Cholesterol and Blood Profile of Bali Cattle Fed Chromolaena odorata Weed with Rice Straw as Basal Feed

Gustaf Oematan1*, Marthen Luther Mullik1, Imanuel Benu1, I Gusti Ngurah Jelantik1, Twenfosel Dami Dato1, Gusti Ayu Yudit Lestari1, Gemini Ermiani Malelak1, Erna Hartatti1, Edwin Lazarus1, Marten Yunus1

1 Faculty of Animal Husbandry, Marine and Fisheries Nusa Cendana University - Kupang - East Nusa Tenggara - Indonesia.

Received: September 9, 2023
Revised: March 30, 2024
Accepted: April 25, 2024
Published: April 30, 2024

Abstract: This study aims to determine the effect of the level of C. odorata (CO) silage-based concentrate on the blood profiles of Bali cattle. Three male Bali cattle (initial 2 years old with CV = 19.28%) were randomly assigned to one of three meals: rice straw and concentrates containing C. odorata silage 30% (RCO30) or C. odorata silage 40% (RCO40) or C. odorata silage 50% (RCO50), respectively, using a 3 x 3 Latin Square Design. The was no significant effect between treatments (P> 0.05) on blood cholesterol (195.74-220.49 mg/dL), blood urea (48.41-49.44 mg/dL), total blood plasma (6.08-6.93 g/dL), blood haemoglobin (Hb; 18.18-18.92 g/dL), hematocrit levels (45.56-53.03%), erythrocytes (7.06-8.24 106/µL), and leucocytes (8.56-8.84/µL). Blood glucose levels, however, differed significantly (P<0.05) between treatment. Feeding Bali cattle with different levels of C.odorata-based concentrate resulted in the same effect on all blood parameters except blood glucose. Therefore, it is recommended that the use of C.odorata in a ration of Bali cattle can be up to 50%.

Keywords: Bali cattle; Blood profile; Chromolaena odorata; Rice straw; Silage

Introduction

Although the contribution is high and plays an important role as savings, cash, or assets in the livelihoods of smallholders in East Nusa Tenggara Province, Indonesia, the productivity and reproductive performance of Bali cattle is still low. This problem is mainly due to the low quantity and quality of feed available throughout the year. As a result, the mortality rate of high birth calves is 24.1 – 51.2% during the dry season (Jelantik et al., 2008) and the animal's weight loss is 36.91% (Mullik & Jelantik, 2009). Therefore, finding alternative feeds that are nutritious and available all year round is very important. Chromolaena odorata (C. odorata) is a Siamese weed that invades most grazing lands in the tropics. This weed has been reported to have a high crude protein content of about 13%-35% (Mullik, 2007; Oematan et al., 2020; Oematan, 2023) and high biomass production (around 70 tons BK/ha/yr) (M. L. Mulik et al., 2015), protein score is 88.2% (Apori et al., 2000; M. Ngozi et al., 2009; Oematan et al., 2020) which are categorized as very high, which can potentially be used as protein supplementation for ruminant animals. However, the use of C. odorata as animal feed is hindered by anti-nutritional factors (Ngozi et al., 2009; Oematan et al., 2023). Conversely, the organic biomass of this plant also has various anti-nutrient compoundsphenolics, alkanolides, and terpenoids (Singh, 2022). These secondary metabolites can be reduced by the bio-fermentation process (Ridla et al., 2016; Mulik, 2016) before being used as a source of ruminant animal feed (Bira, 2016).

One of the strategies to reduce this anti-nutritional issue is through making silage. However, silage production's good quality depends on its carbon-nitrogen (C/N) ratio. (Mulik (2016) found that the best C/N ratio in the bio-fermentation of C. odorata was 30%.
Oematan et al., (2023) showed that the bio-fermentation of C. odorata using a carbohydrate source of rice straw flour with a C/N30 ratio obtained the best results on feed composition. Therefore, adjusting the C/N ratio is vital in making silage C. odorata because, naturally, the C/N ratio in C. odorata is only about 14.9, so it can produce poor bio-fermentation.

Blood metabolites such as blood glucose, blood plasma protein, and blood urea levels, are related to nutritional status and cattle productivity. Supply of glucose and protein has a close relationship with various intakes and the physiological state of cattle. The concentrations of blood glucose are high whenever consumption of energy is high. In addition, urea levels in the blood can be used as an index of protein status and usage. However, information regarding C. odorata utilisation feed on Bali cattle is limited. Therefore, In this paper, we will report on the effect of different concentrations of C. odorata-based concentrates on the ratio of Bali cattle. The feed obtained is expected to be an alternative feed for fattening Bali cattle.

