Microorganism contamination and risk factors associated with Naira notes in circulation within University of Ibadan campus

ADELANI A. Solomon[1]., AKPAN I. Lewis[2], Elizabeth O. JOEL[3], Helen O. NGERE
[1,3,4]*Animal Science Department, University of Ibadan, Nigeria*
[2]*Igbajo Polytechnic, Igbajo, Osun State*
Corresponding author: *adelanisolomon1@gmail.com*

Abstract

Microbial contamination of naira notes is increasingly being reported nationally. Naira note is a good reservoir for harboring and dissemination of microorganisms from one person to the other. Microorganism contamination and risk factors associated with naira notes in circulation within the University of Ibadan campus were investigated. Naira notes were obtained from snack bars, canteens, campus cab drivers, photocopy shops, students and lecturers into sterile polythene bags and analyzed on Blood agar, MacConkey and Mannitol salt agar respectively. Isolates obtained were identified using conventional means of identification. From the results obtained, bacteria like E. coli, Salmonella species., Pseudomonas and other coliforms which cause enteric and illnesses like typhoid, dysentery and other enteric ***sickness*** *were abundantly present. One hundred naira, as a denomination had the highest microbial load of 4.3x10^5 CFU/mL while ₦1000 had the least microbial load of 0.3 x10^5 CFU/mL. Salmonella had the highest frequency of 21.05% (n=4). All the isolated organisms pose a great threat to human health. Therefore, this study suggests a high level of personal safety precautions when handling the naira notes.*

Keywords: Microorganism, Naira notes, Contamination, Personal hygiene.

Contamination par Les Micro-Organismes et Facteurs de risque associés aux Billets naira en circulation au Dans Le campus de l'Université d'Ibadan

Resume

La contamination microbienne des billets de naira est de plus en plus signalée à l'échelle nationale. Le billet de Naira est un bon réservoir pour abriter et diffuser des micro-organismes d'une personne à l'autre. La contamination par des micro-organismes et les facteurs de risque associés aux billets de naira en circulation sur le campus de l'Université d'Ibadan ont été étudiés. Les billets de Naira ont été obtenues auprès des snack-bars, des cantines, des chauffeurs de taxi du campus, des magasins de photocopie, des étudiants et des conférenciers dans des sacs en polyéthylène stériles et analysées respectivement sur gélose au sang, MacConkey et gélose au sel de mannitol. Les isolats obtenus ont été identifiés à l'aide de moyens d'identification conventionnels. D'après les résultats obtenus, des bactéries comme E. coli, des espèces de Salmonella, des Pseudomonas et d'autres coliformes qui causent des maladies entériques et comme la typhoïde, la dysenterie et d'autres maladies entériques étaient abondamment présentes. Cent naira, en tant que dénomination, avait la charge microbienne la plus élevée de 4,3 x 105 UFC/mL tandis que ₦ 1000 avait la charge microbienne la plus faible de 0,3 x 105 UFC/mL. Salmonella avait la fréquence la plus élevée de 21,05 % (n = 4). Tous les organismes isolés constituent une grande menace pour la santé humaine. Par conséquent, cette étude suggère un niveau élevé de précautions de sécurité personnelle lors de la manipulation des billets en naira.

Mots-clés : Micro-organisme, Billets de Naira, Contamination, Hygiène personnelle.

الحية الدقيقة من يتزايد الإبلاغ عن التلوث الميكروبي لنقود النيرة على الصعيد الوطني فنقود النيرة هو خزان جيد لإيواء ونشر الكائنات شخص إلى شخص آخر تلوث الكائنات الحية الدقيقة وعوامل الخطر المرتبطة بنقود النيرة تم التحقيق في تداول نيرا داخل جامعة إبادنتم الحصول على عملة نايرا من بارات الوجبات الخفيفة والمقاصف وسائقي سيارات الأجرة في الحرم الجامعي ومحلات النسخ، والطلاب وبعض المحاضرين إلى أكياس بوليثين معقمة وتم تحليلها على أغار الدم وأغار مركنكي وأغار ملح مانطال على التوالي تم تحديد العزلات التي تم الحصول عليها باستخدام وسائل تحديد الهوية التقليدية.من النتائج التي تم الحصول عليها، بكتيريا مثل الإشريكية القولونية وأنواع السالمونيلا والكاذبة وأشكال القولون الأخرى التي تسبب الأمراض المعوية والأمراض مثل التيفوئيد والزحار وغيرها من الأمراض المعوية كانت موجودة بوفرة مائة نايرا، كفئة لديها أعلى حمولة ميكروبية ب 4.3x105 CFU/mL بينما كان لدى ألف نايرا أقل حمولة ميكروبية من 0.3 ×10^5 CFU/mL كان لدى السالمونيلا أعلى تردد من 21.05% (n=4). تشكل جميع الكائنات المعزولة تهديدًا كبيرًا لصحة الإنسان. لذلك، تشير هذه الدراسة إلى مستوى عالٍ من احتياطات السلامة الشخصية عند التعامل مع نقود نيرا

