

**THE EFFECT OF SUN-DRYING ON RAW EGGS INTO EGG POWDER TO
INCREASE ON TRANSPORTATION, STORAGE AND HANDLING IN
TIMES OF GLUT AMONG RURAL FARMERS**

BY

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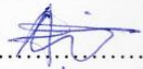
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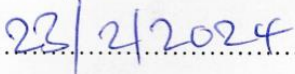
**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF
AGRICULTURE TOWARDS THE FULFILMENT FOR THE AWARD OF
THE DEGREE IN SCIENCE EDUCATION BUSITEMA UNIVERSITY
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DECLARATION

I **AJAMBO LINDA BRIDGET** declare that all the work in this report was carried out in accordance with the regulations of Busitema University, and that this work is original except where indicated in the text and no part of this research has been submitted to any other university for examination and degree award. Any views expressed in this research are those of the author and in no way represent those of Busitema University.


Signature.....

Date

APPROVAL

This is to certify that this dissertation titled "THE EFFECT OF SUN-DRYING ON RAW EGGS INTO EGG POWDER TO INCREASE ON TRANSPORTATION, STORAGE AND HANDLING IN TIMES OF GLUT AMONG RURAL FARMERS." was written by AJAMBO LINDA BRIDGET under our guidance and supervision and meets the requirement set by Busitema University for the award of Bachelor Science Education. It has been submitted with approval of the University Supervisor.

ACADEMIC SUPERVISOR BUSITEMA UNIVERSITY

Signature: 

Date: 23/2/2024

MR. OTEMA PATRICK BEN EMOI

(SUPERVISOR)

DEDICATION

I thank God for the gift of life and for enabling me to complete my research project successfully.

This report is dedicated to; my beloved supervisor **MR. OTEMA PATRICK BEN EMOI**, my dear father **ORIEBA SIMON PETER**, My lovely Mother **AKITWI CHRISTINE** and my brothers and sisters, and friends, and all my course mates, and my dear lecturers for their maximum support that they offered to me morally, technically and financially, materially and in all circumstances that I went through in carrying out my course and this research report. You have been so fundamental in pursuit of my course.

May the good and merciful lord reward you abundantly?

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Special thanks go to my Beloved parents ORIEBA SIMON PETER and AKITWI CHRISTINE who supported me morally and financially, throughout my academic endeavors. Special gratitude also goes to the University management for mentoring and providing me with technical knowledge and advice and for their efforts in ensuring that this research is completed.

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ABSTRACT

Egg is a nutrient dense food (Ruxton, Derbyshire et al. 2010). The cyclical egg glut characterized by egg spoilage, quality deterioration and wastage imparts negatively on poultry farmers. Powdered dried egg provides a convenient alternative to this problem. The focus of this study was to compare and evaluate processed whole eggs into powder form using sun drying as a method of egg powder production and the whole fresh eggs. An experiment was conducted to evaluate the potential of whole egg powders made from sun drying as processing method. The effect of sun drying on yield results of powdered eggs from whole eggs are compared to the results from whole eggs when mixed in baked cake, fried eggs and used in porridge flour so the results are compared and the difference or similarity is observed.

Sun drying was opted than other methods of egg powder production because it is pocket friendly hence matching the standards of rural poultry farmers and also are able to reduce losses of fresh whole eggs in times of glut. The findings of the researcher were successful since he was able to find out that sun drying had no effect of the flavor, taste and even the shelf life of the egg powder remained the same compared with the egg powder made by other modern methods of egg powder production.

This research was carried out in Busitema University Nagongera

CHAPTER ONE

1.0 Introduction

This chapter consists of the background, statement of the problem, justification of the study, objectives, research questions and significance of the study, the research scope and conceptual framework.

Humans have been consuming eggs since the dawn of human time. This is because most of the population participates in Poultry farming. Poultry farming is the form of animal husbandry which raises domesticated birds such as chickens, ducks, turkeys and geese to produce meat or eggs for food. Poultry – mostly chickens – are farmed in great numbers.

Chickens raised for eggs are known as layers (Henry 2002). Egg laying chicken are normally called layers because they are for the purpose of commercial egg production (Whitehead 2004). Layer chickens are such a special species of hens, which need to be raised from when they are one day old (Koenen, Boonstra-Blom et al. 2002). They start laying eggs commercially from 18-19 weeks of age (Robinson, Renema et al. 2001).

Environmental conditions are often automatically controlled in egg-laying systems. For example, the duration of the light phase is initially increased to prompt the beginning of egg-laying at 16–20 weeks of age and then mimics summer day length which stimulates the hens to continue laying eggs all year round; normally, Some commercial breeds of hen can produce over 300 eggs a year which lead to over production of eggs annually hence leading to glut (MOU 2016).

1.1 Overview of Poultry Production

The global poultry industry has more than 23 billion birds and growing more than 5times in the last 50years making the global egg production to reach to 73 million tons (Mottet and Tempio 2017). China and the United States are the biggest chicken producers (Uzundumlu and Dilli 2022).

In 2021, China was the largest producer, with an estimated production of approximately 11,091,585,000 birds and over 15% of the global production.

The United States once accounted for 17% of the global production but is down to a little over 13% of the output, with 9,325,584,000 chickens in 2021. U.S. production is forecasted to rise by 1% in 2023, even with HPAI-related restrictions still in place. This contributed to 1,627 trillion eggs produced globally in 2022

In Uganda Chickens are the most widely distributed livestock among households in Uganda. In 2008, at least half of all households in Uganda were owning chickens and the national chicken numbers stood at 37.2 million (Moges 2010).

In 2017, Uganda's total poultry production is estimated at about 47.6 million chickens and this 87.7% is free range local breeds. Commercial poultry production with exotic breeds is also increasing as seen from 1, 53600 in 2008 to 5,852000.

Poultry production is rapidly gaining popularity. The number of chicken has been increasing by 2.8% in recent years approaching 47.6 million as of 2017, 87.7% of which were indigenous breeds (UBOS 2018).

99% of the households own indigenous chickens with an average flock size per household of 6 chickens (Halima, Nesor et al. 2007). The indigenous chickens are mainly found in Eastern and Northern parts of Uganda while the exotics are more in Central Uganda.

Other poultry species kept alongside the local chicken in the north and west Nile are ducks, turkeys, guinea fowl, and pigeons (Blench 2006).

1.2 Methods of Poultry Farming for Layers

Methods involved in poultry farming are;

Deep litter system; this is commonly used in all over the world, birds are fully confined but can move around freely, In method the birds lay eggs in the nests and are collected , then forwarded to the egg grading plant (this may be done manually) The eggs should be collected at least 5 times a day to reduce on the risks of breaking which may result to egg eating by the birds due to exposure of broken eggs to birds therefore to avoid vices among birds ,they should be picked at least 5 times a day.

Free range (roaming) Poultry farming; under this system, birds are not restricted and can search for food over wide area. Free range birds have specially fitted nest boxes where they go and play every day or collected manually or by hand from different location where they lay and taken to the grading point

Backyard systems; this is the most common system in the rural areas. Birds are housed at night but allowed to roam freely during the day. Eggs are collected just like in the free range poultry farming (Samanta, Joardar et al. 2018).

Battery cage system, this is usually used for laying birds, which are kept throughout their productive life in cages (Lukanov and Alexieva 2013). Each cage is facilitated with automated belts, these automated belts run beneath the cages, gently collecting eggs from each cage and transporting them to central collection.

1.3 Egg Production

Eggs contain highest quality protein, vitamins and minerals (Watkins 2017). Eggs are an amazing food and may be considered (in their dried form) as an addition to your food storage program. Because fresh eggs are so perishable, the popularity of the dried or dehydrated eggs has increased in demand in not only personal home food storage but also in military rations, the food service industry and emergency relief. (Ministry of Agriculture, 2019).

