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Effect of Ambient Temperature and Light Intensity on Body Weightand Feed Utilization Traits of Broiler Chickens

A. A. El-Fiky[1]; G. M. Gebril[1]; G. A. Zanaty[1]; M. A. G. Refaei[1] and S. A. Farrag[1]

[1]*(Poultry and Fish Production Department, Faculty of Agriculture/ Menoufia University, Egypt)*

Abstract:
Background: *Light intensity manipulation is a widely adopted management tool affecting broiler production, behavior and welfare. Most management guides recommend a reduction in intensity after the early brooding period but there is some debate as to the appropriate level that should be used. Heat burden causes many harmful impacts on poultry growth and meat quantity and quality. These effects cause several economic losses to poultry production.*
Materials and Methods: *The current study was conducted in commercial farm, Ashmon, Menoufia Governorate. from January 2019 to February 2019 to study the effect of ambient temperature and different light intensities on body weight, growth rate and carcass traits of broiler chickens. A total of 504, one day old, un-sexed, commercial broiler chicks (Ross 308) were reared in this experiment. Chicks were individually weighed and randomly assigned to 3 experimental groups nearly similar in average body weight (42g) within each group. All groups subjected to the same light intensity (20 lx) until the 6th day of age, there after the three groups subjected to different light intensities (0.5, 3.0 and 20 lx). During the first 17 days of age all chicks reared at the same microclimate conditions. After 17th day of age each group (168 birds/group) was divided into 3 subgroups (56 birds of each), which were reared under control (22.1 ± 1 ^{o}C), low (17.6 ± 1 ^{o}C) and high temperature (26.7 ± 1 ^{o}C), respectively. Feed and water were available ad-libitum during the experimental period which lasted for 35 days. One stocking density (10 birds / m^2) was applied in a closed system, and the light program was 24 h (continuous). Each subgroup(56 birds) was reared in floor area (2.6 × 2.3 m^2) in the present study.*
Results: *The results can be summarized as follow:*
1. Highest mean value of body weight at 35 days of age (2029.4 g) was recorded for 3.0 lx at low temperature.
2. Highest mean value of cumulative feed consumption (1-35 days) was recorded in 20.0 lx light intensity at low temperature (3342.0 g).
3. Best mean value of feed conversion ratio was recorded in 0.5 lx, at high temperature, (1.53).
4. Highest mean value of mortality (7.00%) was recorded in 3.0 lx light intensity and at high temperature.
Conclusion:*In general, and based on the results obtained from light and temperature treatments, it was cleared that light intensity 0.5 lx with 22.1°C after the 17th day of age improved body weight and achieved the best feed conversion and least mortality ratio in comparison with other treatments.*
Key Word*:Light intensity; Temperature; Body weight; Feed conversion; Broilers.*

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I. Introduction

Heat stress has emerged as a major concern to poultry breeders because of reducing heat tolerance in modern poultry genotypes in addition to the dramatic increase in global temperature. Heat burden causes many harmful impacts on poultry growth and meat quantity and quality. These effects cause several economic losses to poultry production. Studies on heat stress in poultry farms, generally focus on exploring the strategies to maintain the conditions which cause heat stress. Specifically, in opened poultry houses, it is important to ensure that the outdoor air can flow smoothly into and out of poultry house. Furthermore, feeding at cooler times, wet feeding, feed withdraw before an expected period of heat stress and dimming lights during feeding could be good strategies to cope with heat stress. In addition, maintaining good ventilation, increasing energy level in poultry rations and supplementing diets and drinking water with vitamins, antioxidants, probiotics and minerals can help in heat stress mitigation[1].

Chickens are visually well equipped, and therefore light plays an important role in their wellbeing and productivity. In addition to physiological evidence (ocular structure), visual capacity of chickens is also reflected by their preference for bright light as compared to dim light. Commercially, broilers are reared under artificial light consisting of three components – photoperiod, wavelength, and intensity. All of these components play an important role in broiler management by affecting production and welfare. Light intensity manipulation is a widely adopted management tool affecting broiler production, behavior and welfare. Most management guides recommend a reduction in intensity after the early brooding period but there is some debate as to the appropriate level that should be used. A usual recommendation is for light intensity to be 5 to 10 lx during the grow-out period but many producers use levels as low as 1 to 2 lx. Comments from industry indicate that the rationale for using very low light intensity is improved feed efficiency, reduced mortality due to sudden death syndrome and reduced carcass damage (scratches, bruises) because of decreased activity. However, these advantages are not confirmed by scientific investigation. Examination of the literature reveals that broiler production traits (body weight, feed intake, feed conversion ratio, and mortality) were unaffected by light intensity within the range of 1 to 150 lx but the use of low to very low light intensity has negative effects on broiler processing characteristics and welfare. Some of these are contrary to industrial perception as mentioned earlier[2].

