Effect of Dietary GroPro-Yeast Based Natural Additive on Hematological Parameters of Starter-Phase Laying Hens

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Abstract. Hematological parameters were evaluated in a feeding trial using one-day-old Hy-Line Brown strain layer chicks supplemented with GroPro, a yeast-based natural feed additive, under open house conditions. A total of 480 chicks were randomly allocated to four dietary treatments with six replicates per treatment (20 birds/replicate) using a Completely Randomized Design. The treatments consisted of a basal diet (T0), and diets supplemented feed additive with 0.2% (T1), 0.5% (T2), and 1.0% (T3) GroPro during seven weeks. At the end of the trial, blood samples were collected from the brachial vein and analyzed for hematological indices. Data were analyzed using ANOVA followed by Duncan's Multiple Range Test when significant differences were detected. The results showed that dietary GroPro significantly ($P<0.01$) influenced hemoglobin (Hb), red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV), mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH). No significant effect ($P>0.05$) was observed on mean corpuscular hemoglobin concentration (MCHC). The inclusion of 1.0% GroPro resulted in the most favorable hematological profile, indicating improved oxygen-carrying capacity and immune status in starter-phase laying hens.

Keywords: GroPro, hematological parameter, laying hens, natural additive, starter phase.

1 Introduction

The rapid increase in the global population has intensified the demand for animal-derived protein sources, particularly poultry products, due to their high nutritional value and affordability [1]. The poultry industry plays a crucial role in supporting food security and economic development through employment generation and income improvement [2].

Feed represents the major cost component in poultry production and directly influences growth, health status, and production efficiency of laying hens. Feed efficiency reflects the

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relationship between feed intake and productive output and is therefore a critical determinant of profitability in the egg industry. Diet composition, along with genetic potential, health status, and environmental conditions, strongly affects feed utilization and physiological performance [3].

Natural feed additives derived from yeast have been widely applied in poultry nutrition due to their ability to enhance gut health, immune response, and nutrient utilization, serving as effective alternatives to antibiotic growth promoters. GroPro is a yeast-derived feed additive produced from *Saccharomyces cerevisiae* and contains bioactive components such as β-glucans, mannan oligosaccharides (MOS), nucleotides, and peptides. These compounds are known to enhance gut health, immune function, and nutrient absorption, which are essential for effective hematopoiesis and overall physiological balance. GroPro was produced by Angel Yeast Co., Ltd. β-glucans stimulate immune cell activity, while MOS improves intestinal integrity and microbial balance, thereby supporting erythropoiesis and leukocyte production. Dietary nucleotides play a critical role in intestinal development, immune modulation, and cellular regeneration in poultry, which may be reflected in improved hematological profiles [4,5]. Hematological parameters are sensitive indicators of nutritional status, immune response, and physiological adaptation in poultry and are influenced by genetic, nutritional, and environmental factors [6]. Therefore, this study aimed to evaluate the effects of the used feed additive GroPro on hematological parameters of starter-phase laying hens.

2 Materials and methods.

2.1 Experimental Birds

A total of 480 one-day-old Hy-Line Brown layer chicks were obtained from a commercial hatchery (PT Charoen Pokphand Indonesia). Birds were randomly assigned to four dietary treatments with six replicates per treatment and 20 birds per replicate. The experiment was conducted in an open house system consisting of 24 pens (1 × 1 × 0.7 m). Feed and water were provided *ad libitum* throughout the experimental period. Feeds used were complete feed Pre-Starter Layer 520 (0-5 weeks) and Layer Starter 521 (6-7 weeks). The treatments of the addition GroPro as feed additive consisted of:

T0 = Basal Diet (Control) 0 %
T1 = Basal Diet + 0.2% GroPro
T2 = Basal Diet + 0.5% GroPro
T3 = Basal Diet + 1.0% GroPro

2.2 Blood Sampling

At week 7, blood samples were collected from the brachial vein using sterile 3-mL syringes. A total of ten birds were randomly selected across treatments. Samples were placed in EDTA-treated tubes, gently mixed to prevent clotting, stored at 4 °C, and analyzed within 24 hours.

