# Establishment of Cost Effective Brooding Method for Chicken

MS Islam[1,2*], MA Masum[3], DH Santa[4], MJ Alam[2], MM Ali[2]

[1]Heilongjiang Academy of Agricultural Sciences (HAAS) Postdoctoral Program, Animal Husbandry Research Institute, Harbin 150086, P. R. China
[2]Department of Animal Production & Management, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[3]Department of Anatomy, Histology & Physiology, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[4]Biotechnology Research Institute, Heilongjiang Academy of Agricultural Sciences (HAAS), Harbin 150086, P. R. China

[*]Correspondence: saiful.apma@sau.edu.bd

## ABSTRACT

This study was conducted to compare the effect of different brooding techniques on production performance of broilers. Eighty four numbers of day-old broiler chicks (Cobb 500) were purchased from a local hatchery and were randomly divided into 4 experimental units (with three replicates) of 21 chicks each. Brooding in treatment T1, T2, T3 & T4 were conducted by using Electric heating, Gas, Charcoal and Rice husk; respectively as fuel sources in four separate areas of same specifications. All the experimental birds were provided standard husbandry conditions like light, space, ventilation and relative humidity. The data regarding body weight, feed consumption, feed conversion ratio, and mortality was recorded. At the end of experiment, two birds from each replicate were randomly picked up and slaughtered for determining dressing percentage and necropsy study. Result showed that there was no significant difference ($P$>0.05) in case of initial body weight, average feed intake, mortality and dressing percentage among different treatment groups. Significantly poorest body weight gain and FCR was observed in rice husk brooding method ($P$<0.05). Economic study showed that significantly higher performance was observed in electric and gas brooding system with high cost of brooding installation (Tk. 24.42 and 21.26; respectively) as compared to charcoal and rice husk brooding method (Tk. 17.56 and Tk.13.89; respectively) ($P$<0.05). Based on the productive performance, brooding installation and economic analysis, it can be concluded that charcoal brooder may be a cost effective brooding method which can be applied in chicken farm especially in remote areas where no electricity access or power failure is common.

**Key words:** Broiler, Brooding, Productive performance

## INTRODUCTION

Chickens are unable to regulate their body temperature post hatch and react as poikilothermic animals (Romanoff, 1941; Weytjens *et al*., 1999). In early stage, the body temperature of a chicken is dependent on the environment and if the environmental temperature decreases, the body temperature of a chicken decreases as well. Chickens become homeotherm within 4 to 5 days post hatch, which is called the early brooding period (Romanoff, 1941; Weytjens *et al*., 1999; Tzschentke, 2007).

The most important factor during the brooding period that needs to be optimized is the body temperature of chickens. With the right body temperature, chickens start their natural activities i.e. eating, drinking, and growing. Several studies have demonstrated that chickens survive and grow better when the brooding temperature is high (>28°C) (Deaton *et al*., 1996; Malheiros *et al*., 2000; Baarendse *et al*., 2006; Leksrisompong *et al*., 2009). However, any information regarding optimal body temperature of chickens has been yet unknown (Purswell *et al*., 2008). In general practice, it is evident that a body temperature between 34.0 and 35.0°C in the brooding period is optimal for the best growth and development. Within this temperature range, chickens exhibit their normal behavior. In addition, optimal brooding may contribute to the reduction in antibiotic usage which is an important tool to prevent the worldwide growing resistance to antibiotics of pathogenic bacteria in humans (Cohen, 2009; Van Duijn *et al*., 2011).

Farmers are facing various problems during rearing of chickens especially at early stage. As regards brooding, most of the modern brooding systems require electricity as the main source of power and heat, but in many parts of a third world country like Bangladesh, electricity is not yet available in all areas. There are several artificial chick brooders are used in Bangladesh. On the basis of fuel sources, these can be classified as electric, gas, oil, coal, saw dust, rice husk etc. However, it is difficult to adopt these brooders by rural household poultry producers owing to unavailability of fuel in all areas (electricity), high fuel cost (electricity, gas, oil), temperature fluctuation by improper handling (coal, saw dust, rice husk), numbers of chicks to be raised and remote locations of the farm sites. Considering the above circumstances and taking into account as an important issue, the present research had been conducted to establish a brooding method which is more efficient by proper handling and of course, cost effective.

