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Impact of Mini Incubator on Brooding, Rural Egg Production, and Socio-economic Status of Rural Farm Women of Andaman Islands

T. Sujatha, Jai Sunder, A.K. De, D. Bhattacharya and E.B. Chakurkar
Division of Animal Science, ICAR-Central Island Agricultural Research Institute, Port Blair,
E.Mail:sujatha@rediffmail.com

Abstract

This work was carried out to study the effect of management intervention with a mini incubator on broodiness, desi egg production, and the socio-economic status of farm women in the Andaman Islands. The effect of mini incubator was compared over traditional brooding.

Farmers who availed hatching facilities showed that all the desi hens are natural brooders, and the brooding period varied from 20- 21 days for the broody hen, which was significantly higher than the brooding pause of 6 days with the intervention of a mini incubator. The length of the incubation period varied from 90 to 132 days for a broody hen with an average incubation pause of 91 days that was significantly ($p \leq 0.01$) reduced to 44 days with the mini incubator. There was no significant difference between traditional and mini incubator brooding in an average mean of clutch traits such as clutch size (6.06 eggs), inter clutch intervals (1.66 days), and several clutches (2.01) per laying cycle. Significantly ($p \leq 0.05$) higher egg numbers per laying cycle with larger egg size was reported with traditional brooding that was four eggs higher than the group of hens whose eggs were taken away for hatching in a mini incubator. However, total egg number and egg mass per hen per year were significantly ($p \leq 0.01$) higher by double fold with a mini incubator brooding group of the hen. The net income with the mini incubator group was significantly higher with a more significant Benefit-cost ratio of 2.5 folds. The mini incubator brooding has paved the way for three income generation avenues for the farmers.

Key words: *Mini incubator brooding, broodiness, egg production, socio-economic status of farmers*

Introduction

Livestock is an indispensable component in the mixed agriculture farming of the Andaman Islands (Swarnam *et al.,* 2018). Rain-fed agriculture is commonly practiced over here due to lacking of permanent facilities for irrigation. Farmers thereby predominantly depend on livestock for nutritional and livelihood security. It has also been reported by Swarnam *et al. (*2018) that net farm income was improved with the dairy-based integrated farming system in these Islands. A Rural poultry-based farming system is another potential integrated farming system for the island farmers. The total poultry population in A&N Islands is 12,83,746 (DAHVS, 2019), out of which backyard poultry is 61.03 percent. The geographical isolation of these Islands has led to dependency at large on rural poultry for eggs and poultry meat that played a significant role in nutritional and livelihood security during the Covid lockdown period. The importance of native birds to the rural economy is also immense in different countries (Magothe *et al*., 2012). The production genetic potential of indigenous birds needs to be exploited fully though they are well known for adaptability and disease resistance (Pathi *et al*., 2016). Growth and egg production of native poultry are deficient under rural farming conditions; better housing, feed, and proper health care have increased their production potential significantly (Dessie *et al.,* 2011). Abdelqader *et al.* (2007) reported a significant improvement in the performance of native fowl of Jordan in terms of survivability, flock size, hatchability, clutches, egg weight, and egg mass with improved management. Thus, advances in traditional management practices can positively impact indigenous chicken production, contributing greatly to rural household incomes (Sarkar and Golam, 2009).

Further, their nature of reproductive physiology of brooding cum maternal care generally affects the production of native poultry as broodiness involves

activities viz., sitting on her eggs to hatch out chicks and taking of hatched chicks for a few months. The high metabolic rate during the brooding period due to frequent nest occupancy, turning and retrieval of eggs, aggressive or defensive behaviors, and characteristic clucking increases their body temperature, subsequently leading to a reduction in feed and water intake and cessation of egg production (Romanov *et al*., 2002; Chen and Li, 2007) The average duration of broodiness in most of indigenous breeds of chickens is approximately 20 d and maternal care for more than 100 days (Jiang *et al.,* 2005). According to the national plan 2022, backyard poultry needs fiscal intervention and as one of the advancements in desi chicken production, farmers have been empowered to use Mini incubators (Sujatha and Shardul, 2020). Hatching desi eggs using a mini incubator was appropriate for advanced rural poultry farming.

However, data on the impact of artificial hatching cum brooding on reducing the brooding period of broody hens are lacking.With this background, this work was carried out to study the effect of management intervention with low input technological tools, the mini incubator on broodiness, desi egg production, and the socio-economic status of farm women in the Andaman Islands.

