ejpmr, 2017,4(9), 593-600

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

ALTERATION IN WEIGHT, HAEMATOLOGICAL AND BIOCHEMICAL PARAMETRS IN BROILER UNDER DIFFERENT CULTURE CONDITIONS

Dr. Manveer Singh Kandari* and Dr. Pooja Agarwal

Faculty of Zoology, Uttaranchal College of Science and Technology, Dehradun (Uttarakhand)–Affiliated to HNBGU, Srinagar (A Central University), Uttarakhand.

***Corresponding Author: Dr. Manveer Singh Kandari**
Faculty of Zoology, Uttaranchal College of Science and Technology, Dehradun (Uttarakhand)–Affiliated to HNBGU, Srinagar (A Central University), Uttarakhand.

Article Received on 10/07/2017 **Article Revised on 31/07/2017** **Article Accepted on 20/08/2017**

ABSTRACT

The present study was carried out on broiler to study the effect of extensive, semi-intensive and intensive condition on weight and hematological parameters for a period of 42 days (7 weeks). For this 60 male broiler (babcobb breed) was divided into three equal groups: Experiment-I(Extensive condition), II(Semi-intensive condition) and III(Intensive condition). At the end of every week (7^{th} day), weight was measured and blood samples were collected from each experimental groups and hematological and biochemical parameters viz, RBC, Hb, PCV, MCV, MCHC, WBC, ESR, serum glucose, total protein and cholesterol were analyzed. The results demonstrated that in experiment –I and II the weight of chicks decreased than experiment-III. In experiment-I and II decreased RBC, Hb, PCV, MCHC, serum cholesterol and protein were recorded while increased MCV, WBC, ESR and serum glucose was observed iin comparison of experiment-III or control. The results of experiment-I and –II was statistically compared with –Experiment-III by Graph pad prism 5 at different significant levels ($P<0.001$, $P < 0.05$, $P<0.01$ and $P > 0.05$ ns).

KEYWORDS: The present study was carried out ($P<0.001$, $P < 0.05$, $P<0.01$ and $P > 0.05$ ns).

INTRODUCTION

In India, in rural areas the extensive culture practice widely adopted due to lack of infrastructure and budget, the semi-extensive practice adopted by the semi-rural areas while intensive practice adopted by urban areas and is based on financial condition of poultry farmers. The growth of broilers mainly depend on diet and other environmental factors viz; litter management, drinking water management, temperature, vaccination etc. and these are main factors intensive poultry culture practice.[1] Hematological and biochemical parameters viz; RBC, Hb, PCV, MCV, MCHC, TLC, ESR, serum glucose, total serum protein and serum cholesterol can be a useful tool for monitoring health status, detecting illness, and following the progress of disease and response to therapy. If hematological and biochemical parameters are within the normal range (reference range) it is the indicator of good health, but when these parameters are below or above the normal range, it is indicator of diseases or poor health, which is directly associated with the growth of all vertebrates.[2] Unfortunately, due to lack of information of such parameters, blood profile is not used widely in avian medicine.[3-4] Although there is limited information in this field, evaluation of blood profiles of broiler strains have been assessed by several studies.[5-8] Mbunwen et al., [2015][9] studied growth traits and haematological parameters of Anak and Nigerian heavy ecotype chickens fed with graded levels of mango seed kernel (Mangifera indica) meal. In this work, an attempt was made to determine the weight, haematological and biochemical changes with changes in broiler chicks during Extensive, Semi-extensive and Intensive cultural practices.

MATERIAL AND METHODS

Experimental Sets

The experiment was carried out on a broiler in three groups. Experiment- I (extensive), experiment-II (Semi-intensive) and experiment- III (Intensive). Each group was consisted 20 healthy babcobb breed (commercial layer) male broiler chicks. The weight of each chick was 37.00±3.00 gm. and brought from market for commercial purpose. One day hatched chicks were used for all three experimental setup and experiment was carried out for 42 days.

Experiment-I(Extensive): the chicks were kept in a closed bamboo yard (10X10feet). The deep litter and drinking water system was managed. The temperature adjusted 95^0 F for the first week and reduce 5^0 every week until 75^0F as suggested by agrifarming.[1] The chicks were fed with semi-gurond wheat and corn flour .The diet was scheduled as pre starter (0-10 days), starter (11-21 days), and finisher(22- till the experiment), the total amount diet was given according to agrifarming.[1]

After 10 days, the chicks were allowed for feeding in the open twice in a day, morning and afternoon along with routine diet. No efforts were made for disease procurement.