## MATERIALS AND METHODS

### Experimental site and study design

The research project has been conducted at the poultry farm of Sher-e-Bangla Agricultural University. Eighty four numbers of day-old broiler chicks (Cobb 500) were purchased from a local hatchery and divided into 4 experimental groups (T1, T2, T3 & T4) with 3 replications of 7 chicks each. Brooding in treatment T1, T2, T3 and T4 was conducted by using Electric heating, Gas, Charcoal and Rice husk as fuel sources. Each treatment group had been kept in separate brooding place of similar specification. Each experimental unit of the chicks had been separated by using fence.

### Management for housing

The deep litter housing system was offered to the chicks, where one square feet space was provided to each chick. The poultry house was entirely cleaned, washed with fresh water and disinfectant. Before housing the chicks, entire shed was coated with limestone and allowed to dry over 24 hours. The recommended temperature and humidity was maintained throughout the experimental period and recorded.

### Preparation of brooders

The artificial brooding preparation was completed two days before the arrival of day old chicks, where one brooder was provided to each replication group. One thermometer was placed in every replication group at the height of 6-12 inch near the brooder to maintain the brooding temperature. In treatment T1, electric brooders of 800 watts (500 chick capacity) had been used. While in treatment T2 gas brooder of 500 chicks capacity had been used, in treatment T3, local made tin charcoal brooder of 500 chick capacity had been used. In charcoal brooder, empty oil can without lid had been used and making small pores around the tin except 2 inch area of the top and bottom. Bottom 2 inch area was filled with sand and then put charcoal in the tin keeping free 2 inch area from the top. After burning the charcoal, an aluminium plate with sand was put over the tin (Fig. 1). Tin-rice husk brooder had been used in treatment T4 group and the brooder had been made in such a way that rice husk has to be placed in empty oil can without lid (made of tin with 14 inch height) by pressing rice husk hardly in it. In the filled rice husk, a hole had been made in the center of the tin with the help of a bamboo stick so that fire can be made easily (Fig. 1).

**Brooding Management**

The experiment was conducted in the month of April to May, 2014. During the experiment, the environmental temperature satisfied the requirement of brooding temperature and no additional heating was required at day time. Only night period, heat had been provided and brooders were fixed according to chicks' behavior and need. Plain sheet was used as a chick guard and was removed at the end of the 1st week.

**General Management Practices**

In order to maintain good ventilation and required temperature and humidity inside the house, Side wall were kept open during day time and kept half open during night. The housing temperature and relative humidity were recorded daily using a thermometer. The lighting was provided by using 100 watt bulbs fitted with ceiling at the height of 8 feet. However, florescent tube light/charger or florescent tube was used at the time of light failure to maintain the 24 hours light. The rice husk was used as litter. Before spreading, the litter was dried under sunlight over 6 hours and checked and taken out its thick material to maintain litter quality. Litter was used at 2-3 inches depth for each group of broiler. Litter turning was practiced 1-2 times a day to minimize the gas production in the shed to ground level. In the later stage of trial, damp litter was replaced by some fresh litter material.

**Ration and vaccination for broiler**

Broiler starter and broiler finisher commercial diet had been purchased from local market and fed *ad libitum* to birds from 1-14 and 15-28 days of age; respectively. The diet has been subjected to proximate analysis as per AOAC (1995). The birds were vaccinated against ND and Gumboro disease as per standard schedule.

**Data collection**

The experiment had been conducted for 4 weeks. Birds were weighed at the beginning of the experiment and subsequently, on a weekly basis. Feed consumption and weight gain were recorded and feed conversion ratio (feed intake/weight gain) was calculated. Mortality was recorded daily.

