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# Adaptability and Productivity of Local Holstein – Frisien Cows in Banyumas District

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**Abstract.** The purpose of this study was to measure the adaptability and productivity of local dairy cows in Banyumas district. About 29 lactation dairy cows from two groups of dairy farmers in the Baturraden and Sumbang sub-districts of Banyumas district were used in this study. To find out the adaptability is done by measuring the rectal temperature and the frequency of respiration at 06.00 am, 10.00 am and 14.00 am. Milk productivity was measured by measuring milk every day. Measurement of all parameters was carried out for one month. The results showed that there were no significant differences ( $P > 0.5$ ) between the two sub-districts for all variables, namely: rectal temperature, respiratory frequency, HTC Benezra and Rhoad, and daily milk production. It can be concluded that the adaptability of local Holstein – Frisiendairy cows in Banyumas district is good, while milk production is moderate.

**Keywords:** rectal temperature, respiratory frequency, HTC, milk production,

## 1. Introduction

Banyumas Regency is one of the milk producing centers in the province of Central Java. In general, the milk produced is derived from local Frisien - Holstein (FH) dairy cows that are raised by smallholder farmers. The nation of dairy cows that is raised is the local Frisien Holstein cow because it has a fairly good performance in climatic conditions in tropical Indonesia. The dairy farmers of the people join in several groups of breeders who are scattered in several districts in Banyumas.

The dairy cow development program in the Banyumas district began in 1986. The dairy cows imported were the FH dairy cows originating from New Zealand. The dairy cows are then bred through artificial insemination using semen imported from New Zealand. The calf produced is given to the dairy farmers of the Banyumas Regency.

There are two potential and important sub-districts as locations for people's dairy farming, namely Baturraden and Sumbang sub-districts. Both districts are located at an altitude between 225 to more than 500 meters above sea level, at the foot of Mount Slamet which has an air temperature of about 22.4°C to 26.4°C, making it suitable for dairy farming. The group of dairy farmers in Baturraden District are Tirto Margo Mulyo and in Sumbang District is Tirto Margo Utomo.

The environmental conditions of the Margo Mulyo and Tirto Margo Utomo livestock groups in the Baturraden and Sumbang Districts are relatively similar, but there are some differences between the two. The differences between the two are in terms of achievement, breeders' knowledge level, and maintenance management. The Tirto Margo Utomo cattle group has a better performance, meanwhile.



Margo Mulyo cattle group is often used as a place of research by researchers from various regions. Based on these differences it is thought to affect the performance of livestock kept.

Different maintenance management between the two groups of livestock in Sumbang and Baturraden Districts can cause differences in the physiological conditions of existing livestock. This can affect the adaptability measured through the Heat Tolerance Coefficient (HTC) and milk production from dairy cows that are kept. Based on this, it is necessary to conduct research to determine the adaptability and production of local FH dairy cows in the two groups as a representation of the current conditions related to dairy cows in Banyumas district.

## 2. Methodology

The study was conducted from the first March to the tenth of April 10, 2019, in the Tirto Margo Utomo Farmer Group, Sumbang District and Tirto Margo Mulyo, Baturraden District, Banyumas Regency. Research based on the number of smallholder farmers in both groups. Samples were taken from one dairy cow from each community farmer, so that the number of lactating dairy cows used as samples was 29.

The tools used in this study include a set of structured questions, stationery, thermometer function to measure rectal temperature, stopwatch used to measure respiratory frequency, daily milk production gauges, seventy percent ethanol (70%) which is used as a disinfectant for thermometer used, and tissue.

The study was conducted by survey method by conducting interviews, measuring the frequency of respiration, rectal temperature, and milk production. Determination of the sample is done by purposive sampling method to determine the location of the study and quota sampling to determine the number of samples of dairy cattle that are measured.

The variables measured were adaptability and daily milk production in both groups. Daily milk production is measured and recorded daily from the results of morning and evening milking for one month.

