
EGG POWDER PRODUCTION AS A REMEDY TO EGG GLUT IN NIGERIA

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ABSTRACT

The importance of eggs in Nigerian nutrition cannot be overstated; being a complete diet, it remains a major supply of protein in infant, children and adult's diets. The 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. The occurrence of egg glut during specific times of the year has become a nightmare for poultry farmers in Nigeria. Although techniques for preventing quality deterioration and wastage may not be an absolute solution, advanced steps such as egg powdering can be considered a long-term solution to egg glut and wastage, with numerous advantages over preservation and storage techniques. This paper thus reviews the causes, features and remedies for the egg glut situation in the contemporary Nigeria poultry industry, exploring its economic potentials, advantages and the prospects.

Keywords: Egg production, Egg glut, Egg powder, Preservation, Value addition

INTRODUCTION

One of the most important products of the poultry industry is the egg, which is a high-quality source of protein, vitamins and minerals (Asghar and Abbas, 2012; Agbede, 2019). These and other nutrients are required by humans and animals for the construction of body structures, the repair of worn-out tissues, growth and reproduction (Chen *et al.*, 2018; Réhault-Godbert *et al.*, 2019). As a result, their nutritional value cannot be overemphasized in a developing country like Nigeria, particularly in the fight against protein-calorie malnutrition (Agbede, 2019). Since eggs have shown to be an effective product in alleviating protein-calorie malnutrition among the population, many agriculturists and poultry farmers have swift into egg production to make it readily available. However, 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 the eventual closure of certain poultry enterprises.

Seasonality in egg production patterns, outbreaks of diseases, changes in citizen eating patterns, holidays and rites, and other variables all contribute to the egg glut observed in Nigeria (Alabi, 2020; Nonye, 2022). However, with the advancement in technology and contemporary food processing methods, poultry eggs may now be powdered, which offers several advantages.

MATERIALS AND METHODS

A comprehensive search of published articles in Google Scholar and Science Direct databases was conducted while interrogations and interview section by national dailies were source through search engines online using the following sentences or phrase egg glut in Nigeria, egg powder, egg production estimate. The results of the search were scrutinized, reviewed and presented in text and tables.

RESULTS

Egg Production and Estimate in Nigeria: In Nigeria, poultry eggs are highly cherish because it provides high quality proteins, carbohydrates, fats, vitamins and minerals (Table 1) (Khoza, 2014).

Table 1: Nutritional composition of raw chicken egg

Nutrient	Nutrient content per 100 g (large egg)
Energy (kcal/100g)	151
Protein (g/100g)	12.5
Carbohydrate (g/100g)	Trace
Fat (g/100g)	11.2
Cholesterol (mg/100g)	391
Salt (mg/100g)	0.31
Vitamins composition (µg/100g)	
Vitamin A or Retinol (µg/100g)	190
Vitamin D (µg/100g)	1.6
Vitamin B ₂ (mg/100g)	0.47
Vitamin B ₉ (µg/100g)	50
Vitamin B ₁₂ (µg/100g)	2.5
Choline (mg/100g)	160
Biotin (µg/100g)	20
Phosphorus (mg/100g)	200
Iron (mg/100g)	1.9
Zinc (mg/100g)	1.3
Iodine (µg/100g)	53
Selenium (µg/100g)	11

Sources: Khoza (2014)

Poultry includes the domestication of chickens, ducks, quails, turkeys, parrots, and geese raised for meat, eggs and by-products like faeces and feathers. Layers are kept primarily for egg production on a commercial basis capable of producing eggs at 18 – 20 weeks of age and one egg per day for 72 weeks of age (Zaheer, 2015). Nigeria now has a standing poultry population of 180 million poultry birds (Mba, 2021), making her the highest annual egg producer in Africa as at 2018 (Table 2), currently the nation produces over 650 Metric tonnes of eggs (FAO, 2020 a,b; Mba, 2021).

Nigeria's Egg Glut and Its Characteristics:

According to Alabi (2020), an egg glut is a period when demand for table eggs falls to alarmingly low levels, considerably below what is produced; it may also be described as a

period when eggs are excess or abundant with little purchase or demand (Bolu and Aremu, 2007). The season is usually characterized in Nigeria by a decrease in the number of eggs requested by wholesalers, retailers, or consumers, spanning for over one to three months. Most buyers prefer fresh and larger sized eggs as the old and small sized eggs continue to spoil on daily basis. Egg distributors will prefer to buy on credit, while cash flow and other projections of the farmer may be affected and thus remained unattainable. Additional costs will be incurred by purchasing more egg crates to store the eggs and striving to maintain the room temperature.

Factors like seasonality, farmer's attitudes, instability in consumers' income, poor national economy, inflation, school vacation and holidays, changes in feeding patterns, inadequate orientation about the advantages of eggs, occurrence of diseases and pandemics, festivals, and other religious activities (Ramadan) are variables that has been identified to contribute to the occurrence of egg glut in Nigeria (Nonye, 2022). However unpredictable occurrences like war and industrial and socio-political crises can also result in egg glut (Alabi, 2020).

