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Nutrient Digestibility and Apparent Metabolizable Energy of Broiler Chick which Nucleotide Supplemented at Different Environmental Temperatures

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ABSTRACT

This study examined the effect of nucleotide supplementation in broiler feeds reared at different environmental temperatures on nutrient digestibility and apparent metabolizable energy. This research used 135 unsexed broilers at 15 days old with an average body weight of 462.20 ± 9 g and nucleotide supplement. This research used a completely randomized design (CRD) in a factorial pattern of 3 X 3 with five replications. The treatments given were nucleotide levels, N0 (0 g/kg feed), N1 (0.5 g/kg feed), N2 (1 g/kg feed), and environmental temperatures, S1 (heat 32±1°C), S2 (comfortable 23±1°C) and S3 (natural 24-34°C). The parameters measured were nutrient consumption, fat digestibility, protein digestibility, and apparent metabolizable energy. Data were analyzed by analysis of variance (ANOVA) with the F test at 5% and continued with Duncan's Multiple Range test. The results showed no interaction (P>0.05) between nucleotide levels with different environmental temperatures on nutrient consumption, fat digestibility, protein digestibility, energy consumption, and apparent metabolizable energy. Heat temperature decreased (P<0.05), as it was in fat, protein, and energy consumption. Supplementation of nucleotide 1 g / kg decreased (P<0.05) protein digestibility, energy consumption, and apparent metabolizable energy. It was concluded that supplementing 1g / kg of nucleotide increased broilers' protein efficiency and energy use.

Keywords: broiler, nucleotide, environment, nutrients, energy

INTRODUCTION

A broiler chicken is a genetically superior chicken with a character of genetics and a rapid growth rate. Superior character genetics broilers need to be supported with gift rations quality, appropriate with suitable nutrition and environment for growth. Optimal environment temperature for broiler chickens in the starter phase, namely 26.3-27.1°C, and in the finisher phase, i.e., 22.5-23.2°C (Cassuce et al., 2013). Problems maintenance broiler chickens in Indonesia which still many use system open houses (cage open), are faced with the condition climate tropics that have temperature and humidity tall, i.e., 24 - 34°C and 60 - 90%. The temperature environment tropical reaches more than 34°C during the day could cause the boiler cock to be exposed to hot stress. Stress-hot impacts negatively on the performance of broiler chickens, the decline in feed consumption, body weight low, and the efficiency of feed Become lower (Sohal et al., 2012).

Stressed chicken does not synthesize enough nucleotides in the body, so broiler chickens need nucleotides in rations broilers. Nucleotides consist of base purine or pyrimidine, pentose sugar (ribose or deoxyribose), and one or more group phosphate. Nucleotides Become essential nutrients for cattle under stress to maintain physiological function (Hess and Greenberg, 2012). Need nucleotides increase moment caught stress hot, lack nutrition, injury, and in the circumstances attacked disease (Jung and Cancel, 2012). on condition stress, synthesis nucleotides through lane de novo and salvage pathway not yet could Fulfill need nucleotides broilers so that need has done addition nucleotides from an outside body.

Nucleotides could play a role in the proliferative process of damaged cells resulting from stress in hot broiler chickens and fixing intestinal morphology. Nucleotides could Upgrade growth bacteria sour gram-positive lactate in the small intestine. Enhancement *Bifidobacterium* and *Lactobacillus* help digestion feed, lowering the small intestine's pH and hindering the growth of bacteria pathogens (Dharma et al., 2014). Giving nucleotides Upgrade tall intestinal villi and compare tall intestinal villi with depth crypt present in the intestinal mucosa (Jung and Batal, 2012). The intestinal mucosa helps digestion and absorption of nutrients so that chickens can take advantage of nutrients faster for growth. Nutrients that can be absorbed with good in the small intestine could use broiler chickens for production to get good performance.

Research this aim to study the influence of gift nucleotides in rations broiler chickens on rearing with different condition environments to digestibility nutrients (fat and protein) and pseudo

metabolic energy. The benefit of studying this is giving information about the role of gift nucleotides in rations broiler chickens on rearing with conditions in different environments to the digestibility of nutrients and pseudo metabolic energy. The hypothesis study is that adding nucleotides at different temperature environments could positively influence the digestibility of nutrients and pseudo metabolic energy in broiler chickens.

