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Lower denomination and dirty currency carries more contaminated than higher denomination in pakistan

Abstract

Aim: There was several study and report of occurrence of microorganisms, in particular bacteria on cash banknotes and coins. One of the main source of pathogenic or food poisoning because of the pathogenic bacteria the people commonly carry these bacteria in their nose, mouth, wounds, and intestine, and on their skin. Modern bank notes are made up of special blend of 75% cotton and 25% of linen with small segment of fiber so paper money is something of a in isomer, this formation is of paper money is the potential source ,substrate for the growth of the bacteria. As the changes of the hand for the handling of money from the valet, from the underneath of breezier, from the socks causing the carrier of the microorganisms. While from different locations| outlets we buy day to day commodities we transfer these microorganisms from one location to another location and transferring diseases specially to the debilated patients and immune compromised patients who are at high risk and vulnerable to get disease. The average life span .of low denomination paper banknotes is about 24months some claims.

Material-Methods: In this total study 720 samples were taken from different locations of currency of different denominations i.e. from Bank counter 243 sample were taken, From, ATM Machine 50 samples were taken From Food seller were 94 samples were taken , From Medical store 35 samples were taken ,From ,Milk seller 92 samples were taken. From Grocery shop 63 samples were taken, From, Meat shop 80 samples were taken, From Road side mechanic 36 samples were taken, From Bus conductor 4 samples were taken and from Beggars 23 sample were taken while study period was from 4.32010 to 31.12011 all the specimens were processed according to standard methods.

Result: In this total study 720 samples were taken from different locations i.e. from Bank counter 243 sample were tken 68microorganisms were isolated, From, ATM Machine 50 samples were taken and 0% microorganism were found, From, Food seller were 94 samples were taken 74 microorganisms were isolated, From Medical store 35 samples were taken 24microorganisms were isolated, From, Milk seller 92 samples were taken 74microorganisms were isolated. From Grocery shop 63 samples were taken 38microorganisms were isolated, From, Meat shop 80 samples were taken 55microorganisms were isolated, From Road side mechanic 36 samples were taken 24microorganisms were isolated, From Bus conductor 4 samples all samples were positive for isolates and from Beggars 23 sample were taken 19microorganisms were isolated while study period was from 4.32010 to 31.12011 all the specimens were processed according to standard methods.

Conclusion: It has been found from the study that the currency circulating in Pakistan is the strong source of the pathogens even the Mycobacterium Tuberculosis were isolated during the study suggestive that the people of Pakistan are at the great risk regarding the health point of view. This study shows that from all types of the outlet we almost where we daily visit and, the microorganisms are present, while from bank counter number of isolates were very low that is 28 % out of 243 sample while 100% from the bus conductor and 80% from the milk seller where it is not possible any person not to visit or purchase the milk on daily basis. This is the situation where people Pakistan are living. While 0% of microorganisms were isolated from the ATM machine so this money Currency is safe that must be used and make the habit for transaction which is so safe regarding the health point of view.

Keywords: locations, banknotes, pakistan currency, microorganisms

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Jawed Ahmed Badvi,[1] Kulsoom Jawed,[2] Maria Jawed Badvi[3]

[1]Department of Pathology, Ghulam Mohmmad Mahar Medical College, Pakistan

[2]Senior lecturer, Dow International Medical College, Pakistan

[3]Reseacher, Liaqat university of Health sciences, Pakistan

Correspondence: Jawed Ahmed Badvi, Professor Department of Pathology, Ghulam Mohmmad Mahar Medical College Sukkur, Pakistan, Email jawedbadvi1958@gmail.com

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Introduction

Food poisoning is on the increase worldwide although it is e a classic characteristic of human parasitic and bacterial agents is the evolution of routes for transmission to susceptible hosts. The environment plays a critical role in transmission to humans, with many environmental materials serving as vehicle.[1] The surface of paper banknotes is not smooth, but irregular, and can harbor many different types of micro-organisms. The two main factors that determine the occurrence of bacteria on currency are

a. The material that the banknotes are made from and
b. The age of the banknote. Bacteria have enormous capabilities to allow them to survive in adverse conditions.

