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D3.2 Annotated bibliography of food consumption information in the five South East-Asian countries



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Contents

- **Preface, p3**
- **Question 1, p4**
- **Question 2, p31**
- **Question 3, p50**

Preface

This deliverable gives an extensive overview of publications and documents available on food consumption in Cambodia, Indonesia, Laos, Thailand and Vietnam.

Three main questions are addressed and details of the documents (author, year, title, city, publisher) and abstracts (if available) are clustered accordingly:

- 1- What are the major nutrition deficiencies of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam
- 2- Which foods are common in a typical diet of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam?
- 3- Which food out of a typical diet of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam are not very common but are still interesting for the food composition table because it contains a high concentration of a particular nutrient?

Details of the documents are highlighted in different colors referring to the different SEA countries:

Cambodia, Indonesia, Lao PDR, Thailand and Vietnam.

We acknowledge all WP3 partners for their input to complete this bibliography!

Question 1: What are the major nutrition deficiencies of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam?

Achadi EL, Hansell MJ, Sloan NL, Anderson MA. Women's nutritional status, iron consumption and weight gain during pregnancy in relation to neonatal weight and length in West Java, Indonesia. *Int J Gynaecol Obstet*. 1995 Jun;48 Suppl:S103-19. Source: Center for Child Survival, University of Indonesia, West Java.

Pregnant and non-pregnant women in Indramayu, West Java were examined for nutritional status, using anthropometric indicators. For the pregnant women, longitudinal data on nutritional status, iron consumption and weight gain were examined in relation to neonatal weight and length. Comparing the non-pregnant women's average nutritional status with reference tables for height, weight and MUAC, they placed at the 25th percentile or less on all indicators. Using original formulae to estimate pre-pregnancy weight and pregnancy weight gain, the study showed that 18% of pregnant women had a pre-pregnancy weight of under 40 kg and the average pregnancy weight gain was under 9 kg. Comparing estimated pregnancy weight gain with the amount of weight gain needed to compensate for generally low pre-pregnancy weight, only about 9% of women gained adequately. In multiple regression models that controlled for other maternal and neonatal factors, iron consumption during pregnancy was a significant predictor of full-term (37 weeks or more) neonatal weight ($P = 0.01$) and length ($P = 0.01$). Consumption of one or more tablets (200 mg ferrous sulfate and 0.25 mg folic acid) per week by women during pregnancy was associated with increased neonatal weight (by 172 g on average) and length (by 1 cm on average). Adequate weight gain during pregnancy and maternal height also contributed to the specification of the neonatal weight model ($P = 0.07$ for both). In the neonatal length model, maternal height was also nearly significant ($P = 0.03$). The same models did not explain the variability in neonatal weight and length in the pre-term group (< 37 weeks gestation).

Aikawa R, Khan NC et al. (2006). "Risk factors for iron-deficiency anaemia among pregnant women living in rural Vietnam." *Public health nutrition* 9(4): 443-448.

Prevalence and risk factors for Fe-deficiency anaemia amongst pregnant women in rural Vietnam were investigated. Subjects were pregnant women ($n = 438$) living in Nghe An Province, Vietnam. Data were collected using food frequency questionnaires and interviews with key informants. Blood samples ($n = 438$) were collected for haemoglobin (Hb) analysis and stool samples ($n = 391$) were examined for parasitic infestation. Amongst the 438 pregnant women, anaemia (Hb <11.0 g/dl) was detected in 43.2% and severe anaemia (Hb <8.0 g/dl) in 0.5%. Anaemic women were less likely to consume beans ($P < 0.05$). Intake of other dietary components was similar between anaemic and non-anaemic women. In multiple regression analysis, Hb concentration. was correlated positively with taking Fe tablets, the consumption of eggs and a preference for Western medicine. In contrast, Hb concentration was correlated negatively with pregnancy duration and hookworm infestation.

Anderson VP, Jack S, et al. (2008). "Co-existing micronutrient deficiencies among stunted Cambodian infants and toddlers." *Asia Pacific Journal of Clinical Nutrition* 17(1): 72-79.

The prevalence of malnutrition in Cambodia is among the highest in Southeast Asia, and diarrhoea and pneumonia are the leading causes of death among children. Whether these adverse health outcomes are associated with co-existing micronutrient deficiencies is uncertain. We have determined the prevalence of anaemia, as well as iron, zinc, and vitamin A deficiency and their co-existence among stunted children (77 females; 110 males) aged 6-36 mos. Non-fasting morning venipuncture blood samples were taken and analysed for haemoglobin (Hb), serum ferritin (via IMx system), retinol (via HPLC), and Zn (via AAS), C-reactive protein (CRP) (via turbidimetry) and Hb type (AA, AE, or EE) (via Hb gel electrophoresis). Children with CRP ≥ 5.0 mg/L ($n=34$) were excluded. Zinc deficiency defined as serum Zn <9.9 micro mol/L had the highest prevalence (73.2%), followed by anaemia (71%) (Hb<110 g/L), and then vitamin A deficiency (28.4%) (serum retinol <0.70 micro mol/L). Of the anaemic children, only 21% had iron deficiency anaemia, and 6% had depleted iron stores. Age, log serum ferritin, and Hb type were significant predictors of Hb in the AA and AE children. Serum retinol was unrelated to haemoglobin or serum zinc. The prevalence of two or more micronutrient deficiencies (low Hb, serum retinol, and/or serum zinc) was 44%. Nearly 10% had low values for all three indices, and 18% had just one low value. In conclusion, anaemia, and deficiencies of iron, zinc, and vitamin A are severe public health

D3.2 Annotated bibliography of food consumption information in the five SEA countries

problems among these stunted Cambodian children. Intervention strategies addressing multiple micronutrient deficiencies are needed.

