The optimization of ginger and Zinc in feed to preventing heat stress at tropical in local duck

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Abstract. This study aimed to determine the optimization ginger flour supplementation and zinc minerals in feed on the performance, carcass, abdominal fat and the weight of the physiological organs of local ducks that experience heat stress at tropical temperatures. This research method is an experimental with Randomized Block Design (RBD) 4 treatment with 5 groups of body weights as replications. Treatment in this study was A (feed + ginger flour 0% + zinc 0 ppm, as control), B (feed + ginger flour 1% + zinc 40 ppm), C (feed + ginger flour 3% + zinc 40 ppm), D (feed + ginger flour 5% + zinc 40 ppm). The results showed that supplementation of ginger flour and zinc minerals in the feed had a significant effect (P<0.05) on performance of body weight, conversion, percentage of carcass and abdominal fat, but had no significant effect (P>0.05) on the physiological weight of local ducks in heat stress at a temperature of 33-34°C. The results of this study concluded optimization of ginger flour and zinc mineral supplementation in the performance, carcass, abdominal fat and physiological organ weights in heat stress were obtained on feed by giving 3% ginger flour and 40 ppm zinc minerals.

1. Introduction
The development of local ducks in West Sumatra in low-lying areas or coastal areas that have high environmental temperatures, can cause stress to the ducks. Because the problems that usually occur in breeders in raising waterfowl such as ducks is that it is easy for animals to experience stress because ducks are warm-blooded animals (homeotherms) which always keep their body temperature normal. One of the causes of stress in ducks occurs because of the temperature of the environment. Environmental temperature can affect the physiology of ducks directly, that is by giving an influence on the functions of several organs such as the heart and respiratory organs. Thermo-neutral zone for poultry is between 18-25°C and for local ducks which are between 23-25°C [1].

Heat stress in livestock will affect the electrolyte balance and affect acid base in body fluids. Electrolyte balance of body fluids becomes disturbed, this condition can inhibit the growth of ducks, and will also affect physiological processes. Liver tissue is an organ that plays an important role in lipid and protein metabolism. The metabolism of biomolecules interacts, can support and inhibit each other. The ability to maintain body temperature in the normal range is an activity that greatly affects biochemical reactions and physiological processes closely related to chicken metabolism [2]. If poultry experiences heat stress the activity of digestive enzymes will decrease so that the secretion of digestive tract enzymes becomes low [3]. Heat stress conditions in poultry also have an influence on decreasing feed consumption, decreasing growth rates, feed efficiency, carcass quality and livestock.
immunity. Based on these problems, efforts need to be made to improve the performance of local ducks if maintained in areas that have high environmental temperatures, carried out by giving antioxidants. Antioxidants are needed to improve the function of enzymes damaged by free radicals during normal metabolic activities. Antioxidants convert free radicals into relatively stable compounds and stop the chain reactions that cause damage. Antioxidant compounds can naturally be found in several types of vegetables, fresh fruits and spices. One of them is ginger. Ginger is often used to increase appetite. This is because ginger can accelerate the work of the small intestine so that it can accelerate gastric emptying, thereby arising hunger and increasing appetite [4]. *Curcuma (Curcuma xanthorrhiza)* Roxb), including the Zingiberaceae family with parts used is the rhizome and is a plant native to Indonesia [5].

According to [6], the composition of curcuma rhizome can be divided into two fractions, namely dyestuff and essential oil. The yellow color in ginger is caused by the presence of curcuminoids. Curcuminoid fraction of curcuma rhizome consists of two types, namely curcumin and desmoteksikurkumin. In daily life, ginger is commonly used as an ingredient of herbs [herbal medicinal plants] to deal with heat pain, cough, stomach disease, high blood pressure, skin diseases and accelerate wound healing and is expected to overcome the effects that are not good at overcoming the heat temperature. Zinc minerals have also been proven to be used as an antidote to heat stress. Zinc minerals are needed for the growth, structure and function of enzymes and to maintain the immune system. In addition, it can also be used to overcome the adverse effects of high temperatures on quail laying [7]. According to [8] in his study that zinc was tried and the results showed that zinc levels of 40 ppm (mg / 1 kg of feed) could be used to deal with heat stress in broilers until the age of 6 weeks.

