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Assessment of micronutrient enriched flour distribution with respect to DDT exposure in Maela refugee camp, North-western Thailand

Micronutrients and DDT residues during pregnancy and postpartum

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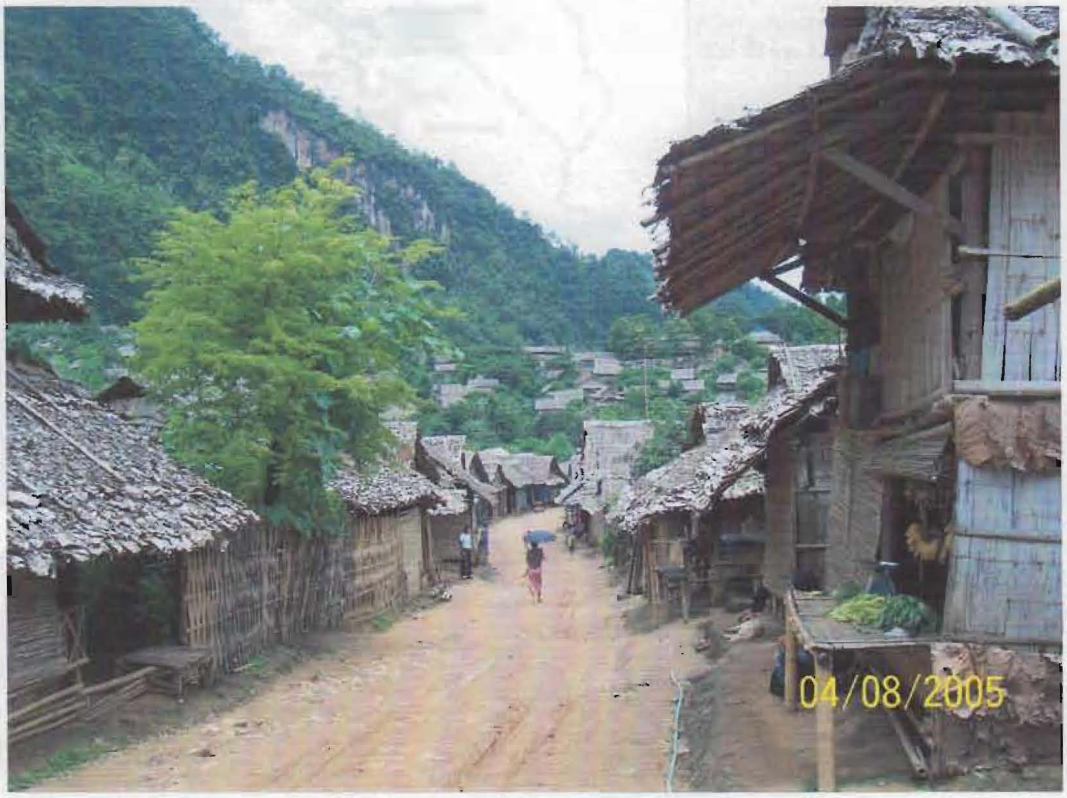

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Project 06/2005: Assessment of micronutrient enriched flour distribution with respect to DDT exposure in Maela refugee camp, North-western Thailand

Micronutrients and DDT during pregnancy and postpartum: impact by

- **supplementation of thiamine and iron**
- **enriched flour on micronutrient status post partum**
- **micronutrients and DDT residues on birth weight**

