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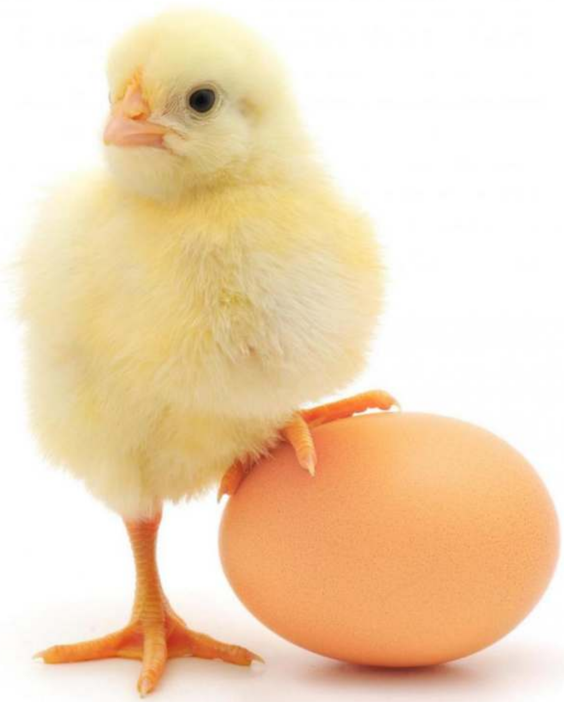

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Physiological and Behavioural Response of Broilers Fed Wet Mash with or Without Drinking Water During Wet Season in the Tropics

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Abstract: The effect of wet feeding with or without drinking water on rectal temperature, respiratory rate, behavioural pattern (panting, eating and resting), haematological and serum biochemistry of broilers was investigated. Seventy (70), six weeks old broilers were used for the study. The treatments consist of: Conventional dry mash and Wet mash with varying amounts of water addition (1.0, 1.5, 2.0 parts of water to 1 part of feed) with or without drinking water. Mixing was done at the time of feeding. Results showed that there was no significant relationship between behavioural pattern (panting, eating and resting) and feeding form in the morning ($p>0.05$, $X^2 = 0.52$), afternoon ($p>0.05$, $X^2 = 3.28$) and evening ($p>0.05$, $X^2 = 0.94$). Respiratory rate was significantly ($p<0.05$) affected by feeding form. The adaptive mechanisms of panting and increased rate of respiration ensured that rectal temperature was not significantly ($p>0.05$) affected by feeding form. Heamatological indices did not show any significant ($p>0.05$) variation with the application of wet feed with or without drinking water. However, WBC differentials for oesinophils and monocytes were significantly ($p<0.05$) affected. Serum urea levels and electrolytes (Na^+, Ca^+, K^+, HCO_3^- and Cl^-) were significantly ($p<0.05$) affected by the use of wet feeding. Serum electrolyte results suggest a slight disturbance in the maintenance of water/electrolytes balance in all wet feed birds except $W^{+1.0}$.

Key words: Wet mash, haematology, serum biochemistry, behaviour, broiler chickens, tropics

INTRODUCTION

Fast rate of weight gain and high feed conversion efficiency is of paramount importance in broiler production and as a means of achieving these feats, wet feeding has been advocated and have been practiced in small scale enterprises (Yalda and Forbes, 1995). Wet feeding has been reported to stimulate an increase in dry matter intake, growth rate and feed conversion efficiency in broilers and cockerels of egg laying strains (Yalda and Forbes, 1995; Tadtiyanant *et al.*, 1990; Awojobi and Meshioye, 2001; Awojobi *et al.*, 2007; Awojobi *et al.*, 2009).

