

Determination of Blood Physiological and Biochemical Values of Blue Peafowl

Xu Xiao-xia¹, Qian Guo-hong², Yang Fu-min^{1*}, Yang Min³, Wang Xue-yan¹

¹College of Food Science and Engineering, Gansu Agricultural University, Lanzhou, China

²Gansu Provincial Health Education Institute, Lanzhou, China

³College of Science, Gansu Agricultural University, Lanzhou, China

*Corresponding author: yfumin@gsau.edu.cn

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Abstract Forty-nine physiological and biochemical indices of blood in blue peafowl were determined in this report. Significant differences were observed in the hematocrit, alkaline phosphatase, CO₂-M and anion gap ($p < 0.01$), as well as mean corpuscular hemoglobin, α -hydroxybutyrate dehydrogenase, Mg²⁺, erythrocyte number, glutamicpyruvic transaminase, total protein and total bile acid ($p < 0.05$) of different sexes. The results may provide a reference for feeding, health examination, diagnosis, and breeding of blue peafowl.

Keywords: blue peafowl, blood, physiological values, biochemical values

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1. Introduction

The peafowl belongs to phasianidae, pavo, a kind of special poultry breed for viewing and admiring [1,2,3]. Peafowl meat has been verified possess detoxifying effect [3]. As recorded in a well-known Chinese medicine book "Outline Treatise of Medical Herbs", peafowl meat is a kind of medicinal diet with the functions of eliminating toxin, beautifying skin [4]. There are two kinds of peafowl in the world, blue peafowl(*Pavo critatus*) and green peafowl(*Pavo muticus*). Compared to green peafowl, the artificial domestication of blue peafowl is earlier than green peafowl, which has a history of 3000 years. Blue peafowl has a higher reproductive capacity under appropriate breeding and management. Wild green peafowl is listed as the national first-class protected animals in China, while home-raised blue peafowl is not included, so they can be raised for edible and medical use. Blue peafowl has breed in the zoo of most countries in recent years [5]. In China, blue peafowl breeding was paid much attention because it has extensive adaptability, higher disease resistance, crude feed tolerance and high economic benefits. Researches on blue peafowl has been listed as a promotion project of Star Program by the State Ministry of Science & Technology, and also has been designed as special livestock and poultry industrial management program by China's State Forestry Administration [4].

The literature focusing on blue peafowl are mainly about breeding, disease diagnosis and treatment [6,7], nutrition [5,8-13], muscle histological characteristics [14], slaughter performance, meat quality traits [4], and genetic

diversity [15-20]. However, the determination physiological and biochemical values of blue peafowl has not been reported. Physiological and biochemical values are important indexes in medical biology research, which can be used to evaluate animal health, and also applied as the important reference of pathology and toxicology studies [21,22]. The paper aimed to determine and compare the blood physiological and biochemical values between male and female blue peafowl. The results can provide reference and theoretical basis for artificial breeding, ecological protection, raising and management, epidemic disease prevention and cure of blue peafowl.

2. Materials and Methods

2.1. Blue Peafowl

The experiment was carried out by using twelve blue peafowl (6 males and 6 females, one-year old, mean body weight were 4.314 kg and 2.755 kg, respectively) from Gansu Hongxiang blue peafowl high-tech agricultural development Co. Ltd in Gansu Province, China. Blue peafowl were subjected to clinical examination before study and only healthy subjects were used.

2.2. Blood Sampling

Blood samples (5 mL) were collected by wing venipuncture before morning feeding (each peafowl was sampled once) in two different vacutainer tubes. To assess blood physiological values, samples were collected in 1ml vacutainer test tubes containing 0.1% heparin anticoagulant. This allowed us to analyze the blood without the risk of clotting in the tube. The rest 4 ml in vacutainer were

centrifuged at 3000r for 15 min, within 30 min for the collection and the obtained serum was stored at -20°C until biochemical analyses.

2.3. Determination of Blood Physiological and Biochemical Values

2.3.1. Blood Physiological Values

Blood physiological values including Red blood cell count(RBC), White blood cell count(WBC), Hemoglobin (HB), Hematocrit (HCT), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin(MCH), Hemoglobin concentration (MCHC), Red cell distribution width (RDW-CV), Platelet count(PLT), Lymphocyte ratio(LYM%), Lymphocyte count (LYM) of blue peafowl blood were determined using an automatic blood cell analyzer (JN1212-ABX-MICROS 60, France).

