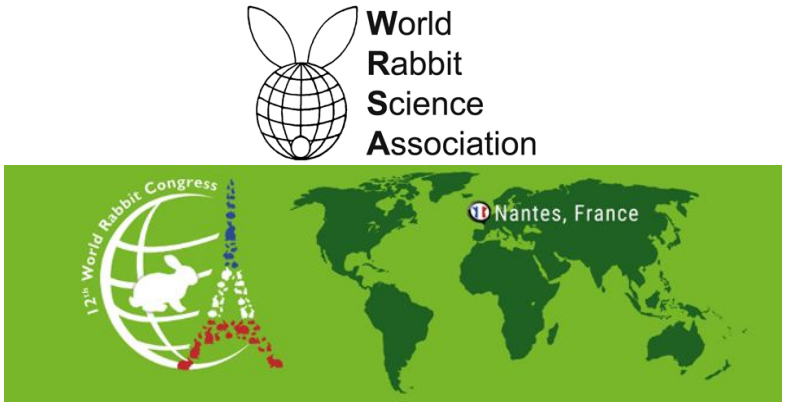

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Full text of the communication

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Poster

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EFFECT OF DRINKING WATER COOLING ON THE REPRODUCTIVE PERFORMANCE OF RABBIT DOES HOUSED UNDER HIGH AMBIENT TEMPERATURE

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ABSTRACT

The aim of the study was to examine the effect of cooled water at high ambient temperature on the reproductive performance of rabbit does. The experiment was conducted at Kaposvár University with Pannon Ka multiparous rabbit does which were housed in two air-conditioned rooms where the average ambient temperature were 20 °C and 28 °C. Specifically, three groups (n=30 does/group) were formed: in the positive control group (PC) the ambient temperature was 20 °C and the drinking water was not cooled, in the negative control group (NC) the ambient temperature was 28 °C and the drinking water was not cooled and in case of TP group the ambient temperature was on 28 °C and the drinking water was cooled. Rabbits were housed in wire-mesh cages and fed *ad libitum* with commercial diet. For the experiment, two reproduction cycles were examined with the same rabbit does. During the first cycle, the cooled water's temperature was 17-18 °C and in the second cycle it was 12 °C. In both cycles, the PC group displayed better feed intake, litter size, litter weight were and lower suckling mortality compared to both the NC and TP groups. No differences were observed between NC and TP groups. It was concluded that cooling the drinking water was not a good strategy to improve the reproductive performance of rabbit does kept under high ambient temperature.

Key words: Rabbit does, Reproductive performance, High ambient temperature, Cooled water

INTRODUCTION

Rabbit doe is exposed to high stress during pregnancy and lactation period: energy requirement increase consistently during lactation and feed intake is not sufficient to cover it, which results in the mobilization of the own reserves (Xiccato and Trocino, 2010). In order to prevent a further exacerbation of this aspect, during this period it is particularly important to ensure proper environmental conditions for the rabbits, with The lower and upper limits of the ambient temperature being 15 and 30 °C, respectively (McEwen and Heath, 1973). At high temperatures, i.e. heat stress, feed consumption, gestation rate, litter size, litter weight and milk production of rabbits decrease (Marai, 2002). In order to reduce the negative effects of heat stress, several methods are applied in production, mainly technological but also different feeding methods. Cooling of drinking water has been tested in several experiments with or without vitamin supplementation (Mousa-Balabel, 2004; Yassein *et al.*, 2008; El-Saidy *et al.*, 2016). In general, water cooling showed to improve the production of the rabbits; specifically, pregnancy rates, litter size, litter weight and milk production were more favorable. Therefore, the purpose of the present experiment was to investigate how the cooled drinking water affects the production of rabbits at high ambient temperature.