Andert CU, Sanchaisuriya P, et al. (2006). "Nutritional status of pregnant women in Northeast Thailand." *Asia Pacific Journal of Clinical Nutrition* 15(3): 329-334.

A comparative study on the nutritional status of primiparous and multiparous women in the first trimester of pregnancy was conducted in the north-eastern province of Thailand, Khon Kaen, to investigate differences in protein-energy-malnutrition, iron deficiency anaemia, vitamin A deficiency and carotenoid status between both parity groups. 94 subjects were recruited at first attendance of antenatal clinic. Data about weight, height, haemoglobin and haematocrit were obtained from hospital records. Anthropometric measurements of mid-upper arm circumference and triceps skinfold were done on a sub sample. Retinol, carotenoids and alpha-tocopherol were analysed using a reversed-phase high-performance liquid chromatography method. Ferritin, transthyretin and retinol-binding protein were determined by enzyme-linked immunosorbent assay. Primiparous women showed lower body mass index, mid-upper arm circumference, corrected arm muscle area ($P < 0.001$) as well as lower retinol, cholesterol and triceps skinfold ($P < 0.05$). After adjusting for age and socio-economic status the significant difference persisted for all parameters but triceps skinfold. No significant differences of alpha-tocopherol, serum proteins, carotenoids and iron indices could be observed, even though a tendency to higher values for ferritin, haemoglobin and haematocrit was shown in multiparous women. Prevalence of protein-energy-malnutrition (body mass index $< 18.5 \text{ kg/m}^2$) in the primiparous group was significantly higher compared to the multiparous group ($P < 0.05$). Prevalence of protein-energy-malnutrition, iron deficiency anaemia and vitamin A deficiency were 15.1%, 6.3% and 3.3%, respectively, in the total study population. No differences between parity groups could be observed for prevalence of iron deficiency anaemia and vitamin A deficiency.

Barenes H, Simmala C, Odermatt P, Thaybouavone T, Vallee J, Martinez-Aussel B, Newton PN, Strobel M. Postpartum traditions and nutrition practices among urban Lao women and their infants in Vientiane, Lao PDR. *Eur J Clin Nutr.* 2009 Mar;63(3):323-31. Epub 2007 Nov 14. *Eur J Clin Nutr.* 2009 Mar;63(3):450. Martinez-Ussel, B [corrected to Martinez-Aussel, B].

Objective: To assess the traditional postpartum practices, mother and child nutritional status and associated factors. *Subjects/methods:* A cross-sectional study in 41 randomly selected villages on the outskirts of Vientiane capital city, Lao PDR (Laos). 300 pairs of infants (< 6 months of age) and their mothers were enrolled. Information was collected about pregnancy, delivery and traditional practices through a standardized questionnaire. Dietary intake and food frequency were estimated using the 24 h recall method, calibrated bowls and FAO food composition tables. Mothers' and infants' anthropometry was assessed and multivariate analysis performed. *Results:* Contrasting with a high antenatal care attendance (91%) and delivery under health professional supervision (72%), a high prevalence of traditional practices was found, including exposure to hot beds of embers (97%), use of traditional herb tea as the only beverage (95%) and restricted diets (90%). Twenty-five mothers (8.3%) were underweight. Mothers had insufficient intake of calories (55.6%), lipids (67.4%), iron (92.0%), vitamins A (99.3%) and C (45%), thiamin (96.6%) and calcium (96.6%). Chewed glutinous rice was given to infants as an early (mean 34.6, 95% CI:29.3-39.8 days) complementary food by 53.7% of mothers, and was associated with stunting in 10% children (OR=1.35, 95% CI:1.04-1.75). *Conclusion:* The high prevalence of traditional postpartum restricted diets and practices, and inadequate maternal nutritional intake in urban Laos, suggest that antenatal care may be an important opportunity to improve postpartum diets.

Berger J, Nguyen Xuan Ninh, Nguyen Cong Khan, Nguyen Van Nhien, Lien DK, Trung NQ, Ha Huy Khoi. Efficacy of combined iron and zinc supplementation on micronutrient status and growth in Vietnamese infants. *Eur J Clin Nutr.* 2006 Apr;60:443-54.

Objective: To evaluate the effect of combined iron-zinc supplementation on micronutrient status, growth and morbidity. *Design:* Randomized, double-masked, placebo-controlled supplementation trial. *Settings:* Rural district of Que Vo, in the Red River Delta in Vietnam. *Subjects:* A total of 915 breast-fed infants aged 4-7 months were included and 784 completed the study. *Interventions:* The Fe-group received daily and for a 6-month period 10 mg of iron, the Zn-group 10 mg zinc, the Fe-Zn group 10 mg iron+10 mg zinc and the placebo group a placebo. Hemoglobin (Hb), serum ferritin (SF) and zinc (SZn), and anthropometry were measured before and at

D3.2 Annotated bibliography of food consumption information in the five SEA countries

the end of the intervention. Morbidity was recorded daily. RESULTS: Changes of Hb and SF were higher in both Fe and Fe+Zn groups (respectively 22.6 and 20.6 g/l for Hb; 36.0 and 24.8 microg/l for SF) compared to Zn and placebo groups (Hb: 6.4 and 9.8 g/l; SF: -18.2 and -16.9 microg/l, $P < 0.0001$). SZn increased more in Zn group (10.3 micromol/l) than in Fe+Zn group (8.0 micromol/l, $P = 0.03$) and more in these groups compared to Fe and placebo groups (1.6 and 1.2 micromol/l, $P < 0.0001$). Weight gain was higher in the Zn group. No significant effects of supplementations on growth in length or morbidity. *Conclusions:* Combined iron-zinc supplementation had a positive effect on iron and zinc status in infants. However, the positive effect of zinc alone on SZn and weight would indicate a negative interaction of iron when added to zinc supplements.

