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SOME ENVIRONMENTEAL FACTORS AFFECTING BROILER HOUSING IN WINTER SEASON

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Abstract

The main objective of this study was to study some environmental factors affecting broiler housing in winter season. The results showed that, temperature fluctuations between house ceiling and floor ranged between 0.4 to 5.93 ºC during the first two days of age. The average house temperature reduced gradually from 29.7 to 21.3 ºC. The indoor relative humidity ranged between 43.6 to 74.3 %. Specific heating power, specific fuel consumption and heating energy requirements ranged between 3850.2 W/ºC , 0.34 kg /h. ºC and 308.9 kJ/h. kg at the first week of age to 6213.4 W/ºC , 0.36 kg /h. ºC and 19.3 kJ/h. kg at the end of the life respectively.

Keywords: *broiler, relative humidity, specific heating power, temperature*

INTRODUCTION

Environmental control is an important factor that effect on broiler performance and meat yield. Indoor air temperature is one of the most important environmental factors because, maintaining the correct air temperature is crucial in chicks brooding, especially during the first seven to ten days of the chick's life. Early in life, the chick is poorly equipped to regulate its metabolic processes to adequately control its body temperature. As a result, the young chick is dependent on environmental temperature to maintain optimal body temperature Supplemental heating systems play an important role in environmental management, especially during the brooding phase. However, in many locations for a portion of the growout supplemental heating may not be needed. On the other hand, proper ventilation is needed throughout a growout, even during times when supplemental heat is being provided, for control of air quality if not for cooling.. Environmental parameters inside the poultry housing are mainly include; air temperature, air relative humidity, ventilation, and light level during brooding. In 2010, Egyptian production of chicken's meat was 685000 tonnes. (FAO, 2012)

(El-Hadidi, 1989) informed that, Light is an important factor during brooding that can not be ignored. There is evidence that such long photoperiods (22-24 h/day) can adversely affect the functional development of eyes of chickens. Broilers must receive 22 hours light and 2 hours darkness from 24 o'clock to 2 o'clock from the second week of bird age. (Lacy, 002) showed that, both pancake and radiant brooders allow chicks to move toward or away from the heat source to seek a comfortable temperature. In recent years radiant brooders have become popular, since they have been shown to reduce fuel costs by 15 to 30% as compared to pancake brooders and forced air furnaces. (Cobb Broiler Management Guide, 2008) reported that, at placement, floor temperatures should be at least 32°C with forced air heating. If radiant heaters/brooder stoves are used, floor temperatures should be 40.5°C under the heat source. (Fairchild, 2009) indicated that, ammonia production can be reduced through the control of air relative humidity which in turn is regulated by ventilation. An air relative humidity level of 50 to 70% is recommended to minimize ammonia production and dust.

(Arbo Acers Guide, 2009).

Light intensity of 30–40 lux (3–4 foot candles) from 0–7 days of life and 5–10 lux (0.5–1.0 foot candles) thereafter will improve feeding activity and growth. The intensity of light should be uniformly distributed throughout the house (reflectors placed on top of lights can improve the distribution of light). (Fouda et al., 2012) found that, when using perforated tube for heat distribution led to reduction in gas consumption, supplementary heating and litter moisture content at the end of life by 27.07, 15.35 and 20.39% respectively. While feed conversion efficiency was increased by 3%. (Ghoname et al., 2012) showed that, using forced air heating without polyethylene tube temperature stratification ranged between 0.4 and 5.93 ºC. Whereas, employing the forced air furnace with perforated tube, led to minimize the temperature stratification to -2.9ºC and 0.043ºC during the first two days age. Using forced air furnace with perforated tube decreased feed conversions ratio from 1.65 to 1.60 after five weeks age.

-The objectives of the present work were to investigate the effect of some environmental factors on broilers.

