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Effect of Polyherbal Formulation on Hematological and Biochemical Parameters in Post-Weaned Ghoongroo Piglets with Diarrhea in West Bengal

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Abstract

Weaning condition is one of the critical and challenging phases of piglet where they get separated from mother and exposed to different environment. Sudden and abrupt changes in the total environment lead to the increase of physical stress that leads to various diseases, such as diarrhea, to the piglets. Use of phytogenic feed additives other than antibiotics is safe not only to the livestock, but also to the consumers and environment. Experiments were conducted to evaluate the effect of polyherbal formulations (herbs extracts mixture) on blood characteristics, blood biochemical profile of weanling pigs. The present study was conducted to evaluate the effect of polyherbal formulations PHF-1 and PHF-2 (mixture of eight different medicinal herbs) on the serum biochemical and hematological profiles of post-weaned Ghoongroo piglets affected with diarrhea in West Bengal. A total of 84 Ghoongroo piglets with average body weight 7.6 ± 0.6 kg were selected after weaning at 42 days and randomly allocated to 3 treatments. Treatments followed a 2× 2 factorial design with 2 levels of PHF-I and PHF-II (T1 & T2) with three different concentrations (100 mg/ BW, 200 mg/BW 250 mg/BW). Blood samples were collected at different intervals to determine biochemical parameters such as albumin (ALB), total protein (TP), glucose (GLU), urea, serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), creatinine (CREA), and hematological indices including hemoglobin (HB), packed cell volume (PCV), red blood cells (RBC), platelets (PLET), total blood count (TBC), lymphocytes (LYM), neutrophils (NEU), monocytes (MONO), and eosinophils (EUSINO). In case of blood profile, significantly higher ($P > 0.05$) WBC values in T1 group as compared to T2 group. Whereas no significant difference was found between T0 and T1 groups was recorded. There was no significant variation in biochemical profile of blood parameters among groups. In conclusion, the beneficial effect on WBC increases, lymphocyte suggested that these kind of PHF have a positive role on growth performance of weaning piglets.

Keywords: Polyherbal formulation, Ghoongroo piglets, serum biochemical profile, haematology, diarrhea, weaning stress

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INTRODUCTION

Piglet weaning, a crucial stage in pig farming, is linked with various challenges, like stress, growth stunting, and vulnerability to diarrhea, all of which have a notable impact on the overall productivity of the farm. Traditionally, the management of these issues often involved the use of antibiotics. However, due to escalating concerns related to antibiotic resistance, the attention has shifted toward exploring herbal alternatives as a viable option. Specifically, polyherbal formulations (PHFs) have emerged as a promising solution, featuring a harmonious combination of medicinal plants known to enhance key aspects such as digestion, immunity, and metabolic functions in livestock species.

Considering this context, the current research undertook a deliberate examination to assess the effectiveness of two specific polyherbal formulations, PHF-1 and PHF-2, concerning their ability to influence the serum biochemical and hematological parameters in post-weaned Ghoongroo piglets experiencing issues with diarrhea under real-world conditions in West Bengal. This evaluation aimed to provide invaluable insights into how these herbal formulations could potentially offer practical solutions to the challenges faced during the critical period of piglet weaning, thereby contributing to the improvement of pig farming practices in the region [1, 2].

MATERIALS AND METHODS

Experimental Site and Climate

The study was conducted at the Ghoongroo Pig Unit, ICAR–Indian Veterinary Research Institute (ICAR-IVRI), Eastern Regional Station, Kalyani, Nadia district, West Bengal. The farm is in a tropical climate, with maximum summer temperatures reaching 39°C and minimum winter temperatures dropping to 8°C.

Animals and Experimental Design

A total of 84 post-weaned Ghoongroo piglets (42 days old, mixed sex) of comparable body weight were selected. Piglets were randomly assigned to three groups: Group I (control, T0; n = 12), Group II (PHF-I, T1; n = 36), and Group III (PHF-II, T2; n = 36). Each group was housed in separate pens under uniform management conditions, with individual labeling for identification. Body weights were recorded weekly, and blood samples were collected at 7- and 15-day intervals.

The experiment followed a completely randomized design (CRD) with a 2 × 3 factorial arrangement, considering two types of polyherbal formulations (PHF-I and PHF-II) and three supplementation levels (100, 200, and 250 mg/kg body weight). The control group (T0) received the basal diet without PHF supplementation.

Diets and Polyherbal Formulations

Two polyherbal formulations (PHFs) were evaluated. PHF-I contained *Mentha arvensis* (pudina), *Curcuma longa* (turmeric), *Zingiber officinale* (ginger), and *Piper nigrum* (black pepper), while PHF-II comprised *Cinnamomum verum* (cinnamon), *Capsicum annuum* (capsicum), *Coriandrum sativum* (coriander seed), and *Allium sativum* (garlic).

