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WATER TURNOVER IN JERSEY AND CROSSBREDS OF JERSEY X LOCAL INDIAN DAIRY CATTLE IN SHADE

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RINGKASAN

Satu kajian mengenai pulangan air tubuh telah dilakukan pada lembu-lembu dari baka tulen Jersey dan kacukan Jersey x Lembu Tenusu Tempatan (Jersey-LID) yang ditempatkan di dalam kandang bagi mengkaji penyesuaiannya dengan iklim di Malaysia. Pulangan air tubuh (dengan kaedah air bertritium) pada Jersey (263 ml/kg$^{0.82}$/hari) didapati lebih tinggi ($P < 0.05$) dari pulangan air lembu kacukan Jersey-LID (222 ml/kg$^{0.82}$/hari) manakala separuh-hayat air dalam baka tulen Jersey (5.71 hari) lebih pendek ($P < 0.01$) dari baka kacukan (6.77 hari). Walau bagaimanapun, tidak ada perbezaan pengambilan bahan kering ($P = 0.05$) di antara baka Jersey (5.50 kg/hari) dan baka kacukan Jersey-LID (5.88 kg/hari).

Hasil kajian ini menunjukkan bahawa lembu baka tulen Jersey mempunyai jumlah haba di dalam tubuh lebih besar dibandingkan dengan baka kacukannya. Sungguhpun begitu, baka tulen Jersey ini masih dapat mengekalkan keseimbangan habanya.

INTRODUCTION

The need to maintain normal body temperature especially for the imported animals, in hot-humid areas is very important. Failure of adjustment or adaptation to high temperature and humidity may result in heat stress which then reduces their productivity (KAMAL, 1965; 1975). For body temperature maintenance, water is used since water has high thermal heat. Through water evaporation from skin and respiratory tract, the animal can dissipate a lot of heat to the environment and thus, reduces its heat load. Therefore, there is a relationship between water turnover and the ability to maintain body temperature. This relationship has been used in studying the heat adaptability of European breeds in hot climate (KAMAL, 1982).

The number of dairy animals imported from temperate areas to this country has increased recently and the imported breed are mainly Sahiwal-Friesian crossbreds followed by Jersey, Australia Milking Zebu and Friesian. However, there were few reports available on the adaptation of these exotic breeds in this country. A preliminary report on the adaptation of purebred Jersey has been compiled (WAN HASSAN, (1982). With better management, the Jersey cattle can perform as well as in the temperate and tropical areas (NORDIN, SHAPII and ABAS, 1982; WAN HASSAN, ABU BAKAR CHIK and TAN, 1982). On the other hand, it has been shown that water splashing has improved the conception rate of this purebred Jersey (MURUGAIYAH, 1980) which indicated that the purebred Jersey may have experienced minor heat stress. To get further information on the adaptability of purebred Jersey raised in Malaysia therefore, an experiment to study the heat balance by measuring the water turnover was conducted in Jersey and Jersey x Local Indian Dairy (Jersey-LID) crossbred heifers.

MATERIAL AND METHOD

A group of eight heifers, consisting of four Jerseys and four Jersey x Local Indian Dairy Cattle (Jersey-LID) crosses, approximately 16 months of age and weighing between 190 and 270 kg were used in this experiment. They were kept in shade and fed cut guinea grass *ad libitum*. Commercial cattle pellet (15%–16% crude protein) at the amount of 3 kg per animal was given daily. Water was available *ad libitum*. Daily feed intake and water intake were recorded.

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A day prior to tritiated water injection (3.7 MBq/kg b.w.), all animals were starved. After the injection, the animals were continued starving for another 12 hours before they were given normal ration.

Ten millilitres of blood samples were taken through jugular vein prior to injection and at two days interval for 15 consecutive days following injection. The blood samples were taken at noon. Plasma samples were immediately separated and kept forzen at −10°C for later determination of radioactivity.

The activity of tritium in the plasma was determined according to the method described by SPRINGELL and WRIGHT (1976) with little modification. Dioxane (200μl) was added to duplicate thawed plasma samples (200μl). After vortexed, the protein precipitate was isolated by centrifugation at 3 000 rpm for 30 minutes. The supernatant (200 μl) was transferred into counting vial containing 15 ml of scintillation cocktail (PCS, AMERSHAM). The radioactivity of tritium was then measured using scintillation spectrophotometer (Beckman, Model 250). The space of body water and water turnover rate were then calculated according to HOLLEMAN, WHITE and LUICK (1982).

