Bacterial contamination of Iraqi paper currency in circulation in Al-Nasiriyah city, Thi – Qar province

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Abstract

The aim of this study was to investigate the types of bacteria which contaminated the Iraqi paper currency in circulation in Al –Nasiriyah city, Thi – Qar province**.** It was collected 75 paper currencies in circulation which included 15 of each one for five category of (250, 1000, 5000, 10,000, 25,000) dinars from different sources (fish vendors, vegetable sellers, cafeteria, officers, butchers) .the study was appeared the higher number of aerobic plate count (APC)were founded in denomination 1000 dinar in range (40 -900)C.F.U. / ml, while the lowest number were in denomination 250 dinar in range (20-80) C.F.U . / ml . Sixty five of different bacterial isolates were obtained from 75 samples of paper currency., the denomination 250 was contaminated with the highest number of isolates ,it recorded 18(27.7%)isolates . *Escherichia coli* was predominated among other bacteria, it was registered 12(18.46%) followed by *Micrococcus* sp.(9(13.8%)). *Streptococcus* sp. was registered the lowest number (1(1.53%))among other isolates .The number of bacterial isolates that obtained from paper currency of fish venders was more than that in other possesses , it was reached 17 (26.15%)**,** and the paper currency of Officers showed the lowest number of isolates(7(10.76%)).

Key words: paper currency, Bacteria, contamination

التلوث البكتيري للعملات النقدية الورقية العراقية المتداولة في مدنية الناصرية ، محافظة ذي قار

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الخلاصة

استهدفت الدراسة التحري عن أنواع البكتريا الملوثة للعملات النقدية الورقية العراقية المتداولة في مدينة الناصرية ، محافظة ذي قار . جمعت 75 عملة ورقية متداولة ، تضمنت 15 ورقة لكل فئة (250، 1000، 5000، 10000، 25000) دينار من مصادر مختلفة (بائعي السمك، بائعي الخضروات ، كافتيريا ، قصابين، موظفين). أظهرت الدراسة أن أعلى عدد للبكتريا الهوائية الكلية (APC)، وجد في الفئة 1000 دينار بمعدل (40–900)C.F.U / مل ، بينما ظهر اقل عدد للبكتريا في الفئة 250 وبمدى (20–80).C.F.U/ مل . تم الحصول على 65 عزلة بكتيرية مختلفة من 75 عينة من العملات الورقية النقدية ، سجلت الفئة 250 دينار أعلى عدد للعزلات البكتيرية ، إذ بلغت 18(27.7%) عزلة.كانت بكتريا *Escherichia coli* أكثر سيادة بين الأنواع البكتيرية الأخرى ، إذ سجلت 12(18.46%) تليها بكتريا *Micrococcus* sp. (9(13%))، وسجلت بكتريا *Streptococcus* sp. اقل عددا (1(1.53%)) بين العزلات البكتيرية الأخرى.وجدت الدراسة أن أعداد العزلات البكتيرية للعملات النقدية التي تم جمعها من بائعي السمك كانت أعلى مما هو عليه في المصادر الأخرى التي جمعت منها العملات النقدية ، إذ بلغت 17(26.15%) ، بينما كانت العملات النقدية التي تم جمعها من الموظفين اقل عددا للعزلات البكتيرية (7(10.76%)).

Introduction

Money is defined as the generally accepted material, embodies the piece of paper and promise, this is the currency note. Money is used as a unit of measure for the price of a transaction. It is a means of exchanging goods and services, settling debts and activities. It is a valuable storehouse of savings .Money is used for all types of trade and plays an important role in human life. However, its wide spread use and continuous exchange make it a factor for disease transmission (Sharma & Sumbali,2014 ; Grima *et al.,* 2014). These coins carry microbes on their surfaces and are responsible for transporting them (Barolia *et al*., 2011)

From day to day dealing, money is traded by people with different health and health characteristics and also stored under different environmental conditions and individual health (Awe *et al* .,2010). . These notes will act as a vesicle to transport of microbes to contamination of hands with next possessor (Barolia *et al*., 2011).

In most countries, the lack of currency trading culture is widespread and there is random arbitrariness of paper currency, personal housing in unhealthy conditions and unhealthy places will contaminate currencies such as keeping coins in socks, running shoes, under carpets ,the pressure on it in the hand will re-enter many microbes into the currency. Attitude, such as moisturizing fingers with saliva or using polluted water. Hand lubrication in counting money or using fingers loaded with contaminated food to carry money may not only facilitate currency contamination but may also increase the risk of injury of the contaminated pieces, addition can produce microbes from dust, soil, water, natural flora of the body. (Awe *et al* .,2010).

A large number of organisms have the viability of surviving on dry fomites such as banknotes, and has developed stages of physiological survival that help them to survive or hibernate due to reduced water activity. Studies on normal paper showed differences in survival length depending on environmental conditions of the room but were fixed on the paper for up to an72 hour and still able to grow after seven days (Hobner *et al*., 2011).

