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Fake Eggs on the Ghanaian Market: An Emperical Evidence - Shukura Market, Greater Accra Region, Ghana

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Abstract— *Background and objectives: In recent times, the Ghanaian media space has news of the proliferation of fake eggs in the market especially in the capital, Accra. The Food and Drugs Authority (FDA) of Ghana, the agency responsible for regulating wholesomeness of food has refuted this assertion after thorough investigations. The issue could affect the contribution of poultry to the economy. The aim of the study therefore is to determine the authenticity of eggs sold in the Ablekuma central sub-metro in the Greater Accra region of Ghana. The results shall contribute to the baseline data on eggs, and to restore consumer confidence in eggs sold in Ghana. Methods: The spectral bands of the shells, albumen and yolk of the egg samples were determined using FTIR analysis, and knowledge about fake eggs through survey. Results: The spectra of the shells, albumin and yolk of the samples corresponded to the standard spectra of authentic egg. The survey revealed lack of knowledge about fake eggs. Conclusion: In spite of the lack of knowledge about fake eggs, the eggs were authentic. This confirms the assertion of FDA of Ghana.*

Keywords— ***Albumin, Fourier Transform infrared (FTIR), poultry, fake eggs, yolk,***

I. INTRODUCTION

Eggs are great source of easily digestible proteins. It is essential nutrient for healthy nutrition (FAO/UN, 2006) [1]. With the advent of more sophisticated and improved poultry management techniques, egg production has risen quickly globally in recent years (FAO 2010) [2]. For instance in Ghana between 2004 and 2012, there was an increase of about 15,000 tons (FAOSTAT 2013) [3]. Ghana has a low per capita consumption rate of 12 eggs annually, which is far lower than the global average (Kirtchevsky, S. & Kritchevsky, D, 2000) [4]. Eggs, however, is linked to higher serum cholesterol levels and cardiovascular illnesses (CVDs) (Song, W.O & Kerver, J.M 2000) [5]. This perception has reduced consumption despite yearly output increases (FAOSTAT 2013, Yilma, K. T, et al., 2022) [3,6].

Another perception that could further reduce consumption is the proliferation of fake eggs in the market. The Food and Drugs Authority (FDA), of Ghana has however refuted this and emphatically stated that there are no such eggs sold on the market (GNA/FDA, 2019) [7]. In Bangladesh, such news was also condemned, and emphatic that no fake eggs on the market (https://www.thepoultrysite.com/news/2017/08/suspected-fake-eggs-sent-for-examination-govt-says-eggs-not-fake) [8].

Fake eggs are real, but used to encourage chickens to lay their eggs in a particular place. They can also be used under

broody chickens to encourage them to sit and incubate other eggs or even to raise day old chicks (ozfarmer.com https://www.ozfarmer.com › ceramic-china-fake-brooder) [9], they are not meant for consumption, because they contain no nutritional values compared to the real eggs (Dibyajyoti Saha S.M., et al., 2013) [10]. The aim of the study therefore is to determine the authenticity of eggs sold in the Ablekuma Central Sub-Metro in the capital of Ghana, Accra. The findings shall contribute to the existing data in informing policy making about poultry.

II. MATERIAL AND METHODS

2.1 Sampling Location

The sampling site has the coordinates at latitude $5^{O}33'01.5''N$ and longitude $0^{O}15'04.7''W$ and 5.55042622508, -0.251316335998 (www.shukura.com retrieved on 17/08/2023). It is part of Ablekuma Central in the capital Accra.

2.2 Sample Collection

Eggs from domestic fowls were from vendors in Shukura market in Accra. Shukura is chosen, because of the vast number of communities it serves, coupled with its economic importance to the sub- metro (Ghana Statistical Service, 2021). Two hundred crates of eggs of equal quantities of brown and white shells were collected in six months.

2.3. Sample Preparation and Analysis

Eggshells dried at 150° C for 6 hours, was pulverized. The powder sprayed, into a drying chamber at 150°C was collected for the analysis.

A drop of the yoke and the albumin, separately put on the surface of a highly polished KBr plate is scanned to generate the spectrum using the FTIR (Bruker Alpha-P ATR FTIR : standard operating procedure) [11] .

2.4. Survey

Questionnaire, administered to vendors and customers to solicit information. The questionnaire is structured into demographic status of vendors, data about eggs, capacity to test eggs, and complaints. Eighty volunteers were involved. The data obtained were analysed using SPSS version 16.

