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# Water and feed consumption in broiler birds during a typical hot weather condition in Akure, Ondo State, Nigeria

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## ABSTRACT

This study investigates the variability in feed and water consumption in broiler birds during a typical hot weather condition in Akure, Nigeria. Feed and water consumption as well as air temperature and relative humidity were monitored and the relationship between them was analyzed. The results showed that the daily water and feeds consumption of the birds are very closely related and increase over the course of the grow out. Water and feed consumption were also observed to be a linear function of broiler's age; the birds were drinking 0.731 times of their age in kg of water and were eating 0.031 times their age of feed at any point in time. The result showed that under the prevailing environmental conditions, birds were consuming no less than 2.3 times more water than feed. The ratio of feed to water consumption is fairly constant over the life of the flocks. For this particular grow out the ratio of kilogram of water to kilogram of feed was 2.32 kg of water per kg of feed consumed. So whether a bird was a week old or seven weeks old, for every kilogram of feed eaten 2.32 kilogram of water was consumed. Ambient temperature was shown to have strongly influence the pattern of feed and water consumption indicated, high temperatures decreasing feed consumption and increasing water consumption.


**Keywords:** Bird age, temperature, humidity, variability, consumption level.

## INTRODUCTION

In many parts of the world, the poultry industry occupies a leading role among agricultural industries, as it is the main supplier of animal protein for human population. Hot weather is a common problem in tropical countries such as Nigeria with dry season temperatures above 30 °C. The detrimental effects of a hot environment on the performance of poultry have been well documented. Heat results in decreased feed consumption and increased water consumption. As temperature rises, the bird has to maintain the balance between heat production and heat loss, and so will reduce its feed consumption to reduce heat from metabolism (Morêki, 2008). Research has demonstrated that feed consumption is reduced by 5% for every 1 °C rise in temperature between 32 and 38 °C. At high temperatures, heat production in birds decreases while heat dissipation increases. The main pathway of heat dissipation for birds under hot environment is respiratory


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evaporation, especially when ambient temperatures approach the body temperature. The annual economic loss in the Americas and Asia due to heat stress is enormous (Lacy, 2002; Donald et al., 2001). Similar losses if not more are likely for broiler production in Nigeria, but this has not been quantified yet.

However, it is well known that at normal temperatures, poultry birds consume at least twice water as much as feed. When heat stress occurs, water consumption will double or quadruple. The water requirement of broiler birds depends on the environmental temperature and relative humidity, the composition of the diet, growth rate, and the efficiency of water resorption by the kidney. Broilers increase water consumption approximately seven per cent for each degree increase in temperature (Fairchild and Ritz, 2012). According to Czarick et al. (2001), for a commercial broiler house, the ratio of pounds of water to pounds of feed was 1.5 pounds of water per pound of feed consumed in winter, but more of a challenge during summer, the ratio of water to feed increases slightly due to the fact that birds drink more water to cool themselves. It is important to note that even though the close relationship between feed and water consumption is a well documented fact, it is difficult to say that birds on all farms, the ratio could change a bit with size of bird grown, breed, density, weather or other factors (Watkins, 2003; Dozier, 2003). Birds constantly regulate heat loss from the body, energy and heat flow in broilers. The normal core body temperature of poultry birds is about 41 – 42 °C, but will fluctuate depending upon the temperature of its environment. Any combination of environmental factors including temperature and humidity that act to increase body temperature will cause heat stress

The optimum body temperature in birds is much closer to the point of heat death than of cold death, and domestic poultry maintain a body temperature, which is only 4 – 5 °C below the point at which enzyme inactivation begins. Meanwhile, before deep body temperature reaches 46 – 47 °C death often takes place because of desiccation (Swick, 1998). In contrast the body temperature of birds can drop by 20 °C below normal body temperature, and then if re-warmed carefully the birds will recover completely (Dozier, 2003). When surrounding air is too cool, the bird has to use its feed energy to just warm and keep itself warm, if the air temperature is too warm and the air is still (no wind), the bird has to expend feed energy in panting or lifting its wing to shed excess internal heat and keep its own temperature from going high (Donald et al., 2001). Birds are more cold tolerant than heat tolerant and they are much more likely to die from heat stress than from cold stress (Tabler, 2003; Tabler, 2013). The proportion of heat lost through radiation, conduction, and convection depends upon the temperature difference between the bird and its environment. At high temperatures, heat production in birds decreases while heat dissipation increases. The heat dissipation pathway for birds under hot environment is respiratory evaporation, especially when ambient temperatures approach the body temperature (Morêki, 2008). Therefore, this study examined the relationship between water and feed intakes on broiler grown-up under typical hot weather conditions and also the effect of air temperature variations on broiler feed and water consumption.

