

# Parastical Ova Isolated from the Various Locations and are the Potential Source of the Parasitic Infection through the Pakistan Currency

## Abstract

There are so many studies of occurrence of microorganisms specially the parasitical ova isolation from the banknotes and coins and causing serious health hazard to the community. Parasitical ova are usually associated with spoilage in foods, but they may also produce toxins and adult parasite after mature can make serious illness and thus their presence on banknotes and on coins is also undesirable and causing serious illness especially the respiratory disease, diarrhea and the itching wound of anal area to children and parasitic infection. Modern bank notes are made up of special blend of 75% cotton and 25% are 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 survival of the parasitical ova. While from different locations we buy day to day commodities we transfer these microorganisms from one location to another location and transferring diseases specially to the depilated patients and immunocompromized patients who are at high risk and vulnerable to get disease. The average life span of low denomination paper banknotes is about 24 months. Study is designed to provide the first insight to add to the limited body of literature on microbial contamination of currency (Pakistan currency circulating in country, papers as well as coins currency) and to address growing community concerns about the risk associated with microbial contamination and handling of money in the country.

## Objectives:

- To identify the common pathogens residual on circulating Pakistan's currency.
- The microbial contamination of currency to enrich in global information bank on subject as the issue is becoming a major public health concern worldwide.
- To take the effective measure regarding bio-safety in Pakistan currency circulating in Pakistan.

**Methodology:** In this total study 720 samples were taken from different locations i.e. from Bank counter 243 samples, TM Machine 50 samples, Food seller 94 samples Medical store 35 samples, Milk seller 92 samples, Grocery shop 63 samples, Meat shop 80 samples, Road side mechanic 36 samples, Bus conductor 4 samples and from Beggars' 23 sample while study period was from 4.3.2010 to 31.12.2011 all the specimens were processed according to standard methods.

**Material and Method:** As Per Criteria.

**Keywords:** Parasitical ova; Parasitic infection; Pakistan currency; Microorganisms

## Research Article

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## Introduction

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. A study in the US showed that only 6% of banknotes tested were free from microbial contamination [1].

The possibility of currency contamination with microorganisms 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 [2].

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 [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 surfaces and the ability to form biofilms (multicellular aggregates) [1].

Usually associated with spoilage in foods, but they may also produce toxins that can make a banknote may contain up to 106 c.f.u. cm<sup>-2</sup>, whilst a coin may have up to 103 c.f.u. cm<sup>-2</sup>. Studies have shown that polymer based banknotes low cfu as compared with cotton content bank notes. This may be due to various physicochemical parameters of polymers. For example, a negatively charged and hydrophilic synthetic polymer would adversely affect bacterial attachment. Banknotes Parasites and bacteria are the common cause of the disease in community [3]. (As the currency notes are being used by the different people and handled by different hands estimated 4000 peoples of different hands [4]. Currency provides the good atmosphere for the growth of the microorganisms and work as the reservoir [5]. The notes or coins are handled by everyone, and dirty money (money contaminated with pathogenic micro-organisms) is always in circulation [6].

The environment plays a critical role in transmission to humans, with many environmental materials serving as vehicle [3]. Microbial contaminants may be transmitted either directly, through hand-to-hand contact, or indirect, via food or other inanimate objects. These routes of transmission are of great importance in the health of many populations in developing countries, where the frequency of infection is a general indication of local hygiene and environmental sanitation levels [7]. the occurrence of bacteria on currency are

- a. The material that the banknotes are made from and
- b. The age of the banknote [8].

*Enterotoxigenic E.coli*, *Vibrio* and *Salmonella* have been isolated from currency notes, from butchers and fishmongers in Rangoon, Myanmar. Paper money in Egypt was found to be contaminated with bacteria organisms such as *Staphylococcus aureus*, *Staphylococcus albus* and *Koebisella pneumoniae*. Similar reports have been made in India [9].

