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IMPACT OF SOLAR AND KEROSENE STOVE BROODING METHODS ON GROWTH RATE AND HAEMATOLOGICAL PARAMETERS OF BROILER CHICKEN

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ABSTRACT

The study compared the growth performance and haematology of broilers raised under solar and kerosene stove brooding systems. A total of 100 day-old broiler chicks were randomly assigned into 2 groups (A and B) of 50 birds each. Chicks in group A were placed in the solar brooder while those in group B were placed under the kerosene stove brooding method. The birds in each group were weighed weekly and their feed intake determined daily. At the 6th week, 3 ml of blood was collected from 5 birds randomly selected from each group. The blood sample was used to evaluate the haematological parameters using standard procedures. The results revealed that birds in group A had relatively higher weight gain and feed intake than group B (P > 0.05). There was no significant difference (p > 0.05) in packed cell volume, red and white blood cell counts and haemoglobin concentration between the two groups. However, lymphocyte counts were relatively higher while eosinophil numbers were significantly (p < 0.05) greater in number in the chickens raised under the kerosene-stove brooding system than the solar brooding system. Based on the findings of this study, solar brooding system was recommended for cheaper brooding cost and improved broiler production.

Keywords: Broiler, Brooding systems, Solar, Stove, Growth rate.

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INTRODUCTION

Poultry farming is a very important branch of animal agriculture in most developing countries, including Nigeria. This is due to its vital role in the economy and the supply of animal protein to the people [1]. Brooding is the care and management of birds for the first few weeks of life - normally 3 – 5 weeks depending on the weather [2]. For efficient poultry production, a good understanding of the brooding management and the adoption of an effective brooding system is imperative. This early stage is critical to the survival and ultimate productive performance of the birds for several reasons. First, at this age, the bird is not completely a ‘homeotherm’ as they are partially ‘poikilotherm’ with a tendency to assume the temperature of their immediate environment, hence the need to provide external source of warmth [2]. Secondly, at this age, the body temperature of the chick is 38.9°C and not up to 40- 41°C which is the

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normal body temperature of the adult bird [2]. Moreover, at this early stage, the five alveolar air sacs are functional and cold air from the environment could get into the chick through these air sacs and create health problems for the bird. Furthermore, the subcutaneous blood vessels are still covered by a thin skin layer at this age and cold air may get into the bird through these blood vessels [2]. Finally, the down feathers are unable to effectively protect the chick from cold weather until the juvenile feathers develop.

These are the important issues that make brooding management the beginning of the success or failure of any intensive broiler production enterprise. Failure to provide adequate conducive environment during the brooding period will reduce profitability, through reduced growth and development, poorer feed conversion and increased disease incidence, condemnation and increased mortality [3].

The common sources of energy for brooding operation are electric bulbs for those that have access to electric power supply, kerosene lamps/stove or a combination of electricity and kerosene lamp/stove. However, even those farmers that have access to electricity, the frequent power outages make that source very unreliable. Researchers have observed that conventional energy consumption in poultry production is quite enormous and expensive [4,5,6,7]. The technology of fueling poultry chick brooding system poses environmental problems and health hazards to plants, animals and man [5,7]. Kerosene brooding systems are known to result to fire outbreaks and production of green house gases (GHG) such as carbon dioxide (CO_2) and carbon monoxide (CO) that constitute environmental pollutants. These pollutants may have contributed to loss of huge sum of money, low productivity, high mortality rate and consequent decreased profitability [5]. For successful poultry production in developing countries such as Nigeria, alternative methods of meeting the energy needs in the poultry industry have to be evolved. Such alternative energy resources should be reliable, in abundant supply, environmentally friendly, pollution free and fire incident free and moreover should be inexpensive. Solar energy appears to be the best alternative for now. This is because solar energy is a clean cheap energy to harness and available all through the year in all parts of the tropics including Nigeria.

The objective of this study was to compare the productive performance of broilers under solar brooding and kerosene-stove brooding systems with a view to determining which brooding technique should be recommended for optimum broiler production in our environment.

