

## RELATIONSHIP BETWEEN VERY LOW DENSITY LIPOPROTEIN SUBTRACTION 2 AND SURVIVAL RATE OF PRE-WEANING PIGLETS

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### SUMMARY

A study was carried out to determine the relationship between very low-density lipoprotein (VLDL) subtraction 2 and survival rate of pre-weaning piglets. The survival rate of pre-weaning piglets was related to the genetic lines from generations 7 and 8 (pooled) and generation 8. The proportion of VLDL (subtraction 2, high affinity for heparin) was related to the variation in piglet survival for 9 genetic lines by a quadratic equation. These observations suggest that VLDL-subtractions play a role in neonatal pig nutrition and heparin. Sepharose chromatography technique can be used to select sows for a breeding programme.

Keywords: lipoproteins, pre-weaning piglets, survival

High mortality of piglets is still a major problem in swine industry. The pre-weaning mortality rate is about 12% of total piglets born alive and this has not changed over the last 15 years (MLC, 1991-1996). The survival of piglets in an adequate environment is dependent on the quality and quantity of milk consumed by each piglet in the litter. It has been shown that adipose triacylglycerol is mobilised during late pregnancy in humans and rats, and the liberated fatty acids are incorporated into very low-density lipoprotein (VLDL) by the liver and secreted into the blood stream. Thus, hyper-triacylglycerolaemia was also observed in late-pregnant sows (Wright *et al.*, 1995). The VLDL plays a significant role in supplying triacylglycerol for milk production in species which is born with very low reserves of body fat but receives milk with a high fat content such as pigs (Gurr, 1988).

The VLDL can be separated into two subtractions by heparin-affinity chromatography. The proportion of VLDL-subtractions 2, which has higher affinity for heparin from pregnant sows was shown to be related to the mortality rate of pre-weaning piglets from generations 1 to 7 of long term breeding trial (Wright *et al.*, 1995). The purpose of this study was to further investigate the relationship between VLDL subtraction 2 from pregnant sows and their piglet survival rates for generation 8.

A total of 332 litters from 9 distinct genetic lines of Landrace pigs, obtained from generations 7 and 8 of divergent selection for lean tissue (Cameron and Curran, 1994) were used in this study. The animals were selected for high (H) and low (L) lean tissue growth rate with *ad-libitum* feeding (LGA), lean tissue food conversion with feeding *ad-libitum* (LFA),

voluntary food intake (VFI) and lean growth with restricted feeding (LGS). Survival rate (%) was calculated by subtracting the number of mortality before weaning from the total piglets born alive and divided by the total number of piglets born alive. An analysis was used to examine the effect of genetic lines on the survival rate of piglets from generations 7 and 8 (pooled) and generation 8 before weaning. The data of the proportion of VLDL-subtraction 2 from pregnant sows (generation 7) were obtained from Wright *et al.* (1995). The linear regression (PROG REG) (SAS, 1989) was used to examine the relationship of survival rate between different genetic lines of piglets from generation 8.

Pre-weaning survival of piglets for generations 7 and 8 (pooled) and generation 8 are presented in Table 1 and 2 respectively. Differences between pre-weaning survival rate of piglets were observed with the lowest survival rate (88%) was observed in the LGSL and VFIH pigs and the highest survival rate (97%) was observed in the LGAH and LGAL pigs. A chi-square test using a 9x2 contingency table of the numbers surviving and dying was highly significant ( $p < 0.001$ , Table 1). Similar observations were found for the survival rate of generation 8 (Table 2) when the LGSL piglets were found to show the lowest survival rate (86%) and the LGAL the highest (97%). A chi-square test of the numbers of surviving and dying was significant ( $p < 0.05$ , Table 2). These results suggest that the number of surviving pre-weaning piglets was dependent on the genetic lines from which they are derived. Mersmann *et al.* (1984) reported that piglets born to leaner dams had a greater pre-weaning

mortality than fatter dams. He suggested that the survivability of piglets could be influenced by leaner sows not providing sufficient energy as fat or other nutrients in milk to newborn piglets.

The variation of piglet survival rate (generation 8) of 9 genetic lines with proportion of subtraction 2 in VLDL from pregnant sow is shown in Figure 1. Using the same data on the proportion of subtraction 2 (Wright *et al.*, 1995) present in the VLDL for pregnant sows, the relationship of survival rate between the different genetic lines of piglets from generation 8 was

examined using linear regression. It was found that a statistically significant quadratic curve ( $R^2=0.61$ ,  $p<0.05$ ) could be fitted to the data. This suggests that in order to achieve a piglet survival rate of more than 90%, the proportion of subtraction 2 in the VLDL should be between 0.30 and 0.70.

In conclusion, these results suggest that VLDL-subtractions play a role in neonatal pig nutrition and survivability. Furthermore, the heparin Sepharose chromatography technique can be used as a predictive tool in determining the mortality of pre-weaning pigs.

**Table 1: Pre-weaning survival and mortality of piglets from different genetic lines for generations 7 and 8**

Genetic lines	No. of litters	Litter size	Total born alive	Piglets surviving to weaning	Survival rate
Control	27	9.30	251	233	92.83
LGSH	41	6.24	256	236	92.19
LGSL	37	9.30	344	302	87.80
LGAH	43	8.60	370	358	96.76
LGAL	27	8.96	242	235	97.11
LFAH	34	7.91	269	248	92.20
LFAL	42	8.86	372	349	93.82
VFIH	43	9.12	392	345	88.00
VFIL	38	9.29	353	318	90.08
Total	332	8.58	2849	2624	92.10

y, 8 @40.84 ( $p<0.001$ )

**Table 2: Pre-weaning survival and mortality of piglets from different genetic lines for generation 8**

Genetic lines	No. of litters	Litter size	Total born alive	Piglets surviving to weaning	Survival rate
Control	14	9.20	129	121	93.80
LGSH	21	6.50	136	126	92.65
LGSL	14	9.40	131	113	86.26
LGAH	20	8.40	168	162	96.43
LGAL	12	8.30	100	97	97.00
LFAH	16	7.70	123	115	93.50
LFAL	21	8.50	179	166	92.74
VFIH	20	9.00	180	161	89.44
VFIL	17	8.60	147	133	90.48
Total	155	8.34	1293	1194	92.34

y, 8 @ 17.43 ( $p<0.05$ )

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## RINGKASAN

**PERKAITAN DI ANTARA PENSUBSTRATAN 2 LIPOPROTEIN KETUMPATAN AMAT RENDAH DENGAN KADAR KEMANDIRIAN ANAK BABI PRAPENYAPIHAN**

Satu kajian telah dijalankan untuk menentu perkaitan di antara pensubstratan 2 lipoprotein ketumpatan amat rendah (VLDL) dengan kadar kemandirian anak babi prapenyapihan. Kadar kemandirian anak babi prapenyapihan telah dikaitkan dengan titisan genetik daripada generasi 7 dan 8 (terhimpun) dan generasi 8. Perkadaran VLDL (pensubstratan 2, keafinan tinggi untuk heparin) telah dikaitkan dengan kelainan dalam kemandirian anak babi untuk 9 titisan genetik melalui persamaan kuadratik. Pencerapan ini menyerankan yang pensubstratan VLDL memainkan peranan dalam pemakanan babi neonat dan kemandirian. Teknik kromatografi sefarosa boleh diguna dalam pemilihan babi betina untuk program pembiakbakaan.