The study around the world was registered high rates of microbial contamination of paper currency in circulation(Ayandele, & Adeniyi,2011; Barro *et al*., 2006).

A number of studies in the United States of America recorded cases of contamination of coins and paper and showed pathogenic microorganisms such as *Echerichia coli, Enterobacter, Kebsiella* and *Staphylococcus aureus* (Vriesekoop *et al*., 2010).

Other organisms such as *Micrococcus* sp., *Corynebacterium* sp., *Vibrio cholerae*, Mycobacterium tuberculosis and, *Shigella dysentriae* is also insulated from banknotes (Saeed & Rasheed,2011). This may be result different diseases such as food poisoning , respiratory and gastrointestinal infections , skin and wound infections and other diseases that threaten the life as septicemia and meningitis (Jane-Francis *et al.,* 2014).Because the studies were revealed microbial contamination of paper currency of different countries in the world , this study was to detection and identify of bacterial contamination of Iraqi currency in circulation in Al – Nasiriyah city, Thi Qar province .

Material And Method

Collection of samples

It was collected 75 paper currencies in circulation which included 15 of each one for five category of (250, 1000, 5000, 10,000, 25,000) dinars from different sources (fish vendors, vegetable sellers, cafeteria officers, butchers) in the city of Nasiriyah. The samples was collected in sterile polyethylene bags between September 2016 to march 2017 and transported to the laboratory of microbiology in pathological analysis department , college of science.

Microbial isolation

It was ministered sterile cotton swabs with peptone water solution and used to swabbing all surface of paper currency and the soaked into 10 ml peptone water solution. and thoroughly mixed by vortex(Grima *et al.,* 2014). Aerobic plate count(APC) was done to detection the total number of aerobic and facultative aerobic bacteria by using spread plate method, it was transported 0.1 ml of sample to plate count agar (Himedia, India)other bacteria were isolated by using MacConkey agar , blood agar , Eosim methylene blue agar(Himedia, India) by spread –plate method , plates were incubated in 37C^{o} of 24hr (Tortora *et al*., 2004).isolates were identified by using API 20 E(BioMerieux, France) , and biochemical tests according to (Colee *et al*., 1996; MacFaddin ,2000)

Resultes

The results of table (1) were appeared the higher number of aerobic plate count (APC) were founded in paper currency 1ooo dinar in range 40-600 C.F.U/ml, while the lowest number were in 2500 dinar in range 20-80 C.F.U./ml.

Table(1) : Rate of Aerobic Plate Count (APC) isolated from paper currency.

Category	Number	No. of APC (C.F.U)*/ml
250	15	30-550
1000	15	40-900
5000	15	40-150
10000	15	20-100
25000	15	20-80
Total	75	

C.F.U : Colony Forming Unit

The results of table 2 were appeared, 65 different bacterial isolated were obtained from different paper currency in circulation, the paper currency in category 250 dinar was contaminated with the highest number of bacteria, it recorded 18(27.7%) isolates, the *E.coli* bacteria predominated among other bacteria, 12(18.46%) were isolated , followed by *Micrococcus* sp 9(13.8). *streptococcus* sp. was registered the lowest number 1(1.53%) among other isolates.

Table(2) : Numbers and distribution of bacteria isolated from paper currency

Microbial isolates	250 NO & (%)	1000 NO & (%)	5000 NO & (%)	10000 NO & (%)	25000 NO & (%)	Total NO & (%)
Bacillus sp.	2 (40)	2 (40)	1 (20)			5 (7.7)
E.coli	4(33.3)	1(8.3)	4(33.6)	1(8.3)	2(16.7)	12(18.46)
Staphylococcus Aureus	2(28.5)	1(14.28)		2(28.5)	2(28.5)	7(10.76)
Staphylococcus Epidermidis	1(20)	2(40)		1(20)	1(20)	5(7.69)
Pseudomonas Aeruginosa	2(40)	1(20)	1(20)	1(20)		5(7.69)
Enterobacter sp.	2(50)			1(25)	1(25)	4(6.15)
Micrococcus sp.		4(44.4)	3(33.3)	1(11.1)	1(11.1)	9(13.8)
Klebsiella sp.	2(100)					2(3.07)
Proteus sp.		1(50)		1(50)		2(3.07)
Shigella sp.	1(25)	1(25)	1(25)	1(25)		4(6.15)
Raoultella sp.	1(50)	1(50)				2(3.07)
Streptococcus sp.		1(100)				1(1.53)
Candida albicans	1(14.28)	2(28.5)	1(14.28)		3(42.9)	7(10.76)
Total	18(27.7)	17(26.15)	11(16.9)	9(13.8)	10(15.38)	65(100)

Table(3) : Distribution of types and bacterial number on different sources.

