

EFFECT OF REPLACING INORGANIC TRACE MINERALS WITH GLYCINATES ON SEMEN CHARACTERISTICS OF AGEING ROOSTERS DURING A HEAT STRESS PERIOD

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Resumo: The trial was conducted to evaluate the effects of replacing 50% of the inorganic trace minerals in the diet via organic trace minerals (glycinates) in diets of ageing roosters (50 weeks old), before and during a six-week-heat stress period. A total of 24 male broiler breeder Arbor Acres were divided in two experimental groups: ITM (premix with 80 ppm Zn, 10 ppm Cu, 80 ppm Mn and 50 ppm Fe-Sulfates in the final feed); GLY (50% of ITM replaced with Zn, Cu, Mn and Fe-Glycinates as organically bound trace minerals). Semen sperm characteristics were measured every two weeks (61, 63, 65): semen volume, sperm count, sperm progressive move, sperm viability, and immotile sperm. There were no statistical differences ($p>0.05$) in the sperm volume between the treatments. Throughout the evaluation period, sperm counts were improved significantly ($p<0.05$) in the GLY group. Sperm viability was significantly improved ($p<0.05$) in the GLY group during the evaluation period. Immotile sperm were significantly reduced ($p<0.05$) in the GLY group. Sperm progressive move was significantly greater ($p<0.05$) at 61 and 63 weeks in the GLY group. In conclusion, the inclusion of glycinates replacing 50% inorganic trace minerals in the diet of roosters during heat stress period improved semen characteristics.

PalavrasChaves: male broiler breeder; organic trace minerals; reproductive performance; sperm viability.

EFEITO DA SUBSTITUIÇÃO DE MICROMINERAIS INORGÂNICOS POR GLICINATOS SOBRE AS CARACTERÍSTICAS ESPERMÁTICAS DE GALOS EM IDADE AVANÇADA DURANTE PERÍODO DE ESTRESSE TÉRMICO

Abstract: O estudo foi realizado com o objetivo de avaliar os efeitos da substituição de 50% dos microminerais inorgânicos da dieta por microminerais orgânicos (glicinatos) em dietas de machos reprodutores de frangos de corte (50 semanas de idade), antes e durante um período de estresse térmico de seis semanas. Um total de 24 galos da linha Arbor Acres foram divididos em dois grupos experimentais: ITM (80 ppm de Zn, 10 ppm de Cu, 80 ppm de Mn e 50 ppm de Fe na ração final, como fonte sulfatos); GLY (50% de ITM substituído por Zn, Cu, Mn e Fe-glicinatos). As características espermáticas foram avaliadas a cada duas semanas (61, 63, 65): volume de sêmen, contagem de espermatozoides, motilidade e viabilidade. Não houve diferenças estatísticas ($p>0,05$) no volume de sêmen entre os tratamentos. Ao longo do período de avaliação, a contagem de espermatozoides e a viabilidade melhoraram significativamente ($p<0,05$) no grupo GLY ($p<0,05$). A quantidade de espermatozoides imóveis foi reduzida ($p<0,05$) e a motilidade espermática foi melhorada ($p<0,05$) no grupo GLY. Conclui-se que a inclusão de glicinatos em substituição a 50% de minerais inorgânicos na dieta de galos durante período de estresse térmico melhorou as características espermáticas.

Keywords: reprodutor de frangos de corte; minerais orgânicos; desempenho reprodutivo; viabilidade espermática.

Introdução: Environmental stressors like extreme cold or heat and humidity can lead to a reduced sperm quality in male breeders (Shanmugam et al., 2012). Dietary interventions with trace minerals have been studied for their positive effect on performance in breeding hens (Smith and Akinbamijo, 2000). However, there is little research on the influence of trace elements on the reproductive parameters of male breeders. Zinc deficiency may lead to impairment in reproductive function, as this mineral is a vital component of enzymes involved in steroidogenesis. Zinc and manganese also play a role in membrane stability and mechanical properties of tail morphology and increased sperm motility (Chesters, 1978). Organic trace minerals, often called chelates, are characterized by a higher bioavailability and supports efficiently high-performing breeder genetics. The aim of the study was to evaluate the effects of trace minerals as glycine chelates on sperm characteristics in ageing roosters.