Experiment-II(Semi-intensive): The chicks were kept in a earthen room and the space 0.8feet/bird was provided. The litter management, drinking water management and temperature adjustment were same as for experiment-I. The feed stock was prepared by of commercially prepared poultry feed and home made feed (1:1 ratio) viz, semi ground corn and wheat flour given. The total amount of diet was controlled according to agrifarming.[1] No diseases procurement majors was considered. The composition of diet is given in table-1(b).

Experiment-III(Intensive): The space for birds 1feet/bird was provided and the litter management, drinking water management and temperature adjustment were same as for experiment-I and II. The chicks was fed with fully commercially prepared feeds, the diet was scheduled as pre-starter (0-10 days), starter (11-21 days), and finisher(22- till the experiment) along with effective microorganism liquid (EM) as suggested by agrifarming.[1] The composition of the diet for experiment-III is given in table-1(c). For disease procurement almost possible majors were considered for experiment-III. The vaccination schedule for experiment-III (intensive) is given in table-I(a). All the vaccines and medicines and for experimental sets was manufactured by VENTRI BIOLOGICAL Pvt. Ltd. VENTRI BIOCHEM, Pvt. Ltd. Pune, India and SHRIWALL HEALTHCARE, Roorkee, India. Vaccines are diluted as directed and given according to protocols.[10] The poultry feed for experiment-II and III was supplied by the HINDUSTAN ANIMAL FEED, Gujrat, India. The total weight of chicks was noticed at the end of every week (7^{th} day) till the end of experiment (42) days. The dead chicks were eradicated from all experimental sets than mean was calculated.

Haeamtological and Biochemical work: For the haemetological and biochemical work the blood samples was collected after every week (7^{th}day) till the end of experiment form each bird of each experimental set up and blood samples were divided according to groups. 3.00ml blood was collected from jagular and branchial vein and 1.00 ml is transferred to vial containing 1.00 mg ethylene-diamine tetra-acetic acid while 2.00ml was tranffered to plane vial(without anticoagulant) for biochemical work.Samples were then kept in ice box and brought to the laboratory and stored at 5°C and examined.[11-12] The haematological parameters viz; RBC, Hb, PCV, MCV, MCHC, TLC and ESR was estimated by complete blood count machine (hematology analyzer, BC2300) supplied by Mindray, Delhi.[13] For quantification of serum glucose, protein and cholesterol were done in a UV, VISIBLE -1280 Spectrophotometer manufactured by SHIMADZU ANALYTICAL Pvt. Ltd. India (Mumbai). The blood glucose level was measured by a glucose kit manufactured by KEE GAD Biogen and measured at 505 nm. Total protein was determined according to the protocols, taking BSA as a standard and measured at 595 nm.[14] To isolate the serum bench centrifuge machine was used supplied by REMI, Maharashtra, India. Serum cholesterol was estimated by Lieberman – Burchard reaction and read at 510 nm.[15] The reaction kit (Enzokit) was manufactured by RFCL, Dehradun. Data were subjected to two-way analysis of variance (ANOVA) by following Bonferroni post test by the software Graph pad Prism -5.

Table 1(a): Vaccination and medicine schedule and for experiment-III or Intensive.

S.NO	Vaccines /medicines	Experiment-III
1.	Marek's	First day from experiment
2.	Ranikhet (F1 strain)	5 day and 30day
3.	Gumboro/IBD	8 and 18 day(booster dose)
4.	New castle vaccine with LaSota strain	13 day
5.	Antihelminthes (Albendazole)	Once in month till the end of experiment

Table 1: (b) Composition of diet (Commercially prepared) for experiment-II.

Components of diet	Pre-starter	Starter	Finisher
Metabolisable Energy	1450 Kcal/Kg	1450 Kcal/kg	1500 Kcal/kg
Crude Protein	1100 %	10.50 %	9.25 %
Crude Fat	1.25%	1.25 %	1.50%
Fibre	1.50%	1.50 %	1.75 %
Calcium	0.500%	0.5 %	0.45 %

For experiment-II, after 10 days the food ratio was given in 1:1, means the half amount of commercially prepared food and half of home made food viz, semi ground corn and wheat flour mixed with commercially prepared Pre-starter, Starter and Finisher feed.

