Friesian Holstein imported cows: Physiological character and blood composition base on altitude difference

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ABSTRACT: This experiment was to study the effect of altitude on physiological character and blood composition of Imported Friesian Holstein cows. Experiment was conducted in a highland area (Cangkringan) Sleman at 900 m above sea level and a low land area (Karangnongko) Klaten at 255 m above sea level. Twenty heads of first lactating Imported Friesian Holstein cows were used in this experiment, (ten heads in Cangkringan and ten heads in Karangnongko). Parameters observed were microclimatic which included: environment temperature and relative humidity; physiological character included: rectal temperature, pulse and respiration rate; blood composition included: RBC, Hb, WBC, TPP, PCV, neutrophyles, eosinophyles, lymphocytes and monocytes. Obtained data were analyzed in analysis variance with completely randomized design. The result showed that air temperatute were different (P< 0.05), and so were pulse and respiration rate of cows which higher in Karangnongko than in Cangkringan. The relative humidity and Hb in Karangnongko and Cangkringan were different (P< 0. 05) which higher in Cangkringan than Karangnongko. Rectal temperature , RBC, WBC, TPP, PCV, neutrophyles, eosinophyles, lymphocytes were not significantly different (P > 0.05). Rectal temperature and neutrophyles higher in Karangnongko than Cangkringan but : RBC, WBC, TPP, PCV, eosinophyles, lymphocytes higher in Cangkringan than Karangnongko. Different altitude were significantly difference in environment temperature, relative humidity, pulse rate, respiration rate, Hb and monocytes, but it not significantly difference in rectal temperature, RBC, WBC, TPP, PCV, neutrophyles, eosinophyles, lymphocytes. Imported dairy cows made good adaptation both in Cangkringan and Karangnongko, however in Cangkringan (high land) they made better it.

Key words: cows, physiological, blood, altitude

INTRODUCTION

Enhancement of human resource quality is significant influent by sufficient on good quality of food. Milk which one of food which high nutrient is very important to fullfill nutrient for human. In Indonesia there is unbalance between milk supply and demand, which number of milk demand is higher, therefore milk production should be more. Increasing the population of cows is one of solutions to solve this problem. Imported cows from other country was conducted for this reason.

Indonesia has differential geography background in each areas, also in term of altitude. Many imported cows from temperate area (Australia) spread in different altitude, both in low land and high land.

Friesian Holstein dairy cows have high productivity in home country which temperate climate, also the farmers conducted grading up and selection however the productivity of them will be lower when they imported to tropical country which have tropic climate also different management by the farmers (Hartadi, 1992). Further explained by Reksohadiprojo (1981) that the lower productivity of Friesian Holstein dairy cows imported in Indonesia because of environmental stress and management system. In tropical country such as Indonesia, environment temperature in some place influence by its altitude from sea above. Previous researched by Payne (1970) showed that average daily temperature will be decrease 1.7^{o}C, when the altitude increase 305 m from sea above. This indicated that the higher place from sea above, so the colder and the opposite one.

The climatic factors which have direct influence for cows is environment temperature (Atmadilaga, 1979). Cows as homeotherm animal can adjust their body temperature in normal range. When the

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body temperature out of normal range, will be followed by change of pulse and respiration rate also sweet secretion (Dowell, 1972). Further the relationship with blood composition explained by Swenson (1977), that when environment temperature decrease, the number of red blood cell (RBC/eritrocite), hemoglobin (Hb) and white blood cell (WBC/leucocite) and other of blood composition of cows will increase.

For the statement above, the research about Imported dairy cows in term of adaption in tropical climate which have different altitude from sea above level is need in order to observe which one is better place for keep dairy cows.

This research which use imported dairy cows from Australia which already 1 year keeping in Indonesia can adjust themselves with tropical temperature. However the cows which keep in high land area will make better adaptation compare with ones in low land area.

MATERIALS AND METHODS

This research used 20 first lactation of FH Dairy Cows which imported from Australia. The equipments and materials that be used:

Termometer to measure rectal temperature of cows.

Termohigrometer to measure temperature and humidity of environment.

Watch, to measure time during measurement.

To take blood sample, consist of: spuit, vacum tube, ice bo, EDTA (Ethylen Diamine Tetraacetic Acid), alcohol 70%, and cuttons.

