Global Scientific JOURNALS

GSJ: Volume 11, Issue 5, May 2023, Online: ISSN 2320-9186
www.globalscientificjournal.com

KNOWLEDGE AND HYGIENE PRACTICE FOR FOOD CONTAMINATED WITH MOLDS AMONG PEOPLE IN OWERRI MUNICIPAL, IMO STATE

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Abstract

Molds are commonly found everywhere in nature and virtually everywhere, both indoors and outdoors including food and the environment. The study assessed the knowledge and hygiene practices of food contaminated with molds among the populace of Owerri. The study adopted Cross-sectional study design and primary data was mainly used and collected through questionnaire developed by Environmental Health Organization Registration Council of Nigeria (EHORECON) to collect information on the status of knowledge, hygiene practices and management of molds in the environment. The collected data was analyzed using descriptive statistics. The finding revealed that most respondents are not aware of the presence of Molds in their environments (55.6%) neither do they have adequate information about molds in food and environment (41.3%). Over half of the participants were not sure they could identify feed/food material suspected to be contaminated by molds. The result revealed poor hygiene practices among the respondents towards molds in food and

environment. It wass recommended that government agencies, stakeholders and public health authorities are to provide health education programmes that will sensitize concerned groups on better development.

KEYWORDS: Molds, Knowledge, Hygiene Practice, Food Contamination, Public Health, Mycotoxin

Introduction

Molds are commonly found everywhere in nature and virtually everywhere, both indoors and outdoors including food and the environment. Certain fungal genera contribute significantly to the spoiling of food and feed, and at various growth stages they can produce a variety of low molecular weight secondary toxic compounds known as mycotoxins (Ismaila et al., 2021). These metabolites form toxigenic and chemically heterogeneous aggregates. These aggregates are only grouped together because they constituents can cause harm and death in humans and other vertebrates. It is not surprising that many mycotoxins have toxicities for plants, invertebrates, and microbes that overlap (Kraft et al., 2021). According to estimates, mycotoxins produced by fungi contaminate 25% of the world's food crops, costing domestic and international trade in agricultural goods billions of dollars in losses (Pankaj *et al*., 2018). It was reported in 2017 that a high level of mycotoxins in food is to blame for the loss of 617 billion naira from non-oil exports that Nigeria could have realized in nine years if the level of contamination were below the safe limit. (Seyi, 2021).

A study conducted by Adekoya et al. (2017) to ascertain that 98% of respondents were unaware of mold contamination, according to the study on the prevalence of mycotoxin contamination in some fermented foods from Nigeria.. Also, a study which tried to assess the determinants of knowledge about aflatoxin and fumonisin contamination in sorghum and post-harvest practices: factors affecting caregivers of children aged 6 to 59 months in Kerio

Valley, Kenya revealed that majority (61.8 percent) of young children's caregivers had inadequate knowledge of mycotoxin contamination in food (Lesuuda et al., 2021). According to Peraica et al. (2014), due to their lower body mass, higher metabolic rate, underdeveloped organs, and insufficient detoxification mechanisms, young people, including animals and children, are more sensitive to the effects of mold than adults. Despite the majority of research on evaluating mold-contaminated food and its exposure, the public health impact is largely disregarded in Nigeria at the expense of rising incidences that are linked to cancers, immune system defects, growth retardations, liver diseases, and death from short- or long-term exposure (Adjovi et al., 2015).

Matumba et al. (2016) The majority of respondents in a study in Malawi to assess respondents' knowledge, attitudes, and practices regarding the presence of molds in foods recognized that molds were harmful to human health (88%); however, about 50% of respondents were unaware that mold toxins are thermally stable and cannot be destroyed by regular cooking processes. The respondent's location also made a big difference. The general population's knowledge score was low, and the respondent's education had a slight influence on it (3.55 ± 1.32 score out of 9). Prior studies have shown that molds, In low- and middle-income nations like Nigeria, food contamination rates are high. Therefore, it became imperative to assess the knowledge and hygiene practices of food contaminated with molds among the populace of Owerri to understand behavioral and knowledge gaps that may predispose them to food and environmental mold’s contamination.