Table 1(c): Composition of diet (Commercially prepared) for experiment-III (Intensive).

Components of diet	Pre-starter	Starter	Finisher
Metabolisable Energy	2900.00Kcal/Kg	2900 Kcal/kg	3000 Kcal/kg
Crude Protein	22.00 % Minimum	21.0 % Minimum	18.5 % Minimum
Crude Fat	2.5 % Minimum	2.5 % Minimum	3.0 % Minimum
Fibre	3.00% Maximum	3.0 % Maximum	3.5 % Maximum
Calcium	1.00%	1.0 %	0.9 %

1.00ml/Litre Effective Microorganism solution (E.M) was mixed with drinking water for 1-15 days, and 0.5 ml/Littre from 15-42 days.

RESULTS

Haematological Parameters: The highest increased weight per week was noticed in experiment-III and lowest mortality was also noticed in this group. In all experimental set up the mortality occurred in 2-3 day of experiment and was 30%, 20% and 5% recorded in experiment-I, II and III respectively. The weekly increased weight is given in table-2 and shown in figure-1. The highest RBCs count and Hb level was also observed in experiment –III in all weeks. Weekly significant decline in RBCs count and Hb level noticed in experiment-II and I when compared with experiment-III. The weekly RBCs count and Hb level is given in table-3 and shown in figure-2, table-4 and shown in figure-3 respectively. Increased PCV in all weeks was noticed in experiment-III or control in comparison of II and I. It is non-significantly declined in experiment-II and significantly declined in experiment-I in all weeks when compared with experiment-III and is given in table-5 and shown in figure-4. Non-significantly increased MCV was observed in experiment-I and-II when compared with experiment-III and is given in table-6 and figure-5. Weekly non-significantly declined MCHC was recorded in experiment-I and II when compared with experiment-III during all weeks of experiments, given in table-7 and figure-6. Significantly increased ESR level was recorded in experiment-I while in experiment-II it is non-significantly increased when compared with experiment-III or control and given in table-8 and shown in figure-7. Highest TLC was noticed in experiment-I. Significant increment was noticed in experiment-II and I when compared with experiment-III or control, given in table-9 and figure: 8.

Biochemical Parameters: Highest and significantly increased serum glucose level was observed in experiment-I while in experiment-II it was increased non-significantly when compared with experiment-III during throughout the experimental period, given in table-10 and shown in figure-9. Highest serum protein level was recorded in experiment-III or control, while in experiment-I and-II it was decreased significantly when compared with experiment-III and given in table-11 and shown in figure-10. Highest serum cholesterol was observed in experiment-III or control while non-significant decline was recorded in experiment-I and II throughout the experimental period, given in table-12 and shown figure-13.

Table 2: Total weight of g/chicks/week in Experiment-I, II and III.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	95 ± 10.20^{ns}	110 ± 12.88^{ns}	140±13.10
II	$150\pm11.10^{**}$	190 ± 14.42^{ns}	250±16.22
III	$350\pm15.22^{***}$	$405\pm14.40^{***}$	535±15.40
IV	$715\pm20.30^{***}$	$820\pm20.60^{***}$	940±20.60
V	$1030.42\pm21.40^{***}$	$1310.15\pm22.50^{***}$	1580.30±28.20
VI	$1320.62\pm20.60^{***}$	$1730.20\pm16.10^{***}$	2150.50±26.50
	Mortality=30%	Motality =20%	Mortality=5%

Each values are mean of and ± is SE are marks with stars are significant at $P<0.001^{***}$, $P<0.01^{**}$, ns ($P > 0.05$) is non significant.