Methodology

It is necessary to give the much-needed infrastructural support of mini hatchery units and training to the targeted beneficiaries to get optimum improvement in rural poultry farming. The study was conducted from 2019 to 2021 in eight (08) randomly selected urban, semi-urban and remote areas such as., Nayagaon, Hasmatabad, Shoalbay, New Wandoor, Garacharma, Sipphighat, Duke Nagar, and Nimbudera of South, North, and Middle Andaman. Seven Mini hatching units (240 eggs capacity) were established at South and Middle Andaman farm women and Krishi Vigyan Kendra, South Andaman, to benefit the widespread unorganized rural farming community, including rural farm women, particularly. The capacity-building program and hands-on training were imparted to educate the farmers on how to operate the mini incubators. Farmers were aware of the hatching facility from the farmers' field unit of mini incubator and Krishi Vigyan Kendra, South Andaman.

Farmers were divided into two groups traditional brooding and mini incubator brooding. In the group of mini incubator brooding, farmers were advised to remove eggs from broody hens for further storage and to set them in the machine. The traditional brooding group practiced the standard method with the broody hen to hatch eggs.

The data on source for hatchable eggs and hatchability, number of chicks supplied to the other farmers, gross expenditure and income and net income, transition in broodiness character in terms of length of broodiness, clutch size, length of the pause, number of clutches per cycle and number of eggs per cycle were arrived from both the targeted beneficiaries and farmers from the concerned community where the mini incubator was located. The same data was collected from farmers in a traditional brooding system under a broody hen. The data on improved knowledge level on advanced hatching in rural poultry and women's perception of their improved empowerment was also collected. Comparisons of data of broody and non-broody (mini incubator) hens were made within each group by 1-way ANOVA.

Results and Discussion

Broodiness

The data (Table 1) from 200 hens and 80 farmers who availed hatching facilities showed that all the desi hens are natural brooders, and the brooding period varied from 20- 21 days for the broody hen, which was significantly higher than the brooding pause of 6 days with the intervention of mini incubator in the present study. The length of the incubation period varied from 90 to 132 days for a broody hen with an average incubation pause of 91 days that was significantly ($p \leq 0.01$) reduced to 44 days with a mini incubator. The intrinsic association of plasma prolactin with maternal behavior (Eltayeb *et al*., 2010) in all avian species had been responsible for lengthy brooding and incubation pause with habitual broody hens. As suggested by researchers (Jiang *et al*., 2010; Eltayeb *et al*., 2010), any managerial techniques or strategies to prevent incubation behavior, the managerial intervention with mini incubator technology in this present study for hatching desi eggs has significantly reduced the brooding pause. The managerial practice without chicks rearing by

broody hens reduced incubation pause by 61 % (Eltayeb *et al*., 2010).

Egg production and its related characteristics

The mean values of egg production traits for one year from age to sexual maturity are presented in Table 1. There was a significant difference ($p \leq 0.01$) in the laying cycle between the traditional system of brooding and hatching with the mini incubator. There were three-fold improvements in the number of laying processes with intervention in the conventional method of contemplating by Mini incubator.

The graphical representation of changes in the laying pattern by the mini incubator is depicted in Figure1. The clutch pattern revealed that there was no significant difference between traditional and mini incubator brooding in the average mean of clutch traits such as clutch size (6.06 eggs) and inter clutch intervals (1.66 days), and the number of clutches (2.01) per laying cycle. Significantly ($p \leq 0.05$) higher egg numbers per laying process with larger egg size was reported with traditional brooding that was four eggs higher than the group of hens whose eggs were taken away for hatching in a mini incubator. However, total egg number and mass per year were significantly ($p \leq 0.01$) higher by double fold with a mini incubator brooding group of hens deprived of brooding activity. This observation agreed with Jiang *et al*. (2010). They also reported thatfor non-broody hens, although they produced significantly more eggs than broody hens, hen day egg production was significantly greater for broody than non-broody hens, excluding the broody period. He also suggested precluding the expression of broody behavior by providing an environment, and the mini incubator has provided that environment for hatching in the present study. However, broodiness had been expressed in the cage system (Yang and Jiang, 2005).