Materials and Method

Study Area

This study was conducted in Owerri municipal LGA of Imo State. It is an urban setting with one autonomous community made up of 5 indigenous kindreds (Owerre Nchi ise) which include: Umuororonjo, Amawom, Umuonyeche, Umuodu and Umuoyima, under the

rulership of one paramount traditional ruler(Owerri Municipal, 2021). It has a Latitude: 5.49 North; Longitude: 7.03East; Altitude: 72.00m/236.22ft. Owerri City is located at the junction of roads from Port Harcourt, Onitsha, Aba, Orlu, Okigwe, and Umuahia. Additionally, it serves as the primary trading hub for yams, cassava, corn, and palm products. (Britannica, 2019). According to 2006 population census, Owerri municipal has a population of about 125,337. With 15 years and above having a population of 87,599.

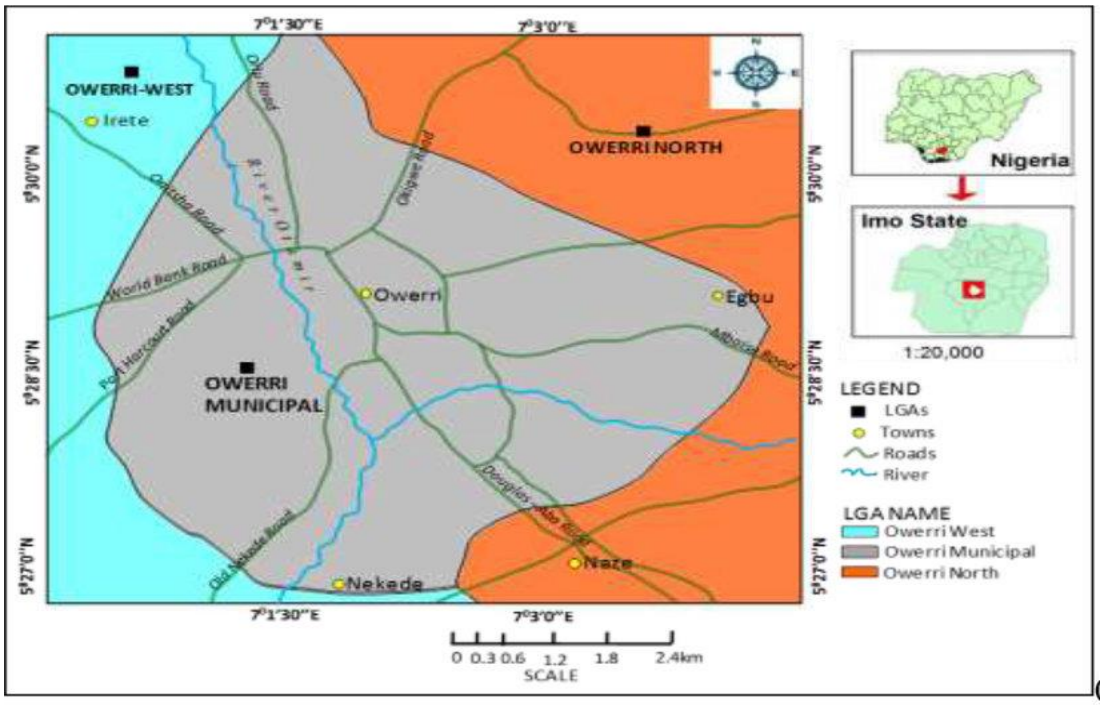


Figure 1: Overview of the Study Area

Research Design and Population

Cross-sectional study design was employed in this study. The study population included all males and females aged 18 years and above (in accordance to the questionnaire developed by EHORECON to collect information on the status of knowledge, hygiene practices and management of molds in the environment, agriculture and food products) who were resident in Owerri Municipal.

