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SEASONALITY OF EGG DEMAND, PRODUCTION, AND SUPPLY IN GREATER PORT HARCOURT CITY, NIGERIA

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Abstract: Seasonality in smallholder chicken egg production, demand and supply in Greater Port Harcourt City (GPHC) was studied using exploratory research to build theory. Six wholesalers, six retailers, three intercity traders, six institutional consumers, and the Chairman, Poultry Association of Nigeria, Rivers State, were interviewed one-on-one using a checklist. Focus Group Discussion with eight egg producers was carried out to obtain insight on seasonal influences on the egg chain. Quantitative data was analyzed using Microsoft Excel while qualitative data was analyzed using thematic analysis. Results indicate that egg production in GPHC is grossly inadequate to meet the demand, thus, encouraging influx of eggs into GPHC from other parts of Nigeria. Egg production, demand and supply in GPHC is influenced by school calendar, Christmas and end of year/new year vacations. Also, smallholder egg production is poorly planned, causing seasonal scarcity and glut. To eliminate seasonal scarcity and glut, capture the full benefits of the high demand periods for stakeholders especially smallholders, extension workers and egg producing entrepreneurs need to emphasize planned production and cost minimization strategies to increase local production and supply competitively priced eggs throughout the year.

Keywords: Calendar, Glut, Scarcity, Vacation, Intercity trade

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1. Introduction

Egg production traditionally follows seasonal cycles (FAO, 2003). Seasonal variation is a major non-genetic factor affecting performance of laying birds as well as marketing and profitability of egg business particularly in the tropics (Schulte-Drüggelte and Thiele, 2013; Oguntunji et al., 2015).

Seasonal variation in egg production is significant in Nigeria's sub-humid zones (Malau-Aduli et al., 2003). High ambient temperature moderated by variation in climatic seasons causes heat stress on poultry. This adversely affects and varies the performance of hens, thereby, reducing egg production, fertility, and hatchability. Example, higher egg production was recorded in wet season (April-September) compared to dry season (October-March) in parts of Nigeria (Guobadia, 1997; Oguntunji et al., 2015).

When production, influenced by climatic season, supports high production in a declining or steady demand, glut results. But, lower production induced by unfavorable climatic season and rising demand causes scarcity. In Ejigbo, Nigeria, seasonal glut could last for four months (March-June) with 6 months' post-glut recovery period. To survive the glut, farmers employ strategies such as sales of live birds, disposal of stale eggs, sales of eggs at prices lower than marginal cost by offering them at high discount rate and credit sales (Bolu and Aremu, 2007). However, modern commercial layers have the genetic potential to maintain high egg production throughout the climatic seasons of the year (Schulte-Drüggelte and Thiele, 2013).

Though gains have been made in reducing the effect of climate-induced seasonality on egg production by layers, the impact of climate and man-made seasons on the demand and marketability of eggs is still a serious problem.

The main aim of egg marketing is to secure a more even supply of eggs over the year at relatively stable prices (FAO, 2003). However, this is not always the case due to seasonality influences, especially in poorly organized markets and weakly coordinated value chains. For instance, though the egg business was lucrative, it was still affected by seasonality in demand in parts of Southwestern Nigeria (Adedeji et al., 2014). Also, a wide seasonal variation in the price of eggs due to change in demand and supply at different times of the year was observed elsewhere in Nigeria (Omar et al., 2013). The overall impact of seasonality on egg production, supply, marketing, and demand include poor food security, unfair business practices by those capable of exploiting the situation to their advantage, and erosion of incomes for the vulnerable groups in the egg chains, such as

smallholders.

To resolve these problems, there is need to analyze effects of seasons on egg production, supply and demand. This type of analysis looks beyond averages of the market to gaining a better understanding of the monthly, seasonal, or holiday business cycles of eggs. Seasonality analysis is important because periods of high demand often bring new opportunities and a premium price as the market expands. Also, seasonality might offer counter-cyclical opportunities to move goods elsewhere where local production is lower. The seasonal opportunities so revealed could be used to improve performance of egg supply chain and target investment (USAID, 2008).

