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Comparative Study of Automation and Conventional System on Production Performance in Poultry Farms

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ABSTRACT

The study was conducted to compare the productivity performance of Layer breeder under conventional house and automatic house. Both houses were studied under small farms with an average of 250 birds. This study covered a period of 22 weeks with five replicates. Based on the results, the effect of different rearing systems on the mean body weight and FCR from week eighteen to forty weeks of age on weekly and cumulative basis were significantly ($P \leq 0.05$) influenced among the various treatment groups in HH-260 birds. Egg production, Hen housed and hen day egg production in experimental birds in automatic rearing system was significantly different from birds reared in conventional rearing system. The study also concluded that ARS birds had better liveability as compared to birds under conventional rearing systems. Litter quality analyzed based on the proximate analysis and *E. coli* count and found significant ($P \leq 0.01$) difference among the two-rearing systems. The proximate analysis of built up litter was significant higher ($P \leq 0.01$) in CRS than the ARS. The higher proximate values like crude protein, crude fat, crude fibre, total ash and energy value were mainly due to feed wastage in conventional rearing system which leads to elevation of these values. There was highly significant difference ($P \leq 0.01$) in working time measurement of automation over conventional system of rearing. It accepted the hypothesis of the study that ARS housing have better productivity and profitability over conventional, this is testified by the general better FCR, egg production, liveability and litter quality in CCS houses.

HIGHLIGHTS

- Impact of rearing system on production parameters of layer breeders was studied.
- Automatic rearing system has significant influence on growth performance, egg production, liveability, litter quality and working time measurement.

Keywords: Feed conversion ratio, Conventional rearing system (CRS), Automatic rearing system (ARS), litter quality

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Poultry sector is one of the fastest growing segments of the agricultural and agriculture allied sector in India. The poultry sector in India has undergone a paradigm shift in structure and operation which has been its transformation from a mere backyard activity into a major commercial agro based industry over a period of four decades. The constant efforts in up gradation, modernization and application of new sensor technologies paved the way for the multifaceted growth in poultry and its allied sectors. The development is not only in capacity but also in productivity, sophistication and quality. According to (BAHS, 2019; 20th Livestock census, 2019), India ranks third in egg production and fifth in broiler production having 851.81 million poultry population with a growth rate of 8.5 per cent. The annual production of eggs has reached to 103.32 billion. Majority of the poultry owners follow the open house conventional rearing system. Farmers are reluctant or hesitate to opt the modern technologies because of easy availability of manpower and their inability to invest on higher short-term capital costs. The trend in poultry production has been towards large commercial farming. This compels the farmers to switch over from traditional practices to mechanized farming which saves time and labour. This includes mechanical cleaning equipment; sensor driven automatic feeding and nipple watering equipment, medication etc. The use of modern technologies makes it possible for large number of bird to be handled in the large scale operation. Controlled feeding and automating a controlled feeding system of broiler for optimum nutrition is a beneficial step and must be applied in poultry enterprises.

The objective of study is to compare the automated system over conventional system on growth performance, age at sexual maturity egg production, egg quality, Per cent settable eggs, fertility, hatchability, litter quality, chick's quality, liveability and working time measurement in deep litter layer breeder farm.

MATERIAL AND METHODS

In order to achieve the proposed objectives, experiment duration of 22 weeks was conducted at the Central Poultry Development Organization and Training Institute (CPDO & TI) Hessaraghatta Bengaluru. The experimental procedures and analytical techniques adopted during the course of the study are detailed here. The trial was conducted by using Hessaraghatta hybrid -260 (HH260, White Leg horn breed) layer breeder birds. Eighteen week layer breed numbering 290 (250 females+40 males) were housed in shed No-2 having dimension of 20 ft × 50 ft. The birds with an average body weight of 1.1 to 1.3kg were selected randomly and assigned to 2 groups (T1-Conventional rearing system and T2-Automated rearing system), one each for automated and conventional system, with 5 replicates in each group and having 25 female and 4 males in each replicate (125 female per treatment). The chicks were reared in open sided house under deep litter system with all standard management practices till 40 weeks of age. Standard vaccination schedule was followed for immunizing the chicks. Birds were fed with layer breeder ration diet from eighteen weeks @ 120 gm/bird/day. Feeding of diets commenced at eighteen week of age and continued till the termination of experiment at forty weeks of age.