2.3 Haematological Analysis

2.3.1 Procedure for analysis of blood parameter by using XP-100 Sysmex

Hematological parameters were analyzed using a Sysmex XP-100 hematology analyzer following standardized laboratory procedures [6].

2.4 Statistical Analysis

The hematology was denoted as Mean±SE laying hens at the starter phase. Analysis using Analysis of Variance (ANOVA) completely randomized design (CRD) using SPSS 2019. If the result is significant then continue with the Duncan's Multiple Range Test.

3 Results and discussions

Hematological parameters consisted of RBC (10^6/µl),WBC (10^3/µL),Hb (g/dL),PCV (%), MCV(fL), MCH(pg), and MCHC(g/dL) were measured and listed in Table 1.

Table 1. Comparison of Hematological Parameters Mean and standard deviation (**SD)** laying hens at starter phase

	T0	T1	T2	T3
RBC (x10⁶/µL)	2.95 ± 0.10^{c}	2.78 ± 0.02^{a}	2.81 ± 0.05^{a}	2.88 ± 0.00^{b}
WBC (x10³/µL)	237.34 ± 0.65^{b}	237.31 ± 0.87^{b}	234.16 ± 0.74^{a}	241.53 ± 0.96^{c}
HB (g/dL)	12.14 ± 0.48^{c}	11.24 ± 0.03^{a}	11.26 ± 0.23^{a}	12.00 ± 0.25^{b}
PCV (%)	37.95 ± 1.42^{d}	34.7 ± 0.0^{a}	35.05 ± 0.65^{b}	36.47 ± 0.19^{c}
MCV (fL)	128.88 ± 0.45^{c}	124.67 ± 1.00^{a}	124.70 ± 0.00^{a}	126.57 ± 1.08^{b}
MCH (pg)	41.2 ± 0.26^{c}	40.38 ± 0.42^{b}	40.07 ± 0.06^{a}	41.66 ± 0.74^{d}
MCHC (g/dL)	31.98 ± 0.09	32.41 ± 0.09	32.13 ± 0.02	32.91 ± 0.87

"a-d Different superscripts within a row indicate significant differences among treatments ($P<0.01$). "

3.1 Effect of Gropro on Total RBCs (Red Blood Cells)

Table 1 showed that dietary GroPro supplementation significantly affected red blood cell (RBC) counts ($P < 0.01$) in starter-phase laying hens. Although the control group exhibited the highest RBC value, birds receiving 1.0% GroPro demonstrated comparable RBC counts, indicating that GroPro supplementation did not adversely affect erythropoiesis. Instead, the significant differences observed among treatments suggest that GroPro contributed to the modulation of RBC production. This response may be associated with the immunomodulatory and gut health promoting effects of yeast-derived β-glucans and mannan oligosaccharides (MOS), which enhance nutrient absorption efficiency and support hematopoietic activity [7,8].

Parveen et al., [9] reported that RBC number and hemoglobin (Hb) concentration increase with the growth and development of chicks to meet the oxygen requirements of rapidly developing tissues. Red blood cells play a central role in the transport of oxygen and carbon dioxide through hemoglobin. Furthermore, increases in Hb concentration may be accompanied by reductions in pCO_2 (partial pressure of carbon dioxide), total CO_2 (TCO_2^-), and bicarbonate (HCO_3^-) levels during prolonged holding periods, reflecting alterations in respiratory and metabolic status under conditions such as stress or dehydration [10]. In the present study, the significant effect of GroPro on RBC counts indicates its potential role in supporting physiological adaptation and oxygen transport capacity during the starter phase.

3.2 Effect of Gropro on Total WBCs (White Blood Cells)

White blood cell (WBC) counts were significantly influenced by dietary treatments ($P < 0.01$). Birds receiving 1.0% GroPro supplementation exhibited the highest WBC values among all treatment groups, indicating a marked enhancement in immune responsiveness.