Seasonality of egg production, demand and supply in Port Harcourt has not been paid serious attention, thus, limiting the use of the data for interventions that could improve the egg supply chain in the study area. This study, therefore assessed the effects of seasons on the demand, production and supply of eggs by commercial smallholder egg producers in Port Harcourt to generate actionable insights for egg market development interventions and investment decision-making for egg producers in the study area and elsewhere.

2. Materials and Methods

2.1. Description of Study Area

Greater Port Harcourt City (see Figure 1) has eight Local Government Areas (Harcourt City, Obio/Akpor, Ikwerre, Etche, Oyigbo, Eleme, Okrika and Ogu/Bolo) and is located in Rivers State, Nigeria. Port Harcourt is the fourth largest city in Nigeria. It covers 1900 km2 area with over 2 million people (Ede et al., 2011). Transportation within and outside the area is by rail, road, air and water. In addition, Port Harcourt is the center of oil and gas business in Nigeria.

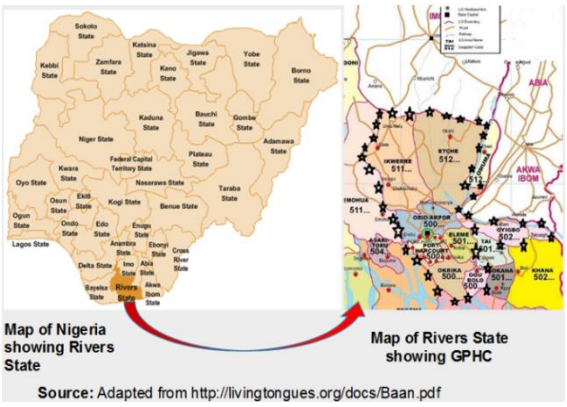

Figure 1. Maps of Nigeria and Rivers State showing Port Harcourt.

2.2. Target Population

The sample was obtained from population of commercial egg producers located in Greater Port Harcourt in Rivers State. Using scale of production based on the number layers owned by the farmer, we classed the commercial egg producers to three: (i) 10,000 layers or more (large-scale), (ii) 2,500-9,999 layers (medium-scale), and (iii) less than 2,500 layers (smallholder or small-scale). The research sample was obtained from class (iii) or small-scale egg producers.

2.3. Operationalization of Variables

1) Commercial smallholder egg production systems refers to egg producing farms or egg producers that have a maximum of 2, 500 layers and the eggs so produced are mainly for sale.
2) Driving distance refers to the distance covered (in kilometers) in moving eggs produced elsewhere in Nigeria to Greater Port Harcourt City for sale.
3) Driving time means the time used to transport the eggs from other parts of Nigeria to Greater Port Harcourt City
4) Seasonality refers to any predictable pattern in egg demand, production and supply that recurs every calendar year.
5) Geographical flow of eggs refers to movement of eggs through any means of transportation to Greater Port Harcourt City.
6) Cost of eggs refers to the variable costs of eggs from the farm gate in other parts of the country to Greater Port Harcourt City. It includes farm gate price of eggs, transportation and handling charges and other costs along the way to Greater Port City.

2.4. Data collection and Analysis

Desk study was first carried out to gather information on background of study area, study concepts, and present state of knowledge in the research area.