Remedy to Egg Glut in Nigeria: Four major steps have been identified as a way to mitigate egg glut, they include better marketing strategy, corporative venture, planning and monitoring of the market structure, and processing and value addition (Deji-Folutile, 2021). The creation of a secondary egg product has been viewed as the best, most cost-effective and practical way to avoid egg wastage, as well as a means of transformation and value addition (Deji-Folutile, 2021). Looking into the multiple advantages, the best solution is to turn the eggs into new item such as egg powder.

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 (Alabi, 2020).

Table 2: Top ten African countries with the highest egg production (thousand tonnes) record

Country	Year								
	2000	2005	2010	2013	2014	2025	2016	2017	2018
Nigeria	400	500.4	609.1	650	660	489.3	448.6	510	481.4
South Africa	329	375	413	468	453	523.1	477.8	445.1	453.6
Egypt	176.7	235	291.1	470.9	481.3	459.4	425.2	435.8	454.3
Algeria	101	175	260.5	347.4	351.5	385.4	388.2	390	314
Morocco	235	232	244	270	319	324.5	269.5	390.6	396
Kenya	60.7	57.9	92.6	81.8	71.3	77.4	84.1	79.4	83.6
Zambia	39.2	42.3	49.5	55	49.5	49.8	51.4	51.7	52.6
Ethiopia	28.6	35	39	41	46.6	54.9	53.4	55	52.2
Uganda	20.4	22	43.4	47	48.5	41.5	43	44	45
Sudan	Nil	Nil	Nil	45	52	55	60	63	65

Source: FAO (2020b) Nil = No report

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 (Food Buddies, 2018; Food Drying Oven, 2021).

Material selection: Materials for powder egg processing should be free of metallic contamination and corrosion, and they should preferably be constructed of aluminum (Sharif *et al.*, 2018).

Order for eggs and handling: Fresh and surplus eggs from poultry farms and egg outlets are transferred to the industry where specks of dirt are removed with an egg washing machine and a nylon brush. Candling is done to remove rotten eggs in order to avoid contamination and terrible flavour (Messens *et al.*, 2011).

Egg breaking and shell removal: The eggs are carefully broken and de-shelled; the separated eggshells can be used to manufacture calcium supplement for animal feed or plant fertilizer (Waheed *et al.*, 2020).

Separation: This approach aids in the preparation of egg white and egg yolk powders. Following shell removal, mixture filtering/separation occurs, in which the egg liquid is filtered, and shell particles that are accidentally spilled into the fluid are recovered (Sujata, 2014).

Pasteurization and drying: Pasteurization has been advocated as a way to treat most germs, including *Salmonella* and *Escherichia coli*, which may be found in liquids and are harmful to human health. It's usually done for 8 – 10 minutes at 60 – 65°C. After pasteurization, the fluid is pumped into a low-temperature storage silo for drying using spray-drying or freeze-drying processes (Singh, 2019; Wikipedia, 2022). All of these techniques and procedures are illustrated in Figure 1.

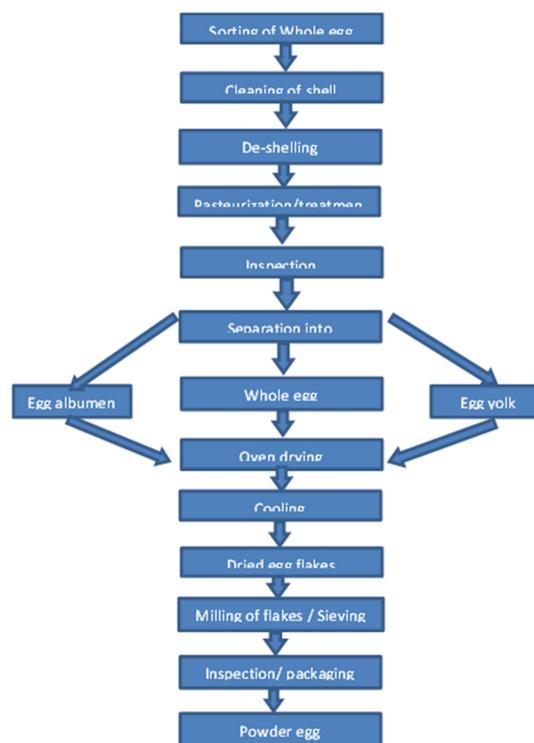


Figure 1: Flow chart describing the processing of whole egg into powder product (Ndife *et al.*, 2010)

Comparative Advantages of Egg Powder over Whole Egg

a) Longer shelf life: The egg powder, if properly packed (in air-tight containers), can last up to 5 – 10 years (far longer than ordinary eggs) (Wikipedia, 2022). This may be linked to its low moisture content of 4 – 5%, which does not enable microbial growth and deterioration (Food Buddies, 2018).

b) Ease of storage and transportation: A large quantity of eggs can be kept on hand in a relatively small space, comparatively easier to handle than liquid eggs with no risk of breakage during transit, and a larger quantity can be shipped across nations without fear of breakage, deterioration of internal qualities due to mechanical actions, or extreme temperature variations, all of which are major factors depleting the qualities of raw eggs (Food Buddies, 2018).

c) Lower risk of foodborne disease: Foodborne illness caused by *Salmonella* bacteria is the most common danger linked with the consumption of raw eggs. Powdered eggs, on the other hand, are pasteurized getting rid of *Salmonella* and other germs that might harm consumers (CDC, 2022).

d) Ease of use and diverse usages: The dry powder may easily be added as an additional dietary supplement for newborns and young children. When baking, it can be used without rehydration, or rehydrated to produce scrambled eggs and omelets, ice creams, biscuits, doughnuts, cakes and other confectioneries (Asghar and Abbas, 2012). Egg powder is also in high demand for skin care products, cosmetics, beverages and instant baby formula (Réhault-Godbert *et al.*, 2019). Other comparative advantages are presented in Table 3.