The following parameters were recorded throughout the experimental period:

*Feed intake:* Feed was provided to the broiler twice daily and refusal of feed was calculated from feeders of each group and weighed and finally consumed feed was noted daily. For this practice, the following formula was used:

Feed intake (g/b/d) = (Total feed offered – Total feed refused)/ Total broiler

*Live weight:* After arrival of day old broiler at Poultry Experimental Station, individual chicks were weighed by using electric weighing scale and later broilers were weighed at the completion of each week.

*Mortality:* Mortality was recorded in each treatment. Survivability was calculated on the basis of mortality record.
Mortality (%) = (Total No. of broiler died X 100) / Total reared broiler

*Temperature and relative humidity:* Temperature and relative humidity of the experimental house and pens during the experimental period were recorded daily with the help of digital Thermo-hygrometer.

**Calculating system**

All data were collected and calculated in the following way:

i) Live weight: Average live weights of broilers were determined at day-old and at the end of each week up to 4 week in each replication.

ii) FCR: Feed conversion ratio was calculated by using the following formula: FCR= Feed intake(g)/Live weight gain (g)

iii) Brooding cost: Brooding cost has been calculated using the following formula as described previously (Hasanuzzaman *et al*., 2004)-
Brooder cost (Tk/chick) = (total cost of brooder (Tk))/ (longevity of brooder (years) × No. of chicks brooded per batch × No. of batches to brood each year)
Fuel cost (Tk/chick) = (cost of fuel in each day (Tk) × duration of the brooding period (days))/ (No. of chicks brooded)
Total brooding cost (Tk/chick) = brooder cost + fuel cost

iv) Dressing percentage: At the end of the experiment, one broiler bird from each replication was selected randomly, live weight taken and slaughtered for processing. Feed and water were withdrawn 12 hours prior to slaughter to facilitate proper bleeding. The slaughtered birds were final processed by removing the skin, head, shank, viscera, oil gland, kidneys, heart and liver. The gall bladder was removed from the liver and the pericardial sac and arteries were excised from the heart. The gizzard was removed by cutting and it was split open with knife, emptied, washed and the inner lining was removed by hand.
Dressing percentage was calculated using dressed weight divided by live weight and the value was multiplied by 100.

v) Necropsy study: At the end of the experiment, one healthy broiler bird from each replication was also selected, live weight taken and performed necropsy study.

**Statistical analysis**

All data were subjected to statistical analysis in a completely randomized design using the general linear models (GLM) of SAS 9.1 (2003). Significant differences between treatments were further analyzed using Duncan's multiple comparison tests.

## RESULTS AND DISCUSSION

### Efficiency of different brooder

In this study, four different brooding techniques have been used. On the basis of fuel, they are categories into electric, gas, charcoal and rice husk. Electric and gas are very simple and convenient to use. But other two methods are a little bit complicated to use. The main problems of charcoal and rice husk were generating smoking and fluctuation of temperature strength. In this study, we avoided smoking by dried up charcoal and rice husk properly by sunlight. Uniform temperature has been maintained in electric and gas brooder by placement hover ups and down. In charcoal and rice husk, temperature strength was gradually decreased over time (due to amount of fuel) and it has been maintained by placement of tin inside and outside of brooding area and filling up new fuel (charcoal and rice husk). Same thing has been done while fluctuating the environmental temperature.

In our experiment, charcoal gave a stronger and more stable heat than rice husk and whatever the situation, required brooding temperature has been provided to all the birds in all brooding methods, which supports the opinion of other study (Mulugeta Ayalew 2012). However, few studies reported that charcoal brooders did not perform well in generating heat necessary for brooding (Hassanuzzaman *et al*.2004).

This study showed that one tin charcoal or one tin rice husk brooder can easily cover the area of 500 birds. The result can be obtained by placing several thermometers in different location of the area of 500 birds before placement of chicks. In electric brooder, 4 bulb (200 watt) is required for the area of 500 birds. Although this study had been performed in summer (April-May), all types of brooder with same pattern can also cover the same area in winter by placing extra curtain around the brooding area.