Boontaveeyuwat N, Sittisingsh U (2003). "Body iron stores in Thai women of reproductive age." Journal of the Medical Association of Thailand **86**(4): 343-347.

Body iron stores is sensitively indicated to iron status. Since iron status strongly affects to iron absorption, body iron stores is a factor of estimating the dietary iron absorption method as proposed by Mosen. This study aimed to determine body iron stores in Thai women of reproductive age, which is one of the iron deficiency risk groups. The serum ferritin levels of 115 normal iron status (serum ferritin ≥ 12 ng/ml) women aged between 18-45 years were included in the body iron stores calculation by Cook's method. The result showed that the mean body iron stores of the women was 292.78 mg. This finding was consistent with previous reports that the values were in the range of 200-400 mg in the women. The mean body iron stores were of 309 mg and nearly 300 mg in American and Australian women, respectively. The values were less than the recommended amount of 500 mg in adult women. Only 3 per cent of the Thai women in the present study met the recommended amount. So, as in American and Swedish women, less than 5 per cent of them reached the storage iron of 500 mg.

Butterworth RF (2001). "Maternal thiamine deficiency: Still a problem in some world communities." American Journal of Clinical Nutrition **74**(6): 712-713.

Danielsson ND, Hoa P, et al. (2004). "Intracranial haemorrhage due to late onset vitamin K deficiency bleeding in Hanoi province, Vietnam." Archives of Disease in Childhood (Fetal and Neonatal edition) **89**(6): 546-550.

Objective: To estimate the burden of intracranial haemorrhage caused by late onset vitamin K deficiency bleeding in Hanoi, Vietnam. *Methods:* Cases of intracranial haemorrhage in infants aged 1-13 weeks were identified for 5 years (1995-99), and evidence for vitamin K deficiency was sought. The data were compared with those on vitamin K deficiency bleeding in Developed Countries and used to obtain an approximation to the incidence of intracranial haemorrhage caused by vitamin K deficiency bleeding. *Results:* The estimated incidence of late onset vitamin K deficiency bleeding in infants who received no prophylaxis was unexpectedly high (116 per 100 000 births) with 142 and 81 per 100 000 births in rural and urban areas, respectively. Mortality was 9%. Of the surviving infants, 42% were neurologically abnormal at the time of hospital discharge. The factors associated with the disease were rural residence, male sex and low birth weight. A significant reduction in the incidence was observed in urban areas during 1998-99, after vitamin K prophylaxis was introduced at one urban obstetric hospital. *Conclusions:* Vitamin K deficiency bleeding is a major public health problem in Hanoi. The results indicate that routine vitamin K prophylaxis could significantly reduce infant morbidity and mortality in Vietnam and, costing an estimated \$87 (<pounds>48, Euro 72) per disability adjusted life year saved, is a highly cost-effective intervention.

De Pee S, Bloem MW, et al. (2002). "The high prevalence of low haemoglobin concentration among Indonesian infants aged 3-5 months is related to maternal anaemia." Journal of Nutrition **132**(8): 2215-2221.

Iron deficiency anaemia among young children is a large health problem. However, there is little information about the prevalence of anaemia among young infants because it has been assumed that normal, breast-fed infants have adequate iron stores until 4-6 mo of age. We analyzed cross-sectional data from the HKI/GOI Nutrition and Health Surveillance System in rural Java, Indonesia from Sept. 1999 to Feb. 2001 for hemoglobin (Hb) of 3- to 5-mo-old breast-fed infants ($n = 990$) and related factors. The prevalence of Hb < 90 g/L was 13.4%, < 100 g/L, 37%, and < 110 g/L, 71%. Multiple logistic regression analysis revealed that normal birth weight infants (> 2500 g) of anaemic mothers (Hb < 120 g/L) had an odds ratio (OR) [95% confidence interval (CI)] of 1.81 [1.34-2.43] to have a low Hb (< 100 g/L) compared with infants of non-anaemic mothers with a normal

D3.2 Annotated bibliography of food consumption information in the five SEA countries

birth weight. Infants of non-anaemic mothers but with low birth weight had an OR of 1.15 [0.61-2.16], and those with low birth weight and anaemic mothers of 3.68 [1.69-8.02]. Other risk factors included stunting (OR 1.70 [0.97-2.95]), a young mother (<20 y, OR 1.54 [0.95-2.49]), lower maternal education and living in West Java or East Java. Considering that maternal postpartum Hb reflects Hb during pregnancy, that anaemia among mothers in this population is due mainly to iron deficiency, and that children born to anaemic mothers are at higher risk of a low Hb, we hypothesize that low infant Hb in this population is due to iron deficiency. Intervention studies in iron deficient populations should test this hypothesis.

Dibley MJ, Senarath U, Agho KE. Infant and young child feeding indicators across nine East and Southeast Asian countries: an analysis of National Survey Data 2000-2005. *Public Health Nutr.* 2010 Sep;13(9):1296-303. Epub 2010 May 4. Sydney School of Public Health, The University of Sydney, Sydney, NSW, Australia. mdibley@health.usyd.edu.au