Method

Location of study
The present study was conducted at the Faculty of Animal Science, Marine and Fisheries field laboratory, Universitas Nusa Cendana Kupang, Indonesia

Animals, diet and experimental design
Three male Bali cattle (initial BW = 108 - 160 kg with cv 19,28%; 2 years old) were randomly assigned to one of three meals: rice straw and concentrates containing C.odorata silage 30% (RCO30) or C.odorata silage 40% (RCO40) or C.odorata silage 50% (RCO50, respectively, using a 3 x 3 Latin Square Design. Each cow was housed in individual pens within a covered cattle house facility with access to water at all times. During each period, all cows were fed rice straw ad libitum, and a 2% BW (DM as fed) concentrate diet. The concentrates consisted of C.odorata silage, corn meal, pollard, rice bran, salt, and premix, formulated with 16% ME. Feed was provided to the animals twice a day. Each treatment period lasted for 28 days and consisted of 14 days adaptation period and seven days of sample collection.

Variables and measurement
Blood samples from each cow were collected at the end of each study period via jugular vein using vacutainer tubes containing EDTA 4 hours after the morning meal. The samples were immediately placed on ice and brought to the laboratory for later analysis. Blood samples were then analysed for blood glucose, blood urea nitrogen, total cholesterol, total protein plasma, haemoglobin, haematocrit, erythrocyte and leucocyte using spectrophotometric.

Statistical analysis
Data obtained in this study were statistically analysed using General Linear Model (GLM) procedure using SPSS 25. Duncan's multiple range tests within the SPSS program were conducted to examine the degree of significance among means. The significant difference was set at P < 0.05 (Morgan et al., 2019).

Table 1. The composition of the research rations.

<table>
<thead>
<tr>
<th>Feed Ingredients (%)</th>
<th>Rations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RCO30</td>
</tr>
<tr>
<td>Rice straw (1/3 part of the body weight) ad libitum</td>
<td>ad libitum</td>
</tr>
<tr>
<td>Concentrate (2/3 part of the body weight) :</td>
<td></td>
</tr>
<tr>
<td>Silage flour C. odorata</td>
<td>30</td>
</tr>
<tr>
<td>Wheat / Pollard bran</td>
<td>47</td>
</tr>
<tr>
<td>Rice bran</td>
<td>12</td>
</tr>
<tr>
<td>Milled corn</td>
<td>10</td>
</tr>
<tr>
<td>Salt</td>
<td>0.50</td>
</tr>
<tr>
<td>Minerals + vitamins (premix)</td>
<td>0.50</td>
</tr>
<tr>
<td>Amount</td>
<td>100</td>
</tr>
<tr>
<td>Crude protein content</td>
<td>18</td>
</tr>
</tbody>
</table>

Result and Discussion

Effect of Treatment on Blood Cholesterol Levels
Cholesterol is found in muscle and adipose tissue because it is an essential component of cell membranes and can be stored as cholesterol esters in lipids. Differences in cholesterol content between species are generally caused by cholesterol absorption and biosynthesis, lipoprotein metabolism, diet, genetic variation, subcutaneous and intramuscular fat and body weight (Dessi and Battela, 2003). Cholesterol levels in this study varied between 195.74 - 220.49 mg/dL. The result of this study was higher than that reported by Syahrir et al., (2010) when mulberry leaf-based concentrate was offered to Bali cattle which is about 207.38 mg/dL vs 168 mg/dL. Similarly, it was lower compared to the results of Mitruka & Rawnsley (1977) on Bali cattle which is between 207.38 mg/dL vs 125 mg/dL. However, the cholesterol level was lower when compared to cholesterol level in dairy cows, about...
Blood glucose is an indicator of food substances, especially animal protein and energy. In ruminants, glucose is needed in a certain amount for basic living needs, tissue growth, and milk production. Glucose levels in the body are controlled through glycolysis, glycogenesis, and gluconeogenesis so that the glucose levels in the body are maintained relatively constant. Glucose is absorbed from the digestive tract in small amounts, and its levels in the blood are maintained through the synthesis of endogenous for the essential functions of body tissues. The average blood glucose obtained in this study varied between 61.57-101.84 mg/dL, with an average of 85.02 mg/dL and still in normal glucose levels. According to Mitruka et al. (1977), cows’ normal range of blood glucose levels varies between 43-100 mg/dL. Typically, the blood glucose levels in this study are not only due to the energy factor supplied from the feed consumed by livestock but also by the control mechanism of insulin and glucagon hormones which functions to regulate the balance of blood glucose levels in the body of Bali cattle.