Plant materials (leaves, roots, fruits, and seeds) were sequentially extracted, dried at room temperature, filtered, and concentrated on a water bath until complete evaporation. The residues were weighed and stored until use. Each PHF was incorporated into the diets at three inclusion levels: 100, 200, and 250 mg/kg body weight.

Sampling and Measurements

Feed intake and body weight gain were recorded to calculate average daily feed intake (ADFI) and feed conversion ratio (FCR). Hematological parameters, including red blood cell count, white blood cell count, hemoglobin concentration, and lymphocyte percentage, were measured using an automated hematology analyzer. Serum biochemical parameters, including total protein, glucose, cholesterol, and triglycerides, were determined using standard colorimetric methods.

Ethical Approval

All experimental procedures were conducted in accordance with the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Government of India. The protocol was approved by the Institutional Animal Ethics Committee (IAEC) of ICAR-IVRI.

Piglets were provided with ad libitum feed and clean drinking water and monitored daily to minimize stress and ensure animal welfare.

Statistical Analysis

Data were expressed as least square means (±SEM). One-way ANOVA was performed, and significant differences were determined at $P < 0.05$.

RESULTS AND DISCUSSION

The present study was conducted to find out the effect of polyherbal formulation on hemato-biochemical study of post-weaned diarrhoeic Ghoongroo piglets. Values of blood parameters play an important role in assessing animals' health status and productivity. The intense growth of piglets, different breeds, and their biological properties, as well as metabolic changes after birth, can significantly affect the blood parameters in pigs.

There has also been observed clinical and Haemato-biochemical characterization of diarrhea in piglets and evaluated of different treatment regimens. Blood biochemical and hematological indices are widely used as sensitive indicators of health, metabolic status, and the physiological adaptation of animals during such transitions.

This study will help both the farmers' planning and policy makers to consider this issue as part of development of the livestock sector, but it will also give a clearer understanding for healthcare professionals to prescribe most appropriate treatments that would relieve sufferings and minimize losses incurred by animal owners.

Biochemical Responses

Analysis of serum biochemical parameters revealed that supplementation with either PHF-I or PHF-II had no detrimental effects on albumin, total protein, glucose, urea, creatinine, or liver enzyme activities (SGPT and SGOT). All values remained within the physiological reference ranges for growing pigs, suggesting the formulations were safe.

Dose-dependent responses were observed: piglets supplemented with 100, 200, and 250 mg/kg BW exhibited significant variation in certain biochemical traits. Among these, supplementation at 100 mg/kg BW showed the most consistent positive effect, particularly on albumin and glucose concentrations (Table 1).

Table 1. Least squares mean (±SEM) of serum biochemical profile of Ghoongroo piglets after weaning.

Treatment (no. of observations = 210)	ALB (g/dl)	TP (g/dl)	GLU (mg/dl)	UREA (mg/dl)	SGPT (U/L)	SGOT (U/L)	CREA (mg/dl)
Control	2.77 ± 0.06	7.65 ± 0.06	100.7 ± 1.15	20.85 ± 0.45	47.95 ± 0.30	75.34 ± 0.83	2.18 ± 0.05
PHF-1	2.83 ± 0.02	7.97 ± 0.03	97.9 ± 0.06	22.34 ± 0.23	40.08 ± 0.15	66.70 ± 0.41	1.45 ± 0.03
PHF-2	2.82 ± 0.02	8.40 ± 0.03	100.5 ± 0.06	20.50 ± 0.23	41.82 ± 0.15	47.42 ± 0.41	1.40 ± 0.03

Note. No significant differences ($P > 0.05$) were observed between control and treatment groups.

Day-wise evaluation demonstrated progressive increases in serum albumin and glucose across both treatment groups. The rise in albumin indicates improved hepatic protein synthesis, while elevated glucose reflects enhanced carbohydrate metabolism (Table 2). These findings align with earlier reports that demonstrated adaptive shifts in hepatic protein metabolism during the transition from milk to solid feed in piglets [3, 4]. Moreover, the normalization of total protein levels suggests that PHFs may support efficient nutrient utilization and protein turnover, thereby reducing the metabolic stress commonly observed after weaning [5, 6].

Hematological Responses

Tables 3 & 4 showed that WBC values were substantially higher ($P > 0.05$) in the T1 group, significantly ($P < 0.05$) lower in the T2 group, and are not statistically different between the T0 and T1 groups. However, WBC values were initially significantly higher (P > 0.05); but then dramatically decreased to lower levels.

Table 2. Least squares mean (±SEM) of serum biochemical profile of Ghoongroo piglets after weaning (between two treatment groups with dose).

