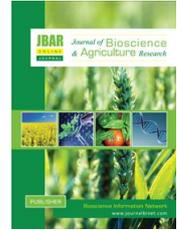


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Egg quality and production constraints in smallholder egg value chain of Greater Port Harcourt City, Nigeria

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ABSTRACT

The study evaluated the quality of eggs and constraints facing smallholder egg producers ($\leq 10,000$ layers) in Greater Port Harcourt City, Nigeria. Desk study, survey of 47 farmers, Focused Group Discussion with eight farmers and weighing of eggs were done at Obio-Akpor, Oyigbo and Etche Municipal Councils out of the eight in Greater Port Harcourt City. Farmers were administered pre-structured questionnaires. Open questions from a checklist were used for in-depth interviews with 22 stakeholders. Thirty eggs per grade were weighed using a digital scale. Numerical data were evaluated using the SPSS statistical package, while qualitative information was assessed using matrices and content analysis. Results indicate that most farmers (56%) sort and grade their eggs for better prices but time constraint discourages others from doing so. The size was the only egg grading criterion used. A five-grade system (jumbo, extra-large, large, small, and bullet) was used. The most important quality parameters were size (41%), shell colour (29%), cleanliness (28%) and weight (2%). Customers prefer brown-shelled (82%) eggs to white (15%). Significant constraints faced by farmers were input-based (high cost and low quality feed, drug breeds, veterinary services, lack of loans); management (staff misbehaviour) and infrastructure (bad roads and poor electricity supply) related. Other stakeholders face quality challenges (small size, dirty eggs, rotting of eggs, no uniformity, low or no grading, high returns rate), financing, egg handling and marketing challenges. Proffered solutions include better chain coordination, local sourcing of eggs, improved quality control, establishment of egg aggregation centres, and introduction of machine-based grading, grade-based pricing and reduction in local production costs. Others include formation of cooperatives and bulk input purchases, improved staff motivation and better quality control. Smallholders' access to the egg market can be improved by producing brown-shelled eggs of large, extra-large and jumbo sizes.

Key Words: Grading, input, upgrading, size, colour and challenges

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I. Introduction

Value chain means all activities carried out by chain actors to get what is produced or services rendered, from idea, over the diverse production phases to supply users and discarding it once used (Kaplinsky and Morris, 2001). The value chain concept is concerned with some issues that influence the sound working of a chain. They include product quality, chain and actor constraints, sustainability, (dis) enabling environment, stakeholders and their roles, governance mechanisms, power relations, transaction costs, value addition, value share, product and information flow, competitive advantage and differentiation, co-ordination and upgrading (Anh et al., 2008). Product quality is the product's total characteristics, which influence the acceptability or preference for the product by customers. The meaning of quality differs from customer to customer depending on customers' quality perception, intended use, and preferences (Luning and Marcelis, 2015). Therefore, egg quality perception differs among customers, is influenced by customer preference and acceptance, and is mostly determined by the egg's physical form and chemical contents. It is necessary that producers and handlers of eggs are well informed of customer perception of egg quality, know what eggs to produce, and how the eggs are treated to improve customers' acceptance (FAO, 2003).

One of the aims of value chain analysis is to reveal the constraints in the chain that prevent stakeholders, especially the vulnerable groups like smallholder farmers, from fully exploiting and benefitting from the opportunities in the chain (Anh et al., 2008; USAID, 2008; Mitchell et al., 2009; KIT et al., 2010). The constraints faced by farmers differ from farm to farm and among geographical areas. In Edo, Nigeria, smallholder egg producers experienced inadequate finance, high feed and medication costs, and low egg price (Ekunwe and Soniregun, 2007). Also, inferior class of feed and feed constituents, no infection management amenities and expensive energy were the farmers' constraints in Ogun State, Nigeria (Afolami et al., 2013). Harnessing the knowledge of the quality issues in the egg business in Greater Port Harcourt and proffering solutions to the egg chain constraints could improve smallholders' livelihood and reveal opportunities for entrepreneurs to exploit. The quality issues in Greater Port Harcourt City egg value chain and chain constraints stunting this subsector's growth are yet to be evaluated. This study aimed to assess issues of quality and limitations confronting small-scale egg farmers in the research area to unravel opportunities for improving the chain for the benefit of smallholders and other chain actors.

