# Vitamin-C and Folates in Climate-smart Noiler chickens' feeding and Egg Production during Peak-Hot-Humid Periods: Awareness and Adoption in Enugu, Nigeria

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# Introduction

- Many researches have suggested, amongst other measures to mitigate the harmful effect of heat, the supplementation of multivitamins and minerals, particularly in layer chickens.
- ascorbic acid is used in the poultry diet because of its anti-oxidant properties in the scavenging of the free radicals generated during heat stress.
- folates (folic acid) has been found to enhance nutrient utilization by poultry species. Folates had been reported to be involved in inter conversion of amino acids, such as serine and glycine, and for the synthesis of methionine from homocysteine
- with enhanced nutrient utilization due to folate supplementation, the effect of vitamin-C stands better improved predominantly in the wake of the recent increasing threat of global climatic warming.
- Based on the premises of having good scavenging ability, easy adaptability to diverse agro-ecosystems, ease of management at village level, low protein requirements, low susceptibility to common diseases like Gumboro, sustenance on conventional and non-conventional feed, higher productivity than local breeds, this study considers the awareness and adoption of supplementing Noiler chickens' feed with vitamin-C and folates as a climate-smart adaptation strategy during peak hot humid periods of the year for sustainable food security in Enugu, Nigeria

# Statement of problem:

- There is a knowledge gap in the area of awareness and adoption of climate-smart nutritional supplementation that could influence feeding and egg production of Tropically-adaptable improved breeds (TAIBs) like Noiler chicken.
- the need to ascertain the productivity of Noiler chickens in intensive housing as is obtainable in commercial production systems.
- Current literature in Nigeria and sub-Saharan Africa shows that previous studies have not sufficiently dealt with the awareness and adoption of vitamin-C and folates in heat-stress management of tropically-adapted improved breeds (TAIBs) of Noiler chicken in climate-smart large scale intensively-managed livestock production system.

# Objectives of the study:

a. -examine the interactional effect of vitamin-C and folates on daily feed consumption of Noiler chickens in deep-litter poultry pens during peak hot humid periods of the year.

b. -examine the interactional effect of vitamin-C and folates on daily egg production of Noiler chickens in deep-litter poultry pens during peak hot humid periods of the year.

c. determine the socioeconomic characteristics of poultry farmers that could influence uptake (i.e. awareness-and-adoption) of vitamin-C and folates as climate-smart mitigation strategy during peak hot humid periods in Enugu, Nigeria.

d. determine the levels of uptake (i.e. awareness-and-adoption) of vitamin-C and folates as climate-smart mitigation strategy during peak hot humid periods in Enugu, Nigeria.

# Methodology

- The research was conducted in two phases:
- Phase One (Experimentation phase):
- Using a Completely Randomized Design to determine the interactional effect of vitamin-C and folates on daily feed consumption and daily egg production of Noiler chickens during peak hot humid period of the year; a total of 144 Noiler chickens aged 31-weeks, were managed under deep-litter intensive system.
- following which experimental diet administration and data collection commenced while maintaining a hygienically clean environment.
- The birds were divided into 4 groups of 18 birds per treatment indicated as T1 (Treatment 1), T2 (Treatment 2), T3 (Treatment 3) and T4 (Treatment 4) while each treatment group was further replicated 3 times. Routine prophylactic hygienic measures were strictly observed during the experimentation. The birds were fed formulated chickens' ration containing crude protein 16.5%, 2500 kcal/kg and supplemented as shown in the Table 1.

**Table 1. Experimental Specifications**

| Treatment Group | Treatment Specification |
|---|---|
| Treatment 1 (T1): | Not supplemented diet. |
| Treatment 2 (T2): | Supplemented with 250 mg of ascorbic acid per kg of feed |
| Treatment 3 (T3): | Supplemented with 250 mg of ascorbic acid + 1 mg of folic acid per kg of feed |
| Treatment 4 (T4): | Supplemented with 300 mg of ascorbic acid + 1 mg of folic acid per kg of feed. |

**Table 2: Formulated Noiler chicken diet**

| Ingredients | % Inclusion |
|---|---|
| Maize | 57.50 |
| Maize offal | 8.00 |
| Soya bean cake | 18.00 |
| Groundnut cake | 10.65 |
| Fish meal | 2.50 |
| Bone meal | 2.50 |
| Oyster shell | 0.15 |
| Salt (iodized) | 0.25 |
| Methionine | 0.10 |
| Lysine | 0.10 |
| Finisher vitamin premix | 0.25 |
| Total | 100 |
| Calculated nutrient composition | |
| Crude protein | 19.50% |
| Gross energy | 3,100 Kcal.ME/Kg |
| Crude fibre | 5% |

## Phase two (Survey Phase):

#Using a Survey Study design, the level of uptake (i.e. awareness and adoption) of vitamin-C and folates as climate-smart mitigation strategy during peak hot humid period of the year in Enugu, Nigeria was determined.