Water intake by animals is intermittent, even more so than food (Iheukwumere and Herbert, 2003), the question now is what happens when food is offered in the wet form, particularly without drinking water. Similarly, water loss from the body has been reported to be continuous (Iheukwumere and Herbert, 2003) and the bird must balance intake and output to maintain its physiological functions. Another question that therefore arises is whether the necessary balance between water intake and output will be maintained when feed is given in the wet form with or without drinking water. It is important to know whether the pattern of feed to water intake and the balance between water intake and output are such that physiological functions of the body are kept within normal limits. Esonu *et al.* (2001) had reported that the physiological response of the animal to its internal and external environment, which include feed and feeding is reflected in the haematology. The process of haemodilution and haemoconcentration has been reported to be dependent on the type and pattern of water restriction (Graf, 1984) and since the level of water added to feed in wet feeding program vary among researchers either extreme can happen. Hill and Powell (1975) have reported that severe restriction of water to animals causes decline in red blood cells. Significant differences in the pattern of haematology and serum biochemical constituents in birds with varying levels of water intake have also been reported by Iheukwumere and Herbert (2003).

The need to examine the physiological response to wet feeding is perhaps more critical in the tropics, this is because of the higher incidence of heat stress on account of the high ambient temperature and relative humidity in the tropics. Heat stress in poultry is characterized by low feed intake and panting or gasping. Abasiekong (1989) has reported beneficial effect of 0.33 or 0.50 addition of water to feed in broiler given *ad libitum* water intake in the hot season (37°C). However, since it has been advocated from studies conducted under temperate conditions using broiler (Yalda and Forbes, 1995) that there is no additional benefit from giving water when feed is adequately wetted, the physiological response of birds to such treatment in the tropics is crucial.

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Also, against the background of animal welfare, it is pertinent to examine certain physiological indices, whether they fall within normal limits as a way of assessing the comfortability of birds on wet feeding. Therefore the objectives of this research are:

- To assess the effect of different levels of water addition to feed with or without drinking water on the behavioural pattern of broilers.
- To assess the effect of wet feeding with or without drinking water on vital organ function through measurements of the vital signs body temperature and respiration.
- To assess the effect of wet feeding with or without drinking water on haematology and serum biochemical constituents of broiler.
- To assess the level of water addition to feed with or without drinking water that is compatible with optimal broiler performance with the least stress to the physiology of the birds.

MATERIALS AND METHODS

Location of study: The experiment was carried out at the Teaching and Research Farm, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus, Ayetoro, Ogun State, Nigeria. Ayetoro is located in latitude 7°15' N and longitude 3°3' E in a deciduous/derived savannah zone with an annual rainfall of 1909.3 mm. Maximum temperature varies between 29°C during the peak of the wet season and 34°C at the onset of the wet season. Mean annual relative humidity is 81% (Onakomaiya *et al.*, 1992).

Experimental animals and management: Day old broiler chicks were obtained from a reputable hatchery in Ogun State, South-West, Nigeria. They were fed commercial broiler starter for the first 6 weeks and broiler finisher for the last 4 weeks. Other details about management are as described by Awojobi *et al.* (2009). At the end of the first 6 weeks, 70 birds were randomly allocated to 7 treatments of 10 birds each. Each treatment was replicated 5 times with 2 birds per replicate. The treatments are as follows:

Dry = Conventional dry feed with drinking water *ad libitum*.

$W^{+1.0}$ = Wet feed (1 part of feed to 1.0 part of water) with drinking water.

$W^{+1.5}$ = Wet feed (1 part of feed to 1.5 parts of water) with drinking water.

$W^{+2.0}$ = Wet feed (1 part of feed to 2.0 parts of water) with drinking water.

$W^{-1.0}$ = Wet feed (1 part of feed to 1.0 part of water) without drinking water.

$W^{-1.5}$ = Wet feed (1 part of feed to 1.5 parts of water) without drinking water.

$W^{-2.0}$ = Wet feed (1 part of feed to 2.0 parts of water) without drinking water.

Data collection

Behaviour and vital signs: The body temperature of the chicks was taken per rectum and the poultry house temperature was also taken by the use of thermometer everyday in the morning (7 am), afternoon (1 pm) and evening (7 pm) during the experimental period. The respiration rate, numbers of birds that are panting, resting and eating were taken at the same time. These data were taken between the 8th and 10th weeks of age.