II. Materials and Methods

Study area

The study was carried out in Greater Port Harcourt City (GPHC), Rivers State, Nigeria. The city is the fourth largest in Nigeria, with about 1900 square kilometers and more than 2 million people (Ede et al., 2011). GPHC can be reached by road, rail, water and air transportation systems. GPHC is an oil and gas hub that is attractive for investments and people. It also records rapid urbanization and fast population growth. The city is made up of eight Local Government Areas (LGAs). Those LGAs include Port Harcourt City, Obio-Akpor, Ikwerre, Etche, Oyiibo, Eleme, Okrika and Ogu-Bolo.

Definition of concepts

A literature review of secondary data, journal articles, books and reports emanating from Nigeria could not yield a generally accepted definition of the term smallholder poultry egg production, particularly based on 'scale of production'. Therefore, this study groups scale of production into large-scale (>10,000 layers), medium-scale (2,500-10,000 layers) and small-scale (<2,500 layers). Therefore, 'smallholder' used in this research comprises small-scale and medium-scale egg producers (i.e. ≤10,000 layers).

Operationalization of variables

Sorting: Separating eggs into their different categories either based on size, weight, colour or any other criteria

Grading: Assigning different names to sorted groups of eggs based on specific order, usually in ascending or descending order of importance or value.

Stakeholder constraints: Challenges or problems the egg value chain actors face as they conduct their businesses in the egg value chain.

Study population

The survey research was conducted using commercial egg producers in Greater Port Harcourt City. The farm's scale, identified by the number of laying birds in the farm, was used to select farmer respondents for the study. Based on scale of production, therefore, we arrived at three groups of commercial egg producers: large-scale, medium-scale and small-scale. Large-scale farm had >10,000 layers, medium-scale was 2,500-10,000 layers, while small-scale had ≤2,500 layers. The respondents were sampled from a population of small-scale and medium-scale commercial egg producers (i.e., ≤10,000 layers) in three (Obio-Akpor, Oyiibo and Etche) of the eight LGAs. In all, forty-seven (47) farmers were used for the study. In-depth interviews were also conducted with 22 other stakeholders.

Research strategy

First, a desk study was carried out during the literature review phase. A multistage selection procedure was used to select the samples. Three Local Government Areas (Obio-Akpor, Onyigbo and Etche) out of the eight (8) in Greater Port Harcourt City were purposively picked for the entire study. They were purposively selected because they had the largest concentration of poultry farms.

From the three selected Local Government Areas, forty-seven (47), commercial smallholder farmers (i.e. owning ≤10,000 layers) i.e. 17 from Obio-Akpor and 15 each from Onyigbo and Etche were selected for survey research, using snowballing method as there was no data of smallholder egg producers in those local governments. Seventeen (17) farmers were picked from Obio-Akpor because it had the largest number of egg farmers among the three LGAs that were picked. Selected farmers were administered pre-structured questionnaires and guided by the researcher to fill in the answers. Forty-six questionnaires (97% response rate) were filled-in and returned. After the survey research, a focused group discussion was held with eight (8) farmers (i.e. 4 females and 4 males) to get insight into some of the survey research issues.

Open-ended questions from a checklist that differ among stakeholders, were used for the in-depth interviews with 22 stakeholders to understand the constraints and potential solutions to the constraints plaguing the egg value chain in Greater Port Harcourt City. The 22 stakeholders interviewed include wholesalers, retailers, institutional consumers, traders and the Chairman, Poultry Association of Nigeria, as shown (Table 01).

Table 01. Stakeholders interviewed

SN	Stakeholder	Type	No.
1	Wholesalers	Hawking wholesaler	3
	-	Sedentary wholesaler	3
2	Retailers	Supermarket	3
	-	Small street shop	3
3	Institutional consumers	Boarding school	3
	-	Fast food chain	3
4	Traders	Intercity trader	3
5	*PAN Chairman	-	1

*PAN = Poultry Association of Nigeria, is an association of actors in poultry value chain, especially farmers. Its goals is to protect interest of farmers

After the in-depth interviews with stakeholders, the colour, weight and grades of the eggs were assessed. The weight of eggs for different grades measured using a digital kitchen scale. Thirty eggs per grade (i.e. one crate of eggs per grade) were selected and weighed. The average weight for each grade was obtained by dividing the total weight of the 30 eggs by 30 to get the weight per egg per grade.

Data collection and analysis

Numerical data was analyzed using SPSS statistical package using descriptive statistics of mean and simple percentages presented in tables and charts. Qualitative data was analyzed using matrixes and themes.

Limitations of study

The Greater Port Harcourt City Authority had no official register of smallholder egg producers. Hence, we had no sample frame from which we could have drawn the sample set. This implies that results of the study may find little application outside the study area.