Globally egg production has reached to 73 million tons between 1961 and 2010 per Capita global egg consumption increased from 4.55kg to 8.92kg (Mottet and Tempio 2017). The production volume of eggs worldwide exceeded 86.3 million metric tons in 2021, down from about 87.07 million metric tons in 2020. Since 1990, the global egg production volume has increased by over 100 percent (ABBASSI Anfel 2023).

China is by far the world's largest egg producer, with 37 percent of global production in 2022. Asia provided more than 64 percent of the world's eggs in 2021, The United States has 28 chickens produced per person yearly, and The Netherlands is the largest export country with 351,223 tonnes of eggs exported in 2021. (Poultry Industry statistics, 2023)

In Africa egg production is estimated at 2367000 tonnes per annum (representing only 3.7% of the global egg output) .The highest egg producing country in Africa is Nigeria, with a total output of 553000 tonnes per annum, followed by south Africa (435,000), Egypt (240,000), Morocco (200,000), Algeria (185,000), Kenya (69,000) and Libya (60,000).

In East Africa, Kenya's poultry sector is the most mature resulting into more egg production than other countries (Vernooij, Masaki et al. 2018).

(Handbook of Egg science and Technology 2023)

In Uganda, egg production has increased from 761.3 million units in 2010 to 856 million units in 2014 (Aryemo, Akite et al. 2019). In 2018, nearly 0.93 billion eggs were produced in Uganda. In 2021, production of eggs in Uganda was 44,889 tons. In 20, May Egg production in Uganda increased at an average yearly rate of 4.44% (Livestock Industry foundation, 2023)

In Uganda egg consumption is set to reach 31 Thousand Metric Tons by 2026 from 32 Thousand Metric Tons, will decrease by 2% per year. Since 2017, the demand rose 0.5% year on year close to 73,110 Thousand Metric Tons. The United States, India and Japan respectively came in numbers 2, 3 and 4 in this ranking.(Forecast: Report Linker Research ,Egg market size in Uganda

2023 to 2027) ,this forecast calls for preparations of the future fall in the consumption of eggs by finding ways of making egg powder.

1.4 Egg Powder

Egg powder is a powder product produced by preferably breaking shelled eggs in hygienic conditions and finally drying followed by some preliminary process (Mnyandu 2014). A powdered egg is a fully dehydrated egg (Chowdhury 2020). Most powdered eggs are made using spray drying in the same way that powdered milk is made (Sagar & Suresh Kumar, 2010). The finest, top quality eggs are used, fresh from the farm. The eggs are broken and only the shells are thrown away or put into other uses , The types of egg powder commonly used varieties for worldwide customers is chicken egg powder, duck egg powder , quail egg powder among other eggs of domesticated birds.

1.5 Drying or Dehydration

Is, by definition, the removal of water by evaporation, from a solid or liquid food, with the purpose of obtaining a solid product sufficiently low in water content (Inyang, Oboh et al. 2017). Drying process is one of the most important factors in the processing of dehydrated egg flour, dehydrated egg flour / powder can be processed from fresh eggs or eggs that have been stored in a freezer (Hayuningtyas, Nurjannah et al. 2022). It has many advantages such as increase shelf life without reducing nutritional value, reduces the volume and expands marketing reach because there is over production of eggs on poultry farms. (Food storage for emergencies by Utah State University extension, 2020)

1.5.1 The Main Technological Objectives of Food Dehydration are:

- Preservation as a result of depression of water activity.
- Reduction in weight and volume.

- Transformation of a food to a form more convenient to store, package, transport, and use; for example, transformation of liquids such as milk, eggs, fruit and vegetable juices, or coffee extract, to a dry powder that can be reconstituted to the original form by addition of water (instant products).
- Imparting to a food product, a particular desirable feature such as a different flavor, crispiness, chewiness, etc., that is, creating a new food (e.g., transformation of grapes to raisins).

1.5.2 The Most Important Engineering and Technological Issues in Food Dehydration are the Following:

The kinetics of drying: With some notable exceptions such as spray drying, drying is a relatively slow process. Knowledge of the factors that affect the rate of drying is essential for the optimal design and operation of drying systems (Defraeye 2014).

Product quality: Removal of water is not the only consequence of most drying operations. Other important quality-related changes in taste, flavor, appearance, texture, structure, and nutritive value may occur in the course of drying. The extent of such changes depends on the process conditions.

Energy consumption: Most common drying processes use extensive quantities of energy at relatively low efficiency. Energy-wise, drying is a wasteful water removal process, compared to other water removal operations such as evaporation or membrane separation (Mercer and Armenta 2011).

1.5.3 The Mechanism of Water Removal by Drying Involves Two Simultaneous Processes Namely;

- Transfer of heat for the evaporation of water to the food
- Transport of the water vapors formed away from the food.

Drying is, therefore, an operation based on simultaneous heat and mass transfer.

1.5.4 Depending on the mode of heat and mass transfer, industrial drying processes can be grouped into two categories:

Connective drying: Hot and dry gas (usually air) is used both to supply the heat necessary for evaporation and to remove the water vapor from the surface of the food. Both heat and mass exchanges between the gas and the particle are essentially convective transfers, although conduction and radiation may also be involved to some extent (Mercer and Armenta 2011). This widespread mode of drying is also known as air drying. Air drying is an inherently slow process. It is said that 2/3 of the drying time is used to remove 1/3 of the moisture.

Conductive (boiling) drying: The moist food is brought to contact with a hot surface (or, in a particular application, with superheated steam). The water in the food is “boiled-off.” In essence, boiling drying is tantamount to evaporation to dryness (Tangkhawanit and Siriamornpun 2019). Vacuum drying, drum drying, and drying in superheated steam are cases of this mode of drying.

Freeze-drying (lyophilization) is another method of water removal based on the sublimation of water from a frozen material under high vacuum (Gaidhani, Harwalkar et al. 2015).

Note: Conductive drying and freeze drying is not applied in this research but it was just supplemented to widen on our understanding.

Eggs are very nutritious products of poultry. It is rich in proteins, vitamins, and minerals. Powdered eggs will help to preserve the surplus eggs to avoid spoilage. Egg powder is a dried egg product with a similar texture to milk powder (dried eggs are complete eggs exclusive of the shells) Powdered eggs are great to pack when going on camping trip and are also a smart reliable source of protein to include among your emergency food supplies at home. Powdered eggs can be used without rehydration when baking and can be rehydrated to make dishes such as scrambled eggs, omelettes, pan cakes and custards.

In contrast to shelled eggs that are easily broken and perishable, egg powder has a longer shelf life. Egg powder processing in highly industrialized countries is done using sophisticated technologies. When produced with fewer regulations, such countries are able to export this product at lower prices compared to domesticated markets (Beise and Rennings 2005).

1.6 Types of Egg Powder

Whole Powdered Eggs

Whole powdered eggs contain the whole egg (whites and yolk) and are very versatile in baking. They can be added with the dry ingredients when baking. Whole egg powder can be used successfully to make mayonnaise. It thickens pudding just like fresh eggs, and can be used to make omelettes, scrambled eggs and Eggnog. The other classical food applications where rising qualities are not essential, such as crackers, cookies and pasta.

Powdered Egg Whites

Powdered egg whites contain just the white of the egg and work just as well in recipes as egg whites that have been hand-separated (Wang, Troendle et al. 2012). Egg white powder is a lot less messy than separating fresh eggs which also make them a great time saver. They are perfect for whipping into a meringue. It is also used in a range of items from fish, meat, and potato preparations to bakery and pastry products.

Powdered Egg Mix

Powdered egg mix is mostly whole egg powder with a bit of powdered milk and vegetable oil blended into the powder. The powdered egg mix has been formulated to make scrambled eggs, omelets or French toast. It is especially well suited for camping trips and other outings and substitute for fresh egg yolk to obtain color, texture, and emulsion capacity. Egg yolk powder is most frequently used in mayonnaise, dressings, sauces and croissants.

