TRANSIENT STRAY VOLTAGE: IS IT DETRIMENTAL TO GROWTH PERFORMANCE, HEALTH STATUS AND WELFARE OF MARKET PIGS?

L. GODCHARLES1, S. ROBERT2, J.J. MATTE2, J. BERTIN-MAHIEUX3 AND G.-P. MARTINEAU1

1Faculté de Médecine Vétérinaire, Université de Montréal, St-Hyacinthe, Québec, Canada, J2S 7C6;
2Research Station, Agriculture Canada, PO Box 90, 2000 Road 108 East, Lennoxville, Québec, Canada, J1M 1Z3;
3Hydro-Québec, Montréal, Québec, Canada, H5B 1H7.

Requests for reprints should be addressed to S. Robert. Contribution No. 405

ABSTRACT


The effects of transient stray voltage associated with an alternating current were evaluated in growing-finishing pigs from 9 to 22 weeks of age. Seventy-two pigs were assigned to 9 blocks of 8 animals each. In each block, the following treatments were randomly distributed: a constant voltage differential created between the feeder or drinker and the metallic floor (woven wire), at a level of 0 volt plus 2-volt pulses (0 V-2 V'), 2 volts plus 3-volt pulses (2 V-5 V), 5 volts plus 3-volt pulses (5 V-8 V'), and a control treatment without any voltage differential (0 V-0 V). The constant voltage was applied 24 h per day. The pulses of 3 s duration were in the form of an increase in the amplitude of the constant 60-Hz signal. One pulse appeared every 20, 40 and 100 s during the hour following feed distribution and every 60, 120 and 300 s during the rest of the day. The animals were fed ad libitum and received fresh feed twice per day. Once during the 2-week periods at 9-10, 13-14, 17-18 and 21-22 weeks of age, the behaviour of the pigs was recorded during the hour following the two daily feed distributions. Animal weights and blood samples were taken every 2 weeks, from 9 to 21 weeks of age. No significant effect of transient stray voltage on any of the variables measured for the feeding, drinking, sitting or lying activities was found (p >0.05). At 9-10 weeks of age, the number of rooting bouts was higher for the 5 V-8 V treatment (p=0.03) and the number of events of butting the penmate was higher for the 2 V-5 V treatment (p=0.05). Although the water and feed intake did not differ between treatments (p>0.39), the average daily gain of the control group was lower than that of treated groups (p=0.04) at 9 and 10 weeks of age, while the pigs submitted to a 2 V-5 V treatment had a higher daily gain than the pigs in the other treatment groups (p=0.05) at 17 and 18 weeks of age. Finally, the frequency of gastric ulceration and the metabolic profile were not affected by the treatments (p>0.05) except for the CO2 and total protein concentrations (p<0.04), where treatment effects were inconsistent among ages. Consequently, under the experimental conditions of the present study, no major impact of transient stray voltage on the health, growth or welfare of fattening pigs was observed.

Keywords: behaviour, electricity, growth, health, pigs, transient stray voltage

INTRODUCTION

Stray voltage is a known problem in farm animal production. It can occur when a voltage differential exists between two points (metal structures and floor or earth) that may be touched at the same time by an animal. The voltage required to create a
response in farm animals will vary according to various characteristics. Stray voltage can be associated with either a direct or an alternating electric current, although alternating current is the most discussed form (Stetson et al., 1981; Zdrojewski and Davidson, 1981; Gustafson et al., 1985). Exposure to stray voltage can be constant or intermittent, the latter being the most frequent on the farm (Aneshansley et al., 1988). Intermittent exposure to an alternating current has been reported as being the most bothersome type of stray voltage (Kirk and Reese, 1982; Appleman and Gustafson, 1985; Gustafson et al., 1985).

The response of an animal to stray voltage is also known to be influenced by the resistance at the contact points and the body resistance, which varies with the species, age, weight, size, physiological condition of the animal and the pathway of the current (Kirk and Reese, 1982; Norell et al., 1983; Hultgren, 1990a; Matte et al., 1992). In pig production, the mouth-to-hooves pathway is the most likely one. When stray voltage is present, field reports mention reluctance by pigs to drink from waterers, reduction in appetite, restlessness, nervousness, increases in aggressive encounters, piglets being crushed, poor weaning performance and various health disorders (Stetson et al., 1981; Gillespie, 1984; Wright et al., 1985). Unfortunately, these responses are not specific to stray voltage and can also result from health, management or nutritional disorders. From the few scientific works that have been published, it has not been possible to relate stray voltage to poor production performance by pigs. Working with an alternating current and constant exposure, Gustafson et al. (1986) demonstrated that voltages of 2.8 V and 3.6 V were required to affect drinking time and water consumption, respectively, for growing pigs weighing 80–90 kg. Robert et al. (1991, 1992), using an alternating current and constant voltage exposure, found that voltages of 5.0 and 8.0 V will affect the drinking and eating patterns of pigs, particularly at the end of the fattening period in restricted-fed pigs. In both studies, stray voltage had no major impact on growth performance, health or aggressivity in the groups.

One hypothesis for the few responses by these animals was that they may adapt to a continuous source of voltage (Robert et al., 1991, 1992). Therefore, the present experiment was undertaken to determine the effects of transient stray voltages on the behaviour, health and growth performance of fattening pigs.

MATERIALS AND METHODS

Animals and experimental design

This experiment was conducted at Agriculture Canada's research station in Lennoxville, Quebec. Seventy-two 8-week-old piglets (Yorkshire × Landrace) weighing 14–27 kg were grouped by range of body weight in 9 blocks of 8 pigs each. Each block consisted of 4 cages of 2 pigs. Each 1.2-m × 1.2-m cage had a metallic feeder and a metallic drinking nipple connected by a plastic tube to a calibrated bottle; the floor of woven wire was isolated from the rest of the cage, so permitting a voltage differential to be created between the floor and the feeder or the drinking nipple. The following treatments were randomly distributed within each block: constant voltage differential of 0 volt plus 2-volt pulses (0 V–2 V), 2 volts plus 3-volt pulses (2 V–5 V), 5 volts plus 3-volt pulses (5 V–8 V) and a control treatment without any voltage differential (0 V–0 V). The voltages were chosen to reflect the normal