MATERIALS AND METHODS

Material study this using 135 CP 707 broiler chickens Ross strain 15 days old with body weight 462 .20 ± 9 g (CV 3.95%), B-11 commercial starter feed for chicken 1-14 days old, treatment basal ration for age 15-35 days (Table 1.) and Supplements Nucleotides Bionutrient ® which is produced by CBH Co. Ltd., China. Supplement the contain adenosine, guanosine, uracil, and cytidine 5'-monophosphate (5'-AMP, 5'-GMP, 5'-UDP, and 5'-CDP). Equipment used in the study this cage partition with a temperature environment that is hot, comfortable, and natural; a lights bulb as a heater in the cage to condition heat, a battery enclosure for total collection, air conditioner (AC) is more relaxed in the cage condition comfortable, fan wind suck for circulation air in the cage condition hot and comfortable, fan wind for circulation air in the cage condition natural, place feed and drink, digital scales for weighing chicken and leftovers feed and place shelter excreta for accommodate excreta on the total collection.

This research design uses a completely randomized design (CRD) pattern factorial 3×3 with five replications so that there are 45 units of an experiment. Factor first is the nucleotide level, N0 (nucleotides 0 g/kg ration), N1 (nucleotide 0.5 g / kg ration), and N2 (1 g / kg ration). The second factor is environmental temperature, S1 (hot temperature of 32±1ºC), S2 (comfortable temperature of 23 ±1 ºC), and S3 (experience temperature of 24-34°C).

Table 1. Composition and content nutrients research basal ration broilers

Ingredient Feed	Composition (%)
Corn Grind	62.00
Oilcake Soya bean	26.50
Bran Paddy	4.00
Meat Bone Meal (MBM)	3.66
Oil Coconut palm	3.00
Premixes	0.30
Limestone Rough	0.25
NaCl	0.20
DL-Methionine	0.09
Total	**100.00**
Analysis Nutrients	
Crude protein (%)	18.90
EM (kcal / kg)	3,145.50
Ca (%)	0.76
P (%)	0.32
Methionine (%)	0.38
Lysine (%)	0.98

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The study procedure consists of preparation, maintenance, and data collection. The stage of preparation covers preparation enclosure and manufacturer rations treatment. Stage of maintenance covers maintenance of chicken up at 14 days old, then weighed for given rations treatment at 15-35 days old. Data collection of fat, protein, and energy digestibility metabolic pseudo implemented with total collection method. Total collection implemented with Fe_2O_3 indicator as much as 0.5 % added into rations treatment. Sample excreta was then dried and analyzed content nutrition in the laboratory Knowledge Nutrition and Feed Faculty Animal Husbandry and Agriculture Diponegoro University, Semarang. The parameters observed in the study were:

1. Fat consumption is calculated with the formula (Wahju, 1997), namely:
consumption = crude fat content ration × consumption ingredient dry rations

2. Fat digestibility was calculated with the formula (Wahju, 1997), namely:

$$\text{Fat Digestibility} = \frac{\text{Ingested ration fat - Excreted fat}}{\text{Consumed ration fat}} \text{ x } 100\ \%$$

Description:
Ration fat consumed = crude fat content ration × consumption ingredient dry rations

Excreta fat = crude fat content excreta × substance dry excreta

3. Protein consumption is calculated with the formula (Wahju, 1997), namely:
   Consumption = ration protein content × consumption ingredient dry rations

4. Crude Protein (CP) Digestibility was calculated with the formula (Wahju, 1997), namely:

$$\text{CP Digestibility} = \frac{\text{Protein consumption - CP excreta corrected}}{\text{Protein consumption}} \times 100\ \%$$

Description:
Protein consumption = ration CP content × consumption ingredient dry rations
Protein excreta = amount excreta × CP excreta
Urine protein = 30% × excreta protein (Muller, 1982)
Excreta CP corrected = CP excreta – CP urine

5. Consumption energy is counted with a formula (Juliati et al., 2016), namely:

Consumption energy = rate energy rations (kcal/kg) × consumption of ration Dry matter

6. Pseudo metabolic energy counted with formula (Scott et al., 1982), namely:

$$\text{EMS} = \frac{\text{GE intake - GE ekskreta}}{\text{Intake}} \times 100\ \%$$

Information:
EMS = Pseudo Metabolic Energy (kcal /kg)
GE intake = Gross Energy of feed in Consumption (kcal/kg)
GE excreta = Gross Energy in excreta (kcal/kg)
intakes = feed consumption

The data obtained in the analysis with use analysis variety with the F test at the level of 5% (Steel and Torrie, 1991). Suppose there is influence treatment, so next with Duncan's test.