1.7 Problem Statement

Some studies have investigated an egg is a perishable animal product due to its high moisture and nutritional content, making it vulnerable to microbial assault and nutrient loss, especially during storage. (Oso, Ayeni et al. 2023).

Limited knowledge of egg storage and preservation methods has led to the underutilization of Eggs in rural communities, and yet if rural communities could process the eggs into powder as is

commercially done, their food security could improve. Processing the eggs into egg Powder by sun-drying seems an economically appropriate technology for rural communities.

The study shows that eggs are a common and significant food source for the rural Community. However, these communities face challenges in the utilization of eggs due to their perishability, which is confounded by their little knowledge on egg storage and Preservation, and a limited access to egg retailers.(Myers and Martin 2021)

Also Egg glut and poor egg storage have become long standing challenges that have grown to become reoccurring problem to the poultry industry, resulting in financial loss, physiological distress to farmers and eventual closure of certain poultry enterprises. However with this research study of drying raw eggs into powder by sun will offer various advantages to rural farmers.

Limited knowledge of egg storage and preservation methods has led to the underutilization of Eggs in rural communities, and yet if rural communities could process the eggs into powder as it's commercially done, their food security could improve. Processing the eggs into egg powder by sun - drying seems an economically appropriate technology for rural communities.

Personally I suggest that processing eggs into powder could be a successful preservation method at rural community Level, which could improve household food security. If done under hygienic conditions.

1.8 Study Justification

Several challenges posed by egg glut so far have brought losses to both small and large scale producers. Therefore, this research focused on how to manage glut conditions by using natural available resource of energy in order to reduce on the costs of production in the processing process of raw eggs into Egg Powder. This is because the available techniques such as spray method, dehydrating tray , oven of processing raw eggs into egg Powder is expensive compared to the costs of machines required to get the final product which do not match the standards of farmers in rural areas and this makes the rural farmers to be attempted to transport excess eggs from one location to

another in times of glut thus leading to the problem of egg breakage and deterioration of the internal quality thereby enhancing micro-organism penetration. Powdered eggs have abundant nutrition, longer shelf, less storage space, cheaper price and little bacterial contamination. The major advantage of powdered eggs over fresh eggs is reduced weight per volume of the whole egg equivalent and the shelf life.

1.9.0 Main Objective

To process eggs into egg flour or egg powder out of raw eggs using minimum resources or locally available resources thus adding value to eggs which increases the prices of eggs hence improving the farmer's standards of living.

1.9.1 Specific Objectives

- To reduce losses that poultry farmers incur in the rural communities due to the breaking of eggs.
(Post-harvest losses)
- To find out the effect of sun on the natural form of egg flavor.
- To increase farmer's awareness about the cheapest method of dehydrating eggs into egg powder
- To help farmers to be able to solve food security cases in the future and in the times of glut among their communities.

1.2.0 Research Questions

1. How many days will the raw eggs take to dry into Powder.
2. What amount of water is needed to reconstitute egg powder?
3. How long will the egg flour take to reconstitute to the liquid form.
4. What test or flavor, uniformity of the mixture will the egg powder give when mixed with other flour such as millet flour, maize flour, and cassava flour among others to make porridges or cakes?

1.2.1 Scope of the Study

The research was carried out in Busitema University, Nagongera sub country, Tororo district, the target population group is the rural poultry farmers who especially deal in egg production. This report covers research time span of two months from October to December 2023 and presents a deep and comprehensive detail on egg powder production using sun drying as a method of preservation during storage in times of glut.

1.2.2 Significance of the Study

The importance of this study is to increase awareness about the limited knowledge of egg storage and preservation methods which have led to underutilization of eggs in rural communities hence egg glut.

And if these rural communities process eggs into powder with cheaper methods of preservation as it is commercially done, their food security would improve and also reduce on wastage of eggs during times of egg glut.

1.2.3 Conceptual Frame Work

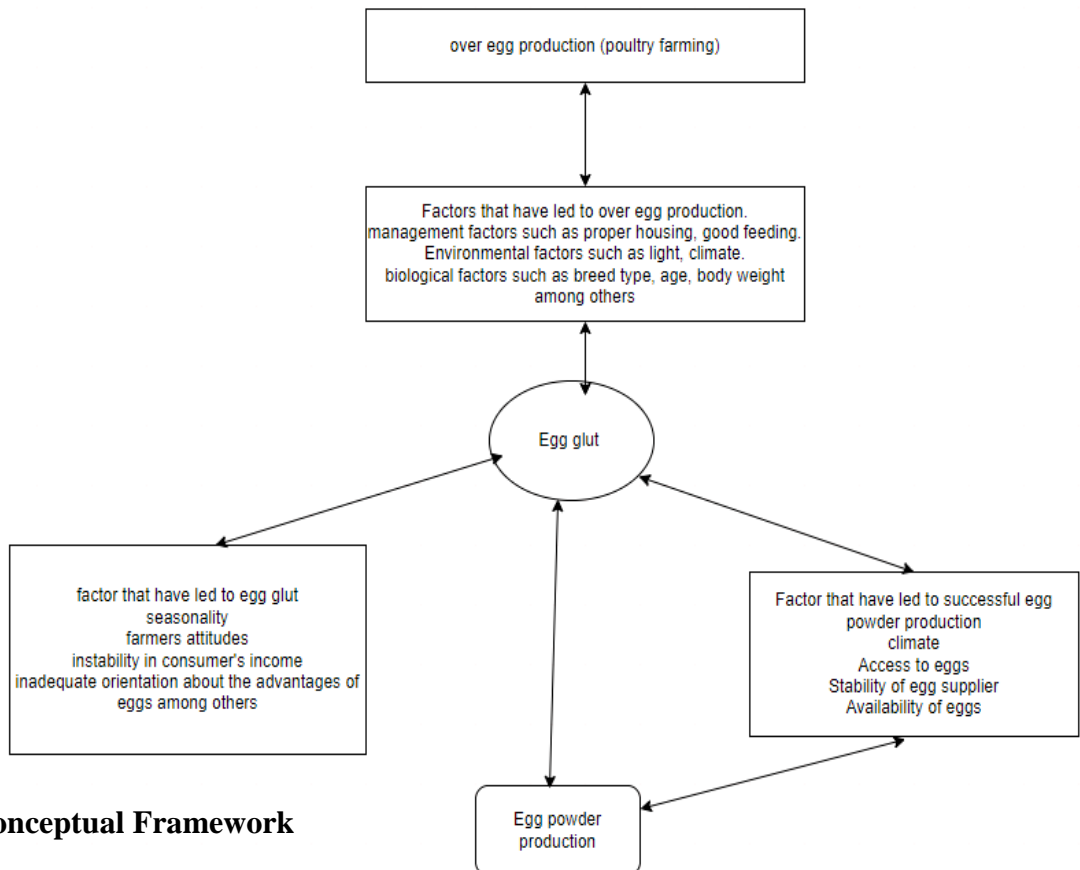


Figure 1: Conceptual Framework

CHAPTER TWO

2.0 Literature Review

The overall inventive work and fabricating processes exercise are estimated to have an impact on the growth of global egg powder market. Geographically North America will continue to be a significant regional market for egg powder manufacturers. Dehydrated egg advertisement appeared in the late 1890s in the United States (Dekker 2019). Powdered eggs appear in literature as a staple of camp cooking at least as early as 1912. Powdered eggs were used in the United Kingdom during **World War II** for rationing, they were also use during the period of rationing in the UK as Ersatz eggs (Tönsmeier, Haslinger et al. 2018). The modern method of manufacturing powdered eggs was developed in the 1930s by Albert Grant and Co of the Mile and Road, London. The cake manufacturer was importing liquid egg from china and one of his staff realized that this was 75% water. An experimental freeze-drying plant was built and tried. Then a factory was setup in Singapore to process Chinese egg. As a war approached, Grant transferred his dried egg facility to Argentina. The British Government lifted the Patent during the war and many other suppliers came into the market, notably in the United in the United States.(Goody 2018)

In East African countries; Tanzania, Uganda, Kenya, Rwanda among others are just planning to pilot a project to process fresh eggs into egg Powder instead of importing from other countries (although there maybe production of egg Powder on small scale holders) this is because chicken population are increasing, a move that could see egg production rise hence leading to production of egg powder in these various countries.

