Analysis of rural egg production to improve the economy of the Andean communities in Ecuador [version 1; peer review: awaiting peer review]

María Belén Bravo Avalos¹,², Maritza Vaca Cárdenas¹, José Luis López Salazar¹, María Fernanda Herrera Chico¹, Jenny Margoth Villamarín Padilla¹

¹Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador
²Dama Research Center limited, Kowloon, Hong Kong

Abstract

Background: An economically active population refers to people involved in any economic activity, such as agriculture, livestock, or industry. This activity can supply benefits to its owners and may generate the growth of small businesses. Our study presents a qualitative analysis of the egg production in Ecuadorian Andean communities (Tzimbuto, Bayushig “La Liberad,” and La Victoria “Pusuca.”)

Methods: Analysis was performed using a random sample of 81 hens and 29 eggs obtained from 65 producers, belonging to 50 farming families at the Utopia Community Fair. Zoometric characterization of the hens was carried out according to FAO protocols, and egg yolk quality, egg width and weight, and egg shell weight and thickness were calculated. The 65 producers were interviewed to answer questions pertaining to selling eggs, costs of production, and realized profit. The profit/cost indicator was calculated from the ratio of expenditure (egress) and total revenue of egg sales.

Results: 84% of surveyed participants indicated that they purchase eggs for their nutritional value, 12% because the animals are raised with organic food, and 4% showed preference for the eggs’ special flavor. The quality analysis of the eggs sold at the Fair demonstrated that the average weight of the eggs was 47.24 g; the length was 55.24 mm; and the width was 41.66 mm; weight and thickness of the shell were 4.90 g and 0.42 mm, respectively. The color of the yolk had a brightness of 57.62 L*, 5.53 a* for red/green tones and 47.15 b* for yellow/blue tones. The costs to produce the eggs for the Fair was US$0.21 with a profit/cost of US$0.04 per egg; the unit sale price is US$0.25.

Conclusions: 84% of surveyed participants indicated that they purchase eggs for their nutritional value, revealing the need to train the communities toward more efficient egg production.

Keywords
domestic economies, rural development , consumer protection, rural egg productionn
**Introduction**
An economically active population (EAP) attempts to grow small businesses, allowing significantly more employment opportunities. Jiménez (2012) states that the purpose of any economic activity, whether agricultural, livestock or industrial, is to supply a benefit to its owners. The main global activity carried out in rural areas is animal raising for commercial purposes (Ordoñez & Lasso, 2010). Poultry farming is a key activity that can provide several benefits especially for the rural economy. However, it is important that poultry farmers become aware of the importance and value of poultry in the creation of companies, more than just meeting basic needs; when the obtained products are marketed, an EAP is formed.

In this study, we examine egg production in Ecuadorian Andean communities (Tzimbuto, Bayushig “La Libertad,” and La Victoria “Pusuca.”) A quality analysis of the eggs and an analysis regarding the demand for egg consumption was carried out at the Utopia Community Fair, Riobamba, Ecuador.

**Methods**

**Research design**
The research was performed over 120 days between February 2019 and May 2019. Zoometric measures and egg quality analysis were carried out in the Escuela Superior Politécnica de Chimborazo, Riobamba. Egg consumption rates and motivation for selling eggs were obtained from producers at the Utopia Community Fair located at Av. Juan Félix Proaño, Riobamba municipality, Chimborazo Province (GPS coordinates: -1.685193, -78.644049).

**Participants**
50 families from the communities of Tzimbuto, Bayushig “La Libertad” and La Victoria “Pusuca” were randomly selected from the main producers of the Utopia Community Fair. 81 hens owned by the selected families were chosen, having undefined age and weight. In addition, 29 eggs were analyzed and 65 consumers/producers from the 50 families were recruited for the study. The methodology related to egg/hen analyses followed procedures described in Martínez, 2016.