Light intensity should be sufficient to allow young birds to find feed and water in the first days after placement in houses. Recommended light intensity for the first 3 - 7 days (20 - 50 lx) is generally higher than for the rearing/growing period for commercial flocks (5 - 10 lx)[3-5].

The present study was focused on the effects of light intensity and rearing temperature on body weight, growth rate and carcass traits of broiler chickens.

II. Material and Methods

The current study was conducted in a commercial farm at Ashmon city, Menoufia Governorate, Egypt. This experiment was done during the period from January to February 2019, to determine the effect of ambient temperature and different light intensities on body weight, growth rate and carcass traits of broiler chickens.

Experimental broiler strains and numbers:

A total of 504, one day old, un-sexed, commercial broiler chicks, (Ross 308) were used in this experiment. Chicks were individually weighed and randomly assigned to 3 experimental groups nearly similar in average body weight (42g) within each group. All groups subjected to the same light intensity (20 lx) until the 6^{th} day of age, there after the three groups subjected to different light intensities (0.5, 3.0 and 20 lx). During the first 17 days of age all chicks reared at the same microclimate conditions. At 18^{th} day of age birds in the first (0.5 lx), second (3.0 lx) and third (20 lx) groups were divided to three subgroups (56 birds of each) which reared under control, (22.1 ± 1 ^{o}C), low (17.6 ± 1 ^{o}C) and high (26.7 ± 1 ^{o}C) temperature, respectively. Feed and water were available *ad-libitum* during the whole experimental period which lasted for 35 days. Density was applied in closed system, 10 birds / m^2 and the light program was 24 h (continuous).

All birds were fed the basal starter, (1-14 days of age, with 23% crude protein and 3030 ME kcal/kg diet), grower (14-28 days of age, with 21% crude protein and 3100 ME kcal/kg), and finisher (28 – 35 of age, with 19% crude protein and 3200 ME kcal/kg), according to NRC[6], as given in Table (1).

LED Lightintensity:

Artificial light was the only used light source (two LED 9 Watt) in the rearing rooms. All treatments were reared until 5 days of age by using light intensity 20.0 lx. After 5 days of age one lamp was used for each treatment. Three light intensities were used in the present study for each group (168 birds):

a- Control intensity as 3.0 lx, the light source was placed 100 cm above the chicks;

b- Low intensity as 0.5 lx, the light source was placed 150 cm above the chicks;

c- High intensity as 20.0 lx, the light source was placed 50 cm above the chicks.

Where light intensity was inversely proportional to the height of the bulbs above the chicks. For monitoring light intensity, Lux meter (LX1010BS), was used with the resolution of ± 0.1.

Temperature levels:

Birds were reared from one day of age on 33^{o}C, and the temperature was reduced 1^{o}C every 3 days till 18 days of age. The groups of birds that previously assigned to different light intensities (3 groups; 168 birds in each group) were divided again to 3-subgroups (56 birds/ group) according to the temperature level:

a- Control temperature with average 22.1 ± 1^{o}C;

b- Low temperature with average 17.6 ± 1^{o}C.

c- High temperature with average 26.7 ± 1^{o}C;

Temperature and humidity measurements: Throughout the experimental period, the thermal data of temperature and relative humidity of the air inside the dormitory were recorded daily. For this monitoring, temperature and humidity were used, with the accuracy of ± 0.1 °C (temperature) and 1% (Relative humidity), and accuracy of ± 0.5 °C (temperature) and ± 1% (humidity). The relative humidity values inside the dormitory for all treatments were maintained in the range of 50% ± 5%. These ranges of relative air humidity values are considered adequate for poultry production, regardless of bird age[7].

Table no 1: Composition and calculated analysis of experimental diets.

