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Developing of database on drying parameters of some Nigerian staple foodstuffs

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ABSTRACT

This work is on the development of databank for drying parameters of some staple foodstuffs: carrot, cassava, Irish potato, sweet potato, cocoyam, yam, water yam, banana, guava, and plantain. Microsoft SQL software 2012 and visual studio net were used to develop the database. The computer database consists of two programs, SQL software serves to make records in the database file and visual studio net searches and retrieves parameters from the database file. The developed program offers a collection of data dedicated to drying parameters on ten Nigerian staple foodstuffs.

Keywords— *Microsoft SQL software, Visual studio net, Hot air drying, Staple foodstuffs*

1. INTRODUCTION

Databases and uses to which they can be put have become increasingly valuable commodities. A database is a collection of related data and information organized to permit search and retrieval or processing and reorganizing (nap.edu). A database is designed, built, and populated with data for a specific purpose. It has an intended group of users and some preconceived applications in which these users are interested. (Elmasri N.,2010). A relational database management system (RDBMS) is a type of database management software that was developed in the 1970s, based on the relational model, and is still the most popular way to manage a database. Microsoft SQL Server, Oracle Database, IBM DB2, and MySQL are the top RDBMS products available for enterprise users (techTarget.com).

Root and tuber crops, including cassava, sweet potato, potato and yam (white yam, water yam, and cocoyam) are the most important food crops for direct human consumption in Africa. These crops are grown in varied agro-ecologies and production systems contributing to more than 240 million tons annually, covering around 23 million hectares. The aggregate value of yam, cassava, potato and sweet potato exceeds all other African staples, including cereal crops (UN, 2015). Carrot is one of the most commonly used vegetables for human nutrition due to the high vitamin and fiber content. Carrots have a variety of health effects; they are rich in vitamins, sugar, starch, potassium, calcium, phosphorus, iron and other nutrients and inorganic salts and five kinds of essential amino acids. (Aboltins, and Upitis, 2011). Fruit crop is a perennial, edible crop where the economic product is the true botanical fruit or is derived from. More than 100million tons of banana and plantain were produced worldwide in 2007 according to the Food and Agriculture Organization, FAO estimates. They are important staple foods in many developing countries, especially in Africa. They provide food security and income for small-scale farmers who represent the majority of producers. Only about 15% of the global banana and plantain production is involved in international trade, most production is consumed domestically. Banana and plantain starch, flour and chips are processed products whose markets are yet to be fully developed. (agronigeria.com.ng). Guava is an evergreen, tropical shrub or small low-growing tree probably originated in the central Americas. Guavas are rich in dietary fiber and vitamin C, with moderate levels of folic acid. These crops are versatile staples to address food and nutrition security for millions of people and produce more food per unit area of land. They are also capable of efficiently converting natural resources into a more usable product, caloric energy in the growing season, which is the most productive of all major arable crops; almost double that of wheat and rice. Recent years have witnessed the expansion of markets for processed products. However, shorter shelf life as a result of deterioration with changes in temperature, humidity, and microbial growth makes root and tuber crops unacceptable to consumers. Drying provides an alternative to increasing the shelf life of these crops.

Drying is an important unit operation in the preservation and processing of food and agricultural materials. It decreases the water activity of a high moisture food product thereby inhibiting microbial and fungal deterioration. Drying improves storability, reduces packaging and haulage costs, enhances appearance, retains flavour and maintains nutritional value (Saeed et al., 2008).

The main objective of drying agricultural products is the reduction of the moisture content to a level which allows safe storage over an extended the period. It also brings about a substantial reduction in weight and volume, minimizes packaging, storage and transportation costs (Doymaz 2007). Conventional air-drying is the most frequently used dehydration operation in the food industry (Gornicki & Kaleta 2007). Drying is the process of moisture removal due to simultaneous heat and mass transfer under controlled conditions (Gatea, 2011 Gurlek, et al, 2009, Radhika, Satyanarayana, Rao, & Raju, 2011). It is one of the oldest methods of preservation and widely applied owing to its simplicity, ease of operation and cost-effectiveness. Besides these advantages, drying decreases the bulk of foods by reducing the volume which eases handling and processing operations, in turn reducing packaging, handling and storage and transportation costs (Gatea, 2011 Goyalde, et al, 2009 Gupta, et al 2011; Kelbaliev & Manafov, 2009; Patel & Kar,2012, Wong & Cheung, 2001). There is thus an increasing need for more complete, accurate, reliable data on preventing food spoilage. This is to enable food security and safety leading to availability and accessibility. To this end, drying parameter on ten food crops was compiled. The aim is to collect data, review the data in accordance with internationally accepted standards, and create a database with the updated compilation.