Sample Size and Sampling Methods

The minimum sample size for the study was calculated using Taro Yamane formula with 95% confidence level. The calculation formula of Taro Yamane is presented as follows.

$$n = N/ 1+ N (e)^2$$

Where n is the required sample size from the population under study,

N represents the population size of the area under study,

e is the error margin (5%=0.05).

By substituting the values,

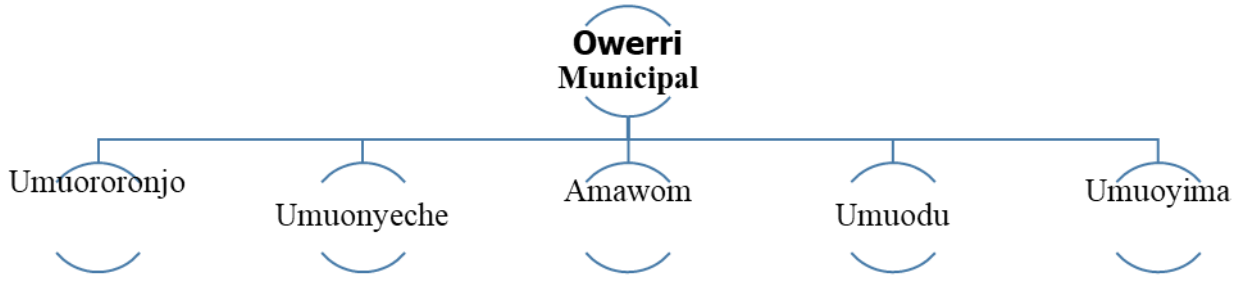
$N = 87,599/1 + 87,599(0.05)^2$

=87,999/1+218.9975

=87,999/219.9975

=400

A multistage cluster sampling was used. In the first stage, five clusters were made based on the five communities in the local Government.



In the second stage, a simple random sampling (balloting) was used to select 80 respondents from each of the community. Respondents were randomly and proportionally selected from

each of the community. Using standard methods, trained field workers measured assessed the participant's awareness, knowledge, hygiene practices and management of food contaminated with molds in Owerri Municipal using a well-structured questionnaire developed the Environmental Health Organization Registration Council of Nigeria (EHORECON).

Method of Data Collection

The questionnaire was administered to the respondents through research assistants after an informed consent have been obtained. The literate respondents were allowed to fill the questionnaire themselves but for non-literate respondents, the questions was read to them in their local language and their responses was filled by the research assistants. Each questionnaire took about 5-7 minutes to be completed.

Method of Data Analysis

The data obtained from completed questionnaires was captured and filtered in Microsoft Excel, 2013 (Microsoft Corporation, Redmond, WA) and analyzed using statistical package for social sciences, (SPSS) version 23 for descriptive statistics and frequencies and Stata Version 16.0 was used to run inferential statistics. Data analyses was conducted with SPSS (Statistical Package for the social scientist) version 23 (descriptive statistics, inferential statistics and figure presentations). Descriptive statistics was conducted for all variables and presented as frequencies and proportions/percentages using SPSS. To evaluate the overall awareness level of the participant, a numerical pattern was used by giving a score of "1" to participants who have heard of mycotoxins and "0" to participants who are not aware after which the frequency and percentage of participant's awareness of mycotoxins was deduced. To evaluate the knowledge level of respondents, a numeric pattern of scoring was also used

by giving a score of "1" for the "correct answer" and "0" for the "incorrect" ones. Out of the 21 questions in the knowledge section, participants who got up to 15 (70%) questions correctly were regarded as having a satisfactory level of knowledge for the purpose of this study. Similarly, the practice level was assessed by giving scores of "0" for wrong practice and "1" for correct hygiene practice. Out of the 11 questions in the hygiene practice section, participants who got up to 8 correct questions were said to have a satisfactory hygiene practice level towards molds. Chi-square test was used to test the following;

- Associations between the socio-demographics of respondents (independent variables) and binary outcomes of knowledge (dependent variables).
- The overall level of knowledge and hygiene practices of the respondents towards mold.
- The respondent's level of education and hygiene practice level to molds.
- The respondent's level of knowledge of molds and their hygiene practices towards symptoms of molds contamination.