Parameters studied

Body weight: The body weights of individual birds were recorded from eighteen weeks of age and at the end of each week till forty weeks of age to monitor the pattern of body weight gain. The weighing of the birds was done in the early hours of the day before feeding by using digital weighing balance.

Feed to egg conversion ratio (FCR): The feed to egg conversion ratio (FCR) expressed as the ratio of amount of feed consumed (kg) per dozen of eggs under each experimental group from twenty third weeks to forty weeks and also determined on cumulative basis. The FCR was calculated by using the following formula:

Feed conservation ratio (PCR) =

$$\frac{\text{Average feed consumption per bird per week}}{\text{Number of eggs produced per week}}$$

Age at sexual maturity and egg production: Age at sexual maturity (days) was recorded when the hen laid her first egg. Age at 50 per cent of flock came into production (days) was also recorded. Egg production was calculated on weekly basis. Hen day egg production (HDEP) and Hen housed egg production for a period (HHEP) was calculated at the end of the trial (40 weeks of age).

Litter Quality: The objective of assessing the litter quality in this experiment was to check the feed wastage in automation and conventional rearing system. Litter quality was assessed based on moisture per cent, proximate principles, microbial load (*Esherichia coli*) and coccidial oocyst load recorded at the time of sexual maturity and at the end of trial. The following methods were opted for assessing the litter quality:

Table 1: Methods opted for assessing the Litter quality parameters

Sl. No.	Parameters	Method of Estimation
1	Moisture	Oven drying (AOAC,2003)
2	Crude Protein	Kjeldahl methods (AOAC,2003)
3	Crude Fibre	Near Infrared reflectance spectroscopy (Tyagi *et al*., 2009)
4	Ether Extract	Soxhlet method (AOAC,2003)
5	Total Ash	Dry Ashing (AOAC,2003)
6	*E. coli*	MacConkey Agar media (Aryal, 2018)
7	Coccidial oocyst	McMaster egg counting technique (Haug *et al.,* 2006)

Liveability: Liveability was calculated with the given formula at the end of the trial for the birds under each treatment

Working Time Measurement: Time and motion study comprising of time taken in feeding, watering, medication in automation and conventional system were calculated**.** A timer was fixed for each routine work and separately calculated for automation and conventional system (Armstrong and Quick, 1986).

RESULTS AND DISCUSSION

Body weight: The effects of different rearing system (Table 2) on the mean body weight from eighteen to forty weeks of age on weekly basis were significantly (P≤0.05) influenced among the various treatment groups in HH-260 birds. The body weights of both the treatment groups were uniform till thirty weeks (P≤0.05). From thirty-one to forty weeks optimum body weight achieved in birds reared in automatic rearing system as compare to birds reared in conventional rearing system. This shows that the uniform feeding achieved in automatic rearing system as compare to conventional rearing system.

Table 2: Effect of rearing systems on weekly average body weight (kgs) of HH-260 birds

Age (Weeks)	Rearing systems		P Value
	Automation	Conventional	
18th	1.211±0.01	1.212±0.05	0.912
19th	1.272±0.01	1.278±0.04	0.635
20th	1.328±0.01	1.326±0.01	0.909
21st	1.360±0.01	1.352±0.01	0.524
22nd	1.390±0.02	1.371±0.04	0.145
23rd	1.420±0.01	1.410±0.05	0.509
24th	1.452±0.04	1.426±0.06	0.784
25th	1.488^{a}±0.03	1.438^{b}±0.06	0.042
26th	1.516±0.04	1.450±0.07	0.241
27th	1.536±0.05	1.454±0.05	0.281
28th	1.566±0.23	1.464±0.42	0.735
29th	1.574±0.41	1.476±0.35	0.583
30th	1.587±0.69	1.494±0.52	0.058
31st	1.612±0.21	1.515±0.33	0.181
32nd	1.624±0.12	1.531±0.47	0.545
33rd	1.644^{a}±0.25	1.541^{b}±0.11	0.011
34th	1.672±0.41	1.565±0.84	0.195
35th	1.681±0.27	1.572±0.43	0.161
36th	1.688^{A}±0.36	1.580^{B}±0.54	0.010
37th	1.697±0.73	1.591±0.51	0.081
38th	1.712±0.26	1.602±0.37	0.092
39th	1.715±0.33	1.608±0.22	0.063
40th	1.721±0.32	1.611±0.44	0.074

A,B-Means bearing different superscripts within rows differ significantly (P≤0.01); a,b- Means bearing different superscripts within rows differ significantly (P≤0.05).