RESULTS AND DISCUSSION

Fat Digestibility

Average fat consumption and digestibility can be seen in Table 2. based on the results, the calculation of analysis of variance show nucleotide addition level, as well as the interaction between ambient temperature and the level of nucleotide addition, had no significant effect (P> 0.05) on fat Consumption and digestibility. However, the environmental temperature factor had a significant effect (P <0.05) on fat consumption, with no influential real (P > 0.05) against fat digestibility.

Hot environment temperature will lower fat consumption. Research data from Salah et al. (2019) shows an increase in maintained broiler body weight with hot temperatures is lower compared to natural temperatures. Decline performance for broiler chickens caused by a decrease in the following ratio lower fat consumption. Environment hot cause stress hot, so lower performance broilers. Goo et al. (2019) stated that stress hot resulted in a decline in consumption ration, efficiency rations, and weight

Table 2. Average fat consumption and fat digestibility

Treatment		Parameter	
		Fat consumption (g/head/d)	Digestibility of Fat (%)
S1	N0	5.15	77.20
	N1	5.20	74.45
	N2	5.26	75.35
S2	N0	6,15	77.04
	N1	6.06	78.66
	N2	6.03	75.16
S3	N0	4.88	75.09
	N1	5.08	74.66
	N2	4.91	72.61
N	N0	5.39	76.44
	N1	5.45	75.92
	N2	5.40	74.37
S	S1	5.21 [b]	75.67
	S2	6.08 [a]	76.95
	S3	4.96 [b]	74.12

Note: Different superscripts in the same column show a significant effect (P < 0.05)

broilers. Decline performance broiler chickens reared at a room temperature environment high (32°C) not caused by fat digestibility but because of consumption ratio. Faria Filho *et al.* (2007) stated that an enhancement temperature environment from 22 °C to 32°C does not influence fat digestibility in broiler chickens.

Protein Digestibility

The average values of protein intake and digestibility can be seen in Table 3. The analysis of variance showed no interaction (P > 0.05) between ambient temperature and the rate of addition of nucleotides to protein consumption and digestibility. The nucleotide addition factor significantly affected protein digestibility (P<0.05). The environmental temperature factor significantly affected protein consumption (P<0.05).

Table 3. Average protein consumption and protein digestibility

Treatment		Parameter	
		Protein Consumption (g/head/d)	Protein Digestibility (%)
S1	N0	25.96	81.03
	N1	26.22	75.86
	N2	26.53	69.07
S2	N0	30.97	75,82
	N1	30.55	68,15
	N2	30,38	71.94
S3	N0	2461	70.14
	N1	25.59	72.30
	N2	24.74	67.96
N	N0	27.18	75.66 [a]
	N1	27.45	72.10 [ab]
	N2	27.22	69.66[b]
S	S1	26,24 [b]	75,32
	S2	30.64 [a]	71.97
	S3	24.98b	70,13

Note: Different superscripts in the same column show a significant effect (P<0.05)

Protein consumption at natural and hot environmental temperatures is lower than comfortable ambient temperatures. Reduced consumption in hot and natural temperatures were chickens exposed to heat stress. According to Habashy et al. (2017), a broiler chicken reduces the consumption of nutrients during heat stress to reduce the heat load due to the digestive process. Broiler protein digestibility at hot, comfortable, and natural ambient temperatures are the same. This result is the same as that of Koelkebeck et al. (1998), Lagana et al. (2007), and Faria Filho et al. (2007) stated that differences in ambient temperature did not affect protein digestibility.

