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THE THERMOREGULATORY CAPACITY OF FARMED CHINCHILLAS (*CHINCHILLA LANIGERA*)

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The aim of this study was examination of temperature dependence of chinchilla body from thermal conditions and humidity pervade on farm. The investigations were carried out through 4 months on 38 individuals breed on three farms. A total of 414 measurements of chinchillas body temperature were completed. The body temperature was measured per rectum with the accuracy 0,1 °C. During experiment the temperature on the farm changes within the range from 1 °C to 21 °C with an air humidity from 10 % to 59 %. The body temperature of chinchilla ranged from 32,0 °C to 37,4 °C. Calculated mean was 34,2 °C ± 0,09 SE, is lower than temperature published generally in literature. It results with different temperature and environment humidity accompanying execution of measurements. Obtained results in this paper indicated on a big thermo regulative ability of chinchilla, regulating quick changes of body temperature on changing temperature of milieu. The analysis of variance showed statistically significant influence of ambient temperature and humidity on changes of chinchilla body temperature.

Key words: LONG-TAILED CHINCHILLA, *CHINCHILLA LANIGERA*, HERMOREGULATION, FARM MICROCLIMATE

One of the most important characteristics of mammals is the ability of maintaining a constant body temperature regardless of environmental conditions. This temperature is 30 ºC in *Monotremata* to 38 ºC in some *Eutheria*. But in most cases, a deviation of about 6 °C from normal temperature is lethal. Homeothermy allows for a continued high level of vital signs regardless of external conditions (Schmidt-Nielsen, 1997).

In farm breeding chinchillas one of the most important tasks is to maintain the appropriate microclimatic conditions, namely to ensure proper temperature and humidity. However these animals endure lowering the temperature to –30 °C and it increased to +39 °C. Although these are the temperatures at which they can barely survive (Kosolapov, 1976). As the Peichao et al. (1984) reported, for chinchillas neutral temperature is 22 ± 0,5 °C. Below this temperature in animals is an imbalance between the use of metabolic energy and its production. This means that as far as temperature is decreasing, the energy provided from the feed is used to cover the heat demand.

With poor ventilation and air temperature above 30 °C, the animals are dying due to heat stroke. However, lowering the temperature below the optimum, while air humidity is increased to 70–80 % adversely affects the health and activity of animals. Such conditions are conducive to any infections, especially colds, because the animals often die (Kosołapow 1976).

The aim of this study was to assess the capacity of the thermoregulatory farmed chinchillas, and in particular their body temperature response to changing of temperature and relative humidity of the farm environment.

Materials and methods

The study was conducted for 4 months from December to March on adult chinchillas (*Chinchilla lanigera*) of standard variety, held in three separate areas (Farm 1, Farm 2, Farm 3) with

different microclimatic conditions. Conditions in Farm 1 and Farm 2 were very similar and largely dependent on weather conditions. Microclimate on a Farm 3 was more stable.

In total, the experiment was conducted on 38 individuals (Farm 1–15 ind., Farm 2–13 ind., Farm 3–10 ind.), which were kept in standard cages used in the breeding chinchillas. A total of 414 measurements performed at different atmospheric conditions. The body temperature was measured *per rectum* with use of the electronic thermometer with an accuracy of 0,1 °C. The temperature of outer space and the relative humidity was measured with electronic thermo-hygrometer.

In order to estimate the relationship between body temperature of the test animals and the changing ambient temperature as well the reaction of animals to changing humidity, obtained results were evaluated statistically using ANOVA. The significance of differences between mean values was examined using Tukey's test. Relationships between the studied factors were presented using the Pearson's coefficient of correlation. For statistical calculations was used the program Statistica 8,0 (StatSoft 2007).

Results and discussion

During the four months of research body temperature of chinchillas ranged from 32,0 to 37,4 °C. The analysis of variance showed that individual variability of the animal affects the body temperature. These differences were statistically significant ($p < 0,01$) within each of the farms as well as for all animals together. Calculated from measurements the mean temperature 34,2 °C (SE = 0,09), is lower than commonly reported in the literature (Peichao et al., 1980; Woody, Wuensche, 1994; Lanszki, 1996). This discrepancy is likely due to a different range of ambient temperature and humidity in which the measurements were made in studies by other authors. Carried out under this work measurements of a room temperature at a farm environment ranged from 1,0 °C to 21,0 °C with an average of 9,7 °C. The humidity at farm adopt values from 10 % to 59 % while its average value was 52 % (tab.). Changes in the body temperature and oxygen demand in chinchillas at different ambient air temperature is not the same. In his research Kosolapov (1976) recorded a minimum body temperature (30 °C) at 10 °C, and maximum (38 °C) at 30 °C. While Boersman (1995) states that in an environment with a temperature of 16 °C body temperature of chinchillas varies in the range of 36,4 to 38,3 °C.