The results of present study are in agreement with Lacin *et al*. (2008) findings as uniform feeding has positive influence on achieving optimum body weight. Leeson and Summers (1991) and Harms *et al*. (1984) noted that there was a significant relationship between feed consumption and body weight. Maximum body weight was found in T_1 group (ARS) which was not significantly high as compared to T_2 group groups during forty week of the experiment. Anderson and Adams (1994) indicated that birds provided with more feeder space will gain the bodyweight faster in white leg horn birds. This follows the same trends found by Anderson and Adams (1992) i.e., (Body weight differences manifested at the end of the rearing period remained through the production cycle). They also concluded that ending BW and BW gain were not affected by the type of flooring material. In contrast of Meunier-Salaun *et al*. (1984), who reported that the rearing environment had no significant effects on hen performance. Breeder management guide programs have suggested that optimum feeder space will ensure that all chicken have access to the feed and that feeder space should increase as the chicken's age (Anonymous, 1997). Furthermore, inadequate feeder space has been generally associated with poor uniformity of flock BW (Anonymous, 2009), but a controlled study found that significantly reduced feeder space had no effect on BW uniformity (Van Krey and Weaver, 1988). Singh *et al*. (2009) also reported that the body weight of hens will be affected by different rearing system. Uniformity of body weight in pullets and layers is of an important managerial concern (Sosnówka *et al.,* 2010). However, on contrary (Adam, 2017) study showed no significant differences in body weight gain during the experimental period for layers housed in different rearing system.

Feed Conversion ratio: Statistical analysis revealed significant difference (P≤0.01) in mean FCR values (Table 3) among the two treatment groups during twenty third week, twenty nine week, thirty week, thirty one week, thirty nine and forty week. The patented *Roxell Haikoo feeder*® designed in such a way that it accommodate more number of birds compare to conventional feeders, which further leads to the optimum feed utilization by the birds. The results of present study are in agreement of Sonkamble *et al.* (2020) findings that feed conversion ratio in terms of feed intake/ egg was influenced by type of rearing systems. Contrary to our findings in this experiment, the results of the present study are in disagreement with Ahammed *et al*. (2014) who reported that there was no significant difference in feed conversion ratio in birds reared in different rearing systems. Conflicting reports from those authors is likely due to the influence of a variety of factors, such as genetics, nutrition, environment, and age (Rakonjac *et al*., 2017). Regarding the genetics of the bird, it is suggested that commercial strain, selected for production under intensive controlled conditions, seem to be inappropriate for alternative and enriched rearing systems, which provide more natural but poorer living conditions (Hovi *et al.,* 2003). However, there was no information regarding the effect of automatic rearing systems on white leghorn chicken (HH-260). Although many researchers have studied laying hen performance response to automatic and alternative rearing systems such as enriched cage, aviary, floor management, and free range systems (Tauson *et al*., 1999; Neijat *et al*., 2011; Ahammed *et al*., 2014), studies on the effect of changing from conventional cages to automatic rearing systems on production traits are continuing, especially in relation to the ability of pure inbred breeds to adapt to these automatic systems under certain climates. Hens under automatic rearing systems (ARS) showed higher FCR, this was probably due to the higher motor activity (Castellini *et al.,* 2006) of the hens of this group. This statement is consistent with report from Lampkin (1997) and Mugnai *et al*. (2009).