MATERIALS AND METHODS

The study was performed in the rabbit farm of the Kaposvár University (Hungary) with Pannon Ka multiparous (3-5th parturition) rabbit does. The rabbit doe were housed in wire mesh cages (57 x 38 x 30 cm), located in rooms equipped with air-conditioning system. Each cage had a nest box (25 x 38 cm), feeding and watering facilities. The rooms were illuminated for 16 hours daily. The rabbit does were fed *ad libitum* with commercial pelleted feed (energy: 10.93 MJ DE/ kg, crude protein: 18.06%, crude fiber: 15.33%) and drinking water was freely available from nipple drinkers. The rabbit does were re-inseminated on the 25th day after kindling and the kits were weaned at 35 days. Litter equalization was done within group.

The effect of drinking water cooling was examined during two consecutive reproductive cycles.

Cycle 1:
Based on the room- and water temperature, n=3 experimental groups were formed: a Positive control (PC; n=30) in which the room temperature was 20 °C and the water was not cooled (19 °C); a Negative control (NC; n=30) in which the room temperature was 28 °C and the water was not cooled (28 °C), and a group Cooled water (Temperated: TP; n=30) where the room temperature was 28 °C and the water was 17-18 °C.
The experiment started when the rabbit does were in the last week of pregnancy. During the investigation the kindling rate, the body weight of does at kindling, the feed consumption, the litter size (total, alive, at 21 and 35 d), the litter weight at 21 and 35 d and the body weight of kits at 21 and 35 d were registered. The mortality was checked daily.

Cycle 2:
The experimental design was similar as that of Cycle 1: a Positive control (PC; n=29): the room temperature was 20 °C and the water was not cooled (19 °C); a Negative control (NC; n=29): the room temperature was 28 °C and the water was not cooled (28 °C) and a Cooled water group (Temperated: TP; n=28): the room temperature was 28 °C but the water was cooled to 12 °C.
In the first half of the pregnancy, the water temperature of the TP group was 17-18 °C and the other half of the pregnancy and the lactation period it was cooled to 12°C. During the Cycle 2, the same productive data of the Cycle 1 were recorded. During the whole experiment, the air- and water temperature and the relative humidity of the rooms were registered every 30 min with an EBI 300 USB data collector (ebro Electronic GmbH, Ingolstadt).

The reproductive performance of rabbit does were analyzed by one-way ANOVA using R-project software package.

RESULTS AND DISCUSSION

Cycle 1
Body weight of does and kindling rate were not influenced by the tested effect, thus showing similar outcomes in the three experimental groups (Table 1). Similarly, no differences were found in the number of total born, born alive and stillborn kits in the three groups. In contrast, the litter size at 21 and 35 d was significantly higher in the PC than in the NC and TP groups, the latter groups showing similar results ($P<0.001$).

Coherently with our findings, Abdel-Samee (1997) observed higher litter size (35 d) at 18 °C than at 24-32 °C of ambient temperature without water cooling. Litter size, individual and litter weight were significantly higher in PC than in NC and TP groups, both at 21 and 35 d, whyle, no differences between the NC and TP groups were observed. Such results contrasted to what it was found by Abdel-Samee (1997), where water cooling improved litter weight at 35 d under hot ambient temperature. Diversely, El-Saidy *et al.* (2016) found a higher individual weight at weaning in the group where water was cooled compared to the control group receiving water at ambient temperature. The mortality

rate of kits was significantly higher in the NC and TP than in PC groups in both periods (0-21 and 0-35 d; P<0.001), which could be in connection with the decline in feed consumption and consequently the lower milk production of the rabbit doe (Marai *et al.*, 2002). At the same time, the differences between TP and NC groups were not significant. The high ambient temperature significantly affected also the feed intake of kits: PC rabbits showed higher values than NC and TP ones throughout the study (P<0.001).