Desk study was followed by a survey using semi-structured questionnaire. Three local government areas (LGAs) of the eight in GPHC were purposively selected for the survey because from observation and enquiries they probably have the largest concentration of poultry farmers. These LGAs included Obio-Akpor, Oyigbo and Etche. Forty-seven commercial smallholder egg producers rearing not more than 2,500 birds were identified and used for the survey. Of this number, 17 were from Obio-Akpor and 15 each from others. Obio-Akpor had 17 because it has the largest population of egg producers based on enquiries from Poultry Association of Nigeria, Rivers State chapter. The snowballing sampling technique was used to sample the farmers. This was because no register of farmers (hence, no sampling frame) could be obtained from government or other agencies, hence, subjects were difficult to come by. The farmers were administered questionnaires and personally guided to fill-in the answers. After an interview, the interviewee was asked for leads to other farmers having 2, 500 birds and below. Input sellers were also helpful in recruiting subjects. All forty-seven questionnaires (100% response rate) were filled and returned.

Following the survey, focus group discussion (FGD) was used to collect data that gave deeper insight on issues that arose from the survey and that needed further

probing. Open-ended questions from a checklist were used for FGD. Eight egg farmers (4 females and 4 males) were purposively selected, considering gender inclusion and spread across the LGAs.

Quantitative data was analyzed using descriptive statistics (mean, median and mode) and simple percentage in Statistical Package for Social Sciences (SPSS) version 24. Data from the FGD were analyzed using matrices and thematic analysis and simple percentage. Results were presented in graphs and seasonality diagram.

2.5. Limitations of the Study

There was no sampling frame because Greater Port Harcourt City Authority does not have a database of egg producers from which we could have drawn the sample. This means the findings may not be generalized to commercial smallholder egg producers outside the study area.

2.6. Definition of concepts

There is no agreement in literature on the definition of smallholder poultry farming in Nigeria, especially, as it concerns 'flock size'. Hence, in this research, we classed flock size as: industrial/large-scale (≥10,000 layers), medium-scale (2,500-9,999 layers) and small-scale (<2,500 layers). The term 'smallholder' as used in this study, therefore, include small and medium-scale egg producing farms (i.e. ≤10,000 layers).

2.7. Research Strategy

This was an exploratory and theory-building research. The aim was to study to understand and explain rather than identify causal patterns and regularities. Preliminary desk study was carried out to identify stakeholders and have an overview of the case. Full desk study was done during literature review phase. This was followed by triangulated one-on-one in-depth interviews with 22 stakeholders (Table 1) in three Local Government Areas (Obio-Akpor, Oyigbo and Etche) of the eight that constitute Greater Port Harcourt City.

Table 1. Stakeholders interviewed

S/N	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	Trader	Intercity trader	3
5	*PAN Chairman	-	1
	Total		22

*PAN = Poultry Association of Nigeria, is an association of poultry farmers formed to protect interest of the farmers.

The three were picked because they have the highest concentration of poultry farmers.

After the stakeholder interviews, focus group discussions were conducted with eight purposively selected farmers (3 females and 5 males) considering gender and spread across the Local Government Areas. The focus group discussion engendered deeper insight on issues that came up during in-depth interviews with other stakeholders. Distances and driving time between Greater Port Harcourt City and other cities were generated from online Google maps. Quantitative data was analyzed using Microsoft Excel to generate averages. Thematic analysis was used to analyze qualitative data. Results are presented in map, charts and seasonality calendar. The Nigerian currency, the Naira (₦) was used for the calculations involving money. As at the time the study was carried out, one US Dollar (1$) was equivalent to ₦ 355.

2.8. Ethical Consideration

Approval was granted by the Research Ethics Committee of University of Port Harcourt for the survey and FGD questionnaires. The consent of respondents and participants were sought before commencement of the research. Assurance of confidentiality for information obtained were given and observed throughout the research.

3. Results

3.1. Geographical Flow of Eggs into Greater Port Harcourt City

The flow of eggs into GPHC is shown (Figure 2). Interview with intercity traders and wholesalers indicate that eggs were brought into GPHC from farms in Lagos, Kwara, Oyo, Osun, Ogun, Enugu, Anambra and Imo states. The Poultry Association of Nigeria, Rivers State Chairman asserted that about 60% of the eggs marketed in GPHC come from other Nigerian cities.