Two of the most important strategies for survival are their ability to adhere to surface and the ability to form biofilms (multicellular aggregates). Members of some genera, such as Bacillus, may form spores and can survive attached to banknotes for many years. Formation of a biofilm or a spore is controlled by genetic activity.[1]

Suggested that only 10% of cases are reported - just the tip of the iceberg. Banknotes play a major role in transmission of pathogenic bacteria. Some mathematical models have been developed to help to understand the movements of currency and how this might contribute to the global spread of disease. One of the main sources of pathogenic or food poisoning bacteria are people. People commonly carry these bacteria in their nose, mouth, wounds, and intestines, and on their skin. There are several reports of the occurrence of micro-organisms, in particular bacteria, on cash banknotes and coins. A study in the US showed that only 6% of banknotes tested were free from microbial contamination.[1] The climatic and environmental conditions of the tropics favor the thriving of many pathogenic microorganisms, and in the face of underdevelopment, inadequate water and sanitation, crowded living conditions, lack of access to health care, and low levels of education, a greater proportion of the populace, particularly the poor, become highly susceptible to infection and disease.[2] Bacterial cells on banknotes are measured by the number of colony forming units (c.f.u.) per cm^2 of banknote. A banknote may contain up to 10^6 c.f.u. cm^{-2}, whilst a coin may have up to 10^3 c.f.u. cm^{-2}. Studies have shown that polymer based banknotes often have a relatively low bacterial count compared with the cotton based paper banknotes. This may be due to various physiochemical parameters of polymers. For example, a negatively charged and hydrophilic synthetic polymer would adversely affect bacterial attachment. Banknotes may be categorized as mint (new or recently produced and obtained directly from the bank), clean (clean appearance without obvious damage) and dirty or mutilated (damaged, soiled, held together with sell tape).

Irrespective of whether it is polymer based or cotton based, more bacteria are likely to be recovered from a dirty banknote than a clean or mint note. A mint banknote would normally contain no or only a negligible number of bacteria. However, by the time it has passed through at least four Passing from hand to hand among all classes of the people, it would be strange indeed, says the Lancet, if money, and especially paper money, did not in its transit become from time to time the vehicle of infectious disease. Even the crisp "fiver" of the Bank of England no doubt has often borne the germs of fever in its folds, and how much more, then, the greasy, discolored, and well thumbed one pound note, or the paper fraction of some foreign currencies. Higher values have here a distinct advantage. Less common, less in keeping of the overcrowded poor, less handled and soiled, therefore they may perhaps in many cases run their circuit without having done much mischief.[3] Passing from hand to hand among all classes of the people, it would be strange indeed, says the Lancet, if money, and especially paper money, did not in its transit become from time to time the vehicle of infectious disease. Even the crisp "fiver" of the Bank of England no doubt has often borne the germs of fever in its folds, and how much more, then, the greasy, discolored, and well thumbed one pound note, or the paper fraction of some foreign currencies. Higher values have here a distinct advantage. Less common, less in keeping of the overcrowded poor, less handled and soiled, therefore they may perhaps in many cases run their circuit without having done much mischief.[1] The micro-organisms isolated from the notes were *Escherichia coli* (80%), *Aerobacter* (59%), Salmonella (40.9%), yeast cells (36.4%), Streptococcus faecalis (31.8%), Staphylococcus aureus (27.3%) and coagulase negative staphylococci (18.2%). Contamination was significantly correlated with the denomination of the notes (r=-0.304; p=0.019). Lower denomination notes were more contaminated than higher denomination notes (x^2=34.036; p=0.03). Dirty and tattered notes had more contaminants than cleaner and newer notes (x^2=11.324; p=0.01). This study has demonstrated that naira notes could be sources of contamination by microbial pathogens.[4] Contamination of objects by pathogenic micro-organisms is of much public health concern as contaminated materials can be sources of transmitting pathogens. Items that are passed from hand to hand are likely to be contaminated with disease causing micro-organisms especially if handled with unclean hands, or kept in dirty surroundings. Paper money, therefore presents a particular risk to public health, since communicable diseases can spread through contact with fomites.[3,5–7] Although paper money is impregnated with disinfectant to inhibit micro-organisms, pathogens are isolated from currency notes and coins,[8] Studies in different parts of the world have reported high rates of microbial contamination[5,8–14] and[3,6,8,12,15,16] of currency notes in circulation.

