WORLD RABBIT SCIENCE 1955, 3 (3), 107-111

USING SOME ANTIBIOTICS AND PROBIOTICS FOR ALLEVIATING HEAT STRESS ON GROWING AND DOE RABBITS IN EGYPT

ABDEL-SAMEE A.M.

Animal Production Department, Environmental Agricultural Sciences College,
Suez Canal University, EL-ARISH, Egypt.

ABSTRACT : The influence was studied of different heat loads connected with the application of some antibiotics and probiotics on growth and reproductive traits of 105 growing and 70 doe New Zealand White rabbits. The augmentation in environmental temperatures increased the respiration rate and rectal temperature significantly, while it significantly decreased daily body gain (24 %) and daily concentrate intake (18 %) in growing rabbits. Similarly,in does, litter size at birth and at weaning, viability percentage, young individual weight at birth and at weaning and gain from birth to weaning decreased significantly by 17, 31, 16, 27, 19 and 18 % respectively. During summer, application of antibiotics : Avoparcin (AV), Flavomycin (FL) or Zinc bacitracin (ZB), or probiotics : either Bospro (BS) or Lacto-Sacc (LS), had positive effect on the physiological status of the animals and improved significantly most of the growth and reproductive traits studied. This improvements include thermoregulation (as observed by respiratory rate decreasing) and daily body gain of fattening rabbits, conception rate (67 *vs* 57 %), litter size at weaning, young individual weight at birth and at weaning and body gain from birth to weaning of does. However, these improvements does not reach the levels observed in spring.

RÉSUMÉ : Utilisation de quelques antibiotiques et probiotiques afin d'éviter le stress dû à la chaleur des lapines et des lapins en croissance en Egypte.
L'auteur a étudié l'influence d'un excès de chaleur (printemps vs automne) et, en été, les conséquences d'un apport de différents antibiotiques et probiotiques sur la croissance et les caractéristiques de reproduction de 105 lapins en croissance et de 70 lapines Néo-zélandais Blancs. L'élévation de la température ambiante augmente significativement le rythme respiratoire et la température rectal, tandis qu'elle diminue significativement le gain de poids corporel quotidien (24 %) et la consommation journalière (18 %) des lapins en croissance. Concernant les femelles, la taille de la portée à la naissance et au sevrage, le pourcentage de viabilité, le poids individuel des lapereaux à la naissance et au sevrage, diminuent significativement, respectivement de 17, 31, 16, 27, 19 et 18 %. Pendant l'été, l'utilisation d'antibiotiques : Avoparcin (AV), Flavomycine (FL) ou Zinc Bacitracine (ZB), ou de probiotiques : Bospro (BS) ou Lacto-Sacc (LS) a un effet positif sur le statut physiologique des animaux et améliore significativement la plupart des caractéristiques de croissance et de reproduction étudiées. Ces améliorations incluent la thermorégulation (telle qu'on peut l'observer par la diminution du rythme respiratoire), le gain de poids quotidien des lapins à l'engraissement, le taux de fécondité (67 vs 57 %) la taille de la portée au sevrage, le poids individuel des lapereaux à la naissance et au sevrage et leur gain de poids corporel de la naissance au sevrage pour les femelles. Toutefois ces améliorations ne permettent pas d'atteindre les valeurs obtenues au printemps.

INTRODUCTION

Recent Egyptian agricultural policy has been directed towards intensive land in the desert area. Now, Sinai is considered as an important desert area due to its natural resources potentialities and strategic situation.

The animal in this area may suffer from heat stress during the long hot humid climate in summer (May to November). A temperature of 13-20°C is known as the "comfort zone" for rabbits. At higher temperature (30°C) the appetite is depressed, the productive and reproductive performances are impaired and the resistance to disease is decreased.

Reduction of heat stress may be obtained in keeping the animals within or very near to the range of their thermoneutral state. Alleviation of heat load on animals can be achieved by providing suitable feeding, housing, management and employing techniques to modify environmental conditions (ABDEL-SAMEE, 1991, 1992 ; ABDEL-SAMEE *et al.*, 1992 a, b).

