

Physiological Response and Physical Quality of Cihateup Duck Meat Given Natural Isotonic in Dry Maintenance System

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ABSTRACT

This study aims to determine the effect of giving natural isotonic and determine which level is the most optimal for the physiological response and physical quality of Cihateup Duck meat. This study used an in vivo experimental method and a completely randomized design (CRD) with a treatment consisting of 4 treatments and 5 replications. The remedies in this study were the addition of celery extract as much as 25 mg, 50 mg and 75 mg, as well as lime juice as much as 2%, 3%, and 4%. The results based on analysis of variance showed that the treatment had a significant effect on the pH value of the meat ($P < 0.05$), but did not affect heart rate, rectal temperature, and cooking loss ($P > 0.05$). The addition of 25mg celery extract and 2% lime juice is the optimal level.

Key words: celery, Cihateup duck, meat, physiological response, lime

INTRODUCTION

The duck rearing system in Indonesia is categorized in three ways: traditional, semi-intensive, and intensive. In the conventional maintenance method, ducks do not apply technology; ducks are left to roam the rice fields to look for food (Suharno, 2012), while the maintenance system is semi-intensive by combining traditional and intensive methods, namely half a day the ducks are grazed at close range and at night. They returned to the cage. An intensive rearing system where ducks need to be caged 100% requires land for water which requires a large area of land. So the maintenance is chosen with a dry system or raising ducks without water. From the results of research conducted by the Livestock Research Agency (Balitnak, 2011) in Ciawi, Bogor, in intensive duck rearing, the average duck production potential reaches 60% or around 220 eggs/year in the nutritional component of the diet consisting of 15-17% crude protein, metabolic energy is 2,900 kcal/kg, and calcium and phosphorus are about 1.3%. Intensive maintenance of dry ducks or without a pool of water to wet their bodies is one of the main reasons ducks have difficulty regulating their body temperature. The body temperature of ducks comes not only from the environment, but also from the heat of the body's metabolism which can lead to stress in ducks (Maulidina, 2016).

Based on the above conditions to anticipate the impact of stress experienced by

Cihateup Ducks on the dry rearing system, an effort is needed, namely by giving natural isotonic as an anti-stress. Giving natural isotonic to ducks is not commonly used because usually breeders still use chemicals as anti-stress, this encourages this research to be developed so that it can be used as a comparison or as an alternative to chemical isotonics. The natural isotonic to be used is made from celery extract and lime juice which contain high vitamin C. Vitamin C is known to be very effective in dealing with stress, especially stress caused by environmental heat. This is based on the evidence that the administration of vitamin C as an antistress is often done to cope with high-temperature environmental conditions. Vitamin C plays a role in the metabolic process of providing energy during stress or in the process of gluconeogenesis. The mechanism is by converting protein and fat into energy for productivity in the process of white blood cell synthesis, especially macrophage and neutrophil cells that play a role in the synthesis of body defenses. The physiological response conditions (heart rate and rectal temperature) of Cihateup duck in a dry rearing system must be considered because it can affect the meat's growth and physical quality, including the meat's pH and cooking loss of Cihateup duck.

MATERIALS AND METHODS

The research method used is the In Vivo experimental method. The livestock used in this

study were 60 unsexed Cihateup Ducks aged one day/DOD divided into four treatments and five replications, and each experimental unit consisted of 3 ducks. The experimental design used was a completely randomized design (CRD). Natural isotonic administration uses the following formulation:

T0 = Water (control)

T1 = Water + 7% sugar + 2% lime juice + celery extract 25 mg + salt 0.8 gr

T2 = Water + 7% sugar + 3% lime juice + celery extract 50 mg + salt 0.9 gr

T3 = Water + 7% sugar + 4% lime juice + celery extract 75 mg + salt 1 g

The test results are isotonic solutions containing 600-800 ppm sodium minerals and 700-1000 ppm potassium, polyphenol compounds, and several secondary metabolites such as tannins, saponins and flavonoids in small amounts (Based on mineral and phytochemical characterization tests of the Central Laboratory of Padjadjaran University, 2020). Ducks were kept in cages with a size of P=75 cm; L=75cm; T=75 cm in 20 plots with a capacity of 3 birds, fed with 20% crude protein and 2900 kcal/kg metabolic energy for eight weeks. The feed components consisted of corn, bran, pollard, meat and bone meal, soybean meal, oil, calcium phosphate, calcium carbonate, sodium chloride, amino acids, vitamins, minerals, and antioxidants. The nutrient content of the feed is shown in Table 1.