Long-term incubation pause, including broodiness cum mother carein the present experiment, has been associated with low egg production in the traditional brooding system (Chen and Li, 2007)due to higher circulation of plasma prolactin that down regulated secretion of gonadotropins resulting in the regressed ovary and subsequently reduction of plasma ovarian hormone which finally decreased the egg production during the brooding period (Romanov *et al*., 2002). The more excellent egg production with mini incubator brooding might be due to the frequent removal of eggs from the nest box for incubation and hatching and artificial brooding arrangement for hatched chicks which was opined by Eltayeb *et al*.(2010).Higher egg production has also been recorded with a broody hen deprived of her hatched chicks after four weeks of hatching (Hossain, 1993). It is then indicated that denying broody hens from their eggs laid and chicks hatched were with desperation for few days and entered into normal feeding behavior after 5 to 10 days and subsequently regular egg production set in and that the reason why the brooding and incubation pause was significantly less in the present study with mini incubator brooding.

Knowledge level of farmers on mini incubator technology for rural poultry

The pre and post knowledge level of farmers on the use of mini incubators for hatching desi eggs is given in Table 2. Demonstrations, hands-on training, intensive awareness programs, and field mini incubator units improved the knowledge level on practices, *viz*., production, handling, and setting of clean hatchable desi eggs and entrepreneurship on rural poultry produce by 70-80%.

The economic impact of the mini incubator on rural poultry farming

The data on economic indicators collected from 6 farm women at whom the mini incubator field unit was established compared to farmers who practiced traditional brooding has been presented in Table 3. The average flock size of laying hens was 15numbers at the age of sexual maturity (25 weeks). This homogeneity of birds among selected groups of farmers was maintained. The total egg production with a group of mini incubator brooders was significantly ($p \leq 0.01$) higher and double-fold increase than the traditional brooders with a broody hen. The mini incubator group had 990 eggs, more than the conventional brooding method. The mini incubator users could set desi eggs for hatching at 2.5 fold more

than the traditional brooders. The hatchability percentage with broody hens was though numerically higher than in the mini incubators; it was not significantly differing. The number of desi chicks hatched out varied between the groups according to the percent hatchability and whole eggs set. Feed consumption was significantly (p±0.01) low with broody hens as compared to the groups under a mini incubator, and hence feed cost was proportionately less with the traditional brooding system. A similar observation by Eltayeb *et al.* (2010) was that there was a significant reduction in feed intake during the brooding period irrespective of genotypes.

The group with the traditional brooding system received income from two sources, viz., the Sale of eggs excluding eggs for setting and home consumption and the Sale of day-old desi chicks, while the mini incubator brooding group had one additional source of income through providing hatching facility to the other farmers. The net income with the mini incubator group was significantly higher with a more significant Benefit-cost ratio of 2.5 folds. As reported in the present study, many researchers have explored backyard poultry farming as a potential tool to reduce malnutrition and rural unemployment (Rajkumar *et al*.,2010; Conan *et al.*,2012; Pathi *et al.,* 2016). The mini incubator brooding has paved the way for three income generation avenues for the farmers. The transition has happened in the traditional brooding through intervention with mini incubator brooding, which proved rural poultry farming as a viable, profitable, and economical enterprise.

Perception of women empowerment in rural poultry farming

Based on the women's response, it was reported that their economic and social status improved by 65 % and 50%, respectively. It improved their psychological empowerment as it increased their self-confidence, and they have become part of family decision-making. They were empowered to solve home problems and could be able to manage home affairs; their contact network in society was widened. It increased their social participation and developed their leadership qualities.

Conclusion

The intervention with mini incubator brooding in tradition brooding under broody hen improves the desi egg and meat production in the remotely located Islands. Further, this managerial strategy provides self-employment and women empowerment through rural poultry production in the rural areas reducing malnutrition through protein security as the per capita availability of eggs and poultry meat is met with the advanced rural poultry. Women's socio-economic status was improved through empowerment on advanced brooding with a mini incubator in rural poultry farming. Entrepreneurship development on country chicken using a mini incubator is an emerging field in A&N Islands.