## MATERIALS AND METHODS

### Experimentation

The study was carried out at the University Teaching and Research Farm (Livestock section), Federal University of Technology Akure, Ondo State, Nigeria (7° 15’N 5° 17’E), in a section of an open sided naturally ventilated poultry house during dry season, with dimension 12 m x 6 m. The birds were raised on floor litter of wood shavings. The feed and water consumption data presented investigate the effect of different ratio mix of feed and water on broiler performance using normal dry feed as control, 0.5:1, 1:1, and 2:1 ratio mixes of feed and water.

There were three replications of each treatment with 10 birds in each replication, raised in a partitioned area of 1.5m x 2m. There were a total of 120 birds. The birds were 8 days old when the measurement started. The feed mixes and water were administered ad-libitum under prevailing weather and environmental conditions and were measured with a weighing scale and measuring cylinder respectively. Air temperature and relative humidity were measured with a digital temperature and humidity sensor (Delta-T RHT1) connected to a data logger (Grant, 1250 series). Measurements were sampled at 30 seconds intervals and 10 minute averages stored. Data was downloaded from the data logger at 48 hours interval with a personal computer.

Data capture was good, about 85%. The 15% loss is responsible for the breaks that would be observed in the presented data later on. The loss was due to rodent and termite attacks on the sensor connection wires and cables inside and outside the poultry house respectively. Rat poison took care of the rodents inside the poultry house. Adequate care should be taken when using such agents, as they could also be harmful to the birds if not used properly. The sensor connection wires and cables outside the poultry house were raised off the ground above the reach of the termites with metal racks and data capture was very good since then.

**Statistical analysis**

Data analysis was performed using basic descriptive statistics and the plots of variability trend of feed and water consumption level as well as linear regression analysis with climatic condition (temperature and humidity measurement) to determine the coefficient of variation.

## RESULTS AND DISCUSSION

The variation of feed and water consumption with bird age, showed that the water intake increases with age (Figure 1a and b). Linear relationship between feed and water consumption was established which shows that under the prevailing environmental condition, birds were consuming no less than 2.3 times more water than feed (Figure 2). This implies that the ratio of feed to water consumption is fairly constant over the life of the flocks. For this particular grow out the ratio of kilogram of water to kilogram of feed was 2.32 kg of water per kg of feed consumed. Water and feed consumption were also observed to be a linear function of broiler age and showed that birds were drinking 0.731 times of their age in kg of water and were eating 0.031 times their age of feed at any point in time. It is important to note that even though the close relationship between feed and water consumption is a well documented fact (Czarick et al., 2001; Dozier et al., 2002), it is wrong to assume that the relationship between feed and water consumption will be the same on all farms. This result further emphasizes this fact. The ratio could change with size of bird grown, breed, and density, environmental or other factors.

Water intakes will also vary considerably depending on the air temperature and relative humidity. Relative humidity was observed to be at or near 90%-100%, inside and outside the broiler house respectively at night when the air temperatures are the lowest, in the low to mid twenties (22-25 $^{\circ}$C). However, as the sun rises and temperatures increase to highs in the mid thirties (32-35 $^{\circ}$C), about a 10 $^{\circ}$C increase, the relative humidity is approximately cut in half and drops to between 40 to 50%. It was generally observed that as temperature increases, the relative humidity decreases. There was no observed significant difference in air temperature inside and outside the broiler house during the hottest part of the day, but the outside temperature was observed to be about 1-4 $^{\circ}$C cooler than the inside of the poultry house at night.

**Effect of high ambient temperature on feed and water consumption**

One of the most important things to look for when monitoring feed and water consumption is sudden increase or decrease, sudden rise in water consumption and a corresponding decrease in feed consumption are typically related to a heat stress situation while decreases could be signs of a disease situation or bad feed, bad water, or light problem. A good example of this can be seen in the graph below in Figure 3; water consumption and average house temperature during a heat wave (a period of abnormally uncomfortable hot and usually humid weather of at least one day duration, but conventionally lasting several days to weeks.