III. Results

Egg sorting and grading

Figure 01 indicates that 56% of the egg producers sort and grade their eggs while 44% do not. In the FGD, farmers that sort and grade their eggs said they do so to attract better prices, while those that do not attribute it to lack of time.

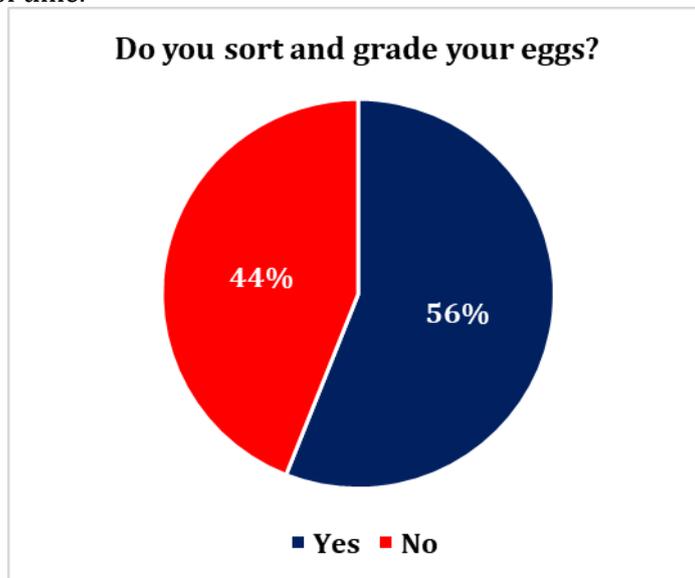


Figure 01. Egg sorting and grading by smallholder farmers

Grading criteria

Figure 02 shows that size was the only criteria used for grading. Weight, cleanliness and shell colour were not considered.

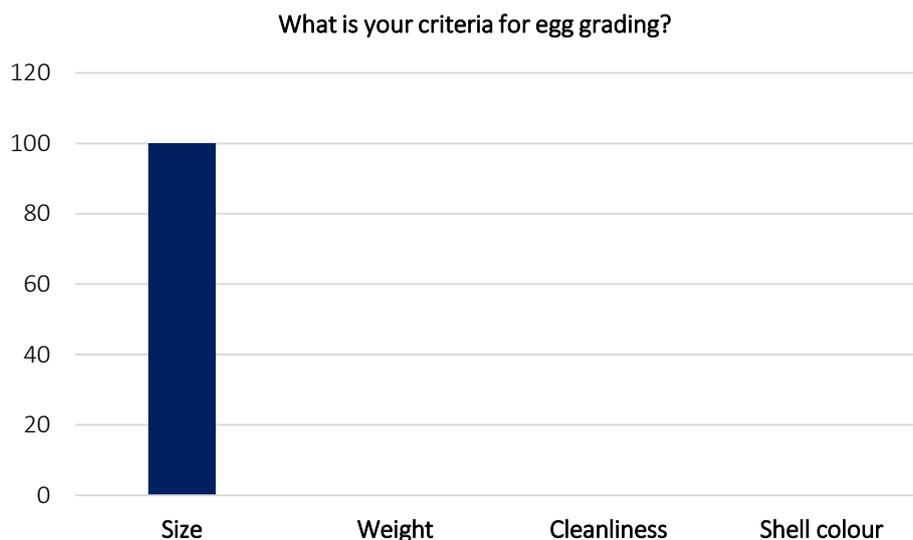


Figure 02. Grading criteria for eggs

Grade types, prices and their occurrence

Results in Table 02 indicate five grades of eggs; jumbo, extra-large, large, small, and bullet as grade I, II, III, IV and V, respectively. Jumbo, extra-large and large weighed 85, 78 and 60.67g, respectively. Small and bullet grades weighed 53 and 47g, respectively.

Table 02. Egg grade, price and occurrence

Grade	Name	Weight (g/egg)	Price (₦/crate)	Eggs per crate	Occurrence
I	Jumbo	85	950	30	Rare
II	Extra-large	78	900	30	Common
III	Large	61	850	30	Common
IV	Small	53	800	30	Common
V	Bullet	47	600	30	Rare

The prices of the grades were ₦950, ₦900, ₦850, ₦800 and ₦600 for grades I, II, III, IV and V, respectively. A crate of all the grades is made up of 30 eggs. Information from FGD indicates that jumbo and bullet were rare because bullets are produced at the beginning of the laying life of the birds while jumbo is laid at the end of laying life.