Background: Micronutrient malnutrition remains prevalent in the Karen displaced population on the north-western border of Thailand. Food is provided by charities and the ration is adequate in energy and protein, but low in micronutrient content. During antenatal care pregnant and lactating women receive a routine supplementary food ration and oral dosages of thiamine, folic acid and ferrous sulphate. In July 2004 flour fortified with vitamins and minerals was introduced in Maela camp (pop: 45 000).
In Thailand, DDT was sprayed as an insecticide to control malaria until 2000; its residues may interact with micronutrients and may affect pregnancy outcomes, i.e. preterm delivery or birth weight, and infant development.
Aims: Assessment of micronutrient supplements, micronutrient enriched flour and DDT exposure in pregnant and postpartum women in Maela refugee camp.
Methods: In cross-sectional studies 533 pregnant women (1st to 3rd trimester) and 89 mothers (12 weeks postpartum) were enrolled prior the introduction of enriched flour for the analysis on vitamin A (retinol), E (α-tocopherol), and B1 (thiamine), zinc, copper, iron (ferritin, sTfR), and DDT in blood as well as vitamins (A/E/B1) and DDT in milk. All the pregnant women were followed to assess pregnancy outcome and birth weight; 100 mothers provided with the enriched flour were followed until 12 weeks postpartum for the analysis on micronutrients and DDT residues.
Results: Pregnancy was associated with lower mean levels of serum retinol (1.42 vs. 1.60 µmol/L), thiamine diphosphate (TDP) in whole blood (52.0 vs. 67.1 µg/L), and lower median sTfR (6.3 vs 7.6 mg/L) and serum zinc (0.48 vs. 0.60 mg/L) compared to postpartum ($p<0.001$); median serum ferritin (39.1 vs. 39.8 µg/L), iron storage and prevalence of iron deficiency were similar while mean serum α-tocopherol (22.1 vs 13.4 µmol/L), cholesterol (4.91 vs 4.64 mmol/L) and triglycerides (2.27 vs 0.95 mmol/L) were significantly higher during pregnancy compared to post partum.
TDP in whole blood (and per gram haemoglobin) increased with gestational age and number of weeks thiamine supplements had been provided while markers for iron status indicated a decrease of iron stores and a high prevalence of iron deficiency anemia (one of 3 women) in late pregnancy despite high doses of provided ferrous sulphate. In addition the prevalence of low serum zinc was quite high in pregnant and breast-feeding women.
Women in the follow-up who consumed the enriched flour had higher mean serum zinc (0.66 vs. 0.60 mg/L, $p< 0.04$) and lower median sTfR (6.9 vs 7.6 mg/L, $p=0.007$) in post partum reflecting the improvement of zinc status and tissue iron stores; mean serum retinol (1.69 µmol/L), α-tocopherol (14.4 µmol/L), whole blood TDP (69.1 µg/L), median serum ferritin (42.0 µg/L) and mean total thiamine in milk (286.7 vs. 262.3 ug/L) were slightly higher than in the 89 women studied before the introduction of the flour. Median retinol (1.0 µmol/L) and α-tocopherol (3.8 µmol/L) and mean zinc (1.85 mg/L) and copper (0.28 mg/L) in breast milk were equal in both groups.
DDT residues were detected in all specimens with a median value of total DDT in breast milk of 134 ug/L (1.8 -1907.7 ug/L), which was 10-fold the median level in serum of 13.1 ug/L (0.3 - 88.3) in post partum. DDT residues were highly correlated

with the years the women had been staying in Thailand; the number of former breast-fed children (parity) reduced the amount of DDT residues in serum and breast milk. Micronutrients as well as DDT had an impact on birth weight. Multiple regression analysis indicated that DDT residues and high hemoglobin (hematocrit) during pregnancy were associated with lower birth weight; serum α-tocopherol was positively correlated whereas serum retinol showed an inverse association with birth weight. Whole blood thiamine had a positive impact on infant's lengths.

Conclusion: Thiamine status in pregnant and breast-feeding women of Maela camp was sufficient reflecting the acceptance and effectiveness of provided supplements; in contrary the high prevalence of iron deficiency anemia in pregnant and breast-feeding women suggest a lower compliance to ferrous sulphate supplements.

The introduction of enriched flour had a positive impact on zinc and iron status in women post partum. Micronutrient enriched flour could therefore reduce the high prevalence of zinc deficiency and iron deficiency anemia in Maela refugee camp.

The impact by DDT exposure needs to be considered if infant's birth weight is assessed in areas where it was sprayed until recently.