Dose (mg/kg)	ALB (g/dl)	TP (g/dl)	GLU (mg/dl)	UREA (mg/dl)	SGPT (U/L)	SGOT (U/L)	CREA (mg/dl)
PHF-1							
100	2.74 ± 0.02	7.93 ± 0.04	95.60 ± 0.57	21.34 ± 0.23	42.63 ± 0.15	59.15 ± 0.41	1.57 ± 0.02
200	2.82 ± 0.04	8.10 ± 0.05	100.2 ± 0.81	19.78 ± 0.33	43.53 ± 0.21	65.48 ± 0.56	1.84 ± 0.04
250	2.81 ± 0.04	7.95 ± 0.06	106.1 ± 0.82	22.57 ± 0.33	43.70 ± 0.22	64.88 ± 0.56	1.61 ± 0.04
PHF-2							
100	2.74 ± 0.02	7.34 ± 0.03	96.01 ± 0.50	21.34 ± 0.33	47.30 ± 0.29	51.04 ± 0.74	1.52 ± 0.03
200	2.86 ± 0.04	8.10 ± 0.04	102.1 ± 0.81	19.71 ± 0.46	39.87 ± 0.41	61.66 ± 1.05	1.85 ± 0.04
250	2.81 ± 0.04	7.12 ± 0.04	107.3 ± 0.81	22.52 ± 0.46	42.20 ± 0.41	62.38 ± 1.05	1.67 ± 0.04

Regarding RBC and Hb levels, similar effects were seen between the treatments when garlic powder was given to broilers [7]. On the other hand, when yakrifit bolus was administered to pigs, Papatsiros et al. (2024) [8] observed a considerably increased (P > 0.01) Hb value. However, Lee et al. (2024) and Xiao et al. (2024) [9, 10] observed that the addition of herbal methionine to grill feed did not affect WBC levels.

Pigs' hematological and biochemical traits may be improved by dietary supplementation with medicinal herbs. *Gynura procumbens*, *Rehmannia glutinosa*, and *Scutellaria baicalensis*, three fermented medicinal herbs, were added to the diet of developing pigs to raise WBC concentration [11]. Weaning pigs were given a diet supplemented with fermented garlic powder at 0 .51, and 2 g/kg feed were shown to have higher RBC counts and blood lymphocytes concentrations [12]. When compared to the control diet, diets supplemented with an herb extract mixture (buckwheat, thyme, curcuma, black pepper, and ginger) at 250 mg and 500 mg/kg feed significantly raised WBC and RBC counts as well as blood lymphocyte concentrations.

In the current work, no significant differences on WBC, Hb, and lymphocytes hematological indicators were found to be within normal ranges for growing pigs, as reported previously [13, 14].

Except for WBC, all the hematological parameters measured from the blood drawn at the 0, 15, 30, 45, and 60-day phases of the trial were within normal limits. Creatinine, protein, albumin, ALT, AST, and urea, glucose were among the biochemical values that were within normal limits. It was determined that none of the polyherbal supplements affected the hematological and biochemical parameters or had a negative impact on the pigs, proving that the dosage used was safe.

Table 3. Least squares mean (±SEM) of hematological profile of Ghoongroo piglets after weaning (control versus treatments groups).

Parameters	Control	Polyherbal-1	Polyherbal-2
HB	11.35±0.11[a]	13.09 ± 0.05[b]	13.00 ± 0.05[b]
PCV	33.26 ± 0.28[a]	37.74 ± 0.15[c]	37.09 ± 0.07[b]
RBC	4.31 ± 0.11[a]	6.17 ± 0.05[b]	6.10 ± 0.05[b]
PLET	4.30 ± 0.12[a]	6.18 ± 0.06[b]	6.09 ± 0.06[b]
TBC	10.42 ± 0.16[a]	8.46 ± 0.13[b]	8.07 ± 0.18[b]
LYM	48.93 ± 0.36[a]	54.13 ± 0.16[b]	54.54 ± 0.16[b]
NEU	45.22 ± 0.20[c]	41.66 ± 0.13[b]	40.11 ± 0.16[a]
MONO	3.03 ± 0.09[a]	3.12 ± 0.05[a]	3.83 ± 0.05[b]
EUSINO	2.26 ± 0.13[a]	2.87 ± 0.06[b]	2.83 ± 0.07[b]

Table 4. Overall least squares mean (±SEM) of hematological profile of Ghoongroo piglets after weaning (concentration wise).