Bacterial Isolates	Fish vendors (No. &(%) of bacteria)	Vegetable sellers (No. &(%) of bacteria)	cafeterias (No. &(%) of bacteria)	Butchers (No. &(%) of bacteria)	Officers (No.&(%) of bacteria)	Total (No. & (%) of bacteria)
Bacillus spp	2 (40)	1 (20)	1 (20)		1 (20)	5 (7.7)
E.coli		5 (41.67)	2 (16.7)	3 (25)	2 (16.7)	12(18.46)
Staphylococcus Aureus	2 (28.6)	2 (28.6)	1 (14.3)	2 (28.6)		7(10.76)
Staphylococcus epidermidis	1 (20)	1 (20)	2 (40)	1 (20)		5(7.69)
Pseudomonas aeruginosa	2 (40)	1 (20)	1 (20)	1 (20)		5(7.69)
Enterobacter spp.	1 (25)		2 (50)		1 (25)	4(6.15)
Micrococcus spp.	3 (33.3)	1 (11.1)	1 (11.1)	2 (22.2)	2 (22.2)	9(13.8)
Klebsiella spp.	1 (50)		1 (50)			2(3.07)
Proteus spp.		1 (50)	1 (50)			2(3.07)
Shigella spp.	1 (25)	2 (50)			1 (25)	4(6.15)
Raoultella spp.	2 (100)					2(3.07)
Streptococcus spp.	1 (100)					1(1.53)
Candida albicans	1 (14.28)		3 (42.8)	3 (42.8)		7(10.76)
Total	17(26.15)	14 (21.53)	15 (23.07)	12(18.46)	7 (10.76)	65(100)

The results of table 3 was founded that the number of bacterial isolates from paper currency of fish venders was more than the numbers of their that collected from other sources , it was reached 17 (26.15%). Officers were recorded the lowest number bacteria 7 (10.76%).

Discussion

124

Money is very important for human life ,it makes easier to meet the general needs of people, the paper is widely traded for goods and services in various countries of the world, it is used for all types of trade, all types of transactions are based on currency, paper currency and coins are used by people who are different from the health suit and are stored under environmental conditions,for this reason, paper and cash coins are a means of carrying many pathogenic microorganisms, so the money that carries pathogenic microorganisms is often reservoirs   for many diseases (sharma & sumbali,2014).

All (75) paper currency that tested in this study were showed microbial contamination by various microbial organisms , these finding were similar to several studies (Grima *et al.,* 2014 ; Vriesekoop *et al*., 2010) .

This study was appeared , the denomination of 1000 dinars was higher contamination with aerobic plate bacteria (APC)followed by 250 dinars , these denomination are considered the lowest denomination notes of Iraqi paper currencies used in circulation , these results were agreement with results of (Tagoe *et al*., 2009;Ahmed *et al*.,2017).these may be due to considered small denominations are the most common categories among people with different occupations and walks of life such as shoe shiners , beggars , street food vendors , bluchers and others , therefore , they are more susceptible to microbial contamination .

In this study many types of bacteria isolated from paper currency included gram negative and gram positive . *E.coli* was predominant bacteria .

E .coli are coliform bacteria that are placed daily with feces in large numbers, and may contaminate paper currency in several ways, but their existence indicates that the hands are not washed after the use of toilet. Pomperayer and Gaylarde (2000) reported that the currency in constant movement, passing in all environments, makes it a reservoirs and a source of various types of bacteria that include *E. coli* . *Staphylococcus aureus* also appeared high percentage among other isolates , these bacteria can colonize the skin and anterior nares in healthy individuals (Williams , 1963), these results were agreement with results of Tagoe *et al* ., (2009), this fact may be lead to contamination of paper currency by transfer of bacteria from nose and other body parts by hand to money . The paper currency evaluated in this study was collected from possessor of currency such as fish vendors , vegetable vendors , cafeteria , bluchers and officers ,

the paper currency that collected from fish vendors were showed the highest number of isolated bacteria , this may be due to the fact that fish bodies are covered with mucous , moist and sticky materials , and this helps in the adhesion of microbes , dust and dirty on them , when these fish touch the hands , the microbes move to it and then contaminate the coins when used by sellers . as record by Benhamed *et al* ., (2014)that , fish are permanent contact with environment , thus they are always exposed to high various external pollutants such as aerobic and anaerobic bacteria , parasites viruses and other pollutants .Many types of microbes such as bacteria and Candida were collected from paper currency which possesses by vegetable vendors and cafeteria , butchers and officers .

CONCLUSION : we conclude from this study that the percentage of bacterial contamination of the Iraqi paper currency was high, and showed different types of pathogenic and opportunistic bacteria , in addition to it may be a means of transmission of diseases to human in hospitals and community.

Recommendation: we recommend to pay attention to the currency and focus on it being a vehicle to transfer the diseases and care of personal hygiene, especially hand washing after using the paper currency .

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