The average blood glucose levels found in this study were higher when compared with the results of Bira (2016) when Bali cows were fed concentrates containing C. odorata (85.02 mg/dL vs 82.47 mg/dL). Whereas when compared to the results of the study by Tahuk et al., (2017) using forage on Bali cattle with different lengths of time of administration to Bali cattle, the results were higher (85.02 mg/dL vs 58.62 mg/dL) and when compared with the results of research conducted by Windi et al., (2016) which used a concentrate containing corn cobs in Bali cattle, the results were also higher, namely (85.02 mg/dL vs 64.23 mg/dL). The difference in blood glucose levels from the results of this study with other reports from other studies may be due to the feed factors used, the physiological status of the research livestock, and other environmental factors.

Blood glucose is an indicator of food substances, especially animal protein and energy. In ruminants, glucose is needed in a certain amount for basic living needs, tissue growth, and milk production. Glucose levels in the body are controlled through glycolysis, glycogenesis, and gluconeogenesis so that the glucose levels in the body are maintained relatively constant. Glucose is absorbed from the digestive tract in small amounts, and its levels in the blood are maintained through the synthesis of endogenous for the essential functions of body tissues. The average blood glucose obtained in this study varied between 61.57-101.84 mg/dL, with an average of 85.02 mg/dL and still in normal glucose levels. According to Mitruka et al. (1977), cows’ normal range of blood glucose levels varies between 43-100 mg/dL. Typically, the blood glucose levels in this study are not only due to the energy factor supplied from the feed consumed by livestock but also by the control mechanism of insulin and glucagon hormones which functions to regulate the balance of blood glucose levels in the body of Bali cattle.

The analysis of variance showed that the cows fed C. odorata-based concentrates had significantly (P<0.05) affected the blood glucose levels of Bali cattle. Blood glucose concentrations were significantly different between feed treatments because blood glucose was maintained by a homeostatic mechanism (Windi et al., 2016). Giving levels of 30%, 40%, and 50% of C. odorata flour in a concentrate ration mixture can have a significant effect on the degradation of feed by microbes and the metabolism of rumen microbial cells to produce propionic acid, which is a precursor for the formation of glucose in the body, causing blood glucose in the body of Bali cattle to have a significant impact. The overall effect of the treatments on the measured parameters can be seen in Figure 1.
Effect of treatment on Blood Urea concentration

Blood urea levels reflect Bali cattle’s physiological status in response to feed consumption, especially protein and ammonia production. The highest average blood urea obtained in this study was in 50% C. odorata flour in the concentrate mixture (RCO50); namely, 49.44 mg/dL, followed by treatment of the addition level of 40% flour. C. odorata in a concentrate ration mixture (RCO40) which is 49.04 mg/dL and the lowest by treatment with the added level of 30% C. odorata flour in concentrate ration (RCO30), which is 48.41 mg/dL. Thus, the mean value of male Bali cattle blood urea produced (Table 2.) varied between 48.41 mg/dL to 49.44 mg/dL with an average of 48.96 mg/dL. The average blood urea produced in this study when compared to the results of Bira (2016) study by giving concentrate made from white flower bush (C. odorata) to Bali cattle, the results were lower (48.96 mg/dL) vs 52.60 mg/dL. Usually, the blood urea levels produced in this study are influenced by the consumption of food substances from Bali cattle. This result is related to the study by Roseler et al., (1993), that high blood urea concentrations cause livestock to be inefficient in using their energy. The high blood urea levels will require more energy to convert the high concentration of ammonia in the rumen fluid into blood ammonia which is then secreted in the form of urea in the urine (Purbowati, 2007).

The analysis of variance showed that the level of addition of 30%, 40%, and 50% C. odorata flour in the concentrate ration mixture had no significant effect (P>0.05) on the blood urea levels of Bali cattle. The same blood urea concentration between feed treatments was probably caused by the level of consumption of food substances, especially the absorption of amino acids and the absorption of ammonia by the same Bali cattle. In this condition, there may be a nitrogen balance in the rumen needed by the microbes of the rumen and the host livestock so that the blood urea levels of Bali cattle used in the study have the same effect.