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 (Food and Agriculture Organization of United Nations, 2005 [1]. 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 sellotape). 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 pairs of hands, numerous bacteria can be recovered [1] 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 [10] An investigation that was reported in 1997 and that involved swabbing and culturing from various coins and paper money collected at random from doctors, laboratory staff and other employees at New York hospital resulted in the recovery of many pathogenic micro-organisms [11,12]. Contamination may occur during production, during storage after production, and during use [13] there are various modes of transmission of infection. Fomites are responsible for the indirect transmission of infection. Various diseases like diphtheria, trachoma, gastroenteritis, whooping cough and pathogenic agents causing diarrhea are known to be transmitted through fomites. Currency might also be a fomite, playing an important role in the transmission of micro-organisms and also in the spread of drug resistant strains in the community. In this era of HIV pandemic this deserves special attention [14]. Study underscores the importance of usage of antiseptics during washing of hands, and to handling of paper money, and to handling of food or eating [15]. Another is a general "contact dermatitis" that is like a rash caused by germs on the razor. People who handle currency in their jobs sometimes get a "contact dermatitis" breakout on their face if they wipe their face with their hand after handling soiled currency. Third is just your ordinary scraping, floor bum type of imitation, usually from going over the same spot too much, or from a very dull razor with an uneven edge or one with a wire edge [16] Abrams and Waterman examined both paper and coin currency and found 70% of the coins and notes to be contaminated with bacteria. A similar study reported higher numbers of bacteria in notes than coins in Hungary. Further, potential pathogens such as members of *Enterobacteria* and *Bacillus cereus* were found but on notes only. However [17] cultured bacterial organisms from monetary coinage from 17 countries and identified environmental bacteria including *Bacillus* and *Staphylococcus* species and concluded that money coinage did not presents do not harm public health. Study reported here differs from those of Ova's [17].

Contamination may occur during production, during storage after production, and during use [13]. So, what can you do? Well, thorough washing of your hands is most important. Or, you could travel to Japan or Australia. In Japan you can go to a 'clean ATM' and get your yen pressed between rollers for one tenth of a second at 392 F, enough to kill many bacteria [4]. The dirtiness of bills in one reason Australia is leading the change to use a plastic currency that is supposed to be inhospitable to both germs and counterfeiters and four times as durable as paper notes. Australia introduced the rubber feeling bills in 1998 and now prints them for 33 other countries, including Romania, Malaysia and Mexico. Another option is to launder your money literally, like the

Industrial and Commercial Bank of China, which took emergency action in an effort to stop the spread of SARS. They put into effect a policy of holding money for twenty four hours before recirculation it long e the probability that every single person in the United States is carrying drug-tainted money is almost certain, "says Dr. James Woodford, forensic chemist from Atlanta. Woodford cites a 1989 experiment by Miami toxicologist Dr. William Hearn, who gathered 136 dollar bills from banks in twelve cities of these 131 had traces of cocaine. A study conducted at the Houston Advanced Research Center in Texas and the Argonne National Laboratory in Illinois examined currency (mostly singles, but also fives, tens, and twenties) in Miami, Chicago, and Houston. This project found an overall 70 to 80% contamination rate in the three cities, with single dollar bills more commonly contaminated than the higher denominations. Overall, the more worn the bills, the more coke was found on them. In very old bills, the contamination rate was closer to 90%. A recent look at money circulating in northern Illinois, found even higher rates: close to 93% of the sample, and 100% of the \$20 bills tested positive for cocaine. "In fact, most Americans handle small amounts of cocaine every day, not as packets sold by drug dealers, but on the dollar bills that line their pockets," were conclusions from this study [18]. Money is also sterilized by being placed under ultraviolet light for an hour. So, you could just carry coins. Patricia Gadsby [4] reports that anything that is very hard and dry isn't terribly hospitable to bacteria, and many metals have antibacterial activity. Pennies often are sterile, presumably due to the copper, and most US coins are also about 75% copper [18]. Currency samples analyzed in amounts above 0.1 microgram and in 54% of the currency in amount above 1.0 microgram. Contamination was widespread and was found in single dollar bills from a number of US cities. During this exchange there is ample opportunity for paper currency to become contaminated [18]. Working days lost due to illness, etc: Normally 1-3 days are lost due to illness. Damage to seafood markets. The economic effects of illnesses reverberate throughout the seafood supply industry causing loss of consumer confidence and concomitant loss of sales. Consequently, a slowing effect for seafood sales overall occurs, which can represent a short term serious economic loss. In general, the various reports of seafood related illnesses also appear to combine to affect the entire seafood supply in a cumulative fashion, which can lead to long term depressed sales. 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 [8].