The results of the [9] stated that the administration of turmeric flour as much as 0.2-0.6% in feed had no significant effect (P>0.05) on carcass weight, percentage of carcass parts (chest and thigh) and carcass percentage. Then the results of a study conducted by [10] that the addition of ginger flour in feed as much as 1%, 2% and 3% and 40 ppm zinc minerals did not have a significant effect on physiological organs of liver, thyroid, kidney and spleen in broiler chickens that experienced heat stress. Giving temulawak has been done a lot, but giving ginger to deal with heat stress is still very rare, so the limited information about the use of ginger and zinc minerals on performance, carcass and physiological organs in heat stressed ducks.

2. Materials and methods

2.1 Experimental design

The research design was experimental in field. In the study used local male ducks original from the East Payakumbuh of Payakumbuh city. There were 54 ducks used age 5 week-old ducks selected from 66 ducks. Data was collection beginning the fifth week to the eighth week of the study, and Enclosure Equipment. The duck used in this study were male ducks (DOD) originating from District Kotobaru Payobasung, Payakumbuh, as many as 80 head.

2.2. Research methods and design

The research method was an experiment with a study design using Randomized Block Design (RBD) for 11 weeks with 4 treatments with 5 groups of body weights as replications. The treatment given in this study was A (feed + ginger flour 0% + zinc 0 ppm, as control), B (feed + ginger flour 1% + zinc 40 ppm), C (feed + ginger flour 3% + zinc 40 ppm), D (feed + ginger flour 5% + zinc 40 ppm). All data obtained were statistically, then analysis of variance obtained was significantly different (P<0.05) followed by further tests using the Duncan Multiple Range Test (DMRT) test based on [11]. The variables observed in this study were Performance (feed consumption body weight gain and feed conversion), Carcass percentage, Percentage of abdominal fat, Physiological organs (heart weight, liver weight, pancreatic weight and small intestinal thickness).
3. Results and discussion

3.1 The effect of treatment on feed consumption, body weight gain, conversion carcass percentage and abdominal fat

The effect of giving several levels of curcuma flour (Curcuma xanthorrhiza Roxb) and zinc minerals to feed consumption, body gain and conversion of Sikumbang janti duck feed which experienced heat stress in each treatment during the study can be seen in Table 1.

Table 1. Average feed consumption, bodyweight gain, conversion, carcass percentage, abdominal fat

| Parameter | Feed Consumption (g/head) | Body weight gain (g/head) | Conversion | Carcass Percentage | Abdominal Fat |
|-----------|---------------------------|---------------------------|------------|--------------------|---------------|
| A         | 6076.00.00                | 913.43<sup>a</sup>       | 8.17<sup>a</sup> | 53.10<sup>b</sup>  | 1.80<sup>a</sup> |
| B         | 7411.02.00                | 1123.70<sup>b</sup>      | 6.65<sup>a</sup> | 55.87<sup>ab</sup> | 1.64<sup>b</sup> |
| C         | 7551.02.00                | 1012.08<sup>ab</sup>     | 7.70<sup>a</sup> | 57.67<sup>a</sup>  | 1.52<sup>ab</sup> |
| D         | 6507.08.00                | 957.27<sup>ab</sup>      | 6.65<sup>b</sup> | 54.32<sup>b</sup>  | 1.40<sup>b</sup> |
| Average   | 6886.55.00                | 1001.63                   | 07.30<sup>ab</sup> | 55.24<sup>ab</sup> | 1.59<sup>ab</sup> |

Explained: ns = non significant (P>0.05) Significant result (P<0.05), to difference superscripts

The results of the variance analysis in Table 1 show that the giving of ginger flour and zinc minerals was not significantly different (P> 0.05) on the consumption of local duck feed, which experienced heat stress during the study.

According to [12] feed consumption is influenced by energy levels in feed. Because the research feed is the same energy content or iso-energy, the feed consumption of each treatment is not statistically different. Result of [13] stated that the use of turmeric and ginger as a feed supplement for broiler chickens did not significantly cause changes in broiler chicken feed consumption. Giving natural herbs or herbs to livestock can increase appetite [14-15]. According to [4] said that essential oils and curcuma have properties to stimulate bile production and facilitate the secretion of increased bile. In line with that, [16] also stated that feed containing herbal ingredients produced a fragrant aroma because curcuma contains an active substance, curcuma.

