



## Mycological Contamination of Nigerian Currency Naira Notes in Circulation at Badeggi Town, Niger State, Nigeria

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**ABSTRACT:** During its passing, money can get contaminated and may thus plays a role in the transmission of microorganisms to other people. Hence this study evaluates the mycological contamination of Nigerian currency naira notes in circulation at Badeggi Town, Niger State, Nigeria using appropriate standard techniques. The findings revealed that all samples contain fungal contaminants and higher contamination rates was recorded in low denominations naira notes. The fungi isolated in these studies include *Aspergillus niger* (16.9%) which was the most prevalent, followed by *Mucor spp* (13.8%) and *Penicillium spp* (13%), *Aspergillus fumigatus* (12.3%), *Fusarium spp* and *Candida glabrata* (10%), *Rhizomucor spp* and *Rhinosporidiosis spp* (8.4%) and the least *Aspergillus flavus* (6.9%). The currency notes are fomites, which serve as a vehicle for transmission of pathogenic organisms causing infections. Good hygiene and proper education of Nigerians on the public health risks posed by mishandling naira notes should be done to reduce the spread of pathogens and parasites through naira notes.

DOI: <https://dx.doi.org/10.4314/jasem.v27i7.27>

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**Cite this paper as:** ABDULLAHI, A. M; TAKUR, S. A; BELLO, B. O; OLUTIMAYIN, T. A (2023). Mycological Contamination of Nigerian Currency Naira Notes in Circulation at Badeggi Town, Niger State, Nigeria. *J. Appl. Sci. Environ. Manage.* 27 (7) 1523-1526

**Dates:** Received: 12 June 2023; Revised: 21 June 2023; Accepted: 04 July 2023 Published: 30 July 2023

Mycological contamination; currency circulation; *Aspergillus fumigatus*; *Fusarium spp*

Currency notes are used in day-to-day transactions and handled by people with varying environment and personal hygiene conditions, providing a large surface area for pathogens to breed (Ofoedu *et al.*, 2021). There are currently eight denominations of naira notes in use in Nigeria: ₦5, ₦10, ₦20, and ₦50, ₦100, ₦200, ₦500, and ₦1000 (Ahmed *et al.*, 2010). Compared to the four higher denominations (N100, N200, N500, and N1000) made of the paper substrate, the four lower denominations (5, 10, 20, and 50) are made of a polymer substrate (Ogbuju *et al.*, 2020) and are more frequently found in circulation, with a higher percentage of the Nigerian population engaging in daily cash transactions. Poor naira note handling customs and indiscriminate money abuse are common in developing nations like Nigeria. Individuals, especially uneducated ones keep cash in odd places such as, armpits, socks, shoes, beneath rugs, or by

squeezing it in the hand can all lead to the introduction of a variety of bacteria (Sharma and Sumba, 2014). Handling notes after sneezing, after handling unclean water, or food items also contribute to the contamination rates of currencies (Matur *et al.*, 2010). Precious Studies on the contamination of naira notes in other parts of Nigeria have shown that money serves as a fomite for transferring various types of pathogenic microorganisms (Mbata *et al.*, 2016, Kawo *et al.*, 2009; Ademokoya, 2018). Some of these pathogens are known to be important reservoirs for multidrug resistance gene, hence transferring them to other pathogens. The constant contamination of paper currency notes by microorganisms is a public health concern due to transfer of notes from person-to-person without knowledge of contamination resulting to high mortality and morbidity (Aminu and Yahaya, 2019). In developing nations especially, bank currency notes

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are the most widely used form of exchange for goods and services (Das, 2015). During transactions, they are one of the goods that are transferred from one hand to the other the most (Gedik *et al.*, 2013). Banknotes have been more widely contaminated with different microbial species as a result of improper handling techniques, including handling food items and banknotes at the same time, using saliva to wet fingers during counting, and placing or storing paper notes on or on dirty surfaces (Girma, 2016). The contaminated banknotes have been demonstrated to be a viable source of cross-contamination and a vehicle for transmission of infectious agents in the community (Kesavan *et al.*, 2016). Therefore, the current information on fungal contaminants on naira notes is of public health importance. It will provide information on potential pathogens found in currency notes in the selected areas. Hence, this study evaluates the mycological contamination of Nigerian currency naira notes in circulation at Badeggi Town, Niger State, Nigeria.