Effect of treatment on Blood Plasma Protein

Plasma protein is a protein replacement source in tissues deficient in protein. Plasma proteins in the tissue will be broken down into amino acids (Guyton, 1983).
The speed of the formation of plasma protein by the liver depends on the concentration of amino acids in the blood, meaning that the plasma protein concentration decreases when the amino acid supply is not suitable. Conversely, when there is an excessive protein in the plasma, it is used to form tissue proteins. So there is a constant balance between plasma proteins, amino acids, and tissue proteins (Dja’far, 1988). The results of research by Utomo et al., (2017) on the characteristics of plasma protein in Bali cattle found that there were plasma protein bands for male and female calves (0.1-5 years old) and puberty (2-2.5 years old), and adults (3-5 years) have protein bands of varying thickness and by Irfan et al., (2014) that clinical, biochemical parameters can be used to explain the mechanism of aberration and provide an overview of livestock health conditions, metabolic status, and help diagnosis so that appropriate handling of livestock can be carried out.

The highest average blood plasma protein data produced in this study was achieved by treatment with the addition of 40% C. odorata flour (RCO50); namely, 6.90 g/dL, followed by treatment with the addition of 30% C. odorata flour (RCO30) was 6.30 g/dL, and the lowest by treatment with the addition of 50% C. odorata flour (RCO50) was 6.08 g/dL. Thus, the mean total blood plasma protein values of male Bali cattle produced (Table 2) varied from 6.08 g/dL to 6.93 g/dL with an average of 6.44 g/dL. The variance results showed that the treatment had no significant effect (P>0.05) on the total blood plasma protein.

The mean total blood plasma protein levels achieved in this study were still within the average level. According to Radostits et al., (2007), the normal range of total plasma protein values in cattle is 5.7 - 8.1 g/dL. Usually the total blood plasma protein levels produced in this study were influenced by the adequate needs for food substances by livestock and the healthy condition of the livestock at the time of the study, although C. odorata had secondary metabolic compounds that did not interfere with the health of the animals studied. Kaslow, (2010) stated that the total plasma protein increases due to chronic infection, hypofunction of the adrenal glands, liver failure, collagen disease in blood vessels, hypersensitivity (allergies), dehydration, and respiratory disease (shortness of breath), hemolysis and leukaemia. Meanwhile, total plasma protein decreased due to malnutrition and malabsorption, liver disease, chronic and non-chronic diarrhoea, hormonal imbalance, kidney disease (proteinuria), low albumin, and low globulin.

This study's mean total blood plasma protein was higher when compared with the results of Radostits et al., (2007), which is between 6.44 g/dL vs 6.9 g/dL. This result was probably due to the factors such as feed used, pathological conditions, the physiological status of the animals, and other environmental factors.

Effect of the treatment on Blood Hemoglobin

The concentration of blood haemoglobin is measured based on the intensity of its colour using a photometer and is expressed in g/100 mL or g/dL. Haemoglobin levels are influenced by the adequacy of feed, especially protein and digestibility in rations, age, sex, and type of livestock (Schalm et al., 1975). Haemoglobin is a solid substance in the blood that causes a red colour and a protein molecule in red blood cells that functions to transport CO2 from tissues, take oxygen from the lungs, maintain acid-base balance, and is a source of bilirubin in livestock. The presence of haemoglobin in the blood allows the ability to transport oxygen and the appearance of red colour in the blood (Frandsen (1993). The highest average blood haemoglobin obtained in this study was achieved by the treatment of the addition level of 50% C. odorata flour (RCO50: 18.92 g/dL), followed by treatment of 30% (RCO30: 13.43 g/dL) and the lowest by treatment with the addition of 40% C. odorata (RCO40:17.68 g/dL). Thus, the mean blood haemoglobin value of male Bali cattle produced (Table 2) varied between 17.68 g/dL to 18.92 g/dL with an average of 18.26 g/dL. The average blood haemoglobin level produced was still above normal levels. Coles (1980) reported that the normal range of blood haemoglobin levels in Bali cattle is 5.70 - 8.50 g/dL. Typically, the blood haemoglobin levels produced in this study are influenced by the consumption and digestibility of sufficient protein for the needs of the Bali cattle used.