**#Primary data were collected with the aid of a well-structured questionnaire which was used to collect quantitative data from 306 selected respondents to generate information on the 3rd and 4$^{th}$ objectives of the study. Section A of the questionnaire contained items on the socioeconomic characteristics of the respondents while section B featured 11 item questions aimed to elicit information on the level of uptake (i.e. awareness-and-adoption) of climate-smart feeding of Noiler chickens using vitamin-C and folates by the respondents. The questionnaire items had a 5-point response scale described below:**

| Scale item | Numerical Points |
|---|---|
| Very High Uptake (VHU) | 5 |
| High Uptake (HU), | 4 |
| Low Uptake (LU) | 3 |
| Very Low Uptake (VLU) | 2 |
| Indifferent (IND) | 1 |
| Total numerical points: | 15 |

## Statistical Analysis:

All data collected from phase one (experimentation) were subjected to one way analysis of variance (ANOVA) while descriptive statistics such as frequency, percentage, means and standard deviation were used to analyze data from phase two (survey).

## Results:

Table 3: Average Weekly Ambient Temperature and humidity of the experimental compartments during the study

| Weeks | Temp. (°C) | Rel. Humidity (°C) |
|---|---|---|
| 3 | 30.15 | 30.09 |
| 4 | 32.07 | 31.10 |
| 5 | 31.28 | 31.98 |
| 6 | 33.30 | 33.06 |
| 7 | 34.01 | 33.80 |
| 8 | 33.77 | 33.76 |
| 9 | 33.90 | 32.72 |
| 10 | 34.03 | 32.70 |
| 11 | 34.18 | 32.55 |
| 12 | 34.18 | 32.39 |

## Results:

**Table 4. Daily egg production, feed intake records, daily water consumption and body weight gain of heat-stressed layers in hot humid environment treated with vitamin-C and folates.**

| Parameters | T1 | T2 | T3 | T4 | SEM |
|---|---|---|---|---|---|
| Daily Egg Prod.%/Treatment | $6.90^{b}$ | $7.56^{ab}$ | $8.15^{a}$ | $8.04^{a}$ | 0.14 |
| Daily Feed intake (kg/bird) | $0.19^{b}$ | $0.25^{ab}$ | $0.42^{a}$ | $0.42^{a}$ | 0.04 |

a,b,c,- means with different alphabetical superscripts across the rows are significantly different at $P<0.05$; SEM- Standard error of the mean.

**Table 5: Socioeconomic characteristics of selected farmers that could influence uptake (i.e. awareness-and-adoption) of vitamin-C and folates In climate-smart mitigation Strategy during peak hot humid periods in Enugu, Nigeria. (N=306)**

| Variable | Frequency | Percentage |
|---|---|---|
| **Age (in years):** | | |
| 31-40 | 36 | 11 |
| 41-50 | 14 | 48 |
| 51-60 | 66 | 22 |
| Above 60 | 58 | 19 |
| **Gender:** | | |
| Male | 34 | 11 |
| Female | 272 | 8 |
| **Marital status:** | | |
| Married | 227 | 74 |
| Single | 43 | 14 |
| Divorced | 18 | 6 |
| Widowed | 18 | 6 |
| **Educational level:** | | |
| No formal education | 46 | 15 |
| Primary education | 98 | 32 |
| Secondary education | 138 | 45 |
| Tertiary education | 24 | 8 |
| **Household size:** | | |
| Below 5 | 119 | 39 |
| 6-8 | 159 | 52 |
| Above 8 | 28 | 9 |
| **Farm size:** | | |
| Small scale | 285 | 93 |
| Medium scale | 15 | 5 |
| Large scale | 6 | 2 |
| **Poultry farming experience (years):** | | |
| 1-3 | 172 | 56 |
| 4-5 | 89 | 29 |
| 6-8 | 24 | 4 |
| 9-10 | 12 | 4 |
| Above 10 | 9 | 3 |
| **Cooperative membership:** | | |
| **(e.g. Poultry Association of Nigeria)** | | |
| Non member | 293 | 96 |
| Member | 13 | 4 |
| **Estimated Annual income from Noiler chicken farming (Naira N):** | | |
| >600,000.00 | 101 | 33 |
| 601,000.00-700,000.00 | 128 | 42 |
| 701,000.00-800,000.00 | 52 | 17 |
| Above 800,000.00 | 25 | 8 |