The ability to adapt dairy cows to the environment is calculated through the Benezra and Rhoad Heat Tolerance Coefficient (HTC) methods, through measurement of respiratory frequency and rectal temperature of dairy cows. The formulation for calculating HTC is:

Benezra coefficient using the formula [1]:

$$IA = IA = \frac{RTI}{38,3} + \frac{NRI}{23}$$

Rhoad coefficient using the formula [1]:

$$HTC = HTC = 100 - 10(BTI - BTO)$$

### Parameter Measurement Method

#### Measurement of Cow's Body Temperature

Measurement of cow's body temperature is carried out in the morning at 06.00 WIB, 10.00 WIB, 15.00 WIB. Body temperature is obtained by measuring rectal temperature using a thermometer that is inserted into the rectum with a depth of 5-10 cm for 2 minutes. Before being used again to measure other cows, the thermometer is sanitized with 70% ethanol and dried using a tissue.

#### Respiration Frequency Check

Checking the frequency of cattle respiration is carried out at 06.00 WIB, during the day at 10:00 WIB and 15.00 WIB. The frequency of respiration is obtained by observing for 1 minute the flank and rib movements.

#### Measurement of Milk Production

Daily milk production is measured from milk production in the morning and evening for a month

## 3. Result and Discussion

### Feed Evaluation

Evaluation of feed given to lactation dairy cows in Sumbang and Baturraden Districts shows that the quality and quantity are relatively the same. Evaluation of feed given to dairy cows in both groups of

breeders was based on average body weight and milk fat content of dairy cows. The average body weight and fat of dairy cows in Baturraden sub-district were 513 kg and 3.38%, while in Sumbang sub-district was 480 kg 2.87%. The complete data is presented in **Table 1**.

**Table 1.** Composition of dairy feed

Group		Dry Matter	Crude Protein	TDN
<b>Baturraden</b>		15.39	1.40	7.89
		15.03	2.85	7.91
		(-) 0.24	(+) 1.45	(+) 0.01
<b>Sumbang</b>				
	<b>Demand</b>	14.40	1.15	6.94
	<b>Supply</b>	14.65	2.99	8.65
	<b>Difference</b>	(+) 0.25	(+) 1.84	(+) 1.71

The feed given to lactation dairy cows raised by the two groups of breeders is relatively the same, however it does not guarantee the success of livestock in producing milk. If the nutrient content of feed ingredients is low, the nutrients received by livestock to produce milk will be low. According to Indriani et al. [2] feeding not only needs to pay attention to the amount or volume of feed given, but the content and quality of nutrients in feed also need attention. Remaining feed provided (low dry matter intake) can be a cause of low milk production, because the incoming nutrients can not be in accordance with the calculations above, so it can be assumed that livestock still lack of nutritional intake to produce milk.

The level of livestock consumption can be influenced by the animals themselves (body weight, sex, age, genetic factors, and breed of cattle) [3], food provided and environmental factors (temperature, humidity and sunlight), DM consumption is influenced by several factors namely body weight, milk production level, and quality of feed ingredients while the recommended consumption of BK in dairy cows is 2.25% - 4.32% [4], feed efficiency (sometimes called milk efficiency or dry material consumption efficiency) is a simple measure to determine the relative ability of cattle to convert feed nutrition into milk or milk components [5]. An additional benefit of increasing the efficiency of cattle feed is that less nutrients will be excreted in manure, so feed efficiency affects both economic and environmental efficiency. The difference between good feeding for lactation dairy cows is that BK is less than 3 kg, protein is less than 1 kg and TDN is less than 1 kg [6].

#### **Adaptability based on HTC Benezra**

Based on the average respiratory frequency of dairy cows in Sumbang and Baturraden Districts, they are still in the normal range, which is 10 - 30 times per minute [7]. The frequency of respiration is influenced by several factors, including body size, age, physical activity, anxiety, environmental temperature, pregnancy, disturbance in the digestive tract, and livestock health conditions [8].