Multinomial Logistic Regression (MLR) was used to examine the association between the respondent's level of hygiene practice toward molds and their prior experience with symptoms of mold contamination. This showed an experience of symptoms of molds contamination is associated with the hygiene practice level of the participants and a positive predictive variable for satisfactory/good hygiene practice towards mycotoxins. A p value of <0.05 was considered statistically significant and odds ratio was computed to determine strength of associations between variables at 95% confidence intervals (CIs).

All illustrations were performed using SPSS version 23, Stata 16.0 and Microsoft excel 2016. Statistical procedures that were adopted was based on each specific object and hypothesis.

Ethical Consideration/ Informed Consent

Letter of introduction was obtained from Head of Department. Permission. The purpose of the study was equally explained to the study participants and verbal informed consent was obtained from the respondents and they were assured of the confidentiality of their responses.

Result

A total of four hundred (400) copies of questionnaires were distributed for the study and three hundred and eighty-seven (387) questionnaires were retrieved and they were properly filled and crosschecked for correctness and were used for the purpose of the analysis.

Socio-Demographic Characteristics of Respondents

Table 1 below revealed that 33.7% (131) of the respondents were between ages 25-40, 24.3% (94) were aged 41-55 years of age, 23.3% (90) 18-25, and 18.6% (72) of the respondents were 56 years and above. 61.3% (237) of the respondents were male, while 38.7% (150) were female. 42.8% (166) of the respondents were married, 34.9% (135) single, 12.4% (48) separated, and 9.9% (38) widowed. 30.2% (117) of the respondents were civil servants, 28.0% (109) said "business", 23.8% (92) were farmers, 15.5% (60) 'others', and 2.2% (9) raw food sellers. When they were asked concerning their educational levels, 33.2% (129) reported tertiary education, 22.7% (88) had secondary education, 18.1% (70) mentioned 'others', 17.2% (67) primary education, and 8.5% (33) had no formal education.

Table 1: Socio-Demographic Characteristics of Respondents

Variable	Frequency (n=387)	Percentage (%)
Gender of Respondents		
Male	237	61.3
Female	150	38.7
Age (years)		
18-25	90	23.3
26-40	131	33.7
41-55	94	24.3
56 and Above	72	18.6
Marital Status		
Married	166	42.8
Single	135	34.9

Separated	48	12.4
Widowed	38	9.9
Level of Educational		
No Formal Education	33	8.5
Primary	67	17.2
Secondary	88	22.7
Tertiary	129	33.2
Others	70	18.1
Occupations		
Civil Servant	92	23.8
Farmers	117	30.2
Raw Food Handler / Seller	9	2.2
Business	109	28.0
Others	60	15.5

Awareness/Knowledge of Common Molds

Demonstrated in Table 2 below, 55.6% (215) of the respondents were not aware of the presence of Molds in their environments, 23.0% (89) replied 'yes' and 21.2% (82) did not know. 41.3% (160) of the respondents did not have adequate information about Mold in food and environment, 32.3% (125) said 'yes', and 26.2% (102) reported they did not know if they had sufficient information. 36.8% of the respondents who replied 'yes' (n = 125) reported the internet as a source of information, 16.8% (21) replied 'newspapers', 12.0% (15) replied 'friends', and 8.8% (11) said "television". 46.7% (181) of the respondents replied 'no' when asked if they thought people could develop cancer from food contaminated with Molds, 31.5% (122) said 'yes', and 21.7% (84) did not know.