The average consumption of research the feed ranged from 4,883.2-4,885.9 g/head. The average consumption in this study was higher than of [16], which was 6,733.7-6,818.6 g/head because of the treatment using curcuma flour and zinc minerals, which causes a higher average consumption. Whereas in [17], the average consumption of local duck feed maintained for 10 weeks was higher compared to this study with an average of 8,139.8-7955.8 g/head, because it used vitamin E and C supplementation in feed. Result of [13] stated that the use of turmeric and ginger as a feed supplement for broiler chickens did not significantly cause changes in broiler chicken feed consumption. In this study, by giving curcuma flour up to 5% and 40 ppm zinc mineral in local ducks that experienced heat stress did not reduce the consumption of duck feed (P>0.05). Zinc is an inorganic element that cannot be converted from other nutrients, therefore absolute minerals and must be in the feed even though there is small amount. The results of the variance analysis in Table 1 show that the addition of ginger flour and zinc minerals showed a significantly different effect (P <0.05) on local duck body weight gain that experienced heat stress.

DMRT further test results showed that the average weight gain of the local duck body that experienced heat stress in treatment A was statistically the same as treatment B and C (P> 0.05), but was significantly higher (P <0.05) compared to treatment D The average weight gain of the local duck body ranged from 823.8-967.4 g/head/during the study. Statistically on treatment D with the administration of 5% ginger flour + 40 ppm zinc mineral has been able to increase the weight of local duck bodies that experience heat stress.

Addition of ginger to 5% and zinc mineral 40 ppm in this study can increase the weight of local duck bodies that experience heat stress. This is presumably because the content of curcuma and...
essential oils contained in curcuma can increase the absorption of food so that the duck body weight gain is markedly increased (P <0.05). Besides that, zinc minerals also function to regulate the speed of growth, where zinc minerals as a cofactor in enzyme thymidine kinase in the process of phosphorylation of dioxin-thymidine to combine with DNA in the synthesis process in addition to multiplication of cells. The cell replication process is needed for growth [18], which is as much as 40 to 70 ppm will not affect the levels of tibia ash, because the administration of calcium and phosphorus to form bone in feed is sufficient. And the zinc mineral content does not interact much because of the effects of stress caused by heat stress that ranges from 33-34.

The results of this study are lower than that of [16] who reported that duck body weight gain due to the addition of beluntas leaf flour (2-10 weeks) in feed with a level of up to 1% was not different from the control treatment. The average body weight gain obtained ranged from 1,126-1,214 g / head. The weight gain of duck bodies in this study was lower than that of [16] because it was caused by heat stress given up to 34°C.

3.2 The effect of treatment on carcass and abdominal fat percentage

The results of the research conducted, obtained an average percentage of local duck carcasses given ginger flour and zinc minerals during the study, can be seen in Table 1. In Table 1, the highest percentage of local duck carcass can be seen in treatment C with the addition of 3% of ginger flour in the feed resulting in a carcass percentage of 57.67% of the live weight. While the lowest average percentage of cyclic duck carcass, namely in treatment A without addition of curcuma flour, resulted in a carcass percentage of 53.10% of body weight. The percentage of carcass can be influenced by the weight of life produced, but it can also be affected by final weight.

Based on the results of the calculated diversity analysis showed that the supplementation of ginger flour and zinc minerals was significantly different (P<0.05) to the percentage of local duck carcass. This shows that the addition of ginger flour and zinc minerals is effective in overcoming heat stress in ducks so as to increase the percentage of the duck carcass. Antioxidants found in ginger can protect the body from attacks by free radicals caused by heat stress, and provide a good response to the duck's immune system.

Then the results in this study were lower compared to the research of [19] which stated that the average percentage of duck carcasses of 11-week-old males was 60.06%. This is because in this study the enclosure's high temperature was 33°C resulting in heat accumulation in the body that also resulted in a decrease in production produced. In addition, it was also caused by the carcass weight obtained in this study so that the percentage of the heart was low. This is in accordance with the opinion of [20] which states that the low percentage of carcass is also influenced by low cut weight, because the lower cutting weight the more wasted parts are. The results of the DMRT test it can also be seen that treatment B and C with the addition of 1% and 3% ginger flour in the feed can increase the percentage of local duck carcass, but in treatment D with 5% addition of ginger flour in feed there is a decrease in carcass percentage.

This indicates that the addition of excessive ginger flour will result in decreased palatability of feed, which will have an impact on the carcass weight produced. In addition, giving 5% of ginger in feed has higher asiri oil content. So, the addition of ginger flour by 3% in feed is good enough because it can show an increase in body weight gain followed by a low consumption level so that the percentage of carcass produced is maximal. Then the results in this study were lower compared to the research of [19] which stated that the average percentage of duck carcasses of 10-week-old males was 60.06%. This is because in this study the enclosure's high temperature was 33°C resulting in heat accumulation in the body which also resulted in a decrease in production produced. In addition, it is also caused by the carcass weight obtained in this study so that the resulting percentage was also low.