MATERIALS AND METHODS

Experimental work was conducted to investigate the effect of some environmental factors on broilers housing. The main experiment were carried out in private broiler house on winter 2011 , Menofia Governorate were located at(30.7° "N and 30.9° "E) ,Egypt. It is most important to arrange all equipment (feeders, drinkers, and supplementary light) so that the tasks associated with management, such as feeding and drinking, can be carried out easily. Therefore, the broiler house was equipped by 100 tubular feeders using hand-feeding system arranged on the interior surface area by 5.25 m^2 per one feeder. It also equipped by 50 round-long drinkers evenly arranged on the interior surface area by 10.5 m^2 per one drinker. To provide adequate light intensity inside the broiler house, 26 lamps (40 Watt) was evenly distributed particularly at the first two weeks of age, so that the chicks can find the feeding and drinking systems easily.

MATERIALS:

Heating air system

Forced air conventional system (furnace, counter flow heat exchanger , axial fan taken motion directly from electric motor 3 phase with 1.5 kW in power). The fan air displacement is 3 m^3 /s. and electric control box.

House specification

Broiler house having gross dimensions of 525m^2 The house is East – west oriented.

Chick

The broiler housing occupy 5000 chicks that have one day age. The hybrid (Cobb) was used in this experiment.

METHODS:

Measurements

Temperature measurements

Sensors were used to measure air temperatures inside and outside the broiler house. Inside the house air temperatures were measured in two different levels at height of 0.25m above the floor surface and at height of 3 of floor surface.

Relative humidity

Indoor relative humidity and out door relative humidity was also measured using digital hygrometer. with ± 5% accuracy .The air relative humidity during the experimental work was measured daily at different pointes inside the house.

Specific heating power

Specific heating power is the quantity of energy added to the broiler house ambient air which make temperature rise in that house by one degree using heating system (Hanan, 1998).

$$Sp = \frac{Q_{add}}{TR}$$

Where:

Sp = Specific heating power, Watt/ ºc

Q_{add} = Heat energy addition, W

TR= the temperature rise in the house ambient air by 1ºC.

Specific heating power for every m3 of the house volume

$$Sp' = \frac{Q_{add}}{TR \times V_h}$$

Sp\ = specific heating power which make temperature rise in the house ambient air by 1 ºC/house volume m^3

V_h = house volume, m^3.

Specific fuel consumption

Fuel consumption really which was used for rise the air temperature in the house by 1ºC

$$S.f.c = \frac{n.f.c}{TR}$$

Where:

S.f.c Specific fuel consumption, kg/h.ºC.

n.f.c = fuel consumption in the operating time, kg/h.

RESULTS AND DISCUSSION

Indoor temperature and air relative humidity

Air temperature is one of the most important factors that effect on broiler performance. (Figure.1) showed the relation between indoor and out door temperature during different day hours.

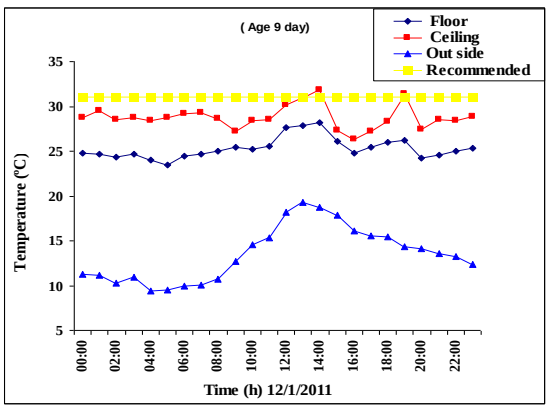

Figure1 .The relation between indoor and out door temperature

The ceiling temperature for all day hours was higher than floor temperature which is more important for chicks' .In addition to the floor house temperature was lower than the recommended temperature for this period of life. The recommended temperature at chicks' zone is 31 ºC but, the average floor and ceiling temperatures were 25.3 and 28.7 ºC respectively while the average outdoor temperature was 13.7 ºC. There is 5.7 ºC difference between recommended temperature and floor house temperature which affecting broiler performance.

The relation between air temperature and relative humidity is adversely proportional. When broiler age increase, the air temperature decreased and air relative humidity increase. (Figure.2) showed the relation between indoor air temperature and relative humidity during birds age. The average house temperature reduced gradually from 29.7 ºC at the end of the first week until reached to 21.3 ºC at the end of the fifth week of age.