The addition of nucleotides 1 g/kg ratio lowers protein digestibility. Still, the research data of Salah *et al.* (2019) shows an increase in broiler chicken body weight tall compared to the control. Addition of nucleotides 1g/kg ration to upgrade the efficiency of protein metabolism in broiler chickens. It is because broiler chickens can synthesize nucleotides through the *de novo* and *salvage pathways*. Jung and Cancel (2012) stated that amino acids become precursors for forming nucleotides in the *de novo pathway*. Research by Salah et al. (2019) showed a nucleotide addition of 0.5 g/kg capable increased the body weight gain of broiler chickens, even though the digestibility value was the same compared to giving 0 g/kg. It is due to the addition of 0.5 g/kg nucleotides to the ratio that increases the length of the duodenal villi. According to Wu et al . (2018), giving nucleotides can increase the length of the intestinal villi and the concentration of lactic acid bacteria to help digest nutrients in the small intestine.

Pseudo energy metabolism

The average consumption of apparent metabolic energy and energy can be seen in Table 4. Based on the calculation of analysis of variance, it shows that there is no interaction (P > 0.05) between the level of addition of nucleotides and ambient temperature on consumption pseudo metabolic energy and energy broilers. Environmental temperature factors and factors nucleotide addition level had a significant effect (P<0.05) on the consumption of pseudo metabolic energy and energy.

Consumption of energy and metabolic pseudo broiler chickens reared at hot ambient temperatures taller than natural temperature environments. Salah et al. (2019) research produced increased broiler body weight maintained at a hot, hot and less than control. It shows that although energy consumption is high, it has efficient use for low production. Hot environmental temperatures cause broiler chickens to need the energy to grow through the thermoregulation process. Broiler chickens will try to minimize heat due to environmental temperature and body metabolic processes. It is by the opinion of Piestun et al. (2011) stated that the energy demand for broiler chickens increases under heat stress to regulate body temperature conditions.

Table 4. Average energy consumption and pseudo metabolic energy

Treatment		Parameter	
		Consumption Energy (kcal/head)	Pseudo Metabolic energy (kcal/kg)
S1	N0	538.75	3.266,64
	N1	550.61	3.282.90
	N2	630.52	3.185,13
S2	N0	642.71	3.242.19
	N1	544,17	3.191.48
	N2	633,91	3.105,68
S3	N0	510.65	3.166,20
	N1	513,36	3.079.67
	N2	530.97	3.068,87
N	N0	564.04 [ab]	3.225.01a
	N1	598.46 [a]	3.184.69 [ab]
	N2	536.05b	3.119.89b
S	S1	573.29 [a]	3.244.89 [a]
	S2	606.93 [a]	3.179.78 [ab]
	S3	518.32[b]	3.104.91[b]

Note: Different superscripts in the same column show a significant effect (P<0.05)

Heat stress conditions make broiler chickens expend much energy to stabilize body temperature. The energy used for production is reduced so that the performance of broiler chickens is hampered. Song et al. (2014) stated that broiler chickens expend much energy to adjust to hot temperatures, leaving little energy for growth.

Consumption energy broiler chickens with added nucleotides of 0.5-1 g /kg rations no different real (P > 0.05) with rations without given nucleotides. The results of Salah et al. (2019) reported an increase of the same body weight in addition of 0.5-1 g/kg, although adding nucleotides 1 g/kg rations lower pseudo metabolic energy. Adding nucleotides to 1 g/kg rations could improve energy efficiency in broiler chickens. Efficiency occurs because nucleotide addition of 1 g/kg ration can contribute to the need for broiler chicken nucleotides. Nucleotides have a phosphate group that can be used as a donor for the formation of adenosine triphosphate (ATP) and adenosine diphosphate (ADP). According to Hess and Grennberg (2012), ATP and ADP facilitate the transfer of chemical energy from energy-producing catabolic reactions to energy-requiring biosynthetic reactions.

CONCLUSIONS

The results of this study could conclude that there is no interaction among temperature environment differences with the addition of nucleotides on the consumption and digestibility of fat consumption and protein, and consumption of energy and pseudo metabolic energy of broilers. The temperature of a hot environment will lower the consumption of fat, protein, and energy; however, no lower digestibility. Adding nucleotides 1 g/kg ration could improve broilers' efficient use of protein and energy. Maintenance of broiler chickens in open cages and a hot ambient temperature of 32±1˚C must be given nucleotides for a 1 g/kg ration.

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