded items among people and all over the world. It is passed through large numbers of people, from different classes and ages, and from different cultures, so it is stored in adverse environments (Gedike *et al.*, 2013), and through the long journey of money from the process of manufacturing, storage, circulation and conservation until it is destroyed, it is contaminated with many pollutants, especially bacteria pathogenic by spray from coughing and sneezing, contact with skin, contaminated wounds and hands contaminated with saliva and nasal secretions, feces, or when contact is made Contaminated (Ogbu and Uneke, 2007).

The paper currency is also contaminated when stored in bags and bags made of leather or cotton in conditions of moisture, sweating and dark, which are suitable for the growth of pathogenic bacteria, and the main characteristics of pathogenic bacteria develop ways of transmission to the host and thus play the environment an important role in the transmission of diseases to humans, Of the materials that act as vector of infection, when contaminated paper currencies microorganisms such as bacteria, fungi and viruses, there is the possibility of functioning as environmental vehicles for the diseases caused by these nurses to many of the dealers, especially the people with weak immunity and children (Lamichhane *et al.*, 2009; Umeh *et al.*, 2007).

Most people do not wash their hands after touching the money. Most of them doubt that they may suffer from many serious diseases that are transferred to them by trading money. Thus, the currency is a dangerous to health. Especially medical professionals or food handlers, neglecting sanitary conditions, and not washing hands well before examining patients or before dealing with food and drink (Veevers, 2006)

Although paper currencies are usually not suitable for the growth of microorganisms except for some species resistant to harsh environmental conditions, they contain a large surface area that many bacterial species can survive for dozens of days (Gedike *et al.*, 2013). Environmental hazards of many pathogens such as bacteria, fungi and viruses, as well as chemical contaminants, and increased risk when these pathogens are resistant to antibiotics and therefore difficult to treat (Sharma and Dhanashr, 2011).

The microbial contamination of paper currencies is not limited to developing countries only, There are studies in the United States of America that have documented the contamination of paper and metal coins with pathogenic bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* (Gadsby, 1998). Pope *et al.*, 2002 have confirmed the isolation of 93 different bacterial species from a coin The dollar falls under the types *Staphylococcus*, *Bacillus*, *Streptococcus*, *Enterobacter*, *Acinetobacter*, *Pseudomonas*, *Klebsiella*, *Escherichia coli* (Pope *et al.*, 2012).

The aim of the research

Investigate the bacterial contamination of the Iraqi paper currency traded between the various categories in the city of Samarra, alerting to the dangers of bacterial contamination of paper currency, and raising the health awareness of people about the proper ways to deal with paper currencies.

Materials and Methods

Samples collecting

30 samples of paper currency were collected in different categories (250, 1000, 5000 dinars) and by 10 samples per monetary category during the period from the beginning of November until December 2018. The samples were collected randomly from different places in the city of Samarra, (The grocer, the Butcher, Cloth seller, the mourning, the carpenter, the municipal worker, the shoe store, the oven worker, the food markets, and the beggars). The paper currency were collected from these people and placed in sterile plastic bags, And after closing the bag, the information on the sample was recorded, The samples were taken directly to the laboratory for bacteriological investigations.

Isolation and Diagnosis:

Each sample was placed in a tube containing 10 ml Nutrient broth. The tube was then thoroughly stirred for 2 minutes. The sample tubes were incubated for 4 hours and 37 °C. The samples were removed from the tubes using sterile forceps, then the Nutrient agar fertilize in striped method, and incubated at 37 °C for 24 h. Diagnosis was done using optional and differential media including: Mannitol Salt Agar, MacConkey agar, Eosin Methylene Blue Agar, Blood agar, Jackets Simmons Citrate agar, incubated dishes 37 m

for 24 hours, and identified touch developing populations based on the morphological characteristics of developing colonies (Isenberg, 2004; Holt *et al.*, 1994).