III. RESULTS

This section describes the various results obtained.

3.1. Questionnaire

The questionnaire is shown in Table 1.

Table 1: Template of the Questionnaire

Number	Parameter
	Demographic status
1.	Age: (< 18yrs, 18 – 50years)
2.	Educational background (literate/illiterate)
	Data about bird and eggs
3.	Source of eggs (local/imported)
5.	Cost of eggs: (affordable/expensive)
	knowledge to test fake eggs
6.	Any knowledge about authenticity of the eggs
	Knowledge about fake eggs
	Any education about fake eggs
	Complaint from customers
7.	Complaints about authenticity of eggs (none/often)

Table 2: Responses (%) from Questionnaire

Parameter	Age	Education	Eggs		Knowledge to test authenticity of eggs	Knowledge about fake eggs	Complaint
	18-50	literate	source	cost per crate	no	yes	none
responses	90	60	100 (poultry)	80 (expensive)	100	10	100

Source: Bartels/ Hussein/ Gadzekpo, statistical analysis, 2023

GC denotes Ghana cedis, the currency of Ghana.

Table 3: Possible Functional Groups in the Samples.

Peak (cm^{-1})	**Possible functional group**
712-876	C-H bending vibration
1426	Carbonate groups of stretching
1645	Carbonyl group stretching
1799	C=O stretching
2516	Hydrogen group stretching
2875-2926	C-H bending vibration
3419	Hydroxyl group stretching

Figures 1-4 depict the spectra of the brown shell, white shell, the yolk and the albumin of the samples.

