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# Dietary omega-3 fatty acids in early gestation induce changes in ratio of omega-6 to omega-3 ratio in sow plasma and affects distribution of birth weight

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## INTRODUCTION

Litter size has increased steadily over the last decades due to intensive breeding programs. This has resulted with an increased number of small or intra-uterine growth retarded (IUGR) piglets in the litter and it is also known that low birth weight piglets have a high mortality. Dietary omega-3 fatty acids given to sows during gestation is believed to improve early embryo survival, piglet birth weight and vitality. The aim of this experiment was to investigate the effect of dietary n-3 (docosahexaenoic acid; DHA) to gestating sows from service to day 42 of gestation on sow plasma, placental and fetal growth and birth weight.

## MATERIALS AND METHODS

The study was conducted in a commercial Danish farm using 238 multiparous DanBred hybrid sows. All sows were fed using the same feeding curves and the same diet (Table) except for inclusion of 1.68 % of DHA Natur (providing 4.9 g/kg of DHA; ADM Animal Nutrition, Illinois, USA) in the treatment group for the first 42 days post service. Diets were based on wheat, barley, wheat bran, soybean meal, sugar beet pellets and soy oil. See composition of Control and DHA diets in Table.

**Composition of diets fed from mating to day 42 of gestation**

| Composition | Control | DHA |
|---|---|---|
| SID CP, g/kg | 103 | 103 |
| SID Lys, g/kg | 4.4 | 4.4 |
| Energy, MJ ME/kg | 11.5 | 11.5 |
| DHA[1], g/kg DM | 0.03 | 4.90 |
| n-6 fatty acids, g/kg DM | 18.1 | 15.2 |
| n-3 fatty acids, g/kg DM | 1.84 | 6.54 |
| n-6:n-3 ratio | 9.87 | 2.36 |

[1]DHA = docosahexaenoic acid

**Registrations on all sows:**

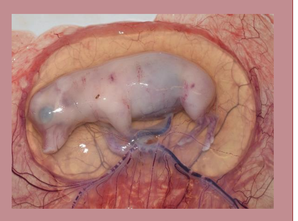
- Back fat thickness (Lean-Meater at P2 site) at weaning, day 14, 42 and 112 of gestation
- Farrowing results in previous and current cycle
- Blood samples from jugular vein at weaning, day 14, 42 and 112 of gestation

**Registrations on fetuses from sows slaughtered at day 42 of gestation:**

- Fetal weight and organ weights
- Characteristics of placenta

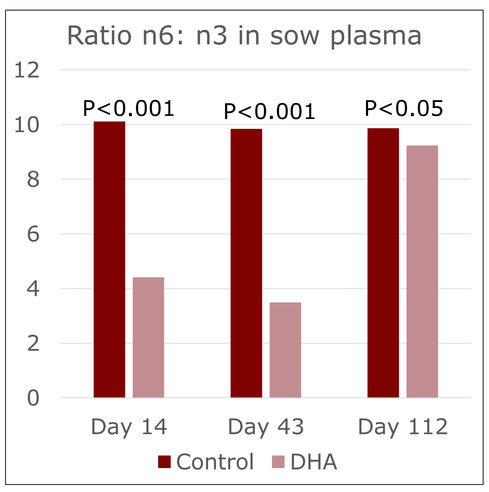
**Registrations on new born piglets at farrowing on a subsample of litters:**

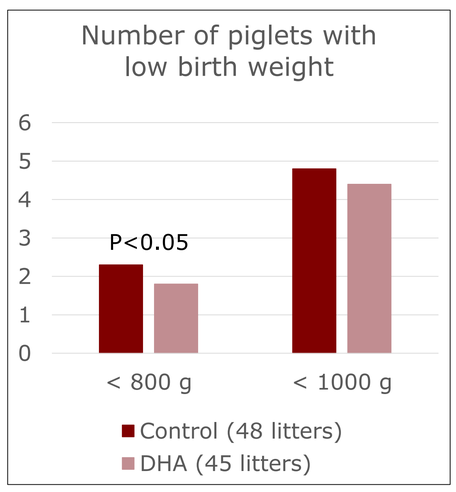
- Individual birth weight
- Crown rump length (CRL)
- Abdominal circumference (AC)
- IUGR-score
- Sex
- Organ weights of 2 piglets (heaviest and lightest) per litter from 10 sows per treatment

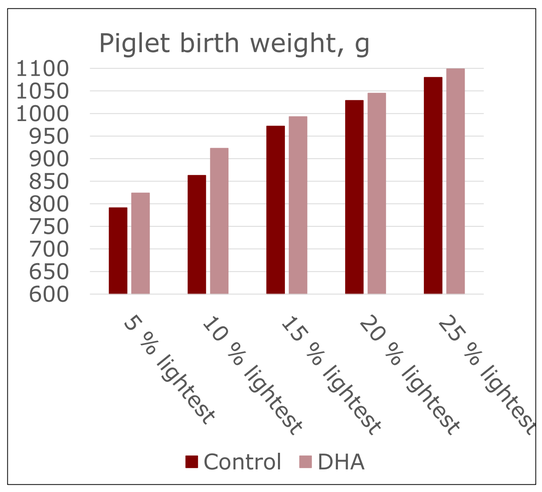


## RESULTS

Back fat thickness of sows, fetal and placental development, litter size, and CRL, IUGR-score and sex of new born piglets was unaffected by diet ($P>0.05$), but there was a tendency for higher AC in new born piglets of DHA sows ($P=0.06$). There were no differences between organ weight of piglets from control and DHA sows ($P>0.05$). The addition of n-3 changed the ratio of n-6 to n-3 in plasma of sows and lowered the number of piglets with birth weight below 800 g.




**Fetal and placental development at day 50 and farrowing results**

| | N sows | Control | DHA | SE | P-value (diet) |
|---|---|---|---|---|---|
| Parity of sows | 238 | 3.8 | 3.9 | 0.19 | 0.84 |
| Fetal and placental development at day 50 | | | | | |
| Number of live fetuses | 14 | 19.7 | 23.4 | 2.58 | 0.16 |
| Number of corpus lutea | 14 | 31.8 | 33.2 | 2.64 | 0.82 |
| Fetal weight, g | 14 | 47.5 | 42.2 | 8.65 | 0.23 |
| Placental area, $cm^2$ | 14 | 851 | 772 | 75.7 | 0.19 |
| Farrowing results | | | | | |
| Live born | 238 | 20.0 | 19.8 | 0.16 | 0.44 |
| Still born | 238 | 1.9 | 2.0 | 0.16 | 0.89 |
| Average piglet birth weight, g | 93 | 1269 | 1291 | 24.4 | 0.20 |
| Within-litter variation in birth weight, g | 93 | 301 | 302 | 9.96 | 0.98 |

## CONCLUSION

- **Increased dietary n-6 to n-3 ratio in early gestation changed sow fatty acid plasma concentrations**
- **Increased dietary n-6 to n-3 ratio in early gestation decreased the number of low birth weight piglets**

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