World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

# Effect of food storage in plastic, polythene and refrigerator

Olawande Temilade FAJILADE [1,*] and Omolara Olajumoke AFOLABI [2]

[1] *Department of Science Technology (Microbiology Unit), Federal Polytechnic, P.M.B. 5351, Ado-Ekiti, Ekiti State, Nigeria.*
[2] *Department of Food Technology, Federal Polytechnic, P.M.B. 5351, Ado-Ekiti, Ekiti State, Nigeria.*

World Journal of Advanced Research and Reviews, 2022, 15(03), 033–036

Publication history: Received on 11 July 2022; revised on 02 September 2022; accepted on 04 September 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.15.3.0839

## Abstract

Food stuffs such as maize (*Zea mays* L.), rice (*Oryza sativa*), and groundnut (*Arachis hypogaea*) are important staple foods in sub-Saharan Africa. The aim of this study is to examine the effect of storage on food samples in plastic, polythene bag, and refrigerator, putting into consideration the weight and microbial load of the food products before and after storage. The samples were obtain from Oba market and subjected to storage for 28 days, after which isolate of fungi and bacteria were obtained. The results revealed the isolation of *Rhizopus* spp., *Fusarium* spp., *Aspergillus flavus*, and *Aspergillus niger*. Also the total bacteria count ranges from 1 – 48 colony forming unit (CFU). Conclusively, storage condition is important for cereal foods in order to increase the shelf-life of such. This study revealed that refrigeration is preferable for storage of food stuff. It is important to preserve food samples in normal storage condition, therefore refrigeration is recommended for storage of food sample, in order to increase the shelf-life of food products.

**Keywords:** Cereal foods; Food storage; Plastic; Polythene bag; Refrigerator

## 1. Introduction

Food storage allows food to be eaten for some time (typically weeks to months) after harvest rather than solely immediately. It is both a traditional domestic skill and, in the form of food logistics, an important industrial and commercial activity. Food preservation, storage, and transport, including timely delivery to consumers, are important to food security, especially for the majority of people throughout the world who rely on others to produce their food. Food is stored by almost every human society and by many animals [1].

Cereal foods such a maize (*Zea mays* L.), rice (*Oryza sativa*), and groundnut (*Arachis hypogaea*) are important staple foods in sub-Saharan Africa but are also used for industrial purposes and animal feed worldwide [2]. In the tropics, in locations where there are two annual cereal harvests, it is not uncommon for one harvest to coincide with the start of the rainy season. As nearly all smallholder farmers rely on sun-drying prior to grain storage, this poses a serious threat of grain quality deterioration [3]. If the crop is stored while still moist and warm, there may be rapid spoilage due to mould growth and insect pests [4]. Due to the demand for high quality and safe food by the consumers, there is a need to maintain and protect cereal grains from insect damage and fungal infection [5].

Refrigeration and freezing of food products is an important and fascinating application area of heat transfer and thermodynamics. Refrigeration slows down the chemical and biological processes in foods and the accompanying deterioration and the loss of quality. The storage life of fresh foods such as meats, fish, fruits, and vegetables can be extended by several days by cooling, and by several weeks or months by freezing [6]. It is of importance of having a broad base and a good understanding of the processes involved when designing heat transfer equipment [6].

* Corresponding author: Olawande Temilade FAJILADE; Email: fajilade.temilade@gmail.com
Department of Science Technology (Microbiology Unit), Federal Polytechnic, P.M.B. 5351, Ado-Ekiti, Ekiti State, Nigeria.

Proper food storage helps to preserve the quality and nutritional value of the foods, and also helps by preventing spoilage. Proper food storage can help prevent foodborne illnesses caused by harmful bacteria [7]. Signs of spoilage that make food unpalatable but not a bacterial hazard are the rancid odor and flavor of fats caused by oxidation, slime on the surface of meat, and the fermentation of fruit juices due to yeast growth. Off-odors in foods and a sour taste in bland foods can indicate dangerous bacterial spoilage. However, food can be high in bacteria count even without such signals [7].