The possibility that currency notes might act as environmental vehicles for the transmission of potential pathogenic microorganisms was suggested in the 1970s [19]. Paper currency is widely exchanged for goods and services in countries worldwide. It is used for every type of commerce, from buying milk at a local store to trafficking in sex and drugs. All this trade is hard on currency, with lower denomination notes receiving the most handling because they are exchanged many times [4]. Money on which pathogenic microorganisms might survive represents an often overlooked reservoir for enteric disease [20]. 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 [21]. 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 [22]; Remember this, cooking could kill viruses, bacteria and fungal elements present on the food but it is not an assurance that the toxins present are destroyed, toxins in bacteria that could create variety of problems in the body [23].

In the United States, a whole division of the Department of Treasury deals with what is termed "mutilated currency," and the department Web site boasts many examples of beleaguered, burned, buried, water-damaged money [24]. Well on the skin and are known to be transferred from fabrics to hand as well as from hand to fabrics [25].

There is various modes of transmission of infection. Fomites are responsible for the indirect transmission of infection. Various diseases like diphtheria, trachoma, gastroenteritis, whooping cough and pathogenic agents causing diarrhea are known to be transmitted through fomites. Currency might also be a fomite, playing an important role in the transmission of micro-organisms [14].

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 [19,26]. Thus the risk of infection is increased several fold when objects that change hands at a high frequency, such as currency notes, are contaminated with microbes. The risk is by no means restricted to residents of the country in question; it might even be greater for expatriates, tourists, and visitors from other countries, who may not be immune to the pathogens [27]. All of these researchers strongly suggested that money plays a role in the transmission of antibiotic-resistant and potentially harmful bacteria agents [28,29].

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Risk of infection is increased several fold when objects that change hands at a high frequency, such as currency notes, are contaminated with microbes. A great majority of the populace does not carry money in wallets, and squeezing of currency notes is a common occurrence. Women, especially among the unenlightened, often place money underneath their brassieres, while men place theirs in their socks. These activities not only enhance currency contamination but may also increase the risk of infection from contaminated notes [4,5].

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 [21]. A classic characteristic of human parasitic and bacterial agents is the evolution of routes for an assessment of the public health risk associated with the simultaneous handling of food and money

in the food industry in Australia [2]. The environment plays a critical role in transmission to humans, with many environmental materials serving as vehicle [3,30].

The isolation of parasitic agents from currency notes in the study reported here confirmed that currency might be a vector playing an important role in the transmission of pathogenic microorganisms, as well as in the spread of drug-resistant strains in the community [31]. Parasites isolated from the currency notes included *Ascaris lumbricoides* (8.0 percent), *Enterobius vermicularis* (6.8 percent), *Trichuris trichiura* (2.8 percent), and *Taenia* species (4.0 percent). To identify the common interestingly the ova of the *ascaris. lumbricoides*, *E. vermicularis*, *T. trichiura* & *taenia* species were isolated from the currency notes. Their presence on objects that frequently change hands is known to be reflection of poor local environmental sanitation and personal hygiene [32].