Table 1. Nutrient content of quail feed

Nutrient Components	Percentage (%)
Water content	12
Crude protein	20
Crude fat	7
Coarse fiber	14
Calcium	3.2
Phosphor	1.0

Source: PT. Sinta Prima Feedmill

Natural isotonic administration is given through drinking water. The parameters observed

were physiological responses, namely heart rate, and rectal temperature, while the meat quality observed was meat pH and cooking loss.

RESULTS AND DISCUSSION

Heart rate is a physiological indicator and one way to find out whether ducks are stressed or not. The average value of the heart rate of Cihateup ducks, which were treated with natural isotonic with different contents during the study, is listed in Table 2.

The analysis of variance in administering natural isotonic to experimental ducks showed that the average treatment of T0, T1, T2, and T3 had no significant effect ($P>0.05$) on heart rate. The average heart rate from the study's results at a cage environment temperature of 30°C was 254.3 – 268.6 times per minute; this condition was still in the normal range. Mushawwir (2011) reported the results of his research that the heart rate of grower poultry at an ambient temperature of 29°C was 233 per minute in the layer phase and 256 per minute, while the results from the research of Putra et al. (2016) stated that the heart rate of poultry at a temperature of 31°C is 294.08 – 305.56 times per minute which is still fairly normal. The difference from these studies shows that environmental temperature can affect the heart rate in poultry, the higher the ambient temperature, the higher the heart rate. Conditions in the cage showed that the temperature was still within the normal range, so the experimental ducks' heart rate did not differ even though they had been given isotonic drinks.

Body temperature as a physiological indicator is relatively easy to obtain by measuring rectal basal body temperature. Rectal temperature is used to measure body temperature because rectal temperature is optimal. An increase in rectal temperature is an indicator of stress in experimental ducks. The average rectal temperature of experimental ducks fed natural isotonic drinks with different intensities during the study period can be seen in Table 2.

Table 2. Average physiological response

Treatment**	T0	T1	T2	T3
Frequency Heart rate	259.6 ± 1 7.7	268.8 ± 1 9.4	254.3 ± 30.6	268.2 ± 26.4
Rectal Temperature (°C)	41.38 ± 0.62	40.84 ± 0.46	41.23 ± 0.31	41.29 ± 0.57

Description: **T0 : (Control) ; T1 (2% SJN + 25mg ES + 0.8g GRM) ; T2 (3% SJN +50mg ES + 0.9g GRM) ; T3 (4% SJN + 75mg ES + 1g GRM).

Based on the analysis of variance giving natural isotonic to Cihateup ducks, there was no significant effect ($P > 0.05$) on rectal temperature. The rectal temperature of the experimental ducks during this study was still in the normal range between 40.84°C to 41.38°C at an average ambient temperature of 30°C . In line with the research of Yuwanta (2008) that the normal rectal temperature of ducks is between $40-41^{\circ}\text{C}$, the results of the research of Sundari et al. (2015) stated that the normal rectal temperature of ducks is between $40.5-41.2^{\circ}\text{C}$. The normal rectal temperature in the Cihateup Ducks was caused by the condition of the cage that provided comfort for the Cihateup Ducks, the presence of adequate air ventilation so that the air circulation in the experimental cage was by the needs of the experimental ducks even with intensive maintenance methods, this is by the statement of Dewanti et al. (2014) Normal rectal temperature in ducks is caused by air circulation even in

intensive care. The goal is to provide comfortable conditions for the ducks even though the temperature of the cage increases so that the duck's body temperature remains within the normal range. Air ventilation used in duck rearing is an important component. Air vents function to circulate fresh air from outside into the cage and to remove carbon dioxide and ammonia gas from the inside out of the cage.