2.METHODOLOGY

Samples of ten food crops were purchased from local market in Enugu and transported to the laboratory for analysis in Enugu, Enugu State. Proximate analysis was done according to the method of AOAC, 2004.

2.1 Literature search

A comprehensive literature search on the food crops is compiled. Sources included Google searches and journals. Articles were limited to drying as a method of preventing spoilage. The information was analyzed and coded into a database by the authors and other supporting researchers.

2.2 Development of a database

To create and maintain a computer database, you need a database program, often called a database management system (DBMS) or relational database programs or RDBMS. (https://github.com/dataflow/RDF...) The steps involved are:

- Collection of data.
- Group your items into categories in a table.
- Install database management system Microsoft SQL server 2012.
- Create a database with a name such as a foodstuff bank database.
- Fill the collected data into the database tables to form records.
- Build graphics users interface with Microsoft visual studio net.
- Create forms interfaces and link them to the database.
- Query the database
- Produce flexible reports (geekgirls.com/2011/09/databases)

Table 1: Coded samples

S. No.	Sample	Coded number
1	Carrot	μ_1
2	Cassava	μ_2
3	Irish potato	μ_3
4	Sweet potato	μ_0
5	Cocoyam	μ_{-3}
6	Yam	μ_{-2}
7	Water yam	μ_{-1}
8	Banana	B_1
9	Guava	B_0
10	Plantain	B_{-1}

3. RESULTS AND DISCUSSION

Table 2: Proximate Analyses of the Raw Samples at Ambient Temperature

S. No.	Sample	Moisture (%)	Lipid (%)	Crude Fibre (%)	Protein (%)	Ash (%)	Carbohydrate (%)
1	Cassava	65.82	1.00	4.31	1.14	3.00	24.73
2	Carrot	86.25	0.16	2.39	1.00	2.50	7.70
3	Irish Potato	88.10	2.01	1.18	2.50	1.14	5.07
4	Sweet Potato	71.87	1.70	1.43	2.34	2.71	19.95
5	Cocoyam	83.22	0.26	0.84	2.50	1.30	11.88
6	Yam (White)	65.70	2.70	1.93	0.87	2.03	26.77
7	Water Yam	76.34	2.86	2.70	1.93	1.83	12.77
8	Unripe Banana	64.46	2.18	1,75	5.84	1.38	24.39
9	Guava	87.33	3.31	0.83	4.18	1.62	2.73
10	Unripe Plantain	61.39	2.44	2.14	2.24	3.15	28.64