Under thermoneutral conditions, antibiotics and probiotics have been shown to have a number of specific beneficial effects on growth and reproductive performances and feed efficiency of poultry and rabbits (GHAZLAH *et al.*, 1990 ; DE BLAS *et al.*, 1991 ; HEGAZY *et al.*, 1991 ; SONBOL and EL GENDY, 1992 ; EL-MAGHAWRY *et al.*, 1993).

In light of these reports, two experiments were carried out to study the effects of heat stressful conditions on rabbits productivity and reproduction and to investigate the possibility of using three types of antibiotics (Avoparcin, Flavomycin, and Zinc

Bacitracin) and two types of probiotics (Bospro and Lacto–Sacc) treatments to improve productive performances of heat stressed rabbits maintained under Sinai conditions.

MATERIALS AND METHODS

Two experiments were carried out in the Rabbit Farm, Animal Production Department, Environmental Agricultural Sciences College, Suez Canal University at El Arish, North Sinai, Egypt. In experiment I, 15 growing male (after weaning at 37 days) and 10 doe (6–9 months old and 4.25 kg weight) New Zealand White (NZW) rabbits were maintained under spring conditions to study the effect of mild climate on growth and reproductive traits (group A). In experiment II, 90 growing male and 60 doe NZW rabbits similar to the animals used in experiment I, were randomly divided to six similar and equal groups of 15 males and 10 does . The six groups were maintained under summer season. Group B was used to study the effect of hot summer on growth and reproductive performances. Groups C, D, E, F and G were used to study the effect of Avoparcin, Flavomycin, Zinc bacitracin, Bospro and Lacto-Sacc respectively. Group A was used as a control for group B which was used as a control for the other treatment groups (C, D, E, F, G). Table 1 presents the experimental design of the study.

The average at 06:00h (minimum) and at 15:00h (maximum) ambient temperatures were 14 and 23°C in Spring and 24 and 34°C in summer. The average maximum and minimum relative humidity were 73 and 47 % in spring and 89 and 65 % in summer at El–Arish North Sinai area.

The calculated temperature humidity index (THI) during the hot hours (10:00 to 15:00 h) of the summer days averages 84 ± 2°C. THI less than 82 means no stress, 82 ≤ THI ≤ 84 means moderate stress, 84 ≤ THI ≤ 86 means severe stress and THI > 86 means very severe stress. THI calculated from dry bulb temperature (db, f) and relative humidity (RH % / 100) using the following formula :

$$THI = db - (0.55 - 0.55\ RH)\ (db - 58).$$

according to livestock and poultry heat stress indices, Agricultural Engineering Technology Guide, Clemson University, SC 29634, USA

In the two experiments, the rabbits were fed *ad libitum* pelleted ration and acacia (Table 2). Feed intake and refusals for growing rabbits were daily recorded by the weight back technique. In experiment II, the rabbit were fed on the basal diet supplemented with one of the three types of antibiotics, Avoparcin 200 ppm (group C), Flavomycin 125 ppm (group D) or Zinc bacitracin 150 ppm (group E) and one of the two types of probiotics, Bospro 2500 ppm (group F) and Lacto–Sacc 2000 ppm (group G). The antibiotics were purchased from the Nile Company for Pharmaceutical and Chemical Industries, Cairo, ARE. The probiotics were purchased from feed product Pet–Ag. Inc., 30 W 432 Rt 20, Elgin, IL 60120, USA.

El-Arish tap water was provided through an automatic nipple system. The rabbits in all groups were kept under the same managerial and hygienic

Table 1 : Experimental design of the study.

Items	Rabbit group	Number of rabbits		Season
		Growing	Doe	
Experiment I :				
Effect of mild climate on growth and reproductive traits	A	15	10	Spring
Experiment II :				
a) Effect of hot climate				
on growth and reproductive traits	B	15	10	Summer
b) Reduction of heat stress				
using the following treatments :				
1. Antibiotics :				
Avoparcin	C	15	10	Summer
Flavomycin	D	15	10	Summer
Zinc bacitracin	E	15	10	Summer
2. Probiotics :				
Bospro	F	15	10	Summer
Lacto–Sacc	G	15	10	Summer

Table 2 : Chemical composition of the experimental feedstuffs.

