Journal of Animal and Veterinary Advances 6 (10): 1155-1157, 2007
ISSN: 1680-5593

A Note on Serum Insulin in Mexican Cuino Pigs

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Abstract: In this study a 2×2 factorial arrangement was used to study the effect of sex and age on serum insulin levels in 24 growing Mexican Cuino pigs between 3 and 6 months old. There were no significant differences ($p<0.05$) neither for sex × age interaction nor for sex in any measured index. Overall, Mexican Cuino pigs had 14.4 and 50.8 kg of live weigh ($p<0.001$) and 9.33 and 19.26 u mL^{-1} of fasting serum insulin levels ($p<0.001$) at 3 and 6 months old, respectively. Pearson correlation matrix revealed significant differences ($p<0.05$) among age, live weigth and fasting insulin levels in the examined period of life in growing Mexican Cuino pigs. According to the present evaluation, hiperinsulinemia should be present in Mexican Cuino pigs, as it has been found in either obese conventional genotypes of pigs or genetically manipulated to be small and obese animals. This effect was accentuated as pigs aged up to 6 months life. Sex appeared to have no influence on serum status of Mexican Cuino pig insulin.

Key words: Mexican cuino pigs, insulin, age, body weight, sex

INTRODUCTION

Cuino pigs belong to one of three local Mexican genotypes which have been adapted to the habitat after near 5 centuries of introduction from East Asia (Lemus and Alonso, 2005). This type of animal is characterized for attaining the adult stage when arriving to approximately 50 kg. In this moment, the Mexican Cuino pigs have a height of 53-65 cm on average, since they have a small body with a marked trend to accumulate fat (Lemus *et al*., 2003, 2005). In this connection, it has been suggested that adipocity in animals such as pigs is related to some extent, to the mechanism of insulin control of metabolism (Elsaesser *et al*., 2002). In this sense, it has been argued that insulin is a crucial regulator of lipids, through different actions and among them, the stimulation of preadipocyte differenciation to adipocytes, glucose cell transport mechanism, triglyceride synthesis (Waltonand and Etherton, 1986) and lipolysis inhibition (Dunshea *et al*., 1992b). On the other hand, it has been claimed that antilipolytic hormones as insulin, have a major effect on subcutaneous than visceral lipid tissue.

In our knowledge, there is not previous information related to the role played by insulin in Mexican Cuino pigs, although insulin status has been examined in other Mexican genotypes employed for studying carbohydrate metabolism (Phillips *et al*., 1979, 1982). In this respect, the Mexican Cuino genotype of pigs could be used in metabolic studies concerning obesity, as it has been done with other local, Mexican breed of small size, due to be well suited for using at laboratory scale, among other reasons (Panepinto *et al*., 1978).

The aim of the present study was the estimation of serum levels of insulin in Mexican Cuino pigs for increasing the knowledge of its physiology status, as attained in natural conditions of animal husbandry.

Area of the study: The study was conducted in the Faculty of Veterinary Medicine and Zootechnics of the Autonomous University of Nayarit, at Tepic, Mexico. The climate was semi-warmth and sub-humid, with rainy summers and average annual temperature of 22°C.

MATERIALS AND METHODS

Animals and diets: A total of growing 24 Mexican pigs of the local, Cuino genotype, from the Faculty herd were used. There were 12 animals of three and another of six months old, castrate male and female in the same proportion. The animals were given ad libitum a

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commercial balanced ration containing either 16 or 14% crude protein (N×6.25) for animals growing up to 3 and 6 months of age, respectively. Housing consisted of pens in an open stable. Management of animals was conducted as previously described (Grageola, 2007).

