

THE EFFECT OF SERUM CONCENTRATION OF LEPTIN IN SOWS ON THEIR REPRODUCTION AND PERFORMANCE OF REARED PIGLETS**

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Abstract: The research was carried out on 17 Polish Landrace sows and their piglets. The aim of this study was to determine a relationship between sows' serum concentration of leptin and reproduction parameters, and performance of reared piglets. Animals were kept under standard conditions and fed standard diets. Blood samples were taken from the jugular vein at 110 days of pregnancy and at 21 days of lactation. Leptin was determined by radioimmunoassay using the RIA method. Blood serum leptin determined at 110 days of pregnancy was positively correlated with litter weight at birth and piglet body weight at birth, the latter being statistically significant ($P < 0.05$). Other Pearson correlations were not statistically significant ($P > 0.05$).

Key words: leptin, blood, sow reproduction, piglets performance

Introduction

Leptin is a protein hormone secreted by adipose tissue cells. It circulates in the blood and assists with appetite regulation and energy balance (*Zhang et al.*, 1994). As adipocytes increase in mass, peripheral concentrations of leptin increase (*Consoline*, 1996). Thus, leptin serves as an endocrine messenger from the body to the brain and elsewhere to communicate the nutritional status of the body, which in turn influences feeding behaviour, metabolism, and energy balance in most animals (*Compfield et al.*, 1995; *Keisler et al.*, 1999). Research has shown that leptin can affect the neonatal

weight of piglets and their postnatal growth (*Ekert et al.*, 2000; *Poore and Fowden*, 2004).

The aim of this study was to determine a relationship between serum concentration of leptin in sows and their reproductive parameters and performance of reared piglets.

Materials and methods

The research was carried out on 17 sows (Polish Large Polish × Polish Landrace) and their progeny. Sows were in the 3rd-4th breeding cycle on average. The animals were fed according to the *Nutrient Requirements of Pigs* (1993) with complete pelleted mixture for sows (LK) and piglets (Prestarter) and had free access to water. Composition of the mixtures used in this study is shown in Table 1. Mated sows were kept in individual bedded pens to 100 days of pregnancy. About 14 days before delivery they were moved to the farrowing house, where they stayed until the piglets' weaning on day 35 after parturition. Feeding rations were adjusted to the production cycle: from mating to 100 days of pregnancy – 3 kg; from 101 to 111 days of pregnancy – 4 kg and then day by day the rations were lowered to 2 kg daily. On delivery day sows were not fed at all. From the 2nd day of lactation to weaning the rations depended on the number of piglets per litter – 5-6 kg.

Blood samples (20 ml) for estimation of leptin level were taken from *vena jugularis interna* of sows at 110 days of pregnancy and at 21 days of lactation. Leptin was determined in blood serum by radioimmunoassay using a commercial Multi-Species Leptin RIA Kit (Linco Research, Inc., St. Charles, MO). Pearson residual correlation test was used to study the relationships between serum leptin level and sows' reproduction and performance of reared piglets traits using the Statgraphics Plus 4.0 software.

Table 1. Nutritive value of complete mixtures used for sows and piglets

Item	Type of mixtures	
	LK	Prestarter
Metabolizable energy (MJ/kg)	12.34	13.80
Crude protein (g/kg)	150.00	190.00
Crude fat (g/kg)	30.00	
Crude fibre (g/kg)	50.00	
Calcium (g/kg)	7.50	
Phosphorus (g/kg)	7.50	
L-lysine (g/kg)	9.00	
Met + Cys (g/kg)	5.00	

Results of investigations and discussion

Means and standard error of the mean for the analyzed sows are presented in Table 2. The means and standard error of traits analysed in the piglets are shown in Table 3.

Table 2. Means and standard error (SEM) of traits analysed in the sows (n=17)

Traits	Leptin level (ng/ml)		Body weight (kg)		Body weight loss during lactation (kg)	Sows' milk production during 21 days of lactation (kg)	Length of the barren period (days)	Litter weight (kg)		Number of piglets in the litter (head)	
	at 110 days of pregnancy	at 21 days of lactation	at 110 days of pregnancy	at 21 days of lactation				at birth	at 21 days of age	at birth	at 21 days of age
Mean	4.20	3.22	230.6	217.4	13.3	236.6	6.1	11.5	58.8	10.3	10.1
SEM	0.43	0.25	6.76	6.97	0.74	11.00	0.47	0.54	2.69	0.47	0.44

Table 3. Means and standard error (SEM) of traits analysed in the piglets (n= 17 litters)

Traits	Piglet body weight (kg)		Daily gain (g)	Piglet milk intake at 21 days of age (kg/head)
	at birth	at 21 days of age		
Mean	1.12	5.82	229	23.38
SEM	0.02	0.06	5.76	0.26

Pearson residual correlations between blood serum leptin determined at 110 days of pregnancy and traits analyzed in the sows and their piglets are given in Table 4. Table 5 presents pearson correlations between sows' serum leptin determined at 21 days of lactation and traits analyzed in the sows and their piglets. In our results serum leptin level determined at 110 days of sows' pregnancy was correlated positively with litter weight at birth and piglet body weight at birth. The latter coefficient of correlation was statistically significant ($P < 0.05$). No significant correlations were found between the serum leptin level of sows determined at 21 days of lactation and traits analyzed in the sows and their piglets.