	Commercial concentrate feed *	Acacia leaves**
Dry matter	100	100
Organic matter	88.22	90.29
Crude protein	18.44	17.13
Crude fibre	15.33	21.55
Ether extract	3.05	5.57
Nitrogen free extract	51.40	46.04
Ash	11.78	9.71

* The commercial concentrate feed contained berseem hay 28 %, barley grain 32 %, soybean meal (44 %) 10 %, decorticated cotton seed meal 3 %, molasses 3 %, wheat bran 21 %, meat meal (60 %) 1.3 %, lime stone 1.0 %, sodium chloride 0.34 %, Vitamin and mineral mixture 0.30 %, Dl–methionine 0.05 %.

** Acacia leaves is a natural shrub vegetation in Sinai.

conditions. Doe rabbits were housed in individual cages (60 x 55 x 40 cm), while the growing rabbits were housed (2 together) in galvanized wire cages (50 x 45 x 40 cm).

Every week growing rabbits were weighed an feed consumption was recorded. Rectal temperature and respiratory rate were measured two times weekly during the experimental periods. Rectal temperature was measured by a clinical digital thermometer after one minute of insertion in the rectum. Respiration rate was estimated by the frequency of the flank movements per minute. A hand counter was used to count the flank movement frequencies. The does were mated and the pregnancy was diagnosed by abdominal palpation 10 days after service. All does were mated on day one after kindling. Does who failed to conceive were immediately remated after pregnancy testing. Conception rate, litter size at birth and at weaning, young individual weight at birth and at weaning were recorded.

Data were tabulated and subjected to statistical analysis according to SNEDECOR and COCHRAN (1982).

RESULTS AND DISCUSSION

Effect of hot temperatures on growing rabbits and reproduction

In growing rabbits (Table 3), the exposure to hot humid summer (THI was 84 ± 2) resulted in a significant decrease in daily gain by 24 %. This may be due to the reduction of concentrate intake by 18 % and the disturbance of normal body thermoregulation as observed by increasing rectal temperature and respiration rate.

Similarly, in does (Table 4) litter size at birth and at weaning, viability percentage, young individual birth and weaning weight and gain from birth to weaning significantly decreased by 17, 31, 16, 27, 19 and 18 % respectively during summer. Conception rate decreased from 74 % in spring to 57 % in summer. The present results revealed that heat stress occurs when the animal cannot lose energy quickly enough to keep its core temperature from rising and then the animal alters its physiological processes. Breathing become faster to increase evaporative heat loss from the

Table 3 : Productive traits of growing rabbits as influenced by season, antibiotics and probiotics supplementation.

Items			Summer + Antibiotics			Summer + Probiotics	
	Spring	Summer	AV	FL	ZB	BS	LS
Initial number	15	15	15	15	15	15	15
Final number (60 days later)	13	10	13	12	13	13	12
Initial body weight (g)	610 ± 53	619 ± 38	628 ± 46	639 ± 49	599 ± 41	589 ± 42	607 ± 51
Final body weight (g)	2523 ± 425	2077 ± 331	2258 ± 317	2280 ± 288	2177 ± 342	2159 ± 284	2186 ± 349
Daily body gain, g (a, b, c, e)	31.9 ± 2.9	24.3 ± 2.5	27.2 ± 2.1	27.3 ± 2.1	26.3 ± 2.1	26.9 ± 3.2	26.3 ± 4.1
Daily concentrate DM intake, g (a, b, c)	114.8 ± 9.2	93.8 ± 6.1	100.5 ± 5.4	99.8 ± 5.0	97.0 ± 8.9	96.7 ± 9.6	98.5 ± 9.4
Daily acacia DM intake, g	9.2 ± 2.0	10.2 ± 2.4	7.9 ± 2.1	8.2 ± 2.2	8.6 ± 2.4	8.0 ± 2.1	8.3 ± 2.1
Feed conversion (DM intake/gain)	3.9 ± 0.4	4.3 ± 0.4	4.0 ± 0.7	4.0 ± 0.8	4.0 ± 0.6	3.9 ± 0.7	4.1 ± 0.6
Rectal temperature °C (a)	38.9 ± 0.3	40.1 ± 0.3	39.8 ± 0.3	39.9 ± 0.3	39.8 ± 0.2	40.0 ± 0.3	39.9 ± 0.3
Respiratory rate (a, b, c, d)	52.5 ± 15.1	110.7 ± 10.9	95.4 ± 10.5	99.2 ± 11.3	100.5 ± 11.4	104.9 ± 10.3	110.0 ± 11.3

a, b, c, d, e = effects of summer, AV, FL, ZB and BS treatments, respectively (P<0.05)