Table 2: Awareness/Knowledge of Common Molds

Variable	Frequency (n=387)	Percentage (%)
Are you Aware of Presence of Mold in your Environment?		
Yes	89	23.0
No	215	55.6
I don't know	82	21.2
Do you have adequate information about Molds in food and environment?		
Yes	125	32.3
No	160	41.3
I don't know	102	26.2
If your answer to Question 10 above is yes, how did you get the information?		
Radio	12	9.6

Television	11	8.8
Newspapers	21	16.8
Friends	15	12.0
Internet	46	36.8
Others	20	16.0
Do you think people can develop cancer from food contaminated with Molds?		
Yes	133	34.2
No	185	47.8
I don't know	69	17.8

Respondent's conception of Molds: knowledge about production and symptoms of Molds

Among the adults in Owerri Municipal who were aware of the presence of Molds in their environments, Table 3 below demonstrated respondent's conception of Molds: knowledge about production and symptoms of molds. 49.1% (44) reported molds as causative factors of mycotoxins, followed by 28.7% (26) damp environment, and 42.3% (38) reported all of the above reasons including damp walls/ stores (14.1%), insects and rodent attacks (19.5%), and mixing of contaminated feed material with clean ones (16.8%) as mechanisms of transmission of mycotoxins into food and feeds. Over half of the participants were not sure they could identify feed/food material suspected to be contaminated by molds.

Table 3: *Respondent's conception of Molds: knowledge about production and symptoms of Molds*

Variable	Frequency (n=89)	Percentage (%)
What produces Molds?		
By insects infestation	8	9.3
Rodents and pest infestation	11	12.7
Damp Environment	26	28.7
Molds	44	49.1
How does molds get into food and feeds?		
Damp walls / stores	13	14.1
Insects and Rodent attacks	17	19.5
Mixing of contaminated feed material with clean ones	15	16.8
All of the above	38	42.3
None of the above	6	7.0
Can you identify a food / feed material suspected to be contaminated by Molds?		

Yes	19	21.5
No	20	22.2
Not sure	50	56.2
Do you think people can develop cancer from food contaminated with Molds?		
Yes	133	34.2
No	185	47.8
I don't know	69	17.8
What are the observable characteristics of Molds contaminated food & feed materials?		
Molds growth	27	30.0
Rotten seeds	7	7.5
Musty odour	20	22.9
All of the above	31	35.1
None of the above	4	4.3
Are there visible signs of dampness anywhere in your residence?		
Yes	53	60.00
No	27	30.34
Not sure	9	9.66
Is there a musty or odd smell on the walls?		
Yes	36	40.5
No	19	21.1
Not sure	34	38.2
Do the walls, floors and ceilings have any visible signs of cracks or stains?		
Yes	41	45.6
No	23	25.9
Not sure	25	28.3
Do your clothes, leather bags, belts, and shoes grow Molds sometimes?		
Yes	37	41.4
No	24	27.4
Not sure	28	31.1
Are air ventilation channels such as AC, Fans, windows, doors etc. supplying clean air?		
Yes	52	58.7
No	21	23.6
Not sure	16	17.5
Do your kitchen cabinets have signs of Molds growing on or in them?		
Yes	27	30.7
No	44	49.1
Not sure	18	20.1

Respondents agreed to visible signs of dampness (60%), cracks in ceilings (45.6%), visible signs of molds on clothes, leather bags, belts and shoes (41.4%), leaks or water stains under the sink (55.4%). The respondents were not also sure they sometimes ate food noticeably contaminated with molds (53.1%), 57.4% (41) reported they threw such food items away. However, majority of the respondents did not think molds contaminated food can lead to death of humans (67.9%).

Hygiene Practices Towards Molds

From Table 4 below, results concerning the hygiene practices towards molds among the participants showed that 51.7% (200) of the respondents replied 'no' when they were asked if they ate food, they observed molds on, 30.3% (117) reported 'not sure', and 18.0% (70) of the respondents said 'yes', sometimes (58.7%). 63.9% (247) of the respondents denied cooking food products contaminated with molds, respondents who did (n =100), cooked 'sometimes' (49.1%), by frying in oil (40.2%). 59.9% (232) of the participants affirmed they cooked/fried their foods deeply, and did not prefer tenderly cooked foods (59.1%). Majority of the respondents in Owerri municipal affirmed knowledge of mushrooms (90.6%), although over half of the study's participants did not consume them (58.1%). When the respondents were asked if they could tell the difference between edible and poisonous mushrooms, over three quarters agreed (75.4%), 18.4% said "No", and 6.0% (21) were 'not sure'.