Table 3: Effect of rearing systems on weekly Feed Conversion Ratio (feed consumed in kg per dozen egg) of HH260 birds

Age (Weeks)	Rearing systems		P Value
	Automation	Conventional	
23rd	2.575^{A}±0.05	3.328^{B}±0.12	0.009
24th	2.574±0.08	2.726±0.08	0.27
25th	1.993±0.02	2.110±0.09	0.33
26th	1.844±0.01	1.826±0.06	0.75
27th	1.861±0.03	1.854±0.07	0.89
28th	1.769±0.07	1.865±0.04	0.1
29th	1.728^{A}±0.01	1.876^{B}±0.08	0.01
30th	1.868^{A}±0.02	1.981^{B}±0.04	0.002
31st	1.849^{A}±0.04	2.560^{B}±0.06	0.009
32nd	1.917^{a}±0.05	2.373^{b}±0.08	0.042
33rd	2.132±0.08	2.246±0.04	0.68
34th	2.148±0.02	2.236±0.07	0.16
35th	2.148±0.03	2.202±0.05	0.78
36th	2.184^{A}±0.04	2.437^{B}±0.04	0.095
37th	2.244±0.03	2.356±0.03	0.67
38th	2.348±0.06	2.437±0.09	0.56
39th	2.654±0.07	2.511±0.08	0.59
40th	2.892±0.08	2.845±0.04	0.87

A,B-Means bearing different superscripts within rows differ significantly (P≤0.01); a,b- Means bearing different superscripts within rows differ significantly (P≤0.05).

This study shows the ability of layers hens to regulate the intake of nutrients which can be used to increase feed efficiency. Greater levels of comfort behaviours such as resting, and preening, perching and mud bathing had shown improved FCR in the white leg horn birds. Clark *et al*. (2019) also had similar study and concluded that significant impact of comfort behaviours such as resting, perching, mud bathing and preening on Feed conversion ratio. Poultry birds are good foragers and converters of feed into bio-available protein in meat and egg (Abanikannda *et al*., 2007). Feed conversion ratio for the entire laying period, the best-feed conversion ratio was observed in layers reared in deep-litter system (Adam, 2017). Also report noted by (Gerzilov, 2012) the feed conversion ratio in layers kept in deep-litter was high versus other both poultry housing systems.

Age at sexual maturity: Age at first egg of the experimental birds (Table 4) was considered as age at sexual maturity during the study. There was no significant difference observed in age at sexual maturity in relation to the rearing system. Age at first egg in both the treatment group did not have impacted on experimental birds since all the experimental birds selected at the age of eighteen weeks. And also, automatic and conventional rearing system did not have significant effects on age at fifty per cent production. The result of the study is in agreement with the findings of Sonkamble *et al*. (2020) as the rearing of birds in different housing system did not have significant effects on age at first egg and age at sexual maturity. Similar results were reported by Anderson and Adam (1994) that rearing feeder space had no effect on the age at 50 per cent production and age at sexual maturity. On contrary to these findings, DeAvila *et al*. (2003) reported that feeding time and frequency triggers early sexual maturity in female broilers breeders.

Table 4: Effect of rearing systems on age at sexual Maturity of HH260 birds

Rearing system	Age at first egg produced(days)	Age at 50% production (days)
Automation	133.98±0.05	147.66±0.08
Convention	134.54±0.03	154±0.04
P value	0.24	0.15

Egg Production: Egg production in experimental birds (Table 5a) in automatic rearing system was significantly different (P≤0.05) from birds reared in conventional rearing system. Similarly, Hen housed egg production and Hen day egg production (Table 5b) was significantly higher (P≤0.01) in automatic rearing system as compare to conventional rearing system. The result of the study are in agreement with the findings of Idowu *et al*. (2018) as rearing system have positive correlation to the egg production. Similar study conducted by Englmaierová *et al*. (2014) reported the highest hen day egg production found in enriched rearing system than other rearing system. Egg production is partly productive and partly reproductive trait (Bell *et al*., 2007). Improving feed conversion ratio and achieving optimum body weight will improve the total egg production. It can be statistically induced that selection for improving one trait will simultaneously improve the other traits and otherwise. This result agrees with Jahan *et al*. (2017). However, on contrary to the findings of Du Plessis, (1972) reported that there is no relationship between total egg production and body weight at sexual maturity. Some studies (Abrahamsson *et al*., 1996; Tauson *et al*., 1999) have reported that egg production of laying hens was influenced by rearing system. The managemental factors like optimum feeding, watering and less manhandling will reduce the stress in the birds which in turn reduce the plasma cortisone level of the experimental birds (Scanes, 2016). Tactacan *et.al*. (2009) studied the comparison of conventional versus enriched house concluded that there was no marked difference in hen day egg production. Poultry hen requires about 24 to 26 hours for producing an egg. After the egg is laid, the hen starts all over again about 30 minutes later (Bell *et al*., 2007).Egg production is a dependent variable and is influenced by several factors like strain of chicken (Shah *et al*., 2006; Petek, 1999), feeding, mortality, culling, health and management practices, age at point-of-lay, and peak for lay and persistency of lay rate (Kristensen and Silleb-Kristensen 1996). Some important factors from the managerial point of view efficient operations, resources utilization, economical feeding, improved housing and standard stocking density rate (Eekeren, 2006). Egg production can be environmentally affected by factors such as quality and quantity of poultry feed, water consumption intensity, photoperiodism and diseases (Kekeocha, 1984). In contrast to the findings of Sonkamble *et al.* (2020), who reported that the average hen day and hen house egg production were not affected due to different housing systems. Similar study reported that egg production of hens showed no difference under different rearing systems (Neijat *et al.,* 2011; Ahammed *et al*., 2014).