## MATERIALS AND METHODS

**Study area:** The study was conducted in Badeggi town, Katcha Local Government area, Niger State. Badeggi has about 8,283 inhabitants and located at latitude 9°03'22.7" N and longitude 6°08'34.8" E. Niger State shares borders with other states like Kwara, Kogi, and Kaduna.

**Collection of samples:** A total of fifty (50) samples of naira notes consisting of five pieces of each of the eight denomination of naira notes (₦5, ₦10, ₦20, ₦50, ₦100, ₦200, ₦500, and ₦1000) were obtained from Badeggi. The samples were randomly collected aseptically from traders, civil servants, butchers, food vendors, beggars and roadside mechanics. The samples were obtained by purchasing an item or paying for a service using a large denomination note and the large denomination note (1000) was obtained by exchange between August and October 2022. The collected currency notes were collected inside the sterile polythene bags and labelled accordingly and transported to the laboratory for immediate analysis.

**Fungal isolation and identification:** Each of the Naira note was aseptically inserted into a sterile beaker containing 10ml of distilled water, was repeatedly shaken and allowed to stand for 20 minutes at room temperature to obtain the resultant test sample for microbial inoculation. The resulting solutions were serially diluted in three folds and an aliquot of 0.1ml was aseptically inoculated on Sabouraud Dextrose Agar supplemented with 0.01% chloramphenicol and incubated for 3-5 days at 37°C. Fungal growth were examined and the total mycological count for each

plate was counted using a digital colony counter. Pure cultures were streaked on SDA and stored for further analysis. The fungi isolates were identified using macroscopic and microscopic examination of the cultures, such as colony growth pattern, conidial morphology and pigmentation (Tafinta, Shehu *et al.*, 2013). The technique for the identification of the isolated fungi using cotton blue in lactophenol stain was conducted according to Chessbrough (2006).

## RESULTS AND DISCUSSION

The fungal contamination of Nigerian currency naira notes was investigated in Badeggi Town, Niger State. The investigation revealed that the samples contain fungal contaminants and higher contamination rate recorded in the low denominations naira notes. The total viable count for fungal isolates from different denomination of naira notes collected revealed that ₦100 had the highest microbial load with a mean  $\pm$  SD of  $140 \pm 11.31$ , followed by ₦10 ( $133.00 \pm 12.73$ ), ₦200 ( $118.5 \pm 30.40$ ), ₦50 ( $111 \pm 12.72$ ), and the least was ₦5 ( $36 \pm 5.65$ ) showed in Table 1.

The highest contamination rate was in ₦100 naira note at 25.3%, followed by ₦10 (23.0%), ₦50 (10.8%), ₦1000 (10.7%), and the least was obtained from ₦5 (2.3%).

The prevalence of fungi isolates from naira denominations is shown in Table 3. Nine (9) different species of fungi were isolated from naira denomination with *Aspergillus niger* being the most prevalent 16.9%, followed by *Mucor spp* (13.8%), *Penicillium spp* (12.4%), *Fusarium spp* and *Candida glabrata* (10%) each, *Rhizomucor spp* and *Rhinosporidiosis spp* (8.4%) and *Aspergillus flavus* (6.9%) was the least. This study has comprehensively analyzed the public health hazards associated with naira notes. Lower denominations of naira notes showed Naira notes (₦10 to ₦200) were reported to have the highest mean  $\pm$  SD of fungal contaminate. This high contamination of lower denomination currency notes has been reported in various part of Nigeria (Usman *et al.*, 2021; Stanley *et al.*, 2014). The level of contamination in this study may be due to the frequent exchange of the lower denominations especially amongst small business owners who constitute majority of the population in the study area. The contamination of naira notes is almost foreseeable due to improper handling practices. A high contamination rate (100%) of the naira currency was observed in this current study. This is consistent with reports from previous studies across the country which confirms that (Sani *et al.*, 2016; Usman *et al.*, 2021). Similarly, in a neighboring African country, 100% contamination rate was reported (Tagoe *et al.*, 2009). The contamination rate of Pakistani and Euro currency notes was also reported at 100% (Sharif and Ansari,