Table 1: Effect of ambient and water temperatures on the reproductive performance of rabbit does (Cycle 1)

	PC	**NC**	**TP**	***SE***	***Prob.***
Kindled does/AI	30/30	27/30	27/30	---	---
Kindling rate, %	100	90	90	---	0.200
BW of does at kindling, g	4433	4286	4490	72.4	0.498
Litter size, n					
total born	9.86	9.13	9.58	0.35	0.689
born alive	9.20	7.66	8.48	0.39	0.277
stillborn	0.66	1.46	1.10	0.21	0.298
at 21d	8.10^{b}	6.64^{a}	6.00^{a}	0.20	<0.001
at 35d	7.89^{b}	6.32^{a}	5.50^{a}	0.23	<0.001
Litter weight, g					
at 21d	2795^{b}	1733^{a}	1608^{a}	77.4	<0.001
at 35d	7293^{b}	4455^{a}	3920^{a}	226	<0.001
Individual weight, g					
at 21d	346^{b}	268^{a}	274^{a}	6.36	<0.001
at 35d	924^{b}	717^{a}	705^{a}	15.8	<0.001
Mortality, %					
0-21d	9.70^{a}	25.0^{b}	31.6^{b}	---	<0.001
0-35d	11.5^{a}	27.7^{b}	33.3^{b}	---	<0.001
Feed intake, g/day					
3-9d	373^{b}	231^{a}	228^{a}	9.78	<0.001
9-16d	409^{b}	241^{a}	235^{a}	11.6	<0.001
16-21d	395^{b}	236^{a}	241^{a}	10.0	<0.001

^{a,b}: Different superscripts means significant (P<0.05) difference between groups.

Cycle 2

Results displayed in Table 2, showed that independently to the ambient and water temperatures, the kindling rate was similar in the three groups which is not consistent with literature data. In fact, according to Marai *et al.* (2001) the kindling rate was higher in winter (15 °C) than in summer (29.7 °C), and the water cooling (10-15 °C) in summer improved it. The body weight of TP does was higher than that of NC ones, with PC group being intermediate for this trait (P<0.05). Similarly to what it was observed in the Cycle 1, the feed intake was lower in TP and NC groups compared to PC one (P<0.001). Also, the water cooling had no positive effect on this trait as NC and TP rabbits showed similar outcomes.

Diversely from what it was observed in Cycle 1, the number of total born and born alive kits (P<0.05) , as well as the litter size at 35 d were significantly higher in the PC group than in NC and TP ones, but in case of litter size at 21 d the difference was only significant between the PC and TP groups. In the same direction of the litter size, also the litter weight differed at 21 and 35 d, it was significantly higher in PC group than TP and NC ones. Similarly to the Cycle 1 the mortality of kits at 21 d was significantly higher in the NC group, than in the PC and TP ones (P<0.05), whereas at 35 d no significant differences among groups were observed for this trait. Similarly to our results, Yassein et al. (2008) found a lower mortality rate when cooling water was used under hot ambient temperature.

Table 2: Effect of ambient and water temperatures on the reproductive performance of rabbit does (Cycle 2)

	PC	**NC**	**TP**	***SE***	***Prob.***
Kindled does/AI	25/29	22/29	22/28	---	---
Kindling rate, %	86	76	79	---	0.594
BW of does at kindling, g	4437^{ab}	4263^{a}	4656^{b}	56.0	0.017
Litter size, n					
Total born	9.32^{b}	9.27^{ab}	6.68^{a}	0.46	0.027
born alive	8.56^{a}	8.40^{a}	6.27^{b}	0.42	0.047
stillborn	0.76	0.86	0.40	0.19	0.595
at 21d	7.00^{b}	6.23^{ab}	5.23^{a}	0.20	<0.001
at 35d	7.04^{b}	5.95^{a}	5.04^{a}	0.21	<0.001
Litter weight, g)					
at 21d	2663^{b}	1892^{a}	1768^{a}	82.4	<0.001
at 35d	6449^{b}	4414^{a}	3889^{a}	199	<0.001
Individual weight, g					
at 21d	377^{b}	308^{a}	338^{ab}	7.43	<0.001
at 35d	915^{b}	751^{a}	776^{a}	12.3	<0.001
Mortality, %					
0-21d	17.5	28.2	19.7	---	0.031
0-35d	20.4	30.4	22.6	---	0.060
Feed intake, g/day					
3-9d	396^{b}	283^{a}	268^{a}	8.78	<0.001
9-16d	441^{b}	311^{a}	303^{a}	10.7	<0.001
16-21d	423^{b}	302^{a}	303^{a}	9.95	<0.001

^{a,b}: Different superscripts means significant (P<0.05) difference between groups.