Table 3: Weekly changes in RBCs (10^6 /µl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	$2.80\pm0.12^{***}$	$3.19\pm0.12^{***}$	4.31±0.13
II	$2.94\pm0.18^{***}$	$3.25\pm0.14^{***}$	4.35±0.15
III	$2.99\pm0.10^{***}$	$3.35\pm0.15^{***}$	4.40±0.18
IV	$3.29\pm0.11^{***}$	$3.60\pm0.28^{***}$	4.57±0.10
V	$3.17\pm0.13^{***}$	$3.55\pm0.10^{***}$	4.40±0.12
VI	$3.25\pm0.17^{***}$	$3.58\pm0.10^{***}$	4.40±0.17

Each values are mean and ± is SE are marked with stars are significant at $P<0.001^{***}$.

Table 4: Weekly changes in Hb (gm/100ml) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	8.10±0.22***	10.50±0.25***	12.81±0.16
II	8.31±0.21***	10.560±0.20***	12.88±0.18
III	8.72±0.22***	10.62±0.18***	12.95±0.15
IV	8.75±0.23***	10.72±0.26***	13.25±0.22
V	8.74±0.21***	10.68±0.22***	13.20±0.20
VI	8.71±0.18***	10.70±0.1***	13.22±0.18

Each values are mean and ± is SE are marked with stars and significant at P<0.001***

Table-5: Weekly changes in Packed Cell Volume (%) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	28.41±2.20*	32.21±2.38ns	37.64±1.80
II	28.50±2.50*	32.40±2.33ns	37.80±1.55
III	29.10±2.10*	32.50±2.40ns	38.15±2.20
IV	29.40±2.70**	32.87±2.11ns	39.80±2.44
V	29.57±1.80**	32.93±2.61ns	39.92±2.10
VI	29.42±2.32**	32.86±2.80ns	39.81±2.16

Each values are mean and ± is SE are marked with stars are significant at P < 0.01**, P < 0.05*, ns (P > 0.05) is not significant.

Table 6: Weekly changes in Mean Cell Volume (fl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	101.46±4.20ns	100.97±5.10ns	87.33±6.20
II	96.93±3.60ns	99.69±4.42ns	86.89±2.80
III	97.32±4.40ns	97.01±3.88ns	86.70±4.62
IV	88.44±3.80ns	91.30±5.20ns	87.08±5.12
V	93.28±2.94ns	91.47±4.80ns	90.72±2.60
VI	90.52±4.50ns	91.78±5.20ns	87.49±4.22

Each values are mean and ± is SEare marked with ns(P > 0.05) is not significant.

Table 7: Weekly changes in Mean Cell Haemoglobin Concentration (g/dl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	28.51±2.50ns	32.59±3.50ns	34.03±3.10
II	29.15±1.62ns	32.59±2.10ns	34.07±2.42
III	29.96±3.40ns	32.67±2.60ns	33.94±2.50
IV	29.76 ±2.64ns	32.61±2.50ns	33.19±1.60
V	29.55±3.10ns	32.43±2.40ns	33.06±1.83
VI	29.60±2.20ns	32.56±2.25ns	33.20±2.80

Each values are mean ± is SE marked with ns (P > 0.05) is not significant.

Table 8: Weekly changes in Erythrocytes Sediment Rate (first hour) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-extensive)	Experiment-III (Intensive)
I	15.30± 2.00**	12.24± 1.60ns	6.80± 0.20
II	15.20± 2.15**	12.04± 2.40ns	6.72± 0.80
III	15.05± 2.50***	9.20± 1.40ns	6.40±1.10
IV	14.70± 2.10***	9.12± 2.10ns	5.37±0.50
V	14.40± 1.60***	9.80± 1.60ns	5.29±0.62
VI	14.10± 2.30***	9.10± 2.20ns	5.20±0.40

Each values are mean and ± is SE are marked with stars are significant at P<0.001***, P < 0.01**, ns (P > 0.05) is not significant.

Table 9: Weekly changes in Total Leucocytes Counts (10^3/mm^3) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-extensive)	Experiment-III (Intensive)
I	8.52±0.10***	5.66±0.30***	3.65±0.20
II	8.57±0.14***	5.71±0.12***	3.71±0.16
III	8.66±0.18***	5.79±0.28***	3.76±0.12
IV	8.72±0.26***	5.82±0.18***	3.62±0.28
V	8.77±0.20***	5.91±0.09***	3.57±0.10
VI	8.74±0.22***	5.67±0.15***	3.42±0.22

Each values are mean and ± is SE are marked with stars are significant at P<0.001 ***, P < 0.01**, ns (P > 0.05) is not significant.