Introduction

Worldwide, currency notes and money in general serve as means of economic exchange of goods and services, to defer payments and settle debts(Okon et al 2003) ; used in our day-to-day transactions and handled by people with varying environmental and personal hygiene conditions, providing a large surface area for pathogens to breed (Ofoedu., 2021). There are currently eight denominations of naira notes being used in Nigeria: ₦5, ₦10, ₦20, and ₦50, ₦100, ₦200, ₦500, and ₦1000 (Ahmed et al., 2010). The four lower denominations (₦5, ₦10, ₦20, and ₦50) are made of polymer substrate and are more commonly found in circulation, with a greater percentage of the Nigerian population engaging in daily cash transactions with them, whereas the four higher denominations (₦100, ₦200, ₦500 and ₦1000) are made of the paper substrate (Ogbuju et al., 2020).

In a developing country like Nigeria, handling culture is the norm, and currency notes are abused indiscriminately. Various habits such as keeping currency notes in socks, shoes, and pockets, under the carpet or rugs, and squeezing them in the hand often introduce a number of microbes to the notes (Sharma and Sumbai, 2014). Methods such as wetting hands or fingers with saliva or contaminated water to lubricate the hand when counting money and handling currency notes with food-contaminated fingers may increase the contamination of currency notes. They may, however, increase the risk of infection from contaminated ones (Ahmed et al., 2010). Furthermore, contamination of currency notes can be traced back to dust, soil, water, and the microflora of handlers' bodies (hand, skin, etc) (Awe et al., 2010). Many studies in various parts of Nigeria have reported microbial contamination of naira notes. The constant microbial contamination of currency notes is a public health concern because because of the accompanying illnesses and high mortality rate. The current bacterial contamination of naira notes, as well as the associated risk factor, is of critical public health importance.

Paper currency is widely exchanged for goods and services worldwide. Paper currency therefore presents a potential risk to public health, since disease can be spread through contact with formites (Pope et al, 2002; Russe, 2006 and Lalonde, 2007).

These currency notes may be subjected to contamination via bare hands, raw products, foods or poor (personal) hygiene. Humans and animals have abundant normal flora that usually do not produce disease. They help to achieve a balance that ensures the survival, growth and propagation of both the organism and the host (Brooks et al, 2002).

It remains unclear how long bacteria can survive on paper or how many organisms may be transferred in a full hand-to-paper-to-hand transmission cycle. Although little has been written concerning the potential of banknotes, coins and fomites to become reservoirs and vehicles for the transmission of pathogens. Paper money therefore presents a particular risk to public health, since communicable diseases can spread through contact with fomites.

Materials And Methods

The study was carried out in University of Ibadan, Ibadan, Oyo state, Nigeria. University of

Ibadan is the citadel of learning located in South west geopolitical zone of the country. Naira notes were collected from snack bars, canteens, campus cab drivers, photocopy shops, students and lecturers into sterile polythene bags. Swaps were collected using sterile swaps sticks and were cultured on Centrimide agar, Sabouraud dextrose agar, Maconkey agar, Eosin methylene blue,Brilliant Green agar Xylose lysine Deoxycholate agar. Isolates obtained were identified using standard microbiological methods.