Objective: To compare infant and young child feeding practices in children aged 0-23 months across nine East and Southeast Asian countries. *Design:* Secondary analyses of cross-sectional data from available Demographic and Health Surveys (DHS; Indonesia, Philippines, Timor-Leste, Cambodia and Vietnam), Multiple Indicator Country Surveys (Lao People's Democratic Republic (Lao PDR) and Myanmar) and national nutrition surveys (Democratic People's Republic of Korea (DPR Korea) and Mongolia) conducted between 2000 and 2005. *Setting:* Seven countries from Southeast Asia and two from East Asia. *Subjects:* Children aged 0-23 months with samples ranging from 826 to 5610 for DHS, and from 477 to 5860 for non-DHS data. *Results:* More than 93 % of infants were ever breast-fed, and over 75 % were currently breast-fed except in the Philippines. Timely initiation of breast-feeding varied from 32 % in Indonesia to 46 % in Timor-Leste. Exclusive breast-feeding (EBF) rate in infants under 6 months of age ranged from 11 % in Myanmar to 60 % in Cambodia. EBF rates were also low in Vietnam (15.5 %) and Lao PDR (23 %), and varied between 30 % and 40 % in Indonesia, Philippines and Timor-Leste. The proportion of infants under 6 months of age who were given breast milk with non-milk liquids was high except in Indonesia and Timor-Leste. Bottle-feeding rates were lower in DPR Korea (3 %), Lao PDR (6 %) and Myanmar (6 %) and higher in the Philippines (49 %) and Mongolia (31 %). Timely complementary-feeding rate varied widely across countries (6-99 %). *Conclusions:* All the countries studied should make greater efforts to improve timely initiation of breast-feeding and EBF for 6 months. Measures should be taken to reduce high bottle-feeding rate in the Philippines, Mongolia, Indonesia and Vietnam, and improve complementary-feeding rate in Lao PDR, Myanmar, DPR Korea and Philippines.

Dijkhuizen MA, Wieringa FT, et al. (2001). "Concurrent micronutrient deficiencies in lactating mothers and their infants in Indonesia." *American Journal of Clinical Nutrition* 73(4): 786-791.

Background: Deficiencies of vitamin A, iron, and zinc are prevalent worldwide, affecting vulnerable groups such as lactating women and infants. However, the existence of concurrent deficiencies has received little attention. *Objective:* The aim was to investigate the extent to which deficiencies of vitamin A, iron, and zinc coexist and the nutritional relation between lactating mothers and their infants. *Design:* In a cross-sectional survey in rural West Java, Indonesia, 155 lactating mothers and their healthy infants were assessed anthropometrically and blood, urine, and breast-milk samples were obtained. *Results:* Marginal vitamin A deficiency was found in 54% of the infants and 18% of the mothers. More than 50% of the mothers and infants were anaemic and 17% of the infants and 25% of the mothers were zinc deficient. There was a strong interrelation between the micronutrient status of the mothers and infants and the concentrations of retinol and beta-carotene in breast milk. Vitamin A deficiency in infants led to an increased risk of anaemia and zinc deficiency (odds ratios: 2.5 and 2.9, respectively), whereas in mothers the risk of anaemia and iron deficiency (odds ratios: 3.8 and 4.8, respectively) increased. In infants, concentrations of insulin-like growth factor I were related to concentrations of plasma retinol and beta-carotene but not to zinc. *Conclusions:* Micronutrient deficiencies were prevalent in West Java. The micronutrient status of lactating mothers and that of their infants were closely related; breast milk was a key connecting factor for vitamin A status. Furthermore, concurrent micronutrient deficiencies appeared to be the norm.

Firestone R, Punpuing S, et al. (2011). "Child overweight and undernutrition in Thailand: is there an urban effect?" *Social Science & Medicine* 72(9): 1420-1428.

An urban advantage in terms of lower risk of child undernutrition has been observed in many developing

D3.2 Annotated bibliography of food consumption information in the five SEA countries

countries, but child obesity is often more prevalent in urban than rural areas. This study aimed to assess whether urban-rural disparities in undernutrition and obesity were attributable to concentrations of socioeconomically advantaged children into urban communities or to specific aspects of the urban environment. A sample of 4610 children ages 2-10 years was derived from the 2004 Round of the Kanchanaburi Demographic Surveillance System, monitoring health and demographic change in the province of Kanchanaburi, Thailand. We used multi-level logistic regression to model the odds of short stature, underweight, and obesity for children in 102 communities. Models tested whether child socioeconomic conditions accounted for urban-rural disparities or if aspects of the social and physical environment accounted for disparities, adjusting for child characteristics. 27.8% of children were underweight, while 19.9% had short stature, and 8.3% were obese. Bivariate associations showed urban residence associated with lower risk of undernutrition and a greater risk of obesity. Urban-rural disparities in odds of short stature and underweight were accounted for by child socioeconomic characteristics. Urban residence persisted as a risk factor for obesity after adjusting for child characteristics. Community wealth concentration, television coverage, and sanitation coverage were independently associated with greater risk of obesity. Undernutrition was strongly associated with household poverty, while household affluence and characteristics of the urban environment were associated with odds of obesity. Further research is needed to characterize how urban environments contribute to children's risks of obesity in developing countries.

Gibbs M, Bailey KB, et.al. (2011). The adequacy of micronutrient concentrations in manufactured complementary foods from low-income countries. *J Fd CompAnal* 24:418-26.

Iron, zinc, and calcium in complementary foods (CFs) are defined as problem micronutrients by the World Health Organization (WHO), as their concentrations in CFs fall below the calculated requirements for breast-fed infants of micronutrients obtained from CFs. Consequently, manufacturers often fortify plant-based CFs with these threem micronutrients. We have analyzed concentrations of iron, zinc, calcium, and phytic acid (as hexa- and penta-inositol phosphates) in 57 cereal-based CFs purchased in five countries each in Africa and Asia. Molar ratios of phytate:iron, phytate:zinc, and phytate:calcium were also calculated. Intakes of iron, zinc, and calcium from these CFs were then calculated assuming breastfed infants aged 9–11 months consume the recommended daily ration size of CF (40 g/d; dry weight), and compared with WHO estimated needs from CFs. Even though manufacturers claimed to fortify 84% (48/57) of the CFs, 79%, 10% and 32% had molar ratios for phytate:iron, phytate:zinc, and phytate:calcium, respectively, above desirable levels. Despite fortification, only 4% of the CFs met the WHO estimated needs for breast-fed infants aged 9–11 months for iron, 2% for zinc, and 4% for calcium. Appropriate fortification of cereal-based CFs is necessary to ensure they meet WHO estimated needs for iron, zinc, and calcium for breast-fed infants.