Preparation of cultural media

cultural media were based on the manufacturer's information on the packaging and dissolved in distilled water. They were then sterilized by the sterilizer at 121 °C, under pressure 15 pound for 15 minutes and the dishes were incubated at 37 ° C and 24 hours to investigate for non-contamination, Then stored in the refrigerator.

The groups used in this study are

Nutrient broth: This medium was used to isolate bacteria from paper currencies.

Nutrient agar: This medium has been used for the purpose of culture the bacteria, purifying colonies and conserving for short periods.

Mannitol Salt agar: This medium was used as selective mediums of *Staphylococci spp.* (Colle *et al.*, 1996).

Eosin Methylene Blue: This medium was used to diagnose *E. coli* bacteria.

MacConky agar: This medium was used to develop chromosomal *bacillus* (Baron *et al.*, 1994) and is also used to differentiate between species belonging to the fermented and non-fermented intestinal family of lactose sugar (Colle *et al.*, 1996).

Blood agar base: This medium was used to detect the ability of isolates to produce the current hemolysin enzyme (Atlas *et al.*, 1995).

Table 1 : Shows the results of the diagnosis of bacterial contamination of paper

No	Categories	250	1000	5000
1	Grocer	<i>S.aureus</i>	<i>S.aureus</i>	<i>S.epidermidis</i>
2	Butcher	<i>S.aureus</i>	<i>S.aureus</i>	<i>Klebsiella spp</i>
3	Cloth seller	<i>S.epidermidis</i>	<i>Enterobacter spp</i>	<i>Enterobacter spp</i>
4	The carpenter	<i>Klebsiella spp</i>	<i>Enterobacter spp</i>	<i>Enterobacter spp</i>
5	The municipal worker	<i>S.aureus</i>	<i>E.coli</i>	<i>Klebsiella spp</i>
6	The shoe store	<i>S.aureus</i>	<i>S.aureus</i>	<i>S.aureus</i>
7	The mourning	<i>E.coli</i>	<i>Klebsiella spp</i>	<i>E.coli</i>
8	The oven worker	<i>S.epidermidis</i>	<i>S.epidermidis</i>	<i>S.epidermidis</i>
9	The food markets	<i>S.aureus</i>	<i>E.coli</i>	<i>E.coli</i>
10	The beggars	<i>S.aureus</i>	<i>Enterobacter spp</i>	<i>Enterobacter spp</i>

The results showed the contamination of paper currencies with 5 different bacterial species since the *S.aureus* bacteria took the highest percentage (33.33%) followed by the other types of *S.epidermidis* (16.66%), *E. coli* (16.66%), *Enterobacter spp* (20%) and *Klebsiella* (13.33) As in Table (2) and Figure (1).

Table 2 : Shows the percentage of bacterial isolates isolated from Currencies paper.

No	The name of bacteria	Percentage %
1	<i>S.aureus</i>	33.333%
2	<i>Enterobacter spp</i>	20%
3	<i>S.epidermidis</i>	16.66%
4	<i>E.coli</i>	16.66%
5	<i>Klebsiella</i>	13.33%

Diagnosis of bacterial isolates

The morphological characteristics of developing colonies were observed through:

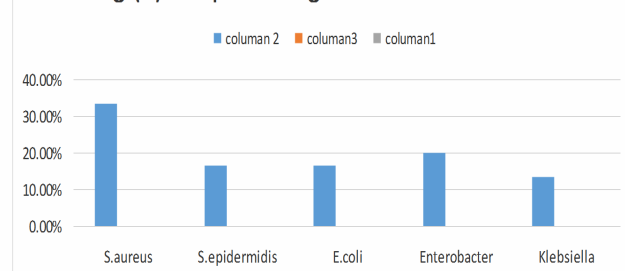
(A) Microscopic and agricultural characteristics: The bacteria were first identified by observing the growing characteristics of the growing colonies on the media used in terms of size, height and color of the colony. Thin swabs were stained with chromium to observe the cell shapes and their order ability and pigmentation of this stains (Prescott *et al.* 1996).