Blood samples: At 10 weeks of age, blood samples were collected from the birds on the 7 treatments by taking 1 bird per replicate. Blood was collected in the morning from the jugular vein. Blood was collected into sample bottles treated with Ethylene Diamine Tetra Acetic Acid (EDTA) for haematological assay and a second set of glass tubes without anticoagulant for serum separation.

Analytical procedure: The blood samples collected were assayed within 3 h of their collection for total erythrocyte counts which was obtained from blood diluted to 0.02 ml in an automatic diluter CELM DA 500. The diluted sample was then analyzed in an automatic counter and the result was expressed in cell number/mm^3. Haemoglobin was determined by the cyanometahaemoglobin method. Cells were lysed and centrifuged for 5 minutes at 3,000 rpm. Colour was read with a spectrophotometer at 540 nm and values were expressed in g/100 ml. Hematocrit (PCV) evaluation was done with the microhaematocrit method and values obtained expressed in percentage. White blood cell counts were determined using a Neubauer chamber and results were expressed in cell number/mm^3. Mean Cell Volume (MCV), Mean Cell Hemoglobin (MCH) and Mean Cell Hemoglobin Concentration (MCHC) were calculated as described by Mitruka and Rawnsley (1977). The hematological analysis techniques used in this study are as described by Dein (1984).

The coagulated blood samples were subjected to standard method of serum separation. The total protein was determined by Kjedahl procedure as described by Kohn and Allen (1995) while albumin was determined using Bromocresol Green (BCG) method as described by Peters *et al.* (1982). Serum glucose and urea estimation was carried out as described by Jain (1986) while creatinine was determined by the method of Kaplan and Szabo (1983). Chemical constituents (Na^+, K^+, Ca^{++}, Cl^- and HCO_3^-) were also determined by standard flame photometry (Gallencamp).

Statistical analysis: The data obtained from this study were subjected to Analysis of Variance for a completely randomized design while the treatment means were compared using Duncan's Multiple Range Test as outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Figure 1 shows the mean effects of wet feed with or without drinking water on the behavioural (panting, eating and resting) pattern of broilers in the morning. The result showed that there is no significant relationship ($p>0.05$, $X^2 = 0.52$) (Table 1) between the form of feeding and behavioral pattern. In the morning birds were either eating or resting. There was no incidence of panting across all experimental treatments in the morning. This is understandable, (mean morning temperature was 23.7±4°C) since the birds were not under any form of heat load. In the morning majority of the birds across all treatments were resting. The morning feed was yet to be served at the time the morning observations.

In Figure 2 behavioural pattern have changed in the afternoon. All the same, there were no significant relationship ($p>0.05$, $X^2 = 0.28$) (Table 1) between treatment mean and feeding form. Expectedly, the rate of panting has increased across all experimental treatments. Panting is a behavioural adaptation to maintain body temperature within normal limits in the face of increasing room temperature (27.4±4°C). Panting was followed by resting across all treatments while very few birds were eating. Reduction in feed intake is a normal behavioral response to high ambient temperature in birds (Oluyemi and Robbert, 2001). Moreso, since animals (including birds) eat to satisfy their energy requirement part of which is dissipated off as heat.

Figure 3 shows the behavioural response of birds to treatment effects in the evening. The order of behavioural response was resting > eating > panting across all treatments. However, results do not show any significant relationship ($p>0.05$, $X^2 = 0.94$) (Table 1) between feeding form and behavioural patterns. Again, the room temperature has decreased (25.1±4°C) and panting drastically reduced though birds are fed *ad libitum*. Feeding has been done by 6:00pm and the birds have eating to satisfaction, hence the majority were found in the resting category.