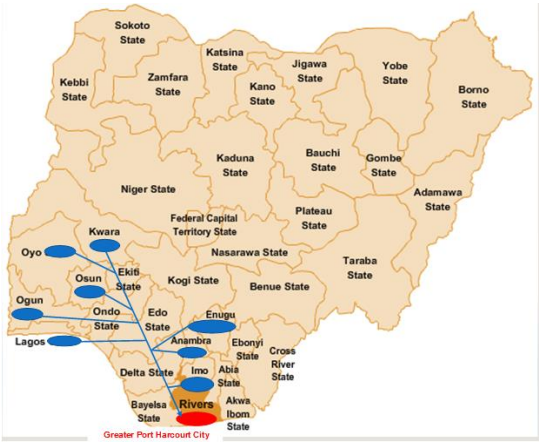

Figure 2. Geographical flow of eggs into Greater Port Harcourt City.

3.2. Driving Distances

Figure 3 presents driving distances by road to the study area. Lagos, Ilorin and Ibadan cities are 619, 655 and 626 kilometers to GPHC, respectively. Also, Enugu, Onitsha, Owerri and Port Harcourt suburbs are 226, 206, 108 and 16 kilometers to GPHC center, respectively.

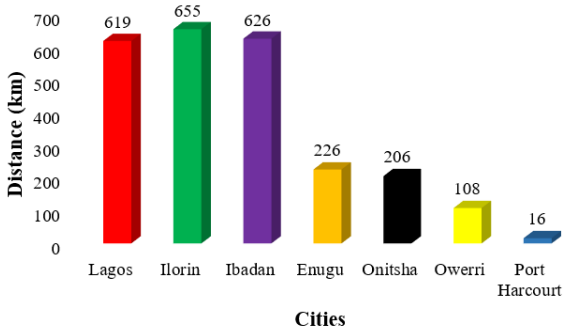

Figure 3. Driving distances from other cities to Port Harcourt.

3.3. Driving Time

The driving times by road to Greater Port Harcourt City center from other cities are presented (Figure 4). Lagos and Ibadan take 8 hours while Ilorin is 9 hours. Enugu and Onitsha take 3 hours each while Owerri and Port Harcourt suburbs take 2 and 0.5 hours each, respectively.

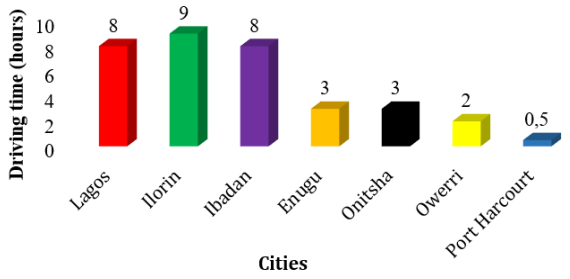

Figure 4. Driving times from other cities to Port Harcourt.

3.4. Cost of Eggs

Transport cost, cost price (farm gate) and total cost per crate of bringing eggs from other cities to GPHC are shown (Figure 5). The transport costs were ₦60 (Lagos), ₦65 (Ilorin), ₦63 (Ibadan), ₦30 (Enugu), ₦29 (Onitsha), ₦21 (Owerri) and ₦4 (Port Harcourt suburb). The farmgate cost of a crate of egg at the different cities were N650 (Lagos, Ilorin and Ibadan), ₦680 (Enugu, Onitsha and Owerri) and ₦750 (Port Harcourt environs). In sum, the total costs were ₦710 (Lagos), ₦715 (Ilorin), ₦713 (Ibadan), ₦715 (Enugu), ₦709 (Onitsha), ₦701 (Owerri), and ₦754 (Port Harcourt environs).

3.5. Seasonality of Egg Production, Demand and Supply

Information from focus group discussion with farmers and in-depth interviews with other stakeholders were used to construct a seasonality calendar showing patterns of climatic season, egg production, demand and supply in Greater Port Harcourt City as shown (Figure 6).

