Performance, immunity, and physiological responses of broilers to dietary energy and protein sequential variations

S. S. Ale Saheb Fosoul,* 1 M. Toghyani,‡ A. Gheisari,† S. A. Tabediyani,‡ M. Mohammadrezaei,§ and A. Azarfar#

* Young Researchers and Elite Club, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran; †Department of Animal Science, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran; ‡Department of Animal Science, Isfahan Agricultural Research Center, Isfahan, Iran; §Department of Animal Science, University of Mohaghegh Ardabili, Ardabil, Iran; and #Department of Animal Science, Lorestan University, Khorraramabad, Iran

ABSTRACT The current trial was designed to examine effects of sequential feeding of diets varying in energy and protein contents on performance, gut development, welfare indices, and immune responses of broiler chicks. A total of 240 one-day-old broiler chicks (Ross 308) were randomly allotted to 4 treatments with 5 replicates in a completely randomized design. Sequential feeding was evaluated in 48-h cycles during 8 to 28 d of age. Diets varied in energy (E+ = 3,210 kcal/kg and E− = 2,790 kcal/kg) and protein (P+ = 25.14% CP and P− = 16.76% CP) contents. The 4 feeding programs were: control (ME: 3,000 kcal/kg, CP: 20.95%); P+/P− (P+ followed by P− containing 3,000 kcal/kg energy); E−/E+ (E− followed by E+ containing 20.95% CP), and E−P+ / E+E− (E−P+ followed by E+E−). The experiment lasted 42 d and birds were fed by a standard finishing diet from d 28 to 42. Broilers fed on E−/E+ and E−P+/E+E− had lower daily feed intake than control ones during 8 to 28 d of age (P < 0.05), while daily weight gain and feed conversion ratio were not affected significantly. Footpad dermatitis was lower in birds sequentially fed E−/E+ and E−P+/E+E− at 35 d of age (P < 0.05). Sequential feeding of diets varying in either energy or protein or both increased duration of tonic immobility at d 39 of age (P < 0.05). Feeding with E−/E+ regime decreased jejunal crypt depth, while feeding P+/P− regime increased villus height and crypt depth in the duodenum and ileum (P < 0.05). However, no relationship was found between intestinal morphology and growth performance of broiler chicks. Antibody production against sheep red blood cells as well as Newcastle and influenza disease viruses was not affected by sequential feeding. In conclusion, digestive organs and intestinal morphology might be adjusted to energy and protein variations. Sequential feeding increased the fear level in chickens.

Key words: broilers, sequential feeding, gut development, immune responses, welfare

INTRODUCTION Nowadays, the broiler chicken industry has seen enormous improvements in commercial production. However, increased daily feed intake (DFI) and skeletal disorders are the other side of progress in growth performance of chickens (Robinson et al., 1992). It has been proposed that birds need diurnal nutritional changes across their production period because their requirements alter gradually with age, and each diet could be properly balanced for a particular time period (Watkins et al., 1993). Thus, different feeding programs have been developed by nutritionists to improve the efficiency of production in broilers (Shariatmadari, 2012).

Sequential feeding is a feeding regime based on providing diets of varying contents on consecutive cycles (Gous and Du Preez, 1975). This schedule has been applied to enhance locomotor activity of chicks through early growth reduction and consequently to ameliorate their welfare condition (Bizeray et al., 2002; Leterrer et al., 2006, 2008). Nevertheless, sequential feeding of diets either moderately rich in protein or energy fed across 48-h cycles had no weight reducing impact on broiler chicks (Bouvarel et al., 2004). Similar growth performance and carcass composition in the control group also was observed, when birds received diets containing various energy and protein contents (Bouvarel et al., 2008a). Otherwise, Leterrer et al. (2008) indicated that feeding diets alternating in energy and protein levels during 8 to 28 d of age resulted in early growth reduction of chicks, owing to decreased DFI and unbalanced feed consumption. Also, the feed preference of broilers under a sequential feeding program, which

http://dx.doi.org/10.3382/ps/pew084

© 2016 Poultry Science Association Inc.
Received August 25, 2015.
Accepted January 31, 2016.
*Corresponding author: sadra.sahebfosoul@gmail.com