The possibility that currency notes might act as environmental vehicles for the transmission of potential pathogenic micro-organisms was suggested in the 1970s.[2] The average U.S. dollar, for instance like most currency notes worldwide lasts a mere 18months. Paper currency also provides a large surface area as a breeding ground for pathogens.[17] In most parts of the developed world, there is a popular belief that the simultaneous handling of food and money contributes to the incidence of food related public health incidents.[18] Over the last two decades, data indicating that simultaneous handling could indeed be a cause of sporadic food borne illness cases have accumulated from studies of the microbial status and survival of pathogens on coins and currency notes in Turkey.[10] The possibility of currency contamination with micro-organisms has also been observed among food handlers. An assessment of the public health risk associated with the simultaneous handling of food and money in the food industry in Australia.[16] Suggested that without hygienic intervention, human occupational activities, especially those involving simultaneous money handling, could introduce the risk of cross contamination to foods.[18]

Money in the form of notes or coins is handled by everyone, and dirty money (money contaminated with pathogenic micro-organisms) is always in circulation.[3] Micro-organisms on the skin can be transferred from cashiers, salespeople and the general public to the currency notes that they handle. Contamination from the anal region, wounds, nasal secretions and aerosols generated by sneezing and coughing are potential sources of transfer of micro-organisms to currency notes during handling. *Staphylococcus epidermidis, Pseudomonas aeruginosa* and *Klebsiella aerogenes* have been reported to survive well on the skin and are known to be transferred from fabrics to hand as well as from hand to fabrics.[10] According to Dr. Peter Ender, lead researcher, sixty four (94%) of the bills were contaminated with bacteria known to cause either serious or mild illness. Five bills (7%) were found to be contaminated with bacteria which can cause infections in healthy people. Those bacteria included *Staphylococcus aureus* and *Klebsiella pneumonia*, both of which can cause pneumonia and blood infections. Fifty nine bills were contaminated with bacteria that are usually harmless in healthy individuals, but can still trigger serious illness in those with depressed immune systems, such as people undergoing various types of medical treatment or those with HIV. However, Ender stressed that real health risks to the average consumer are pretty low, adding that US dollar bills may be no more or less covered in microbial goo than, say, doorknobs, pens, or computer keyboards. But he points out that US currency, especially 'finds its way into all areas of the world'. "With the rapid dissemination of money in the era of drug-resistant bacteria, perhaps a resistance clone could be spread from one geographic location to another.[19]

The potential role of influenza virus on banknotes in the spread of this disease has been documented. One strain, H3N2, can remain infective for up to 3days, on banknotes, and other strains may be

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active for up to 17days. Typically, humans carrying the influenza virus may shed copious amounts of virus during sneezing; contaminating any money they may be in contact with the eggs and larvae of parasitic worms or helminthes have been recovered from currency. Banknotes, particularly from developing economies where street foods are common, have been found to contain eggs of Ascaris, Trichuris and Taenia species. Intestinal helminthes represent one of the most prevalent forms of parasitic disease and it is estimated that majority of the community population may be infected with parasitic worms. Farm animals and domestic pets also carry helminthes. Again, thorough hand washing is an effective way of reducing the transfer of eggs of parasitic worms onto cash.[4] Lower denomination notes having more contamination rate in compare with the higher denomination note. (r=-0. 304; p=0. 019). (x2=34.036; 11p=0. 03). Notes which are dirty, torn and apparently soiled are more contaminated than clean ones. (11p=0.01).[20]