LD1: Low demand season I. It is the first week of January. Most people that travel for Christmas, end-of-the-year, New Year and schools' vacation are not yet back. Demand is low.

HD1: High demand season I. It begins from second week of January to fourth week of March. Most people are back from vacation. Schools have resumed for Second Term. Households buy eggs to prepare food for their children as they go to school. Demand is high.

LP: Low-production season. There is high atmospheric temperature which is not good for productivity of layers. Begins from the first week of January to end of April. Mass culling of old layers in December to target the huge demand for poultry meat at Christmas, end-of-year and New Year festivities without planning for pullets that would start laying by January the following year. Industrial farms exploit this gap by planning their production. There is egg scarcity at this period, increasing the prices by 6-13%.

LD2: Low-demand season II. Begins from second week to third week of April. Schools have vacated for the Second Term. Demand is low.

HD2: High-demand season II. Begins from fourth week of April to third week of July. Schools are in session for the Third Term. Demand is high.

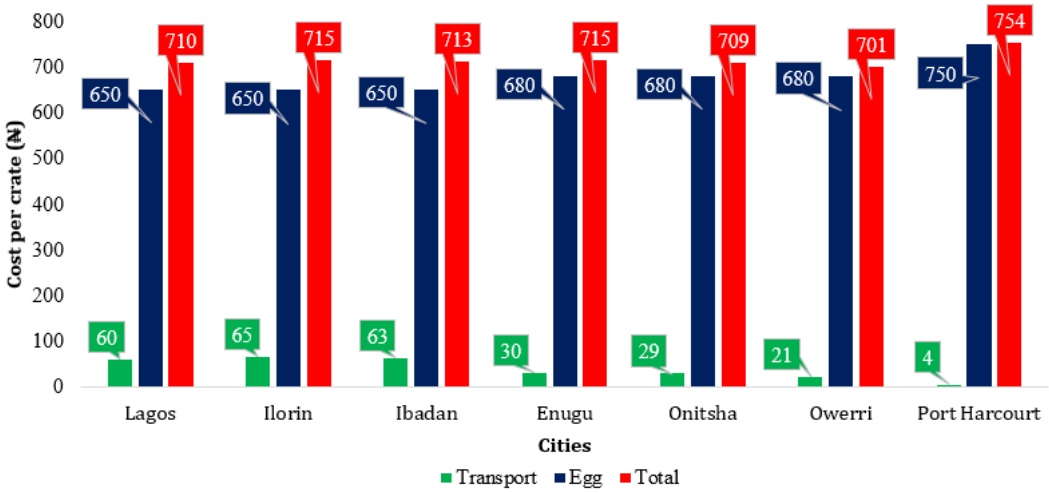

Figure 5. Cost of eggs brought from other cities to Greater Port Harcourt City.