Table

Microclimate parameters of farm environment and body temperature of *Chinchilla lanigera*

	N	Environmental temperature (°C)				Environmental humidity (%)				Body temperature (°C)			
		Mean	SE	Min	Max	Mean	SE	Min	Max	Mean	SE	Min	Max
Group 1	164	6,2	2,6	1,0	11,0	51,2	12,3	10	58	34,1	0,9	32,1	36,9
Group 2	150	7,6	1,8	3,0	10,0	53,2	12,3	10	59	33,9	0,9	32,0	36,6
Group 3	100	18,5	1,4	16	21	50,9	5,8	34	54	34,6	0,7	33,4	37,4
Total	414	9,7	5,4	1,0	21,0	51,9	11,1	10	59	34,2	0,9	32,0	37,4

The results obtained in this study suggests a high thermoregulation capacity of chinchillas, responsive rapid changes of body temperature to changing ambient of environmental temperature. At all three farms ANOVA showed a statistically significant influence of ambient temperature on body temperature of chinchillas. However, humidity had an influence on body temperature in the chinchilla Farm 1 and Farm 2. On a Farm 3 microclimatic conditions were more stable and such a relationship was not observed. With a total analysis of all obtained results, both ambient microclimate parameters had a statistically significant influence ($p < 0,01$) on body temperature of animals (Fig. 1, 2). Furthermore, ANOVA showed a statistically significant influence of a Farm factor on the animal's body temperature. Tukey test showed statistically significant differences between the Farm 3 and the other two farms.

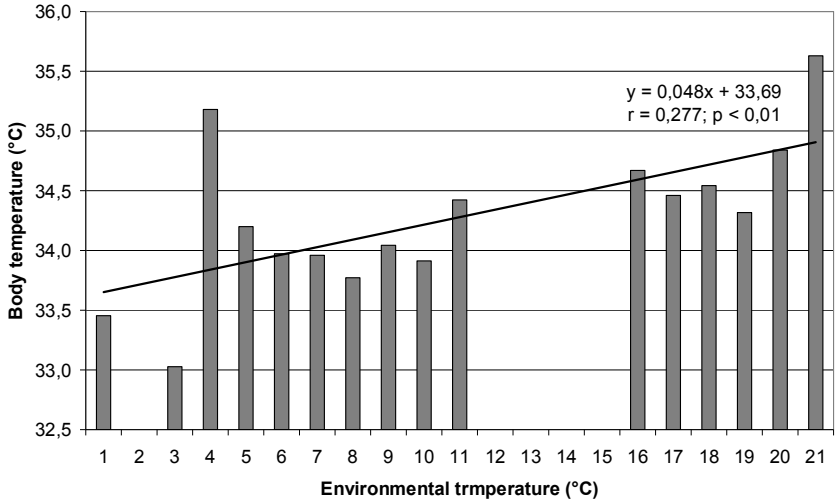

Fig. 1. Mean values of chinchillas' body temperature under different values of farm environment temperature

Cortes et al. (2000) write that probably chinchillas have the thermoregulation dependency of expenditure and heat gain, which is best suited for desert environmental conditions. They estimated the metabolic energy of animals, loss of water to evaporation and body temperature in different ambient temperatures. Their researches indicate that the basic metabolic rate and thermal conductivity respectively, 80,4 and 72,5 % of the expected value for the group of animals to which belong chinchilla (*Eutheria*). This value is the highest recorded so far for rodents, which indicates that a *Chinchilla lanigera* has a very high thermal insulation. In addition, water loss by evaporation was 95 % of the expected value for *Chinchilidae*. Which indicates that a long-tailed chinchilla shows a clear relationship to the expenditure of heat gains in thermoregulation.

The coefficient of correlation calculated for chinchillas' body temperature and ambient temperature adopted r = 0,227 and was statistically significant ($p < 0,01$) (Fig. 1). The relationship between humidity were not as clear, however, found statistically significant differences between averages for different humidity and coefficient of the correlation had a value r = 0,163, it was statistically significant ($p < 0,01$) (Fig. 2).

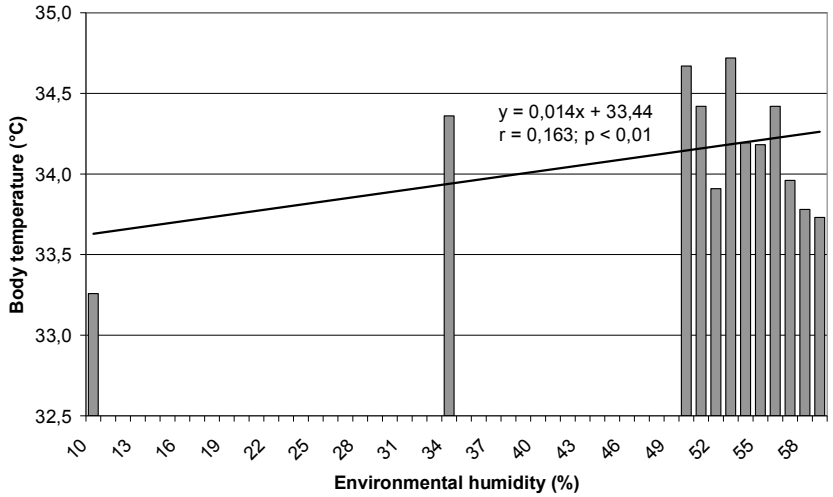

Fig. 2. Mean values of chinchillas' body temperature under different values of farm environment humidity