The analysis of diversity obtained, showed that the administration of ginger and zinc minerals at different levels were significantly different (P<0.05) to the percentage of local abdominal fat during the study. This shows that the addition of ginger and zinc minerals strengthens each other in reducing the percentage of abdominal fat in local ducks that experience heat stress. The average percentage of...
abdominal fat in Table 1, decreased the percentage of abdominal fat in each treatment, namely treatment A by 1.80%, treatment B by 1.64%, treatment C by 1.52% and treatment D by 1.40 %. It can be seen that the addition of ginger flour with a level, and 5% can reduce abdominal fat 1, 4. This reduction in the percentage of abdominal fat is related to the role of curcumoid and essential atsiri oils found in ginger. This is explained by [20] which states that curcuma on curcuma in the body will stimulate the gallbladder to actively expel bile which will help breakdown fat. Then, [4] added that essential oils and curcuma have the property of stimulating liver cells to increase production and facilitate the secretion of bile which functions to emulsify fat. This will reduce the solid particles found in the gallbladder so that the fat content decreases.

The results obtained in this study are lower than the results of [21] which say the average percentage of abdominal fat in Mojosari ducks, Tegal ducks and Mojosari Tegal cross ducks is 0.55-0.89%. This is because the type, nation, age of livestock used are different, and the feed given is different. In addition, in this study also has a high temperature of the enclosure environment, so that the use of energy to maintain more body temperature. Then zinc minerals can also function as antioxidants so they can reduce the impact of heat stress experienced by ducks. This is in accordance with [18] study that zinc minerals function as antioxidants, which are able to neutralize free radicals so that the planned process of cell death can be suppressed and zinc is needed in the metabolism of proteins, carbohydrates and fats. Zinc also plays a role in the immune system. This reduction in the percentage of abdominal fat is related to the role of curcumoid and essential oils found in ginger. This is explained by [20] which states that curcuma curcuma in the body will stimulate the gallbladder to actively expel bile which will help breakdown fat. Then, [4] added that essential oils and curcuma have the property of stimulating liver cells to increase production and facilitate the secretion of bile which functions to emulsify fat. This will reduce the solid particles found in the gallbladder so that the fat content decreases.

3.3. The effects of treatment on physiologis physiologies organ
data on the effect of supplementation of ginger flour in feed and zinc minerals in drinking water on the heart weight of local ducks experiencing heat stress during the study can be seen in Table 2. The average heart weight (mg/100g BW) obtained from diversity analysis showed that the addition of ginger flour and zinc minerals were not significantly (P>0.05) on the heart weight of local ducks experiencing heat stress. This shows that the addition of curcuma flour and zinc minerals has no effect on heart function which will cause enlargement of heart size. [22] which states that the heart weight of local ducks aged 8 weeks ranged 822.13-1132.28 mg / 100 g body weight. It can be seen in Table 2 that the study weight of the local duck tends to decrease from treatments A, B and C, then tends to increase in treatment D. This is due to treatment D giving 5% of ginger in feed can inhibit the working system of the heart organ in circulation blood so that it results in enlargement of the heart of the local duck. that the heart is very susceptible to toxins and anti-nutrients, enlargement of the heart can occur due to the accumulation of toxins in the heart muscle.

In addition, the high temperature of the enclosure, which increases the heart’s heart rate, causes it. Ducks are homeothermic animals, which according to [23] say that the homeothermal properties of poultry cause the amount of heat produced by muscle activity and tissue metabolism is proportional to the loss of heat due to the environment. In Table 3 it can also be seen that the highest average weight of the heart of the Sikumbang janti duck is in treatment A of 877.82 mg/100g body weight, then the lowest heart weight is in treatment C of 746.30 mg / 100 g body weight. This difference is caused by the resulting final body weight is low in each treatment so that it also affects the weight of the heart produced.
Data on the effect of adding curcuma flour in feed at different levels and zinc minerals in drinking water to the weights of local ducks experiencing heat stress can be seen in Table 2. The results of the diversity analysis showed that the addition of ginger flour and zinc minerals was not significantly different (P> 0.05) on the weight of local duck liver that experienced heat stress during the study. The different weight of local duck liver produced in this study is due to the use of ginger and zinc minerals which have no significant effect on the weight of duck liver, but only provide the effect of treatment and maintenance of the liver due to heat stress experienced by the duck. Factors that affect the size of the heart are when there are poisons and germs that enter through feed [24].