Table 10: Weekly changes in Serum glucose (g/dl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	310.30±10.40**	262.60±12.60ns	254.21±10.18
II	317.61±8.21**	268.81±13.82ns	260.52±12.82
III	325.29±11.32**	275.30±9.81ns	265.10±8.20
IV	333.20±15.20***	282.51±10.20ns	268.81±13.70
V	344.14±9.63***	288.10±9.10ns	274.66±14.10
VI	346.25±12.70***	290.17±13.70ns	276.12±8.96

Each values are mean of 10 observations and ± is SE marked with stars are significant at P<0.001***, ns(P > 0.05) is not significant.

Table 11: Weekly changes in Serum protein (g/dl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	1.76±0.12***	2.19±0.18***	3.30±0.14
II	1.81±0.10***	2.23±0.06***	3.41±0.16
III	1.86±0.05***	2.29±0.10***	3.49±0.04
IV	1.90±0.14***	2.32±0.16***	3.57±0.12
V	1.94±0.17***	2.35±0.08***	3.60±0.13
VI	1.92±0.09***	2.30±0.12***	3.56±0.18

Each values are mean and ± is SE marked with stars are significant at P<0.001***, ns(P > 0.05) is not significant.

Table 12: Weekly changes in Serum cholesterol (g/dl) in all experimental groups.

Weeks	Experiment-I (Extensive)	Experiment-II (Semi-intensive)	Experiment-III (Intensive)
I	165±7.20ns	221±8.20ns	235.00±3.98
II	171±5.62ns	227±6.42ns	247.00±8.20
III	176±9.32ns	234±4.80ns	255.00±5.60
IV	181±4.50ns	239±9.51ns	262.00±5.20
V	189±4.10ns	246±4.50ns	265.00±4.42
VI	180±8.20ns	241±9.22ns	260.00±5.10

Each values are mean of and ± is SE marked with ns (P > 0.05) is not significant.

Figures

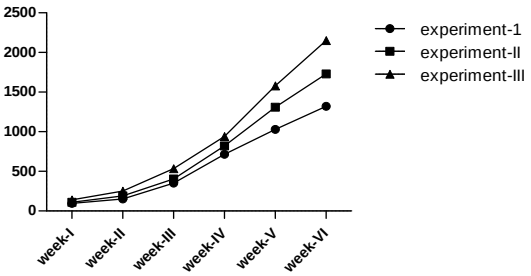

Figure I: Weekly changes in weight gained by the broiler chicks.

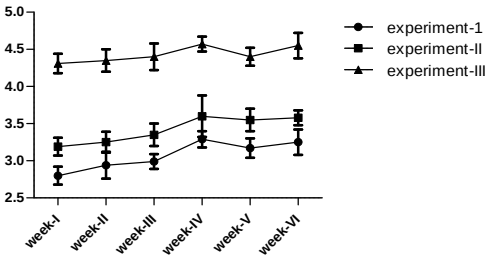

Figure 2: Weekly changes in RBCs count in broiler chicks.

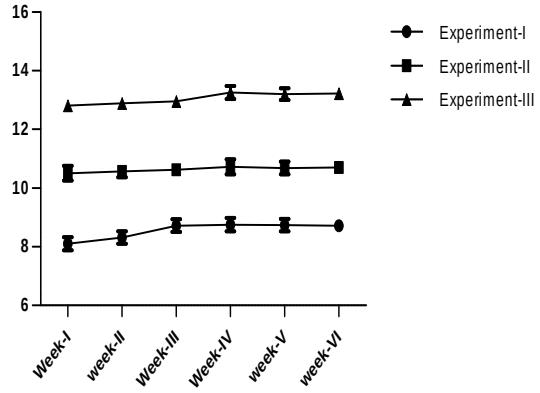

Figure 3: Weekly changes in Hb level in broiler chicks.