Challenges Confronting Egg Powder Production in Nigeria: Some of the limiting factors facing egg powder production in Nigeria include:

a) Cost of production: Cost of establishment, purchase of equipment and maintenance, taxes, and other factors are capable of raising the cost

of production, making the price of powder eggs over a raw egg, making the product less marketable and difficult to persuade people, particularly the middle and lower class citizens (Alabi 2020).

b) Non-availability of power supply: The country's erratic power supply does not support industrial development; running on independent power would raise the cost of egg powder production, making it less viable, and rendering the entire process unsustainable (Alabi 2020).

c) Quality assurance and safety: Even when approved by regulatory bodies in charge of food hygiene and quality controls such as the NAFDAC, SON and others, detailed monitoring and quality assurance may be compromised due to poor record keeping, monitoring plans, and corrupt practices (Sujata, 2014).

d) Socio-cultural view: A typical Nigerian lifestyle is either governed by religion or cultural ideology, rate of acceptance may reduce due to sentiment. Seeing eggs in powdered form becomes unusual and believe it is a diversion from their normal meals, leading to rejection and poor patronage (Heise *et al.*, 2015).

e) Socio-economic factor: citizens with limited financial means and low income which account for the highest portion of the population find it extremely difficult to achieve their nutritional demands, particularly protein, as a result, there is a high likelihood that powder egg demand will be low (Heise *et al.*, 2015).

f) Unfavorable government policy: Government policy has been a stumbling block for agro-allied industries in cases of high taxation, unfavorable policy, and importation. Allowing the importation of egg powder by baking industries and other confectioneries doesn't support the domestic growth and development of this product (Heise *et al.*, 2015). Beyond the problems militating against its production and acceptability, nutrient loss and complication may arise if not well processed (Table 3).

Table 3: Comparative advantages and disadvantages of egg powder over raw egg

Advantages	Sources	Disadvantages	Sources
Used as food preservative	Wei <i>et al.</i> (2019)	Discoloration of Yoke and whole egg	Sproston and Akoh (2016)
Microbiologically safe	Food Buddies (2018); Rannou <i>et al.</i> (2013)	Increase maillard reaction	Stadelman <i>et al.</i> (2017)
Easy transport and storage	KOÇ <i>et al.</i> (2011); Rannou <i>et al.</i> (2013)	Off flavour	Stadelman <i>et al.</i> (2017)
Increase uniformity	Caboni <i>et al.</i> (2005)	Increase oxysterol level	Obara <i>et al.</i> (2006); Guardiola <i>et al.</i> (1995a)
Increase shelf life and stability	Food buddies (2018) Salinas-Gonzalez (2017)	Increase cost due to processing and packaging	Alabi (2020)
Easy to handle and quantify	Salinas-Gonzalez (2017); Rannou <i>et al.</i> (2013)	Loss of essential Polyunsaturated fatty acid and fat-soluble vitamins	Guardiola <i>et al.</i> (1995b)
Reduce nutrient deterioration	Labuza (1984)	Denature of protein if exposed to excess heat	Salinas-Gonzalez (2017)
Increase emulsification properties	Salinas-Gonzalez (2017)		
Reduce oxidation of Carotene	Guardiola <i>et al.</i> (1995a)		
Decrease food borne diseases and poisoning	CDC (2022) Guardiola <i>et al.</i> (1995a)		
Diverse use and application	Asghar and Abbas, (2012)		
Easy to standardize and fortify	Salinas-Gonzalez (2017)		

Prospects of Powder Egg Production in Nigerian: If the government and other stakeholders can embrace egg powder production, it has the capacity of becoming an economic empowerment initiative, creating jobs for millions of Nigerians (Ajala *et al.*, 2021), and raising people out of poverty, especially poultry farmers who suffer financial loss during egg gluts.

Nigeria's food processing industry is estimated to spend one billion Naira every year on egg powder importations, this can become a means to boost domestic production and increase her GDP (Food buddies, 2018; Akpan and Nkanta, 2022). Moreover, data revealed that no amount of powder eggs produced locally can be a waste as there is a global market for it, hence the nation can benefit from this if its production can be enhanced sufficiently and it becomes an export product (Business A.M., 2020).

Conclusion: It's fascinating to learn that the answer to the egg glut cycles that have plagued

Nigeria's 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 Nigeria. Following this evaluation, it is critical to take the following actions to address Nigeria'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.

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