(B) Bacteriological tests: IMVIC tests (including Indole test, methyl red, Voges psorkauer, Simmon citrate (Koneman *et al.*, Prescott *et al.*, 1996), as well as the Catalase and Coagulase tests to confirm isolated bacterial species (Colle *et al.*, 1999).

Results and Discussion

This study showed the extent of the bacterial contamination of Iraqi paper currency from some categories in the city of Samarra (The grocer, the Butcher, Cloth seller, the mourning, the carpenter, the municipal worker, the shoe store, the oven worker, the food markets, and the beggars), With 10 categories per 250, 1000 and 5000, dinars which were contaminated with different types of bacteria and 100% pollution as shown in Table (1). This result is consistent with what was stated (Abd, 2012) how obtained a percentage of pollution of the cash currency traded and with different workers and gobs from the city of Baghdad.

fig (1) the percentag of bacterial isolation



The most common bacteria found were *S.aureus*, a naturally occurring bacteria on the skin and mucous membranes, which is of medical importance because many studies have proven to be a causative agent for many diseases, including wound inflammation, dermatitis, and Abscess (Saeed *et al.*, 2011). *Staphylococci* bacteria are the

normal flora of the human body. They are found on the skin, nose, mouth and intestines, as well as in the air, water and sewage. They can be transferred to the money by contact with the skin of the hands or contact with the hands contaminated with droplets from the nose and mouth during sneezing. Or from the saliva used to moisten the fingers. When counting currencies paper (Tartora and Funke, 2003), since these bacteria live naturally on the skin, their presence will be confirmed in most samples.

The contamination of currencies paper with intestinal bacteria *E.coli*, *Klebsiella*, *Enterobacter spp*, and the presence of these bacteria on paper currencies, an indication of the contamination of feces of hands because of washing hands well after the use of toilets, which is an important factor in the contamination of paper currency of these bacteria, and other species belonging to the intestinal family, which are found naturally in the intestines of the human, In addition, has emerged *Enterobacter* bacteria and these bacteria opportunistic pathogenic, causing inflammation of the respiratory tract and urinary tract (Goktas and Oktay, 1992).

The rest of the other species are species that are everywhere in the environment, rarely causing diseases in the proper host, but opportunistic bacteria that cause diseases in the case of weak immunity (Tartora and Funke, 2003).

The results of the present study showed the bacterial contamination of the paper currencies, especially the small groups. This study is consistent with several studies, including what was reporting by Abed (2012), where the contamination of paper currencies in the city of Baghdad by bacteria, 100% and the isolation of 12 different bacterial species, (21.1%) *Bacillus spp* (28.1%) Coagulase negative *Staphylococcus aureus* (7.9%), *Proteus spp.* (3.5%), *Pseudomonas aeruginosa* (4.4%), *Enterobacter spp* (4.4%), *Salmonella spp* (3.5%), In addition, the small dinar categories were more polluted than the large categories. The study also agrees with Jassim and Madinah (2018), the contamination of paper currencies in the city of Diwaniyah, 7 types of bacteria. If the bacteria *Bacillus spp* occupied the highest percentage, 31.64% followed by Coagulase negative *Staphylococci* with 30.38%, while *Escherichia coli* showed 10.13%. *Staphylococcus aureus* and *Pseudomonas spp* had the same percentage of 8.86 and *Klebsiella* with 6.33%. The incidence of haemolytic *streptococci*- was 3.8%. The contamination of small groups showed more than the large categories of paper currencies, especially the least-used for all transactions in daily life, for the exchange of goods and in all services around the world. These leaves will be contaminated with some bacteria. There is a risk of disease spreading through it and a risk to the public health of the community (Umeh, 2007).