The average rectal temperature of FH cattle measured in the morning at 10:00 - 11:00 West Indonesia Time in Sumbang District was  $38.12 \pm 0.34^{\circ}\text{C}$  with a minimum value of  $37.6^{\circ}\text{C}$  and a maximum value of  $38.5^{\circ}\text{C}$  with the ambient temperature at the time of measurement which was  $26.20^{\circ}\text{C}$ . The average rectal temperature is also still in the normal range, which is between  $37^{\circ}\text{C}$  -  $39.3^{\circ}\text{C}$  [9].

Based on respiration frequency and rectal temperature of FH cattle in Sumbang and Baturraden Districts that are still in the normal range, it can be concluded that FH cattle in both districts are in a comfortable condition. This is consistent with the statement of Fajar and Isroli [10], that physiological variables in the form of respiration frequency and high rectal temperature indicate the occurrence of mild stress while a value that is too low also indicates that cattle are not in the comfort zone. A high frequency of respiration indicates an increase in the body's mechanism for maintaining physiological balance in the body. An increase in the frequency of respiration causes an increase in the activity of the muscles of respiration so that it requires more oxygen supply which must be met through pumping blood flow.

The adaptability of livestock in the two sub-districts is good, because based on the coefficient, the value is close to 2. This is thought to be due to the physiological condition of the livestock in both locations in a comfortable condition or in accordance with their environmental conditions. The value of perfect heat resistance is if the value of heat resistance (HTC) = 2 and if the HTC value is higher or lower than number 2 [1], it can be said that the heat resistance of livestock measured is lower. Animals which were seized with heat would, among others, be reflected in the frequency response of the breath and pulse that aims to maintain body temperature so that it remains in normal condition [11].

**Table 2.** Adaptability of dairy cows based on HTC Benezra in Sumbang and Baturraden sub-districts

Parameter	group	N	Minimum	Maximum	Average±SE
Respiration rate	Sumbang	9	18	30	25,87±3,52
	Baturraden	20	22	30	26,63±2,11
Rectal temperature	Sumbang	9	37,6	38,5	38,12±0,34
	Baturraden	20	36,5	39,5	37,94±0,71
HTC (Benezra)	Sumbang	9	1,77	2,31	2,12±0,16
	Baturraden	20	1,94	2,29	2,15±0,01

Statistical analysis showed that the respiratory frequency and rectal temperature of dairy cows in the two groups were not significantly different ( $P > 0.05$ ), nor was the adaptability based on HTC Benezra between the two groups not significantly different ( $P > 0.05$ ).

According to Anderson [12], the response of FH dairy cows to changes in environmental temperature and humidity can be seen from the frequency of respiration and heart rate, which is the mechanism of the animal's body to reduce or release heat received from outside the animal's body. Changes in the frequency of respiration in line with an increase in air temperature, it causes livestock to increase the frequency of respiration to tolerance to heat [13].

#### Adaptability Based on HTC Rhoad

Based on the table above, the average value of HTC Rhoad in Sumbang District is  $95.4 \pm 2.74$ , while in Baturraden District  $95.78 \pm 3.50$ , with a minimum value of 90 and 84 respectively. This shows that the comfort level of livestock from the MM and TMU groups is quite good because the HTC value is near perfect, which is 100. According to Fajar and Isroli [10], the normal value of HTC (Rhoad) is 100, the higher the increase in body temperature from morning to afternoon, the smaller the HTC value expressed by cows, so the closer it gets to 100 the better the cows' resistance to the environment.

**Table 3.** The results of research on the adaptability of dairy cows based on HTC Rhoad in Sumbang and Baturraden Districts.