Most important quality parameter

Figure 03 shows that 41% of the farmers choose size as the most important quality parameter while 29%, 28% and 2% picked shell colour, cleanliness and weight as their most important quality parameters.

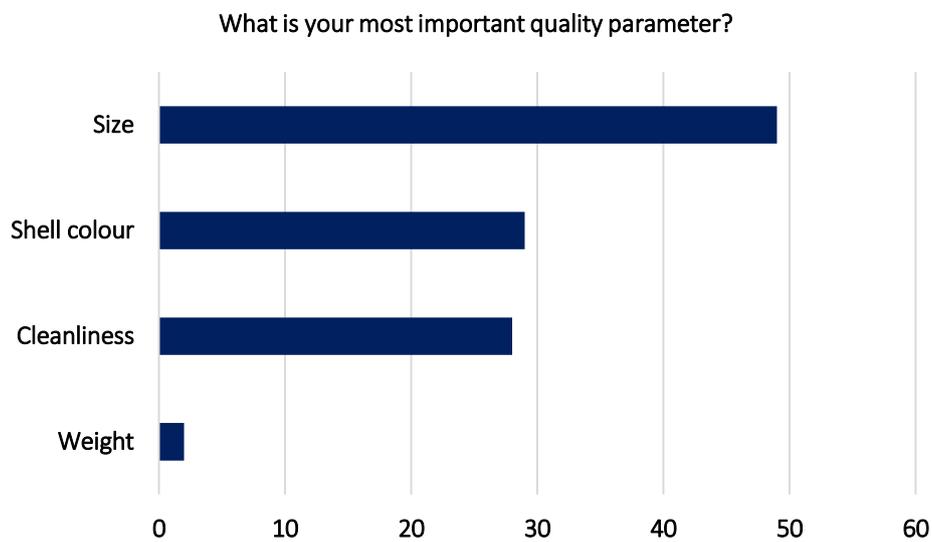


Figure 03. Most important quality parameter

Preferred egg shell colour

Figure 4 indicates that 82% of egg farmers' customers prefer brown shelled eggs, while 15% prefer white shelled eggs. Three percent had no preference.

What is your customer's preferred eggshell colour

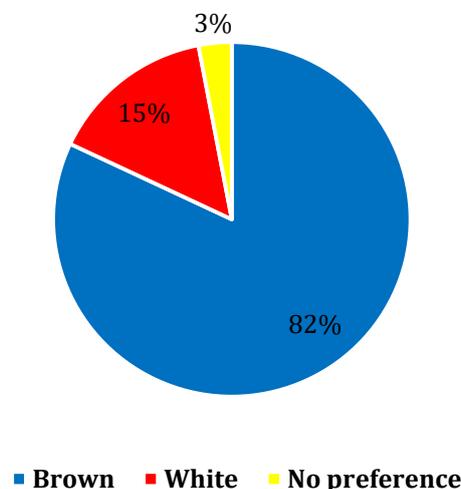


Figure 04. Buyers' preferred eggshell colour

Stakeholder constraints and potential solutions

The constraints faced by stakeholders and potential solutions as obtained from the FGD and stakeholder interviews are shown in [Table 03](#). Poor quality breeds and feeds weak quality regulation of drugs and feed, professional rivalry and weak poultry association were the significant challenges faced by input suppliers. Producers encounter high cost and low-quality feed and drugs, poor breeds, incompetent veterinarians, disease burden, bad roads and poor electricity, lack of credit and staff indiscipline.

Table 03. Stakeholder constraints and potential solutions

Actor	Constraint	Potential solution
Input supplier	-Poor regulation of feed and drugs	-Input standards enforcement
	-Poor breed	-Multi-stakeholder coordination
	-Professional rivalry	-Trust building
	-Weak PAN	-Increase local hatchery capacity
	-Import ban of fertile eggs	
Producer	-High cost and low quality feed	-Improved quality control and standards
	-High cost and low drug efficacy	-Multi-stakeholder coordination
	-Poor breeds	-Formation of producer cooperatives
	-Incompetent vets	-Bulk input purchase
	-Disease burden (AI)	-Strict biosecurity
	-Bad roads and poor electricity	-Use of solar energy and lobbying government
	-No loans	-Staff training and motivation
Trader	-Staff misbehavior	
	-Dispersed farms	-Aggregation centers
	-Low local production	-Increased local production
	-Bad roads	-Local sourcing
	-High transport cost	-Use-by date for eggs
Wholesaler	-Cracking and rotting eggs	-Lobbying government road repair
	-No loans	-Multi-stakeholder coordination
	-Glut	-Market planning/coordination
	-Transit breakage	-Local sourcing
	-High returns rate	-Use-by date for eggs
	-Producers not accepting returns	-Collective action
Retailer	-Credit purchase by institutions	-Alternative sourcing
	-Inconsistent availability	
	-Dirty eggs	-Aggregation center
	-Small size	-Increased local production
	-Cracking and rotting	-Grade-based pricing
	-No grading by wholesalers	-Credit sales
Consumer	-Long distance to wholesalers	-Local sourcing
	-No credit sales by wholesalers	-Use-by date for eggs
	-Small size	-Grade-based pricing
	-No uniformity in size	-Stricter quality control
	-Poor grading	-Multi-stakeholder coordination
	-High price/cost	-Reduce local cost of production