Bacterial infections account for 67 percent of all food poisoning in the United States. The three basic bacteria types responsible for most food-related illnesses are *Staphylococcus*, *Clostridium perfringens* and *Salmonella*. *Staphylococcus* is transferred to foods by humans during preparation. *Clostridium perfringens* and *Salmonella* can be on the food or transferred to the food during preparation. At low levels these bacteria do not cause trouble. Under favorable conditions, however, they can multiply to dangerous levels within a few hours.

Chief factors contributing to bacterial growth and possible food poisoning are temperature, time, food type and moisture. Bacteria need all these factors to grow. If any of the factors is missing, bacteria will not increase as fast. Temperatures between 4.4 $^{o}$C and 60 $^{o}$C permit fast bacterial growth. If food is kept for three or four hours in this temperature range, the number of bacteria present could cause illness. Food type will affect the rate of bacterial growth. Low-acid foods such as meat, cooked vegetables and egg dishes are particularly risky. Amount of moisture available will also affect microbial activity. The aim and objective of this study is to examine the effect of storage of cereal food samples in plastic, polythene bag, and refrigerator, putting into consideration the weight of the food products before and after storage.

## 2. Material and methods

### 2.1. Collection and preparation of samples

Food samples (maize, groundnut, and rice) were obtained from Oba market in Ado-Ekiti, brought to the Microbiology Laboratory. A 3 g of each sample was weighed, and then stored for 21 days. First part was stored in refrigerator, second part was stored in polythene bag, and the third part was stored in plastic container. The initial weight of food samples were recorded to be 3 g, the weight was also recorded after 28days of storage.

After 28 days of storage, 1 ml of Jik was added to 99 ml of distilled water, which was used to rinse each food sample, after three minutes, it was rinsed again in order to reduce the population of organisms.

### 2.2. Isolation of organisms

Food samples (maize, rice, and groundnut) were subjected to surface sterilization with 0.2% sodium hypochlorite solution for 2 minutes and rinsed with distilled water. The samples were directly placed on the prepared nutrient agar and PDA plates. Nutrient agar plates were incubated for 24 hours at 37$^{o}$C in an incubator; and the PDA plate were incubated at room temperature (25$^{o}$C) for 3 days and then observed for growth. Each fungal colony obtained were sub-cultured on PDA and incubated at 25$^{o}$C for 3 days for subsequent characterization and taxonomic identification.

## 3. Results

**Table 1** Weight of the food samples after storage for 21 days

| Samples | Storage device | Weight (g) |
|---|---|---|
| Maize | Fridge | 3.21 |
| Rice | | 3.20 |
| Groundnut | | 3.14 |
| Maize | Polythene | 2.99 |
| Rice | | 3.12 |
| Groundnut | | 3.08 |
| Rice | Plastic | 3.01 |
| Groundnut | | 3.15 |

The initial weight of all samples before storage = 3.0 g

**Table 2** Fungal isolates from food samples

| Samples | Storage device | Appearance | Fungi isolates |
|---|---|---|---|
| Maize | Fridge | Whitish black | *Rhizopus* spp. |
| Rice | | Whitish | *Fusarium* spp. |
| Groundnut | | Black, yellow, green, greenish blue | *Aspergillus flavus* |
| Maize | Polythene | Black | *Aspergillus niger* |
| Groundnut | | Whitish black | *Rhizopus* spp. |
| Rice | Plastic | Whitish black | *Rhizopus* spp. |
| Groundnut | | Black, whitish black | *Aspergillus* spp., *Rhizopus* spp. |

**Table 3** Total bacterial count of bacteria isolates from food samples

| Samples | Storage device | Total bacteria count (CFU/g) | |
|---|---|---|---|
| | | Before storage (x 103) | After storage (x 103) |
| Maize | Fridge | 1.4 | 1.5 |
| Rice | | 1.0 | 1.1 |
| Groundnut | | 0.6 | 0.7 |
| Maize | Polythene | 3.7 | 6.8 |
| Rice | | 1.4 | 3.4 |
| Groundnut | | 2.4 | 4.0 |
| Rice | Plastic | 1.2 | 1.5 |
| Groundnut | | 1.4 | 2.0 |

## 4. Discussion

Different species of fungal isolates are shown in table 2. The fungal isolates include; *Rhizopus* spp., *Fusarium* spp., *Aspergillus flavus*, and *Aspergillus niger*. The most common genera isolated were *Aspergillus*. These genera are known to produce mycotoxins in food products such as aflatoxins and ochratoxin [8]. As could be seen from the table, some species were detected in all cereal samples, while some were present in only one cereal sample. Nowadays, 80,000 – 100,000 fungal species have been described and some are known to produce toxic secondary metabolites which lead to adverse effects in animals and humans [9].