The bank currency was for the first time labeled as the source of the disease transmission.[2] As the notes or coins are handled by everyone, and dirty money (money contaminated with pathogenic micro-organisms) is always in circulation.[2] Currency notes are being used by the different people and handled by different hands estimated 4000 peoples of different hands. (Gads by, 1998) Currency provides the good atmosphere for the growth of the microorganisms and work as the reservoir...[13,17] There is also the risk of unwarranted trade barriers, i.e., when countries apply a microbial standard if that standard is not based upon sound risk management decision wherein justifying the standard as a public health measure.[18] As with currency, the amount, form, and location of axon affect which transactions are possible. Other factors, such as what commodities are available in a given time and place, constrain which transactions axon can facilitate. For instance, you cannot usually buy a goldfish at a shoe store, and it is quite challenging to purchase an ice cream sundae at 8am.[18] Diarrhea is mainly caused by enteric pathogens that are transmitted through fecal oral route. There are different routes for the faecal pathogens to reach the mouths of susceptible persons. Direct routes may be through contaminated fingers and fomites, and indirect routes may be through food, water, flies etc. currency notes which are handled daily by many people, have, like fingers, the potential for carrying coterie pathogens on them. E.coli was isolated from 50% of all the samples. Vibrios were isolated from samples of fish mongers and Salmonella from butchers in all the 3 seasons. Shigella was not isolated. The isolates of Salmonella belonged to the species of S. derby and S. anatum.[2] The isolation of Vibrio, Salmonella, and ETEC (ST) from the currency notes indicates the importance of paper money as a source of contamination. Disease transmission by pathogens that require a small inoculums to start infection, such as Shigella, may be plausible via paper money; however, it is less likely that a pathogen which requires a larger inoculums for infection, e.g. V. cholerae 01, will cause disease by this route. The lack of isolation of Shigella may be due to its short life span in dry condition. This study underscores the importance of usage of anti septics during hand washing, handling paper money, and handling of food or eating.[2]

Aims of study

This study was aimed to provide the first insight into the distribution of lower denomination contamination microorganisms than higher contamination from the Pakistan currency circulating in Pakistan, as the Pakistan currency is contaminated with microbial (PAPER AS WELL AS COINS). And to address the growing community concern about the risk associated with microbial contamination and handling of money in the country. To identify lower denominations are more contaminated than the higher denomination, the common pathogens residual on circulating Pakistan currency. The microbial contamination of the currency to enrich in global information bank on subject as the issue is becoming a major public health concern word wide and to alarm the government about the situation. And to take the effective measures regarding bio-safety in Pakistani currency circulate. Total 720 samples were taken and divided in 20 of mintcurncy, 20 of clean currency and 20 of dirty muttilated currency from all the denomination currency of Pakistan circulating in Pakistan.

RS.5000|,Rs1000|Rs500|Rs100|Rs50|Rs20|RS10|,Rs5|. Rs5|(coin),Rs2|,Rs.2|(coin)Rs.1(Silvercoin),RS1(brass coin). The samples was collected From different locations i.e. from Bank counter, ATM mechanic, Medical Food seller, Milk seller, Grocery store, Meat shop, Road aside mechanic, Bus conductor, and from the, Baggers. All the samples were collected in sterile condition and processed according to the standard methods in the BMSI (basic medical sciences institute) LABORATORY at (JPMC Karachi).

Method

Coagulase test by tube method

This test was used to differentiate *Staphylococcus aureus* which produces the enzyme coagulase from other *Staphylococcal species* which do not produce coagulase.

Principle

Coagulase carries plasma to clot by converting fibrinogen to fibrin. Two types of coagulase are produced by most of the strains of *Staphylococcus aureus*. Free coagulase which converts fibrinogen to fibrin by activating a coagulase reacting factor present in plasma. Free coagulase is detected by clotting in the tube test. Bound coagulase (clumping factor) which converts fibrinogen directly to fibrin without requiring a coagulase reacting factor, it can be detected by clumping of bacterial cells in the rapid slide test.