### Performance of broiler

The performances of broilers are presented in Table 1. The results of the present research work are stated under the following subheadings to evaluate the effects of different brooding techniques on broiler performance.

### Feed Intake

The weekly average feed intakes of broilers in T1, T2, T3 and T4 treatment groups were 2205.48g, 2205.67g, 2201.30g and 2158.67g; respectively (Table 1). It was observed that different feed intake among different treatment groups were insignificant ($P$>0.05). The result was partial similar with the findings of Ahmad *et al*., 2008. They stated that there was non significant difference between electric and gas brooders. Fluctuation in brooding temperature resulted in low feed intake in broilers which was found in charcoal and rice husk brooder in some findings (Ahmad *et al*., 2008, Orban and Roland 1990). Uniform consumption of feed in present study may be due to quite maintain uniform temperature inside the brooding area of all treatment groups.

### Weight gain

Day old chick and the weekly average live weight of broilers in different treatment groups: T1, T2, T3 & T4 were 1411.85g, 1413.54g, 1388.53g and 1330.23g; respectively (Table 1). It was observed from the results that the average live weights of broilers were increased gradually from beginning to 4th week of age. Initial weight of chicks on different treatments was similar (*P*>0.05). The result shows that significantly higher body weight gain was observed in final live weight at 4 weeks of bird (*P*<0.05). Poorest live weight gain was found in T4 (Rice-husk brooder). The results of present study is the partial similar with the findings of Gill *et al*. (1993), Washburn (1982); Buys *et al*. (1999); Malheiros *et al*. (2000) Harris *et al*. (1975); Orban and Roland (1990). Improvement in weight gain due to the brooding technique has also observed by Buys *et al.* (1999). Based upon the findings of present study it may be stated that decreased weight gain in treatment T4 (Rice husk) may be due to the slight fluctuation in brooding temperature (Low or high) (Ahmad 2008). Although stated earlier, uniform temperature had tried to be maintained in the present study but it was really very difficult to maintain uniform temperature entire brooding period. More weight gain in treatment T1 (Electric), T2 (Gas) & T3 (Charcoal) might be due to less stress and healthy birds as there was more uniform temperature in these treatments.

### Feed Conversion Ratio

The average values of feed conversion ratio of the birds under treatments T1 (Electric), T2 (Gas), T3 (Charcoal) and T4 (Rice husk) was 1.56, 1.56, 1.59 and 1.62; respectively (Table 1). The use of different brooding techniques exhibited a significant effect on the feed conversion ratio of the broilers (Renwick and Washburn (1982); Buys *et al.* (1999). The improvement in feed conversion ratio of broilers in treatment A (Electric), B (Gas) and C (Charcoal) may be due to more uniform brooding temperature and less stress to the birds in entire period of rearing.

**Table 1:** Performance of broiler

| Treatments | Initial Body Weight (BW) (g) | Final BW at 28 days (g) | BW gain (g) | Feed Intake (g) | FCR | % Mortality | Dressing % |
|---|---|---|---|---|---|---|---|
| T1 (Electric) | 43.15 | $1455.00^{a}$ | $1411.85^{a}$ | 2205.48 | $1.56^{a}$ | 0 | 65.86 |
| T2 (Gas) | 43.33 | $1456.87^{a}$ | $1413.54^{a}$ | 2205.67 | $1.56^{a}$ | 0 | 65.32 |
| T3 (Charcoal) | 43.24 | $1431.77^{a}$ | $1388.53^{a}$ | 2201.30 | $1.59^{a}$ | 0 | 64.54 |
| T4 (Rice Husk) | 43.11 | $1373.34^{b}$ | $1330.23^{b}$ | 2158.67 | $1.62^{b}$ | 0 | 66.12 |
| Level of Significant | NS | * | * | NS | * | NS | NS |

Means within the column followed by different superscript are significantly different
*= Significant at 5% level, NS= Non significant

### Survivability

No death of chicken was observed in all brooding method in this study which is close with few findings (Tikhonovskaya and Snitsar (1992) and differ from many other studies Mulugeta Ayalew (2012, Renwick and Washburn (1982), Ahmad *et al*., (2008), Hasanuzzaman *et al*., (2004). This was happened due to rearing low number of birds which was possible to take care intensively. The main cause of mortality may be due to more fluctuation in temperature during brooding and as a result birds go in stress and their immunity is not developed and hence more prone to diseases and death of the birds as any pathogen strikes (Renwick and Washburn (1982), Ahmad *et al*. (2008).