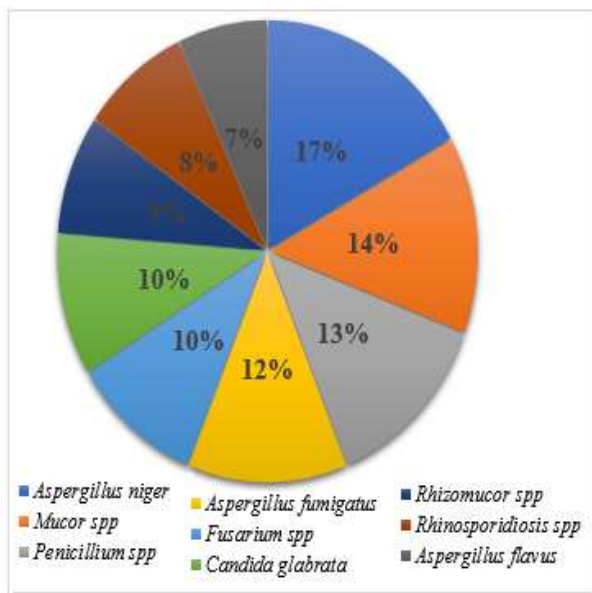
2017; Gabriel *et al.*, 2013). This has confirmed that pathogens are capable of surviving on the currency notes. The contamination may have aroused due to the improper handling alongside other materials during exchange and trades (Alabbasy, 2019).

**Table 1:** Mean Microbial Colony Count from Different Denominations

S/N	Naira Denomination	10 <sup>1</sup>	10 <sup>2</sup>	Mean ± SD
1	₦5	40	32	36 ± 5.65
2	₦10	142	124	133±12.73
3	₦20	108	84	96 ± 16.97
4	₦50	120	102	111 ± 12.72
5	₦100	148	132	140±11.31
6	₦200	140	97	118.5±30.40
7	₦500	116	72	94 ± 31.11
8	₦1000	96	69	82.5 ± 19.09

**Table 2:** Distribution of the fungal isolates according to different currency denominations

Naira Denomination	Contamination (%)
₦5	3 (2.3)
₦10	10 (23.0)
₦20	12 (9.2)
₦50	14 (10.8)
₦100	33 (25.3)
₦200	14 (10.8)
₦500	10 (7.6)
₦1000	14 (10.8)
Total	130



**Fig 1:** Prevalence of Fungal Contaminants from Naira Notes

These studies also shows that Nigeria currency notes are indiscriminately contaminated with a variety of fungi species some of which are pathogenic. This study identified the following medically important fungi: *Aspergillus niger*, *Aspergillus fumigatus*, *Aspergillus flavus*, *Fusarium spp*, *Mucor spp*, *Rhizomucor spp*, *Penicillium spp*, *Candida glabrata*,

and *Rhinosporidiosis spp*. *Aspergillus niger* was the most prevalent and *Aspergillus flavus* as the least fungi identified in this study. Similar results were reported by Otu-Bassey *et al.*, (2021), however, the current study is dissimilar to Usman *et al.*, (2021) where *Aspergillus flavus* was most prevalent and *Aspergillus niger* as the least prevalent.

Generally, the currency notes are fomites, which serve as a vehicle for transmission of pathogenic organisms causing infections within the communities (Girma, 2016). Moreover, handlers of these notes keep the notes in areas where there is direct contact with skin, predisposing them to possible infections.

**Conclusion:** This present study has identified fungi isolates on the surface of naira notes, which may be associated with causing infections. The result of this study also revealed that lower denominations have higher contamination rate due to its frequent circulation. The presence of this organisms may pose a public health risk, although evidence linking these fugal isolates from naira note to infections are sparse. Therefore, to minimize the hazards associated with contaminated naira notes, proper handling of notes using wallets and proper hygiene such as hand sanitizing should be encouraged.

**REFERENCES**

Ahmed, MSU; 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.

Alabbasy, AJ (2019). International Journal of Environmental Chemistry. A Literature Review on Microbial Contamination of Paper Currency

Aminu, BM; Yahaya, HS (2019). Antibiotic sensitivity pattern of bacteria isolated from Nigerian currencies (Naira) circulating in some hospitals of Kano metropolis, Kano state, Nigeria. *Bayero Journal of Pure and Applied Sciences*. 11(1):185-190. <http://dx.doi.org/10.4314/bajopas.v11i1.30S>

Cheesebrough, M (2006). District Laboratory Practice in Tropical Countries. Cambridge CB2 8RU, UK: California State University.