Sampling and analysis: Live weight of pigs was determined in the day of blood extraction. Blood sampling was carried out in the morning after a 24 h fasting period. Two different methods for blood extraction were employed. In young, 3 months old pigs blood was obtained from vena cava, whereas the orbital sinus (Morton *et al*., 1993) was used for blood sampling in sixth months old pigs. Blood was collected by using plastic syringes and immediately transferred to iced test tubes for transporting to the laboratory. Afterwards the serum was obtained by blood centrifugation at 5 000 rpm during 5 min. Pig serum was stored at -20°C until analysis. Serum samples were analyzed by duplicate according to a radioimmunoassay by using a ^{125}I-RIA commercial kit. Pig serum samples were prepared following the instructions of the manufactures, according to conventional procedures (Hales and Randle, 1963; Steele *et al*., 1985), with porcine insulin as standard.

Statistical analysis: Statistical analysis were performed using ANOVA techniques of SAS (1987). Means were compared by least significant differences at $p<0.05$, according to a GLM procedure. Factors in the model included sex, age and sex × age interaction, whereas serum insulin and body weight were response variables.

RESULTS AND DISCUSSION

There were no significant differences ($p>0.05$) for neither sex × age interaction nor for sex in any measured index. Therefore, data were pooled regardless of the sex effect. Overall, Mexican Cuino pigs had 14.4 and 50.8 kg live weight ($p<0.001$) at 3 and 6 months old, respectively (Table 1) and this was in agreement of the slow growth rate of this genotype, as to be expected (Lemus and Alonso, 2005).

A significant effect ($p<0.001$) was encountered for fasting serum insulin levels when data of animals of 3 and 6 months old were contrasted (9.33 and 19.26 u mL^{-1}, respectively). In this connection, blood insulin levels has been found in pigs to be affected by several factors, not only from the nutritional status point of view (Atinmo *et al*., 1976; Buonomo and Baile, 1991), but also by other causes such as physiological conditions (Steele *et al*., 1985; Dunshea *et al*., 1992a, b, c) and breed (Wangsness *et al*., 1977). Even more, Elsaesser *et al*. (2002) obtained evidences that divergent pig genotypes, the small, obese Gottingen miniature and the large, lean German Landrace animal could reflect differences in blood insulin status. In fact, according to Elsaesser *et al*. (2002), obese pigs exhibited fasting plasma insulin values evidently higher than that of the Landrace breed. In the particular case of lean and genetically obese pigs, Wangsness *et al*. (1977) observed that at 1, 3 and 6 months of age, obese pigs were not clearly hyperinsulinemic animals but had lower plasma somatotropin than lean pigs.

Table 1: Effect of age on live weight and serum insulin in Mexican Cuino pigs

	Age, months		
	3	6	SE±
n	12	12	-
Live weight, kg	14.4	50.8	1.4***
Serum insulin, u mL^{-1}	9.33	19.26	2.82***

*** $p<0.001$

Table 2: Pearson correlation matrix of growth and insulin indices in Mexican Cuino pigs (n = 24)

	Age	Live weight
Live weight	0.982***	0.585***
Insulin	0.559**	

** $p<0.01$; *** $p<0.001$

As it is shown in Table 2 data from the Pearson Matrix Correlation revealed a clear, strong interdependence ($p<0.001$) was observed between age and sex of young Mexican Cuino pigs. In this connection, serum insulin values were also significantly correlated ($p<0.01$) to either age or sex of the animals, although the coefficient of determination did not reached 0.6 values. According to these findings, it could be assumed that fasting insulin response to age in young Mexican Cuino pigs could be somewhat linear up to six months of age, according to the following expression

$$y = 5.39 + 0.07\ x,\ SD \pm 0.02$$

Where, y and x expressed fasting insulin levels (in U mL^{-1}) and age (in days), respectively.

In summary, according to the present evaluation, hiperinsulinemia should be present in Mexican Cuino pigs, as it has been found, with the exception of Weiler *et al*. (1998), in obese conventional genotypes of pigs (McCuskers *et al*., 1985) or in genetically manipulated to be small and obese animals (Wangsness *et al*., 1981; Mersmann *et al*., 1982; Elsaesser *et al*., 2002). This effect was accentuated as pigs aged up to six months life. Sex appeared to have no influence on serum status of Mexican Cuino pig insulin.

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