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M Pachuau
MVSc Scholar, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

G Kalita
Professor and Head, Department of Livestock Production, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

NK Roy
Ph.D. Scholar, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

L Hmar
Professor and Dean of the College, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

R Goswami
Assistant Professor, Department of Livestock Production and Management, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

AK Samanta
Professor and Head, Department of Animal Nutrition, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

K Lalrintluanga
Professor, Department of Animal Reproduction, Gynaecology & Obstetrics, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

H Lalrinkima
Assistant Professor, Department of Veterinary Parasitology, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

Corresponding Author
NK Roy
Ph.D. Scholar, College of Veterinary Sciences & Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India

Effect of dietary supplementation of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) on haemato-biochemical parameters of weaner pig

M Pachuau, G Kalita, NK Roy, L Hmar, R Goswami, AK Samanta, K Lalrintluanga and H Lalrinkima

Abstract
Plant extracts have been used as effective additives in swine industry for potential beneficial effects on better pig performance. Changes in the morphology of GI tract and immune status results in better nutrient absorption, decreased gut secretion and increase the overall performance of the pig. Hence, an experiment was conducted to assess the effect of ginger and garlic powder on haemato-biochemical parameters in weaned pigs. A total number of 27 weaned pigs were randomly allotted into 3 treatments with 3 replicates each, with 3 pigs per replicate and arranged in a completely randomized design. Statistical analysis of the data revealed that supplementation of ginger and garlic don't have much effect on the haemato-biochemical indices of weaner pigs during post weaning period, however further study with more number of animals and dose variations might be helpful to ascertain the exact quantity to be incorporate in the feed and beneficial effect of dietary supplementation of ginger and garlic in weaner pigs.

Keywords: large white yorkshire pig, ginger (*Zingiber officinale*), garlic (*Allium sativum*), haemato-biochemical

Introduction
Weaning is one of the most stressful events encountered by pig in their life, as the weaner pigs must have to rapidly adapt to changes in the diets, physical and social environments (Moeser *et al*., 2007) [1].
Weaning imposes abrupt and simultaneous stressors on pigs that typically causes low and variable feed consumption, sub-optimal weight gain, episodes of diarrhoea, and (or) increased morbidity and (or) mortality (Pluske *et al*., 1997) [2]. Nutrition and management after weaning is directed primarily towards encouraging rapid feed intake whilst reducing mortality and morbidity. To avoid infection especially during stressful event like weaning, antibiotics are commonly used along with weaner feed as preventive measures. However, due to increase drug resistance and other health related issues, use of antibiotics in livestock production is being discouraged worldwide. Many countries tend to minimize or prohibited the use of many antibiotics in livestock production, because of their deleterious side effects on both animals and in human. Consequently, the use of natural growth promoters such as probiotics, prebiotics, symbiotics, enzymes, toxic binders, organic acids, oligosaccharides, phytogenics etc., are gaining momentum (Borazjanizadeh *et al.*, 2011) [3].
Garlic and Ginger contains antimicrobial, antioxidant and antiviral properties (Hanieh *et al*., 2010; Rivlin, 2001)) [4, 5], these herbs may promote growth and feed utilization in monogastric animals such as pig. That will open the new dimension of the ban of antibiotic. Few workers have studied the effect of dietary inclusion of garlic and ginger in the performance of poultry birds and in different categories of pigs. However, not much information's regarding use garlic and ginger in combination on performance young pigs more particularly early weaned piglets on their growth and health status available. Thus objectives of this study is to identify the growth performance of weaner pig fed diet supplemented with ginger and garlic, as well as the important Haemato-biochemical parameters of weaner pig fed diet supplemented with ginger and garlic.

Materials and Methods
The experiment was conducted to study the effects of garlic and ginger supplementation on

Haemato-biochemical indices of weaner pigs. The whole study includes collection of feed stuffs, diet formulation, management, feedings of piglets, and collection of blood serum and analysis of blood parameters.

Location and duration of experiment

The study will be carried out at the piggery farm of Instructional Livestock Farm Complex, College of Veterinary Sciences & Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, India. This study was conducted during November, 2018 to March, 2019.