Results

Table1: Microbial load of the isolates obtained from naira notes x10[1](CFU/mL)

Sample Identity	Coliforms, cfu	Non-Coliforms, cfu	E. coli, cfu	Shigella spp., cfu	Salmonella Spp. cfu	Pseudomonas, cfu.	Proteus, cfu.	Aspergillus spp. Sfu.
#10	.----	TNTC	.----	3cfu	TNTC	TNTC	.----	.----
#20	.----	TNTC	.----	30cfu	TNTC	TNTC	.----	.----
#20	.----	TNTC	.----	.----	.----	.----	.----	.----
#50	.----	TNTC	.----	.----	.----	.----	.----	.----
#100	.----	TNTC	.----	.----	.----	.----	.----	.----
#200	.----	TNTC	.----	.----	TNTC	.----	.----	.----
#500	TNTC	.----	TNTC	TNTC	TNTC	TNTC	.----	.----
#1000	.----	TNTC	.----	.----	.----	.----	.----	.----

Note:

Cfu: colony forming unit
Sfu: spore forming unit
TNTC: Too numerous to count

Table 1 shows the microbial load contained in the different denominations of the naira currency being used for our day-to-day transactions. One hundred naira had a too numerous to count value of greater than 100cfu/mL of non coliforms, while ten naira had the least count *of Shigella* species (3.0 x 10) cfu/ml; but a too numerous to count value for Salmonella and *Pseudomona*s species. Five hundred naira notes had the gretest occurrence of the pathogens, as it had a too numerous to count value *for Coliforms: E.coli, Salmonella, and Shigella species*; values greater than 100cfu,mL of microbial loads. Fungi like Aspergillus species was absent in all the naira denominations; while four bacteria generals were isolated from the naira notes used for this study. This includes: *Escherichia coli, Shigella, Salmonella,and coliforms*.

Escherichia coli, Salmonella species, Pseudomonas and other coliforms which cause enteric disorder and illnesses like typhoid were abundantly present on five hundred notes.

Non coliforms were abundantly present in all other naira denominations except five hundred naira notes S*almonella species*. and *Pseudomonas species* .were isolated from ten, twenty and five hundred naira culture plates. This implies that the notes are common among both the young that spends ₦10 and ₦20 and even the old or adults, which can predisposed the two categories to typhoid fever.

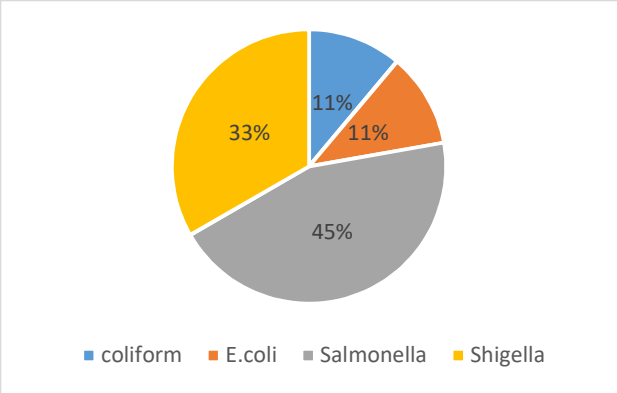

Figure 1: Showing the frequency of the occurrence of the isolates

In figure 1, the frequency of occurrence showed that *Salmonella* had the highest frequency of 45.00%, which implies that users or handlers of contaminated notes are more and can be more susceptible to the pathogen causing typhoid fever from naira notes. *Shigella* had 33.00 % , while *Escherichia coli* had the least percentage of occurrence of 11% . This organism has been implicated to causing enteric problems and infections.