Table 5(a): Effect of rearing systems on egg production (No's & %) in HH-260 birds

Age (Days)	Egg production (No's)		Egg production (%)		P Value
	Automation	Conventional	Automation	Conventional	
126	0	0	0	0	
133	13.00	12.00	10.40	9.60	0.91
140	30.25	28.42	24.20	22.74	0.28
147	70.00^{A}	54.80^{B}	56.00^{A}	43.84^{B}	0.0001
154	75.42^{A}	67.28^{B}	60.34^{A}	53.82^{B}	0.005
161	90.28	83.57	72.22	66.86	0.48
168	97.66	83.57	78.13	66.86	0.06
175	99.42^{a}	86.14^{b}	79.54^{a}	68.91^{b}	0.04
182	102.14^{A}	92.85^{B}	81.71^{A}	74.28^{B}	0.0007
189	104.00^{A}	94.00^{B}	83.20^{A}	75.20^{B}	0.0008
196	102.57^{a}	98.70^{b}	82.06^{a}	78.96^{b}	0.05
203	97.42	97.14	77.94	77.71	0.85
210	95.22	96.57	76.18	77.26	0.81
217	94.22	96.00	75.38	76.80	0.28
224	92.14	91.00	73.71	72.80	0.35
231	91.52	90.00	73.22	72.00	0.25
238	90.50	88.50	72.40	70.80	0.35
245	85.14	87.36	68.11	69.89	0.18
252	84.14	86.47	67.31	69.18	0.22
259	84.57	81.36	67.66	65.09	0.12
266	82.52	79.00	66.02	63.20	0.09
273	81.20	77.42	64.96	61.94	0.06
280	77.57	74.71	62.06	59.77	0.46
Mean (S.E)	83.67 ± 4.84	79.40±4.78	66.94 ± 3.87	63.52±3.82	0.52

A,B-Means bearing different superscripts within rows differ significantly (P≤0.01); a,b- Means bearing different superscripts within rows differ significantly (P≤0.05).

Table 5(b): Effect of rearing systems (ARS & CRS) on Hen Day egg production and Hen Housed egg production (%)

Rearing system	HDEP (%)	HHEP (%)
Automation	66.93^{a}±0.26	66.93^{A}±0.32
Conventional	65.61^{b}±0.99	63.52^{B}±2.40
P value	0.04	0.008

A,B-Means bearing different superscripts within rows differ significantly (P≤0.01); a,b- Means bearing different superscripts within rows differ significantly (P≤0.05).