Drying is one of the most ancient methods of food preservation known to mankind. Preservation of meat, fish, and food plants by drying in the sun or in the deserts and mountains has been practiced since prehistoric times and is still a vital operation in the life of many rural communities (Hodgson 2015)

Dried eggs can be purchased from many emergency preparedness, camping, and food storage retailers. For best quality and safety, purchase only dried egg products that have been pasteurized and bare the USDA inspection mark.

In 1970 Congress passed the Egg Products Inspection Act which requires that all egg products distributed for consumption be pasteurized to destroy Salmonella. In the past 40 years, there have been no recorded outbreaks of salmonellosis linked to pasteurized egg products, since the institution of mandatory pasteurization. This safety record is especially impressive considering the volume of eggs consumed in this country. Of the more than 76 billion eggs eaten annually, slightly more than 30 percent are in the form of egg products, further processed into either a liquid, frozen, or dried form (Gautron, Dombre et al. 2022).

Manufacturers need to adhere to good manufacturing practices and buyers should be aware of product variability between brands of dehydrated whole egg(Manning 2018)

Dried eggs can be found in three main forms: Dried whole eggs; dried whites; and dried yolk. (See Use from Storage section.)

Packaging

Products made from dried eggs are to be kept in a container with a tight, unbroken seal. The packing must, above all, guard against moisture and damage from rodents and insects. Numerous vendors present dehydrated eggs in a range of sizes of cans or tightly sealed pouches. It is crucial to keep in mind that the shelf life of packaging reduces the moment it is opened. Numerous stores provide huge cans at discounted prices when purchased in bulk. These might be less expensive, but it's advisable to avoid buying a can that will be too big to finish in a fair amount of time once it's opened.

Storage Conditions and Shelf Life

Dried eggs need to be stored in clean, cool, and dry conditions. It is important to keep the food in as cool a temperature as possible, without freezing. A temperature range of 50° to 60°F is ideal, but probably not possible for most of our home storage conditions.

The shelf life for optimum quality and nutrition of dried eggs is 1 to 2 years, depending on storage temperature, and if left unopened. This is not the shelf life guidelines being promoted from the manufacturers. (Yang, Jin et al. 2022).

Many producers advise refrigerating dried eggs after they have been opened. After opening, many choose not to refrigerate the leftover portion; instead, it should be kept in an airtight, cool, dry environment. Repackaging in a more compact, airtight container with an oxygen absorber is one possibility.

Challenges Facing Egg Powder Production in Uganda Include the Following:

Cost of production: Establishment costs, equipment purchases and maintenance, taxes, and other factors can drive up the cost of production and drive up the price of powdered eggs over raw eggs, which reduces the product's marketability and makes it harder to convince people to buy it, especially middle-class and lower-class people.

Lack of power: The nation's unstable power supply hinders industrial development; relying solely on independent power would increase the price of producing egg powder, reduce its viability, and make the entire process unsustainable (Morris, Backeljau et al. 2019).

Safety and quality assurance: In spite of approval from regulatory agencies such as the SON, NAFDAC, and others that oversee food hygiene and quality controls, thorough monitoring and quality assurance may be jeopardized by inadequate documentation, shoddy monitoring strategies, and unscrupulous behavior (Opia 2020)

Socio-cultural perspective: Religious or cultural ideologies either dictate the normal Ugandan lifestyle, and sentimentality may lower acceptance rates. When people see eggs powdered, they perceive it as strange and assume it is a break from their regular diet, which can result in rejection and low customer satisfaction (Fieldhouse 2013).

Socioeconomic factor: People with low incomes and limited resources, who make up the majority of the population, find it very difficult to meet their nutritional needs, especially those for protein (Sharif, Saleem et al. 2018).

Unfavorable government policy: Government policy has shown to be a barrier for agro-allied firms in a variety of scenarios, including excessive taxation, unfriendly policy, and imports. The domestic growth and development of the product is hampered by enabling the baking sector and other confectionaries to import egg power, (Baker, Machado et al. 2020). Improper processing may lead to complications and nutrient loss, in addition to problems impeding acceptance and output.

Uganda's Egg Glut and Its Characteristics

According to Oso, Ayeni et al. 2023, it might alternatively be defined as a time when there is minimal demand or purchase and an abundance of eggs. In Uganda, the season is typically defined by a decline in the quantity of eggs that consumers, retailers, or wholesalers seek, and it lasts for more than a month or three. Larger, fresher eggs are preferred by most consumers since smaller, older eggs deteriorate more quickly every day. Egg distributors will choose to purchase on credit, even if this may have an impact on the farmer's cash flow and other expectations.

Egg distributors will want to purchase eggs on credit, which could negatively impact the farmer's cash flow and other goals and prevent them from being met. Keeping the temperature at normal temperature and buying more egg crates will result in further expenses.

The occurrence of an egg glut in Uganda has been attributed to a number of variables, including seasonality, farmer attitudes, consumer income volatility, a weak national economy, inflation, school vacations and holidays, changes in feeding patterns, the occurrence of pandemics and diseases, festivals, and other religious activities. Unpredictable events, such as war and economic and sociopolitical crises, can potentially exacerbate the egg oversupply, though.

2.1 Factors That May Have Led to Over Production of Eggs

Several factors can affect egg production such as:

Age Egg output is directly correlated with the laying poultry's age. Approximately 18 to 22 weeks of age (five months of life) is when poultry begin to lay eggs. This is the optimal time to lay, and until the end of the egg production cycle, eggs usually get bigger. Then, in the first eight weeks,

this lay can reach a peak production of 90%, which could result in an excess of eggs being produced at that specific moment.

Dietary and feeding with all of its ramifications, nutrition is unquestionably the most crucial component in chicken production. A sufficient number of extension workers can reach out to these specific poultry farmers and educate and guide them on the most appropriate and recommended feeds at every stage of production, including initiation, growth prior to laying, and laying itself, thereby contributing to increased egg production. Adequate egg production depends on proper nutrition and a supply of balanced and sufficient feed. Energy in the diet is a factor of great importance since laying is a process that requires a considerable amount of energy. Therefore, a diet with sufficient energy should be offered.

Protein: Since eggs are a high-protein product, protein is the primary component in laying. Thus, in order to prevent a decline in egg laying, the diet must contain an adequate amount of protein.

Calcium is an essential component of the diet since it plays a major role in the development of the eggshell. For laying hens, around 3.25% of their diet must consist of calcium. If insufficient calcium is given, there may be a compromise in egg development and a decrease in egg laying.

Vitamin D: Ensuring that the food contains enough of this vitamin is crucial since it controls the intestinal level of calcium absorption.

Water. Water consumption in poultry is an important parameter since water is vital for all physiological processes. Egg production depends to a large extent on the hydration status of the hens. In general, water is involved in all physiological processes as it makes up the intracellular and extracellular fluid. For egg formation, water is required, and poultry must consume it according to their needs.