Ducks are homeothermic animals that can adjust their body temperature. The hypothalamus is the most important organ in the duck's body as the center of body temperature regulation. The hypothalamus is an integrated center for controlling body temperature and heart rate; environmental conditions influence rectal temperature. Sulistyoningsih (2004) stated that the homeothermic nature of ducks causes the amount of heat generated by muscle activity and tissue metabolism. Directly proportional to the heat loss caused by the environment.

Table 3. Average physical quality of meat

Treatment**	T0	T1	T2	T3
meat pH*	5.92 ± 0.94^a	7.3 ± 0.55^b	5.98 ± 0.14^a	6.42 ± 0.29^a
Cooking Loss (%)	23.2 ± 5.16	23.6 ± 4.27	21.2 ± 6.14	25 ± 7.07

Notes: * a, b, c : The mean of the same row with superscripts is significantly different ($P < 0.05$) according to the LSD (Least Significant Different) test.

**T0: (Control); T1 (2% SJN + 25mg ES + 0.8g GRM) ; T2 (3% SJN +50mg ES + 0.9g GRM) ; T3 (4% SJN + 75mg ES + 1g GRM).

Giving natural isotonic to the Cihateup Duck significantly ($P < 0.05$) on the pH of the meat. In treatment T0 has a pH value of 5.92, treatment T1 has a pH value of 7.3, treatment T2 has a pH value of 5.98, and treatment T3 has a pH value of 6.42. The average pH value of duck meat from the four treatments ranged from 5.92 to 7.3. The results of this study were still declared normal. The pH range of duck meat is around 5-7, while the results of previous studies revealed that duck meat soaked in various concentrations of turmeric extract had a normal pH value of 5.10 to 6.10 (Sari et al., 2015).

Giving natural isotonic treatment T1 with the addition of 25 mg celery extract and 2% lime juice was the best treatment for the pH value of Cihateup Duck meat compared to T2 (celery extract 50 mg and lime juice 3%) and T3 (celery extract 75 mg and lime juice 4%). Natural isotonic in T1 treatment with a pH value of 7.3 is influenced by isotonic. Isotonic with minerals and vitamins as electrolytes is useful for channeling nerve impulses and contracting muscles. It allows the occurrence of chemical

processes in the body to help the level of acid-base degrees of the fluids in the body to decrease the condition of dehydration. However, if isotonic is consumed in high quantities, it can have side effects such as impaired absorption of minerals such as iron, zinc and copper. This condition can poison the body, trigger loss of appetite, weak muscles and can cause death (Syafriani, 2012). The decrease in the pH value of the meat from treatment T1 to T2 and T3 was due to the addition of too much lime juice, this is by the statement above. Ermawati et al., (2014) suggested that the more concentration of lime added, the lower the pH value.

Oxidative stress conditions lead to anaerobic glycolysis process. The glycogen will be converted into lactic acid to produce energy to be used quickly. This process will continue until the muscle glycogen stores are depleted or the pH is low enough to stop glycolytic enzyme activity. Dewi (2012) stated that there are many glycogen reserves, so lactic acid is produced from the anaerobic glycolysis process. Lactic acid in meat greatly affects the pH value of meat,

where meat with high lactic acid has a low pH. This is by the opinion of Nugraha (2019), the degree of acidity of meat is strongly influenced by glycogen levels and lactic acid levels in the muscles. If the glycogen content is high, the lactic acid level is also high, so the final pH of the meat will be low.

Based on the analysis of variance giving natural isotonic to experimental ducks, there was no significant effect ($P > 0.05$) on cooking loss. In treatment T0 had a cooking loss of 23.2%, treatment T1 had a cooking loss of 23.6%, treatment T2 had a cooking loss of 21.2% and treatment T3 had a cooking loss of 25%. The average cooking loss of the four treatment samples was between 21.2% to 25%, the results of this study still stated that the cooking loss was normal. It is by Soeparno's (2005) statement that cooking loss generally varies between 1.5% - 45.5%. The results from Rohim et al. (2016) research ranged between 27% and 31%.