Das, A (2015). Money as a Medium of Exchange: Then and Now: Can Technology be a Facilitator of Exchange? *Glob J Manag Bus Res*. 15: 1–7.

- Gabriel, EM; Coffey, A; Mahony, JMO (2013). Investigation into the prevalence, persistence and antibiotic resistance profiles of staphylococci isolated from Euro currency. *J Appl Microbiol.* 115: 565-571. <https://doi.org/10.1111/jam.12247>.
- Gedik, H; Voss, TA; Voss, A (2013). Money and transmission of bacteria Money and transmission of bacteria. *Antimicrob Resist Infect Contr.* 2: 1-4.
- Girma, G (2016). Health Risk Associated with Handling of Contaminated Paper Currencies in. *Int J Food Nutr Sci.* 2: 1-5.
- Girma, G (2016). Health Risk Associated with Handling of Contaminated Paper Currencies in. *Int J Food Nutr Sci.* 2: 1-5.
- Kesavan, J; Stephens, A; Kesavan, M (2016). Bacterial Cross-contamination Potential Associated with Contaminated Currency. *J Forensic Sci.* 1-4.
- Matur, MB; Malann, DY; Yvoun, E (2010). Survey of parasite cysts, eggs and bacteria on Nigerian currency in FCT, Abuja. *New York Science Journal.* 3:10-13.
- Ofoedu, CE; Iwouno, JO; Agunwah, IM; Obodoechi, PZ; Odilichukwu, C; Okpala, R; Korzeniowska, M (2021). Bacterial contamination of Nigerian currency notes. A comparative analysis of different denominations recovered from local food vendors. *Peer Journal* 9: e10795.
- Ogbuju, E; Usman, WO; Obilikwu, P; Yemi-Peters, V (2020). Deep learning for genuine Naira banknotes. *FUOYE J. Pure Appl. Sci.* 5 (1):56-66
- Otu-Bassey, IB; Ibeneme, EO; Udomfuh, NB (2021). Used Nigerian currency notes as potential sources of infection in Calabar, Nigeria. *Bayero J. Med. Lab. Sci.* 6(1): 61 -69
- Sani, N.M; Baba, B; Yahuza, S; Salim, F; Yaro, SA; Mujahid, NS; Kwada, AD (2016). Prevalence and Public Health Implications of the Microbial load of Abused Naira notes in Dutse metropolis, Jigawa state. *Journal of Pharmacy and Biological Sciences.* 11(4), 52-57.
- Sharif, M; Ansari, F (2017). Assessment of Bacterial Load On Pakistani Currency Notes and Coins in Circulation. *Eur J Biomed Pharm Sci.* 4: 474- 481.
- Sharma, S; Sumbali, G (2014). Contaminated money in circulation: a review. *International Journal of Recent Scientific Research* 5(9):1533- 1540.
- Stanley, MC; Obeagu, EI; Nwosu, DC; Ejiofor, AC (2014). Microbiological evaluation of naira notes handled by fish sellers in Umuahia metropolis. *World Engineering & Applied Sciences Journal,* 5(2), 44-52.
- Tafinta, IY; Shehu, K; Abdulganiyy, H; Rabe, AM; Usman, A (2013). Isolation and identification of fungi associated with the spoilage of sweet orange (*citrus sinensis*) fruits in Sokoto state. *Nigeria J. Basic Appl. Sci.* 21 (3): 193-196.
- Tagoe, D; Baidoo, S; Dadzie, I; Ahaton, D (2009). A study of Bacterial Contamination of Ghanaian Currency Notes in Circulation. *Internet J Microbiol.* 8: 1-5.
- Usman, M; Sani, J; Ibrahim, A; Olowo-okere, A (2021). Microbial contamination of Naira notes circulating in Bauchi metropolis: prevalence, microbial load and detection of extended spectrum beta-lactamase producing Gram-negative bacteria. *Afr. J. Clinical. Experi. Microb.* 22(2), 244-251