Ingredients	Starter diet (1-14 day)	Grower diet (14-28 day)	Finisher period (28 -35 days)
Ground yellow corn (8.5%).	541	592.0	656.7
Soybean meal, (44%).	320	260	190
Full soya fat.	29	29	30
Gluten, (60%).	71.5	78.0	84.9
Mono calcium phosphate.	16.6	17.5	15.3
Limestone.	13	13.4	11.8
L-lysine.	1	2	3
DL-methionine1.	1.2	1.4	1.6
Salt (NaCl).	3.7	3.7	3.7
Premix (Minerals and Vitamins)2.	3	3	3
Total mixture.	1000	1000	1000
Calculated analysis3:			
Crude protein, (%).	23	21	19
C/P ratio	132	148	168
ME (kcal/kg).	3030	3100	3200
Crude fiber, (%).	3.77	3.41	3.06
Raw fat is not less than, (%).	5.56	5.7	5.96

[1] DL-Methionine 98% feed grade (98% methionine).
[2] Premix at 0.30 % of the diet supplies the following/ kg of the diet: Vit. A, 12000 IU;Vit.E, 10 mg; Vit.K_3, 3 mg; Vit B_1, 1 mg; Vit. B_2, 4 mg; Pantothenic acid, 10 mg; Vit. D_3, 2500 IU; Nicotinic acid, 20 mg; Folic acid, 1 mg; Biotin, 0.05 mg; Niacin, 40 mg; Vit.B_6, 3 mg; Vit B_{12}, 0.02 mg; Choline chloride, 400 mg; Mn, 62 mg; Fe, 44 mg; Zn, 56 mg; I, 1 mg; Cu, 5 mg and Se, 0.01 mg.; [3] Calculated according to NRC (1994).

The studied traits:

Body weight and body weight gain at different ages:

Weekly body weights were measured weekly from the first day of age till the marketing age (35 days of age). Each week sample (20 birds) was taken randomly and weighed to estimate average body weight for all experimental groups.

Feed consumption (FC) (kg bird/period) and feed conversion ratio (FCR):

The amount of weekly and cumulative feed consumption per bird per period were calculated by dividing the total feed intake during the period of measuring on the life birds number in each dormitory.

The feed conversion ratio was calculated as follow:

$$FCR = \frac{The\ feed\ consumption\ (kg/bird)}{Body\ weight\ gain\ /\ bird\ (kg)}$$

Mortality percentage:

Mortality (%) was calculated as follows:

$$Mortality, \% = \frac{Total\ number\ of\ died\ birds\ /\ cycle}{Total\ number\ of\ housed\ birds} \times 100$$

Statistical analysis:

Data were computerized and analyzed according to the following two models by SPSS Program[8]. Also, significant differences among means were detected by Duncan[9].

Model (1):

$Y_{ij} = \mu + L_i + e_{ij}$

Where:

Y_{ij} : Observation of i light intensity level;

μ : General mean;

L_i : Fixed effect of (L_i) light intensity;

e_{ij} : Residual effect.

Model (2):

$Y_{ijk} = \mu + L_i + T_j + (L \times T)_{ij} + e_{ijk}$

Where:

Y_{ijk} : Observation of i light intensity, and j temperature levels;

μ : General mean;

L_i : Fixed effect of (L_i) light intensity;

T_j : Fixed effect of (T_j) temperature levels;

$(L\times T)_{ij}$: Effect of interaction $(L\times T)_{ij}$;

e_{ijk} : Residual effect.

III. Resultand Discussion

Effect of light intensity on body weights at 7 and 14 days of age:

Data in Table (2) showed the body weights in different groups of light intensity (0.5, 3.0 and 20 lx) for Ross 308 chicks at 7 and 14 days of age. Although, studied light intensities were applied at the 6th day of life, the statistical analysis of body weight at 7 days of age revealed that there were significant differences in body weights between different light intensities (0.5, 3.0 and 20 lx) ($P \leq 0.05$). Highest mean value of body weight at 7 days of age was recorded for 3.0 lx (177.30 ± 6.268 g), followed by 20.0 lx group (171.77 ± 1.633 g), while 0.5 lx group registered the least value (171.13 ± 1.846 g). It is cleared that, body weight results were disagreed with those found by Newberry *et al.*[10],who showed that body weight was unaffected by using 0.1, 1, 10, and 100 lx.