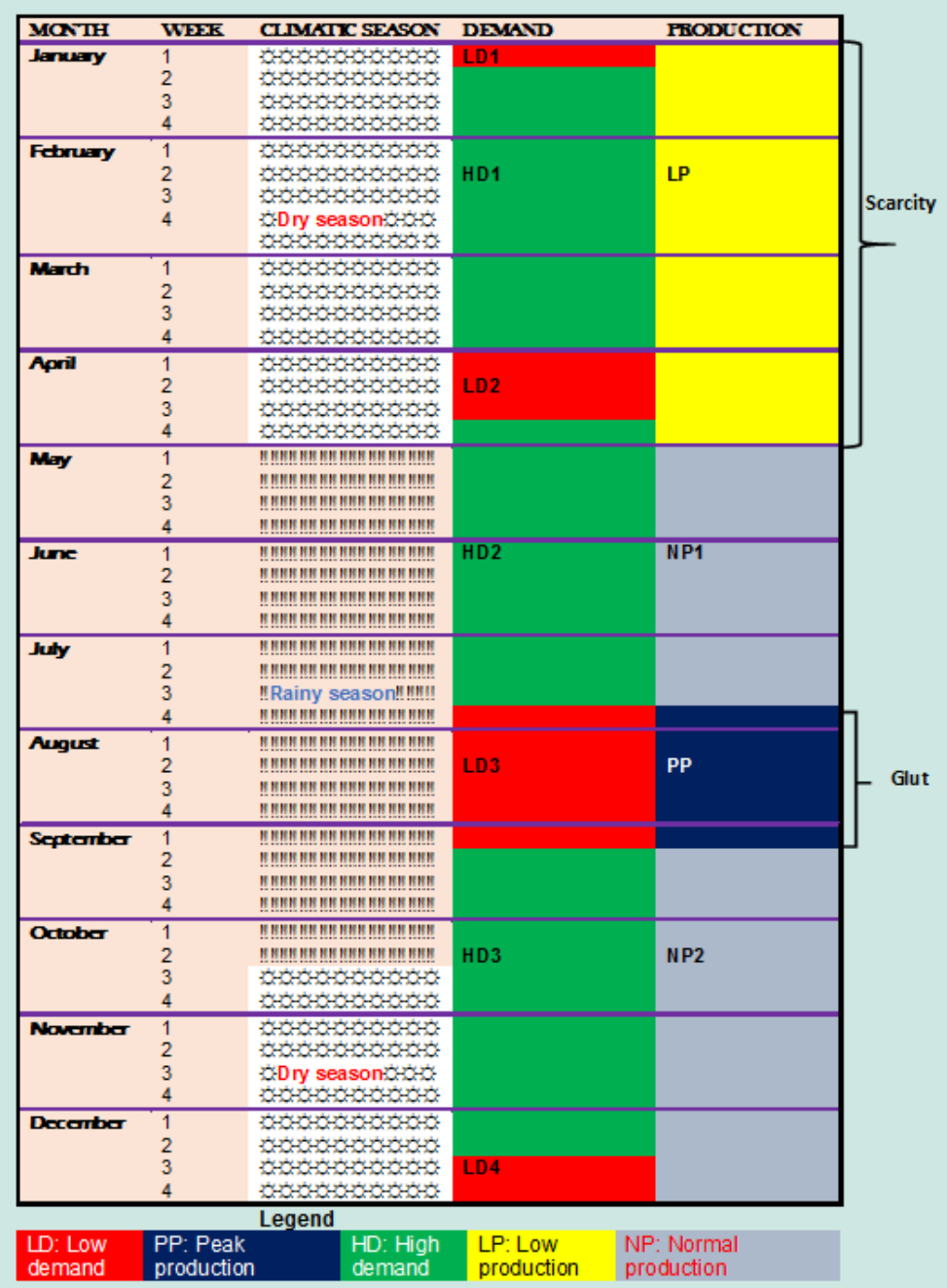

Figure 6. Seasonality of egg production, demand and supply in Greater Port Harcourt City.

NP1: Normalized production season I. Pullets stocked between January and February have started laying. Local production in GPHC has started picking up and fully normalizes by the end of this phase. Begins from the fourth week of May to the third week of July. Also, atmospheric temperature is reducing as rains have started fully. Weather is cool and good for layers' productivity. Production is normal.

LD3: Low-demand season III. Begins from the fourth week of July till the first week of September. Schools are on long vacation for the Third Term. Demand is low.

PP: Peak production. Starts from the fourth week of July to the first week of September. All the farms that stocked earlier in the year have started producing. Weather is cool and good for layers' productivity. Glut is observed in the chain by the middlemen bringing in many eggs from other cities without considering that local production has peaked.

HD3: High-demand season III. Begins from second week of September to the second week of December. Schools have resumed for the First Term. Demand is high.

NP2: Normalized production season II. Begins in the second week of September and ends by the last week of December. Weather is cool and good for layers' productivity. Influx of eggs from outside GPHC has been adjusted to the peak local production.