The results of this study were higher when compared with that the results reported by Bira (2016) when Bali cattle offered C. odorata-based concentrates, which were between 18.26 g/dL vs 11.42 g/dL. Similarly, the results of this study were higher when compared with the results of Dewi et al. (2018) when weaned Bali cattle fed different proteins and energy (18.26 g/dL vs 10.78 g/dL). In addition, blood haemoglobin in this study was higher compared with the results of Windi et al., (2016) when Bali cattle offered concentrate containing corn cobs (18.26 mg/dL vs 13.56 g/dL). Furthermore, this study's results are still higher than Coles (1980) in cattle, namely (18.26 g/dL vs 7.10 g/dL). The difference in blood haemoglobin levels from this study with the research reports conducted by the researchers may be due to the feed factors used, the physiological status of the research livestock, and other environmental factors. There were no significant differences between treatments on (P>0.05) the blood haemoglobin concentration of Bali cattle. The same level of protein consumption and absorption of amino acids by Bali cattle probably caused this.

Effect of treatment on Blood Hematocrit

Hematocrit or packed cell volume (PCV) is the ratio between erythrocytes and blood plasma expressed in
Effect of treatment on Blood Erythrocyte

The primary function of erythrocytes is to transport haemoglobin and oxygen from the lungs to all body tissues. Cattle are considered anaemic if their erythrocyte count is below the usual range. Erythrocytes consist of 65% water and 33% Hb; the rest are fat stoma cells, minerals, vitamins, other organic materials, and K ions (Oematan et al., 2023). This result is due to inadequate nutrition, so that blood formation is not good (Utama et al., 2001).

The highest erythrocyte average data produced in this study was achieved by the treatment of the addition level of 40% C. odorata flour in a concentrate ration mixture (RCO50), namely 8.24 x 10^6/µL followed by a treatment level of addition of 30% flour. C. odorata in a concentrate ration mixture (RCO50) which is 8.14 x 10^6/µL and the lowest by treatment with the added level of C. odorata 50% in the concentrate ration mixture (RCO50), that is 7.06 x 10^6/µL. Thus, the mean value of male Bali cattle erythrocytes (Table 2) varied between 7.06 x 10^6/µL to 8.24 x 10^6/µL with an average of 7.81 x 10^6/µL.

The mean erythrocyte levels were 7.81 x 10^6/µL, still within the range of normal erythrocyte levels. According to Dharmawan (2002), Bali cattle's normal range of erythrocyte levels is between 5.0 - 10.0 x 10^6/µL. Typically the erythrocyte levels produced in this study are influenced by the consumption of food substances, especially amino acids, iron, minerals, and vitamins which are good enough for the needs of erythrocyte formation, and Bali cattle used in this study do not experience anaemia. The levels of livestock erythrocytes are known to be significantly impacted by the availability of appropriate feed components to suit livestock demands (Adam et al., 2015). Feeding nutrients such as amino acids, iron, Vitamins, and Cu are essential components affecting livestock's erythrocyte levels Putriningisih and Arjentinia, (2015) (Frandsen, 1993). Several vitamins and minerals play an essential role in the erythropoiesis process (Adam et al., 2015) and Dewi et al., (2018). Iron is required for heme synthesis. Copper...
in ceruloplasmin is needed to release iron from plasma tissue, while vitamin B6 acts as a cofactor in the enzymatic heme synthesis stage. Cobalt is needed in the synthesis of vitamin B12 in ruminants. The deficiency of vitamin B12 and folic acid can cause the failure of maturation in the maturation of red blood cells (erythropoiesis), which causes the total internal erythrocytes to be below. In addition to dietary factors such as amino acids, iron, vitamins, and Cu can affect erythrocyte levels, consumption of tannins over a long time can affect blood erythrocyte levels even though the content of tannins can function as antioxidants in the body (Delimont et al., 2017). However, the tannin content in the research did not affect the erythrocyte levels of the research livestock, so it did not interfere with livestock health in the form of anaemia.

The analysis of variance showed that the application of 30%, 40%, and 50% of C. odorata flour in the concentrate ration mixture had no significant effect (P>0.05) on the erythrocyte levels of Bali cattle. The same level of consumption and absorption of amino acids by Bali cattle probably caused the same erythrocyte concentration between feed treatments.