The statistical analysis (Table, 2) of body weight at 14 days of age revealed that there were significant differences in body weights between different light intensities groups (0.5, 3.0 and 20 lx) ($P \leq 0.05$).Highest mean value of body weight at 14 days of age was recorded for 0.5 lx (432.23 ± 1.178 g), followed by 20.0 lx group (426.23 ± 2.356 g), while 3.0 lx group registered the least value (425.00 ± 1.732 g). Body weight results were in disagreement with those found by Olanrewaju *et al.*[11]. They cleared that body weight at 14 days of age was 379 and 378 g for broilers reared in 0.5 and 20 lx, respectively ($P = 0.549$).

Effect of light intensity on weekly feed consumption at 7 and 14 days of age:

The feed consumption in different groups as affected by light intensity (0.5, 3.0 and 20 lx) at 7 days of age for Ross 308 strain chicks was reported in Table 2. The statistical analysis of feed consumption revealed that there were insignificant differences in feed consumption between different light intensities (0.5, 3.0 and 20 lx) ($P = 0.296$). Highest mean value of feed consumption at 7 days of age was recorded for 20.0 lx group (173.00 ± 1.000 g), followed by 3.0 lx group (172.00 ± 1.000 g), while, 0.5 lx group registered the least value (171.00 ± 0.000 g). Moreover, highest mean value of feed consumption at 14 days of age was recorded for 3.0 lx (354.00 ± 0.00 g), followed by 20.0 lx group (350.00 ± 2.00 g), while 0.5 lx group which at 14 days of age for Ross 308 strain chicks. The statistical analysis revealed that there were significant differences in feed consumption between different light intensity groups (0.5, 3.0 and 20 lx) ($P \leq 0.05$). Feed consumption results were in disagreement with those found by Olanrewaju *et al.*[12]whonoted that dim light (1 lx) in comparison with 150 lx, did not affect feed intake.

Table no 2: body weight (BW) and weekly feed consumption (FC) at 7 and 14 days of age as affected by light intensity.

Light intensity	BW7	BW14	FC7	FC14
0.5 lux	171.13 ± 1.84^b	432.23 ± 1.18^a	171.00 ± 0.09	347.00 ± 1.45^c
3.0 lux	177.30 ± 6.27^a	425.00 ± 1.73^b	172.00 ± 1.00	354.00 ± 2.50^a
20.0 lux	171.77 ± 1.63^b	426.23 ± 2.35^b	173.00 ± 1.00	350.00 ± 2.00^b
ANOVA				
light int. (p value)	0.045*	0.031*	0.296 N.S.	0.015*

^{a}, ^{b}, ^{c}: Means in the same column bearing different superscripts are significantly different.

Effect of light intensity and temperature levels on body weight at 21, 28 and 35 days of age:

Table (3) showed the body weights of different groups as affected by light intensity (0.5, 3.0 and 20 lx) and temperature levels (control, low and high temperature) at 21 days of age for Ross 308 strain chicks. The statistical analysis of body weight at 21 days of age revealed that the effect of interaction between light intensity and temperature levels was insignificant ($P = 0.929$) at 21 days of age, but there were significant differences in body weights between different light intensity groups (0.5, 3.0 and 20 lx) ($P \leq 0.05$), also, there were significant differences between different levels of temperature groups ($P \leq 0.05$).Highest mean value of body weight at 21 days of age across all groups was recorded for 0.5 lx at low temperature, followed by control temperature at 0.5 lx group. While high temperature registered the least value of body weight overall studied light intensity levels.

The same trend was noticed for body weight at 28 days of age in current study, but with no significant differences due to either main (light intensity and temperature level) or interaction effect. In addition, at 35 days of age body weight mannered as same as at 21 days of age regarding the effect of light intensity and temperature level. The statistical analysis revealed significant differences due to either main or interaction effects of light intensity and temperature levels at 35 days of age.

Body weight results were in disagreement with those found by Olanrewaju *et al.*[12]except for body weight at 28 days of age for current experiment. They noted that body weights at 21 days of age were not affected by varying light intensities of 25, 10, 5, 2.5 and 0.2 lx. But, Ipek and Sahan[13] mentioned that body weight gain up to 3 wks was significantly affected by cold stress. The chicks in the control environment had greater body weight gain compared to chicks in the cold stress treatment. Aengwanich[14], determined the effect of high environmental temperatures and breed on live productive performances of Thai indigenous (TIC), Thai indigenous crossbred (TICC) and broilers (BC) chickens. and, they found that the average daily weight gain of chickens maintained at 26± 2°C was higher than that of chickens at 38± 2°C ($P < 0.05$).

