DEVELOPMENT OF OPERATIONAL STRATEGIES TO ENHANCE TOLERANCE TO ENVIRONMENTAL STRESSORS

I. Zulkifli, A.H. Ramlah and M.K. Vidyadaran

Faculty of Agriculture
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia

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Introduction

Poultry environments under modern production systems are comprised of an array of factors that may stress chickens. Birds respond by altering various physiological, behavioural and immunological mechanisms, which may impede animals' productivity, health and overall welfare. Many techniques to improve tolerance against stressors have been evaluated. However, findings have been variable. Several factors, including climate, nutritional status, inter- and intra-population genetic variations and husbandry procedures may lead to discrepancies in results obtained. With an expanding poultry industry in Malaysia, it is essential that research be conducted on procedures to reduce the deleterious effects of stresses on the well being and production performance of poultry under local production systems and environment. The objectives of the project were: (a) to determine various methods of increasing tolerance to environmental stressors and eliciting acclimation in poultry; and (b) to define the relationship of stress response, habituation, production and health in poultry.

Materials and Methods

This project can be categorised into two major sub-projects. (1) Thermal stresses. Genetic variations to climatic fluctuations were evaluated according to chronological and physiological ages. The effect of dietary supplementation of ascorbic acid, chromium, antibiotic and probiotic on heat resistance were determined. Prior experience and adaptation to thermal stressors were studied. The effects of feeding practices on heat resistance were also evaluated. Broiler chicks were exposed to various degree of stress during the neonatal stage to study the ability of acclimation at alter ages particularly prior marketing. Physiological and cellular (heat-shock protein 70 response) modifications were investigated. Various physiological, haematological, anatomical, immunological and production performance were used to assess heat tolerance. (2) Management-related stresses. Management procedures such as feed and water restrictions, lighting programme, transportation and handling may result stress response. Thus, the project evaluated the effects of those practices on physiology, immunity, welfare and production performance.

Results and Discussion

(1) Based on physiological and behavioural parameters, at a common age (8 weeks), red jungle fowl were more heat tolerant than commercial broiler chickens. However, at a common body weight (1000 ± 150 g), both breeds responded similarly to heat treatment. These findings suggest that innate differences in heat tolerance between breeds could be confounded with differences in body weight. While heat stress had no effect on fear response, red jungle fowl were more fearful than their commercial broiler counterparts. (2) Dietary self-selection of ascorbic acid (AA) was inadequate to provide AA for the birds physiological requirement and AA at the dosage of 2500 mg/kg improved growth, feed efficiency, immunity and liveability of heat-stressed broilers. (3) Suppression of growth and antibody response in heat-stressed broiler chickens could be alleviated by continuous supplementation of oxytetracycline (0.05 g/kg). Administration of Lactobacillus (I g/kg) as probiotic had negligible effect on heat tolerance. (4) Daily short-term fasting which induced behavioural and physiological changes enhanced productivity and antibody response to Infectious Bursal Disease vaccinations. (5) Broiler chicks subjected to 60% feed restriction at 4, 5 and 6 days of age had improved heat shock protein (HSP) 70 expression, growth, antibody response to Newcastle Disease vaccinations and liveability compared to those that were fed ad libitum throughout the study in response to heat treatment at later ages. These results suggest that neonatal fasting evoked heat tolerance later in life through enhanced response of HSP 70. (6) While daily water restriction had no detrimental effect on broiler breeder chickens during the growing stage, egg production and liveability were adversely affected during the laying period. Thus, there is a possibility that limiting the water intake of broiler breeders under the hot and humid tropical conditions could be practised during the growing period without deleterious effects. (7) Continuous lighting augmented stress and fear responses in broiler chickens, and less economic when compared to 12 hours of daylength. (8) Although pretreatment for a minimum of 24 h with 1, 000 ppm of ascorbic acid failed to ameliorate the physiological stress response attributed to handling, cooping and transportation, the procedure markedly reduced fear-related behaviour. These findings suggest that ascorbic acid supplementation may reduce underlying, non-specific fearfulness in poultry. The precise mechanisms underpinning the phenomenon are unclear.

Conclusions

Although the adoption of intensive production systems for poultry has resulted in remarkable increase in productive efficiency, they may also impose costs on the well being of animals. Physiological, immunological, behavioural and anatomical alterations in response to acute and chronic stressors may seriously harm an animal's welfare, management, performance and profitability. Thus, it is obviously desirable that the incidence of stressful situations should be reduced. Nutritional factors, feeding practices, neonatal stimulation (through improved heat-shock protein response) are of cardinal importance in combating the deleterious effects of stress in poultry.

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