Required

i. (EDTA Ethylinediaminetetra-acetic acid), Anticoagulant, Human plasma (preferably proved and previously HIV and hepatitis tested) or rabbit plasma the plasma should be allowed to warm at room temperature before being used.

ii. Tube test method (detect free coagulase).

iii. Take 3 small test tube and label T=Test organism (18-24 hours nutrient broth culture).

iv. Pos= Positive positive control (18-24 hours Staphyloccus aureus nutrient broth culture).

v. Neg=Negative control (sterile nutrient broth).

vi. With pipette 0.2 ml of plasma into each tube.

vii. Add 0.8 ml of the test broth culture to tube T.

viii. Add 0.8 ml of *Staphylococcus aureus* culture to the tube labeled Pos.

ix. Add 0.8 ml of sterile nutrient broth to the tube labeled Neg.

x. After mixing gently, incubate the three tubes 35-37ºC. Examine for clotting after 1 hour if no clotting has occurred examine after 3hours. If the test is still negative leave the tube at room temperature over night and examine again.

Note: When looking for clotting tilt each tube gently.

Result

Clotting of tube contents or fibrin clot in tube - *Staphyloccus aureus*.

Identification of staphylococcus epidermidis: Isolates were inoculated in urea broth for 24hours at 37°C turned in pink color shows urease positive. Isolate were inoculated on Mueller- Hinton agar by making lawn, Novobiocin disc was applied and plate was incubated at 37°C for 24hours. The result was sensitive to Novobiocin by forming zone of inhibition. Isolates were inoculated in Nitrate broth for 24hours at 37°C turned in red color shows Nitrate positive. → Isolates were inoculated on agar media containing maltose sugar for 24 hours at 37°C, yellow color of medium shows maltose positive. → Isolates were inoculated on agar media containing trehalose sugar and were incubated for 24hours at 37°C medium was colorless. No color change shows trehalose negative. Resulting the isolates was Staphylococcus epidermidis.[21] Oxidation fermentation (OF) medium, sterile paraffin oil (liquid paraffin)**.**

Method

By using the sterile straight wire, inoculate the test organism to the bottom of two bottles (or more if testing several carbohydrates) of sterile of medium use heavy inoculums. Cover the inoculated medium in one of the tubes (or one from each carbohydrate pair) with a 10mm deep layer of sterile paraffin oil or molten wax. Incubate the tubes at 35-37ºC for up to 14days. Examine daily for carbohydrate utilization showing the acid production.

Result

	Open tube	Sealed tube	Interpretation
1.	Yellow	Green	Oxidative organism
2.	Yellow	Yellow	Fermentative organism
3.	Green or blue	Green	Non utilization of carbohydrate

Control

a. cFermentative control *E. coli.*[22]

b. Control *Pseudomonas aeruginosa*

c. Oxidative.

Identification of salmonella

The isolates which were pale yellow or nearly colorless, 1-3mm in diameter and were easily distinguished from the pink red colonies fermenting commensalls. Coli form bacilli e.g. E. coli inoculated for fermenting test (Production of gas and acid in sugar peptone water within 6-7hours at 37ºC. Isolates were inoculated and indole negative, isolates were inoculated for identification, Gluconate which were not utilized, Isolates were inoculated for urease for produce and urease was not produced, resulting isolates were Salmonella.[21]

Identification of shigellae

Isolates were inoculated in urea broth (Appendix 5) for an hour at 37ºC, no turning in pink color shows urease negative, isolates were inoculated in indole and, indole negative, isolates were inoculated in glactose broth, growth turn in yellow color, isolates were inoculated for 2days at 37ºC in lactose . ., isolates were inoculated in sucrose broth for 24hours at 37ºC, isolates were inoculated in menitol growth turned in yellow, resulting isolates were Shigella.[21]

