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POSTER

# Effects of sex and intrauterine growth restriction on fatty acid composition of Iberian newborn piglets

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Additional keywords

RCIU.
Muscle.
Liver.
Iberian pig.
Monounsaturated fatty acids.

## SUMMARY

The occurrence of Intrauterine Growth Restriction is a spontaneous event which negatively influences the postnatal development. This effect has been assessed in pigs, but there are few data about potential changes in fatty acid composition. Hence, we analyzed fatty acids composition in the liver and muscle (longissimus dorsi) of 43 Iberian x Duroc newborn piglets. Sixteen of them were classified as Normal Birth-Weight piglets (8 males and 8 females, average weight 1402.2 ±321 g) and 27 were identified as Low Birth-Weight piglets (14 males and 13 females, average weight 635.7 ±159.1 g; P<0.0001). Regarding the fatty acid composition in both liver and muscle, significant differences were observed between Low Birth-Weight and Normal Birth-Weight.Therefore, the liver fatty acids also showed sex-related significant effects; especially in the polar fraction. The analysis of the neutral fraction in muscle showed lower monounsaturated fatty acids (MUFA; P<0.0001) concentration and higher polyunsaturated fatty acids (PUFA; P<0.005) concentration in Low Birth-Weight neonates. In relation to polar lipids of the liver, Low Birth-Weight piglets had lower saturated fatty acids concentration (SFA) than Normal Birth-Weight (P<0.05). Sex affected the neutral MUFA/SFA ratio and the polar polyunsaturated fatty acids concentration of the liver, being respectively higher and lower in females (P<0.05 for both). In conclusion, the present study shows that Intrauterine Growth Restriction and sex are related to changes in the muscle and liver fatty acid composition that may affect meat quality.

**Efecto del sexo y la restricción de crecimiento intrauterino en la composición de ácidos grasos en lechones ibéricos recién nacidos**

Palabras clave adicionales

CIUR.
Músculo.
Hígado.
Cerdo ibérico.
Ácidos grasos monosaturados.

## RESUMEN

La aparición de la restricción del crecimiento intrauterino es un evento espontáneo que influye negativamente en el desarrollo postnatal. Este efecto ha sido estudiado en cerdos, pero hay pocos datos sobre los cambios potenciales en la composición de ácidos grasos. Para este estudio se analizó la composición de ácidos grasos en el hígado y músculo *(longissimus dorsi)* de 43 lechones Ibérico x Duroc recién nacidos. Dieciséis de ellos fueron clasificados como lechones de normopeso al nacimiento (8 machos y 8 hembras, peso promedio 1402,2 ± 321 g) y 27 fueron identificados como lechones de bajo peso al nacimiento (14 machos y 13 hembras, peso promedio 635,7 ± 159,1 g P<0,0001). Respecto a la composición de ácidos grasos tanto en el hígado como en el músculo, se observaron diferencias significativas entre los lechones de bajo peso y de normopeso. Además, el perfil de ácidos grasos hepáticos también mostró efectos significativos relacionados con el sexo; especialmente en la fracción polar. El análisis de los lípidos de la fracción neutra del músculo mostró una menor concentración de ácidos grasos monoinsaturados (P<0,0001) y una mayor concentración de ácidos grasos poliinsaturados (P<0,005) en los recién nacidos con bajo peso. También los lechones de bajo peso presentaron una menor concentración de ácidos grasos saturados (P<0,05) en la fracción polar del hígado. El sexo afectó a la relación de ácidos grasos monoinsaturados respecto a los saturados en la fracción neutra y a la concentración de ácidos grasos poliinsaturados de la fracción polar del hígado, siendo respectivamente mayor y menor en las hembras (P<0,05 para ambos). En conclusión, el presente estudio muestra que la restricción del crecimiento intrauterino y el sexo están relacionados con cambios en la composición de los ácidos grasos del músculo y el hígado, lo que puede afectar a la calidad de carne.

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## INTRODUCTION

Intrauterine growth restriction (IUGR) is defined as the failure of the fetus to reach its potential growth-rate and is mainly due to insufficient supply of nutrients and oxygen, as a consequence of inadequate maternal nutrition or placental efficiency, which causes Low Birth-Weight (LBW) offspring. In pig production, LBW pigs have a worse postnatal development than their Normal Birth-Weight (NBW) littermates causing a lack of homogeneity in growth patterns and carcass among pigs in the same feedlot (Gondret et al. 2005). This

effect has been assessed, but data regarding how the IUGR process could affect the fatty acid (FA) profile are scarce. For that reason, this study aimed to assess the effect of the IUGR process on FA composition in the liver and muscle (*longissimus dorsi*) of Iberian x Duroc newborn piglets.