The results of behavioural pattern in this experiment showed that response was largely influenced by the house temperature. The application of wet feed (with or without) drinking water therefore did not predispose the birds to an undue increase in body temperature that cannot be controlled by the adaptive mechanisms of panting and increased rate of respiration.

Table 2 shows the effect of wet feed with or without drinking water on the rectal temperature of the birds. The results obtained from this study showed that there are no significant ($p>0.05$) differences in the rectal temperature of the birds both in the morning, afternoon and evening.

The broilers on $W^{+1.0}$ showed the highest mean value of rectal temperature of 41.5°C in the morning while the bird on $W^{-1.5}$ showed the lowest mean value (41.24°C) of rectal temperature. The broiler on $W^{+2.0}$ showed the highest mean value of rectal temperature of 41.9°C in the afternoon while the birds on $W^{-2.0}$ showed the lowest mean value (40.6°C). The mean rectal temperature for birds on all treatment was 41.7°C in the evening. Therefore, temperatures were lowest in the morning and highest in the evening across all treatments. In the mornings and afternoons the lowest average temperature were recorded in birds on wet feed without

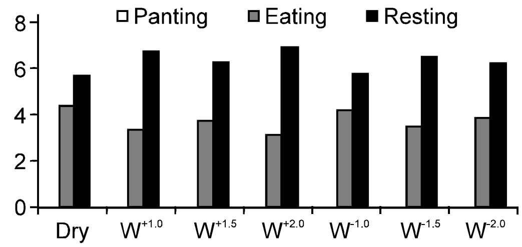

Fig. 1: Behavioural pattern of broilers in the morning when fed wet feed with or without drinking water

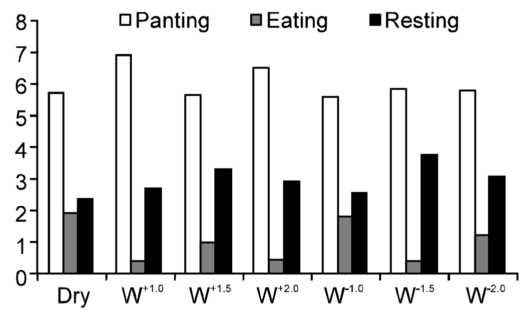

Fig. 2: Behavioural pattern of broilers in the afternoon when fed wet feed with or without drinking water

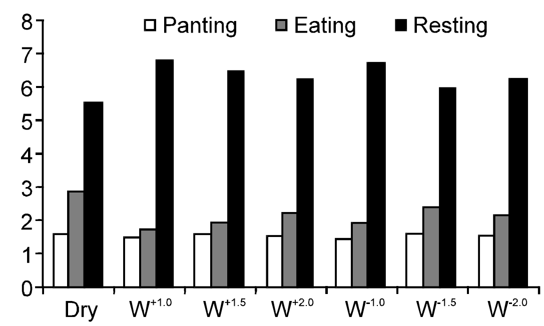

Fig. 3: Behavioural pattern of broilers in the evening when fed wet feed with or without drinking water

Table 1: Behavioural pattern (panting, eating and resting) in broiler fed wet mash with or without drinking water

Period	X^2 cal	X^2 tab	Decision
Morning	0.52	21.026	NS
Afternoon	3.28	21.026	NS
Evening	0.94	21.026	NS

Table 2: Rectal temperature of broiler fed wet mash with or without drinking water

Periods	DRY	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
Morning	41.49	41.54	41.34	41.39	41.44	41.24	41.29	0.30
Afternoon	41.92	41.93	41.90	41.99	41.85	41.87	40.68	0.83
Evening	41.71	41.71	41.66	41.71	41.67	41.65	41.66	0.08

a,b- Means in the same row with different superscript differ (p<0.05)