Conclusions

To sum up the obtained results can be concluded that chinchillas have a high thermoregulation capacity. The body temperature of these animals changed from 32 to 37ºC, depending on ambient temperature and humidity. The farm microclimate influence for a significant differences between mean body temperature of chinchillas from different breeding rooms. The average temperature of animals kept in a farm conditions take a value around 34ºC what is lower than temperature generally published.

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ТЕРМОРЕГУЛЯЦІЙНА ЗДАТНІСТЬ ШИНШИЛ НА ФЕРМАХ (*CHINCHILLA LANIGERA*)

Р е з ю м е

Визначено залежність температури шиншил від температурних умов та вологості на фермах. Дослідження проводились протягом 4 місяців на 38 особинах на трьох фермах. Загалом було проведено 414 замірів тіла шиншил. Температуру тіла виміряли *per rectum* з точністю 0,1 °С. Протягом досліду температура на фермі змінювалась від 10 до 59 %. Температура тіла шиншил коливалась від 32,0 °С до 37,4 °С. Обчислено, що значення температури були 34,2°С ± 0,09 SE і це нижче ніж загалом вказано у літературі. Це є наслідком різних температур та вологості навколишнього середовища, при яких проводились вимірювання. Одержані результати вказують на високу регуляторну здатність шиншил до змін температури тіла. Аналіз цих відмінностей показав значний вплив температури та вологості на зміни температури тіла шиншили.

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ТЕРМОРЕГУЛЯТОРНАЯ СПОСОБНОСТЬ ШИНШИЛ НА ФЕРМАХ (*CHINCHILLA LANIGERA*)

А н н о т а ц и я

Определино зависимость температуры шиншилл от температурных условий и влажности на фермах. Исследования проводились в течение 4 месяцев на 38 особях на трех фермах. В целом было проведено 414 измерений тела шиншилл. Температуру тела измеряли per rectum с точностью 0,1 °С. В течение опыта температура на ферме изменялась от 10 до 59 %. Температура тела шиншилл колебалась от 32,0 °С к 37,4 °С. Вычислено, что значения температуры были 34,2 °С ± 0,09 SE и это ниже, чем в целом указано в литературе. Это является следствием разных температур и влажности окружающей среды, при которых проводились измерения. Полученные результаты указывают на высокую регуляторную способность шиншилл к изменениям температуры тела. Анализ этих отличий показало значительное влияние температуры и влажности на смены температуры тела шиншиллы.

1. *Boersman A. A.* Studied on motor activity and body temperature of chinchillas (*Chinchilla laniger*) / A. A. Boersman. — Tierartzliche Facultat, Ludwig-Maksimilians-Universitat, Munchen, 1995. — 141 p.

2. *Chudy A.* Heat production of adult blue chinchilla in dependence on ambient temperature, feed level and sex / A. Chudy, J. Wuensche. — Archiv fur Tierzucht, 1994. — 37, 1–86 p.

3. *Cortes A.* Water economy in rodents: evaporative water loss an metabolic water production / A. Cortes, M. Rosenmann, F. Bozinovic // Revista chilena de historia natural — 2000. — 73 (2), 311–21 p.

4. *Kosolapov I. T.* Osobiennosti termoregulacii u szinszill. Krolikovodstvo i Zveravodstvo. — 1976. — 5, 30 p.

5. *Lanszki J.* The effect of litter size and individual weight at birth on the growth and mortality of chinchillas. — Scientifur. — 1996. — 42–47 p.

6. *Peichao W.* Heat energy metabolism during pregnancy and lactation in *Chinchilla lanigera*. / Peichao W.,Guozhen Q., Houji L., Helin S., Longbiao Z Scientifur — 1984. — 141 p.

7. *Peichao W.* Influence of environment temperature on oxygen consumption and heat production of adult chinchilla (*Chinchilla lanigera*) / Hogee L., Helin S., Kuochen Ch., Longbiao Z. — 1980. — 16 p.

8. *Schmidt-Nielsen K.* Fizjologia Zwierząt: Adaptacja do środowiska. Warszawa. — Wyd. Nauk. PWN, 1997.

9. StatSoft, Inc. 2007. STATISTICA (data analysis software system), version 8.0. www.statsoft.com.

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