The average erythrocyte yield in this study, when compared with the results of Bira (2016) study by giving a concentrate made from silage made from white flower bush (C. odorata) to Bali cattle, the results were lower (7.06 x 10⁶ to 8.24 x 10⁶/µL) vs 10.70 x 10⁶ to 14.50 x 10⁶/ml). Meanwhile, when compared with the results of research by Dewi et al., (2018) on Bali cows weaning off using feed with different protein and energy content, the results are almost the same, namely (7.06 x 10⁶ to 8.24 x 10⁶/µL vs 10.70 x 10⁶ to 14.50 x 10⁶/µL) and when compared with the results of research conducted by Roland et al., (2014) on cattle, the results are relatively the same, namely (7.06 x 10⁶ to 8.24 x 10⁶/µL vs 4.90 x 10⁶ to 10.0 x 10⁶/µL). The difference in erythrocyte levels from this study with the research reports conducted by the researchers may be due to the feed factors used, the physiological status of the research livestock, and other environmental factors.

**Effect of treatment on Leukocyte**

Leukocytes can indicate deviation in organ function or infection of infectious agents and foreign bodies and support clinical diagnosis in animals (Frandsen, 1993). In general, total and differential leukocytes can provide an overview of and health status of animals (Sugiharto, 2016). Guyton and Hall (1997) stated that total leukocytes reflect the level of health influenced by several internal factors, including gender, age, disease, and hormones, as well as external factors, such as environmental conditions, livestock activity, stress, and feed. Furthermore, Isroli et al., (2009) state that to determine the level of immunity, it can be seen from blood variables in the form of leukocytes and a total differential of leukocytes.

The highest average leucocyte data produced in this study was achieved by the treatment of the level of adding 40% C. odorata flour in a concentrated mixture (RCO₄₀), namely 9.62 x 10³/µL. They are following adding 30% flour C. odorata in a concentrate ration (RCO₃₀), which is 8.84 x 10³/µL and the lowest by treatment with the addition of 50% C. odorata flour in a concentrate ration mixture (RCO₅₀), which is 8.56 x 10³/µL. Thus, the average leucocyte values of male Bali cattle produced (Table 2) varied between 8.56 x 10³/µL to 9.62 x 10³/µL with an average of 9.01 x 10³/µL.

The average level of leucocytes: 9.01 x 10³/µL, was still in the range of normal leucocyte levels. According to Dharmawan (2002) that the total average leucocyte value for Bali cattle is 4 x 10³/µL - 12 x 10³/µL, while according to Brooks et al., (2022), it is 5.1 - 13.3 x 10³/µL. Typically, the levels of leucocytes produced in this study were influenced by feed and healthy animal health during the study. However, it is known that C. odorata contains secondary metabolic compounds; the administration level of up to 50% has not been given a negative response to livestock health. The Bali cattle infected with dermatosis have high total leukocytes and monocytes compared to ordinary Bali cows (Nurani et al., 2017).

The analysis of variance showed that the level of C. odorata addition of 30%, 40% and 50% in the concentrate ration mixture had no significant effect (P>0.05) on the blood leucocyte levels of the research cattle. The same leukocyte concentration between feed treatments was more due to the composition and content of food substances used by the same Bali cattle. The function of leucocytes is to protect the body from pathogens using phagocytosis, producing antibodies and factors that determine the number of leucocytes, including biological activity, environmental conditions, age, and feed (Hartoyo et al., 2018).

The average leucocyte produced in this study, when compared with the results of the study by Pawitri et al., (2014) in Bali cattle, results were not much different, namely (9.01 x 10³/µL vs 8.3 x 10³/µL). Meanwhile, when compared with the results of research by Nurani et al., (2017), the results were higher, namely (9.01 x 10³/µL vs 6.98 x 10³/µL). The difference in leucocyte levels from this study with the results of research reports conducted by other researchers may be due to the feed used, the physiological status of the research livestock, and other environmental factors.

**Conclusion**

The results showed that the administration of C. odorata-based concentrate to Bali cattle with different
levels (30%, 40%, and 50%) had an effect on blood glucose but not on other blood variables. Therefore, *C. odorata* can be used in concentrates to increase the productivity of Bali cattle.

**Author Contributions**
Each author contributes in some way to the completion of this research activity. The main author provides basic ideas and provides research materials and the second, third, fourth authors design research methods and furthermore, all authors share responsibility for data collection, data tabulation and analysis, review process, and article writing.

**Funding**
This research received no external funding.

**Conflicts of Interest**
Regarding this study, the author declares that there is no conflict of interest.

**References**