Table 3: Respiratory rate of broiler fed wet mash with or without drinking water

Periods	DRY	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
Morning	46.17^{ab}	51.91^{a}	54.40^{a}	51.80^{a}	43.11^{b}	49.31^{ab}	49.80^{ab}	3.39
Afternoon	58.7^{ab}	59.26^{ab}	66.46^{a}	67.40^{a}	51.54^{b}	63.00^{ab}	59.80^{ab}	5.79
Evening	49.17^{b}	54.74^{a}	59.71^{a}	56.71^{a}	44.89^{b}	54.68^{a}	56.17^{a}	4.27

^{a,b}Means in the same row with different superscript differ (p<0.05) significantly

drinking water. The result of this experiment has demonstrated that wet feed without drinking water, at least within the limits of 1:1-1:2 did not have negative effect on temperature regulation. It has also established that the provision of drinking water for birds on wet feed did not confer any additional advantage from the standpoint of temperature regulation. Yalda and Forbes (1995) have reported that wet feeding with and without drinking water did not affect the performance of broilers significantly.

According to Oluyemi and Robbert (2001), mean adult temperature for domestic fowl is 40°C. Average temperature recorded across all treatments was slightly higher than the literature values. This is likely due to the effect of prevailing temperature in the poultry house. The mean room temperature in the poultry house was 23.7°C (morning), 27.4°C (afternoon) and 25.1°C (evening).

Table 3 shows the effect of wet feeding with or without drinking water on respiratory rate of experimental birds. Morning, afternoon and evening respiratory rates showed significant (p<0.05) variations between treatments. In the morning all wet fed groups with drinking water had higher respiratory rates than the control and all birds on wet feed without drinking water. Similar trends were observed for the afternoon and evening respiration rates. Mean respiratory rates of birds on $W^{-1.0}$ (1 part of feed to 1 part of water, without drinking water) was significantly (p<0.05) lower than all wet fed treatments with drinking water for morning, afternoon and evening measurements. Values for the evening measurement for $W^{-1.0}$ are also comparable with the control.

The pattern of respiration changes from morning through evening followed the same trend as for temperature. Hence, the lowest respiratory rate occurred in the morning and the highest rate in the afternoon. As observed for temperature changes, respiratory rates were also lowest in birds on wet feed without drinking water. This result again suggests that wet feed without drinking water does not have a negative effect on the respiratory rate of the birds. Respiratory rate in the domestic fowl ranged from 18-37 times per minute (Merck Vet. Manual, 1979). The respiratory rate observed across all treatments was however higher than the literature value. This is expected since the same trend was observed with rectal temperature. Generally increasing body temperature is always accompanied by increased rate of respiration. It is a natural body mechanism for dissipating excessive body heat.

Table 4 shows the effect of wet feed with or without drinking water on the haematological indices (PCV, WBC, RBC, Hb, MCV, MCH and MCHC) of broiler birds. The results showed that there were no significant differences (p>0.05) in all the parameters investigated. PCV results in this experiment ranged from 30.80% for the broiler on $W^{-1.5}$ to 35.40% for the broiler on $W^{-1.0}$. The values of PCV obtained from this study all fall within the normal range of 26.0-45.2% (Mitruka and Rawnsley, 1977; Frandson, 1981; Health and Olusanya, 1985). The broilers on $W^{+1.0}$ showed the highest mean value of RBC (5.40×10^6/l) while the broiler on $W^{-1.0}$ showed the lowest mean value of RBC (4.13×10^6/l). The values of RBC obtained from this study are all higher than the normal range of 2.90-4.10 ($\times 10^6$/l) (Mitruka and Rawnsley, 1977; Frandson, 1981; Health and Olusanya, 1985). WBC values obtained from this study ranged from 3.97×10^3/l for broilers on $W^{-1.0}$ to 5.90×10^3/l for broiler on $W^{-2.0}$. The normal value of WBC ranged from 9.76-31.0 ($\times 10^3$/l) (Mitruka and Rawnsley, 1977; Frandson, 1981; Health and Olusanya, 1985) which indicate that the WBC values obtained from this study are all lower than the normal limit. Hb values in this experiment ranged from 9.85 g/100 ml for broilers on $W^{+1.0}$ to 11.30 g/100 ml for broiler on $W^{+2.0}$ and Hb values obtained in this study are all fall within the normal range of 7.50-13.1 g/100 ml. MCV values also ranged from 62.40-102.43 cμ2 and the values are lower than the normal value of 100-128.7 cμ (Mitruka and Rawnsley, 1977) except the highest mean value. The broiler on $W^{-1.0}$ showed the superior value of 26.93 pg in MCH while the broiler on $W^{+1.0}$ showed the lowest value of 18.65 pg and some of the values obtained for MCH in this experiment are lower than the normal limit while others are within the limit of 25.4-33.4 pg (Mitruka and Rawnsley, 1977; Frandson, 1981). MCHC values ranged from 26.90 (%) for broiler on $W^{-1.0}$