2.3.2. Blood Biochemical Values

The serum was separated and used for the assay of 29 biochemical attributes including Creatine kinase(CK), Creatine kinase-MB(CK-MB), α -hydroxybutyric dehydrogenase (α -HBDH), Alanine aminotransferase (ALT), etc. with standard analytical procedures. The reagent kits supplied by Biological Engineering Co., Ltd. Beijing, China were utilized for the analysis of biochemical attributes with automatic biochemical analyzer (AMS-I8, Italian). Electrolyte analyzer (HX-7185, Hengxing Technology Development Co., Ltd. Heifei, China) was used to analyze the content of K, Na, Cl, iCa, Ca, Mg, P, CO₂-M) and AG of blue peafowl blood, and the operation can refer to specification supplied with the above mentioned instruments.

2.4. Statistical Analysis

All the measurements were carried out in triplicate. The values were averaged and reported along with their standard deviation (S.D). Data were analyzed with paired *t* test. Probabilities lower than 0.01 were considered as statistically highly significant ($p < 0.01$). Probabilities lower than 0.05 were considered as statistically significant ($p < 0.05$). All statistical calculations were performed with the SPSS 13.0 statistical software for Windows.

3. Results and Discussion

3.1. Blood Physiological Values of Blue Peafowl

Blood physiological values of blue peafowl were shown in Table 1. MCV was very significantly different ($p < 0.01$) between male and female blue peafowl, RBC and MCH were significantly different ($p < 0.05$) between male and female blue peafowl blood, while other physiological values were not significantly different ($p > 0.05$) between male and female.

The normal values of blood physiological are the main indicators that reflect body health, it is also one of the index for diagnosis and monitoring of diseases. The number and size of RBC as well as the content of HB reflect oxygen-transport ability of the animal [23]. The

number of RBC is not fixed, and can change in response to factors such as breed, age, gender, physical status, living environment and other factors. In general, the number of RBC in young animals is higher than that of adult animals, the number of RBC in male animals is higher than that of female animals, the number of RBC in good nutrition animals is higher than that of malnutrition. Many studies have found that hungry animals contain less RBC and HB as well as low metabolism. This is the instinctive response of hungry animals to reduce the use of stored energy in order to maintain basic life activities [24].

Table 1. Blood biochemical indices of blue peafowl ($\bar{x} \pm s$, n=3)

Items	Male blue peafowl	Female blue peafowl	<i>p</i> -value
WBC ($10^9/L$)	219.467±8.262	227.600±6.634	NS
RBC ($10^{12}/L$)	1.397±0.085	1.593±0.049	*
HGB (g/L)	119.000±9.644	116.333±6.027	NS
HCT	25.100±1.637	26.867±0.568	NS
MCV(fL)	179.700±2.893	168.700±2.291	**
MCH(pg)	85.200±4.503	73.133±5.871	*
MCHC (g/L)	473.667±17.926	433.333±29.704	NS
RDW-CV (%)	8.600±0.889	10.733±1.209	NS
PLT ($10^9/L$)	28.333±1.527	30.000±1.000	NS
LYM (%)	95.800±1.126	62.367±4.039	NS
LYM ($10^9/L$)	210.300±9.417	140.433±21.919	NS

** $p < 0.01$; * $p < 0.05$; NS $p \geq 0.05$.

The results showed that the RBC of male was significantly lower than that of female ($p < 0.05$), the MCH of male was significantly higher than that of female ($p < 0.05$), the MCV of male was very significantly higher than that of female ($p < 0.01$). Frequent and intensive activities as well as big oxygen consumption of male blue peafowl have caused these results. WBC mainly take part in immune response for body, and it can resist the invasion of the bacteria, viruses and other pathogens. The results of WBC, LYM and LYM % were not significantly different ($p > 0.05$) between male and female showed the immunity of male and female is basically equal.

3.2 Blood Biochemical Values of Blue Peafowl

3.2.1. Blood Enzyme Activities

Blood enzyme activities of blue peafowl were shown in Table 2. Except α -HBDH, ALT and ALP, other enzyme activities were not significantly different ($p > 0.05$) between male and female.

