Differences in adaptation to tropical weather between buffaloes and cattle

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ABSTRACT: Twenty buffaloes and twenty Vietnamese yellow cattle from peri-urban Hue city were kept indoor and used for measurement of effect of environmental temperature (Tₒ) and humidity (H%). The Tₒ and H% were recorded by thermo-hygrometers for temperature and humidity index (THI) measurement. Breathing rate was observed by moving rate of diaphragm, heart beat rhythms was calculated by stethoscope around 3 to 4 ribs and body Tₒ tested by 42°C thermo-meters in animal rectums.

The results showed that the Tₒ in the area studied varied widely during the day and when Tₒ increased H% often decreased. During the study period the average Tₒ changed from 24°C in February to 39°C in May. The H% varied from 57 to 86. The environmental Tₒ and H% had very little effect on body Tₒ for both types of animals (37°C to 39°C) but there were changes in heart beat from 42 to 45 in cattle but from 44 to 57 in buffaloes. In warmest period with high H% (THI 83) breathing rates in cattle varied from 18 to 21 while in buffaloes from 20 to 35 and in May it increased to 50. At the warmest time of the day the heart beat in cattle were 42 while in buffaloes 57. The breathing rate in cattle only increased when ambient Tₒ was above 39 degrees.

The results clearly showed that buffaloes were easily stressed when Tₒ and H% increased. Buffaloes need water and swamps to help to avoid heat stress while indigenous cattle are much better adapted to high environmental Tₒ and H%.

Key words: Temperature, Humidity, Buffaloes, Cattle.

INTRODUCTION - Vietnam is a tropical country being the weather warm and humid. Buffaloes and cattle are the main livestock keeping for the important role of power and meat contribution. For a thousands year the people kept them in the country, they are almost adapted to the local weather. But during the year, the weather is not stable. Some time very hot in the spring, some time rainy or too hot in the summer, the ambient Tₒ even reach to 39-40°C. The study was done to investigate the adaptation capacity of the buffaloes and cattle in central Vietnam from spring to early summer to understand what is the effect of the local weather on the animal and what is the physiological response of the animal to the weather, so that the people could control the animal production in the area.
MATERIALS AND METHODS - Twenty female buffaloes and twenty female Vietnamese yellow cattle from West-North and East-South area of Hue city were kept indoors and used for measurement of effect of environment T_o and H% during the time from February to May. The T_o and H% from environment and animal houses were recorded by thermo-hygrometers for T_o and H% index (THI) measurement (Used Wiersma, F. (1990) THI table for dairy cows). Breathing rate was observed by moving rate of diaphragm, heart beat rhythms was calculated by stethoscope around 3 to 4 ribs and body T_o tested by 42°C thermo-meters in animal rectums.

RESULTS AND CONCLUSIONS - 1. Environment temperature and humidity. The variation of T_o and H% in the area is expressed in Figure 1, when the T_o increasing then the moisture often decreasing. The T_o in area varied during the day and during the study period. From 8h to 11h the increase was 8°C increasing to (35°C) (THI at this time was 86), then the T_o slowly decreased (29°C) after 11h, later steady increase from 30 to 32°C. So the highest T_o at 8-10h, this also gave the lowest H%. The H% was highest (83%) in early morning when T_o was lowest. Not very different in T_o and H% of ambient environment and animal house indoors because the people often build the house very simple and open by a bamboo or wood fence and cover by a grass or fibrocement roof above.

According to the table of temperature and humidity index (THI) for heat stress precaution for dairy cows (Chestnut, 2006) the THI indoor in the experiment, particularly the point of March 12, it was in spring but the T_o suddenly increased so THI reach to 83, this is dangerous area of heat stress, and similar is point of April 28 and May 6.
2. Effect of environmental $T_o$ and $H\%$ on animal physiology.

The results showed that the reach of $T_o$ and $H\%$ via the point times almost not affected very much to the heart rhythm and body $T_o$. The average curve of heart rhythm did not change very much and not difference to the normal index from local buffaloes and cattle, while breathing was sensitive to the change in $T_o$ at the moment of 8-10 h, when ambient $T_o$ increased so the $T_o$ from animal house also increased and then the breathing rate reach at the level of 56 time/minute, but normally the breathing level for buffaloes is 18-21 and for cattle is 10-30 time/minute (Nguyen Xuan Tinh, 1996). The THI observed at the moment is 86. The curves from Figure 3 show that the relation between breath rate and environment $T_o$ is high in buffaloes ($r^2 = 0.57$). To compare the effect of $T_o$ and $H\%$ to the physiology indexes in the study period, figure 4 show that while body $T_o$ almost not very change by the variation of $T_o$, the heart rhythms had light increase but not over the normally level of 40-50 time/minute (Nguyen Xuan Tinh et al., 1996), but breathing rate go beyond the amplitude of normal level (35 than 18-20/time/minute in normal) at middle of March and starting of May, the breathing rate increased to 50 time/minute at May 5 in buffaloes.

When the $T_o$ suddenly increased in March (32°C), the physiology indexes in cattle did not indicate a stress, just when it increasing until 38°C in May, the breathing rate go above normal (56/minute meanwhile the normal from 10-30/minute in cattle). That is different to what happen with the buffaloes. These show that because cattle have more sweat glands so they can easy adapt to the hot weather. The sweat gland in buffaloes are underdeveloped (Koga, 1999), so that they like living near to water resource as river or swamp (almost all buffaloes in Vietnam are swamp buffalo) for the use water or mud to decrease body $T_o$ in hot weather. But the buffaloes in this study were kept indoors, so when the weather got hot, they found it difficult to control body $T_o$, so they increase the breathing rate and were stressed.

The results showed that in warmest period in the day (10h30 -13h50) the buffaloes are sensitive to the change of the weather. Figure 5 shows that although the body $T_o$ almost did not change, but in the point of March 12, the $T_o$ suddenly increased to 32°C, the heart rhythm in buffaloes were increasing (56 time/minute), and the breathing rate double to
normal (40 time/minute). While in cattle (Figure 6) the physiology indexes just varied when To reached 39°C and THI reach to 87 at the measure point of 6th of blazing May. The results clearly showed that indigenous cattle tolerate hot weather better than buffaloes. These latter animals are easily stressed when To and H% are high so they need water and swamps to reduce heat stress.

REFERENCES - Chestnut, A. 2006. Heat stress and cooling cows. http://www.vigortone.com/heat_stress.htm. Koga, A. Kurata, K., Furukawa, R., Nakajima, M., Kanai, Y., Chikamune, T., 1999. Thermoregulatory responses of swamp buffaloes and Friesian cows to diurnal changes in temperature. Asian - Aus. J. Anim. Sci. 12, 1273-1276. Le Van Phuoc. 2006. The effect of some environmental aspects to physiology indexes and production of Yorkshire and Mong Cai F1 cross breed growing pigs. PhD thesis. Hue University of Agriculture and Forestry. pp.60-67. Nguyen Xuan Tinh, Tiet Hong Ngan, Nguyen Ba Mui, Le Mong Loan. 1996. Livestock Physiology. Agriculture Publishing House. Hanoi. pp.227.