Identification of proteus

Isolates were inoculated in glucose broth, gas production and color changed in yellow isolates were incubated in urea broth color changed in Pink color, and urease were positive, isolates were inoculated in Indole resulting indole negative observed color changed in light yellow, isolates were inoculated for dextrose oxylation on orinthine broth, isolates were oxylation negative. Isolates were inoculated in TSI, H_2S produced gas, and H_2S positive, isolates were inoculated on agar gel which was positive gelatin liquefaction occurred hence gel positive. Isolates were inoculated on mannose sugar agar growth turned in yellow color hence isolates were mannose positive, isolates were inoculated on adonitol growth no change occur in color hence adonitol negative, isolates inoculated on maltose agar media no color change occur hence maltose -ve, isolates inoculated on trehalose agar media growth turned in yellow color hence trehalalose positive isolates were inoculated on xylose (Appendix I) isolates were xylose positive hence isolates were identified as Proteus mirabilus.[21]

Identification of klebsiella

Isolates were inoculated on VP which showed positive, isolates were inoculated for lactose fermentation and fermentation occurred by producing and VP positive isolates were inoculated for gas production in glucose, gas was produced, isolates were inoculated in indole negative, urea were positive, isolates were inoculated on citrate which showed citrate positive, isolates were inoculated malonate result was molonate positive, isolates were inoculate in lysine medium for decarboxylation which was positive, isolates were inoculated on KCM medium and confirmed as Klebsiella.[21]

Identification of sarratia

Isolates were inoculated for lactose which was negative, isolates were inoculated for maltose which was negative, isolates were inoculated for the anositol which was positive, isolates were inoculated for arabinose which was negative, isolates were inoculated for rafinose and was negative, isolates were inoculated for sorbitol which was positive, isolates were inoculated for maltose which was positive and identified as Sarratia.[21]

Identification of Mycobacterium tuberculosis

Amplified sample for the Mycobacterium tuberculosis direct AMTD test, TMA.

Results

Of the 720 samples, 243 samples were taken from the Bank counter total 68(28%) microorganisms were isolated including OUT OF 243 Samples Salmonella were 3(1.23%), Staphylococcus areus were 52(21.3%), E.Coli were1(41%), Proteeus were 0%, Staphylococcus epidermidis were 12(4.93%), Mycobacterium Tuberculosis were0%, Klebsella were0%, Shigilla were 0%, Seratus were0%, Pseudominas were0%. Of the 720 samples 50 samples were taken From the ATM machine none of the microorganism was found. Of the 720 samples from the Medical store 35 samples were taken total 24(74.3%) microorganisms were found, including OUT OF 35 samples, Salmonella were 3(8.57%), Staphylococcus are us were 9(25.57%), E.Coli were 6(17.14%), Proteus were 0%, Staphylococcus were 6(17.14%), Mycobacterium Tuberculosis were 0%, Klebsella were 0%, Shigilla were, Of the 720 samples 94 samples were taken from the Food seller, 66(70.2%), microorganisms were found including OUT OF 94 Samples. Salmonila were 37(39.36%), Staphylococcus aureus were6(6.38%0, E.Coli were 5(5.3%), Proteus were 3(3.1%),

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Staphylococcus epidermidis were 5(5.43%), Mycobacterium Tuberculosis were 16(17.39%), Klebsella were 1(1%), Sigella were 1(1%), Seratuswere0%, and pseudomonas were 0% Of the 720 samples, 92 sample were taken from the Milk seller 74(80.4%) were found including OUT OF 92 Samples. Salmonila were 27 (29.34%), Staphylococcus aureus were 9 (9.78%), E.Coli were 9(9.78%), Proteus were 6(6.52%), Staphylococcus epidermis were 5(5.45%), Mycobacterium Tuberculosis were 16(17.39%), Klebsela were 1(1%), Shigella were 1(1%), Seratus were 0%. Of the 720 samples63 samples were taken from the Grocery store, 38(60.3%) were found microorganisms including OUT OF 63 Samples. Salmonella were 9(14.28%), Staphylococcus aureus were 8(12.69%), E.Coli were 3(4.76%), Proteus were 12(19%), Staphyloccus epidermidis were 5(7.9%), Mycobacterium Tuberculosis were 0%, Klabsella were 1(15), Shigella were 0%, Seratus were 05, Pseudomonas were 0%.