Laying house. The laying house should be built according to local climatic conditions and the farmer's finances. A good house protects laying birds from theft, predation, direct sunlight, rain, excessive wind, heat and cold, as well as sudden changes in temperature and excessive dust. If the

climate is hot and humid, for example, the use of an open house construction will enable ventilation. The inside of the house should be arranged so that it requires minimum labor and time to care for the birds. In closed houses, where layers are not exposed to natural light, the length of the artificial day should be increased either in one step, or in a number of steps until the artificial day reaches 16 to 17 hours, which will ensure constant and maximized egg production.

Lighting, Light is included among the factors that affect poultry laying. Lighting generates several reactions and hormonal cascades that favor egg production. Lighting schedule. Egg production is stimulated by daylight; therefore, as the days grow longer production increases. In open houses, found commonly in the tropics, artificial lighting may be used to increase the laying period. When darkness falls artificial lighting can be introduced for two to three hours, which may increase egg production by 20 to 30 percent.

Breed. The breed of the laying bird influences egg production. Now days the breed of the layers have been improved compared to the past years where farmers depended on the local breeds.

Body weight. In general, optimum body weight during the laying period should be around 1.5 kg, although this varies according to breed. Proper management and the correct amount of feed are being achieved thus making them have optimum body weight.

Broodiness Prevention. Poultry lay eggs to reproduce and may enter periods of broodiness. At this stage, the hen stops laying eggs as they focus their energy on incubating the last eggs laid. To prevent hens from having broodiness, it is recommended to isolate them from the group in areas where they do not have nests. In this way, they quickly pass the physiological state of broodiness and restart laying.

Molting acceleration. Birds have natural molting periods during their lives to renew their feathers. Feathers are of great importance as they are a physical skin barrier and have a vital thermoregulatory function for laying hens. Molting occurs every year and during that period time egg production decreases drastically. All available nutrients are diverted from egg production to the generation of new feathers. Therefore, laying decreases for a few weeks while the poultry is being

replaced. During this period, it is recommended to increase the protein level in laying hens to accelerate the molting process and restart laying which increases egg production...

Culling. Culling is the removal of undesirable (sick and/or unproductive) birds, from the flock. There are two methods of culling:

Mass culling, when the entire flock is removed and replaced at the end of the laying cycle; and

Selective culling, when the farmer removes individual unproductive or sick birds.

Culling enables a high level of egg production to be maintained, prevents feed waste on unproductive birds and may avert the spreading of diseases.

Climate. The optimal laying temperature is between 11° and 26° C. A humidity level above 75 percent will cause a reduction in egg laying. (Source: Kekeocha, 1985) When the temperature rises above 28° C the production and quality of eggs decrease. Seasonal temperature increases can reduce egg production by about 10 percent. Heat prostration are set in, measures to cool the house are taken.

Management factors. Effective and efficient management techniques are necessary to increase the productivity of the birds and consequently increase income. This entails not only proper housing and feeding, but also careful rearing and good treatment of the birds. Vaccination and disease control.

Collection of eggs. Frequent egg collection will prevent hens from brooding eggs or trying to eat them and will also prevent the eggs from becoming damaged or dirty

Stress reduction among birds. Laying hens are susceptible to stress states due to their nature as prey animals. Therefore, sudden changes of any kind should be avoided: temperature, feed, humidity, noise, location, flocks, and predators. In addition, diseases themselves cause stress in the poultry due to the symptoms they generate. If stress is high, egg production starts to decrease significantly. Therefore, producers should take care to maintain the best environmental and surroundings conditions in the poultry houses where the poultry remain calm.

Reduced Mortality rate. Mortality rate may rise due to disease, predation or high temperature. The mortality rate of small chicks (up to eight weeks of age) is about 4 percent; that of growers (between eight and 20 weeks of age) is about 15 percent; and that of layers (between 20 and 72 weeks of age) is about 12 percent. The average mortality rate of a flock is from 20 to 25 percent per year. This can be done through proper house management, disease control, good feeding, provision of fresh and clean water, reduced stress among others Roberts, and 1979

2.2 Composition of Eggs

Eggs can be brown or white; color has no effect on quality or flavor but depends on the breed of the hen. The egg is composed of Shell, Membrane, and air cell, Egg White, Egg Yolk and Chalaza. The egg white forms 2/3rd of the whole egg and the yolk forms 1/3rd.

Egg shell

The Shell our outer covering of the egg, is either white or brown.

It is the outer hard covering of the egg and is made up of Calcium, Magnesium carbonate and Calcium phosphate.

The shell gives shape to the egg and holds the inner contents.

The shell contains thousands of pores that allow CO₂ and moisture to escape, as well as air to enter.

The shell is covered by a cuticle membrane or Bloom and should not be washed.

The bloom acts as protective covering blocking the pores and prevents moisture loss and bacterial contamination.

When eggs are washed before going to the market, the cuticle is removed.

To protect the egg, the washed eggs are coated with a thin film of edible oil.

The color of the shell has no effect on the quality, cooking properties or nutritive value of the egg, the color of the shell is normally determined by the breed of chicken.

Membrane

A membrane lines the shell and forms an air cell at the large end of the egg.

The Mother Nature has worked very hard to create the right package for the contents of the egg.

Beneath the shell, there are two semi-permeable membranes - the outer and the inner.

These membranes act as a protective layer in case the shell cracks.

Air cell

On one side of the egg (broader), both these membranes separate to form an air cell.

This is formed by contraction of the contents as soon as the egg is laid, due to the difference in the outside temperature.

Egg white

It has 1/8th part of the protein, which is called albumin; the remaining being water. The egg white consists of three parts – the outer thin albumen, the middle thick albumin and the inner thin albumin.

The white is clear and soluble when raw and white and firm when coagulated.

Albumin in the egg white is valued by the chefs for its ability to hold air when beaten.

Egg yolk

The yolk is the unfertilized embryo in the egg, yellow in color.

The yolk is separated from the white by a membrane called the vitelline membrane.

This membrane prevents the mix of both yolk and white. 1/6th parts of the egg yolk contain proteins, 1/3rd fat and the rest water, Vitamins and minerals like Calcium, Phosphorus, Iron etc.

The yolk is held centered in the egg by the Chalazae and these are the two white strands which are present when the egg is broken.

The yolk is high in fat and protein and contains iron.

A Large yolk has around 59 calories.

The yolk is valued for the richness and texture which it provides in both cooking and baking.

Chalaza

The egg is kept in position at the center of the egg with the help of the chalaza.

It has a thick-cord like an appearance and is composed of proteins.

This chord-like structure may have to be strained while making custards.

The function of the chalazae is to hold the yolk in place.

Baking, the chalazae are sometimes removed in order to ensure a uniform texture.

2.3. Benefits of Eggs in Human Diet

Below are some of the proven key health benefits of eating eggs:

Eggs Are Nutrient Rich, An average serving of 2 eggs contains: 82% of your daily vitamin D requirement, 50% of your daily folate requirements, 25% of your daily riboflavin (Vitamin B2) requirements, 40% of your daily selenium requirements

Eggs also contain useful amounts of vitamins A, E, B5, B12, as well as iron, iodine and phosphorus – all vital nutrients in supporting your healthy, balanced diet.

Eggs Provide Excellent Quality Protein, Eggs are widely considered to be a valuable source of quality protein. Proteins are the building blocks of life, essential for the strength and repair of muscle and tissue – with one single egg containing about 6.3 grams of protein.

Eggs Improve Levels of “Good” Cholesterol: Eggs help increase high-density lipoprotein (HDL) levels – or “good” cholesterol as it’s commonly known – and this is one reason why eggs have been found to have little to no effect on heart disease risk.

Eggs Provide are Great Source of Vitamin D, Egg yolks are one of a handful of foods that naturally contain vitamin D.

Eggs are filling and Help with Weight Management, Relatively low in calories and a rich source of quality protein, eggs are one of the best food options to assist with weight management.