## MATERIAL AND METHODS

The experiment involved 43 piglets of Iberian x Duroc genotype selected by sex and birth-weight from the litters of 35 multiparous (third pregnancy) Iberian sows. Classification of LBW newborns was performed on the basis of birth-weight bellow a standard deviation to the mean birth-weight of the piglets from all litters (LBW ≤ 1kg). The final distribution of piglets was 16 NBW (8 males and 8 females, average weight of 1402.2 ±321 g) and 27 LBW (14 males and 13 females, average weight of 635.7 ±159.1 g; P<0.0001). Piglets were sacrificed immediately after birth and liver and muscle (*longissimus dorsi*) were sampled. The analysis of the fatty acid composition included the extraction (Segura & Lopez-Bote 2014), separation of neutral and polar lipid fractions (Ruiz et al. 2004) and identification and quantification of FA by gas-chromatography (Lopez-Bote et al. 1997). The effects of the birth-weight and sex were assessed by analysis of variance (ANOVA). All results were expressed as mean ± SD.

## RESULTS

The intramuscular fat was greater in NBW piglets than in LBW newborns (8.1±1.2 *vs.* 6.6±1.1 g/100 g of dry tissue; P<0.0001). Regarding the FA composition in both liver and muscle, significant differences were observed between LBW and NBW and the liver FA also showed sex-related significant effects; especially in the polar fraction. The analysis of the neutral fraction in muscle showed lower monounsaturated fatty acids (MUFA; P<0.0001; **Figure 1B**) concentration and higher polyunsaturated fatty acids (PUFA; P<0.005) concentration in LBW neonates. In relation to FA of the polar fraction in the liver, LBW piglets had lower saturated FA (SFA) concentration and higher MUFA than NBW newborns (P<0.05 and P<0.01, respectively; **Figure 1A**). Sex affected the MUFA/SFA ratio of the neutral fraction of the liver and the PUFA concentration of polar lipids, which were respectively higher and lower in females (P<0.05, for both; MUFA/SFA ratio, 1.29±0.3 *vs.* 1.13±0.2 for females and males).

## DISCUSSION

The results of the present study support that the IUGR process produces changes in the body condition and in the FA profile of the Iberian pig at birth. In addition, there were sex-related effects in livers, which could be related to different organ development during the pregnancy (Torres-Rovira et al. 2013). The lower birth-weight and intramuscular fat in LBW piglets are deleterious for the piglet, because in early phases these traits are related to a better growth. In liver, LBW newborns also showed significant differences in FA profile of polar lipids. This fact may explain why the asymmetrical growth patterns of LWB piglets may improve their probabilities of survival (Gonzalez-Bulnes et al. 2016).

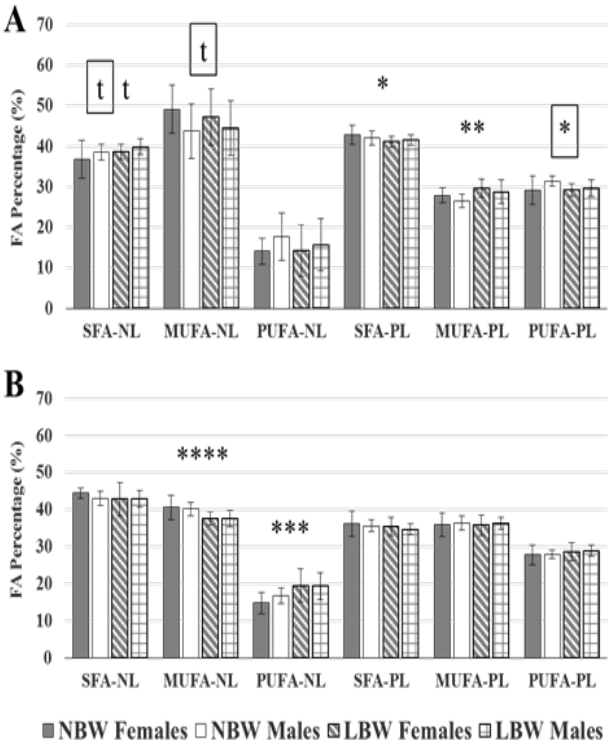


**Figure 1. Effects of sex and birth-weight on fatty acids composition.** The Pannel A shows the FA composition in liver. The Pannel B shows the FA composition in muscle (Efectos del sexo y peso al nacimiento en la composición de ácidos graos, El panel A representa la composición en ácidos grasos del hígado. El panel B represnta la composición de ácidos graos en el músculo. The symbols indicate significant differences: t, 0.09<P>0.05; *, P<0.05; **, P<0.01; ***, P<0.005; ****, P<0.0001. Birth-weight differences: symbols without box. Sex differences: symbols with box. NL= neutral lipids; PL= polar lipids; SFA= saturated fatty acids; MUFA= monounsaturated fatty acids; PUFA= polyunsaturated fatty acids; NBW= normal birth-weight; LBW= low birth-weight.

In conclusion, significant differences in FA profile were observed between NWB and LBW piglets in muscle and liver. Moreover, there were sex-related significant effects in the liver Fatty Acids. These changes in the FA profile may affect the meat quality.

## ACKOWLEGMENTS

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