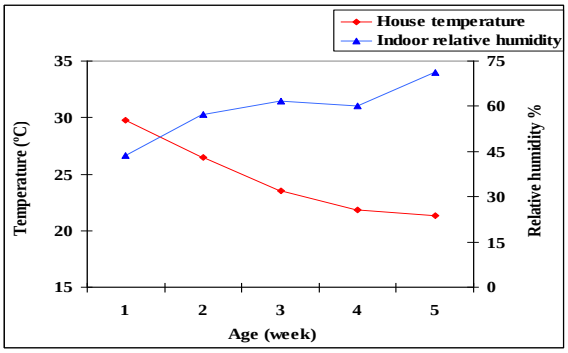

Figure 2. The relation between indoor air temperature and relative humidity during birds age

The floor temperature was lower than the recommended temperature during all age periods . If chicks are chilled, nutrients that might have been used for body development are used to maintain body heat. Chilled chicks also tend to huddle together and most do not seek out feed or water, so a number of birds may die. The performance of the chicks that survive chilling is likely to be limited due suppressed digestive or immune system functions.

The ability of indoor air to hold moisture depends upon its temperature. The level of indoor air relative humidity influences the ability of the birds to cool them through panting and influences ammonia production. The indoor relative humidity was increased from 43.7 % in the first week of age until reached to 71.3% at fifth week of age. Indoor air relative humidity increased at the end of the heating period due to the heat energy supplied during that time was insufficient to

absorb more moisture from the indoor air. In addition to, increasing the moisture adding to the house from broiler faecal. An air relative humidity level of 50 to 70% is recommended to minimize ammonia production and dust.

Energy requirements

The heating energy requirements is dependent up only in broiler age and mass. As birds increased in age, the body mass increased and sensible heat from birds increased also. As a result , The heating energy requirements reduced. (Figure.3) showed the relation between heating energy requirements and body mass during birds age .The broilers body mass was increased from 0.13 kg at the first week of age until reached to 1.9 kg at fifth week of age. So, the heating energy requirements decreased gradually from 308.9 kJ/h.kg at the first week of age until reached to 19.2 kJ/h.kg at fifth week of age.

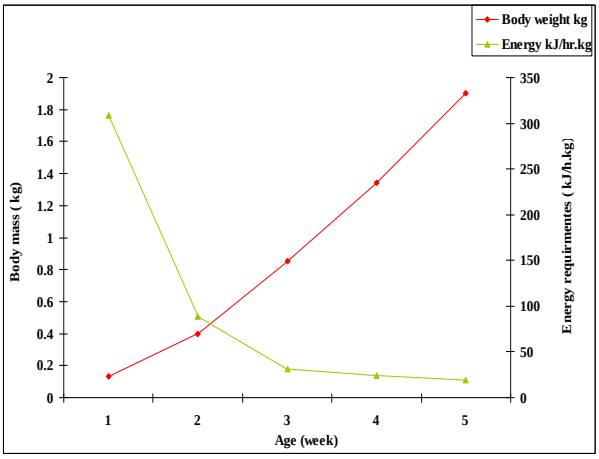

Figure 3 .The relation between heating energy requirements and body mass during birds age

Specific heating power (SP)

Specific heating power dependent on heat energy addition to the house and temperature rise in the house. (Figure.4) showed the relation between specific heating power during different period of age . Specific heating power increase from 3850.3 W/ºC at first week to 5929.5 W/ºC at the end of the second week of age because the brooding area was increased after 10 days of age and reduced to 3122 W/ºC at the end of third week because the heat energy addition reduce with increased birds in age. But, after that the brooded birds were translocated from a small partial area to the whole house brooding . In addition to, the heating system can not be delivered hot air to the end of the house leaved the third part of house volume cold. Therefore, the heating system was continuously operated to rise the indoor air temperature to the recommended level. This means that, more increased in supplementary heat energy addition and gas consumption rate occurred. As a result of that , the heated house volume increased so, the specific heating power increased again until reached to 6213.4 W/ºC.