RESULT AND DISCUSSION

The coefficient of variation of the activity of each sample was between 5% and 8 per cent. The value of water turnover, water intake and dry matter intake in Jersey and Jersey-LID cross heifers kept under the shade are shown in *Table 1*. The mean total body water for purebred Jersey (69.38% b.w.) and Jersey cross (68.96% b.w.) was not significantly different ($P > 0.05$). The values are comparable with that reported by KAMAL and SIEF (1969). The mean water turnover rate in purebred Jersey (263 ml/kg$^{0.82}$/day) was significantly higher ($P < 0.05$) than Jersey-LID cross (222 ml/kg$^{0.82}$/day) while the mean half life of body water for purebred Jersey (5.71 days) instead, was shorter ($P < 0.01$) compared to its crossbreds (6.77 days). The results indicated that the purebred Jersey used more water probably to dissipate heat than its crossbreds. In other words, the purebred Jersey has higher body heat than its cross-

Table 1. Water turnover, dry matter intake and water intake in Jersey and Jersey x Local Indian Dairy (LID) cattle cross heifers kept under the shade

Breed	Body weight (kg)	Water space (% b.w.)	Total body water (% b.w.)	Water turnover rate (ml/kg$^{0.82}$/day)	Half life (day)	Dry matter intake (kg/day)	Total water intake (litre/day)
Jersey	214	91.2	77.52	284	5.84	6.09	14.97
	244	73.8	66.73	236	5.83	5.40	15.63
	234	89.2	72.82	284	5.81	5.70	15.20
	219	72.3	61.45	246	5.36	4.82	13.86
Mean	228^{a}	81.6^{a}	69.38^{a}	263^{a*}	5.71^{a**}	5.50^{a}	14.91^{a*}
S.D.	14	10.0	8.46	25	0.23	0.54	0.75
Jersey - LID	233	75.2	63.92	231	6.03	6.35	9.53
	231	80.6	68.51	211	7.06	6.19	11.26
	268	85.7	72.85	232	7.00	6.02	14.13
	196	83.0	70.55	212	7.00	4.96	13.40
Mean	232^{a}	81.1^{a}	68.96^{a}	222^{b}	6.77^{b}	5.88^{a}	12.08^{b}
S.D.	29	4.5	3.80	11	0.50	0.63	2.09

a b Comparison of mean within column.
* Significant at $P < 0.05$.
** Significant at $P < 0.01$.

bred under the same environmental condition (under the shade). Higher water turnover as an indication of higher heat dissipated to the environment has been shown by many workers (WRIGHT, 1982; WRIGHT and JONES, 1975; EL-HADI and HASSAN, 1982). They found that the water turnover of sheep and cattle were higher during the summer than during the winter. Nevertheless, the Jerseys were capable of maintaining heat balance under the shade. This was indicated by the similarity in the dry matter intake between the purebred (5.50 kg/day) and its crossbreds (5.88 kg/day). The failure to maintain the heat balance which leads to the heat load, can be observed by the reduction in the dry matter intake as it is part of the physiological response to heat load. The evidence for this relationship has been shown by many workers (KAMAL, 1965; 1975) who indicated that the level of food intake was inversely related to the increase of rectal temperature. In addition, the similarity in the total body water between purebred Jersey and its crossbred also indicated that these animals were having similar body heat (KAMAL, 1982).

Water turnover of Jersey heifers in this study was lower than the turnover reported elsewhere (WRIGHT and JONES, 1975; WRIGHT, 1982; RANJHAN, KALANIDHI, GOSH, SINGH and SAXENA, 1982; AGGREY, 1982; DOLLAH and ABDULLAH SANI RAMLI, 1984). The reason for this difference possibly is due to the fact that our animals were kept in shade while the reported studies were done on grazing animals.

The study has indicated that the purebred Jersey under the shade was capable of maintaining heat balance similar to its crossbred possibly by having high water turnover. This enabled higher heat dissipations through water evaporation from skin and respiration. Unfortunately, the respiration rate of these animals was not measured. Thus, there is a possibility that, in the long run, the purebred Jersey would not perform as expected even though its heat balance can be maintained. The reason lies in the purebred Jersey's ability of shifting its normal hormonal and neurohormonal balance as to increase heat dissipation and reduce metabolic heat production. For example, the secretion of adrenaline might be increased to increase the sweating rate and tryroxine secretion might be reduced to reduce metabolic rate (KAMAL, 1965; 1975).

To overcome the possible effects of heat load and to maintain the performance of this purebred Jersey similar to the temperate, therefore, the heat dissipation rate should be increased. This could be done by water splashing which has been shown to increase the conception rate of this purebred (MURUGAIYAH, 1980).

In conclusion, water turnover of purebred Jersey was higher than their crossbred with Local Indian Dairy cattle under the same environmental condition. The purebred Jersey therefore, seems to have higher body heat. Improving this purebred by crossing with local breed might help the Jersey animal to have better adaptation to hot-humid climate.

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SUMMARY

An experiment was conducted to determine water turnover in purebred Jersey and Jersey crosses (Jersey x Local Indian Dairy cattle: Jersey-LID) heifers kept under the shade to study their adaptation to Malaysian climate. Tritiated water was injected intramusculary to determine the water turnover. Water turnover of purebred Jersey (263 ml/$kg^{0.82}$/day) was significantly higher ($P<0.05$) than Jersey-LID crosses (222 ml/$kg^{0.82}$/day), while the half life of former (5.71 days) was shorter ($P<0.01$) than the later

(6.77 days). Dry matter intake, however was not significantly different ($P \neq 0.05$) between Jersey (5.50 kg/day) and Jersey-LID (5.88 kg/day).

The results of the experiment indicate that the purebred Jersey kept under the shade had higher heat load than its crossbred (Jersey-LID). However, the purebred Jersey was capable of maintaining its heat balance.

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