Gibson RS, Manger MS, Krittaphol W, Pongcharoen T, Gowachirapant S, Bailey KB, Winichagoon P. Does zinc deficiency play a role in stunting among primary school children in NE Thailand. (2007) *British Journal of Nutrition*, 97 (1), pp. 167-175.

Stunting in school-age years may result in a decrease in adult size, and thus reduced work capacity and adverse reproductive outcomes. We have compared the mean intakes of energy, protein and selected growth-limiting nutrients in fifty-eight stunted children and 172 non-stunted controls drawn from 567 children aged 6–13 years attending ten rural schools in NE Thailand. Control children were selected randomly after stratifying children by age in each school. Dietary data were calculated from 24-h recalls using nutrient values from Thai food composition data and chemical analysis. Inter-relationships between stunting and sociodemographic, anthropometric and biochemical variables were also examined. Biochemical variables investigated were serum albumin, zinc, ferritin, transferrin receptor and retinol, and iodine in casual urine samples. Significantly more males than females were stunted (males, n 38, 65.5% v. females, n 20, 34.5%; $P=0.025$). Stunted males had lower mean intakes of energy, protein, calcium, phosphorus and zinc, and a lower mean (95% CI) serum zinc (9.19 (8.53, 9.84) v. 9.70 (8.53, 9.29) mmol/l) than non-stunted males; no other biochemical differences were noted. Stunted males also had a lower mean arm muscle area ($P=0.015$), after adjusting for age, than nonstunted males. In conclusion, the lower dietary intakes of the stunted males compared to their non-stunted counterparts may be associated with anorexia and hypogeusia induced by zinc deficiency. Hence, zinc deficiency may be a factor limiting linear growth, especially among boys in NE

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Thailand, but more research is needed to establish whether other factors also play a role.

Green TJ, Skeaff CM, et al. (2008). "Vitamin D status and its association with parathyroid hormone concentrations in women of child-bearing age living in Jakarta and Kuala Lumpur." *European journal of clinical nutrition* 62(3): 373-378.

Objective: To describe the vitamin D status of women living in two Asian cities, Jakarta (6 degrees S) and Kuala Lumpur (2 degrees N), to examine the association between plasma 25-hydroxyvitamin D and parathyroid hormone (PTH) concentrations, and to determine a threshold for plasma 25-hydroxyvitamin D above which there is no further suppression of PTH. Also, to determine whether dietary calcium intake influences the relationship between PTH and 25-hydroxyvitamin D. *Design:* Cross-sectional. *Setting:* Jakarta, Indonesia and Kuala Lumpur, Malaysia. *Participants:* A convenience sample of 504 non-pregnant women 18-40 years. *Main Measures:* Plasma 25-hydroxyvitamin D and PTH. *Results:* The mean 25-hydroxyvitamin D concentration was 48 nmol/l. Less than 1% of women had a 25-hydroxyvitamin D concentration indicative of vitamin D deficiency (<17.5 nmol/l); whereas, over 60% of women had a 25-hydroxyvitamin D concentration indicative of insufficiency (<50 nmol/l). We estimate that 52 nmol/l was the threshold concentration for plasma 25-hydroxyvitamin D above which no further suppression of PTH occurred. Below and above this concentration the slopes of the regression lines were -0.18 (different from 0; P=0.003) and -0.01 (P=0.775), respectively. The relation between vitamin D status and parathyroid hormone concentration did not differ between women with low, medium or high calcium intakes (P=0.611); however, even in the highest tertile of calcium intake, mean calcium intake was only 657 mg/d. *Conclusion:* On the basis of maximal suppression of PTH we estimate an optimal 25-hydroxyvitamin D concentration of approximately 50 nmol/l. Many women had a 25-hydroxyvitamin D below this concentration and may benefit from improved vitamin D status.

Gross R, Schultink W. Micronutrient deficiency in urban Indonesia. Source Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)/SEAMEO-TROPMED Jakarta, Indonesia. *Int J Gynaecol Obstet*.

The economic situation of Indonesia is characterized by a large increase in the gross national product which has been on average 7% annually during the last ten years. This was accompanied by rapid urbanization. With the economic improvement, "First World" and "Third World" health and nutrition problems are coexisting in Indonesia. In 1992, the most common of death cause was cardiovascular disease whereas tuberculosis was the second ranking. About 40% of the preschool children are stunted. The main staple food and energy source is rice, although the urban population has a more diverse food pattern than the rural population. In Jakarta, many children receive too late colostrum feeding and mothers are not aware about the importance of correct breastfeeding practices after delivery. Three studies had shown that about one fifth of preschool children and one fourth of elderly take micronutrient supplements. Nevertheless, micronutrient deficiencies are prevalent in Jakarta. About one third of women suffer from moderate vitamin A deficiency (plasma retinol < 0.70 mmol/L) and 50% of pregnant women are anemic. More information is necessary on other micronutrient deficiencies. For example, a small study revealed that nearly two thirds of non-institutionalized elderly living in Jakarta experience thiamine deficiency. Appropriate interventions to reduce micronutrient deficiencies should sensitize the urban population to the fact that the government should restrict itself to use its resources to assist only the poorest individuals and groups, whereas it must be expected from the middle class to spend more time and money to solve their own problems 1995 Jun;48 Suppl:S103-19.

Ha DTP, Feskens EJM et al. (2011). "Nationwide shifts in the double burden of overweight and underweight in Vietnamese adults in 2000 and 2005: two national nutrition surveys." *BMC public health* 11: 62.