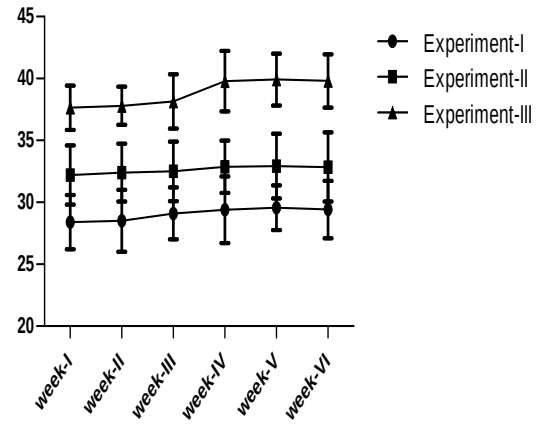

Figure 4: Weekly changes in PCV level in broiler chicks.

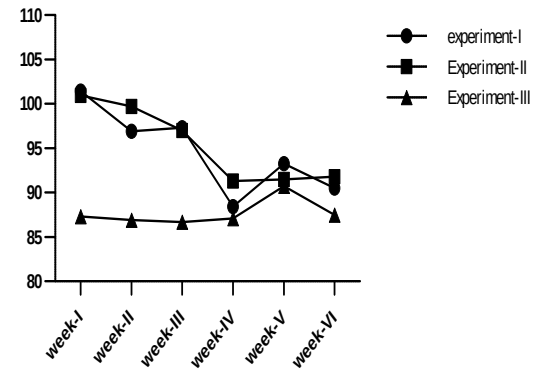

Figure-5: Weekly changes in MCV level in broiler chicks.

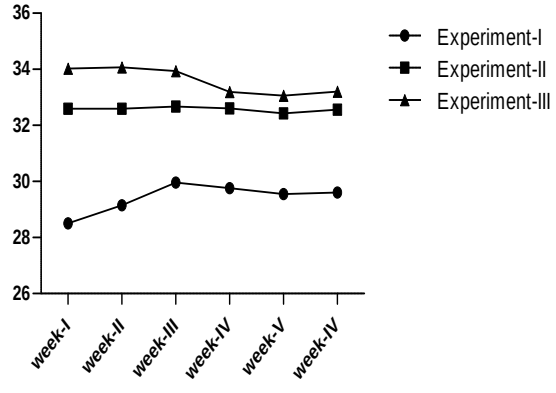

Figure 6: Weekly changes in MCHC level in broiler chicks.

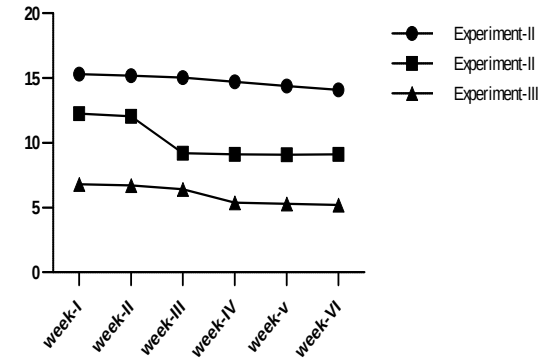

Figure 7: Weekly changes in ESR level in broiler chicks.

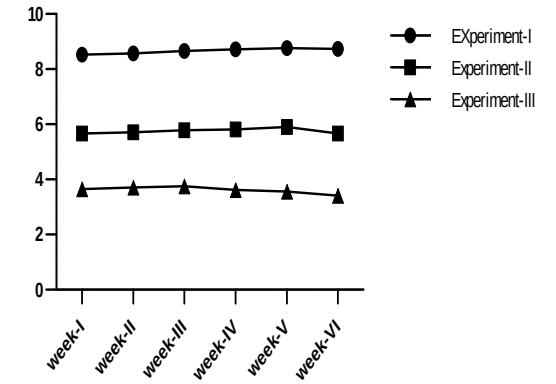

Figure 8: Weekly changes in TLC in broiler chicks.

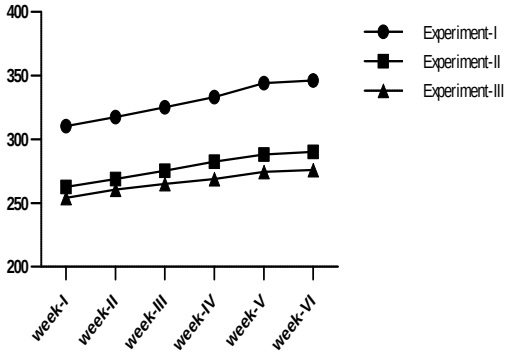

Figure 9: Weekly changes in serum glucose level in broiler chicks.