### Dressing percent and necropsy study

The data presented in Table 1 showed that dressing percentages were not significantly different among the dietary treatment groups. The necropsy report indicated that there was no remarkable abnormal lesion found in all of the dietary treatment groups. This result is partially similar with the findings of Gill *et al*. (1992) and Tikhonovskaya and Snitsar (1992)

### Cost effectiveness

Cost of brooding differed significantly ($P$<0.05) among different treatment groups. Brooding cost per chick was Tk. 24.42 (Electric brooder), Tk. 21.26 (Gas brooder) Tk 17.55 (Charcoal brooder), and Tk. 13.89 (Rice husk brooder) (Fig. 2). Charcoal and rice husk brooding systems were found to be more laborious as compared to electric and gas brooding. Electric and Gas brooder both systems exhibited almost similar production performance but high cost of installation (gas brooding) and more chances of power failure (electric brooding). These limitations make them uneconomical when compared with charcoal and rice husk brooding system.

## CONCLUSION

In conclusion, higher level of chickens' survival and performance together with other brooders was observed by charcoal brooder. This brooder is most effective and usable to achieve poultry extension plan in rural areas where there is no electricity or gas supply. However, further experimental trial by measuring the amount of heat it produces per unit volume of charcoal is suggested. Charcoal brooding may be an economical system of brooding of chicks to enhance the production performance of the birds.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

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**Fig. 1:** Preparation of brooding- Charcoal (A & B) and Rice husk (C & D) brooding.

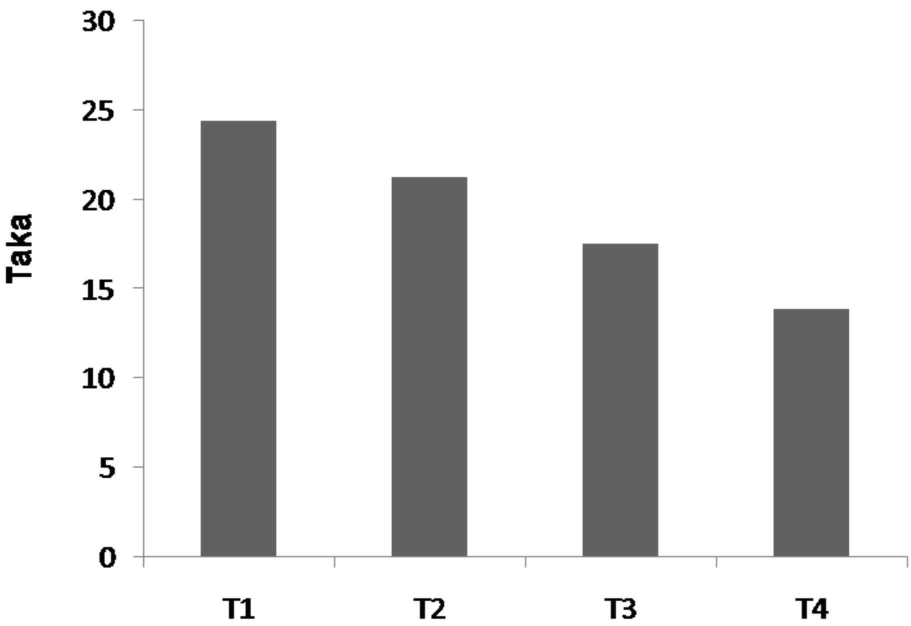


**Fig. 2:** Cost analysis of different brooding system- T1 (Electric), T2 (Gas), T3 (Charcoal) and T4 (Rice husk).

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