To analyze blood, consist of: pipet, kuvet, improved neubaueur, rulin hemacytometer, microskop, spectrofotometer object glass, NaCl fisiologis, Giemsa colour, aquadest, alcohol 96%, Turk reagent and Drabkins liquid.

This research conducted in 2 location where have diffrential altitude. First at Cankringan with altitude 900 m sea above (high land), and second one in Karangnongko with altitude 255 m sea above level (low land). Both of them have 10 dairy cows to be measured. At Cangkringan the Cows keep by 5 farmers and at Karangnongko by 6 farmers.

Environment temperature and humidity measured by termohigrometer on pen, which temperature was showed by red pointer, and humidity was showed by blue pointer. The data on physiological character took every two week for sixth times, consist of: Pulse; which be measured by hold inside of the tail (arteri coccygialis) and felt its throb for 1 minutes. Respiration rate; which be measured by observe cows breaths through nose and stomach for 1 minutes. Rectal temperature, be measured by put thermometer in rectal of cow during 1 minutes. Blood sample removal by suction on vena jugularis in neck of cow. Data analyzed; all data which be collected thus analyzed in analysis variance with Completely Randomized Design (CRD)

RESULTS AND DISCUSSION

Micro climate condition, consist of relative humidity and environment temperature during the research show in table 1.

Table 1. Relative humidity and environment temperature at Cangkringan and Karangnongko

Measurement	Relative Humidity		Environment Temperature	
	C	K	C	K
I	80.0	65.2	27.0	33.1
II	76.4	75.2	24.5	29.5
III	77.0	67.0	25.3	31.8
IV	70.2	66.8	27.4	32.0
V	73.2	64.6	27.1	33.2
VI	77.4	68.7	25.6	31.1
Means	75.7[a]	67.9[b]	26.1[a]	31.7[b]

[a,b] Different superscripts in same row and parameter mean the data is significantly different ($P < 0.05$).

Base on statistical analyzed the relative humidity between Cangkringan and Karangnongko was significantly different, which higher in Cangkringan than Karangnongko. This condition was caused by rainfall in Can g kringan more often (2006 mm) compare one in Karangnongko (1968 mm), also because there are many plantations in Cangkringan which block sun shine radiation to earth surface. Low number of relative humidity very useful for body cooling through sweat secretion. According to Dowell (1972) although the environment temperature is high number if the relative humidity in low number, this supporting condition for cows to do respiration.

Environment temperature between Cangkringan and Karangnonko is significantly different which higher in Karangnongo than Cangkringan.This condition because the altitude of Cangkringan is higher compare it in Karangnongko, so regarding Dowell (1972) that when altitude increase 100 m the daily environment temperature will decrease 0.65 ^{o}C. Form this research result show that the differential altitude between Cangkringan and Karangnonko is 645 m, and following by differential environment temperature 5.6^{0}C

Physiological Character that be observed were, rectal temperature as indicated the body temperature of the cow, respiration and pulse rate. The result show in table 2

Table 2. Physiological character of dairy cows at Cangkringan and Karangnongko[1]

	Rectal Temperature		Respiration Rate		Pulse Rate	
	C	K	C	K	C	K
	38.0	39.4	30.5	68.1	50.6	59.6
	37.9	39.2	30.1	60.3	48.8	57.3
	38.2	39.1	37.5	65.6	52.5	57.8
	38.3	38.2	38.6	60.0	49.3	59.0
	38.5	38.8	44.3	39.8	49.8	52.8
	39.0	38.3	41.0	31.6	54.8	50.0
	38.8	38.6	51.3	48.5	58.3	53.5
	39.2	38.5	66.1	50.8	53.5	55.2
	38.1	38.6	35.0	52.3	52.1	54.6
	37.9	38.5	39.0	43.0	49.6	53.0
Mean:	38.4	38.7	41.3[a]	52.0[b]	51.9[a]	55.2[b]

[1] Cangkringan, K: Karangnongko
[a,b] Different superscripts in same row and parameter mean the data is significantly different ($P < 0.05$).