**Data collection**

**Table 1. Experimental measures used in the present study.**

<table>
<thead>
<tr>
<th>Social component</th>
<th>Productive component</th>
<th>Egg quality</th>
<th>Production cost</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of family members</td>
<td>Weight (g)</td>
<td>Head: type of crest, color of the ears, color of the beak</td>
<td>Weight of the egg (g)</td>
<td>Study of the demand on the consumption of eggs in the “Utopia Community Fair”.</td>
</tr>
<tr>
<td></td>
<td>Length of the head (cm)</td>
<td></td>
<td>Weight of the egg (mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width of the head (cm)</td>
<td></td>
<td>Length of the egg (mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the ears (cm)</td>
<td></td>
<td>Weight of the eggshell (g)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the crest (cm)</td>
<td></td>
<td>Thickness of the eggshell (mm)</td>
<td></td>
</tr>
<tr>
<td>Educative level</td>
<td>Width of the crest (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the peak (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the neck (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dorsal length (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ventral length (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toraxic perimeter (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Femoral iliac ischiatic width (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migration from the area</td>
<td>Length of the humeral wing (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of middle wings (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of distal wings (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the thighbone (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic activity</td>
<td>Length of the tarsus, tibia leg (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Circumference of tarsus, tibia leg (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of tarsus and metatarsus bones (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the middle phalanx of index finger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of the first phalanx spur (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*FAO (1981); Lázaro et al. (2012) and Pérez & Polanco (2003).*

In brief, the birds were weighed manually by Chick Scale (model: 103; Agrologic.
In total, 29 eggs from three communities were analyzed. The width of the egg was measured with a digital Vernier caliper (Dongguan Kuaijie Ltd., China); thickness of the eggshell was measured by Egg Shell Thickness Gauge (Orka Food Technology, LLC., USA); and the weight and the eggshell without the egg was determined by means of digital balance (model galaxy SF-107R; Ravi Scientific Industries, Delhi). Konica Minolta (CR 400) Colorimeter was used for three-dimensional interpretation of the yolk’s color. Color of the egg yolk was obtained on three scales L*, a*, b*: L*, luminosity, ranging from 0 (absolute black) to 100 (absolute white); a*, red and green tones, ranging from –60 to +60, with green tones indicated by negative values and red tones assessed by positive values; b*, yellow and blue tones, ranging from –60 to +100, with blue tones shown by negative values and yellow tones corresponding to positive values (González et al., 2015; Ochoa, 2014).

Human participant data. A total of 65 registered members (demographics: age, gender, marital status, number of family members) were subjected to a descriptive statistical analysis according to Rustom (2012). To understand the demand for eggs, we analyzed the type of consumed eggs, frequency of consumption, quantity of consumed eggs, amount of money spent on buying eggs, preferred characteristics of eggs and place of purchase (Underlying data (Bravo Avalos, 2019d)) using central trend measures (mean, media and mode) and deviation (variance and standard deviation). For the economic analysis, the profit/cost indicator was established from the ratio of expenditure (expenditure) to total revenue corresponding to the sale of eggs as follows: total revenues (US$) divided by expenditure (US$) (Anzola, 2002; Díaz, 2005; Hammershoj, 2015). See Extended Table 2 for the survey used in the study.

Data analysis
Summary percentages were calculated for survey responses from participants, and hen and egg parameters. Egg quality analysis, production costs, and demand analysis for egg consumption were analyzed according to Bruni (2000); FAO (2014); Jeréz (2014); Juárez (1999); Juárez, (2000); Quintana (2011); Villanueva (2015), and World Visión (2008).

All statistical analyses were performed with SPSS (version 22.0).

Ethical statement
The Committee Fundación UTOPIA approved this study. Participants provided informed oral consent to participate in the study prior to its start. Oral consent was obtained from participants instead of written consent because of time constraints and illiteracy of some participants.

Results and discussion
From farming family surveys, it can be observed that 100% of producers own Creole birds. The majority of producers (72%) own 0–10 birds and 28% own 10–20 birds.

Analysis of the types of egg consumed found that 49% of families consume laying eggs, 47% consume rural eggs, while only 4% consume quail eggs.

In total, 84% of producers buy eggs because of their nutritional value, 12% because the animals are fed with organic food, and 4% because the eggs have a special flavor. Therefore, it is necessary to inform producers about the requirements of hens to produce eggs rich in essential nutrients, and to convey an added value to the product by disseminating the nutritional composition of the egg being commercialized, based on nutritional information.