Experimental design

The feeding trail was conducted for 6 weeks (42 days). Twenty-seven Large White Yorkshire (LWY) weaner pigs of 28 days of age from the pig farm of Instructional Livestock Farm Complex, College of Veterinary Sciences & Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, India, were utilized for the study. After individual identification with plastic ear tags, considering their body weights, all the animals were divided into three equal groups of 9 weaner pigs in each group viz., Group 1 (C), Group 2 (T_1) and Group 3 (T_2), in such a way that each group in having similar average body weight. Each treatment was replicated thrice with three pigs per replicate. All the experimental animals were fed standard weaner rations prepared as per NRC 1998 specification by using conventional feed ingredients including skim milk powder. Pigs of Group 1 were fed the basal diet without any supplementation of ginger and garlic, therefore served as control (C). Feed containing sun dried powder of garlic and ginger @ 0.5% each were fed to the weaner pig of T_1 group and feed containing sun dried powder of garlic and ginger @ 1.5% each were fed to the weaner pigs of T_2 group. The feeding trail was conducted for 42 days' period (day 28-70). Brooding facility were created inside the weaner pen to maintained required temperature for the young weaned pigs. Routine managemental practices like deworming, castration etc. were followed as per standard procedure.

Processing of garlic and ginger

Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) were purchased from the local markets of Aizawl district of Mizoram. The materials so collected were washed thoroughly in clean water, cut into chips and thereafter it was sun dried. Dried garlic and ginger were converted into powder form with the help of grinding machine available in the college.

Collection of feedstuffs

Maize grain, wheat bran, soybean meal, ground nut cake, mineral mixture, common salt, lysine and methionine were purchased from Guwahati, Assam whereas raw materials like garlic and ginger were purchased from local market of Aizawl, Mizoram.

Management of weaner pigs

Experimental pigs were reared in weaner pens made up of polypropylene plastic slated floor. The weaner pigs of different treatment groups were provided with identical care and management throughout the experimental period. Drinking water was provided through nipple drinker. Feeding was done up to their appetite twice daily at 8 AM and 4 PM respectively. Prestarter feed were offered to the weaned pigs during the 1st 2-3 days of post-weaning, which was followed with weaner 1 ration upto the age of 42 days of age and further 43-70 days was continued with weaner 2 ration.

Collection and preservation of blood sample

Blood samples (about 4ml from each piglet) were collected from the weaner pigs through anterior venacava. A total of 2 number of weaner pigs were selected randomly from each replicate. Blood sample was taken into two separate vials. One containing EDTA (anticoagulant) for haematology and another without anticoagulant was used for serum preparation for biochemical analysis. Blood samples containing EDTA were analysed for haematological parameters like Hemoglobin (%), Packed Cell Volume (PCV), Total Leukocyte Count (TLC) and Total Erythrocyte Count (TEC) with the help of automated blood analyser in the Department of Veterinary Medicine.

A volume of 2ml blood collected without anticoagulant were allowed to clot for 30min and then centrifuged at 3000rpm for 10 minutes to separate the serum. The separated serum samples were preserved into deep freeze at -18 °C and biochemical analysis were done within 7 days. Blood biochemical parameters like Total Protein, Albumin, Globulin, Total Cholesterol, Triglyceride and Glucose were estimated by using commercial kits in the Department of Veterinary Biochemistry of the college.

Statistical analysis

The data so collected from the study were subjected to statistical analysis using suitable formula for meaningful and accurate comparison and interpretation (Snedecor and Cochran, 2004) [7].

Results

The mean ± SE of haematological indices namely White blood cell (WBC in m/mm^3), Red blood cell (RBC in m/mm^3), Pack cell Volume (PCV in %), Haemoglobin (HB in g/dl) and Lymphocytes (LYM in %) of LWY weaned pig of different groups are presented in the Table 1. Statistically analysis revealed non-significant ($P \leq 0.05$) difference between control and treatment groups for most of the haematological indices except for RBC, wherein the RBC count (m/mm^3) on day 70 was significantly lower in pigs reared control group (6.61±0.11) as compared pigs reared under T_1 (6.71±0.06) and T_2 (7.35±0.15) groups.

Table 1: Haematological indices in LWY weaned pigs under control and treatment groups

Parameters	Control (C)	Treatment 1 (T_1)	Treatment 2 (T_2)	SEM	F-Value	P-Value
WBC (m/mm^3)	19.83	19.56	20.21	0.46	0.11 ^{NS}	0.90
RBC (m/mm^3)	6.61^a	6.71^b	7.35^b	1.54	12.38*	0.03
PCV (%)	38.98	39.32	40.83	0.53	1.18^{NS}	0.41
HB(g/dl)	10.66	11.03	10.83	0.14	0.43 ^{NS}	0.68
LYM (%)	45.91	45.56	45.6	0.32	0.07 ^{NS}	0.93

^{ab}: Means along the row with the same superscript are not significantly different ($P>0.05$)

The mean ± SE of serum biochemical indices namely Glucose (GLU in mg/dl), Total Cholesterol (T.CHO in mg/dl), Total Protein (T.P in mg/dl), Total Glycerol (T.G in g/dl), Albumin (ALB in g/dl) and Globulin (GLO in g/dl) of LWY weaned pigs of different groups are presented in the Table 2. Statistically analysis revealed non-significant ($P \leq 0.05$) difference between control and treatment groups for most of the serum biochemical indices except for T.CHO, wherein the T.CHO (mg/dl) on day 70 was significantly higher in pigs reared control group (131.33±9.83) as compared pigs reared under T_2 (112.00±3.21) group.