One of the cooking loss factors is the length of meat storage; the meat samples to be tested for cooking shrinkage are stored for 5 days after cutting in the freezer at -2°C . Research conducted by Prayitno et al. (2020) stated that what affects cooking loss is the conditions that occur during the post-mortem. A treatment during storage, namely the immersion treatment, can affect the cooking loss condition. The frequency of soaking time affects the protein chain of the meat. The protein chain of the meat will become simpler due to the soaking process, affecting the cooking loss of the meat. In addition, the factors that affect the cooking loss of meat include the amount of meat protein, storage time and cooking temperature. The amount of lactic acid that accumulates under stress conditions will damage myofibril proteins, followed by a loss of protein's ability to bind water, thus affecting the cooking loss of meat. The amount of lactic acid that accumulates during the postmortem glycolysis process is also influenced by the rate of glycolysis and the type of muscle. Septinova et al. (2018) stated that the energy metabolism process that occurs in the pectoral muscle of poultry is anaerobic metabolism so that the amount of glycogen in the chest muscle is more than that of the thigh meat. According to Berri et al. (2005), the process of glycolysis is increased if animals use these muscles for faster movement. Research on chickens shows that chest muscles are used to support the speed of movement, so that there is more glycogen in the chest muscles. In this

study, the ducks were treated while still alive under maintenance. So that the effect of the treatment does not appear on the cooking loss parameters.

The cooking loss of meat is related to the pH value of the meat. The results of Kartikasari et al. (2018) show the relationship between the pH value of meat and cooking loss. When the pH value does not have a significant effect, the cooking loss condition also has no significant effect. A high pH value will result in a low cooking loss, so the possibility of nutrients in the meat being lost during cooking also decreases. Cooking loss is influenced by the pH value followed by the ability of the meat to bind water. A study comparing the relationship between meat pH and water holding capacity in the breast and thigh of poultry showed that thigh meat's pH and water holding capacity were higher. The pH of the meat in this study was influenced by the use of isotonic at the T1 treatment level, namely the pH value of the meat was close to normal. So that at this level, the lowest cooking loss should also be produced by T1. However, the cooking loss did not show a significant difference. Septinova et al. (2018) examined meat soaked in a solution of bay leaves that did not affect cooking loss conditions due to differences in the parts of the meat used.

CONCLUSION

Natural isotonic containing celery extract (*Apium graveolens*) and lime juice (*Citrus aurantiifolia*) can affect the pH of meat but do not affect heart rate, rectal temperature and cooking loss. Natural isotonic with plain water, 7% sugar, 2% lime juice, 25 mg celery extract, and 0.8 g salt is the most optimal dose influencing meat quality, especially in the pH parameter of Cihateup Duck meat.

REFERENCES

- Berri, C.I., M. Debut, V. Santé-Lhoutellier, C. Arnould, B. Boutten, N. Sellier, E. Baéza, N. Jehl, Y. Jégo, M.J. Duclos, and E. Le Bihan-Duval. 2005. Variations in chicken breast meat quality: implications of struggle and muscle glycogen content at death. *British Poultry Science* 46 (5): 572—579.
- Departemen Pertanian. 2011. Kelebihan dan Kekurangan Kandang Tradisional dan Intensif. Departemen Pertanian. Jakarta