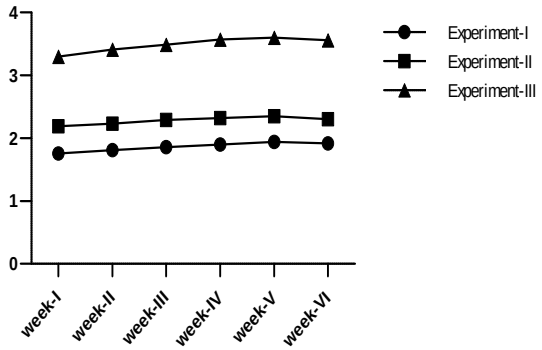

Figure 10: Weekly changes in serum protein level in broiler chicks.

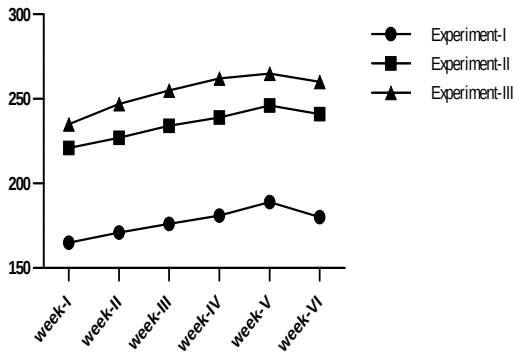

Figure 11: Weekly changes in serum cholesterol level in broiler chicks.

DISCUSSION

In all three experiments the weekly and total weight of chicks obviously increased, but in comparison of Experiment-III, the total weight of chicks in experiment-I and II was significantly decreased might be due to variation in diets and no proper treatment of disease or physio-pathological stress. The similar trend was observed in case of RBCs count in all three experiments. For healthy chicken the normal range of RBCs is 4.21-4.84×10^3/mm^3.[16] In the present study the significantly decreased RBCs was recorded in experiment-I and II in comparison of experiment-III or control or intensive culture practice. The increased RBCs count was the result of increased haemopoisis rate and decreased haemolysis due to all favorable condition provided to experiment-III, viz: deit, proper vaccination for disease cure and EM solution which was mixed with drinking water, deforming medicine, temperature etc. The normal range of Hb for chicken is 11.60 - 13.68 gm/100ml.[16] The amount of Hb increased in all experiments throughout the experimental period.The highest Hb % was recorded in experiment-IIIor control, in experiment-I it was recorded far bellow the normal range while in experiment-II it was recorded just bellow the normal range, was due to decreased production or RBCs consequently decreased Hb level and are the primary sign of anaemia.[17] Further the decreased PCV level in birds of experiment-I and II indicated one more sign towards the anaemia because in healthy chicken the PCV level should remain 35.9-41.00gm/100.[16] The value of MCV increases when PCV increases and count of RBCs decreases sharply. MCV more than 100.00fl should be reported as macrositic anaemia and bellow the 81.00fl it called micrositosis anaemia. In present study, in all experimental sets the MCV level was recorded between 81-100 during 1- 6 week (except experiment-I in 1 week). The normal range of MCHC for chicken is 32.41 - 33.37gm/dl.[16] The MCHC level recorded in experiment-II and III and was between the normal range while in experiment –I it was recorded bellow the normal range and finally confirmed the anaemia due to low RBC and Hb.[18] Increased ESR level was recorded in experiment-I and –II it might be due to stress caused by improper food supply (nutrient deficieny) or pathological infection in experimental chicks.[19] In healthy chicken the normal range of total leucocytes count ranges between 4.07-4.321.[16] In present study the total leucocytes was recorded more than normal range in experiment-I and –II while in experiment-III it was recorded between normal range. It might be due to elevated immune response against pathogens or other environmental stress. In present study the increased serum glucose level also indicated the stress in the birds of experiment – Iand II when compared with experiment-III[19] which was already determined by increased ESR and TLCs. The reduction in serum total protein and cholesterol level in was noticed in experiment-I and II when compared with experiment III. It might be due to less amount of protein and cholesterol in their diets as result low amount of protein and cholesterol was observed in birds.[20]

CONCLUSION

In the present study the weekly negative changes in total body weight, hematological and biochemical parameters in experiment-I(extensive) and II(semi-intensive) in broiler chicks suggested that intensive poultry farming is

beneficial or profitable. Extensive and semi-extensive farming is cheap but not profitable and always risky.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to the Director, Dr. S. S. Sawhney, Uttaranchal College of Science and Technology, Dehradun (Uttarakhand) for providing necessary Laboratory conditions for conducting the study. The help extended by the poultry farmer, Mr. Kunwar Bohra, village-Balawala, district-Dehradun for allowing us to do this practice in his poultry farm.