Specific heating power for every m^3 of the house volume ($SP^/$)

Specific heating power for every m^3 of the house volume dependent on heat energy addition to the house , temperature rise in the house and house volume. (Figure.5) showed the relation between specific heating power for every m^3 of the house volume during different period of age . Specific heating power increase from 6.6 $W/m^3.ºC$ at first week to 6.8 $W/m^3.ºC$ at the end of the second week of age because the brooding area was increased after 10 days of age and reduced to 2.88 $W/m^3.ºC$ at the end of third week because the heat energy addition reduce with increased birds in age. But, after that the brooded birds were translocated from a small partial area to the whole house brooding . In addition to, the heating system can not be delivered hot air to the end of the house leaved the third part of house volume cold. Therefore, the heating system was continuously operated to rise the indoor air temperature to the recommended level. This means that, more increased in supplementary heat energy addition and gas consumption rate occurred. As a result of that , the heated house volume increased so, the specific heating power increased again until reached to 3.8 $W/m^3.ºC$.

Specific fuel consumption (S.F.C)

Specific fuel consumption dependent on gas consumption and temperature rise in the house (Figure.6) showed the relation between specific fuel consumption during different period of age. Specific fuel consumption increase from 0.34 kg/h.ºC at first week to

0.54 kg/h.ºC at the end of the second week of age because the brooding area was increased after 10 days of age and reduced to 0.2 kg/h.ºC at the end of third week because the gas consumption reduce with increased birds in age. But, after that the brooded birds were translocated from a small partial area to the whole house brooding . In addition to, the heating system can not be delivered hot air to the end of the house leaved the third part of house volume cold.

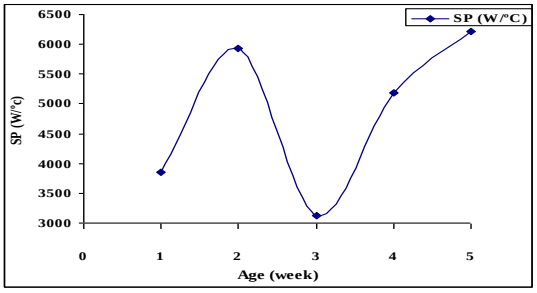

Figure 4. The relation between specific heating power during different periods of age.

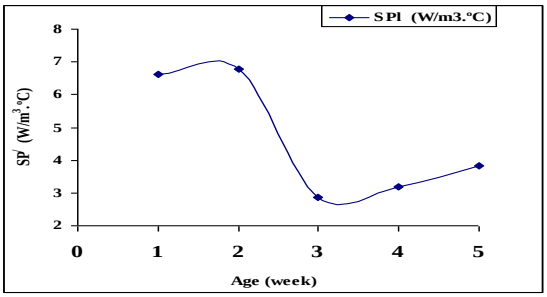

Figure 5 . The relation between specific heating power for every m^3 during different periods of age

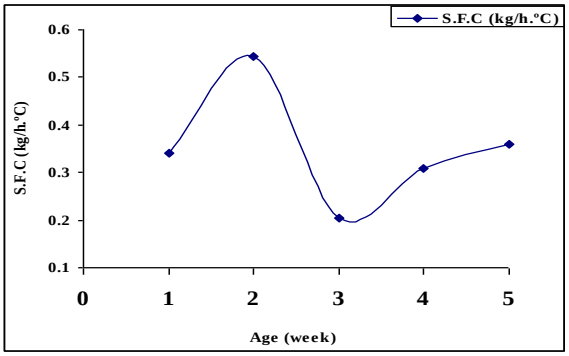

Figure 6. The relation between Specific fuel consumption during different periods of age.

Therefore, the heating system was continuously operated to rise the indoor air temperature to the recommended level. This means that, more increased in supplementary heat energy addition and gas consumption rate occurred. As a result of that , the heated house volume increased so, the specific heating power increased again until reached to 0.36 kg/h.ºC.

CONCLUSIONS

The main results of the present research can be summarized as follows:

- Temperature at chick zone was lower than the recommended by 18.4 % which affecting broiler performance at 9 day age .
- The average floor house temperature was lower the recommended by 11.8 % through the life cycle.
- Average house indoor air relative humidity through the life cycle was 58.8% which was in the recommended range.
- Heating energy requirements reduced gradually with increasing birds in age by 93.7% from the first week of age.
- Average specific heating power was 4860.8 W/ºC.
- Average specific heating power for house volume was 4.7W/m^3.ºC.
- Average specific fuel consumption was 0.35 kg/h.ºC.

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