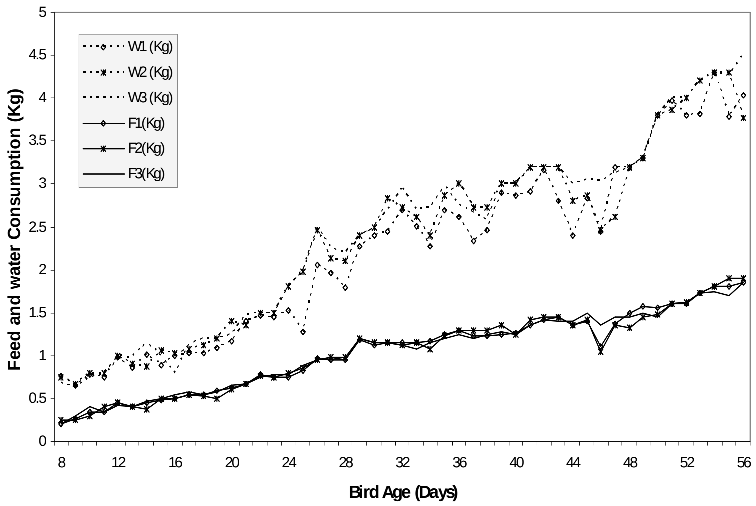


**Figure 1a:** Feed and water Consumption during a hot weather broiler grow out.

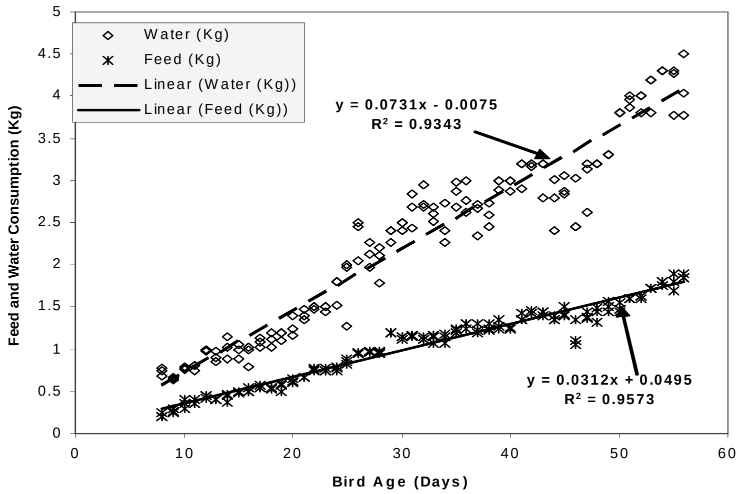


**Figure 1b:** Relationship between feed and water consumption with bird's age during a hot weather broiler grow out.

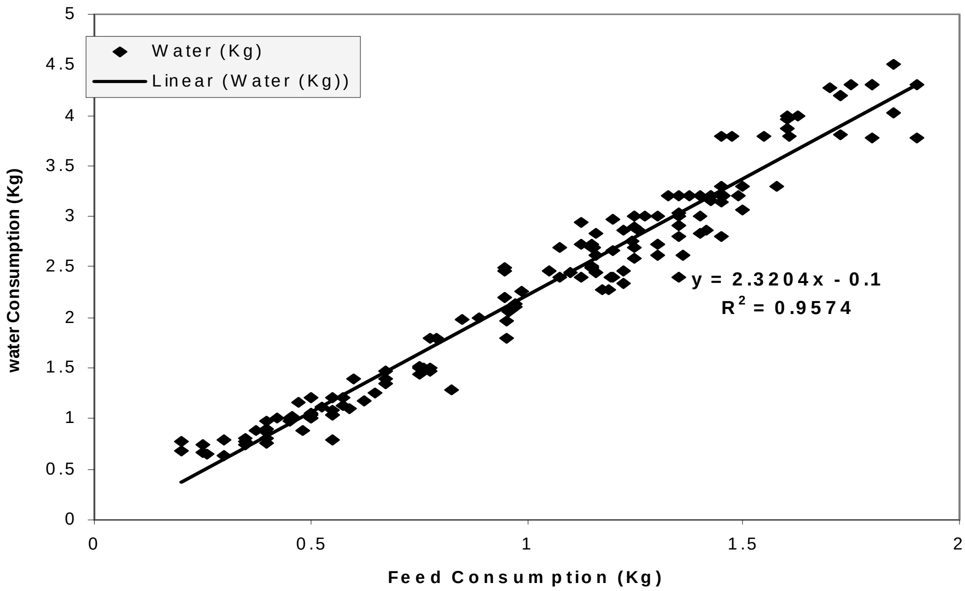


**Figure 2:** Relationship between feed and water consumption during a hot weather broiler grow out.

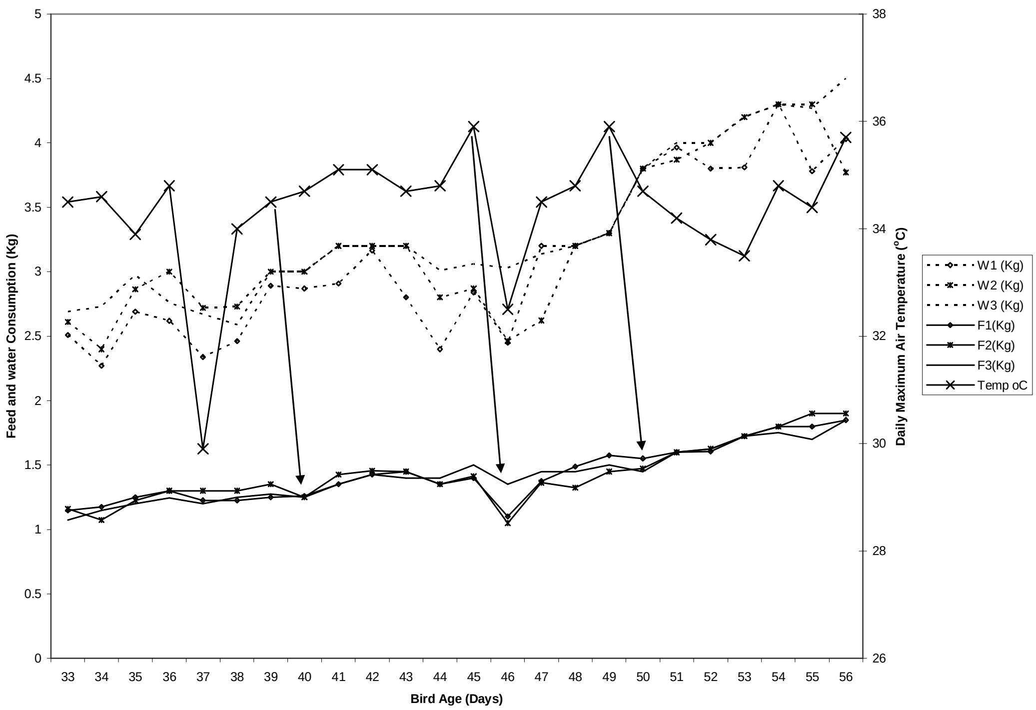


**Figure 3:** Variation of feed and water consumption, and maximum air temperature during a heat wave period during the study.

Operationally heat wave is defined as 3-5 successive days with maximum temperature exceeding a threshold, of 32 °C (Donald et al., 2001; Morêki, 2008) period during this particularly hot weather grow out study.

As depicted in Figure 3, it can be seen that on days with high temperatures, there is a drop in feed consumption and slight increase in water consumption. The dips in the temperature series were due to rainfall events occurring on the evenings or nights of days with very high temperature maximum. It is also observed that the drastic drop in temperature after rain does not significantly alter feed, but slightly reduced water consumption. This indicate that on the cool days, birds were fairly comfortable, ate as much as they could and did not need as much water to cool themselves has they would on hot days.

## Conclusion

The result shows that feed and water consumption increases with the bird age looking at the relationship during the study period and the conditions under which broilers are raised is very crucial. It's showed that the naturally ventilated open-sided broiler houses in Akure are far from adequate for maximum production efficiency as performance will be greatly adversely affected due to heat stress. The actual level of loss to the farmer still needs to be quantified. Broilers are constantly producing