Of the 720 samples, 80 samples were taken from the Meat shop 55(68.8%0 were found microorganisms. including, OUT OF 80 Samples. Salmonella were 22(22(27.5%), Staphylococcus aureus were 6(7.5%), E.Coli were 11(13.7%), Proteus were 7(8.75%), Staphylococcus epidermidis were 2(2.5%), Mycobacterium Tuberculosis were 1(1.25%0, Klebsela were 3(3.75%0), Shigella were 1(1.25%), Seratus were0%, Pseudomonas were 2(2.5%). Of the 720 samples 36 samples were taken from the Road side mechanic, 24(66.7%) were found microorganisms, including OUT OF 63 Samples. Salmonella were 9(14.28%), Staphylococcus aureus were 8(12.69%), E.Coli were 3(4.76%), Proteus were 12(19%), Staphyloccus epidermidis were 5(7.9%), Mycobacterium Tuberculosis were 0%, Klabsella were 1(15), Shigella were 0%, Seratus were 05, Pseudomonas were 0%. Of the 720 samples 4 samples were taken from the Bus conductor 4(100%) were found microorganism including OUT OF4 Samples. Slmonella were 2(50%), E.Coli were 1(25%), Klebsella were 1(25%). Of the 720 samples, 23 sample were taken from the Beggars 19(82.6%) were found microorganisms, including OUT OF 23 Samples. Slmonella were 4(1789%0), Staphylococcus aureus were 2(8.69%), E.Coli were 0%, Proteus were 7(30.43%), Klebsella were 3 (13%0, Shigella were 1(4.34%) Seratus were 2 (8.69%).

Table 1 Bacteria isolated from various locations

Location	No. of Samples	Salmonella	*S. aureus*	*E.coli*	Proteus	*S. Epider.*	*M.Tuber.*	Kleb	Shigella	Seratus	Ps.	Total	%
Bank counter	243	3(1.25%)	52 (21.3%)	01(.41%)	0	12(4.93%0	0	0	0	0	0	68	28
ATM	50	0	0	0	0	0	0	0	0	0	0	0	0
Medical store	35	03 (8.57%)	09(25.57%)	06(17.19%)	0	06(17.14%)	0	0	2(5.7%)0	0	0	26	74.3
Food seller	94	37 (39.36%)	06(6.38%)	05(5.3%)	03(3.1%0	07(7.44%)	04(4.2%)	02(2.12%)	02(5.12%)	0	0	66	70.2
Milk seller	92	27(29.34%)	09(9.78%)	09(9.78%)	06(6.52%)	05(5.43%)	16(17.39%)	01(15)	01(1%)	0	0	74	80.4
Grocery store	63	09(14.28%)	08(12.69%)	03(4.76%)	12(19%)	05(7.9%)	0	01(1.58%)	0	0	0	38	60.3
Meat shop	80	22(27.5%)	06(7.5%)	11(13.1%)	07(8.75%)	02(2.5%)	1	03(3.75%)	01(1.25%)	0	02(2.5%)	55	68.8
Roadside merchant	36	08(22.2%)	01(2.77%0	05(13.8%)	04(11.11%)	0	0	04(11.11%)	02(5.53%)	0	0	24	66.7
Bus conductor	4	02(50%)	0	01(25%)	0	0	0	01(25%)	0	0	0	4	100
Beggar	23	04((17.89%)	02(8.69%)	0	07(3043%)	0	0	03(13%)	01(4.34%)	02(8.69%)	0	19	82.6
Total	720	115	93	41	39	37	21	15	9	2	2	374	51.9

Table 2 Isolated micro-organisms from pakistan currencies

Micro-organisms	Number	%
Bacteria		
Salmonella	115	16
Staphylococcus aureus	93	12.9
E.coli	41	5.7
Proteus	39	5.4
Staphylococcus epidermidis	37	5.1
Mycobacterium tuberculosis	21	2.9
Klebsiella	15	2.1
Shigella	9	1.3
Seratus	2	0.3
Pseudomonas aeruginosa	2	0.3
Parasites		
Ascariasis lumbercoidis	187	26
Enterobacterium	60	8.3
Tinea saginata	23	3.2
Fungi		
Candida albicans	151	21
Aspergillosis	83	11.5
Cryptococcus	20	2.8
Total	898	2.8

