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CIRCADIAN CYCLE OF RABBIT BODY TEMPERATURE IN THE HOT SEASON *

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Abstract

Circadian rhythm of body temperature was tested in summertime on a group of 16 N.Z.W. rabbits (8 bucks and 8 does) aged 10 weeks.

The results showed a two-wave trend with a major peak at 16.00 (40.6 ± 0.2) and a minor one at 06.00-08.00 (39.7 ± 0.2°C). The minimum was observed at 10.00 and 22.00-02.00 and was 39.7 ± 0.3°C and 39.5 ± 0.2°C respectively.

The comparison with data from literature shows that the day-time wave is an effect of perturbation induced by ambient temperature, while the peak in the early morning can be related to metabolic activity.

The comparison with experimental data collected in Egypt, in similar ambient conditions, suggests that North African rabbits have developed a better resistance to heat stress.

Key words: rabbit, body temperature, heat stress

Introduction

Rabbit physiological body temperature is quoted in literature as a range between 38.6°C and 40.1°C (Sutherland et al., 1958). When ambient temperature is ranging from 15°C to 20°C body temperature is 39.0°C or 39.1°C, (Gonzales et al.,1971; McEwen et al.,1973). Usually there is no reference to any circadian rhythm.

Rabbit thermal homoeostasis is impaired in hot ambient temperatures (Finzi et al.,1986; Finzi et al.,1988a; Finzi et al,1988b). During an experimental trial, carried out in summertime in Egypt (Finzi et al.,1992a), it was observed that rabbit temperature is relatively high in the early morning (39.5°C at 06.00) then decreases progressively (39.3°C at 10.00) to increase again until late afternoon (39.8°C at 20.00).

This happened when the animals were bred in cages, as to say directly exposed to ambient temperature. When rabbits were allowed to reach an underground cell they could profit better environmental conditions (Finzi et al.,1992b; Morera et al.,1989; Morera and Kuzminsky,1990). During the day, rabbits lay in the fresher cells and body temperature was decreasing until noon (38.8°C) to increase again abruptly in the afternoon after 16.00, being body temperature at 06.00 and 18.00 nearly the same as observed in cage breeding (Finzi et al.,1992a). These results in the underground cell in summertime were coherent in shape and range with the ones observed in controlled environmental conditions (Rosi et al.,1984) and show that high levels of ambient temperature are able to perturb the circadian rhythm of rabbit body temperature. To define this one in the hot season a summer trial was planned, including also the night time.

Materials and methods

Sixteen N.Z.W. rabbits (eight for each sex), weighing 2.250 ± 0.15 kg and 64 days old, were set in single cages in a light structure rabbitry in which ambient temperature and relative humidity were recorded. The trial was performed in the month of August in Central Italy.

Rabbit rectal temperature was controlled every two hours, for a period of 28

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consecutive hours, starting from 06.00, utilizing a digital thermometer with a probe inserted for 5 cm into the rectum.

Results and discussion

Circadian ambient and body temperature are shown in figure 1. The trend of body temperature was similar to the one of the ambient with a delay of about two hours. Relative humidity, which is also depending on ambient temperature, was inversely correlated with this parameter ($r=-0.7$; $P<0.001$).

The higher body temperature at 06.00, in comparison with 10.00, observed in summertime in Egypt (Finzi et al.,1992a) was confirmed. This can be related with an higher metabolic activity during the night, depending on feeding activity, which is very reduced in the stressed animals during the day (Prud'hon,1976; Simplicio et al.,1988; Wittorff et al.,1988; Chiericato et al.,1992; Finzi et al.,1992c; Borgida and Duperray,1993).

At 10.00 body temperature was at its morning minimum in Italy (39.7°C) and in Egypt (39.3°C). After this time the trend was different in intensity and evolution, though in both cases the values of ambient temperature were casually nearly identical.

In Italy body temperature of the rabbits rose rapidly after 10.00 to reach a maximum at 16.00 (40.6°C; +0.9°C; $P<0.001$), then it decreased to a minimum at midnight (39.5°C) to grow slowly again, showing a two-wave trend. In Egypt the circadian rhythm showed a single wave with a maximum at 20.00 (39.8°C; +0.5°C).

While at beginning of the trial body temperature was decreasing after 06.00, in the next day it was still growing at 08.00, probably as a consequence of an early rising of ambient temperature.

Since in Egypt, when the rabbits were allowed to reach the underground cell, body temperature decreased until noon, it must be concluded that the circadian rhythm of body temperature is highly influenced by ambient temperature. Fig.1 shows the result of such an interference.