LD4: Low-demand season IV. Begins in the third week of December till early January of the following year. People have started travelling out of city for Christmas, end-of-the year and New year vacations. Demand is low.

4. Discussion

The flow of eggs into Greater Port Harcourt City (GPHC) from as far as Lagos, Ilorin, Ibadan, Onitsha and Enugu indicates the dynamism of the Nigerian egg market as encouraged by open market economy, free movement of goods across the country and weak geographical barriers of entry from one state to another, within the country. It also confirms the PAN chairman's position that 60% of eggs in GPHC come from outside GPHC and further shows where they come from. Inter-city traders are acting as a transmission belt, moving eggs from surplus to deficit regions to fill the gap created by insufficient local production (Clapp, 2015).

Cities like Lagos, Ibadan and Ilorin are more than 600 kilometers from GPHC while Enugu and Imo are above 100 kilometers away. When the risks of bad roads and high cost of transport (Tunde and Adeniyi, 2012; Mohammed et al., 2013) in the country are factored in, it indicates that for the inter-city traders to still prefer procuring eggs from these far-flung cities, local egg production in GPHC is either inadequate to satisfy the local demand or local prices are far higher than cities where the eggs originate or both. This situation likely offers a better margin. This is supported by the traders' complain during interviews that they are unable to procure enough local supply.

The driving time by road to Greater Port Harcourt City center from other cities (Figure 3) shows Ilorin to be the longest (9 hours) followed by Lagos and Ibadan (8 hours), Enugu and Onitsha (3 hours), Owerri (2 hours) and Port Harcourt suburbs (0.5 hours). The time spent on the road reflects the distance, state of the road, traffic situation and the state of the vehicle. In this analysis, only the distance is considered. If the bad state of Nigerian roads and thick traffic situation (Tunde and Adeniyi, 2012) are added, then the time could be higher because interviews with intercity traders indicate they spend about 12 hours on the road to GPHC from Ilorin, Ibadan and Lagos. The low local production in GPHC, cheaper farm gate prices in those other cities, higher market prices in GPHC and resultant higher margins could be the reason why these traders go so far in search of eggs.

Transport cost, cost price (farm gate) and total cost per crate of bringing eggs from other cities to GPHC (Figure 4) indicate that Ilorin had the highest transport cost per crate (N65) followed by Ibadan (N63), Lagos (N60), Enugu (N30), Onitsha (N29), Owerri (N21) and Port Harcourt environs (N4). The closer the city to GPHC, the lower the transport cost. This is normal as transport cost is charged per distance (Tunde and Adeniyi, 2012). Transportation between production and consumption areas is expensive, difficult to organize and risks heavy losses. Seasonal changes in the prices of eggs mainly reflect variations in production (FAO, 2003).

The farm gate cost was similar (N650) for Lagos, Ilorin and Ibadan, N680 for Enugu, Onitsha and Owerri and N750 for Port Harcourt environs. The farm gate price increased as the cities got closer to GPHC. This could be due to cost of production (cost of feed, labour, day-old-chicks, transportation and medication) which is cheaper elsewhere than GPHC. Most producers of poultry inputs are located in the Southwest (Ibadan, Abeokuta Lagos) which has the most developed poultry industry in Nigeria and feed ingredients are cheaper in the North where Ilorin is located (Akinwumi et al., 2010). Also, Onitsha and Enugu are closer to the North where feed ingredients are cheaper. The intercity egg trade is encouraged by the lower farm gate price of eggs in those other cities and lower costs of moving them to GPHC.