The average yield of local duck liver weight with the addition of ginger flour between 1-5% obtained results from the study 2536.62 -2.660.18 mg / 100 g body weight. Based on the results of analysis of variance, the results were not significantly different (P>0.05), meaning that the administration of ginger in feed up to 5% and mineral zing did not affect the weight of local duck liver. The results of this study are lower than the opinion of [25] which states that the percentage of normal weight of the liver in ducks ranges from 3.1-4.1% of body weight. This indicates that the addition of ginger flour does not interfere with liver function so that liver function continues to work optimally even though ducks are at high ambient temperatures.

In Table 2 it can be seen that the mean liver weight in treatment B, C and D tends to decrease liver weight from treatment A. This indicates that the decrease in duck weight is due to the addition of ginger flour in zinc feed and minerals in drinking water which can reduce the influence due to heat stress given to ducks. This is in accordance with the opinion of [26] that zinc minerals can prevent the occurrence of free radicals due to high temperatures so that the planned process of cell death can be pressed. Then it is also supported by the opinion of [27] stating that curcuma functions as an antioxidant, because antioxidants can protect cells from the harmful effects caused by free radicals that enter the body of poultry.

Data on the effect of ginger flour in feed and zinc minerals in drinking water on the weight of local duck pancreas, which experienced heat stress during the study, can be seen in Table 3. The results of the diversity analysis, it was shown that the addition of curcuma flour in different levels of feed and zinc minerals in drinking water was not significantly (P>0.05) on the weight of the local duck pancreas produced at the end of the study. This shows that the addition of ginger flour and zinc minerals does not have an effect on the weight of duck pancreas that has heat stress so it does not interfere with the activity of the duck pancreatic organs. The results of the effect of giving curcuma flour in zinc feed and minerals in drinking water to the thickness of the small intestine of local ducks maintained at a high temperature of the cage during the study can be seen in Table 3.

Based on the results of the diversity analysis, it was shown that the addition of curcuma flour in diets with different levels and zinc minerals in drinking water was not significantly different (P> 0.05) to the thickness of the local intestine small intestine that experienced heat stress during the study. This indicates that the addition of ginger and zinc minerals did not affect the thickness of the small intestine of local ducks that experienced heat stress during the study. Not influential addition of ginger flour

| Treatment | Heart (mg/100 g BW) | Liver (mg/100 g BW) | Pancreas (mg/100 g BW) | Thick of intestine (mg/100 g BW) |
|-----------|---------------------|---------------------|------------------------|-------------------------------|
| A         | 877.82              | 2660.18             | 319.17                 | 0.192                         |
| B         | 750.78              | 2569.55             | 309.13                 | 0.180                         |
| C         | 746.30              | 2536.62             | 303.18                 | 0.173                         |
| D         | 819.72              | 2604.70             | 318.10                 | 0.201                         |
| Average   | 798.65              | 2592.76             | 312.39                 | 0.187                         |

Explained: ns = non significant (P>0.05)
and zinc minerals due to the digestive process in the small intestine does not cause interference causing the function of the small intestine to produce digestive enzymes running normally.

Most digestion and absorption of nutrients occur in the small intestine. The digestive process aided by the intestinal glands that produce mucin serves as a lubricant and the enzyme sucrose breaks down sucrose into glucose and fructose, maltase breaks down maltose into two glucose, eripsin breaks down the intermediate form of protein into amino acids. In the opinion of [3] states that when birds experience heat stress the activity of digestive enzymes will decrease so that the secretion of the digestive tract becomes low. So giving ginger flour and zinc minerals can work together to overcome the adverse effects caused by heat stress, so that the enzymes produced by the small intestine can work optimally. Thus nutrition digestion that includes carbohydrates, fats, proteins and vitamins can be solved by poultry and directly absorbed into the body. This is because ginger can speed up the work of the small intestine so that it can accelerate gastric emptying, thereby arising hunger and increasing appetite [4].

Based on the results of the analysis, it was found that the thickness of the small intestine ranged from 0.17 to 0.20 g / cm. The results of this study were lower than [28] who stated that the addition of several levels kiambang of the thickness of the local intestine ranged from 0.22-0.29 g / cm. The low yield in this study is because in this study ducks experienced heat stress, thus inhibiting the action of enzymes found in the small intestine. In addition, the type of feed provided is also different. According to [29] that the crude fibre content in feed affects the performance and proliferation of the intestine, has an impact on weight, intestinal length, and increased feed efficiency.

4. Conclusions
The results of research that have been done can be concluded that the addition of ginger flour in feed to 5% and 40 ppm zinc mineral in drinking water significantly affected body weight gain and feed conversion, carcass and abdominal fat percentage, but did not have a significant effect on duck yield in this study

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