Effects of Dietary Arsenic Levels on Serum Parameters and Trace Mineral Retentions in Growing and Finishing Pigs

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Received September 9, 2005; Revised January 13, 2006; Accepted February 6, 2006

ABSTRACT

This experiment was conducted to investigate the effect of dietary arsenic (As) levels on growth performance, serum biochemistry, and the retention of iron, copper, and zinc in tissues of growing and finishing pigs. Ninety-six crossbred pigs were randomly allotted to four dietary treatments. The corn–soybean basal diets were supplemented with 0, 10, 20, and 30 mg As/kg. Arsenic trioxide was used as the arsenic source. The feeding experiment lasted for 78 d. The results showed that the high arsenic diet decreased average daily gain (ADG) \((p<0.05)\) and increased feed gain ratio (F/G) \((p<0.05)\). Arsenic intake significantly increased \((p<0.05)\) serum \(\gamma\)-gultamyltransferase (GGT), glutamic-pyruvic transaminase (GPT), and alkaline phosphatase (ALP) activities, and decreased \((p<0.05)\) total protein, urea nitrogen, creatinine, and triglycerides. Glutamic-oxalacetic transaminase (GOT) activity, albumin, and cholesterol were not affected \((p>0.05)\). Arsenic feeding elevated \((p<0.05)\) liver and kidney copper concentration, but reduced \((p<0.05)\) copper concentration in heart, bile, and lymphaden of intestine mesentery. There were increases in iron levels in liver, bile, spleen, thymus, and pancreas in pigs fed the high As diets \((p<0.05)\), but iron contents in kidney, heart, and serum were decreased by the arsenic treatment \((p<0.05)\). Zinc concentrations were increased \((p<0.05)\) in liver, kidney, and thymus of pigs with arsenic treatment, but decreased \((p<0.05)\) in bile and lymphaden of intestine mesentery. This study suggested that high dietary

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As levels could alter serum biochemical parameters and the retention of copper, iron, and zinc in the viscera of growing and finishing pigs.

**Index Entries:** Arsenic; growing and finishing pigs; serum parameters; trace mineral retention.

**INTRODUCTION**

Arsenic (As) is a metalloid found in water, soil, and air from natural and anthropogenic sources (1). Arsenic occurs in both organic and inorganic forms in nature, but the inorganic form is more toxic and represents a potential threat to the environment, human health, and animal health. Exposure to high levels of inorganic arsenic has been found to be causally associated with a variety of acute and chronic adverse health effects, including cancers. Non-cancer effects are degenerative inflammatory and neoplastic changes of the skin and respiratory, gastrointestinal, haematopoietic, cardiovascular, nervous, hepatic, endocrine and renal systems; as well as cancer end points typically in skin, lung bladder and liver (2,3).

Administration of a relatively high dosage of As could affect animal performances and serum clinical parameters. High As intake decreased weight gains of weanling pigs, broilers, and rats (4–7) and altered serum clinical chemistry profiles of rats (7–9). However, little data have been reported in growing and finishing pigs.

The interaction between essential and toxic metals is a significant aspect of trace metal nutrition and metabolism. Studies showed that As could interfere with the transport and metabolism of many essential trace minerals, such as iron, zinc, and copper (7,10–14). However, most studies have focused on a single trace mineral–trace mineral interaction, especially on arsenic–copper interaction, and the mechanisms of both As absorption and the way in which other trace minerals interfere with this process is still unclear. Generally, ample daily dietary intakes of iron, copper, and zinc would occur in domestic animal feed at present. Very little work has been done in examining the interactions between As loading levels and copper, iron, and zinc retentions in growing and finishing pigs.

Thus, this study was conducted to examine the effects of dietary arsenic levels on performance, serum clinical parameters, and the visceral retention of iron, copper, and zinc in tissues of growing and finishing pigs.

**MATERIALS AND METHODS**

Ninety-six Duroc–Landrace–Yorkshire crossbred pigs (48 barrows and 48 gilts, respectively), with an average body weight of 30.6±1.35 kg, were randomly assigned to four different dietary treatments. Each of these groups consisted of three replications (i.e., pens) with eight pigs per repli-