heat as they eat and grow; this waste heat needs to be eliminated. Hot and humid weather slows this natural process and reduces performance and profit. However, to maintain body temperature by sensible heat loss, the birds do not need to drastically alter their normal behavioural patterns, feed intake, or metabolism. The poultry house design and ventilation will therefore be to maintain a high enough air velocity or a low enough temperature in the house that the birds can maintain body temperature by sensible heat loss. It is important to know that broilers have a strict priority system in the process of converting feed to meat, dictating that feed nutrients always go first to body maintenance functions, such as maintaining internal body temperature. This implies that, the feed nutrients that can be used for growth and weight gain are those available after the broiler's survival needs has been met. When birds are stressed, they are unable to maximize weight gain, using more feed nutrients for body maintenance and less for growth.

Therefore, any management technique that increases nutrient intake during heat stress will minimize the drop in bird's efficiency. Nutrient consumption can be increased by increasing nutrient density, taking advantage of natural increases in feed consumption at certain times of the day, and keeping birds as cool as possible. Birds can be kept cool by providing adequate ventilation (use of circulation fans, tunnel ventilation) and evaporative cooling systems. The provision of ample cool water and prevention of solar radiation into the poultry house and water system will also be highly beneficial. The use of high chick quality, balanced nutrition, and lower stocking density will also be extremely useful. A combination of sound environmental and nutrition management will greatly improve production efficiency and yield maximum profitability.

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