Background: In developing countries, overweight prevalence is increasing while underweight prevalence is still high. This situation is known as the double nutrition burden. Both underweight and overweight are related to increased risk of chronic non-communicable diseases, reduced well-being and quality of life. This study aims to compare the prevalence of overweight and underweight among Vietnamese adults in 2000 and 2005. *Methods:* The study was based on two nationally representative surveys, the National Nutrition Survey 2000 (14,452 subjects) and the National Adult Obesity Survey 2005 (17,213 subjects). Adults aged 25-64 years were sampled to be nationally representative. Multiple multinomial logistic regression analysis was used to investigate the association of underweight and overweight with socio-economic indicators. *Results:* The distribution of BMI

D3.2 Annotated bibliography of food consumption information in the five SEA countries

across the population and population groups indicated a shift towards higher BMI levels in 2005 as compared to 2000. The nationwide prevalence of overweight (BMI ≥ 25 kg/m²) and obesity (BMI ≥ 30 kg/m²) was 6.6% and 0.4% respectively in 2005, almost twice the rates of 2000 (3.5% and 0.2%). Using the Asian BMI cut-off of 23 kg/m² the overweight prevalence was 16.3% in 2005 and 11.7% in 2000. In contrast, the underweight prevalence (BMI < 18.5 kg/m²) of 20.9% in 2005 was lower than the rate of 25.0% in 2000. Women were more likely to be both underweight and overweight as compared to men in both 2000 and 2005. Urban residents were more likely to be overweight and less likely to be underweight as compared to rural residents in both years. The shifts from underweight to overweight were clearer among the higher food expenditure levels. *Conclusions:* The double nutrition burden was clearly present in Vietnam. The distribution of BMI across the population groups generally indicated a shift towards higher BMI levels in 2005 as compared to 2000. The prevalence of overweight was increased while the declined level of undernutrition was still high in 2005. The shifts of underweight to overweight were most obvious among population groups with higher food expenditure levels.

Holmes W, Hoy D, Lockley A, Thammavongxay K, Bounnaphol S, Xeuatvongsa A, Toole M. Influences on maternal and child nutrition in the highlands of the northern Lao PDR. *Asia Pac J Clin Nutr.* 2007;16(3):537-45.

In two remote northern provinces of the Lao People's Democratic Republic, provincial and district teams were trained and subsequently conducted a qualitative study using a participatory approach to investigate people's knowledge, attitudes, beliefs and practices in relation to women's and children's nutrition. Using focus group discussions, key informant interviews, and structured observation, the teams found that certain nutrition behaviours, including food taboos, may contribute to the high prevalence of child malnutrition and micronutrient deficiencies in these northern provinces. Ethnic groups gave details of nutrition-related beliefs and practices; the teams found that many of these are likely to be amenable to change through relatively low-cost nutrition promotion informed by these findings. In particular, barriers to exclusive breastfeeding, food taboos and hygiene behaviour could be addressed. The study also demonstrated that with appropriate training, supervision and support, local teams are able to plan and conduct a large-scale qualitative study

Ho-Pham, LTND Nguyen, et al. (2011). "Vitamin D status and parathyroid hormone in a urban population in Vietnam." *Osteoporosis International* 22(1): 241-248.

In this cross-sectional study in Vietnam, the prevalence of vitamin D insufficiency was 46% in adult women and 20% in adult men. There was a linear inverse relationship between serum 25(OH)D and PTH concentrations, but there was no threshold of 25(OH)D at which PTH levels plateaued. Introduction Vitamin D insufficiency is adversely associated with health outcomes. Vitamin D status in Asian populations is not well documented. This study sought to assess vitamin D status and its relationship to parathyroid hormone in a Vietnamese population. *Methods* This cross-sectional study involved 205 men and 432 women aged 18-87 years, who were randomly sampled from various districts in Ho Chi Minh City (Vietnam) according to a proportional sampling scheme. Serum concentration of 25(OH)D and PTH were measured by the Electrochemiluminescence immunoassay on the Roche Elecsys 10100/201 system (Roche Diagnosis Elecsys). Vitamin D insufficiency was quantified as serum 25(OH)D levels below 30 ng/ml (75 nmol/L). *Results* The average age for men and women was 43.8 \pm 18.4 years (mean \pm SD) and 47.7 \pm 17.1 years, respectively. The mean 25(OH)D concentration in men (36.8 \pm 10.2 ng/mL) was significantly higher than in women (30.1 \pm 5.9; $P < 0.0001$). The prevalence of vitamin D insufficiency in men was 20% (41/205) which was significantly lower than in women (46%, 199/432). Age, height and weight were independent predictors of 25(OH)D concentrations, and the three factors explained 15% and 5% of variance in 25(OH)D in men and women, respectively. There was a linear inverse relationship between serum 25(OH)D and PTH concentrations, but there was no threshold of 25(OH)D at which PTH levels plateaued. *Conclusions* These data show that vitamin D insufficiency is common even in tropical region, and that women had a greater risk of vitamin D insufficiency than men. These data suggest that an elevation in PTH cannot be used as a marker for vitamin D deficiency.

Isaranurug S, Mo-suwan L, Choprapawon C (2006). Differences in socio-economic status, service utilization, and pregnancy outcomes between teenage and adult mothers. *J Med Assoc Thai* 89 (2): 145-51.