Fig.1: Spectra of Brown Shell

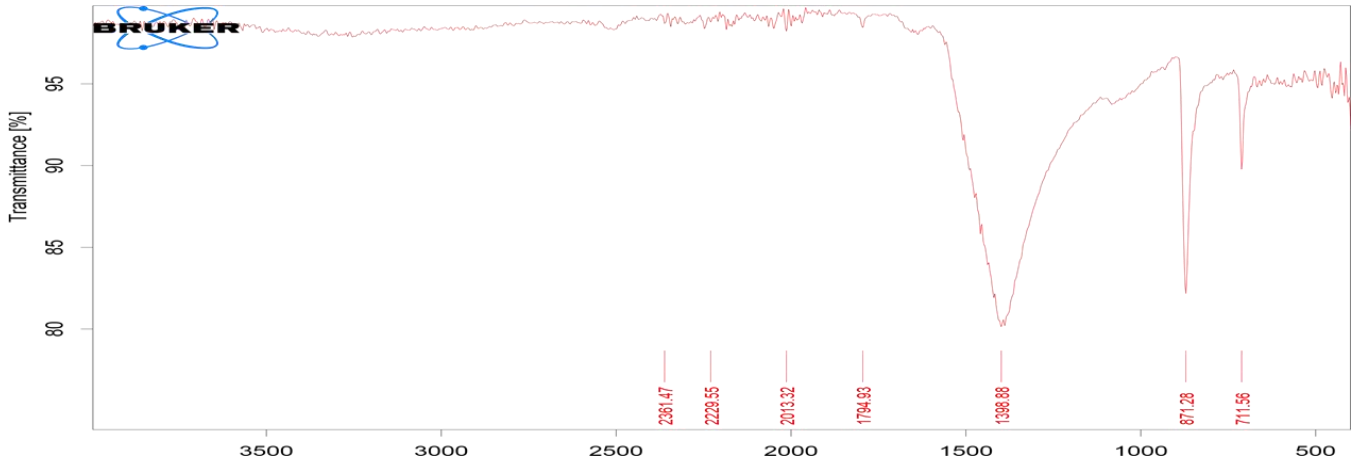

Fig.2: Spectra of White Shell

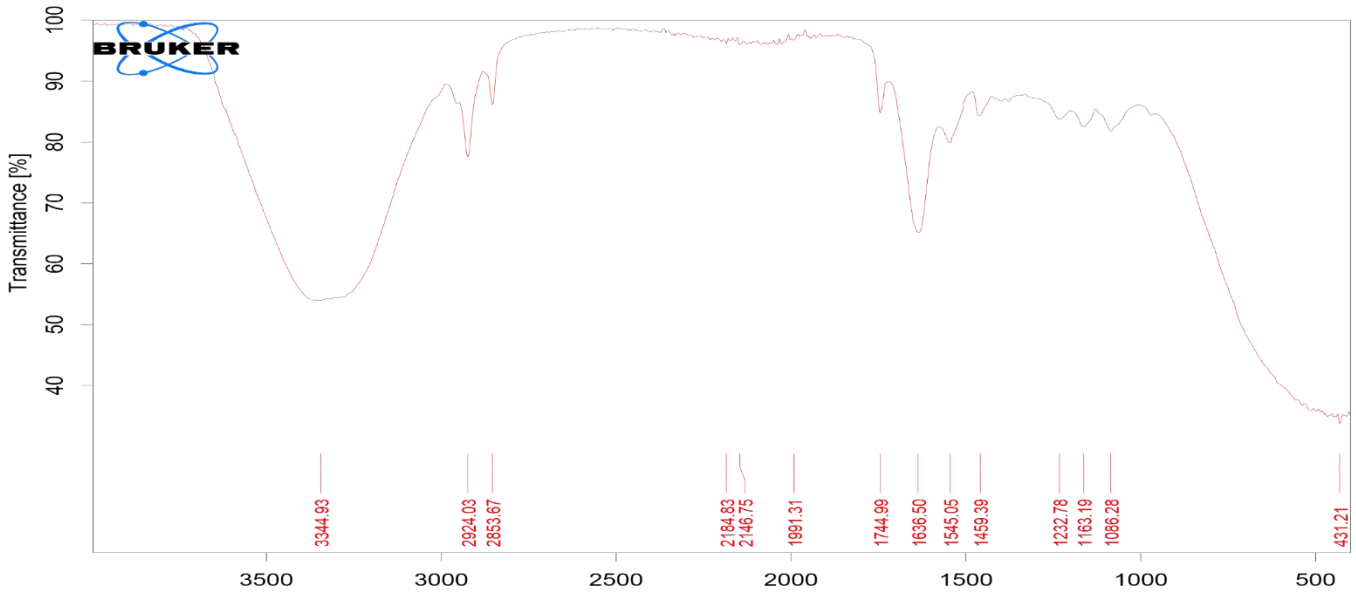

Fig.3: Spectra of Yoke

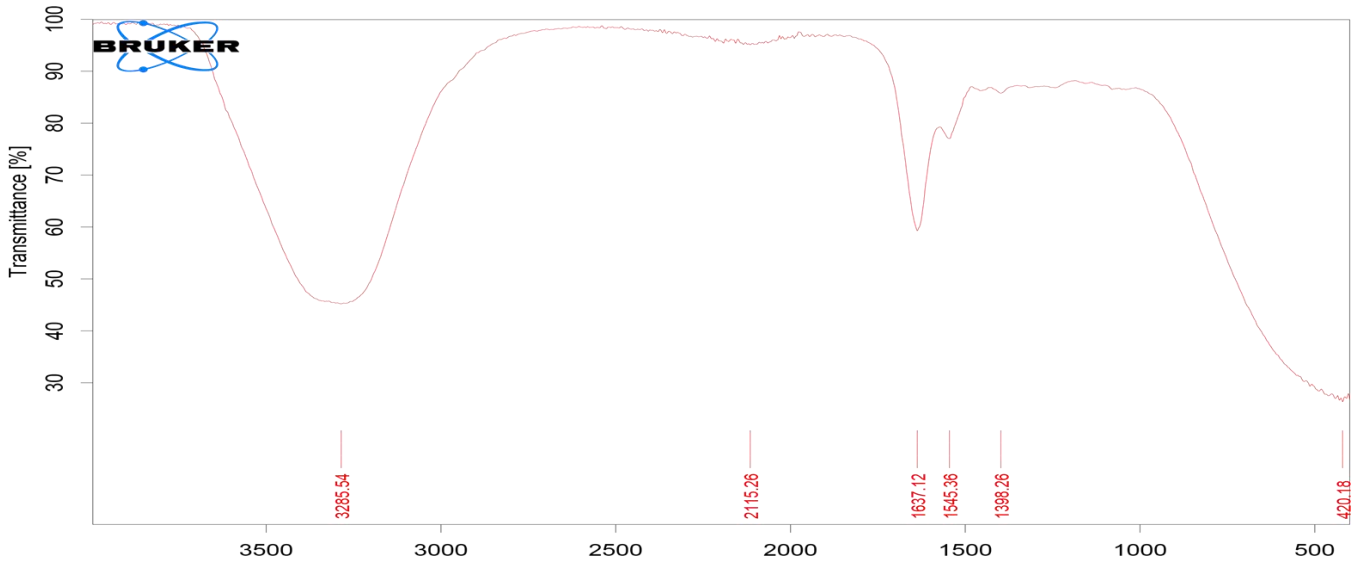

Fig.4: Spectra of Albumin

IV. DISCUSSION

4.1. Response from Survey

The survey instrument is shown in Table 1. As shown in Table 2, most (60%) of the vendors are literate suggesting the ability to acquire information and communicate if education about fake eggs is available. Concerning the supply, the eggs were sourced from local poultry farmers, indicating the inability of the farmers to produce fake eggs. Majority of the respondents (80%) found the eggs expensive at the current cost of 45 – 55 GC (4.1-5.0 USD) per crate; such could compel them to patronize fake eggs if available. The vendors (100%) had no knowledge about testing the authenticity of the eggs, because such information is not available to them through any of the media outlets including television, radio, information vans, and billboards. Few (10%) had knowledge about fake eggs, which came through rumors. About complaints, none received about authenticity of the eggs sold out; this could confirm the integrity of the eggs.

4.2. Peaks and Possible Functional groups

Figures 1-4 depict the spectra of the brown shell, white shell, the yolk and the albumin of the samples respectively. The various peaks are shown in Table 3. The functional groups in the samples thus include C-H at 712-876 and 2875-2926 cm^{-1}, carbonyl C=O at 1645 and 1799 cm^{-1}, carbonate C=O at 1426 cm^{-1}, and H at 2516 cm^{-1} whilst OH at 3419 cm^{-1}.

4.2.1. The eggshells

The *brown shell* showed peaks at 872.1 and 712.13 cm^{-1}. Such indicate the presence of carbonate and C-H functional groups, whilst 1795.53 and 1641.49 cm^{-1} correspond to carbonyl functional group as shown in Fig. 1 and Table 3 (Yilma, K. T et al., 2022, Brudnicki, P. A. P et al., 2022)[6,12]. Similar results for white shell is shown in Fig. 2 and Table 3 with peaks at 871.28 and 711.56cm^{-1}. This implies the shells are identical (Brudnicki, P. A. P et al., 2022) [12]; the difference could be the length of time it stays in the uterus, and the speed at which calcium deposits as the shell forms[13]. As shown in