Table 4: Haematological indices of broiler fed wet feed with or without drinking water

Measurements	DRY	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
PCV (%)	32.67	34.00	32.60	33.20	35.40	30.80	33.00	1.67
RBC ($x10^6$/l)	4.54	5.40	4.47	5.23	4.13	4.38	5.10	0.78
WBC ($x10^3$/l)	5.40	5.05	5.87	4.85	3.97	4.43	5.90	0.78
Hb (g/100 ml)	10.77	9.85	11.10	11.30	10.33	10.07	10.00	1.04
MCV (cµ2)	75.57	66.30	68.17	62.40	102.43	81.7	62.7	16.62
MCH (pg)	24.63	18.65	23.30	21.90	26.93	26.57	19.55	4.96
MCHC (%)	32.77	28.15	34.43	34.95	26.90	32.50	31.10	3.01

Table 5: Differential count of wbc of broiler fed wet feed with or without drinking water

Measurements	W^0	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
Neutrophils (%)	63.33	60.00	65.67	52.50	60.00	50.00	59.00	5.70
Lymphocytes (%)	35.67	40.00	33.00	43.50	39.33	47.33	41.00	4.86
Eosinophils (%)	1.00^a	0.00^b	1.33^a	3.00^a	0.67^a	2.67^a	0.00^b	0.74
Monocytes (%)	0.00^b	0.00^b	0.00^b	1.00^a	0.00^b	0.00^b	0.00^b	0.13
Basophils (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[a,b]Means on the same row with different superscript differ (p<0.05) significantly

to 34.95 (%) for broiler on $W^{+2.0}$ and for all the values obtained for MCHC some of it within the normal limit while others are higher than the limit of 25.3-32.5%. (Mitruka and Rawnsley, 1977; Frandson, 1981).

Table 5 shows the effect of wet feed with or without drinking water on differential count of WBC of broilers. The results obtained from this study indicate that there are no significant differences (p>0.05) in all the indices investigated with the exception of monocytes and eosinophils that showed significant variation (p<0.05) with experimental treatments. Neutrophils result in this experiment ranged from 50.00% for broilers on $W^{-1.5}$ to 65.67% for broilers on $W^{+1.5}$ and the values obtained are higher than the upper limit of the normal range of 19.1-43.9% (Mitruka and Rawnsley, 1977; Frandson, 1981; Health and Olusanya, 1985). Neutrophils are responsible for providing the body with a defense against invading micro-organism (Frandson, 1981). High values of neutrophils in the experiment suggest the possibility of higher incidence of microbial load. The experiment was conducted in the rainy season in a tropical environment. Higher incidence of pathogenic microbes has been reported to occur during the rainy season in the tropics. The broilers on $W^{-1.5}$ showed the highest mean value of 47.33% of lymphocytes while the birds on $W^{+1.5}$ showed the lowest mean value of 33.00%. All the values of leucocytes count obtained except $W^{+1.5}$ are lower than the minimum threshold normal range of 43.9-67.7%. An important complement of lymphocytes is the β-lymphocytes found in the bursa of fabricus (Frandson, 1981). They are largely responsible for the development of specific immunity against foreign substances, or antigens such as micro-organisms. Lower values in this study suggest a general low immune status of the experimental birds, which has nothing to do with the treatment effects. Eosinophil values ranged from 0.00% for both $W^{+1.0}$ and $W^{-2.0}$ to 3.00% for broilers on $W^{+2.0}$ and all the values obtained are lower than the normal range of 6.34-9.66%. The broiler on $W^{+2.0}$ showed the highest mean value of 1.00% of monocytes while others showed the lowest values of 0.00%. Basophils values for all the treatments showed the value of 0.00% which is lower than the normal value of 3.15-5.36%. The number of eosinophils and basophils are reduced when there is an increase in the amount of the hormone hydrocortisone (Ross and Wilson, 1981). Increasing levels of hydrocortisone is usually indicative of stress. However if the lower values of oesinophils<basophils in this research are of stress origin, it is certainly not along experimental lines as the values cut across all experimental groupings.