OF all the intestinal helminthes isolated *A.lumbricoides* acquired with the highest frequency. One possible reasons for this the resilience of the ova [19,33]. The result did not suggest that anyone denomination was particularly susceptible to or protected against contamination, since pathogens were found on all denominations of the currency notes and were absent only on the mint notes from the banks [24].

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### Aims of the Study

a. Study is designed to provide the first insight to add to

the limited body of literature on microbial contamination of currency (Pakistan currency circulating in country, papers as well as coins currency) and to address growing community concerns about the risk associated with microbial contamination and handling of money in the country.

- b. To identify the common pathogens residual on circulating Pakistan's currency.
- c. The microbial contamination of currency to enrich in global information bank on subject as the issue is becoming a major public health concern worldwide.
- d. To take the effective measure regarding bio-safety in Pakistan currency circulating in Pakistan.
- e. Pathogens residual on circulating Pakistan currency.

### Material and Method

Total 720 samples were taken and divided in 20 of mint currency, 20 of clean currency and 20 of dirty| mutilated 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(Silver coin), RS1(brass coin).

The samples was collected From different locations i.e from Bank counter, TM mach nic, Medical tore Food seller, Milk seller, Grocery store, Meat shop, Road aside mechanic, Bus conductor, and from the, Beggars. All the samples were collected in sterile condition and processed according to the standard methods in the BMSI (basic medical sciences jpmc, Karachi) (Figure 1) (Table 1 & 2).

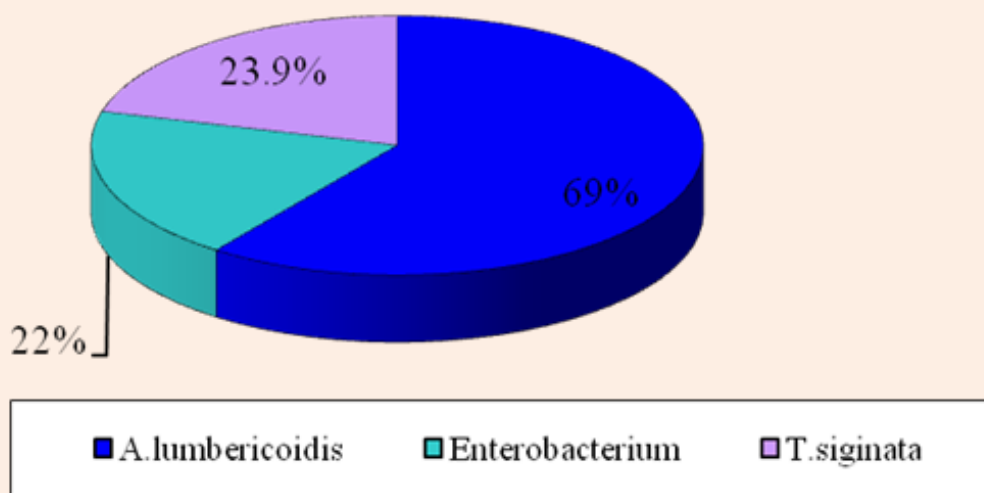


Figure 1: Distribution of Parasites Isolated from 720 Specimens.

**Table 1:** Distribution of Denominations of Currency into Three Groups.

Denomination	Groups			
	Mint	Clean	Dirty/Mutilated	Total
Rs. 5000 Paper	20	20	20	60
Rs. 1000 Paper	20	20	20	60
Rs. 500 Paper	20	20	20	60
Rs. 100 Paper	20	20	20	60
Rs. 50 Paper	20	20	20	60
Rs. 20 Paper	20	20	20	60
Rs. 10 Paper	20	20	20	60
Rs. 5 Paper	20	20	20	60
Rs. 5 Coin	20	20	20	60
Rs. 2 Coin	20	20	20	60
Rs. 1 Silver coin	20	20	20	60
Rs. 1 Brass coin	20	20	20	60
Total	240	240	240	720