Table 4: *Hygiene Practices Towards Molds*

Variable	Frequency (n=387)	Percentage (%)
When you observe molds in food, do you eat it?		
Yes	70	18.0
No	200	51.7
Not sure	117	30.3
If yes, how often?		
Sometimes	41	58.7
Always	18	25.0
Never	11	16.2
Do you cook food products contaminated with molds?		
Yes	100	25.9
No	247	63.9
Not sure	39	10.1
If yes, how often?		
Sometimes	49	49.1
Always	33	33.3
Never	18	17.5
Total	**247**	**100**
How do you cook such mold contaminated food materials		
Boiling	12	24.3
Frying in oil	20	40.2
Roasting	7	14.6
Others	10	20.7
Total	**49**	**100**
Do you cook / fry your foods deeply?		
Yes	232	59.9
No	76	19.5

Not sure	79	20.4
Do you prefer tenderly cooked foods?		
Yes	52	13.4
No	229	59.1
Not sure	106	27.3
Do you know what mushrooms are?		
Yes	351	90.6
No	15	3.8
Not sure	21	5.4
Total	**387**	**100**
Do you eat mushrooms?		
Yes	147	41.8
No	204	58.1
Total	**351**	**100**
Can you tell the difference between edible and poisonous mushrooms?		
Yes	265	75.4
No	65	18.4
Not sure	21	6.0
Total	**351**	**100**

Discussion

The objective of this study was to provide relevant evidence on the knowledge and hygiene practices of food and environmental contaminated with molds among people in Owerri Municipal. From this study in contrast to a research conducted by Ladeira et al., (2017) in which 82% of the participants had prior awareness of molds in food, the knowledge of molds among study participants in this study (48%) is assessed as poor. In contrast to previous research, it was discovered that participants in the current study had a greater perception of health risk. About 70% of participants in a research conducted in Belgium said molds may cause harm in people or animals (Lesuuda et al., 2021). Consumers are often unaware of the biohazards that molds cause mycotoxins represent.

From this study in the opinion of almost half of the participants, pesticides are equally harmful as molds. This shows that there is little awareness of and concern about molds in food (Ladeira et al., 2017; Chilaka et al., 2018). In terms of incidence, concentration, and associated harmful effects on people, the xenobiotic categories utilized for comparison, such

as pesticides, microplastics, etc., vary. Participants in the study disagree with experts' assessments of the relative hazards of molds and pesticides, who believe that molds pose a greater risk to people than pesticides when used as directed. According to Imade et al., (2021) in terms of exposure and severity of chronic diseases, especially cancer, molds currently appear to pose a higher risk than anthropogenic contaminants, pesticides (when used as directed), and food additives." sums up the expert opinion in an appropriate manner. Since certain molds have a higher health risk of causing diseases like estrogenic or carcinogenic effects as a result of chronic exposure than, for example, pesticides or food additives (Rofiat et al., 2015; Adetunji et al., 2014; Oyedele et al., 2017). The knowledge gap between experts and lay people is clearly visible in this study.

Conclusion and Recommendations

In contrast to other investigations, the findings of the current study show a typically low level of awareness of mycotoxins and a limited sense of their hazards. Molds were thought to pose a danger comparable to that posed by pesticides, heavy metals, microplastics, and food additives. This runs counter to both the poll respondents' beliefs and the evidence provided by professional opinions. From this study it is recommended that government agencies, stakeholders and public health authorities are to provide health education programmes that will sensitize concerned groups on better development. Also, in particular, the regulations applied to fruits and vegetables that had apparent rot, bruising, or symptoms of injury, in order to achieve a long-term decrease in dietary molds exposure, molds avoidance techniques should be applied in private homes and in informal trade sectors in addition to retail settings.

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