MATERIALS AND METHODS

Brooding Equipments

Solar brooding chamber

The solar brooding chamber used for the study has capacity for brooding and raising 50 birds to maturity. This solar brooder has a wooden frame and an aluminum top installed with a solar heater (Fig. 1). The 50 bird capacity solar brooder is estimated to cost fifty thousand naira (₦50,000.00) and has a life span of 20 years [4]. At an average brooding rate of 4 batches per year, it would produce 200 birds each year such that during its life span, it would have produced 4,000 birds.

Kerosene stove brooder

One kerosene stove and a brooding hover were provided in a poultry brooding room that has capacity for 50 birds. It has been estimated that to brood 1000 day-old chicks, a farmer used 40 litres of kerosene per day [5]; amounting to 0.04 litres/bird/day. Therefore, for a 28 day (4 week) brooding period, the farmer would require 1.12 litres of kerosene/bird in a batch of 1,000 birds.

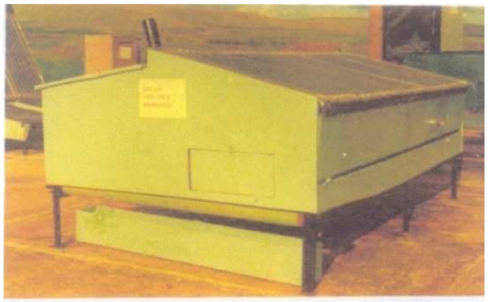

Fig. 1: Small Scale Solar energy poultry chick brooding system (50 Chicks capacity

Day Old Chicks inside Solar Energy Brooding System

Experimental Birds/Design

One hundred day-old Abor Acres breed broiler chicks procured from a hatchery at Ibadan, Nigeria were randomly assigned into 2 groups (A and B) of 50 birds each. Group A chicks were placed in the solar brooding chamber while birds in group B were kept under the kerosene stove and brooding hover. All the birds were given the same broiler starter and finisher *ad libitum* and the quantity of feed consumed each day was determined by subtracting the quantity of feed left each morning from the quantity of feed that was fed the previous day. Water was also given *ad libitum.* The birds in each group were weighed weekly. The study was conducted at the Experimental Poultry Unit of the Centre for Energy Research and Development, University of Nigeria, Nsukka.

Medication/vaccination

A multivitamin preparation (Keproceryl®, Pantex Co., Holland) was given in water for the first 5 days as an anti-stress. Pantacox® was chemoprophylactically administered at the age of 2 weeks and repeated at the 5th week to prevent coccidiosis. Newcastle disease vaccine and Infectious bursal disease (Gumboro) vaccine were given according to the manufacturer’s instructions (National Veterinary Research Institute, Vom, Nigeria).

Haematological Parameters

At the 6th week, 5 birds were randomly selected from each experimental group and 3 ml of blood was collected from the wing vein into a sample bottle with EDTA as anticoagulant. The blood sample was used to determine packed cell volume (PCV), haemoglobin concentration (HbC), red blood cell (RBC) and total leukocyte (TLC) counts and differential leukocyte counts following standard procedures (Hutchison *et al*, 2011). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were determined using the standard formulae [8].

Data Analysis

Results of the weekly weight and feed intake were analyzed using repeat measure analysis of variance (ANOVA) while the haematological parameters were analyzed with one-way ANOVA. Group means were compared using least significant difference (LSD) tests. Level of significance was accepted at $p<0.05$. All the analyses were performed with SPSS for Windows 15.0.

RESULTS

It is estimated that for the solar brooder to produce 4,000 birds during its life span of 20 years, each bird would have contributed ₦12.50 to off-set its purchase price of ₦50,000.00. On the other hand, at the current price of ₦140/litre of kerosene, each bird in a brooding batch would have required 1.12 litres of kerosene at ₦156.80.

None of the birds in the two brooding groups died during the study. Mean weight gain, feed intake and feed efficiency were slightly higher in the group under solar brooding than the kerosene stove brooding system although these were not statistically significant ($p > 0.05$) (Table 1). Consequently, feed conversion ratio was relatively higher in the kerosene brooding than solar brooding group. The haematological parameters evaluated during the study were not significantly different ($p > 0.05$) between the kerosene and solar brooding systems (Table 2).