Serum enzyme is an important sign of the integrity of the cell membrane function. The changes of serum enzyme activity reflect the status of metabolism of material and the different states of organizational structure function [25,26]. Analyzing the activity and change rule of serum enzyme is of great practical significance to understand the animal growth and breeding character as well as meat quality improvement [27,28]. Studies have reported that ALT activities are positively associated with slaughter performance, breast meat rate, thigh meat rate, lean meat rate and belly fat percentage [29]. ALT has a very important function in amino metabolism as well as in protein, fat and glucose metabolism. The activities of ALT in serum are normally very low, but its levels in the blood

would increase when the liver tissue is damaged or diseased. Thus, ALT can be used as an indicator for clinical diagnosis. ALP is an important enzyme widely distributed in the animal blood and organs, catalyzing various phosphates and release of inorganic phosphorus. ALP plays a central role in bone formation and fat synthesis, so it is an important index for the physiological activity and related disease diagnosis [28,30]. For example, the serum level of ALP is an index for evaluating the metabolism status of liver and kidney which become active as the content of ALP increasing. HBDH mainly comes from cardiac, kidney and red blood cells, among which cardiac tissue contains the most abundant, so the HBDH activity of blood was apparently elevated cardiac diseases. Additionally, HBDH is an isozyme of LDH, which activity changes is paralleled with the LDH [31,32]. The serum level of HBDH is also an important index for evaluating the nutrition status.

Table 2. Enzyme activity in blood of blue peafowl ($\bar{x} \pm s$, n=3)

Items	Male blue peafowl	Female blue peafowl	p-value
CK (U/L)	1684.333±233.432	1508.667±503.701	NS
CK-MB (U/L)	2982.333±415.587	2659.333±882.413	NS
HBDH (U/L)	110.333±17.926	69.000±15.524	*
LDH (IU/L)	196.000±57.035	137.000±74.987	NS
ALT (U/L)	2.667±0.619	9.333±3.650	*
AST (U/L)	106.667±7.234	137.000±42.036	NS
CHE (U/L)	3522.333±598.640	3317.333±765.569	NS
ALP (U/L)	140.333±97.961	29.000±2.000	**
GGT (U/L)	2.333±0.577	2.333±1.309	NS
AMY (U/L)	635.666±40.251	644.333±5.508	NS

** $p < 0.01$; * $p < 0.05$; NS $p \geq 0.05$.

The results show that the ALP of male was very significantly higher than that of female ($p < 0.01$), but the ALT of male was significantly lower than that of female ($p < 0.05$). The HBDH of male was significantly higher than that of female ($p < 0.05$), which are not in accordance with Zhou Qin-ping's conclusion that no significant difference of ALT was between males and females ($p > 0.05$) [28]. The HBDH of male was significantly higher than that of female might be one reason for the difference between the sexes.

3.2.2. Blood Organic Content

Blood organic content of blue peafowl were shown in Table 3. Except TP and TBA, other organic content were not significantly different ($p > 0.05$) between male and female.

TP is an effective index to reflect the protein metabolism of poultry. High TP content of the serum reflects protein metabolism activity, which is conducive to improve the protein absorption and promote the animal's growth [33]. The TP content was influenced by dietary protein content to a certain extent, which related to energetic materials, and also has relationship with age, physiological state and health status [34,35]. The content of TP and album are reduced in malnutrition animals, while high-protein diets will raise the content of urea nitrogen [36,37].

The results showed that the TP of male was significantly lower than that of female ($p < 0.05$), it may

be attributed to multi-factors including physiological metabolism, movement difference, and so on. The TBA is formed by cholesterol, which is the important basis for judging animal liver disease. The results showed that the TBA of male was significantly lower than that of female ($p < 0.05$). The difference of blood organic content between male and female may attribute to sexes and take feeding status. Therefore, we cannot conform diseases rely on sexes when use the changes of organic content as diagnostic indexes in practice. We need to increase the protein levels of feeds in the feeding.

