

Interrelationships between maternal subclinical mastitis (SCM) and infant anthropometry in Guatemala: Role of infection, inflammation, hygiene and lactation practices

HM Wren¹, NW Solomons², ME Scott¹, KG Koski¹

¹ McGill University, Montreal, QC, Canada ² CeSSIAM, Guatemala City, Guatemala

Background: Subclinical mastitis (SCM) is an asymptomatic inflammatory condition of the lactating breast and has been associated with adverse outcomes including poor infant growth. During SCM, tight epithelial junctions become “leaky”, allowing movement of plasma constituents, including sodium ions, into milk. A milk sodium/potassium ratio (Na/K) > 0.6 is considered indicative of SCM. The goals of this longitudinal study were to: (1) explore the determinants of a Na/K ratio >0.6 in mothers during early (0-6 wks) and established (4-6 mo) lactation and to (2) investigate the contribution of breast infection and/or inflammation, urine and stool infections, hygiene and lactation practices, and growth factors present in milk to infant weight-for-age (WAZ), length-for-age (LAZ) and head-circumference-for-age (HCZ) during each period of lactation.

Methods: Breast milk samples were collected from a cohort of lactating Mam-Mayan mothers during early (n=136) and established (n=120) lactation. Inductively Coupled Plasma Mass Spectrometry measured Na and K, and Luminex measured pro-inflammatory cytokines (IL-6, IL-8, IL-1, TNF- α) and growth factors (EGF, VEGF) in milk. Analysis for presence of urine leukocytes and direct smear of maternal stool samples for non-pathogenic protozoa (*Blastocystis hominis*, *Entamoeba coli*, *Iodamoeba butschli* and *Endolimax nana*) were measured. A structured questionnaire describing lactation practices (breastfeeding category, initiation, frequency) and measures of hygiene (water source, sanitation) was administered. Anthropometry of both mother and infant was measured.

Results: Prevalence of SCM was 27% in early and 9% in established lactation; only 5 mothers had SCM during both periods. Determinants of SCM at 0-6 wks were lack of home faucet and parity and at 4-6 mo were lack of home faucet, lower feeding frequency, and higher early milk Na/K ratio.

In early lactation, LAZ was positively associated with maternal height and urine leukocytes. WAZ was positively associated with maternal weight but negatively with milk Na/K ratio and maternal stool *Blastocystis hominis*. HCZ was also negatively associated with milk Na/K ratio and maternal stool *Blastocystis hominis* but positively with the pro-inflammatory cytokines IL-6 in milk.

In established lactation, LAZ was associated positively with maternal height but negatively with maternal stool *Entamoeba coli* and EGF in milk. WAZ was also associated negatively with maternal stool *Entamoeba coli* but positively with maternal weight and pro-inflammatory cytokine TNF- α in milk. HCZ was associated positively

with maternal height and the pro-inflammatory cytokine IL-6 in milk but negatively with EGF in milk.

Conclusion: Compromised infant anthropometry was associated with breast “leakiness” and higher rates of non-pathogenic protozoa in maternal stool. In comparison, biomarkers of inflammation in milk may be a necessary defense against infection. Given that lack of a home faucet was the only determinant of SCM at both periods of lactation, interventions may need to focus on hygiene practices to minimize fecal-oral transmission of protozoa and thereby reduce SCM and improve infant anthropometry. Further research will be required to understand how non-pathogenic protozoa and pro-inflammatory cytokines and growth factors in milk may be interrelated and contribute to infant growth.

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