Table 6 shows that there is a significant difference (p<0.05) in the sera mean values of all the chemical constituents investigated which are Na^+, Ca^+, K^+, HCO_3^- and Cl^-. Sodium results obtained from this study ranged from 142.50 mmol/l for broilers on $W^{+1.0}$ to 171.00 mmol/l ($W^{+1.5}$). $W^{+1.5}$ has the highest mean values of Na^+ and is significantly different from other treatments. Some of its values fall within the normal range while others did not fall within the normal range of 148-163 mmol/l (Mitruka and Rawnsley, 1977). K^+ result in this experiment ranged from 3.63 mmol/l ($W^{-2.0}$) to 4.50 mmol/l ($W^{-1.5}$). $W^{+1.5}$ also showed the superior value and some of the K^+ values obtained from this study are all lower than the normal limit of 4.60-6.50 mmol/l (Mitruka and Rawnsley, 1977). Chlorine results from this study ranged from 101.67-121.00 mmol/l. The broilers on $W^{+1.5}$ showed the highest mean value while the birds on $W^{-1.0}$ showed the lowest value. Only the highest value is within the normal limit while others are higher than the range which is 116-140 mmol/l (Mitruka and Rawnsley, 1977). The broilers on $W^{+1.5}$ shows the higher mean value of HCO_3^- (29.00 mmol/l) while the broilers on W^0, $W^{+2.0}$ and $W^{-1.0}$ showed the lowest values of 26.00 mmol/l. The values obtained in this study all fall within the normal limit of 17.6-29.8 mmol/l. Ca^+ values obtained from this study ranged from 9.75 mg/dl ($W^{+1.5}$) to 11.90 mg/dl ($W^{+2.0}$) and the broiler on the highest mean value differ significantly

Table 6: Serum electrolytes of broiler fed wet mash with or without drinking water

Measurements	DRY	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
Na^+ (mmol/l)	143.00^c	142.50^c	171.00^a	154.00^b	147.30^b	153.67^b	152.67^b	3.28
K^+ (mmol/l)	4.60^a	4.25^a	4.50^a	3.87^b	4.60^a	3.87^b	3.63^b	0.28
Cl^- (mmol/l)	109.5^b	106.0^b	121.00^a	110.33^b	101.67^c	110.67^b	110.33^b	1.89
HCO_3^- (mmol/l)	26.00^b	28.50^{ab}	29.00^a	26.00^b	26.00^b	28.00^{ab}	26.30^{ab}	1.37
Ca^+ (mg/dl)	9.85^d	10.20^b	9.75^d	11.90^a	10.00^C	10.27^b	10.03^C	0.05

^{a,b,c,d}Means on the same row with different superscript differ ($p<0.05$) significantly

Table 7: Serum protein, glucose, urea and creatinine of broiler fed wet feed with or without drinking water