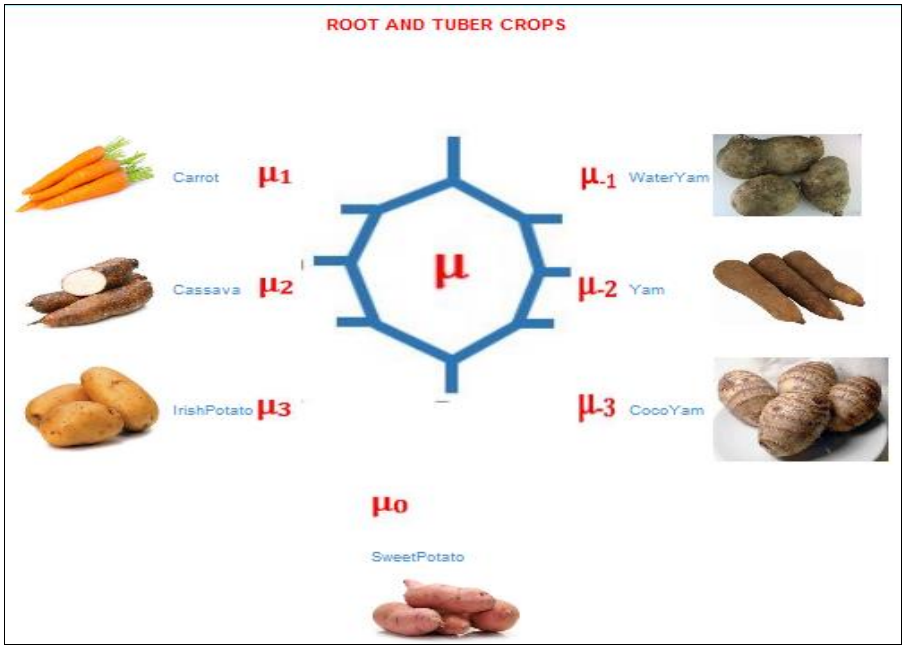

Fig. 1: Root and tuber crops

FoodSymbol	StapleFoodStuff	EndProduct	MoistureContents	StorageTemperature	RelativeHumidity	ShellLife
μ1	Carrot	Chips	2%-5%	Below 10oC	55%-70%	6 months

MethodofProcessing	BestMethodofProcessing	MethodofPreservation	BestPackageMethod	BestStorageMethod
Fresh Carrot, Washing, Peeling, Slicing, drying and dried carrot.	carrot chips	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

Fig. 2: Data on preserving carrot

FoodSymbol	StapleFoodStuff	EndProduct	MoistureContents	StorageTemperature	RelativeHumidity	ShellLife
μ2	Cassava	Flour	10%-12%	25oC	85%-90%	1-2 Years

MethodofProcessing	BestMethodofProcessing	MethodofPreservation	BestPackageMethod	BestStorageMethod
Fresh cassava, Peeling, Grating, Pressing, Drying, Milling, Sieving, Packaging, Cassava flour.	cassava Flour	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

Fig. 3: Data on preserving cassava

FoodSymbol	StapleFoodStuff	EndProduct	MoistureContents	StorageTemperature	RelativeHumidity	ShellLife
μ3	Irish Potato	Flour or Chips	9%	14oC	85%-90%	1 year

MethodofProcessing	BestMethodofProcessing	MethodofPreservation	BestPackageMethod	BestStorageMethod
Fresh irish potato, Peeling, Slicing, Blanching, Drying, Cooling, Milling, Sieving, Irish potato flour.	Irish Potato Chips	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

Fig. 4: Data on preserving Irish potato

FoodSymbol	StapleFoodStuff	EndProduct	MoistureContents	StorageTemperature	RelativeHumidity	ShellLife
μ0	Sweet Potato	Flour or Chips	7%-12%	13oC	85%-90%	1 year

MethodofProcessing	BestMethodofProcessing	MethodofPreservation	BestPackageMethod	BestStorageMethod
Sweet potato tuber, Desugaring, Peeling, Slicing, Washing, So2 dipping,Draining, Atmospheric frying, Cooling, Sweet potato chips.	Sweet Potato Chips	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

Fig. 5: Data on preserving sweet potato

Food Symbol	Staple Food Stuff	End Product	Moisture Contents	Storage Temperature	Relative Humidity	Shell Life
μ-1	Wateryam	Chips or Flour	10%-13%	Below 20°c	55%-70%	1 year

Method of Processing	Best Method of Processing	Method of Preservation	Best Package Method	Best Storage Method
Harvesting, Cleaning, Peeling, Blanching, Slicing, Drying, Milling, wateryam flour.	Wateryam Flour	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

WaterYam μ_{-1}

Fig. 6: Data on preserving water yam

Food Symbol	Staple Food Stuff	End Product	Moisture Contents	Storage Temperature	Relative Humidity	Shell Life
μ-2	Yam	Chips or Flour	10%-13%	Below 20°C	55%-70%	1 Year

Method of Processing	Best Method of Processing	Method of Preservation	Best Package Method	Best Storage Method
Harvesting, Cleaning, Peeling, Blanching, Slicing, drying(10%), milling, yam flour.	Yam Flour	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