Litter Quality: Litter quality analyzed based on the proximate analysis and *Ecoli* count and found significant difference (Table 6a & 6b) among the two-rearing system (P≤0.01).The proximate analysis of built up litter was significantly higher (P≤0.01) in conventional rearing system than the automatic rearing system. The higher proximate values like crude protein, crude fat, crude fibre, total ash and energy value were mainly due to feed wastage in conventional rearing system which leads to elevation of these values. The results of the study of Ensimnger (1977); Devendra and Raghavan (1978); Lamidi (1995) all reported approximately 25 per cent crude protein for poultry litter. The differences in the proximate content of poultry litter used in this study (20 per cent) when compared to the findings of other authors as cited above could be attributed to the difference in the type of bedding material, feed wastage, the type of rations used, method of handling and method of processing and storage of the poultry litter. However, the feed wastage is the major attributed factor for the high value of proximate principles in the poultry litter in conventional rearing system. (Cole *et al.,* 2009) claimed less feed wastage due to special patented designed which doesn't allow feed to drop outside the feeders. Saleh *et al*. (2002) who compared the nutritive contents of poultry litter obtained Crude Protein scores of 23 per cent. The total ash content provides important data and information about the quality of poultry litter. This is because it measures the mineral content of the litter. Ash is normally high in poultry litter because of the paddy husk. In this study, the ash content of the litter was 18.40 per cent in automatic rearing system to 19.09 per cent in conventional rearing system. Ash samples between 15-25 percent are acceptable (Ruffin and McCaskey, 1990). This finding is in line with their recommendation and they further observed that high ash content (above 28 percent) too dry litter causes respiratory and eye irritation to the poultry flock. With respect to the Dry Matter content, the study observed a DM content of 79.70 to 81.8 per cent in automatic and conventional rearing system, respectively. This means that the poultry litter had 18.20 and 20.30 per cent moisture in automatic and conventional rearing system respectively. From earlier reports Ruffin and McCaskey (1990); Burdine *et al.* (1993); Bagley *et al.* (1994), it was concluded that moisture in the litter should be between 12 and 25 percent. Results obtained in the present study are strongly in agreement with their findings. The *E.coli* count in conventional system was significantly higher than

Table 6a: Effect of rearing systems on Litter Quality parameters of experimental birds at the beginning of study

Sl. No.	Proximate principle and microbial load	T1 (Automation)	T2 (Conventional)	P- value	
		Beginning of study	Beginning of study		
1	Moisture %	12.51±0.11	12.41±0.13	0.85	The result is not significant at p <0.05
2	CP %	3.10±0.01	3.00±0.01	0.69	
3	CF%	42.30±0.19	42.30±0.21	0.95	
4	EE%	2.41±0.02	2.42±0.01	0.92	
5	Ash%	16.50±0.12	16.40±0.13	0.74	
6	*E. coli* (CFU/g)	450	480	0.68	
7	Coccidial oocyst	0.00	0.00	—	

Table 6b: Effect of rearing systems on Litter Quality parameters of experimental birds at the end of the study

Sl. No.	Proximate principle and microbial load	T1 (Automation)	T2 (Conventional)	P value	
		End of study	End of study		
1	Moisture %	$18.20^{A}\pm0.23$	$20.30^{B}\pm0.33$	0.002	The result is significant at p ≤ .01.
2	CP %	$20.11^{A}\pm0.15$	$23.12^{B}\pm0.21$	0.001	
3	CF%	$26.62^{a}\pm0.11$	$27.34^{b}\pm0.38$	0.02	
4	EE%	$2.51^{A}\pm0.05$	$2.83^{B}\pm0.03$	0.01	
5	Ash%	$18.40^{A}\pm0.17$	$19.09^{B}\pm0.15$	0.004	
6	*E. coli* (CFU/g)	$4.2^{A}\times 10^{5}$	$5.1^{B}\times10^{7}$	0.01	
7	Coccidial oocyst	0.00	0.00	—	

A,B-Means bearing different superscripts within rows differ significantly (P≤0.01); a,b- Means bearing different superscripts within rows differ significantly (P≤0.05).