Body weight results were in disagreement with those found by Abu-Dieyeh[15] and Al-Fataftah and Abu-Dieyeh[16]at the end of the four weeks of the experiment. They reported that body weight of broilers in all heat treatments were significantly decreased ($P \leq 0.05$) at the ambient temperature of 25º C that had higher body weight than those at 21-30º C, but significantly ($P \leq 0.05$) higher than those reared at 35º C.

Body weight results were in agreement with those found by Beckford *et al.*[17]. Heat-stressed birds had a lower BW ($P \leq 0.05$) at the time of sampling on day 31 when compared to the control birds. While, results were in agreement with those found byŠkrbić*et al.*[18]. They found highly significant impact of the intensity of light (20 and 150 lx) on the body weight of broilers at the 42nd day of age. Also, Senaratna*et al.*[19]studied different light intensities (320 lx; high intensity red [HR]), (20 lx; medium intensity red [MR]), (5 lx; dim intensity red [DR]), (control/20 lx; medium intensity white [WT]) and found that at the time of slaughter (35d), significantly ($P \leq 0.05$) highest body weight was recorded by DR and the lowest by negative control.

Table no 3: Body weight (BW) at 21, 28 and 35 days of age as affected by interaction between light intensity and temperature levels.

Light intensity	Temperature Levels	BW21	BW28	BW35
0.5 lux	Control	840.7^b	1415.3	2007.1^a
	Low Temp.	848.1^a	1420.4	2029.4^a
	High Temp.	834.9^c	1414.4	1996.6^b
3.0 lux	Control	828.7^b	1400.7	1992.9^a
	Low Temp.	840.0^a	1410.4	2009.0^a
	High Temp.	828.4^b	1394.6	1903.4^b
20 lux	Control	832.9^b	1398.0	1977.6^a
	Low Temp.	836.9^a	1404.0	2000.4^a
	High Temp.	829.3^c	1417.2	1910.2^b
	Pooled SE	4.8	10.8	10.9
Temp.	P value	0.039*	0.734N.S.	0.000*
light int.	P value	0.040*	0.253N.S.	0.000**
T*L	P value	0.929N.S.	0.683N.S.	0.011*

$^{a, b, c}$: Means in the same column same light intensity bearing different superscripts are significantly different.

Effect of light intensity and temperature levels on weekly (during 3rd, 4th and 5th week of age) and cumulative (1-35 days of age) feed consumption:

Data presented in Table (4) showed the feed utilization traits (FC and FCR) of different groups as affected by light intensity (0.5, 3.0 and 20 lx) and temperature levels (control, low and high temperature) during 3rd, 4th and 5th week of age for Ross 308 strain chicks. The statistical analysis revealed that the effect of interaction between light intensity and temperature levels was highly significant ($P \leq 0.01$) for all feed consumption and feed conversion studied traits (i. e. feed consumption during the 3rd, 4th and 5th week of age, cumulative FC during the whole production cycle (1-35 days of age) and FCR for either main or interaction effects.

The lowestmean value of feed consumption during the 3rd week of age across all treatments was recorded for 0.5 lx at high temperature (695g), while, low temperature either at 3.0 or 20 lx light intensity registered the highest value of feed consumption during 3rd week of age (774g). Moreover, weekly feed consumption during 4th and 5th week of age didn't differed in trend as well as the 3rd week of age regarding the lowest and highest values (Table, 4). Highly statistical differences were observed between different treatments ($P \leq 0.01$) in weekly and cumulative feed consumption due to either main (light intensity and temperature levels) or interaction effects.

Qureshi *et al.*[20], noticed that at the end of the 3rdand 4thweek of age lowest feed consumption was recorded in treatment groups reared under normal temperature conditions. The broiler birds reared under cold stress showed significantly ($P \leq 0.05$) higher feed consumption at the end of 3rd week when compared to the control group. Also, Almeida, *et al.*[21]mentioned that feed consumption by birds during the same period in the cold treatment was significantly higher ($P \leq 0.05$) at 3rdand 4thweek of age.