Parameter	group	Number	Mainimum	Maximum	Average±SE
Rectal temperature (06.00 pm)	Sumbang	9	36.6	38.2	37.7±0.46
	Baturraden	20	36.3	38.9	37.5±0.60
Rectal temperature (11.00 pm)	Sumbang	9	37.6	38.5	38.12±0.34
	Baturraden	20	37.6	38.5	37.94±0.71
HTC Rhoad	Sumbang	9	90	98	95.4±2.74
	Baturraden	20	84	100	95.78±3.50

Statistical analysis showed that rectal temperature both in the morning and afternoon in the two groups was not significantly different ( $P > 0.05$ ). Adaptability based on HTC Rhoad between the two groups was also not significantly different ( $P > 0.05$ ).

The physiological conditions of dairy cows that are relatively similar in terms of heat resistance (HTC) in the two subdistricts measured are influenced by the environmental conditions in which cattle are bred, where the results of environmental temperature measurements in both measurement locations have an average that is not much different at 27.5°C and 26.2°C. This can be said because the temperature and humidity directly influence the physiological changes of dairy cows. In conditions of high temperature and humidity a determination will occur between the balance of the heat recovery process with heat dissipation in order to maintain normal body temperature levels. The higher the ambient temperature above the Thermoneutral zone will cause more heat gain than the release of heat, consequently an increase in body temperature [14].

The difference in ambient temperature above can affect the productivity performance of FH dairy cows, which are very sensitive to high ambient temperature. This is in line with the statement of Hammami et al. [15], that genetic-environmental interactions can reduce the efficiency of genetic improvement programs. According to Mirkena et al. [16] and Anggraeni [17], FH cows, known as one of the *Bos taurus* dairy cows, are capable of producing high milk in their native sub-tropical climate and it is quite difficult to maintain their genetic potential to produce milk in Indonesian tropical stress conditions.

### Milk Production

These results indicate that the production of dairy cows in the two districts is still below the minimum value required by Indonesian National Standard No. 2735: 2014 concerning Holstein Indonesian Dairy Cattle Seedling, namely the production of cow milk  $\geq 5,000$  kg (305.2 x ME) or equivalent to 4,4868 liters, if it is converted into daily production to 15.96 liters. However, when compared to the condition of dairy farming in Indonesia, milk production in Sumbang and Baturraden Sub-districts can still be said to be in the normal category, the current FH cow's milk production in Indonesia has an average production around 10 liters / head / day or around 3,471 kg / lactation [17].

**Table 4.** Average daily milk production ( l/day) in Sumbang and Baturraden districts

Group	Number	Milk Production (Minimum)	Milk Production (Maximum)	Average $\pm$ SE
Sumbang	9	8	18	11.9 $\pm$ 3.72
Baturraden	20	6	26	14.3 $\pm$ 5.33

Based on the "t" test, there were no significant differences in milk production ( $P > 0.05$ ) between Sumbang and Baturraden Districts. There are two factors that influence milk production and composition, namely genetics and the environment [18]. Genetic factors include breed, individual, inheritance, length of lactation, production persistence, estrous, hormonal, length of pregnancy, age, and body weight.

Environmental factors that contribute to the milk produced are feed, season, length of dry cage (length of drying of period), conformation of the mother's body, calving interval, lactation time, milking, maintenance management, disease and medical treatment.

The average low milk production in both districts is thought to be caused by factors in the availability of nutrients in animal feed, including protein and energy. The ratio between forage and concentrate in rations that are ideal for dairy cows is 60% compared to 40% (in dry ingredients rations) [19]. Provision of forage that is too much, especially the low quality will result in not meeting the needs of food substances for lactating dairy cows that produce high milk

### 4. Conclusion

1. The adaptability of the local Frisien Holstein dairy cattle in Banyumas Regency is good;
2. Productivity of local dairy cows in Banyumas district is moderate