Discussion

This huge number of the isolated microorganisms from the Pakistan currency circulating in Pakistan is very alarming situation in Pakistan regarding the health point of view especially for the immunocompromised patients and debliated patients. In this study the distribution of isolates were from different locations Of the 720 sample size 68(28%) from the bank counter, From ATM machine 0%,From medical store 26(74.3%), From food seller 66(70.2%), From milk seller 74(80.4%),From Grocery shop 38(60.3%) From Meat shop 55(68.8%), From Road side mechanic 24(66.7%), From Bus conductor 4(100%), From Beggars 23(82.6%).[23,24] Indeed it is confirmed that the microorganisms are present in all locations, except bank ATM cash where these pathogens are killed during the process of heating that is 392F as claim of the Gads by (1998). Hence during my study microorganisms were isolated from all location, the highest number of isolates from Bus conductors that was 100%. microorganisms were found While 2nd highest number of isolates were found from beggars that were 82.6%, while lowest number of isolates were 28% found from the bank counter might be because of supply of the clean currency notes, which is lowest number of isolates in comparison to other locations. But it is evidential proof that all locations are providing the microorganisms to the people of

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Pakistan. The main component of paper is cellulose. The degradation of cellulose by bacteria, which secret the enzyme cellulose. Growth of microorganisms causing biodeterioration of cellulose is greatly influenced by environmental conditions, which provides the strong environment for the survival of the microorganisms, thus the currency contamination is of important to public health as it can provide a vehicle for easy transmission of pathogens between the handlers.

Table 3 Isolated organisms in groups % of microorganisms from isolated898 microorganisms from 720 sample Size

Organisms	Groups				
	Mint	Clean	Dirty/Mutilated	Total	%
Bacteria					
Salmonella (12.8%)	0	51	64	115	12.8
Staphylococcus aureus (10.35%)	20	52	21	93	10.35
E.coli(4.56%)	0	20	21	41	4.56
Proteus(4.34%)	0	10	29	39	4.34
Staphylococcus(4.12%) epidermidis	10	24	3	37	4.12
Mycobacterium(2.33) tuberculosis	0	7	14	21	2.33
Klebsiella(2.3%)	0	1	14	15	2.3
Shigella(1%)	0	4	5	9	11
Seratus(.2%)	0	0	2	2	0.2
Subtotal (Bacteria)	30	169	175	374	41.64
Parasites					
Ascariasis lumbercoidis (20.8)	0	92	95	187	20.8
Enterobius vermicularis (6.6%)	0	28	32	60	6.6
Tinea saginata (2.56%)	0	2	21	23	2.56
Subtotal (Parasites)	0	122	148	270	38
Fungi					
Candida albicans (16.8%)	0	68	83	151	16.8
Aspergillosis (9.24%)	0	36	47	20	9.24
Cryptococcus (2.2%)	0	8	12	20	2.2
Subtotal (Fungi)	0	112	142	254	28.28
Total	30	403	465	898	100

Table 4 Distribution of isolated micro-organisms

Micro-organism	Number	%
Salmonella	115	12.8
Staphylococcus aureus	93	10.35
E.coli	41	4.56
Proteus	39	4.34
Staphylococcus epidermidis	37	4.12
Mycobacterium tuberculosis	21	2.33
Klebsiella	15	2.3
Seratus	2	0.2
Pseudomonas	2	0.2
Ascariasis lumbricoides	187	20.8
Enterobious vermicularis	60	6.6
Tinea saginata	23	2.56
Candida albicans	151	16.8
Aspergilus	83	9.24
Cryptococcus	20	2.2

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Conflicts of interest

Author declares there are no conflicts of interest.

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