USE OF SEMI-ANAEMIC PIGLETS TO MEASURE IRON BIOAVAILABILITY OF MEAT AND MEAT FRACTIONS

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ABSTRACT

Iron deficiency is a major nutritional problem. According to the World Health Organization (WHO), there are approximately 3.7 billion people in the world with iron deficiency (WHO, 2000). Red meat is known to enhance iron absorption due in part to the presence of a meat factor. Domestic pigs (*Sus domesticus*) have been utilised as models for humans in many medical and nutritional studies. The first experiment reported here used 20 4-week-old piglets to compare the bioavailability of iron in diets containing meat (ME), a water-soluble extract of meat (SA), a water-insoluble fraction of meat (SR), and a meat-free control diet (CO). Bioavailability of iron was assessed on the basis of changes in iron-related blood parameters over a 4-week feeding trial. Iron retention in haemoglobin, red blood cell counts (RBC), haemoglobin levels (HGB), haematocrit (HCT), and mean corpuscular volumes (MCV) for ME, SR, and SA was significantly higher ($p < 0.05$) than for CO indicating that all meat fractions enhanced the bioavailability of iron. For some blood parameters the iron status of group SA was significantly lower ($p<0.05$) than for groups ME or SR. It is concluded that the meat-factor is primarily present in the water-insoluble fraction of beef.

In the second experiment nine four weeks old of age female pigs were allocated into three groups of diet treatments, i.e. E200, which contained 48 g/kg live weight$^{0.75}$ of meat extrinsically labelled with Fe^{57}; I200 and I300 , which contained 48 g/kg liveweight$^{0.75}$ and 69 g/kg liveweight$^{0.75}$ of meat intrinsically labelled with $Fe^{57.}$ The isotope labelled diets were fed only on day 0. Afterwards all pigs received the same weaner diet. The pigs were also injected by ^{58}Fe via *intra venous.* E200, I 200, and I 300 were not significantly different ($p > 0.05$) in growth parameters (i.e. average daily gain and average daily feed intake) and in the blood parameters (i.e. white blood cells and RBC, HGB, HCT, MCV, the mean corpuscular hemoglobin and the total iron body in the blood circulation) and iron absorptions. The findings indicate that the different labeling method and different meat levels gave same results.

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INTRODUCTION

Iron deficiency is one of the major nutritional problems. According to the World Health Organization (WHO), there are approximately 3.7 billion people with iron deficiency status (WHO, 2000). Iron deficiency, especially iron deficiency anemia conditions, reduces human productivity and increases public health costs enormously.

Domestic pigs (*Sus domesticus*) have been utilised as a model for human in many medical and nutritional studies. It is a mammal, monogastric animal and its physiological/digestive system has many similarities to human.

Red meat is known as a good source of haem iron, which has a higher bioavailability than non-haem irons. A meat factor is involved in this enhanced effect. To find out more about the meat factor, beef meat was separated into a water-soluble fraction and a water-insoluble fraction. In the first experiment, these fractions were fed to semi-anaemic pigs and their iron status monitored

Stable isotopes are preferred to radioisotopes in nutritional studies for ethical and health reasons. In the second experiment, lamb meat was, intrinsically and extrinsically, labelled with iron stable isotopes to study iron absorptions in semi-anaemic pigs. The aim was to determine whether the level of stable isotope in the lamb meat was high enough to detect clear changes in the level in red blood cells following consumption of the meat, before conducting a human study.