**Table 6: Responses on levels of uptake (i.e. awareness-and-adoption) of vitamin-C and folates in Noiler chicken climate-smart feeding during peak hot humid period in Enugu, Nigeria.**

| Questionnaire Item | VHU % | HU % | LU % | VLU % | IND % | Total no. of respondents | X | St. Dev. | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1. Dietary supplementation | 18 | 46 | 6 | 19 | 11 | 306 | 3.41 | 0.77 | Up-taken |
| 2. Water supplementation | 18 | 46 | 6 | 19 | 11 | 306 | 3.41 | 0.77 | Up-taken |
| 3. Feed formulation with vitamin-C and folates-rich ingredients e.g. citrus pulp | 0 | 0 | 0 | 20 | 80 | 306 | 1.20 | 0.23 | Not-Up-Taken |
| 4. Timing of supplementation | 0 | 9 | 0 | 28 | 63 | 306 | 1.55 | 0.47 | Not-Up-Taken |
| 5. Combination with other electrolytes to prevent hydration | 22 | 49 | 7 | 13 | 9 | 306 | 3.62 | 0.92 | Up-taken |
| 6. Use of protected vitamin-C such as coated & encapsulated to reduce degradation & bioavailability. | 11 | 22 | 15 | 18 | 34 | 306 | 2.58 | 0.87 | Not-Up-taken |
| 7. Monitoring of vitamin-C and folates level in feed and blood. | 0 | 0 | 0 | 20 | 80 | 306 | 1.20 | 0.23 | Not-Up-taken |
| 8. Use of vitamin-C and folates-rich premixes | 0 | 5 | 7 | 74 | 14 | 306 | 2.25 | 0.89 | Not-Up-taken |
| 9. Incorporating probiotics Such as Lactobacillus | 0 | 0 | 0 | 90 | 10 | 306 | 1.90 | 0.19 | Not-Up-taken |
| 10. Use of natural sources of vitamin-C and folates | 0 | 9 | 28 | 63 | 0 | 306 | 1.55 | 0.47 | Not-Up-taken |
| 11. Consultation with Animal nutritionist. | 0 | 5 | 7 | 74 | 14 | 306 | 2.25 | 0.89 | Not-Up-taken |

**Note:**

**VHA**- Very High Awareness/Adoption

**HA**- High Awareness/Adoption

**LA**- Low Awareness/Adoption

**VLA**- Very Low Awareness/Adoption

**IND**- Indifference

**X** – Mean

**St. Dev.** – Standard deviation

# Significance of the findings of the study:

- the prevailing high ambient temperature (AT) and high relative humidity (RH) acting on the birds during the period predisposed the birds to heat stress as an indication of climate change impact.
- Noiler chickens in the treated groups (T2, T3 and T4) must have been able to utilize the antioxidant effect of vitamin C in neutralization of the free radicals generated during peak hot humid periods.
- farmers' socioeconomic status in determined their ability to become aware and adopt the supplementation of Noiler chickens' diet with vitamin-C and folates as a mitigation strategy and as a way of adapting to climate change impact.
- This understanding is crucial for developing targeted climate-resilient adaptation policies and strategies to achieve food security..

- Out of the 11 climate-smart feeding adaptations strategies, 3 were up-taken i.e. the respondents in the study area were aware and adopted these strategies to help Noiler chicken adapt during peak hot humid period.
- The remaining 8 items not up-taken imply that the respondents might lack concern about the impacts of climate change on Noiler chickens especially during peak hot humid periods, have limited interest in learning about climate-smart feeding strategies, have no strong opinion about the benefits or drawbacks of adopting these practices, have no motivation to advocate for or invest in climate-smart feeding strategies etc.
- This provides evidence-based data for making policies aimed at increasing awareness and adoption of nutritional supplementation for Tropically-Adapted Improved Breeds (TAIBs) of chickens' diets and contribute significantly to agricultural development and food security in the study area.

# Conclusions and Recommendations

- **What is the main take away from this research:**
- **The interaction of vitamin C and folates during peak hot humid periods of the year significantly increased daily feed intake, significantly increased daily egg production.**
- **supplementation of Noiler chicken feed with vitamin-C and folates was a climate-smart adaptation and management strategy to intensively raise Noiler chickens which is dependent on socioeconomic characteristics of farmers and their awareness/adoption and as a contributor to climate change adaptation and resilience.**
- **Recommendations:**
- **It is recommended that Noiler chickens' diet in the hot humid ecological zone of West African Sub regions should be given combined supplementation of vitamin C (at 300 mg/kg feed) and folate (at 1 mg/kg feed).**
- **Noiler chicken farmers in Enugu State should be exposed to an interactive session with extension agents within their localities to be enlightened on the impact of climate change on poultry production,**
- **Noiler chicken farmers should be assisted with credit facilities and day-old chicks of Noiler chickens,**

- **Recommendations continues:**
- **Government and all the stakeholders in the livestock industry should harmonize and establish guidelines regarding adoption and implementation of climate-smart strategies in the mitigation and management of poultry species in hot humid environments,**
- **Noiler chicken farmers should be well informed on efficient, cost-effective, climate-smart and sustainable feed formulation strategies to ensure efficient poultry production systems as these would ensure the achievement of animal protein security in hot humid environments like Enugu, Nigeria.**
- **It is lastly recommended that further research is needed in the different and most effective awareness methods to be adopted by extension agents as this will bridge the gap in knowledge of utilizing vitamin-C and folates in climate-smart adaptation strategies in achieving sustainable food security in Enugu, Nigeria.**

# THANK YOU FOR LISTENING

- This research paper is presented at the:

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