Table 1. Weight gain, Feed intake, Feed conversion ratio and Feed efficiency of broilers under Solar and Kerosene/ Stove Brooder Systems.

Parameters	Solar Brooder	Kerosene/Stove Brooder
Day old live weight (Kg/Bird	0.09 ± 0.01	0.09 ± 0.01
Final 6 weeks live weight (Kg/Bird)	2.51 ± 0.05	2.43 ± 0.07
Final 6 weeks weight gain (Kg/Bird)	2.42 ± 0.04	2.34 ± 0.06
Daily weight gain (g/kg)	57.62 ± 0.01	55.71 ± 0.09
Daily Feed Intake (g/Bird)	103.20	101.36
Feed Conversion Ratio (FCR)	1.79	1.82
Feed Efficiency (FE, %)	55.83	54.96

Table 2: Mean (± standard errors) haematological profile of broilers managed under Solar (SB) and Kerosene Stove (KS) brooding systems.

Parameters	Solar Brooder	Kerosene/Stove Brooder
Packed cell volume (%)	29.50 ± 0.50^a	29.17 ± 0.44^a
Red blood cell count ($x10^6/\mu L$)	2.51 ± 0.09^a	2.45 ± 0.03^a
Haemoglobin cencentration (g/dl)	9.31 ± 0.30^a	8.45 ± 0.91^a
Mean corpuscular volume (fl)	117.75 ± 5.48^a	118.81 ± 3.37^a
Mean corpuscular haemoglobin (pg)	37.07 ± 0.70^a	34.31 ± 3.35^a
Mean corpuscular haemoglobin concentration (mg/dl)	31.58 ± 1.16^a	29.07 ± 3.54^a
White blood cell count ($x10^3/\mu l$)	12.98 ± 0.90^a	13.22 ± 1.16^a
Heterophil count ($x10^3/\mu l$)	5.97 ± 0.39^a	6.76 ± 2.26^a
Lymphocyte count ($x10^3/\mu l$)	9.89 ± 0.54^a	14.31 ± 3.64^b
Monocytes ($x10^3/\mu l$)	0.08 ± 0.08^a	0.16 ± 0.10^b
Eosinophils ($x10^3/\mu l$)	0.21 ± 0.03^a	0.54 ± 0.10^b
Basophils ($x10^3/\mu l$)	0.05 ± 0.05^a	0.17 ± 0.10^b

^{ab}Figures in the same row with different superscripts are significantly ($p<0.05$) different.

DISCUSSION

The results suggest that birds in the solar brooder (group A) gained slightly more weight and had slightly higher feed intake and feed efficiency than those under the kerosene stove brooder. It is also probable that birds under the solar brooder may have experienced less stress and thus were more comfortable enabling them to consume relatively more feed to grow relatively faster than those in the kerosene brooder group. The slightly better efficiency of feed utilization by the birds under solar brooding agrees with earlier observations [5] that reported faster growth rate with solar brooding than with kerosene brooding system.

The haematological profile revealed that the chicks under the solar brooder had slightly higher PCV, RBC and HBC values while those in the kerosene stove had relatively higher total leukocyte counts with relatively greater numbers of differential leukocytes. It is possible that birds under the kerosene brooding may have had greater exposure to opportunistic pathogens which may have necessitated the proliferation of leucocytes, especially the lymphocytes and eosinophils; an indication of enhanced immune response.

The results suggest that at the cost of ₦12.50/bird, the solar brooder system is comparatively cheaper than the ₦156.80/bird in a batch under the kerosene stove brooder system. The later cost, which excludes the purchase price of the kerosene stove and the brooding hover, is more than twelve times higher than the cost of using the solar brooding system.

In conclusion, therefore, the results of this study suggest that the solar brooding system had relatively greater advantage over kerosene/stove brooding in terms of cost, weight gain and better haematological profile which make for improved health status in broilers during the brooding period. Based on the findings of this study, the solar brooding system is recommended over the kerosene/stove brooding system for cheaper and improved broiler production in the study area.

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