Table 4 : Reproductive performance of doe rabbits as influenced by season, antibiotics and probiotics supplementation ($\bar{x}$ ± SD)

Items			Summer + Antibiotics			Summer + Probiotics	
	Spring	Summer	AV	FL	ZB	BS	LS
No of litters born	25	17	22	23	23	22	21
No of mating	34	30	33	34	35	35	34
Conception rate %	73.5	56.7	66.7	67.6	65.7	62.9	64.7
Period between 2 kindlings (days	36.6 ± 6.6	45.2 ± 11.1	39.3 ± 6.6	40.2 ± 8.5	39.2 ± 8.5	39.0 ± 8.4	39.6 ± 9.4
Litter size at birth (a) alive	7.1 ± 0.6	5.9 ± 0.9	6.5 ± 0.9	6.4 ± 0.7	6.4 ± 0.7	6.1 ± 0.7	6.2 ± 0.8
Litter size at weaning (a, b, c, d, e, f)	5.9 ± 0.6	4.1 ± 0.9	4.9 ± 0.9	4.8 ± 0.8	4.9 ± 0.7	4.7 ± 0.8	4.8 ± 0.7
Viability % (0 to 28 days) (a, b, c, d, e, f)	83.1 ± 6.1	69.5 ± 4.7	75.4 ± 4.3	75.0 ± 4.9	76.6 ± 6.1	77.0 ± 6.5	77.0 ± 6.3
Young individual birth . weight, g (a, b, c, d, e, f)	62.9 ± 7.6	45.7 ± 5.7	52.9 ± 5.0	53.4 ± 4.9	53.2 ± 5.3	51.8 ± 5.0	51.3 ± 6.1
Young individual weaning weight, g (a, b, c, d, e, f)	427 ± 39.6	344 ± 33.1	395 ± 30.8	389 ± 28.6	398 ± 33.0	380 ± 24.2	383 ± 24.2
Gain from birth to weaning, g (a, b, c, d, e, f)	363.8 ± 15.9	298.7 ± 16.7	341.9 ± 17.4	335.9 ± 14.0	344.3 ± 16.5	328.2 ± 13.4	331.2 ± 16.8

a, b, c, d, e, f = respectively : spring, AV, FL, ZB, BS treatments are significantly different from the summer group, ($P<0.05$).

nostrils and lungs. Feed intake decreases to reduce metabolic heat production. The observed impairment in production and reproductive performances of rabbits results from the disturbances in animal normal physiological processes and the decreasing in feed intake.

The role of antibiotics and probiotics in the reduction of the heat stress.

Antibiotics

Supplementation of the heat stressed growing rabbits (Table 3) with Avoparcin or Flavomycin improved daily gain significantly when compared to the non supplemented animals. This may be due to increase of the concentrate intake and decrease the heat load on animals, as observed by decreasing rectal temperature by 0.3°C and respiratory rate by 10 %. The mortality rate during experimental period decreased from 33 % to 16 % as a function of AV, FL or ZB supplementation.

Exposing the heat stressed does to AV, FL or ZB treatments, significantly improved litter size at weaning (19 %), young birth weight (16 %), young weaning weight (15 %) and gain from birth to weaning (14 %) than controls. Conception rate increased by about 18 % in supplemented animals compared to the non supplemented. It was observed that the AV, FL or ZB induce the same result in improving reproductive performance. This may be attributed to that the antibiotic which have the same mode of action, it decreased heat load, as indicated by decreasing rectal temperature and respiratory rate (Table 3), increased concentrate intake and reduced the disease effects, especially incidence on the enteritis than the control group. Moreover, antibiotics have a beneficial effects in modification of gut bacterial population (CHEEKE, 1987) and increase absorption and sparing of nutrients (GHAZALAH *et al.*, 1990).

