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饲料叶酸对鹅生长性能、血清生化指标和酶活性及肝脏亚甲基四氢叶酸还原酶基因表达量的影响

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Dietary Folic Acid Level Affects Growth Performance, Serum Biochemical Parameters, Enzyme Activity and *MTHFR* Gene Expression of Geese

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摘要 本试验旨在通过探讨饲料叶酸水平对1~15周龄鹅生长性能、血清生化指标和酶活性及肝脏亚甲基四氢叶酸还原酶(*MTHFR*)基因表达量的影响,以确定在育雏期(1~4周龄)、育成期(5~15周龄)鹅饲料中叶酸的适宜添加水平。试验选用1日龄青农灰鹅360只,随机分为6个组,每组6个重复,每个重复10只鹅。试验鹅分别饲喂在基础饲料中添加0(对照组)、1、2、4、8、16 mg/kg叶酸的试验饲料。试验期15周。结果表明:1)饲料添加叶酸能显著或极显著提高1~4周龄鹅平均日增重($P<0.05$ 或 $P<0.01$),显著降低1~4周龄鹅料重比($P<0.05$),降低死淘率。2)饲料添加叶酸能显著降低1~4周龄鹅血清葡萄糖含量($P<0.05$),显著提高1~4周龄鹅血清甘油三酯含量($P<0.05$)。饲料添加8 mg/kg叶酸可显著降低1~4周龄鹅血清尿素氮含量($P<0.05$);添加16 mg/kg叶酸可显著降低5~15周龄鹅血清尿素氮含量($P<0.05$)。饲料添加2~16 mg/kg叶酸可显著降低1~4周龄和5~15周龄鹅血清同型半胱氨酸含量($P<0.05$)。3)饲料添加1、2 mg/kg叶酸可显著提高1~4周龄鹅血清MTHFR活性($P<0.05$),显著降低血清二氢叶酸还原酶(DHFR)活性($P<0.01$, $P<0.05$),添加2 mg/kg叶酸可显著降低血清草酰转氨酶和乳酸脱氢酶活性($P<0.05$)。饲料添加2 mg/kg叶酸可显著提高5~15周龄鹅血清MTHFR活性($P<0.05$)。4)1~4周龄,*MTHFR*基因表达量与MTHFR活性显著正相关($P<0.05$),与DHFR活性显著负相关($P<0.05$);5~15周龄,*MTHFR*基因表达量与MTHFR和谷丙转氨酶活性显著负相关($P<0.05$)。由以上结果可知:1)根据生长性能建立的回归方程得出,建议鹅饲料中育雏期叶酸添加水平为2.45 mg/kg,育成期添加水平为2.08 mg/kg;添加叶酸可降低死淘率;2)叶酸水平对鹅血清生化指标和酶活性有重要的调控作用;3)叶酸对鹅肝脏中*MTHFR*基因的表达量有直接影响,*MTHFR*基因表达量与MTHFR、DHFR和谷丙转氨酶活性密切相关。

关键词: 叶酸 鹅 生长性能 血清生化指标 酶活性 *MTHFR*基因表达量

Abstract: This experiment was conducted to study the effects of dietary folic acid level on growth performance, serum biochemical parameters and enzyme activity and methylenetetrahydrofolate reductase (*MTHFR*) gene expression of geese, and to determine the folic acid optimum supplemental level of geese aged 1 to 4 weeks (brooding period) and 5 to 15 weeks (finishing period). Three hundred and sixty 1-day-old *Qingnonghui* geese were randomly selected and divided into 6 groups with 6 replicates per group and 10 geese per replicate. Geese in the six groups were fed the basal diet supplemented with 0 (control), 1, 2, 4, 8 and 16 mg/kg folic acid, respectively. The experiment lasted for 15 weeks. The results showed as follows: 1) dietary folic acid significantly increased average daily weight gain of geese aged 1 to 4 weeks and 5 to 15 weeks ($P<0.05$, $P<0.01$), significantly decreased feed to gain of geese aged 1 to 4 weeks ($P<0.05$), and reduced mortality rate. 2) Dietary folic acid significantly decreased serum glucose content of geese aged 1 to 4 weeks ($P<0.05$), and significantly increased serum triglyceride content ($P<0.05$), and the supplementation of 8 mg/kg folic acid significantly decreased serum urea nitrogen content ($P<0.05$). The supplementation of 16 mg/kg folic acid significantly decreased serum urea nitrogen content of geese aged 5 to 15 weeks ($P<0.05$). The supplementation of 2 to 16 mg/kg folic acid significantly decreased serum homocysteic acid content of geese aged 1 to 4 weeks and 5 to 15 weeks ($P<0.05$). 3) The supplementation of 1 and 2 mg/kg folic acid significantly increased serum MTHFR activity of geese aged 1 to 4 weeks ($P<0.05$), and significantly decreased serum dihydrofolate reductase (DHFR) activity ($P<0.01$ or $P<0.05$), and the supplementation of 2 mg/kg folic acid significantly decreased serum glutamic-oxaloacetic transaminase and lactate dehydrogenase activity ($P<0.05$). The supplementation of 2 mg/kg folic acid significantly increased serum MTHFR activity of geese aged 5 to 15 weeks ($P<0.05$). 4) In the brooding period, the *MTHFR* gene expression was significantly positive

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correlation with MTHFR activity ($P < 0.05$), and significantly negative correlation with DHFR activity ($P < 0.05$). In the finishing period, the MTHFR gene expression was significantly negative correlation with MTHFR and glutamic pyruvic transaminase activity ($P < 0.05$). It is conclusion that: 1) according to the regression equation between growth performance and dietary folic acid level, the suggestion of optimum dietary folic acid level is 2.45 mg/kg in brooding period, and 2.08 mg/kg in finishing period. Dietary folic acid can decrease mortality rate. 2) Dietary folic acid level has an important role in the regulation of serum biochemical parameters and enzyme activity. 3) Folic acid has a direct impact on MTHFR gene expression in geese liver, and MTHFR gene expression is closely related to the activities of MTHFR, DHFR and glutamic pyruvic transaminase.

Keywords: folic acid, geese, growth performance, serum biochemical parameters, enzyme activity, MTHFR gene expression

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