On the other hand,Arcila*et al.*[22]noticed that the birds kept at the environmental temperatures of 25 °C and 28 °C, during the 4th, 5th and 6th weeks of life, respectively, presented higher feed intake (FI), whereas the opposite occurred in 31 °C, 34 °C and 37 °C treatments, with had reduction in feed intake.

Cumulative feed consumption 0-35 days of age in different groups was recorded in Table 4 as affected by light intensity (0.5, 3.0 and 20 lx) and temperature levels (high temperature, control temperature and low temperature) for Ross 308 strain. The highest CFC (1-35 days of age) across all groups in the recent study was recorded by the birds which subjected to low temperature under 20 lx light intensity, however, the lowest value of CFC observed in birds that subjected to high temperature with light intensity 0.5 lx. The statistical analysis of cumulative feed consumption revealed that the effect of interaction between light intensity and temperature levels was highly significant ($P \leq 0.01$), and there were highly significant differences in cumulative feed consumption between different light intensity groups (0.5, 3.0 and 20 lx) ($P \leq 0.01$). Also, there were highly significant differences between different levels of temperature groups ($P \leq 0.01$).

At the marketing age (week 5), birds under HS showed a numerical decreased FC than control (729 versus 1187 g, respectively) and addition of probiotic to the diet of heat stressed broilers didn't increase FC (835 g) than control (1187 g) but it was higher than heat stressed birds without probiotic feeding (835 versus 729 g, respectively)[23]. The total amounts of feed consumption by birds in the four weeks of the experiment at the different ambient temperature treatments were 4158.4, 3988.7, 3642.6 and 3004.5 g/bird at the natural variable temperature (24-28° C), 25°, 30° and 35° C, respectively[16].

The greatest feed consumption was ($P \leq 0.001$) in the 20-lx compartment and lowest in the 5 lx. There was a positive relationship between feed consumption per day and light intensity (adjusted $R^2 = 0.655$, $P = 0.0318$)[24]. Qureshi *et al.*[20] noticed the highest cumulative feed consumption ($P \leq 0.05$) was observed in broiler birds reared under cold conditions in comparison with birds reared under normal conditions.

Effect of light intensity and temperature levels on feed conversion ratio during the period from 1-35 days of age:

Feed conversion ratio in different groups as affected by light intensity (0.5, 3.0 and 20 lx) and temperature levels (high temperature, control temperature and low temperature) for Ross 308 strain chicks during the period from 1-35 days of age was recorded in Table 4. Best mean value of feed conversion ratio was recorded for 0.5 lx at high temperature (1.55kg feed/kg live BW). Where, low temperature under 20 lx light intensity had worst value (1.71kg feed/kg live BW). The statistical analysis of feed conversion ratio revealed that the effect of interaction between light intensity and temperature levels was highly significant ($P \leq 0.01$), and there were highly significant differences in feed conversion ratio between different light intensity (0.5, 3.0 and 20 lx) ($P \leq 0.01$). Also, there were highly significant differences between different temperature levels ($P \leq 0.01$).

Reece and Lott[25]indicated that feed efficiency on an equal weight basis is the same at 26.7° C as at 21.1° C but that birds grown at 15.6° C require 3% more feed when weights are equated. Birds grown to 49 days at 15.6° C would require 16% more feed than those grown to 49 days at 26.7° C would weigh 177 g more. At the 5th and 6th weeks, broilers reared under heat stress have an increased feed conversion ratio (FCR) (2.37 and 9.04, respectively) than control birds (1.99 and 4.36 respectively) as noticed byKhalifa *et al.*[23].

Al-Fataftah*and Abu-Dieyeh*[16]cleared that broilers reared at 35° C, had significantly ($P \leq 0.05$) the lowest growth rate and feed consumption. On the contrary, broilers kept at 25° C had significantly ($P \leq 0.05$) highest growth rate, and best feed conversion ratio in comparison with the birds kept at the other heat treatments; and the birds kept at 35° C had significantly ($P \leq 0.05$) highest and the poorest feed conversion ratio (FCR). Gharahveysi*et al.*[26] noticed that the effect of light intensity was not significant ($P > 0.05$) on the FCR in the whole phase. They also added with increasing the light intensity from 5 to 50 lx, FCR was reduced. Reducing FCR is means increasing the efficiency of the use of consumed feed by the chicken for the body weight.