The high satiety levels of eggs leads to greater feelings of satisfaction, less hunger and a lower desire to eat later in the day, meaning you'll be less inclined to reach for that mid-afternoon snack.

Increasing levels of a hormone that helps you feel satisfied after eating

Eggs Are Among the Best Dietary Sources of Choline. Choline is an important nutrient that is made in the liver, however, as most people don't produce enough choline to meet daily requirements, it also needs to be consumed through the food you eat. Similar to the function of B vitamins, choline is essential for normal cell functioning, playing an influential role in brain and spinal cord development during pregnancy, cognitive development in infants and also helping to reduce cognitive decline in the elderly.

Eggs are a rich source of choline providing more than double the amount of choline per 100g than any other commonly eaten food. This makes eggs a highly effective and simple means of meeting your daily nutritional intake.

Eggs Are a Good Source of Omega-3s. Eggs and poached salmon, delicious and high in omega 3s .Omega-3s are special types of polyunsaturated fatty acids, and are a family of "essential fats" that play an important role in the way your cell membranes work; from heart and brain health through to protecting your eyes. And as your body produces a limited amount of Omega-3s on its own, it's beneficial to actively consume them through various food sources.

Eggs are Mother Nature's incredible and edible source of Omega-3 fatty acids, providing on average, 180mg per serve (2 eggs). Of this amount, 114mg is the long-chain type of omega-3 fatty acid – which represents between 71-127% of the desired intake for adults.

Eggs Contain Antioxidants That are beneficial for the eyes eggs are important for eye health .Eggs contain a range of vitamins and minerals including vitamin A, vitamin E and selenium which all act as important antioxidants in supporting eye health, retina function and helping counteract degenerative vision as you age.

Eggs are rich in the antioxidants lutein and zeaxanthin, both of which play a protective role in reducing the risk of certain eye diseases, including cataracts and age-related macular degeneration.

Studies show that these antioxidants are also better absorbed by the body from eggs than from alternate plant sources.

Eggs Help Boost Nutrient Intake for Healthy Aging. Eggs great for older people

Eggs contain a significant amount of leucine, an amino acid that is important for ongoing muscle support, as well as other key nutrients including vitamin D and Omega-3 fatty acids, plus a little known nutrient, choline, which is important for brain function.

They're Affordable. At a low cost serving, you can't beat it for a high-quality protein that won't break the bank. Add a slice of whole-grain toast, some avocado, and a little hot sauce, and you have a meal fit for a king at a pauper's price. And you don't have to worry about sugar or carbs because eggs don't have either.

They satisfy. Have those for breakfast and you'll feel full longer. That'll make you more likely to eat less throughout the day. For example, on average, teens who eat an egg in the morning have 130 fewer calories at lunch.

They Can Lower Your Odds of a Stroke. Though studies vary, it appears that a daily egg might lower your risk. In a recent Chinese study, people who had about one a day were almost 30% less likely to die from hemorrhagic stroke than those who had none.

2.4 Uses of Egg Powder

Egg powder can be incorporated into a number of recipes, and there especially useful for producing free from foods as there gluten free.

They provide functional and logistical benefits to bakery applications, playing the same role a fresh egg would.

Egg powder can be used as a replacement in omelettes and scrambled eggs, or soups and sauces

2.5. Advantages of Egg Powder over Whole Fresh Eggs

Dried eggs are smaller in volume when compared to fresh eggs, which means they can be accommodated in a smaller package. So it is easier to transport and saves you valuable storage space

Ease of use and diverse use, dry powder can simply be added and mixed with the porridge.

They also have a reduced weight per volume.

They have longer shelf life. Powdered eggs benefit from an extended shelf - life of 18months and if properly sealed 5 to 10 years.

There is little bacterial contamination.

Affordable; compared to whole eggs, egg powder is more affordable.

Reduced risk of food borne illness; the primary risk associated with egg is food borne illness caused by Salmonella bacteria

CHAPTER THREE

3.0. Methodology

3.1 Research Design

This research will be first surveyed in the field to find out how rural farmers especially those who practice poultry farming, how they locally manage egg production in times of glut (during its excess)

The study will be an experimental research and the findings will be collected through observation of the results during the experiment and other research papers across the world to obtain relevant literature.

3.2 Population and Sampling

This research will target the rural population of farmers which are involved in egg production. And how they manage to transport, handle and store during times of glut and this will enabled me find the real problem on the ground or field hence the research topic above.

I will also select a few people around 5- 7 who will test the samples of products made from fresh whole eggs and egg powder who will help to analyze the difference and similarity of these products.

3.3 Data Analysis Tool

The data will be collected using observation method from the samples of the experiment and will be presented in table and essay format.

3.4 Methods of Data Collection

Unstructured Interviews

I first interviewed a specific group of respondents particularly the poultry farmers who deal in egg production and the problem they face such as difficult in storage, losses due to breakage of eggs during handling and transportation.

The information collected and observed from various farmers in the field made me come up with the topic of this research which I believe will solve some of the problems observed and noted down through this experiment to be carried out in this research study if successfully achieved. This method helped me to collect raw data and interact with farmers and other respondents physically. The method was beneficial and helped me to obtain hidden information and also build good relationship with respondents.

Recording

I used recording to obtain information during interview and observation of useful data. I used materials like a ball pen, paper, pencil, ruler, and an umbrella under strong sunshine.

Observation

I used observation method to collect data using naked eyes. For example, to obtain accurate results, I have to be keen on the steps the eggs will go through during the drying process, the effect the sun energy will have on the egg powder.

3.5 Method

Connective Drying Using Solar Energy

Procedure...

Beat the eggs with a spoon to open or break into a bowl

Mix them on a medium speed for about 5minutes to obtain a uniform mixture.

Pour the liquid of eggs into the drying tray whose surface is covered with a black surface to observe heat energy from the sun and the steel tray which is beneath it.

The heat energy observed from both the sun and the steel tray to the black turn to the liquid of eggs ensures maximum drying of eggs (liquid) into crispy like particles because of heat transfer to the egg liquid.

Ensure that the eggs are dry to its maximum to avoid spoilage and a foul smell. And also to make it easy to bound without making a mold.

Pour the particles into the mortar and pound using a pestle

Sieve and re-pound the bigger particles of egg flour to obtain a uniform and fine particles.

If you do not grind the eggs powder thoroughly, they may not form a uniform solution

Ensure maximum drying of eggs, grind or pound using a mortar and pestle, Using a mortar and pestle may take more time and energy but the results will be the same.

If the eggs have been thoroughly dehydrated, then store properly, in a clean and well tight container to avoid the egg flour from absorbing air from the surrounding, this may shorten the shelf life of the egg powder and lead to spoilage.

Reconstitute the egg powder with water, once the eggs have been rehydrated, it can be able to be used as one uses fresh eggs.

3.7 Materials

The materials I used during the experiment in this study research include the following;

- Raw eggs
- Black polythene
- Mortar and Pestle.
- Sun/solar energy
- Water
- Spoon/fork

- Sheet or steel like bowl or tray
- Container
- Dish or bowl

CHAPTER FOUR

4.0. Results and Discussion

Production of Egg Powder; Experts in product preservation have recommended dehydrating eggs and turning them into powder as a practical way to preserve them for a longer period of time, particularly during the glut

Steps in the Production of Egg Powder; Any type of poultry egg may be processed into powdered egg, however, the most frequent varieties for international consumers are chicken, duck, or quail egg powdered. The following processes are engaged to have an awesome powder egg safe for human consumption

4.1 Steps Involved in Production of Egg Powder

1. Selection and Arrangements of Materials to Use

The materials and equipment's to be used are arranged and assembled for preparations of the experiment. The diagram below shows the equipment to be used in the experiment. I ensured that they were thoroughly washed, dried and assembled ready for the set up. Eggs, forks, spoons, containers during the preparation stage. The Chicken eggs were used, these were sorted and washed thoroughly I preferred to use chicken eggs this is because they are readily available in the locality, therefore they can easily be got anywhere.