Table 3. Blood organic content of blue peafowl ($\bar{x} \pm s$, n=3)

Items	Male blue peafowl	Female blue peafowl	p-value
GLU (mmol/L)	18.100±0.625	17.500±1.418	NS
GSP (mmol/L)	1.467±0.116	1.500±0.200	NS
BUN (mmol/L)	0.267±0.058	0.433±0.153	NS
CRE (umol/L)	16.300±5.032	22.233±10.504	NS
BUN/CL	4.780±2.352	5.247±1.025	NS
UA (umol)	163.333±62.565	213.667±71.598	NS
TCH (mmol/L)	2.800±0.625	4.067±1.343	NS
TG (mmol/L)	1.633±0.116	2.000±0.557	NS
HDL (mmol/L)	1.107±0.317	1.457±0.144	NS
LDL (mmol/L)	1.377±0.231	2.417±1.649	NS
APO A1 (g/L)	0.080±0.003	0.093±0.015	NS
APOB (g/L)	0.063±0.038	0.053±0.040	NS
APO-A(A1/B)	1.963±0.765	4.443±2.681	NS
TP (g/L)	33.533±4.680	49.300±7.436	*
ALB (g/L)	17.600±3.396	21.367±0.503	NS
TBIL (umol/L)	3.400±0.400	4.733±0.757	NS
DBI (umol/L)	1.900±0.600	2.733±0.473	NS
IBIL (umol/L)	1.500±0.872	2.000±0.819	NS
TBA (umol/L)	30.333±15.502	57.333±5.132	*

** $p < 0.01$; * $p < 0.05$; NS $p \geq 0.05$.

3.2.3. Blood Electrolyte Content

Water and electrolyte are main composition in body fluids, and electrolyte content is varied with different gender and age. Electrolytes are important to keep the balance of salts in animal body. The concentration of plasma electrolytes plays a key role maintaining cell metabolism, osmotic pressure, proper water distribution, body acid-base balance, neuromuscular excitement, blood pH, muscular excitement and the status of heart and kidney [23,38].

Blood electrolyte content of blue peafowl are shown in Table 4. CO₂-M and AG of male were very significantly higher than that of female ($p < 0.01$), the Mg of male was significantly higher than that of female ($p < 0.05$), while K, Na, Ca, and P content were not significantly different ($p > 0.05$) between male and female. Some researchers reported that inorganic phosphorous content in serum of *Crossoptilon mantchuricum* was significantly different ($p < 0.05$) between male and female [39]. The Cl and Na content of male *chrysolophus pictus* were significantly higher than those of female ($p < 0.05$) [23]. The K content of male cabot's tragopan was higher than that of female (male 62.57 mg/L, femal 153.41 mg/L), while the Ca content of male cabot's tragopan was lower than that of

female (male 136.21 mg/L, female 145.53 mg/L) [40]. It shows that the concentration of plasma electrolytes may be different among animals, and it also suggests that body was in abnormality.

Table 4. Blood electrolyte content of blue peafowl ($\bar{x} \pm s$, n=3)

Items	Male blue peafowl	Female blue peafowl	p-value
K (mmol/L)	3.183±0.032	3.893±0.667	NS
Na (mmol/L)	149.667±0.577	150.000±2.000	NS
Cl (mmol/L)	102.000±0.006	102.667±1.528	NS
iCa (mmol/L)	1.393±0.006	1.417±0.051	NS
Ca (mmol/L)	2.787±0.011	2.833±0.103	NS
Mg (mmol/L)	0.617±0.129 ^a	0.403±0.015 ^b	*
P (mmol/L)	1.370±0.241	1.667±0.258	NS
CO ₂ -M (mmol/L)	29.933±2.424 ^A	20.227±1.395 ^B	**
AG (mmol/L)	17.737±3.004 ^A	27.107±1.465 ^B	**

** $p < 0.01$; * $p < 0.05$; NS $p \geq 0.05$.

4. Conclusion

11 of 49 physiological and biochemical indexes were showed significantly differences between male and female. Among them, the MCV, ALP, AG and CO₂-M of male was very significantly higher than that of female ($p < 0.01$), the MCH, HBDH and Mg of male were significantly higher than those of female ($p < 0.05$). The RBC, ALT, TP and TBA of male were significantly lower than those of female ($p < 0.05$), while other index were not significantly different ($p > 0.05$) between male and female. It showed that there were differences existing in part physiological and biochemical indexes between male and female in normal circumstances. Thus, we should not use uniform standard to evaluate the status of nutrition, health and diseases diagnose of male and female blue peafowl when use blood physiological and biochemical indexes were referenced in practice.

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