Table no 4: Weekly (FC), cumulative (CFC) feed consumption and feed conversion ratio (FCR) as affected by interaction between light intensity and temperature levels.

Light intensity	Temperature Levels	FC3	FC4	FC5	CFC	FCR
0.5 lx	Control	741.0^{a}	852.0^{b}	1000.0^{b}	3093.0^{b}	1.58^{b}
	Low Temp.	741.0^{a}	861.0^{a}	1057.0^{a}	3177.0^{a}	1.62^{a}
	High Temp.	695.0^{b}	833.0^{c}	981.0^{c}	3046.0^{c}	1.55^{c}
3.0 lx	Control	755.0^{b}	887.0^{b}	1019.0^{b}	3189.0^{b}	1.63^{c}

	Low Temp.	774.0^{a}	903.0^{a}	1100.0^{a}	3302.0^{a}	1.68^{a}
	High Temp.	717.0^{c}	849.0^{c}	1000.0^{c}	3091.0^{c}	1.66^{b}
20 lx	Control	774.0^{a}	849.0^{b}	1038.0^{b}	3178.0^{b}	1.64^{c}
	Low Temp.	774.0^{a}	922.0^{a}	1120.0^{a}	3342.0^{a}	1.71^{a}
	High Temp.	750.0^{b}	830.0^{c}	1019.0^{c}	3125.0^{c}	1.67^{b}
	Pooled SE	3.7	3.6	4.7	2.9	0.01
Temp.	P value	0.000**	0.000**	0.000**	0.000**	0.000**
light int.	P value	0.000**	0.000**	0.000**	0.000**	0.000**
T*L	P value	0.000**	0.000**	0.000**	0.000**	0.000**

a, b, c: Means in the same column same light intensity bearing different superscripts are significantly different.

Effect of light intensity and temperature levels on mortality (%) at 35 days of age:

Data in Table (5) showed mortality (%) in different groups as affected by light intensity (0.5, 3.0 and 20 lx) and temperature levels (high temperature, control temperature and low temperature) for Ross 308 strain till 35 days of age. High mortality percentages observed for birds reared under high temperature from all light intensity levels, with highest value (7.0%) recorded under 3.0 lx light intensity. The light intensity 0.5 lx recorded the lowest mortality % regardless the level of temperature. Highly significant differences due to either light intensity or temperature level have been noticed in current study ($P \leq 0.01$), more over the interaction effect between light intensity and temperature level was highly significant (Table, 5).

Result was found by Ipek and Sahan[13]apparent in the cold stress group during 3 and 6 wk. Showed significant difference in mortality due to ascites between the groups. Total and individual causes of mortality were not affected by light intensity level, (1, 10, 20, and 40 lx)[27].On the other hand, Olanrewaju *et al.*[28]found that mortality was not significantly different between treatments for temperature and light intensity, but rather variable and did not appear to be either temperature, light intensity or their interaction dependent. Al-Fataftah*et al.*[29]found that total mortality rate during the periods of the experiment (4 weeks) at the different ambient temperatures were 11.79, 5.73, 5.16 and 2.53% at 35º C, natural (24-28º C), 30º C and 25º C, respectively. These results indicates clearly that a significant ($P \leq 0.05$) high mortality rate occurred when ambient temperature reached 35º C.

Table no 5: Livability (%) as affected by interaction between light intensity and temperature levels.

	Light intensity										ANOVA		
	0.5 lux			3.0 lux			20 lux				Significancy		
Temperature Levels	Control	Low Temp.	High Temp.	Control	Low Temp.	High Temp.	Control	Low Temp.	High Temp.	Pooled SE	Temp.	Light Intensity	T*L
Mortality %	1.90^{a}	1.91^{a}	1.93^{a}	3.83^{b}	1.90^{c}	7.00^{a}	3.83^{b}	3.83^{b}	5.10^{a}	0.59	**	**	**

a, b, c: Means in the same row same light intensity bearing different superscripts are significantly different.

IV. Conclusion

Light intensity 0.5 lx with 22.1°C after the 17th day of age improved broiler chickens (Ross 308) body weight and achieved the best feed conversion and least mortality ratio in comparison with other treatments.

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