Yam μ_{-2}

Fig. 7: Data on preserving yam

Food Symbol	Staple Food Stuff	End Product	Moisture Contents	Storage Temperature	Relative Humidity	Shell Life
μ-3	Cocoyam	Chips or Flour	9%-12%	20-25°C	70-80%	1 year

Method of Processing	Best Method of Processing	Method of Preservation	Best Package Method	Best Storage Method
Harvesting , Washing Cooking, Peeling. Slicing, Drying, cocoyam slices	Cocoyam Chips	Drying	Airtight, moisture proof container	Dry, Dark and cool environment

CocoYam μ_{-3}

Fig. 8: Data on preserving cocoyam

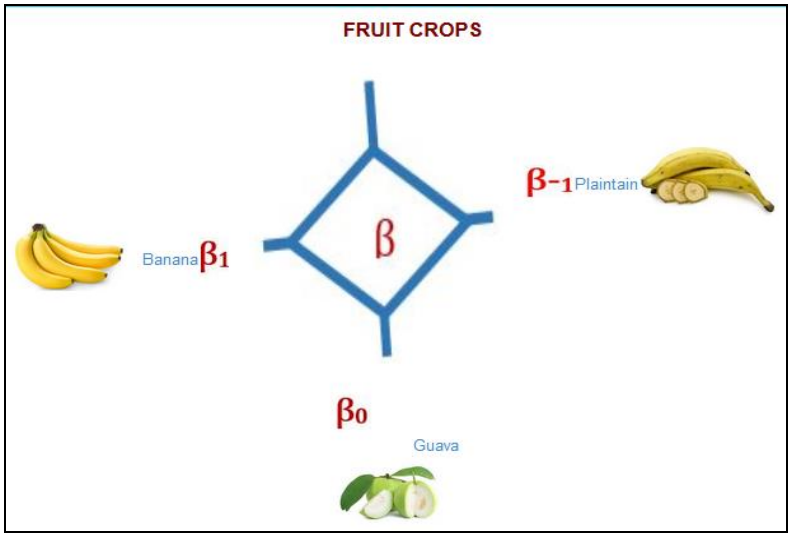

Fig. 9: Fruit Crops

Food Symbol	Staple Food Stuff	End Product	Moisture Contents	Storage Temperature	Relative Humidity	Shell Life
β1	Banana	Flour or Chips	10-15%	13-15°C	90%-95%	1 year

Method of Processing	Best Method of Processing	Method of Preservation	Best Package Method	Best Storage Method
Unripe banana, Washing, peeling, sulphite dip process, osmovac process, dipping in sugar solution, drying low moisture banana slices	Banana Flour	Drying	Moisture proof, Airtight bag	Dry cool area

Banana β_1

Fig. 10: Data on preserving banana

Food Symbol	Staple Food Stuff	End Product	Moisture Contents	Storage Temperature	Relative Humidity	Shell Life
β0	Guava	Guava chips	5-10%	12-15°c	70%-90%	1 year

Method of Processing	Best Method of Processing	Method of Preservation	Best Package Method	Best Storage Method
Fresh Guava, peeling, washing, drying and dried Guava Chips	Guava chips	Drying	Sealed Polyethene bags	Dry cool area

Guava β_0

Fig. 11: Data on preserving guava

FoodSymbol	StapleFoodStuff	EndProduct	MoistureContents	StorageTemperature	RelativeHumidity	ShelfLife
β1	Plantain	Flour or Chips	10-15%	13-15ºC	90%-95%	1 year

MethodofProcessing	BestMethodofProcessing	MethodofPreservation	BestPackageMethod	BestStorageMethod
From Mature Plaintain to Cleanin to Peeling to Slicing to Drying to Milling then Plaintain flour	Plantain Flour	Drying	Moisture proof, Airtight bag	Dry cool area

Fig. 12: Data on preserving plantain

4. CONCLUSION

The development of a database on drying parameters of some Nigerian staple foodstuffs is never static. It requires continuous expansion, reorganization, update, and revalidation. Future research should include collecting and analyzing additional publically available articles on drying food crops.

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