IV. Discussion

Most farmers (56%) sort and grade their eggs to get a fairer price through grade-based pricing, while 44% do not grade their eggs due to lack of time ([Figure 01](#)). This agrees with other studies that smallholder farmers increased their revenue by grade-based pricing ([Abanikannda and Leigh, 2012](#)). Farmers used only egg size as a criterion for grading ([Figure 02](#)). This may become inefficient and subjective when egg number increases. The use of machines in grading eggs would require using weight as a parameter for calibration. Therefore, an opportunity to upgrade the chain is to encourage the use of machines for egg grading to enable the 44% of farmers who do not have time to grade their eggs.

The five grades of eggs used in GPHC include jumbo, extra-large, large, small and bullet as grades 1, 2, 3, 4 and 5, respectively (Table 02). These grades attract different prices. In comparison, the American six grades system was used to achieve a 15% increment in revenue from eggs elsewhere in Nigeria (Abanikannda and Leigh, 2012). The five-grade system used in GPHC and the American six-grade system may need comparison to ascertain the best system for farmers in Greater Port Harcourt City.

From Figure 03, farmers selected size (41%) as the most important quality parameter, followed by shell colour (29%), cleanliness (28%) and weight (2%). This agrees with studies in another Nigerian city and the high premium placed on size is could be because consumers believe that large eggs have more edible content (Jibir et al., 2012). Also, customers of farmers prefer brown coloured (82%) eggs to white (15%) ones. This preference for brown eggs in Nigeria is supported by a previous report (Guyonnet, 2012), which attributed the preference to culture and tradition. Whether the preference in GPHC is due to the same reasons is not known. However, for smallholders to easily access the egg market, brown eggs large to jumbo should be produced.

The constraints faced by producers are mostly input based (high cost and low quality feed, drug breeds, veterinary services, lack of loans); management related (staff misbehaviour) and poor infrastructure (bad roads and poor electricity supply). The potential solutions offered by stakeholders and supported by other works (KIT et al., 2010; Luning and Marcelis, 2015) include improving chain coordination, forming cooperatives and bulk purchasing of inputs, and staff motivation (e.g. increase in pay and training) and quality control.

Other stakeholders have problems of quality (small size, dirty eggs, rotting of eggs, no uniformity, poor or no grading, high returns rate), lack of credit facilities and egg breakage in transit, high cost of egg and glut. These can potentially be solved by local sourcing, chain coordination, quality control, establishing an aggregation center, grade-based pricing, and reduced local production costs. Different authors have reported all these constraints (Adene and Oguntade, 2008; Akinwumi et al., 2010; Abanikannda and Leigh, 2012) and need to be resolved in strategies geared towards upgrading the chain.

V. Conclusion

The research aimed to assess the quality of eggs and constraints facing smallholder egg producers in Greater Port Harcourt City to reveal entrepreneurs' opportunities and improve the chain for smallholders and other chain actors. Most farmers sort and grade their eggs for better prices but time constraint discourages others from doing so. A five-grade system based on size was in use. The most important quality parameters include size>shell colour>cleanliness>weight in that order of priority. Customers prefer brown shelled eggs to white. Smallholder farmers faced mainly input based, staff management and infrastructure related constraints while other stakeholders are confronted by quality, financing, egg handling and marketing challenges. It sums up a more functional chain that creates a win-win situation for smallholder entrepreneurs and other chain actors, it an utmost need for better chain coordination, local egg sourcing by mediators and consumers, quality control improvement, egg aggregation, machine-based grading and grade-based pricing, production cost reduction, producers' cooperatives formation, bulk input purchasing by farmers, improved staff motivation and production of brown eggs of large to jumbo sizes.

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