Figure 2: Materials

Eggs, spoons and forks and the container where the eggs will be broken into.

2. Egg Breaking (De-Shelling)

Beat the eggs gently using a fork to break them into the container to separate the egg white and yolk from the shells. Note that the shells were not disposed off but also dried and kept for other purposes.



Figure 3: De-shelled eggs

The de - shelled eggs before being mixed-up and the empty eggs shells

3. Mixing of Eggs

The diagram shows the eggs being mixed-up in the container which was wide enough to avoid it from pouring and ensure a uniform mixture. I mixed them on medium speed for about a minute. Until they became thick and foamy



Figure 4: Mixing process

During mixing and after mixing

4. Dehydration/Drying of Eggs

The eggs are poured into different large bowls each having a little of the liquid egg mixture, little of it is put in order to have a thin layer between the container and the eggs for the heat to be easily transferred to the eggs, this ensures quick loss of water from the eggs hence making the results to be achieved fast. The eggs were put under sunshine for after which they had started forming amold like and gummy stuff.

This was later transferred to a stainless metal tray to quicken it's drying. In about two days, the moldy and gummy eggs started to change to a crispy like form with continuous drying of eggs under sunshine with good hygienic conditions maintained.

On the 5th day, after the eggs receiving some short period of sunshine, the crispy like form of eggs were pounded into a fine powder using mortar and pestle.

The powder was sieved to attain a fine and uniform powder, then the rest of the big particles retained in the sieve are re-pounded and sieved until all the particles become fine and uniform powder with the same texture.



Figure 5: Solidified eggs

The eggs are dried under the sun in wider containers since they are in a liquid form.

The eggs turn into molds and gummy

Transfer of eggs into a tray (Eggs turn from gummy molds to crispy form)

The eggs are transferred into stainless trays when it becomes moldy.

Dry Samples of Un-Pounded Eggs



Figure 6: Dry samples of un-pounded eggs

The eggs took a maximum of 6 days to dry completely with a shiny appearance on the surface of the eggs being dried.

5. Grinding/Pounding Process

The eggs were pounded using mortar and pestle this was done to achieve a fair and small texture or from the crispy like eggs particles that can easily be sieved (pass through the holes of the sieve) Continuous pounding is ensured until maximum particles are achieved.



Figure 7: Pounding process

6. Sieving Egg Powder

The pounded particles of different sized egg powder are sieved to achieve fine powder, this is done to easily reconstitute the egg powder, and the big particles that cannot pass through the sieve are re-pounded until all the particles have fine small particles of egg powder.



Figure 8: Sieving egg powder

7. Packing

Dried egg products should be in a container that has a tight, unopened seal. Most importantly, the packaging must prevent moisture and rodent/insect damage. In order to avoid contamination and bacterial spoilage, the egg powder was stored in a tight and unopened container in order to avoid it from absorbing moisture from the surroundings; this may lead to quick spoilage of egg powder. It is important to remember that once the packaging has been opened, its shelf life decreases.



Figure 9: Packing

8. Storage Facilities

Dried eggs need to be stored in clean, cool, and dry conditions. It is important to keep the food in as cool a temperature as possible. The container/ glass jar used for storage tightly tied hence keeping the eggs in dry conditions.



Figure 10: Storage

9. Reconstitution of Eggs by mixing the powder with water

2 Table spoon of warm water was mixed with 2 table spoon powdered eggs. The two ingredients water and eggs was stirred together thoroughly, then left to settle for about 5 minutes, or until the eggs thicken and set to mix.

Once the eggs have been rehydrated, you should be able to use them as you would use regular eggs. Also Once reconstituted, dried eggs can replace fresh eggs in any recipe. Dried eggs are a great addition to homemade dry mixes, such as muffin n mixes, cake mixes, and cookie mixes. Dried, whole eggs (powdered whole egg solids): Dried egg powder can be added right to the other dry ingredients in a recipe and the liquid in the recipe adjusted according to the number of eggs, making this a very convenient approach to baking. They can also be added to water and reconstituted before baking, or as an egg dish, such as an omelet.

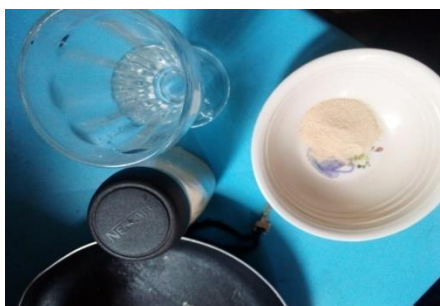


Figure 11: Reconstitution process

The egg powder during reconstitution

4.2 Comparison of Results from Samples of Powdered Eggs and Whole Eggs in Different Ingredients in Order to Find Out the Effect of Sun Drying on the Flavor, Taste among Others

Fried Dish of Eggs

a) Fresh Whole Eggs



Figure 12: Results from fresh fried whole eggs

b) Powdered Eggs



Figure 13: Results from fried powdered eggs

2. Baked Cakes

a) Cake made with fresh whole eggs



b) Cake made with powdered eggs



Figure 14: Results of baked cakes from different samples of eggs

S/N	Name of the participants	Baked Cakes	
		A	B
1	OBBO ALEX	Nice	Somehow nice
2	NABISO BRENDA	Sweet	Sweet
3	NASUSA HANNAH	Good taste	Good taste
4	WAMADA DANIEL	Nice	Nice
5	OPIO PATRICK	Nice	Nice
6	WAKOLI ANTHONY	Sweet	Sweet

Table 1: The Participants Who Tasted the Samples of Baked Cakes

S/N	Name of participants	Fried eggs	
		A	B
1	WAKOLI ANTHONY	Delicious	Delicious
2	NABISO BRENDA	Nice	Nice but appears packed
3	NASUSA HANNAH	Yummy	Same test
4	WAMADA DANIEL	Good taste	Good taste
5	OPIO PATRICK	Nice	Nice flavor somehow yellow

Table 2: Participants who tasted fried eggs from both samples

The table above shows the comparison of results obtained from some of the participants who tested the different samples of baked cakes and fried eggs from both powdered eggs and fresh whole eggs.

A represents Samples of product made from fresh whole eggs.

B represents Samples of product made from powdered eggs

The results from the selected participants who were involved in testing and comparing the results from the two samples of baked cakes and fried eggs from Table 2 most of them could not differentiate the taste, flavor and odor but identifying all the two samples as the same therefore this means that sun drying as a method of egg powder production has no effect in regards of changing the properties but only that the sample A appears spongy and Sample appears somehow packed after frying.

4.3 Requirements I Considered For a Successful Egg Powder Production Fit for Human Consumption

Egg powder must be homogeneous, fit for human consumption, practically free from shell fragments, antibiotics residues and foreign matter. The taste, color and odor of egg powder shall be natural and characteristic of each product.

The eggs were not contaminated with the egg content of dirty eggs

The eggs, before breaking, were properly washed, dried and cooled.

The egg powder has a uniform yellow, white or orange-yellow color and a smooth and uniform texture free from lumps and gritty material.

The egg powder retained the original properties of fresh egg, like aerating capacity, binding power and palatability.

The egg powder reconstituted readily and quickly when mixed with three times its mass of lukewarm water.

Hygiene; Egg powder was handled, stored and transported following hygienic precautions.

4.4 Precautions

The following precautions and directions were observed during packing, handling and storage of egg powder sample

Samples were a protected place not exposed to damp air, dust, or soot.

Precautions were taken to protect the samples, containers of sample from adventitious contamination. Such as washing hands before handling the containers

The samples were placed in clean and dry glass containers.

Each container was sealed airtight after filling.