This significant increase suggests that GroPro effectively modulated leukocyte production rather than merely maintaining baseline immune status. Yeast-derived β-glucans are well documented to stimulate leukocyte proliferation and activate immune defense mechanisms in poultry, thereby strengthening both innate and adaptive immune responses [11].

3.3 Effect of Gropro on Hb (Hemoglobin) Concentration

Hemoglobin (Hb) concentration differed significantly among dietary treatments ($P < 0.01$). Birds fed diets supplemented with 1.0% GroPro exhibited higher Hb levels compared with other supplemented groups, indicating a positive effect of GroPro on hemoglobin synthesis. This improvement may be attributed to enhanced nutrient utilization and increased availability of essential micronutrients required for erythropoiesis, facilitated by yeast-derived bioactive components and dietary nucleotides [12,13].

Furthermore, supplementation with β-mannanase has been reported to improve nutrient utilization efficiency and blood metabolite profiles in poultry, which was associated with enhanced productive performance. These findings support the concept that dietary factors influencing nutrient digestibility and metabolic efficiency play a crucial role in regulating hemoglobin synthesis and overall physiological status in laying hens [14].

3.4 Effect of Gropro on Ht (Hematocrit) Volume

Packed cell volume values increased significantly with GroPro supplementation ($P<0.01$). Higher PCV values indicate improved oxygen transport capacity and physiological adaptation during the starter phase, which is critical for tissue growth and organ development Feed with the addition of natural feed additive GroPro 1%/kg effect on hematocrit volume. Hematocrit volume mostly affects the oxygen level and helps in absorption of nutrients. The hematocrit value (%PCV) is defined as the ratio of the weight of blood cells to the weight of fluid in the capillary blood. It helps in carrying oxygen along with absorbed nutrients into tissues. Hematocrit levels are usually determined during the starter phase, including the first few weeks of preparation for coming egg laying, which, as an index of efficient oxygen transport, meets the needs for growth and organ development in hen's [15].

3.5 Effect of Gropro on MCV, MCH & MCHC

The research findings showed that there was significant difference in the values of MCV and MCHC layer birds but MCHC is non-significant. Feed with the addition of natural feed additive GroPro 1 %/kg also affects MCV and MCH. According to table 1 MCV values ranged from T0, T1, T2, and T3 respectively for birds. Their result shows significant ($P<0.01$). The MCH values range from higher to lower T3, T0, T1 and T2 respectively for birds. Their result shows significant ($P<0.01$). The MCHC values range from T0, T1, T2 and T3 respectively for birds and are non- significant. Feed with the addition of natural feed additive GroPro 1%/kg having nucleic acids effect on PCV and MCV is due to their involvement in cellular function and regeneration. Nucleic acid intake improved erythropoiesis, and production of red blood cells resulted in higher PCV levels. The increase in MCV and MCH suggests enhanced erythrocyte size and hemoglobin content per cell, potentially associated with improved cellular regeneration and metabolic activity supported by dietary nucleotides. MCH and MCHC levels are representative indices of blood profile and decline with age [9].

4 Conclusion

Dietary supplementation of GroPro significantly influenced several hematological parameters in starter-phase laying hens. The inclusion of 1.0% GroPro resulted in significant improvements in red blood cell (RBC) counts, white blood cell (WBC) counts, hemoglobin (Hb) concentration, packed cell volume (PCV), mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH), while mean corpuscular hemoglobin concentration (MCHC) was not affected. These findings indicate that GroPro supplementation positively modulated erythropoiesis, immune responsiveness, and oxygen-carrying capacity without exerting adverse effects on blood cell integrity. The observed hematological responses suggest that the bioactive components of GroPro, including yeast-derived β-glucans, mannan oligosaccharides, and nucleotides, enhanced nutrient utilization, supported immune function, and promoted physiological adaptation during the starter phase. Overall, the inclusion of GroPro at 1.0% in starter diets can be considered beneficial for improving hematological status and supporting early growth and organ development in laying hens. Further studies under commercial production conditions are recommended to confirm these effects and evaluate their long-term implications on laying performance.

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