

Increasing metabolizable energy and protein levels during late gestation stimulate subsequent milk production by increasing proliferation and reducing apoptosis prepartum in the goat mammary gland

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Short title: **Periparturient nutrition and mammary remodeling**

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Summary

A total of 32 pregnant goats were assigned randomly to four diets fed from d 100 of pregnancy to d 30 after parturition to determine the effects of metabolizable energy (E) and metabolizable protein (P) levels on subsequent colostrum and milk production and expression of genes (qPCR) regulating mammary cell proliferation and apoptosis. Diets contained 1) provided E and P according to NRC recommendations (control), 2) As diet 1 but with extra 10% E, 3) as diet 1 but with extra 10% P, and 4) as diet 1 but with 10% extra of both E and P relative to NRC recommendations. Mammary biopsies were obtained from each udder half 24 hours after parturition. Colostrum (Kg/d) and milk (Kg/month during one month) production increased with combined extra levels of E and P provided prepartum and in early lactation ($P < 0.05$). Relative mRNA expressions increased in the mammary gland of Insulin-like growth factor 1 (IGF-1) ($P = 0.004$, 4.3 fold), IGF-1 receptor (IGF-1R) ($P = 0.01$, 3.6 fold) and B-cell lymphoma 2 (Bcl-2) ($P = 0.003$, 4.6 fold), whereas, insulin-like growth factor binding protein 3 (IGFBP-3) ($P = 0.01$, 3.2 fold), Bcl-2-associated X protein (Bax) ($P = 0.001$, 16.7 fold) and the ratio of Bax/Bcl-2 expressions decreased ($P = 0.007$, 69.8 fold) with increased E and P levels fed in late gestation ($P = 0.01$). Expression of IGFBP-5 mRNA ($P = 0.28$) was not affected. In conclusion, colostrum production and milk yield in the early lactation period is sensitive to nutrient supply during gestation, where increased dietary E as well as P levels protein during late gestation will favor mammary development by increasing expression of genes stimulating cellular proliferation and reduced those stimulating apoptosis.