Samples were stored in such a manner that the temperature of the material does not vary unduly from the normal temperature.

CHAPTER FIVE

5.0 Challenges Encountered During the Experiment

These were some of the challenges faced during the research.

Weather Changes; this was one of the major challenge I faced, the first 2 days were sunny and then the next day of the experiment it was cloudy limiting the drying process of egg powder.

Costs incurred. Some of the costs I incurred such as buying raw materials, equipment was not enough as planned before in my budget, this affected my research process

Insects. During the drying process of the egg powder, insects such black insects entered the egg powder but with continuous heating by the sun they disappeared.

Language barrier; This occurred before starting when I was collecting prior information from the field when I wanted to find out what was there on ground with the poultry farmers ,and most of these poultry farmers were Japadhola which kinder made it hard but at the end to collect information and came up with the above topic.

5.1 Conclusion

It's fascinating to learn that the answer to the egg glut cycles that have plagued Ugandans' poultry industry over the past years isn't far-fetched. The most significant concept highlighted in this review is the modification and transformation of excess table eggs into forms suitable for long-term preservation thereby helping in battling against a repeat of the egg glut in the coming years in Uganda. Following this evaluation, it is critical to take the following actions to address Uganda's egg glut:

- (i) In the egg distribution chain, value addition should be incorporated and prioritized and
- (ii) Government and other stakeholders should embrace and invest on the transformation of eggs into powder as it comes with numerous nutritional and economic benefits.

The findings of this research were achieved successfully and the results achieved from the comparisons made between the egg powder produced under the effect of the sun and the fresh whole

egg gave the same results as observed from the sampling experiment made (the fried eggs and the baked cake) from both the egg powder and the fresh whole egg this concludes that using sun drying a method of processing eggs into egg powder did not have any effect on the odor, color and other properties of eggs therefore this I encourage rural farmers to adopt this method of egg processing since it requires less costs compared to other processing methods of egg powder which requires huge sums of capital to start than this that is pocket friendly to rural farmers.

5.2 Recommendations

Egg powder production has the potential to become an economic empowerment effort, lifting millions of Ugandans out of poverty and providing jobs if the government and other stakeholders can support it. This is especially true for chicken producers who lose money during egg gluts. Egg powder imports are thought to cost Uganda's food processing industry one billion shillings annually; this may be leveraged to raise GDP by increasing domestic production. Furthermore, statistics showed that there is a market for powdered eggs worldwide, so producing them locally cannot be a waste. If production can be increased to a point where it can be exported, the country stands to gain from this.

Thus, the present researcher suggests that the next interested party investigate the effects of combining eggshells and egg powder to create a mixture, and ascertain the implications for human health when ingested by humans, particularly in terms of mitigating nutritional deficiencies and imbalances among the elderly and younger populations.

Additionally, combine the ground eggshells with animal foods, particularly pig and poultry feeds, and compare the outcomes to see where it performs best.

Additionally, you could use these shells to create fertilizers, which might boost Uganda's agriculture yield.

Lastly, to ascertain through research how much water is actually lost from whole fresh eggs in order to precisely calculate the reconstitution of egg powder

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APPENDIX

A Flow Chart Describing the Processing of Whole Egg Powder Product

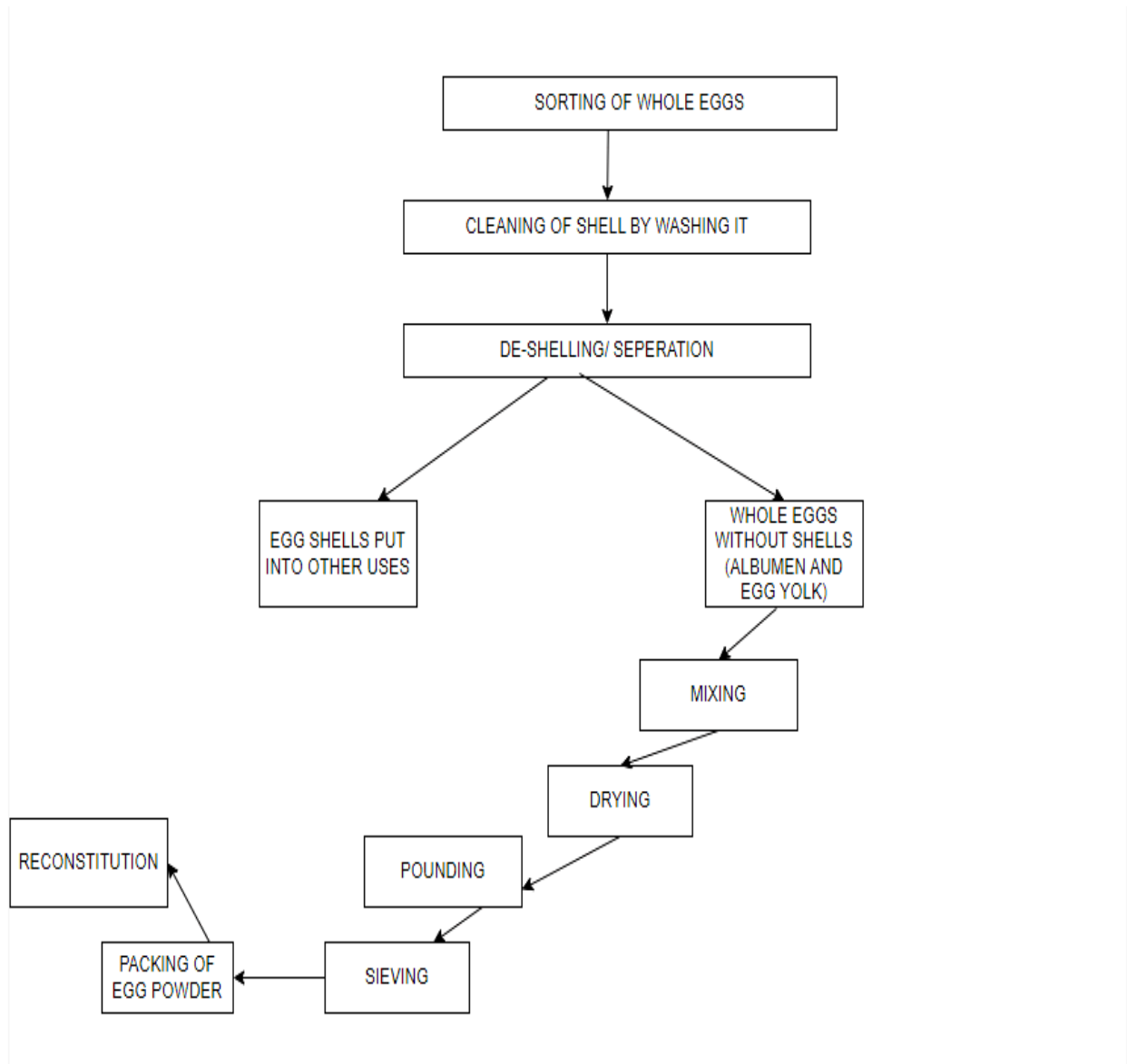


Figure 15: Flow chart

Budget

S/N	ITEM	QUANTITY	UNIT PRICE @ QUANTITY	AMOUNT
1	Eggs	2 trays	15000	30000
2	spoon	2	700	1400
3	forks	2	700	1400
4	Mortar and pestle	-	15000	15000
5	Bowel/ mixing dish	2	5000	10000
6	Stainless tray	3	12000	36000
7	Transport and up keep	-	-	50000
8	total	-	-	130000

Table 3: Budget used in the research experiment

Work Plan

WEEK	ACTIVITY
1	Prior survey in the field
2	Proposal writing and submitting
3	Buying of equipment to use during research
4-5	Drying of eggs into egg powder and storage
6-7	Report writing
8	Submitting of the report

Table 4: Schedule