Probiotics

Supplementation of the heat stressed rabbits with Bospro significantly increased daily gain (11 %) in growing rabbits. While, Bospro and Lacto-Sacc treatments significantly improved reproductive performances of heat stressed does. These includes litter size at weaning (16 %), young individual weight at birth (13 %) and at weaning (11 %) and gain from birth to weaning (11 %). This beneficial effect may be due to that probiotics decreased rectal temperature and respiration rate and improved feed efficiency. Probiotics reduced also the incidence of diseases and reduced mortality rate (16 %) than the control's. YAMANI *et al.* (1992) reported that probiotics supplementation improved digestibility of various nutrients, feed efficiency and daily gain of rabbits.

The present data revealed that heat stress can be reduced and production and reproduction of rabbits can be improved by substituting rations containing

antibiotics or probiotics. This may correct the decrease in feed intake through increasing absorption and sparing of nutrients and modificating the gut bacterial populations. Also, it reduces the heat load, as observed by the decrease in respiratory rate and rectal temperature. Moreover, it has a disease control effect as observed by reducing the incidence of enteritis. However, the observed improvements did not reach the levels observed in spring. This may be attributed to that the present treatments did not completely return the animals to normal physiological steady state and animals still suffer from heat stress.

In conclusion, it seems that the antibiotics and probiotics technique is a simple, safe, economical and practical method for partially decreasing the heat stress effects on rabbits and consequently improving growth and reproductive traits under hot humid climate.

Received : November 1994
Accepted : May 1995.

ADEL-SAMEE A.M., 1991. Detection of heat adaptability of growing lambs in subtropics. *Zagazig Vet. J., 19, 719-731.*

ABDEL-SAMEE A.M., 1992. The role of resorcyclic acid lactone (Ralgro) in ameliorating heat load on Egyptian buffalo (*Bubalis bubalis*) and cattle (*Bus indicus*) calves during hot summer conditions in Egypt. Alexandria *J. Agri. Res., 37, 1-18.*

ABDEL–SAMEE A.M., EL–MASRY K.A., EL–SAYIED GH.A., 1992a. Some physiological aspects of Dl–methionine or niacin in heat stressed growing rabbits. *Egypt. Poult. Sci., 2, 249-264.*

ABDEL-SAMEE A.M., KAMAL T.H, ABU-SINA G., HAGAG A.M., 1992b. Alleviation of heat load on lactating goats with the use of diuretics and driking cool water. *Beitr. Trop. Landwirtsch. Vet. Med., 30, 91-99.*

CHEEKE P.R., 1987. Rabbit feeding and nutrition. *Academic Press Inc., London.*

DE BLAS G., GARCIA J., ALDAY S., 1991. Effects of dietary inclusion of a probiotic (Paciflor) on performance of growing rabbits. *J. Appl. Rabbit Res., 14, 148-150.*

EL-MAGHAWRY A.M., TAWFEEK M.I., HABEEB A.A., 1993. Growth, liver and kidney functions and carcass traits of rabbits as affected by supplementation with Bospro under conditions of Egypt. *Egypt. J. Rabbit Sci., 3, 1-11.*

GHAZALAH A.A., BOULOS N.Z., EL-ABBADY M.R., ALI A.M., 1990. Using some antibiotics as growth promotors and their sparing effect on protein in broiler rations. *3rd Conf. Agri. Dev. Res., Faculty of Agric., Ain Shams University, Cairo, Egypt. Annals Agric. Sci., special issue, 627-649.*

HEGAZY M.A., EL-TOHAMY A.M., TELEB H.M., YOUSSEF A.H., AWADALLA S.A., 1991. Effect of Zic bacitracin on the growth and reproductive performance of rabbits. *Egyptian Soc. Anim. Reprod. Fert. 3rd Annual Congress, Cairo, 85-100.*

SNEDECOR C.W., COCHRAN W.G., 1982. Statistical Methods. *7th edition, Iowa state, University Press, Ames, USA.*

SONBOL S.M., EL-GENDY K.M., 1992. Effects of dietary probiotics on performance of weaning New Zealand White rabbits. *Egyptian J. Rabbit Sci., 2, 135-144.*

YAMANI K.A., IBRAHIM H., RASHAM A.A., EL-GENDY K.M., 1992. Effect of pelleted diet supplemented with probiotic (Lacto-Sacc) and water supplemented with a combination of probiotic and Acidifier (Acid-Pak 4-Way) on digestibility, growth, carcass and physiological aspects of weanling New Zealand White rabbits. *J. Appl. Rabbit Res., 15, 1087-1100.*