Material e Métodos: Animals in this study were raised and treated according to the INTERNATIONAL COUNCIL FOR LABORATORY ANIMAL SCIENCE covering the accommodation and care of animals used for experimental and other scientific purposes. A total of 24 male broiler breeder Arbor Acres aged 50 weeks (average initial body weight: 5.40 kg) were divided in two experimental groups, individually housed in cages per bird. Experimental treatments were as follows: 1. ITM (premix with 80 ppm Zn, 10 ppm Cu, 80 ppm Mn and 50 ppm Fe-Sulfates in the final feed), and 2. GLY (50 % of ITM replaced with Zn, Cu, Mn and Fe-Glycinates as organically bound trace minerals (E.C.O.Trace®, Biochem Zusatzstoffe Handels- und Produktionsgesellschaft mbH). The duration of the study was 15 weeks, with a six-week heat stress period (\bar{O} $31\pm0.53^{\circ}\text{C}$ and 35% humidity) from week 60-65. All birds were offered 145 g of feed / day from 50 to 60 week and 150 g of feed / day from 60 to 65 week according to the Arbor Acres manual guideline (Arbor Acres Plus Parent stock objectives, 2021). Birds consumed all daily feed and did not differ between treatments. Water was provided ad libitum. Neat semen from broiler breeder males was collected during the heat stress period (from 60 wk. until 65 wk. old) and pooled every two weeks for analyses. Statistical analyses were conducted by one-way ANOVA and Tukey Test (post hoc) by using Minitab software ver. 18.0, differences were considered significant if $p<0.05$.

Resultado e Discussão: There were no statistical differences ($p>0.05$) in the sperm volume between the treatments. Throughout the evaluation period, sperm counts were improved significantly ($p<0.05$) in the GLY group. There was an improvement ($p<0.05$) in the sperm progressive move in the GLY group at 61 and 63 wk. Viable sperm cells was also

improved ($p < 0.05$) in the GLY vs. ITM group. Immotile sperm cells were reduced significantly in the GLY group ($p < 0.05$) (Table 1). These results demonstrate that roosters fed with glycines, in a replacement of 50% of the inclusion of ITM may cope better with the negative effects of high temperatures on semen characteristics in broiler male breeders. High temperature influence fertility parameters in broiler breeder (Boone and Hudson, 1963) and can increase the cellular reactive oxygen species (ROS) levels resulting in an impairment of antioxidant activities. Due to the abundance of polyunsaturated fatty acids in the plasma membrane and cytoplasm of sperm cells, makes it vulnerable to the attack of ROS (Alvarez and Storey, 1995). This can result in lipid peroxidation, cell damage and a detrimental in sperm motility, gamete numbers and consequently fertility (McDaniel et al., 1998). Organic trace minerals like Zn, Cu, and Mn, are consider important antioxidants, due to their involvement in different reproductive, and enzymatic processes with greater absorption than inorganic forms. In the present trial roosters fed with glycines presented improved semen parameters than those fed with ITM, indicating a higher absorption and bioavailability.

Table 1. Semen and sperm characteristics.

Parameter				
Semen Volume (cc)	ITM	GLY	P-value	SEM
61 wk.	0.97	0.74	ns	0.069
63 wk.	0.83	0.89	ns	0.066
65 wk.	0.68	0.69	ns	0.081
Sperm count (million/ml)				
61 wk.	2494.2 ^b	3069.3 ^a	<0.05	72.6
63 wk.	2434.6 ^b	3184.7 ^a	<0.05	87.1
65 wk.	2299.8 ^b	2918.0 ^a	<0.05	90.6
Sperm progressive move (%)				
61 wk.	2.9 ^b	12.5 ^a	<0.05	2.29
63 wk.	18.2 ^b	31.6 ^a	<0.05	1.51
65 wk.	28.6	39.8	0.06	2.96
Immotile sperm (%)				
61 wk.	59.9 ^a	47.2 ^b	<0.05	1.02
63 wk.	26.4 ^a	8.1 ^b	<0.05	2.37
65 wk.	14.5 ^a	7.9 ^b	<0.05	1.05
Sperm viability (%)				
61 wk.	44.7 ^b	52.3 ^a	<0.05	0.92
63 wk.	43.3 ^b	49.7 ^a	<0.05	0.75
65 wk.	40.0 ^b	46.3 ^a	<0.05	0.70

^{a-b} Values within a row with different superscripts letters are significantly different ($p < 0.05$). ns= non-significant at ($p > 0.05$).

Conclusão: Broiler male breeders fed a replacement of 50 % inorganic trace minerals through glycines in the diets can deal better with the negative effect of high temperatures on semen characteristics by significantly improving viability, sperm progressive move, sperm count and reducing sperm immotile.

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