Cereals in the field are exposed to fungi from the soil, birds, animals, insects, organic fertilizers, and from other plants in the field. Mechanical damage of raw material or food due to insects and pests is a disturbing problem mainly in tropical regions, particularly as food contaminants are present in the field more abundantly than in the storage according to the report of Magan and Lacey [10].

Presence of different species of fungi associated with food products used in this study could represent a serious problem by secretion of different kinds of mycotoxins which could affect human health, and all relevant authorities should work together in reducing the risk of contamination and risk of mycotoxins exposure from consumption of cereals and derived products.

The vast growth of these fungal and bacterial isolates is due to the storage conditions the food samples are being subjected to. High temperature does not favor the storage of majority of food, this will lead to deterioration and reduce the quality of cereal foods. And probably lead to infestation and proliferation of organisms.

Polythene and plastic storage is unfavorable to storage of food stuff for a longer period of time, however, refrigeration is far better, but does not favor some dry food sample, as it might lead to increase of moisture content of such food samples.

## 5. Conclusion

Conclusively, storage condition is important for cereal foods in order to increase the shelf-life of such. This study revealed that refrigeration is preferable for storage of food stuff. *Aspergillus* spp., *Rhizopus* spp., and *Fusarium* spp. were isolated from food samples stored in plastic containers and polythene bag. It is important to preserve food samples in normal storage condition, therefore refrigeration is recommended for storage of food sample, in order to increase the shelf-life of food products.

## Compliance with ethical standards

### *Disclosure of conflict of interest*

Authors have declared that no conflict of interests exists.

## References

[1] Latter Day Saints Family Home Storage. Provident Living. 2011; Archived 2011-10-29 at the Wayback Machine,

[2] Nwosu LC, Amana O, Onyeje O. Efficacy of bone charcoal dust of six mammalian species as eco-friendly alternatives to conventional synthetic insecticides in the control of Sitophilus zeamais Motschulsky (Coleoptera: Curculionidae) infesting stored resistant and susceptible maize cultivars," Jordan Journal of Agricultural Sciences, 2016; 12(1): 311–320.

[3] Mendoza E, Rigor AC, Mordido Jr. CC, Marajas AA. Grain quality deterioration in on-farm level of operation, in Progress in Grain Protection, N. C. Tefer and A. S. Frio, Eds., pp. 107–117.

[4] Weinberg ZG, Yan Y, Chen Y, Finkelman S, Ashbell G, Navarro S. The effect of moisture level on high-moisture maize (*Zea mays* L.) under hermetic storage conditions-in vitro studies. Journal of Stored Products Research, 2008, 44: 136–144.

[5] Sinha RN. The stored-grain ecosystem, in Stored Grain Ecosystems, D. S. Jayas, N. D. White, and W. E. Muir, Eds., pp. 1–32, Marcel Dekker, New York, NY, USA. 2005.

[6] Penner K. Refrigerator/Freezer Approximate Storage Times. Kansas State University Cooperative Extension Service. Manhattan, KS. 2010; Available at: http://www.ksre.ksu.edu/library/ fntr2/l805.pdf

[7] Kendall P, Dimond N. Food Storage for Safety and Quality. Food and Nutrition Series|Health. Fact Sheet No. 9.310, 2012.

[8] Alkenz S, Sassi AA, Abugnah YS, Alryani MB. Isolation and identification of fungi associated with some Libyan foods. African Journal of Food Science, 2015; 9(7): 406-410.

[9] Probst C, Bandyopadhyay R, Price LE, Cotty PJ. Identification of AtoxigenicAspergillus flavusIsolates to Reduce Aflatoxin Contamination of Maize in Kenya. Plant Disease, 2011; 95(2): 212–218.

[10] Magan MI, Lacey J. The relationship between fungal biomass and grain spoilage. Journal of Applied Microbiology. 2011; 40(5): 35-42.