Measurements	DRY	$W^{+1.0}$	$W^{+1.5}$	$W^{+2.0}$	$W^{-1.0}$	$W^{-1.5}$	$W^{-2.0}$	SEM
TP (g/dl)	45.50	44.85	45.90	40.10	45.73	42.10	43.30	2.48
Albumen (g/dl)	28.45	32.15	28.45	24.93	28.90	26.97	27.20	2.42
Globulin (g/dl)	17.05	12.70	17.45	15.17	16.83	15.13	16.10	2.5
Glucose	135.00	161.70	210.00	193.30	178.90	187.80	155.20	2.47
Urea (mg/dl)	7.75^{ab}	7.40^b	5.65^c	9.10^a	7.17^b	7.27^b	7.73^b	0.40
Creatinine (mg/dl)	0.75	0.70	0.70	0.83	0.73	0.73	0.83	0.40

^{a,b,c}Means on the same row with different superscript differ ($p<0.05$) significantly

($p<0.05$) from other value among the treatments. The values of Ca^+ obtained all fall within the normal limit of 9.0-23.7 mg/dl (Mitruka and Rawnsley, 1977). The results obtained from this study follow the same trend in all the indices investigated with the broilers on $W^{+1.5}$ showing the highest mean values in all with the exception of Ca^+ that deviated from the trend.

Table 7 shows the effect of wet feed with or without drinking water on serum protein, glucose, urea and creatinine of broiler birds. The result showed that there are significant differences ($p<0.05$) in the mean value of urea among the treatments. Total protein result from this experiment ranged from 40.10 g/dl for broilers on $W^{+2.0}$ to 45 g/dl for broilers on $W^{+1.5}$ and its values all lower than the normal range of 52.00-69.00 g/dl (Mitruka and Rawnsley, 1977). The broilers on $W^{+1.0}$ showed higher mean value of albumen (32.15 g/dl) while the broilers on $W^{+2.0}$ showed the lowest value of 24.93 g/dl and the values of albumen obtained in this study all fall within the normal range of 21.00-34.5 g/dl. Globulin result also ranged from 12.70 g/dl ($W^{+1.0}$) to 17.45 g/dl ($W^{+1.5}$) and the values obtained for globulin are all lower than the normal range of 31.00-34.5 g/dl (Mitruka and Rawnsley, 1977). Broilers on $W^{+1.5}$ showed the highest mean value of glucose (210) while the broiler on *ad libitum* Showed the lowest mean value of (135) and the values of glucose obtained in this study have some of its values within the normal limit while others are higher than the normal limit of (152-182). Creatinine results also showed that the broilers on $W^{+2.0}$ and $W^{-2.0}$ both having the highest mean value of 0.83 mg/dl while the broiler on both $W^{+1.0}$ and $W^{+1.5}$ having the lowest mean value of 0.70 mg/dl and the values of creatinine obtained in this study all higher than the normal limit of 0.90-1.85 mg/dl (Mitruka and Rawnsley, 1977). Urea result showed that the broiler on $W^{+2.0}$ showed the highest mean value of 9.10 mg/dl, which differ significantly from the birds on *ad libitum* and the broiler on $W^{+1.5}$ showed the lowest mean value of 5.65 mg/dl. The values of urea obtained in this study are all higher than the normal limit of 1.50-6.30 mg/dl.

Conclusion: The results observed from this study showed that rectal temperature, behavioural pattern and haematological indices except oesinophil and monocyte were not significantly affected by treatment effects. Respiratory rate, serum electrolyte and urea showed significant variations among treatments. Serum electrolyte results suggest stress in the maintenance of water /electrolyte balance in all wet fed birds except $W^{+1.0}$. Respiratory rate, electrolyte and urea values are comparable between the control and birds on $W^{+1.0}$ (1 part of feed to 1 part of water, with drinking water). Overall, wet feeding was not detrimental to the maintenance of normal physiological activities at least within narrow limits. However, the results of this research favour the use of 1 part of feed to 1 part of water, with drinking water ($W^{+1.0}$) as it has comparable results with the control.

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