CONCLUSIONS

Overall, results of the present experiment showed that water cooling was not an effective strategy to improve the reproductive performance of rabbit does kept under hot ambient temperature.

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REFERENCES

Abdel-Samee A.M. 1997. Response of New Zealand white rabbits to thermal stress and its ameloriation during winter and summer of North Sinai, Egypt. *J. Arid Environ., 36, 333-342.*

El Saidy N.R., Allam F.E., Balabel T.M., El-Midany S.A. 2016. Evaluation of Using Honey, Cool water and Levamisole against Heat Stress on Different Traits of Rabbits under Egyptian Summer Conditions. *World Vet J., 6, 10-18.*

Marai I.F.M., Ayyat M.S., Abd El-Monum U.M. 2001. Growth performance and reproductive traits at first parity of New Zealand White female rabbits as affected by heat stress and its alleviation under Egyptian conditions. *Trop. Anim. Health Pro., 33, 451-462.*

Marai I.F.M., Habeeb A.A., Gad A.E. 2002. Rabbits' productive, reproductive and physiological performance traits as affected by heat stress: a review. *Livest. Prod. Sci., 78, 71-90.*

McEwen G. N., Heath J. E. 1973. Resting metabolism and thermoregulation in the unrestrained rabbit. J. *Appl. Physiol., 35, 884-886.*

Mousa-Balabel T.M. 2004. Effect of heat stress on New Zealand White rabbits' behaviour performance. *Minufiya Vet. J. 3 , 125-134.*

Xiccato G., Trocino A. 2010. Energy and Protein Metabolism and Requirements. *Nutrition of the Rabbit, 2nd Edition, 83-117.*

Yassein S. A., Mahmoud K. Gh., Maghraby N., Ezzo O. H. 2008. Hot climate effects and their amelioration on some productive and reproductive traits in rabbit does. *World Rabbit Sci., 16, 173-181.*

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Material and methods

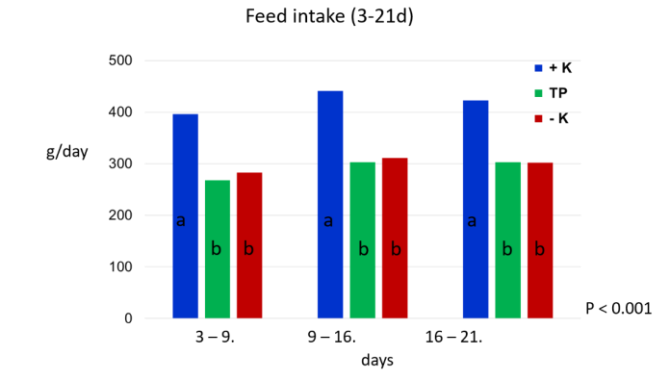
Experimental groups:

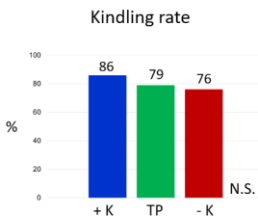
1st experiment	Positive control (+K)	Temperated group (TP)	Negative control (-K)
Ambient temperature	20 °C	28 °C	28 °C
Temperature of water	20 °C	17-18 °C	28 °C

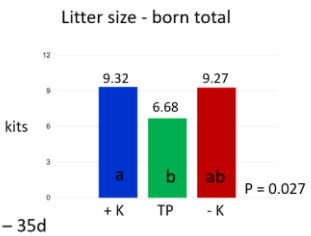
Water cooling did not improve the performance!

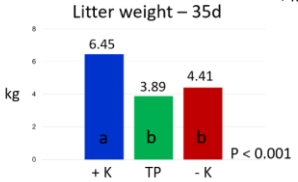
2nd experiment	Positive control (+K)	Temperated group (TP)	Negative control (-K)
Ambient temperature	20 °C	28 °C	28 °C
Temperature of water	19 °C	12 °C	28 °C

Results









Conclusion

Based on the results it can be concluded that water cooling was not an effective strategy to improve the reproductive performance of rabbit does kept under hot ambient temperature.