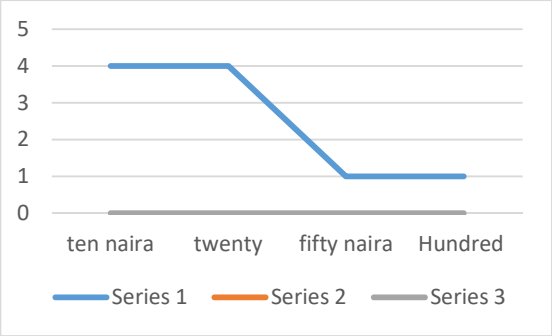

Figure 2 : Showing the degree of contamination of different naira denominations

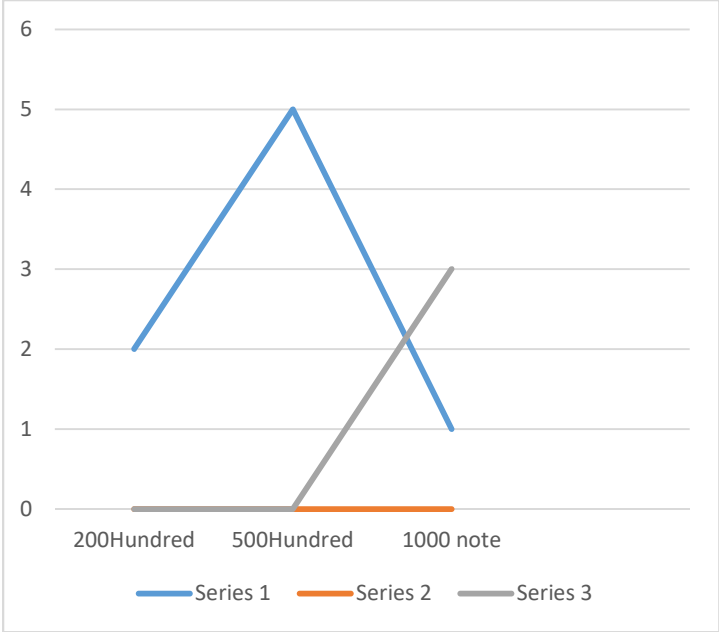

Figure 3: Showing the degree of contamination of different naira denominations

From the figure 2 and 3 above, fifty naira, hundred naira and one thousand naira had the least degree of contaminations. Ten and twenty naira had a higher degree of contaminations, which might be as a result of the fact that those denominations are common among children and teens. Five hundred note had the highest level of contaminations; this might be owing to the fact that the denomination is common among the all degree of the socio-economic status; thus predisposing it more to contaminations.

Discussion

Results obtained in this study showed that the Nigerian naira notes/currency is contaminated with different microorganisms of which some are pathogenic. This is in agreement with reports from other parts of the world that currency notes are often contaminated with microorganisms that can cause different types of diseases and illnesses (Pope *et al.,* 2002, Sicklique, 2003, El-Dars and Hassan, 2005). The presence of *E.coli* in this study confirms the report that currency notes are usually contaminated with Enteropathogens (Xu *et al.,* 2005). It can be

deduced from this study that naira notes are possible sources through which infectious agents can be disseminated to humans. High contaminants found on the naira notes can be as a result of poor handling. Handlers of these notes especially the females may put the naira notes in their brassieres or other areas where there is intimate contact with the skin and thus expose them to the pathogens. Also, some individuals usually wet their fingers with saliva to ease the counting of the naira notes, consequently resulting in cross-contamination. Food vendors, too, simultaneously handling money and ready to eat foods could also facilitate the transmission of potential pathogenic organisms from currencies to their clients.

Conclusion

Emphasis should be made on personal hygiene and safety precautions, such as thorough washing of the hands with soap and water before and after using the toilet, eating, handling naira notes and visiting the hospital. Money should not be handled together with food in order to guide against cross-contamination.

Conflict Of Interest

There was no conflict of interest among the authors.

References

Ahmed, M .S. U, Parveen, S., Nasreen, T., Feroza, B. (2010). Evaluation of the microbial contamination of Bangladesh paper currency notes (Taka) in circulation. Advanced Biological Research 4(5):266-271.

Awe, S., Eniola, K. I. T., Ojo F. T., Sani, A. (2010). Bacteriological quality of some Nigerian currencies in circulation. African Journal of Microbiology Research 4(21): 2231-2234.

Brooks, A. M. T, Janet S. B and Stephen A .M (2002). "Medical Microbiology" 21st edition published by application &lange.

El-Dars, F. M., Hassan W. M. (2005). A preliminary bacterial study of Egyptian paper money. International Journal of Environmental Health Research. 2005; 15 (3):235–239.

Lalonde, M. (2007). Time for antibacterial wallets-germ fester on paper money. The Gazette, 2007, 1, 1-2.

Ogunleye, A. G. (2005). Macroeconomics: an introductory test. One Ado: Emmaon Educational Publisher; 2005. pp. 1–22.

Okon, A. I., Akinloye, O., Okoh, O. M., Oladipo, A. A. (2003) The microbiological quality and heavy metal regimes of some dirty currency notes found in a typical Nigerian community. Science Focus. 2003; 4: 116–119.

Pope, T. M, Ender, P. T and Woclk, W. K. (2002). Bacterial Contamination of Bank Notes & Coin" International Journal of Tropical Medicine 5 (3), 149-152.

Sharma, S., Sumbali, G. (2014). Contaminated money in circulation: a review. International Journal of Recent Scientific Research 5(9):1533-1540.

Xu, J, Moore, J. E, Millar, B. C. (2005). Ribosomal DNA (rDNA) identification of the cultural bacterial flora on monetary coinage from 17 currencies. Journal of Environmental Health. 2005; 67(7):51–55.