REFERENCES

1. http//:www. Agrifarming. in/broiler /farming. 2017.
2. Clauss, T., Dove, A. and Arnold, J. 2008. Haematological disorder of fish in veterinary clinics of *North America Exotic Animal Practice*, 11(3): 445 - 462. FAO Fish State 2012 "Aquacultur Production 1950 - 2010.
3. Kral I, Suchy P (2000) Hematological studies in adolescent breeding cocks.Acta Vet Brno, 69: 189-194.
4. Mushi EZ, MG Binta, Chabo RG (1999) Hematological studies on apparently healthy Tswana indigenous chickens (*Gallus domesticus*) around Gaborone, Botswana. INFPD News letter, 9: 83-88.
5. Hauptmanova K, Literak I, Bartova E (2002) Hematology and leucocytozoonosis of great Tits (Parus major) during winter. ACTA Vet Brno, 71: 199-204.
6. Levi A, Perelman B, Waner T, Van Grevenbroek M, Van Creveld (1989) Haematological parameters of the ostrich (Struthio camelus). Avian Pathol, 18: 321-327.
7. Onifade AA, Odunsi AA (1998) Efficacy of procaine penicillin as growth promoter in broiler chicks fed low and high fiber diets in the tropics. Arch Zootec, 47: 621-628.
8. Uko OJ, Ataja AM (1996b) hematological studies of pure indigenous domestic fowl (Gallus domesticus) and guinea fowl (Numida meleagris) in Northwest Nigeria. Revue Elevage Med Vet Pays Trop, 49: 257-26.
9. Mbunwen NF, Ngongeh LA, Okolie PN, Okoli EL.(2015) Comparative study of growth traits and haematological parameters of Anak and Nigerian heavy ecotype chickens fed with graded levels of mango seed kernel (Mangifera indica) meal, 47(6): 1109-15.
10. Aliasghar T, Javad J, Saeed A, Mehdy A, Hassan, Amirali S, Sayad G, Hamid A, (2012) Haematological Studies on Broiler Chickens Fed with Different Levels of Artemia Urmiana. J. Biotecnol Biometer.
11. Bermudez AJ, Stewart-Brown B (2003) Diseases of Poultry. (11thedn), Iowa State Press, a Blackwell Publishing Compan, USA.
12. Sorgeloos P (1980) The use of brine shrimp *Artemia* in Aquaculture. The Brine Shrimp *Artemia*, 3: 25-45.
13. Chaves FMD (2005) Quantitatative determination of neutrophil VCS parametes by the Coulter automated hematology analyzer American Journal of Clinical Pathology, 2005; 124: 440-444.
14. Spector AR, refinement of the Coomassie blue method of protein quantitation. Analytical Biochemistry, 1978; 86(1): May, 142-146.
15. Hanry RJ, and Hanry M. 1974 Clinical Chemistry, Principles techniques. 2nd Ed., Harper and RowPublishers, New York, 140-1443.
16. https//www.en.wikivet.net/Chicken-Haematology.
17. May BK, Dogra SC, Sadlon TJ, Bhasker CR, Cox TC, Bottomley SS (1995) Molecular regulation of heme biosynthesis in higher vertebrates. Progr Nucl Acid Res Mol Biol, 51: 1.
18. Jordan PM (1994) Highlights in haem biosynthesis. Curr Opin Struct, 4: 902.
19. Banday MT, Darzi MM, Khan, AA (2006)Applied Biological Research, 8: 40-43.
20. Reddy AG, RaoVR, Rao PV and Yadagiri B (1982) Effect of experimentally produced afltoxicosis on the performance of commercial broiler chicken. Indian Journal of Animal Science, 52: 405-410.