The total landing cost for a crate of egg varied widely among the cities under examination: Ilorin and Enugu (₦715), Ibadan (₦713), Lagos (₦710), Onitsha (₦709), Owerri (₦701) and Port Harcourt environs (₦754). Eggs purchased from farms within GPHC were the most expensive followed by those from Ilorin and Enugu, Ibandan, Lagos and Onitsha in that order. Though the lowest was from Owerri, interviews with stakeholders reveal that consistent availability and in required quantities was a setback that necessitates them going as far as Ilorin, Lagos, Ibadan, Onitsha and Enugu to source for eggs. Availability affects the demand for food products (Dixie, 2005).

Seasonality analysis in value chains helps to identify seasonal opportunities for chain improvement and investment (USAID, 2008). From Figure 5, in GPHC, egg production by hens increase in the rainy season when the weather is cool and temperature is within the comfort zone of the birds but reduce during the dry season when the weather is hot causing heat stress. This agrees with several literatures that demonstrated the significant influence of high ambient temperature, prevalent in the dry season, on the lowering of egg production by commercial layers in humid southern Nigeria (Guobadia, 1997; Malau-Aduli et al., 2003; Oguntunji et al., 2015). Therefore, there is opportunity for introduction of season management practices with proper planning to ensure exploitation of rainy and dry season for the benefit of the birds and farmer by reducing the effect of high humidity and ambient temperature on production (Guobadia, 1997).

Also, interviews and FGD findings indicate that mass culling of old layers, by smallholder farmers in December, without restocking pullets that will start laying by January of the new year, causes egg scarcity throughout the first half of the new year leading to a 13% increase in price. Thereafter, egg glut occurs at the middle of the year when unrestrained influx of eggs from other cities combines with peak local production. Production, however, normalizes between May-July and September-December. This agrees with literature as there was a wide seasonal price variation of egg in the selected markets due to change in demand and supply at different times of the year in India (Omar et al., 2013) and climatic seasons influence egg consumption (Karthikeyan and Nedunchezhian, 2014).

The demand for eggs increase when schools are in

session and decreases when they are on holidays. Also, Christmas, end-of-the-year and New Year vacations reduce demand for eggs. In Nigeria, this agrees with literature but reports from India indicate that festival seasons (New year and Christmas) increase demand for eggs, thus, helping rise in prices during the months of November and December (Karthikeyan and Nedunchezhian, 2014). Differences could be due to whether eggs are used for the festivals in question. In India, the eggs are used for the celebration but in Greater Port Harcourt City the low demand is due to reduction in town population as people migrate from GPHC to their villages thus reducing the demand for eggs. In addition, in GPHC, chicken, beef and other types of meat and not eggs are used to celebrate the festivals.

In all these, opportunities exist for planning of production by smallholders. The main aim is to secure a more even supply of eggs over the year at relatively stable prices (FAO, 2003). Therefore, producers can vary their production schedules to maximize their income from egg, reduce costs, considering seasonal price cycles, preferences of middlemen and specific customer demands. Optimal replacement schedule calls for keeping the current flock in production if its weekly contribution margin exceeds the expected average weekly contribution margin of a new flock but not ignoring seasonal variation in monthly egg income (Schulte-Drüggelte and Thiele, 2013). Another opportunity may be through vertical integration mechanisms e.g. contract farming, which narrows seasonal variation in production and prices of poultry eggs (Gillespie, 1998).

5. Conclusion

The study examined seasonality in the smallholder egg value chain in Greater Port Harcourt City using exploratory research. It is concluded that egg production in the study area is poorly planned and inadequate to satisfy demand, hence, causing seasonal scarcity and glut, with attendant influx of eggs from other parts of Nigeria. Egg value chain is significantly influenced by school calendar, Christmas and New Year vacations. To eliminate seasonal scarcity and glut, capture the full benefits of the chain for smallholders, egg extension workers and entrepreneurs need to focus on strategies that will plan production, minimize cost to increase supply of competitively priced eggs throughout the year in GPHC.

Author Contributions

JNI; conceived the research idea, planned, gathered, analyzed and interpreted the data and wrote the manuscript. JM; supervised the research, validated the research instruments and methods, structured the paper and corrected the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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