Background: Teenage pregnancies put mothers at high-risks to many health-related complications and newborn infants to poor birth-outcomes. *Objective:* The present study aimed to explore the relationship of socio-

D3.2 Annotated bibliography of food consumption information in the five SEA countries

economic status, service utilization, and pregnancy outcomes between teenage and adult mothers. *Material and Method:* The study design was a population-based prospective cohort study conducted in four districts located in different geographical areas of Thailand. All pregnancies occurring within one year, in each of the selected districts as of October 2000, were identified and recruited as the study's cohorts. Data was collected by interviewing cohort-respondents and through reviewing medical records. *Results:* The present study showed that teenage pregnancies accounted for 13.3% of all pregnancies in the study area. Approximately two thirds of the teenage cohort (i.e. 68.8%) were 18-19 years of age, while the remaining cohort members were 14-17 years of age (i.e. 26.1% aged 16-17 years, and 5.1% aged 14-15 years). The percentage of low-birth weights for teenage and adult mothers were 15.1% and 8.8% respectively. A higher percentage of teenage mothers enrolled in or completed secondary or higher levels of education has had more abnormal deliveries in comparison with adult mothers. In comparison with the non-teenage mothers, a greater proportion of teenage mothers had insufficient income, did not own their homes/houses, were single parents, had fewer consultations with health personnel, did not plan their pregnancy, were pregnant for the first time, and delivered infants with low-birth weights. *Conclusion:* The prevalence of teenage pregnancies in Thailand remains high. Most teenage mothers and their newborn infants are vulnerable to a variety of potentially serious health problems, and accordingly need appropriate help and support.

Isaranurug S, Mo-suwan L, Choprapawon C (2007). A population-based cohort study of effect of maternal risk factors on low birthweight in Thailand. *J Med Assoc Thai* 90 (12): 2559-64.

Objectives: To determine the maternal risk factors of low birthweight (LBW) in Thailand and to address the possible activities to reduce the incidence of LBW. *Material and Method:* The data were obtained from the Prospective Cohort Study in Thai Children (PCTC). Three thousand five hundred twenty two pregnancies initiated the follow-up in the year 2000 at four districts across Thailand. The birthweight was retrieved from the Delivery Summary Sheet of the hospitals. The babies born in the hospital were weighed within the first day of life. The babies born at home were weighed within 3 days after birth by the research assistants. Only singleton live births were included in the present study. *Results:* Three thousand three hundred twenty two live births with birthweight data, 8.6% were LBW. Maternal factors affecting LBW with high attributable fraction (AF) and moderate population attributable risk (PAR) were maternal extreme age (AF = 45.96, PAR = 16.24) and weight gain during pregnancy less than 10 kg. (AF = 40.12, PAR = 16.05). The factors with moderate AF and PAR were first and more than two parities (AF = 21.9, PAR = 15.51) and less consultation to health personnel (AF = 20.96, PAR = 16.98). *Conclusions:* Improving nutritional status of pregnant women is a potential activity to reduce the incidence of LBW. Pregnant women with extreme age, first and more than parity two and less consultation to health personnel should also be closely followed-up.

Isabelle M, Chan P (2011). "Seminar on young child nutrition: improving nutrition and health status of young children in Indonesia." *Asia Pacific Journal of Clinical Nutrition* 20(1): 141-147.

The Seminar on Young Child Nutrition: Improving Nutrition and Health Status of Young Children in Indonesia held in Jakarta on November 2009 reviewed the current nutritional and health status of young children in Indonesia and identified key nutrient deficiencies affecting their optimal growth. The continuation of child growth from fetal stage is of paramount importance; and maternal and child health should be a central consideration in policy and strategy development. Clinical management of nutrient deficiency and malnutrition, as well as strategies and education to improve feeding practices of young Indonesian children were discussed in the seminar. Relevant experiences, approaches and strategies from France, New Zealand and Malaysia were also shared and followed with discussion on how regulatory systems can support the development of health policy for young children. This report highlights important information presented at the seminar.

Kamiya Y. Socioeconomic determinants of nutritional status of children in Lao PDR: effects of household and community factors. *J Health Popul Nutr.* 2011 Aug;29(4):339-48.

The prevalence of undernutrition among Lao children is among the highest in the region. However, the determinants of childhood undernutrition in Laos have not been fully analyzed. This paper, using the dataset of the Lao Multiple Indicator Cluster Survey 3, which is a nationally-representative sample in Laos, investigated the effects of socioeconomic factors at both household and community levels on the nutritional status of children. In the estimation, a multilevel linear model with random-intercepts was used for estimating the determinants

D3.2 Annotated bibliography of food consumption information in the five SEA countries

of child anthropometric indices. The empirical results revealed that children from households in southern Laos and from ethnic minority groups were less-nourished. Level of education of parents, attitudes of mothers towards domestic violence, assets of household, local health services, and the condition of sanitation and water were considered to be important determinants of nutritional status of children. The pattern of growth-faltering in children by age was identified. Children aged 12-59 months were less-nourished than those aged 0-11 months. The empirical results were consistent with the collective household model which incorporates a decision-making process within the household. Since there is scarce evidence about the predictors of childhood undernutrition in Laos, the findings of this study will serve as a benchmark for future research

Khamhoung K, Bodhisane N, et al. (2000). "Nutritional status of pre-school children and women in selected villages in the Suvannakhet Province, Lao PDR--an intervention trial." *Southeast Asian Journal of Tropical Medicine & Public Health* 31 Suppl 2: 63-74.