Table 1 Impact of the mini incubator on desi egg production and brooding traits of laying hens (n=80 farmers ; N=200 hens)

Parameters	Mean ± SE	
	Traditional system	Intervention with mini incubator
Brooding pause (days	21.45±1.62^{b}	6.56 ± 2.65^{a}
Incubation pause (days)	91.16 ± 3.24^{b}	44.45 ± 4.62^{a}
Clutch size (days)^{NS}	6.62 ± 1.75	5.56 ± 2.53
Inter-clutch interval (days) ^{NS}	1.48 ± 0.54	1.84 ± 0.76
Number of clutches per laying cycle ^{NS}	2.06 ± 0.51	1.95 ± 1.24
Laying cycles per year	4.15 ± 0.09^{b}	12.55 ± 1.35^{a}
Egg number per cycle	15.15 ± 0.02^{a}	11.54 ± 0.07^{b}
Total egg number per hen per year	60.0^{b}	126.0^{a}
Egg weight	40.74 ± 0.83^{a}	37.80 ± 0.97^{b}
Total egg mass (g) per hen per year	2279.2^{b}	4762.8^{a}

Figure 1: Effect of intervention with mini incubator on laying pattern of desi poultry

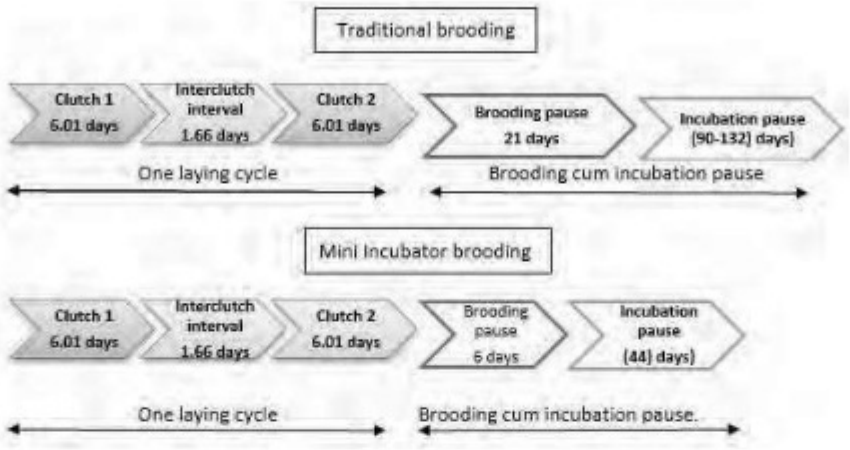

Table 2: Knowledge level of the farmers on the use of mini incubators in rural poultry (n=200)

Practices	Pre-establishment	Post - establishment
Clean egg production and its storage before incubation	4.55 %	93.54%
Fumigation, setting, and handling of eggs	12.35%	85.45%
Micro – business and Sale of rural poultry produce	15.15%	92.85%

Table 3: Economics of adopting Mini incubator (240 eggs capacity) technology

Particulars	Traditional brooding (n=60 farmers)	Mini Incubator brooding (n = 6 farm women)
No of hens	15	15
Total egg production per year	900[b]±6.85	1890[a]±4.35
Eggs set for brooding/hatching in a year, excluding home consumption and selling	420[b] (Broody hen)	1080[a] (mini incubator)
Hatchability %	95.15±0.56	85.45±2.67
Number of chicks hatched per year	400.0	918.0
Additional eggs through hatching with mini incubator	0	990
Hatching facility for desi eggs to the other farmers (nos) per year	-	30 farmers and 1800 eggs
Income		
Sale of eggs @ Rs.20 per egg, excluding eggs for setting and home consumption	Rs 4800 (240 eggs)	Rs 11400 (570 eggs)
Sale of day-old desi chicks @ Rs.50 per chick	15700 (314 chicks)	45000 (900 chicks)
Providing hatching facility @ Rs.20 per egg	-	36000
Total Gross Income	20500.0	92400.0
Expenditure		
Supplemental feed requirement (kg/year)	305.25± 8.26[a]	517.75±9.47[b]
Feed cost (@ Rs 11.0 per kg – broken rice/wheat)	3357.75	5695.25
Labor cost	500	1000
Miscellaneous cost (Medicine, tonic, setting the price of eggs, etc.)	500	2900
Total expenditure (Rs)	4357.75	10113.00
Net income (Rs.)	16142.25	82287.0
Benefit: cost ratio	3.7	8.1
source of desi chicks	Desi birds were rarely available on the market	Small-scale desi bird farming is emerging
Improvement in the availability of rural ducklings/chicks	4 to 8 times	

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