The comparison between the European and the North African circadian rhythm indicates an higher capability of North African rabbits to control their body temperature during the day.

In both cases the animals tested were N.Z.W. and the results suggest the interesting hypothesis that the North African strains have undergone a selective evolution. In fact a still better resistance to heat stress was observed in Baladi rabbits (Finzi et al.,1992b). As a consequence the use of local breeds or strains must be considered when development programmes are planned for subtropical and tropical countries.

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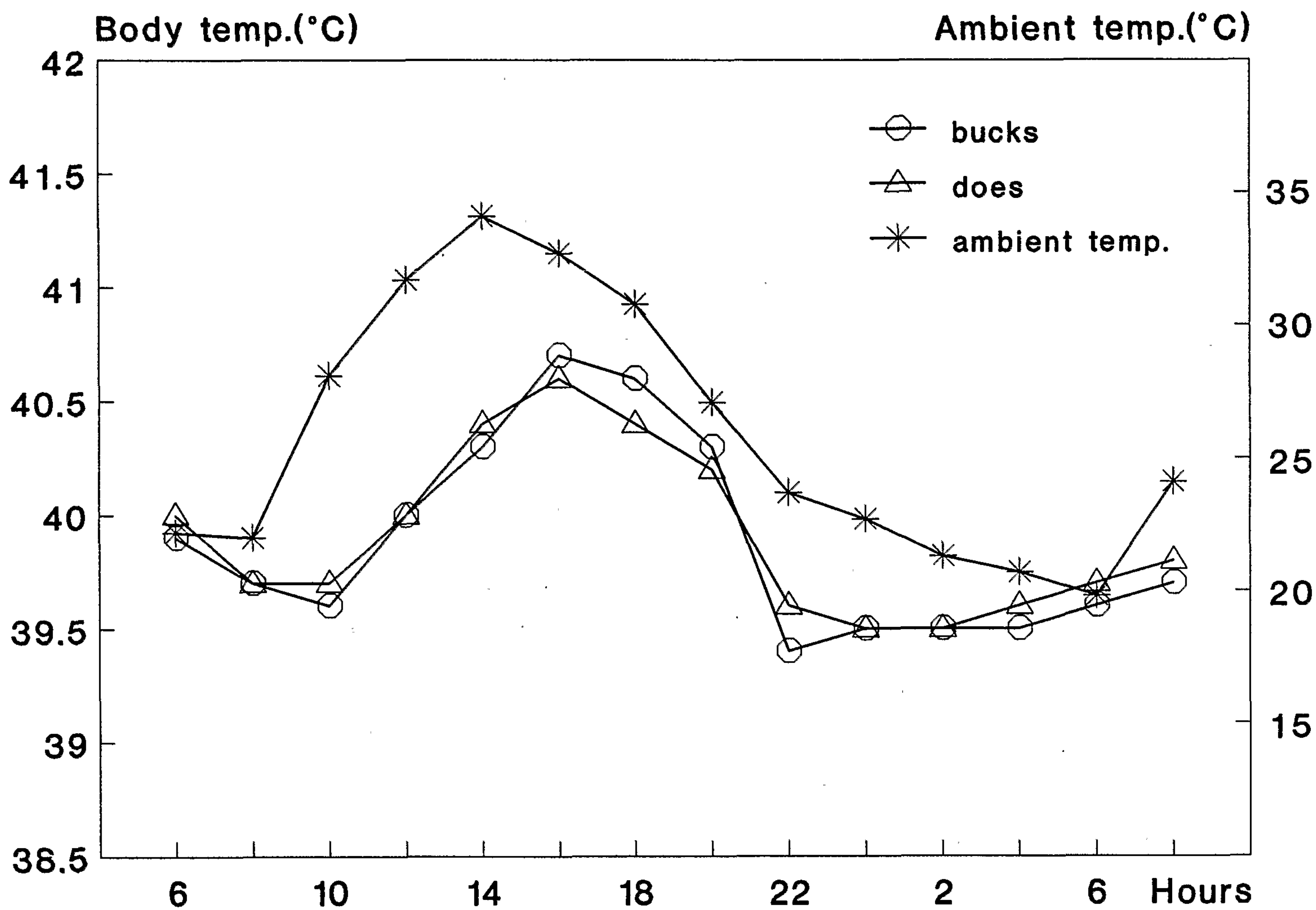

Fig. 1 - Body temperature circadian rhythm in relationship to ambient temperature in summertime