

Serum Creatine Kinase isoenzyme activities as criterium for stress susceptibility in pigs

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In order to evaluate standard models for practical diagnosis of stress-susceptibility in pigs the CK isoenzyme pattern in serum of halothanpositive (HP) and halothan-negative (HN) pigs was investigated under normal conditions and after different types of stress.

After electrophoretic separation of serum from pigs two CK isoenzyme fractions are normally present; nervous type, CK-BB (CK-1) and skeletal muscle type, CK-MM (CK-3). Furthermore trace amounts of heart muscular type, CK-MB (CK-2) are often detected. A fourth fraction referred to as CK-4 probably an aberrant migrating CK-BB enzyme was invariably detected, (1).

Halothanpositive HP and HN littermates of Swedish landrace or crossbreed of Swedish landrace x Yorkshire breed were tested at weekly intervals from about 10 weeks of age to slaughter. During this period the HP pigs differ from the HN pigs concerning the CK isoenzyme activities. The linear regression on age (or weight) for CK was significantly different for HP and HN pigs with the HP pigs showing a steeper increase with age (or weight). In the HP pigs CK-1 and CK-3 showed significantly greater linear regression on age than the HN pigs. For CK-3 this difference was established also for regression on weight. CK-2 showed a linear regression on age but no difference between HP and HN pigs was obtained, (3).

Although under normal conditions stress susceptible pigs show significantly higher total-CK, CK-1 and CK-3 activities than non-reacting pigs at different intervals during the fattening period, quantitation of CK isoenzymes without previous stress seems not satisfactory as an ultimate test for stress susceptibility, (2,4). In another series of experiments the effect on serum CK isoenzyme activities after different forms of stress as selection criterium for PSS was therefore investigated. Littermates aged between 2-4 months were studied.

At 18 and 24 hours after a standardized exercise on a treadmill or after halothane anaesthesia there was a pronounced increase

in the CK and CK-3 activities in the HP pigs. The difference between HP and HN pigs was highly significant.

In the same animals s.c. administration of adrenocorticotrophin (SCTH) 2-4 I.U./kg bodyweight, and neostigmine bromide, approximately 0.05 mg/kg bodyweight (according to Bickhardt et al. (5), was examined as a stress models. The CK isoenzyme activities were assayed at regular intervals during the next 24 hours after the injection. The highest CK values were obtained between 10 and 18 hours after the administration of ATCH or neostigmine and declined rapidly during the next 12 hours. The HP pigs showed significantly higher total-CK and CK-3 activities 12 hours after the injection than the HN pigs. There was still a difference at 24 hours.

The findings suggest a multicompartiment kinetic model as described by Bickhardt (6), for the regulation of plasma CK; A rapid increase of creatine kinase due to changes in the hemoconcentration during stress and/or physical exercise and a slower mobilisation of CK from skeletal muscular cells caused by an increased enzyme efflux especially in the halothane sensitive animals. This was demonstrated by the progressive increase in the CK-MM activity 6-24 hours after the standardized exercise as well as ACTH or neostigmine treatment.

Selected References.

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