Regarding the commercialization of eggs, 57% of producers sell their products at the Utopia Community Fair, 30% sell them in stores, and 6–7% go to markets or deliver them directly to consumers’ homes. This shows that there is great support for direct community association with producers. Therefore, producers understand that direct association with customers results in beneficial sales channels, as they avoid intermediate vendors, who usually obtain higher profits without investing in or producing the product.

According to the producers, 96% of them sell 1–2 egg cartons, each containing 30 eggs, and only 4% sell 3–4 cartons. Using the latter figure, this means that 90–120 eggs are sold at a cost of US$0.25/egg. These statistics represent that the egg production is intended for a retail scale; however, an increase in production will yield greater profits.

This study demonstrated that production cost of eggs contains several expenses: cost of poultry, chick feed, natural alternative medicines for hens, labor cost, and transportation (Table 2). Poultry purchase according to Andrade (2011) indicates that production cost of the chicken at the end of the breeding phase is US$3.78. When all incurred costs are considered, the total cost of rearing the 81 birds included in this study summed to US$306.18/hen.

For the purchase and rearing of animals (including food and medicine), labor and transportation, the total costs are US$1263.77. Sales of eggs amounted to US$1,500.00. The profit/cost indicator for egg production is US$1.19, indicating that producers have a profit margin of 0.19 cents for each dollar invested, value that can vary according to the age, production phase, and feeding of birds, complying with very strict food principles, the quality of production, and necessary marketing (Table 2).

Out of the surveyed producers, 75.4% were women and 24.6% were men; 61% have a family composed of 4 to 5 members,
followed by 28% with 2 to 3 members, and the remaining 11% with 6 to 7 members. In total, 98.46% of producers surveyed include eggs in their diet, while only 1.54% do not consume eggs.

The results show that 72.31% of producers purchase both types of egg (processed and rural), 16.92% prefer processed eggs, 9.23% like for rural eggs, while as few as 1.54% do not consume eggs at all. Exploration of consumer behavior revealed that 48.44% of the producers surveyed buy eggs daily, 37.50% purchase eggs fortnightly, 12.50% acquire eggs weekly, and 1.56% buy them monthly. The average number of eggs that families purchase is 13 units daily, 33 weekly, 30 fortnightly, and 60 per month. The average amount that producers pay to buy eggs is US$7.50 for rural eggs and US$3.25 for commercial eggs; producers said they allocate US$8.00 to buy any type of eggs per week.

A total of 60% of the producers go shopping in stores located in their neighborhood, 18.46% go to Utopia Community Fair, 13.85% choose public markets, while 4.62% prefer to buy them directly from producers.

The main characteristics of the eggs sold at the Utopia Community Fair show that the average weight of the eggs was 47.24 g; the length 55.24mm; width 41.66mm; weight and thickness of the shell 4.90 g and 0.42 mm, respectively. The color of the yolk obtained a brightness of 57.62 L*, 5.53 a* for red/green tones and 47.15 b* for yellow/blue tones. The measurement of color and brightness of the yolks reveals high quality of the overall egg, which can be rated as a top product offered by the Ecuadorian market.

**Conclusions**

The costs to produce a rural egg for the Utopia Community Fair is US$0.21 with a profit/cost of US$0.04 per egg (the unit sale price being US$0.25).

Statistical data of our study reveal that 18.46% of producers purchase rural eggs, their average consumption is 30 units, and they spend US$7.50 fortnightly. It can be noticed that all producers possess Creole birds; 72% own 0-10 birds and 28% own 10-20 birds. Therefore, it was considered that poultry production is not widespread even though it is considered a very profitable business. Training those who farm Creole hens can be provided in the future so that they provide greater livestock and demand in the market. Analysis of the type of eggs consumed found that 50% of producers consume Creole hen eggs, 44% consume eggs from laying birds, and only 1% prefer quail eggs, which demonstrates high acceptance of Creole eggs by families living in the area of the Utopia Community Fair.

**Data availability**

**Underlying data**


Extended data


Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

**References**


Food and Agriculture Organization (FAO): Genética y cría de aves de corral en los países en desarrollo. 2014. Reference Source

Food and Agriculture Organization (FAO): Historia de la producción avícola doméstica, 2014a. Reference Source


Publisher Full Text
The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com