- Dewanti, A. C., P. E. Santoso dan K. Nova. 2014. Pengaruh Berbagai Jenis Bahan Litter terhadap Respon Fisiologis Broiler Fase Finisher di Closed House. Universitas Lampung. Bandar Lampung.
- Dewi, S. H. C. 2012. Korelasi Antara Kadar Glikogen, Asam Laktat, pH Daging dan Susut Masak Daging Domba Setelah Pengangkutan. *Jurnal Agrisains* 4 (5): 59-70. Universitas Mercu Buana Yogyakarta. Yogyakarta.
- Ermawati, D., M. A. M. Andriani dan R. Utami. 2014. Pengaruh Ekstrak Jeruk Nipis (*Citrus Aurantifolia*) terhadap Residu Nitrit Daging Curing Selama Proses Curing. Jurusan Teknologi Hasil Pertanian. Universitas Sebelas Maret. Jawa Tengah.
- Kartikasari, L. R., B.S. Hertanto, I. Santoso, dan A. M. Patriadi Nuhriawangsa. 2018. Kualitas fisik daging ayam broiler yang diberi pakan berbasis jagung dan kedelai dengan suplementasi tepung purslane (*Portulaca oleracea*). *Jurnal Teknologi Pangan* 12 (2): 64-71.
- Lawrie, R.A. 2003. Ilmu Daging. Edisi ke-5. Terjemahan: A. Parakkasi. Penerbit Universitas Indonesia, Jakarta.
- Mushawwir. A. dan D. Latipudin. 2012. Respon Fisiologi Thermoregulasi Ayam Ras Petelur Fase Grower dan Layer. *Proceeding of National Seminar on Zootechniques of Indigenous Resources Development*, Semarang.
- Nugraha, I. P. dan D. A. Kusuma. 2019. Efek Pemberian Isotonic Water dan Air Kelapa terhadap Kadar Asam Laktat dalam Darah setelah Melakukan Aktivitas dengan Intensitas Tinggi. *Jurnal Prestasi Olahraga* 2(3).
- Putra, A, S. R. Sutrisna, dan E.S. Purnama. 2016. Kondisi Fisiologis Itik Mojosari Betina Yang Diberi Ransum Berbeda. *Jurnal Ilmiah Peternakan Terpadu* 4(2): 108-114.
- Prayitno, S. S., J. Sumarmono, dan A.H.D.Rahardjo. 2020. Pengaruh lama perendaman daging itik afkir pada ekstrak kulit buah carica (*Carica candamarcensis*) terhadap keempukan dan susut masak daging. *Jurnal Peternakan Nusantara* 6 (1): 15-20.
- Rohim M. N., V. P. Bintoro dan I. Estiningdriati. 2016. Uji (Warna, Tekstur Dan Susut Masak) Daging dari Ayam Pedaging Lohman yang Diberi Tepung Daun Kayambang (*Salvinia molesta*) sebagai Campuran Pakan. *Jurnal Pengembangan Penyuluhan Pertanian* 13 (23): 1-6.
- Sari M. L., F. N. L. Lubis dan K. Dewi. 2015. Pengaruh Pemberian Probiotik dan Tepung Kunyit (*Curcuma domestica* Val.) dalam Ransum terhadap pH, Warna, dan Aroma Daging Itik Pegagan. *Jurnal Peternakan Sriwijaya* 4 (1): 47-53.
- Septinova, D., M. Hartono, P. E. Santosa, P. E., dan S.H. Sari, S. H. 2018. Kualitas Fisik Daging Dada dan Paha Broiler yang Direndam dalam Larutan Daun Salam (*Syzygium polyanthum*). *Jurnal Ilmiah Peternakan Terpadu* 6 (1): 83-88.
- Soeparno. 1992. Daging Dada Otot Pectoralis Superficialis Sebagai Standar Penilaian Kualitas Daging. Laporan Penelitian No: UGM/ 5887/M/09/01.
- Suharno, B. dan T. Setiawan. 2012. Beternak Itik Petelur di Kandang Baterai. Penebar Swadaya. Jakarta.
- Sulistyoningsih, M. 2004. Respon Fisiologis dan Tingkah Laku Ayam Broiler Starter Akibat Cekaman Temperatur dan Awal Pemberian Pakan yang Berbeda. Tesis. Magister Ilmu Ternak Program Pasca Sarjana Universitas Diponegoro. Semarang.
- Sundari, R. S, Erwanto dan P. E. Santosa. 2015. Respon Fisiologis Ayam Jantan Tipe Medium yang Diberi Ransum dengan Kadar Serat Kasar Berbeda. *Jurnal Ilmiah Peternakan Terpadu*. Universitas Lampung. Bandar Lampung.
- Syafriani, R. 2012. The Effect of Coconut Water (*Cocos nucifera* L) and An Isotonic Drink on The Change of Heart Rats Induced Hypertension. Institute of Technology School of Pharmacy.
- Yuwanta T. 2000. Dasar Ternak Unggas. Kanisius. Yogyakarta.