Rectal temperature at Cangkringan and Karangnongko in normal range (38°C-39^{0}C). Karangnongo which has environment temperature higher than it at Cangkringan, indicated that rectal temperature of cows also higher. Cows as homeoterm animal keep their body temperature in normal range, it is mean that them success to make adaptation in term of body temperature from temperate to tropical climate.

Normal range of respiration rate in Indonesia regarding Foley et al (1975) is 24 – 42 times/minute. Table 2 show that respiration rate of cows at Cankringan in normal range, in other hand it in Karannongko is out of normal. Dairy cows in Karangnongko adjust themselves to high environment temperature with increase the number of respiration in order to maintain the normal body temperature.

Table 3. Blood composition of dairy cows at Cangkringan and Karangnongko[1]

	RBC		WBC		Hb		PCV		TPP	
	C	K	C	K	C	K	C	K	C	K
	9.55	6.99	8.00	5.95	11.6	10.5	34.0	25.0	9.0	8.3
	6.40	5.38	8.35	6.20	9.3	8.0	28.0	26.0	8.0	7.0
	9.20	6.39	9.60	6.40	11.3	8.5	35.0	31.0	8.2	7.3
	4.35	7.05	3.05	9.20	9.8	10.1	31.0	34.0	8.1	8.4
	9.00	6.72	6.05	5.75	7.7	10.1	33.0	31.0	7.8	7.7
Mean	7.70	6.50	7.01	6.70	9.9[a]	9.5[b]	32.2	29.4	8.2	7.7

[1] Cangkringan, K: Karangnongko
[a,b] Different superscripts in same row and parameter mean the data is significantly different ($P < 0.05$).

The other way to keep normal body temperature is indicated with increasing the number of pulse rate. Table 2. show that pulse rate in Karangnongko higher than it in Cangkringan. High heat production in body stimulated hearth to work hard for blood supply to whole body for normal body temperature, so the number of pulse will increase. Regarding Duke (1955) the normal pulse rate of cow is 40 – 60 times/minutes, it is mean that pulse rate in both Cankringan and Karangnongo in normal range.

Red blood cell (RBC) of cows (Table 3) in Cangkringan and Karangnongko in normal range (table 5), there were not polisitemia (higher number of RBC) and anemia (less number of RBC with or with out hemoglobin decreasing) of cows at there. There were not Cows in both two research location in stress as indicated that WBC (White Blood Cell) in normal range. PVC (comparation between RBC and Total Plasma Volume) of all cows which used in this rearch in normal range. Total Protein Plasma (TPP) off them also in normal range, as indication that cows were not infected (gama globulin as protein will increase when cows infected).

Table 4. Differential leucosite of dairy cows at Cangkringan and Karangnongko[1]

	Neutrophyles		Limfocytes		Monocytes		Eosinophyles	
	C	K	C	K	C	K	C	K
	25	37	56	39	1	8	18	16
	23	29	66	43	3	15	8	13
	27	51	63	31	2	14	8	5
	23	17	70	55	2	18	9	10
	43	21	56	66	1	6	-	7
Mean:	28.2	31	62.2	46.8	1.8[a]	12.2[b]	10.75	10.2

[1]C: Cangkringan, K: Karangnongko

Differential leucosite of cows consist of neutrophyles, lymphocytes ,monocytes and eosinophles. All catagories except monocytes (table 4) in normal range. Monocytes of cows in Karangnongko very high, indicated that cows felt uncomfortable situation because of environment stress.

Table 5. Normal range of blood composition of dairy cows

Blood Composition	Normal Rate			Mean
RBC (million/m^3)	5.0	-	10.0	7.0
WBC (million/m^3)	4.0	-	12.0	8.0
PCV (%)	24.0	-	46.0	35.0
Hb (g %)	8.0	-	15.0	11.0
TPP (g %)	7.0	-	8.5	-
Neutrophyles (%)	15.0	-	45.0	28.0
Eosinophyles (%)	2.0	-	20.0	9.0
Limfocytes (%)	45.0	-	75.0	58.0
Monocytes (%)	2.0	-	7.0	4.0

CONCLUSIONS

Imported dairy cows made good adaptation both in Cangkringan and Karangnongko, however in Cangkringan (high land) they made better it. Policy of imported dairy cows should consider with microclimate, altitude and other environment aspect to keep cows in host country.

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