Table. *Effects of water temperature and 0·05% alcohol on mean feed intake, water intake, live-weight gain, final live-weight, gain/feed and mortality of broilers (3–8 weeks of age)*

Variable	Water treatments				ANOVA ±SED	*P*-value
	OW	CW	OWA	CWA		
Feed intake (g/b/d)	116·6	113·8	115·5	118·8	6·540	NS
Water intake (ml/b/d)	449·0	410·0	407·0	409·0	32·300	NS
Live-weight gain (g/b/d)	46·8^{c}	50·1^{b}	47·6^{c}	52·2^{a}	0·958	0·002
Gain/feed ratio	0·40	0·44	0·41	0·44	0·020	NS
Final live-weight (kg/b)	2·1^{c}	2·2^{b}	2·1^{c}	2·3^{a}	0·033	0·002
Mortality	1/30	4/30	0/30	2/30	–	–

SED, Standard Error of Difference; *P*, probability. Means in a row with different superscripts are significant ($P<0·05$).

per group (8 males/2 females) with mean initial live-weight of 450 g/bird. The birds were housed in raised-floor pens ($1·8 \times 0·9$ m $= 0·16$ m^2/bird). They were fed grower mash formulated to contain 201 g/kg CP and 12·6 MJ/kg ME based on maize, fishmeal, soybean meal and wheat bran. Feed and water were given *ad libitum*. Data collected were analysed by ANOVA using "GenStat" (8th edition).

RESULTS

Mean ambient temperature increased from 27·0 to 38·5°C during the study period with consequent increase in cloacal temperatures (42·5–43·9°C) of all the birds above their normal body temperature (41·6°C). Also, there were increases in the temperatures of the control water (25·9–31·7°C) and cooled water (19·4–24·5°C) with increasing ambient temperature. Birds given cool water or cool water with alcohol had higher ($P<0·01$) live-weight gain than control birds (Table). Also, addition of alcohol to the cool water further improved ($P<0·01$) live-weight gain of the birds; but had no effect when added to the ordinary water. However, none of the water treatments had significant ($P>0·05$) effects on feed intake and feed efficiency (Table). Birds given cool or alcohol-treated water drunk less ($P>0·05$) water (Table).

CONCLUSIONS

Provision of cool drinking water during the hot dry season in the Guinea Savanna zone had a beneficial effect on growth of broilers. Addition of alcohol at low concentration in cool drinking water had beneficial effects on heat dissipation of broilers in a hot climate and improved their growth performance.

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Effects of divercin on gastrointestinal microflora and performance of broiler chickens

D. JÓZEFIAK, S. KACZMAREK, A. RUTKOWSKI and A. SIP

Poznań University of Life Sciences, Poznań, Poland

INTRODUCTION

In the post antibiotic growth promoters era, many strategies have been proposed to eliminate pathogenic microbiota from poultry gastrointestinal tract (GIT). This includes probiotics, prebiotics, organic acids, essential oils etc. (Rehman *et al.*, 2007). However, little is known about bacteriocins, which are extracellularly released, proteinaceous compounds lethal

Table. *The effects of divercin on performance and gastrointestinal microflora of broiler chickens*

Treatment	BWG			FCR			FI		
	1–14	14–35	1–35	1–14	14–35	1–35	1–14	14–35	1–35
C	303	1360	1663	1·55	1·67	1·63[a]	468	2268	2736
D	319	1412	1731	1·49	1·67	1·58[b]	476	2314	2790
P-value	NS	NS	0·058	NS	NS	0·047	NS	NS	NS
	pH			Lactic acid bacteria., log cfu g^{-1} digesta			Enterobacteriaceae, log cfu g^{-1} digesta		
	Crop	Ileum	Caeca	Crop	Ileum	Caeca	Crop	Ileum	Caeca
C	3·94[b]	5·14	5·78[a]	7·94[b]	8·53	7·66[a]	7·08	6·28	7·71
D	4·31[a]	5·55	5·52[b]	7·41[a]	8·00	6·95[b]	6·55	6·04	7·13
P-value	0·011	0·001	0·043	0·049	NS	0·051	NS	NS	0·09

[a,b]Corresponding values with different superscripts are significantly different at $P < 0.05$.

to bacteria other than the producing strain (Joerger, 2003). The present study was undertaken to evaluate the potential effects of bacteriocin – divercin, produced by lactobacilli strain *Carnobacterium divergens* S1-KKP on microflora status and performance of broiler chickens.

MATERIALS AND METHODS

A total of 300 male broiler chickens (Ross 308) were included in a feeding experiment. The study design consisted of two dietary treatments, control (C)-unsupplemented and divercin supplemented (D) one, with 15 replicates each. The experimental group (D) received diets with 200 AU ml^{-1} of divercin. The AU/ml-bacteriocin titre was expressed in activity units per militer (Arbitrary Units, AU/ml) by the critical dilution assay. The titer was defined as the reciprocal of the highest dilution showing definite inhibition zone. Over the entire experimental period (d 1–35), the animals were provocative diets in terms of stimulation of *Clostridiacae* bacteria fed *ad libitum*. The feed intake and body weight were registered at weekly intervals, and the feed conversion ratios (FCR) and body weight gains (BWG) were calculated. In last day of the fifth week of the experiment, for counting microflora, 21 male chickens, were slaughtered. Immediately after slaughter, fresh samples of digesta from the crop, ileum and caeca were pooled (5 g per sample) into 7 replications per each segment and. Subsequently, the samples were serially diluted in 10-fold steps using pre-reduced salt medium. Lactic acid bacteria were counted on de Man Rogosa and Sharp agar after anaerobic incubation at 39°C for 2 d. *Enterobacteriacae* were counted on MacConkey agar after aerobic incubation at 39°C for one day. Statistical differences between treatments were calculated by analysis of variance using the GLM procedure of SAS (Sas/Stat, 1998). Differences among treatment means were determined using a Duncan means comparison when the significance of the model was $P < 0{\cdot}05$.

RESULTS

In general the performance of the broiler chickens was not significantly affected by the divercin supplementation (Table), although throughout the trial trend in better body weight gains as well feed conversion was observed (Table). Only final FCR was improved by divercin supplementation. The value of the pH was higher in the crop contents ($P = 0{\cdot}001$) and lower in the caeca ($P = 0{\cdot}043$) in D treatment. Irrespective of the used agars and segments of the gastrointestinal tract the tendency in lower bacterial counts were marked. However only in crop and caeca significantly lower lactic acid bacteria were counted after divercin supplementation.

CONCLUSION

The divercin improves feed utilisation and may change pH level and GIT microflora profiles in broiler chickens, even in lower segments (i.e. caeca) which should be not targeted due to peptide structure of this bacteriocin. The effects of divercin on performance of the broiler chickens need further investigations.

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