**Table 2:** Parasites Isolated from Various Locations.

Location	No. of Samples	Ascariasis Lumbericoidis	Enterobious Vermicularis	Tinea Saginata	Total	%
Bank counter	243	18(7.40%)	0	0	18.7	7.4
ATM	50	0	0	0	0	0
Medical store	35	06(17.14%)	0	0	6	17.1
Food seller	94	41(43.61%)	19(20%)	04(42%)	64	68.1
Milk seller	92	51(55.43%)	08(8.69%)	03(3.26%)	62	67.4
Grocery store	63	26(41.1%)	05(7.9%)	0	31	49.2
Meat shop	80	23(28.72%)	11(13.75%)	13(16.23%)	47	58.8
Roadside mech	36	17(47.2%)	03(8.3%)	01(2.7%)	21	58.3
Bus conductor	4	03(75%)	0	01(25%)	4	100
Beggar	23	02(8.69%)	14(60.86%)	01(4.34%)	17	73.9
Total	7720	187	60	23	270	37.5

## Discussion

This study was conducted at Microbiology Department, Basic Medical Sciences Institute (BMSI), Jinnah Postgraduate Medical Centre, Karachi with special permission by late Professor Dr. Saleem Ahmed Kharal (Late), head of Department, under the kind supervision of Dr. Saleem Hafiz, Professor and Head of Microbiology Department SIUT (Sindh Institute of Urology and Transplantation), Karachi during the period from 22.02.2010 to 31.01.2011 in these about 8 months and 9 days period of time. 720 samples were collected from the different location i.e. Bank counter, Bank ATM Machine, Medical Stores, Milk seller, Grocery shop, Mutton/Beef shop, road side mechanics, bus conductors and from beggars of different denomination of Pakistan currency circulating in Pakistan and these denominations were grouped as under. Groups of different denominations Group I: 60 samples from Rs. 5000 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group II: 60 samples from Rs. 1000 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group III: 60 samples from Rs. 500 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group IV: 60 samples from Rs. 100 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group V: 60 samples from Rs. 50 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group VI: 60 samples from Rs. 20 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group VII: 60 samples from Rs. 10 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group VIII: 60 samples from Rs. 5 denomination of Pakistan paper currency notes, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group IX: 60 samples from Rs. 5 denomination of Pakistan currency coins, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group X: 60 samples from Rs. 2 denomination of Pakistan currency coins, 20 of mint, 20 of clean and 20 of dirty/mutilated. Group XI: 60 samples from Rs. 1 denomination of Pakistan currency coins, 20 of mint, 20 of clean and 20 of dirty/mutilated. (silver) Group XII: 60 samples from Rs. 1 denomination of Pakistan currency coins, 20 of mint, 20 of clean and 20 of dirty/mutilated. (Bross While dirty/mutilated currency notes have important role and potential to spread the infection Prompt hand washing awareness mass campaign after handling of money through electronic media and print media. In the study conducted by Siddiqui [34] the result do not suggest that any one denomination was particularly susceptible to or protected against contamination, since pathogens were found on all denominations of the currency notes and were absent only on the mint notes from the banks. My study confirm this statement by isolation of microorganisms from all denomination and negligible number of microorganisms were isolated.

In the study conducted by Gadsby [4] stated that most significant association ( $P > 0.05$ ) between contamination with parasites or bacteria and denomination of currency, although contamination was relatively more prevalent among lower denomination notes. Presumably as a result of higher rate of handling on hand to hand exchange, this also confirms my study that more number of microorganisms were found on lower denomination.