Parameter	Control	PHF-1			PHF-2		
		100	200	250	100	200	250
HB	11.35 ± 0.11^{P}	13.13 ± 0.09^{S}	13.30 ± 0.07^{S}	12.83 ± 0.08^{RQ}	13.06 ± 0.08^{RS}	13.31 ± 0.07^{S}	12.62 ± 0.07^{Q}
PCV	33.26 ± 0.28^{P}	37.06 ± 0.10^{Q}	38.76 ± 0.19^{R}	37.38 ± 0.30^{Q}	37.03 ± 0.08^{Q}	37.25 ± 0.07^{Q}	37.00 ± 0.27^{Q}
RBC	4.31 ± 0.11^{P}	6.14 ± 0.08^{RST}	6.37 ± 0.08^{ST}	6.01 ± 0.08^{QR}	6.13 ± 0.09^{RS}	6.40 ± 0.08^{T}	5.77 ± 0.08^{Q}
PLET	4.30 ± 0.12^{P}	6.13 ± 0.09^{SR}	6.40 ± 0.09^{S}	6.00 ± 0.11^{QR}	6.12 ± 0.09^{SR}	6.42 ± 0.10^{S}	5.73 ± 0.09^{Q}
TBC	11.42 ± 0.16^{P}	7.22 ± 0.18^{Q}	8.04 ± 0.17^{R}	8.22 ± 0.31^{Q}	7.56 ± 0.31^{P}	7.58 ± 0.11^{Q}	8.07 ± 0.21^{S}
LYM	48.93 ± 0.36^{P}	54.24 ± 0.40^{Q}	54.18 ± 0.28^{Q}	53.98 ± 0.24^{Q}	54.41 ± 0.34^{Q}	54.48 ± 0.26^{Q}	54.73 ± 0.34^{Q}
NEUTRO	45.22 ± 0.12^{S}	41.19 ± 0.23^{Q}	41.03 ± 0.22^{Q}	42.86 ± 0.08^{R}	39.16 ± 0.34^{P}	41.52 ± 0.11^{Q}	39.64 ± 0.25^{P}
MONO	3.03 ± 0.09^{Q}	3.23 ± 0.08^{RQ}	3.45 ± 0.04^{R}	2.68 ± 0.08^{P}	4.24 ± 0.07^{T}	3.45 ± 0.04^{R}	3.82 ± 0.09^{S}
EUSINO	2.26 ± 0.13^{P}	2.71 ± 0.07^{Q}	2.47 ± 0.10^{QP}	3.43 ± 0.05^{R}	2.47 ± 0.10^{QP}	2.57 ± 0.07^{Q}	3.45 ± 0.14^{R}

Comparative Effect of PHF-I and PHF-II

Although both formulations improved health parameters, subtle differences were noted. PHF-I appeared to be more strongly influencing protein metabolism, as evidenced by higher albumin and total protein levels, while PHF-II exerted greater effects on hematological indices, particularly lymphocyte and monocyte counts. These differences may be attributed to the distinct phytochemical compositions of the two mixtures: PHF-I (pudina, turmeric, ginger, and black pepper) contains compounds known for anti-inflammatory and hepatoprotective activities, while PHF-II (cinnamon, capsicum, coriander, and garlic) is rich in bioactives with immunostimulatory and antimicrobial properties [15, 16].

Practical and Scientific Implications

The improvement observed at the lowest supplementation level (100 mg/kg BW) are of particular importance for practical pig production. From both biological and economic perspectives, this dosage provided sufficient benefits without requiring higher supplementation rates, which may increase feed costs. Additionally, the absence of adverse effects on liver function markers (SGPT and SGOT) and renal parameters (urea and creatinine) highlights the safety of long-term use [4, 17].

Our findings corroborate previous reports that phytogenic feed additives can improve feed efficiency, immune responses, and stress tolerance in livestock while reducing reliance on antibiotic growth promoters [5, 18]. Furthermore, the observed improvement in hematological indices suggests that PHFs could play a role in reducing the incidence of post-weaning diarrhea by strengthening the immune system and metabolic resilience.

CONCLUSION

Polyherbal formulations significantly improved hematological and biochemical parameters in post-weaned Ghoongroo piglets with the most pronounced effects observed at 100 mg/kg BW. Supplementation enhanced protein metabolism, glucose utilization, and hematological health particularly lymphocyte-mediated immunity, without adverse effects on liver or kidney function. PHF-I appeared more effective in supporting protein metabolism, while PHF-II exerted stronger immunostimulatory effects, reflecting their distinct phytochemical profiles.

These findings demonstrate that PHFs are safe, effective, and economical feed additives for supporting piglet health during the vulnerable post-weaning period. They offer a viable alternative to antibiotic growth promoters, contributing to sustainable pig production, improved animal welfare, and reduced public health risks associated with antimicrobial resistance. Future research should focus on long-term performance traits, gut microbiota modulation, and field-level validation under diverse management conditions.

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