Table 2: Serum Biochemical indices in LWY weaned pigs under control and treatment groups

Parameters	Control (C)	Treatment 1 (T_1)	Treatment 2 (T_2)	SEM	F-Value	P-Value
GLU (mg/dl)	114.33	113.67	116.33	3.56	0.03 ^{NS}	0.96
T.CHO (mg/dl)	131.33^{a}	123.00^{ab}	112.00^{b}	5.60	4.54*	0.04
T.P (mg/dl)	75.67	71.67	75.66	1.98	0.38 ^{NS}	0.69
T.G (g/dl)	6.20	5.67	5.50	0.14	3.72 ^{NS}	0.08
ALB (g/dl)	3.56	3.80	3.73	0.18	1.69 ^{NS}	0.45
GLO (g/dl)	4.90	5.00	4.80	0.12	0.15 ^{NS}	0.85

^{ab}: Means along the row with the same superscript are not significantly different ($P>0.05$)

Discussions

Haemato-biochemical indices

Hematological constituents reflect the physiological responsiveness of animal to its internal and external environment. In this present study, RBC count was found to be significantly ($P<0.05$) higher at 70 days of age in weaned pigs reared under T_2 as compared pigs under C and T_1 groups and there was non-significance shown from the values of WBC, Hemoglobin, PCV and LYM among the different groups. The levels of WBC, PCV, HB and LYM were also generally increased in weaner pig fed garlic and ginger supplementation T1 and T2 groups as compared to control groups, which were at the normal range (Etim *et al.* (2014) [10]. The increase in the RBC values of garlic and ginger supplemented group compared to control group came into agreement with earlier report made by Onu and Aja (2011) [12] and they recorded higher level of RBC counts in rabbits, fed diet containing garlic and ginger. Shalaby *et al.* (2006) [11] mentioned that garlic has some constituents that may play a role in the function of organs related to blood cell formation such as thymus, spleen and bone marrow.

T.CHO level in blood was significantly lower ($P<0.05$) in T_2 (112.00±3.21 gm/dl) comparing to T_1 (123.00±5.03) and C (131.33±9.83) group which is in agreement with Grela and Klebaniuk (2007) [9] and Onyimonyi *et al.* (2013) [8]. Morakinyo *et al.* (2011) [13] mentioned that ginger extract controls the quantity of free radicals and the peroxidation of lipids and have anti-diabetic properties. Garlic contains a higher concentration of sulfur compounds than any other *Allium* species and is known for anti-thrombosis, anti-microbial and cholesterol lowering activities. Dry garlic powder also contains good amount of sulfur compound which has cholesterol lowering activities (Mariam and Devi 2016) [14]. Garlic depressed the hepatic activities of lipogenic and cholesterogenic enzymes, such as malic enzyme, fatty acid synthase, glucose-6 phosphate dehydrogenase and3-hydroxy-3-methyl-glutaryl-CoA reductase, a key enzyme for cholesterol synthesis, leading to prevention of cholesterol synthesis (Busquet *et al.* (2005) [15]. Protective effect of garlic on atherosclerosis has been attributed to its capacity to reduce blood lipid content. Singh *et al.* (2006) [16] indicated that the compounds (allyl-disulphide or allyl-sulfhydryl) present in garlic caused inhibition of cholesterol synthesis.

Conclusions

The conducted study shows that Dietary supplementation of ginger and garlic helps to improve the growth performance of weaner pigs with better feed conversion efficiency during post weaning period. Dietary supplementation of ginger and garlic helps to reduce the incidence of diarrhea and faecal coliform count of weaner pigs during post weaning period. Supplementation of ginger and garlic don't have much effect on the Haemato-biochemical indices of weaner pigs during post weaning period. Further study with more number of animals and dose variations might be helpful to ascertain the dose rate and beneficial effect of dietary supplementation of ginger and garlic in weaner pigs.

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