## Recommend

As in my study highest number of *Ascariasis lumbricoidis* were also isolated and supported by the study conducted by Hotez et al. [35] in which the highest number of isolation of ova of the *Ascariasis lumbricoidis* is seen because of the capability and having enormous capability for survival and withstands the environmental extremes of urban environment as the lumbricoids eggs are coated with the mucopolysaccharides that render them adhesive to a wide variety of environmental surface this adhesive property to inanimate subjects proof the survival and large number of isolated *A. lumbricoidis* from my study which is also supported by study conducted by Crompton [16], Kajei [19]. In the study conducted by Siddiqui [34] which revealed a significant association between bacterial contamination on the dirty/mutilated notes, this finding has very important health and economic implications, especially in under developed and developing tropical nations of the world and particularly in Asia and Africa. This statement support to my study as higher number of micro-organisms were isolated from the dirty/mutilated currency, which definitely play a negative role on the health of people/population resulting a great economic loss which occurs to the affects for restoration of their health, by paying huge amount for their illness, and of course a great economic loss for not going to their jobs during illness till not going back to their jobs.

Handling money is like shaking hands with somebody so improvement of personal hygiene and the cultivation of regular, scrupulous hand washing cannot be over emphasized support the isolation of micro-organisms from the clean notes by Farlex (2007). In the study conducted by Brady et al. [2] that the possibility of currency contamination with micro-organisms has also been observed among food handlers. An assessment of public health risk associated with the simultaneous handling of food industry in Australia, study conducted by Ellen [35] says that credit cards, electronic banking and even cheque cashing have yet much importance to gain much of the foot hold in west Africa helping to make it a cash dirt in the society and putting more dirt with sweat making and putting cooking oil and germ on the currency.

In the study conducted by New et al. [12] diarrhea is mainly caused by enteric pathogens that are transmitted through faecal oral route. There are different routes for the faecal pathogens to reach the mouth 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 potential for the transmission of pathogens. In the study conducted Hotez et al. [36] that interestingly the ova of *Ascaris lumbricoides*, *E. vermicularis*, *T. trichuria* and *Tenia* species were isolated from the currency notes. Their presence on objects that frequently change hands is known to be reflection of poor local environmental situation and personal hygiene, further Bundy [37] says in his study that these conditions are more typical of tropical and subtropical regions of the world. Where upto 15% of host population harbour approximately 70% of worms population and serves as the major source of contamination. In the study conducted by Hotez et al. [36] declared that of all the intestinal helminthes isolated *A. lumbricoides* acquired with the higher frequency. One possible

reason for this is the resistance of the ova. It is established that the infective states of *A. lumbricoides* the embrowned eggs have enormous capacity of withstanding the environmental extremes of urban environment and supported by the Crompton Kate [19] that *A. lumbricoides* eggs are coated with mucopolysaccharide that regards them adhesive to wide variety of environmental surfaces. This feature accounts for their adhesiveness to carry thing from door handles to dust, fruits and vegetables, paper money and coins. During present study the emergence of different parasitological ova concerned with the Bundy [37], in which *A. lumbricoides*, *Enterobius vermicularis* and *Tinea saginata* were isolated from all locations from the paper currency and coins from bank counter up to beggars, from where samples were collected. In my current study the ova of *A. lumbricoides* were isolated in higher number that is 25.9% (187) of the 720 sample, along with the isolation of *E. vermicularis* 60 (8.3%) and *Tinea saginata* 23 (3.19%) (Table 1 & 2). This study proves the study conducted by Burdey, et al. [38-41] who claims the highest prevalence of *A. lumbricoides* and the study conducted by the Hotez, et al. [36] supports my study in which the environmental condition that is tropical and isolation of *A. lumbricoides*, *E. vermicularis* and *Tinea saginata* species isolations from the currency as well as from coins and my study also coincides with Kangei [19].

### Recomendations

- Use of ATM for withdrawal of money and electronic devices for purchasing of daily life commodities
- Life of circulation of currency in the public should be reduced.
- Every bank should have the ultra violet treatment for the currency in every bank, when these banks receive back in the bank and should be treated accordingly.
- Pakistan currency should be replaced by plastic currency which is easily washable with detergents as in Australia and other countries has adopted.

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