Nutritional Science-2013

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Nutritional Science & Therapy

July 15-17, 2013 Courtyard by Marriott Philadelphia Downtown, Philadelphia, USA

Milk from high-fat/high-sugar fed mothers induces abnormal mammary development in offspring

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Abstract

Obesity has become a significant worldwide health issue. Overweight and obesity, are often negatively associated with initiation and duration of breastfeeding in humans. In animal models, numerous data demonstrate the influence of nutrition on mammary growth and differentiation and highlight the importance of critical periods during which nutrition induces long-term effects on mammary development and lactation. Using a model of rabbits receiving a high-fat/high-sugar (OB) diet started before puberty, we investigated the long-term effects on mammary gland development in the offspring. For this purpose, newborn rabbits were nursed with milk from OB-diet fed dams (OB milk) or with milk from control-diet fed dams, from birth to weaning. The animals were then subjected to either a control (C) or an OB diet from weaning to day eight of pregnancy.

OB milk showed a highly modified fatty acid composition. Histological and ultrastructural observations revealed that the ingestion during the suckling period of milk produced by OB-diet fed dams combined with an OB diet, leads to a strongly altered mammary gland development during early pregnancy. Moreover, when we evaluated leptin transcript levels in mammary glands, we observed 1) an increase in leptin mRNA in the OB milk/OB diet group as compared to the other groups and 2) a local leptin synthesis by the luminal alveolar cells. Mammary leptin gene expression has been related to leptin secretion into colostrum and milk and may thus contribute to long-term effects of neonatal leptin in several physiological processes including metabolic programming.

Biography

Eve Devinoy, head of a group at the INRA, is co-author of more than 60 peer-reviewed publications and acted as a co-editor for a special issue for the J. Mammary Gland Biol. Neoplasia. She has contributed to understand milk protein gene specific expression, patented the regulatory regions of one of these genes to produce pharmaceutical proteins in the milk of transgenic rabbits, reported about epigenetic modifications surrounding milk protein genes and their association with spatial rearrangement within the nucleus. She is currently studying long-term effects of nutrition on mammary gland development and lactation.