References

- Abid, H.S. (2012). Bacterial contamination of Iraqi paper currency and bacterial resistance to antibiotics. *Iraqi Journal of Science*, 870(1): 53.
- Al-naciri, O.N. and Najris (2002). A bacteriological chemical and molecular study of *Staphylococcus aureus*. Ph.D. thesis, college of Science, Mustansiriyah university.
- Alfred, E.B. (2005). *Bensons Microbiological applications in Laboratory Manual in general microbiology*. 9thed. McGraw-Hill Companies.
- Atlas, R.M. (1995). Pathogenesis of infections diseases. In: *Principle of microbiology*. 1sted. Moisy. Year book, Inc.1st Louis, Baltimore, 505-509.
- Baron, E.J.; Petron, L.R. and Finegold, S.M. (1994). *Bailey and Scoff's Diagnostic Microbiology*. 9thed. Mosby. Co. U.S.A., 735-759.
- Collee, G.; Fraser, A.G.; Marmion, B.P. and Simmons, A. (1996). *Makie and McCarthey practical microbiology*. 14th ed. Churchill Livingstone. New Yourk. U.S.A. Francisco: Benjamin/ Cummings Publishing.
- Gadsby, P. (1998). Filthy lucre: bugs, drugs and grime hitch a ride on the back of every buck. *Discover*. 19: 76-84.
- Gedik, H.; Timothy, A. and Andreas, V. (2013). Money and transmission of bacteria. *Antimicrobial Resistance and Infection Control*, 2: 22.
- Goktas, P. and Oktay, G. (1992). Bacteriological examination of paper money. *Mikrobiyol. Bull.*, 26: 344- 438.
- Holt, J.G.; Krieg, N.R.; Sneath, P.H.; Staley, J.T. and William, S.T. (1994). *Bergey's manual of Determinative Bacteriology*. 9thed. William & Wilkins Co. Baltimor, 1406-1410.
- Isenberg, H.D. (ed.). (2004). *Essential procedures for clinical microbiology*. 2nd ed. Washington, DC: ASM Press.
- Jassim N.H. and Madraa, H.A. (2018). Bacterial contamination of Iraqi paper currency traded in the city of Diwaniyah. college of Science, university of Qadisiyah.
- Koneman, E.W.; Allen, S.D.; Janda, W.M.; Schreckenberger, P.C. and Winn, W.C. (1997). *Color atlas and textbook of diagnostic microbiology* -5th ed. Lippincott; chapter 12: 577-649.
- Lamichhane, J.; Adhikary, S.; Gautam, P.; Maharjan, R. and Dhakal, B. (2009). Risk of handling paper currency in circulation chances of potential bacterial transmittance. *Nepal J. Sci. Technol.*, 10: 161-166.
- Ogbu, O. and Uneke, C. (2007). Potential for parasite and bacterial transmission by paper currency in Nigeria. *J. Environ. Health*, 69(9): 54- 60.
- Pope, T.W.; Ender, P.T.; Woelk, W.K.; Koroscil, M.A. and Koroscil, T.M. (2002). Bacterial contamination of paper currency. *Southern Med. J.* 95: 1406- 1410.
- Prescott, L.M.; Harley, J.P. and Klein, D.A. (1996). *Microbiology*. 3rd ed; Wm.C. Brown Communication; Inc. Austraua; Oxford; England. Iowa; USA .
- Saeed, S. and Rasheed, H. (2011). Evaluation of Bacterial Contamination of Pakistani paper Currency Notes (Rupee) in Circulation in Karachi. *European Journal of Biological Sciences* 3(3): 94-98.
- Sharma, A. and Dhanashiree, B. (2011). Screening of currency in circulation for bacterial contamination. *Current sci.*, 100(6): 822- 825.
- Tartora, G.J. and Funke, B.R. (2003). *Microbiology: An introduction*. 8th ed. San Francisco: Benjamin/ Cummings Publishing.
- Umeh, E.U.; Juluku, J.U. and Ichor, T. (2007). Microbial contamination of naira(Nigerian currency)notes in circulation. *Research Journal of Environmental Science*, 1(6): 336-339.
- Veevers, L. (2006). Shared banknotes 'health warning to cocaine users'. *The observer*, Retrieved April 06, 2010.