in automatic rearing system (P<0.05). Bell *et al*. (2007) reported that drinking water, human handling and in ovo route are the important mode of transmission of *E coli*. The usage of nipple drinkers in automatic rearing system reduces the microbial contamination. Controlling bacterial load is much more difficult with open drinker systems as they are exposed to contamination by faecal dust and the oral and nasal secretions of birds as they drink. Closed nipple systems have the advantage of reducing disease spread since these systems will always equipped with filtration system (Goan, 1994). This statement can be conclusive with the work of Macari and Amaral, (1997) who compared the nipple drinkers versus bell drinker in commercial poultry farms and concluded that *E.coli* count in bell drinkers 10^5 times more than nipple drinker system. The oocyst of *coccidia* was not found during entire study period and concluded that there is no significant evidence to support the viability of oocyst in automatic and conventional rearing system. Alternatively, moisture is less than 20 per cent attributed to the non viability of the coccidial oocyst. Result of the study is in consonance with Reyna *et al.* (1983) who reported that viability of coccidial oocyst are 100 per cent declined in litter having moisture less than 20 per cent. The working time measurement for feeding was observed to be 8.4 man power minutes per day for T_1 group of automatic rearing system as compare to 22 minutes man power minutes per day in T_2 group of conventional rearing system. Machine known for precision and accuracy in less time, however no studies reported so far. Statistical analysis reveals that the values are highly significant (P≤ 0.01) among the treatments.

Liveability: The liveability rate (Table 7) of the experimental birds was significantly higher (P≤0.05) in automatic rearing system than the experimental birds in conventional rearing system. The high liveability rate in automatic rearing system is mainly due to less manhandling and human contamination. Nipple watering systems are more hygienic water delivery system for commercial poultry. (Cobb breeder management guide, 2009). This is in contrast with reports of (Tanaka and Hurnik, 1992; Abrahamsson *et al.*, 1995), which found that mortality, can be low in alternative housing systems such as Aviary and enriched housing system.

Table 7: Effect of rearing systems on Liveability (%) of HH260 birds

Rearing system	Liveability (per replicate)	Total no. of experimental birds live on 40th week	(In %)
Automation	$25.00^{a}\pm0.00$	125^{a}	100%
Conventional	$24.20^{b}\pm0.48$	121^{b}	96%
P value	0.03		

a,b-Means bearing different superscripts within the column differ significantly($P\leq0.05$).

Table 8: Working time measurement of feeding, watering and medication

Working time measurement (Manpower Minutes/day)			
Rearing system	**Feeding**	**Watering**	**Medication**
Automation	$08.40^{A}\pm0.27$	$02.00^{A}\pm0.00$	$07.00^{A}\pm0.5$
Conventional	$22.00^{B}\pm0.79$	$61.20^{B}\pm1.55$	$25.20^{B}\pm1.67$
P value	0.001	0.001	0.001

A,B-Means bearing different superscripts within rows differ significantly ($P\leq0.01$); a,b- Means bearing different superscripts within rows differ significantly ($P\leq0.05$).

However, mortality is caused by several components and it is difficult to categorize the real causes according to housing systems. Another study from Tauson *et al.* (1999) found that the overall higher mortality of Lohmann Brown hens in floor pens than in cages is largely due to cannibalism and feather pecking with no difference between housing systems. To ensure health and optimum egg quality the water supplied to the hens should be of potable standard (Thiele and Pottguter, 2008). The overall symmetry and mechanisms of immune system in birds are relatively similar to those in mammals which is directly influenced by genetic, physiological, nutritional, and environmental factors (Qureshi *et al.,* 1998; Rautenschlein *et al.,* 2003). The immune system of birds is complex and is composed of several cells and soluble factors that must work together to produce a protective immune response. A well developed and functional immune system is important to poultry because most commercial flocks are raised under intensive rearing conditions. Under such conditions, the flocks are vulnerable to rapid spread of infectious agents and disease outbreaks (Rautenschlein *et al.,* 2003). Contrary to these findings, Platz *et al.* (2009) reported that the assessment of healthiness of hens housed in furnished houses did not indicate any significant advantage over those housed in aviaries**.** The working time measurement for feeding was observed to be 8.4 man power minutes per day for T_1 group of automatic rearing system as compare to 22 minutes man power minutes per day in T_2 group of conventional rearing system. Machine known for precision and accuracy in less time, however no studies reported so far. Statistical analysis reveals that the values are highly significant ($P\leq 0.01$) among the treatments.

CONCLUSION

The result of the present study indicated that automation rearing system for commercial poultry is beneficial for eliciting optimum production performance in HH-260(white leg horn) Breeder birds. It accepted the hypothesis of the study that ARS housing have better productivity and profitability over conventional, this is testified by the general better FCR, egg production, liveability and litter quality in CCS houses.

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