Methionine balanced diet improves performances and biosynthetic traffic in mammary epithelial cell

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Methionine (Met) or energy supplementation increase milk protein and fat yields in cow. Here we investigated whether this could be explained by increasing flow of milk components in the secretory pathways of mammary epithelial cells. Multiparous Alpine goats (mid lactation, n=47), grouped by levels of expression of *CSN1S1*, were assigned to 4 treatments in a randomized complete block design. Treatments were: LE (Low Energy), LEMet (LE, balanced Met), AE (Adequate Energy) and AEMet (AE, balanced Met) for 5 weeks. Diets consisted in a fixed amount of hay per group with individual amount of energy concentrates (LE vs. AE: 1.47 vs. 1.54 Mcal/kg DM). Isopropyl ester of 2-hydroxy-4-methylthio butanoic acid (HMBi 0.24% concentrate DM) was incorporated in the LEMet and AEMet concentrates based on 100% cow Met requirement (INRA, 2007). Goats (n=23) were slaughtered and mammary tissue was processed for Western blotting using secretory compartment specific markers. In goats fed Met balanced diets, milk protein yield and casein content significantly increased ($P = 0.01$), as was previously observed in cow. The amount of the endoplasmic reticulum (ER) markers Calnexin and ERLIN2 decreased (20%, $P \leq 0.05$) in goats fed the LE diet. Met balanced diets had the opposite effect on both markers (20%, $P \leq 0.05$) and on protein disulfide isomerase (45%, $P \leq 0.05$). These observations are in agreement with a positive effect of Met on the activity of the ER, the site where milk specific proteins and lipids are synthesized. On the other hand, a specific marker of the exit site of the Golgi apparatus and secretory vesicles formation (AP1) decreased with the LE diet (25%, $P \leq 0.05$) and its highest level was found in goats fed Met balanced diet at AE supply. Concerning ßCOP, a marker of intra Golgi transport, its variation clearly evoked a decrease in membrane transport at LE diets. These data show that energy level has a direct impact on membrane traffic in the secretory pathway of mammary epithelial cell while suggesting that Met improves ER activity and has the tendency to further promote intracellular transport of milk components and, ultimately, their secretion.