Figs. 1, 2, and Table 3, the intense peak observed around 1398.88 is due to the matrix's carbonate mineral content; this confirms the eggshell is entirely $CaCO_3$. Moreover, there is no peak around 1200 cm^{-1} indicating the presence of SO_4 (Plaster of Paris, CaSO4), or $CaCl_2$, which form shell of fake eggs (Brudnicki, P. A. P et al., 2022) [12]. The structure for the eggshells is authentic.

4.2.2. The yoke and albumin

As shown in Fig.3, the peaks at 1744.99 and 1615.39cm^{-1} which indicate C= O functional group for homogenized yoke of the eggs were identical (Brudnicki, P. A. P et al., 2022) [12]. However, concerning albumin, the distinctive peaks at 1636.72 cm^{-1} and 1545.03 cm^{-1} in Fig. 4 correspond to C=O stretching (due to the amide I band) and C-N stretch (with N-H bending mode due to the amide II band), and O-H stretch at 3285 cm^{-1}. This structure indicates the presence of protein (Tizo, M. S., et al., 2018a) [13]. The structure is –NHCHRCONHCHRCONHCHRCO or the amino acid moiety, n (NH2CHRCOOH) (Brudnicki, P. A. P et al., 2022) [12] .

V. CONCLUSION

The study investigated the speculation that the Ghanaian market is flooded with fake eggs, which created anxiety among the populace in view of its health hazards. This news is denied by the Food and Drugs Authority of Ghana, the body responsible for the authentication and approval of foods and drugs for consumption. The study thus aimed at providing an empirical evidence about the issue, and delved into some of the possible reasons for patronizing fake eggs.

1.The study revealed that there are no fake eggs on the Ghanaian market. The spectra obtained are consistent with that of authentic domestic birds' eggs. The eggs on sale are therefore good for consumption.

2.Among the possible reasons for patronizing fake eggs if available were high cost of eggs, lack of information and knowledge of testing fake eggs.

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RECOMMENDATION

Though the samples were not fake, there is the need for the relevant agencies to be vigilant in avoiding the sale of fake eggs for consumption. This could be educating the public and the stakeholders in the poultry industry about fake eggs.

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