## References

- [1] Soeharsono. 2008. Knowledge of Dairy Production. Widya Padjajaran, Bandung.
- [2] Indriani, A. Muktiani, and Pangestu. 2013. Consumption and Production of Lactation Dairy Milk Protein Given Temulawak (*Curcuma xanthorrhiza*) Supplement and Zinc Proteinate. *Animal Agriculture Journal*. 2 (1):128-135.
- [3] N. Adhani, Tri, and Soelih. 2012. Potential of commercial concentrate feed formula for consumption and content of dry material without milk fat. *Agroveteriner* 1(1):1-6.
- [4] A. Astuti, A. Agus, and S. P. S. Budhi. 2009. The Effect of Use of High Quality Feed Supplement on the Consumption and Digestion of Early Lactation Cattle Nutrients. *Animal Husbandry Bulletin*. 33(2):81-87.
- [5] Nardone, A. B. Ronchi, N. Lacetera, M. S. Ranieri and U. Bernabucci. 2010. Effects of climate change on animal production and sustainability of livestock systems. *Livestock. Sci.* 130:57-69.
- [6] A. Zakariah. 2012. Evaluation of the Digestibility of Some Feed Materials in Ongole Peranakan Livestock (PO) and Holstein Friesian Peranakan Livestock (PFH). *Thesis*. Gadjah Mada University, Yogyakarta.
- [7] P.G.G. Jackson and P. D. Cockcroft. 2002. Clinical Examination Of Farm Animals. University of Cambridge, UK.
- [8] W.R. Kelly. 1984. Veterinary Clinical Diagnosis. Bailliere Tindall, London.
- [9] M. Ismail. 2006. The Effect of Watering and aerating on Moregulated Response and Consumption Rate for Holland Dara Fries Cattle. *Thesis*. Animal Production Technology Study Program, Faculty of Animal Husbandry, Bogor Agricultural University, Bogor.
- [10] M. Y. Fajar and Isroli. 2015. Differences in physiological responses and heat resistance of beef and dairy cattle in "UPT.PT-HMT JEMBER". *Proceedings of the National Seminar on Technology and Agribusiness*. Faculty of Animal Husbandry, Jenderal Soedirman University, Purwokerto.
- [11] B. Utomo, D. P. Miranti and G.C. Diamond. 2009. Lactation period thermoregulation study of lactation period with introduction to feed quality improvement technology. *Seminar on Animal and Veterinary Research Results*. Central Java Agricultural Technology Study Center, Bukit Tegalepek, Sidomulyo, Ungaran:263-268.
- [12] B. E. Anderson. 1983. Temperature Regulation and Environmental Physiology. In: Dukes' Physiology of Domestic Animal. 10th ed. M. J. Swenson (Ed). Cornell Univ. Press :719- 726.
- [13] B. Utomo and D. P. Miranti. 2010. Display of dairy milk production that gets improved maintenance management. *Caraka Farmer* 25(1):21-25.
- [14] D. Suherman. 2014. Effects of feeding time and energy level on heat stress based on rectal temperature and holland fries. *Indonesian Anim. Sci. J.* 9(2):117-129.
- [15] H. Hammami, B. Rekik, H. Soyeurt, A. B. Gara and N. Gengler. 2008. Genetic parameters for tunisian holsteins using a test-day random regression model. *J. Dairy Sci.* 91:2118-2126.
- [16] T. Mirkena, G. Duguma, A. Haile, M. Tibbo, A. M. Okeyo, M. Wurzinger and J. Solkner. 2010. Genetics of adaptation in domestic farm animals: a review. *Livest. Sci.* 132:1-12.
- [17] A. Anggraeni. 2012. Genetic improvement of milk production properties and quality of holstein friesland cow milk through selection. *J. Wartazoa* 22 (1):1-11.
- [18] G. H. Schmidt, L. D. V. Vlect and Hutieuns. 1988. Principle of Dairy Science. Second Ed. Prentice Hall, Englewood Cliffs, Newjersey.
- [19] S. B. Siregar. 1992. Feeding system in an effort to increase milk production in dairy cows. *J. Wartazoa*. 2(3): 23-27.