The recently discovered protein, leptin, which is secreted by fat cells in response to changes in body weight or energy, has been implicated in the regulation of feed intake, energy expenditure and the neuroendocrine axis in mammals (*Barb et al.*, 2001). Administration of leptin to ob/ob mice led to improved reproduction as well as reduced feed intake and weight loss

(Zhang *et al.*, 1994). The porcine leptin receptor has been cloned and is a member of the class 1 cytokine family of receptors. Leptin has been implicated in the regulation of immune function and anorexia associated with the disease. The leptin receptor is localized in the brain and pituitary of the pig (Barb *et al.*, 2001).

Table 4. Pearson correlations between blood serum leptin determined at 110 days of pregnancy and traits analysed in the sows (n=17) and their piglets (n= 17 litters)

Traits	Body weight of sow at 110 days of pregnancy	Litter weight at birth	Piglet body weight at birth	Number of piglets in the litter at birth
Leptin	0.113	0.301	0.595	0.074
Significance	NS	NS	*	NS

NS – P>0.05

* - P<0.05

Table 5. Pearson correlations between sows' blood serum leptin determined at 21 days of lactation and traits analysed in the sows (n=17) and their piglets (n= 17 litters)

Traits	Body weight of sows at 21 days of lactation	Body weight loss during lactation	Sows' milk production during 21 days of lactation	Length of the barren period	Litter weight at 21 days of age	Number of piglets in the litter at 21 days of age	Piglet body weight at 21 days of age	Daily gain of piglets	Piglet milk intake at 21 days of age
Leptin	0.171	-0.209	-0.147	-0.287	-0.149	-0.237	0.391	-0.015	0.360
Significance	NS	NS	NS	NS	NS	NS	NS	NS	NS

Leptin concentrations in the circulation were determined in sows that differed in body condition at farrowing, and in feed consumption during lactation. Serum concentrations of leptin at farrowing and weaning were highest in sows exhibiting the greatest amount of backfat (Estienne *et al.*, 2000). Meanwhile, De Rensis *et al.* (2005) observed a positive relationship between blood leptin level in sows and the thickness of their backfat. These authors found no correlation between plasma leptin concentrations and reproductive performance after weaning, and believe that plasma leptin is associated with backfat depth and that loss of backfat depth during lactation is associated with reproductive performance.

Like in our study, Govoni *et al.* (2007) found blood leptin level in sows to decrease during lactation. This phenomenon could have been associated with reduced body weight of animals, as confirmed by the findings of Berg

et al. (2003), who found a highly positive correlation between serum concentrations of leptin and subcutaneous fat measurements. *Barb et al.* (2005) stated that in the lactating sow serum leptin concentrations were positively correlated with backfat thickness and level of dietary energy fed during gestation as well as feed consumption. Although these results identify leptin as a putative signal that links metabolic status and neuroendocrine control of reproduction, other adipocyte protein products may play an important role in regulating the reproductive axis in the pig.

Conclusions

Blood serum leptin level determined in sows at 110 days of pregnancy was positively correlated with litter weight at birth and piglet body weight at birth. It is concluded that plasma leptin is associated with reproductive performance.

UTICAJ KONCENTRACIJE LEPTINA U SERUMU KRMAČA NA REPRODUKCIJU I PROZVODNE REZULTATE U ODGOJU PRASADI

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Rezime

Cilj ovog istraživanja je određivanje odnosa između koncentracije leptina u serumu krmača i reproduktivnih parametara, i proizvodnih rezultata u odgoju prasadi. Istraživanje je izvedeno na 17 krmača rase poljski landras i njihovoj prasadi. Životinje su gajene u standardnim uslovima i hranjene standardnim obrocima. Uzorci krvi su uzimani iz vene na vratu 110. dana bremenitosti i 21. dana laktacije. Leptin je određivan radio-imunološkom analizom korišćenjem komercijalnog Multi-Species Leptin RIA test. Pearson test rezidualne korelacije je korišćen za ispitivanje odnosa između nivoa leptina u krvnom serumu i reprodukcije kod krmača i proizvodnih rezultata odgajene prasadi koristeći Statgraphics Plus 4.0 software. Leptin u krvnom serumu određivan 110. dana bremenitosti je bio u pozitivnoj korelaciji sa težinom legla na rođenju i telesnom težinom prasadi na rođenju, gde je

utvrđena i statistička signifikantnost ($P < 0.05$). Ostale Pearson korelacije nisu bile statistički signifikantne ($P > 0.05$).

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