A project to promote the health and nutritional status of women and pre-school children was started from 1995 to 1997 in three villages in Suvannakhet Province, Lao PDR. One village served as control. In 1995, for the baseline survey, 456 females, and in 1997, for the final evaluation, 363 females from the four villages volunteered for further investigations. An attempt was made to involve all females in the reproductive age residing in the villages. At the same time also the nutritional status of 321 and about 540 randomly selected pre-school children respectively was also assessed through physical examination and anthropometric measurements. Intervention measures included introducing growth charts and taking regular anthropometric measurements of women in the reproductive age and of pre-school children. Training in nutritional aspects such as giving colostrum to new-borns, prepare proper weaning food and supplementary feeding, animal-raising and home gardening was also introduced and provided to health personnel, village leaders and in women clubs. Special attention was given to the control of acute infectious diseases. The conventional EPI program was enforced as well. Health education in matters of mother and child health care was also provided. The proportion of undernourished women was rather high at about 15%. For pre-school children, the proportion of wasting was around 5%, and of stunting 50% and above. Intervention did not improve the nutritional status either of the women or of the children. It was concluded that the time span of two years is too short for a decrease in the proportion of undernourishment to be observed. An improvement was achieved for some indicators of mother and child health care. This seems to indicate the population's willingness to follow suggestions to improve their health. Most probably, if attempts to improve the nutritional status were continued, an improvement in this aspect could also be observed, if the population can be encouraged to take actions and develop initiatives by themselves.

Khor GL. (2003). "Update on the prevalence of malnutrition among children in Asia." *Nepal Medical College Journal: NMCJ* 5(2): 113-122.

Approximately 70.0% of the world's malnourished children live in Asia, resulting in the region having the highest concentration of childhood malnutrition. About half of the preschool children are malnourished ranging from 16.0% in the People's Republic of China to 64.0% in Bangladesh. Prevalence of stunting and underweight are high especially in South Asia where one in every two preschool children is stunted. Besides protein-energy malnutrition, Asian children also suffer from micronutrient deficiency. Iron deficiency anaemia affects 40.0-50.0% of preschool and primary school children. Nearly half of all vitamin A deficiency and xerophthalmia in the world occurs in South and Southeast Asia, with large numbers of cases in India (35.3 million), Indonesia (12.6 million) and China (11.4 million). Another major micronutrient problem in the region is iodine deficiency disorders, which result in high goitre rates as manifested in India, Pakistan and parts of Indonesia. While under-nutrition problem persists, overweight problem in children has emerged in Asia, including Taiwan, Singapore and urban China and Malaysia. The aetiology of childhood malnutrition is complex involving interactions of multiple determinants that include biological, cultural and socio-economic influences. Protein-energy malnutrition and micronutrient deficiency leading to early growth failure often can be traced to poor maternal nutritional and health care before and during pregnancy, resulting in intrauterine growth retardation and children born with low birth weight. While significant progress has been achieved over the past 30 years in reducing the proportion of malnourished children in developing countries, nonetheless, malnutrition persists affecting large numbers of children. The socio-economic cost of the malnutrition burden to the individual, family and country is high resulting in lower cognitive outcomes in children and lower adult productivity.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Interventions that are cost-effective and culturally appropriate for the elimination of childhood malnutrition deserve the support of all. [References: 56]

Kurniawan YA, Muslimatun S, Achadi EL, Sastroamidjojo S. Anaemia and iron deficiency anaemia among young adolescent girls from the peri urban coastal area of Indonesia. *Food Nutr Bull.* 2002 Sep;23(3 Suppl):124-8. Ministry of Health, Republic of Indonesia. H.R. Rasuna Said, Block X-5, Kav 4-9, Jakarta 12950

Anaemia due to iron deficiency is still a widespread problem. Among adolescent girls, it will bring negative consequences on growth, school performance, morbidity and reproductive performance. This cross sectional study aimed to identify the different nutritional and iron status characteristics of young adolescent girls 10-12 years old with iron deficiency anaemia and anaemia without iron deficiency in the rural coastal area of Indonesia. Anaemic girls (N =133) were recruited out of 1358 girls from 34 elementary schools. Haemoglobin, serum ferritin, serum transferrin receptor and zinc protoporphyrin were determined for iron status, whilst weight and height were measured for their nutritional status. General characteristics and dietary intake were assessed through interview. Out of 133 anaemic subjects, 29 (21.8%) suffered from iron deficiency anaemia, which was not significantly related to age and menarche. About 50% were underweight and stunted indicating the presence of acute and chronic malnutrition. The proportion of thinness was significantly higher ($P < 0.05$) among subjects who suffered from iron deficiency anaemia (51.7% vs. 29.8%). Furthermore, thin subjects had a 5 fold higher risk of suffering from iron deficiency anaemia ($P < 0.05$) than non-thin subjects (OR: 5.1; 95%CI 1.34-19.00). Further study was recommended to explore other factors associated with anaemia and iron deficiency anaemia, such as the thalassemia trait and vitamin A deficiency. The current iron-folate supplementation program for pregnant women should be expanded to adolescent girls.

Krittaphol W, Bailey KB, Pongcharoen T, Winichagoon P, Thomson C, Gibson RS. Primary school children from northeast Thailand are not at risk of selenium deficiency. (2006) *Asia Pacific Journal of Clinical Nutrition*, 15 (4), pp. 474-481.

Selenium has important roles as an antioxidant, in thyroid hormone metabolism, redox reactions, reproduction and immune function, but information on the selenium status of Thai children is limited. We have assessed the selenium status of 515 northeast Thai children (259 males; 256 females) aged 6 to 13 years from 10 rural schools in Ubon Ratchthani province. Serum selenium (n=515) was analyzed by Graphite Furnace Atomic Absorption Spectrophotometry and dietary selenium intake by Hydride Generation Absorption Spectrophotometry from one-day duplicate diet composites, from 80 (40 females; 40 males) randomly selected children. Inter-relationships between serum selenium and selenium intakes, and other biochemical micronutrient indices were also examined. Mean (SD) serum selenium was 1.46 (0.24) $\mu\text{mol/L}$. Concentrations were not affected by infection or haemoglobinopathies, but were dependent on school ($P < 0.001$), sex ($P = 0.038$), and age group ($P = 0.003$), with serum zinc as a significant covariate. None of the children had serum selenium concentrations indicative of clinical selenium deficiency (i.e. $< 0.1 \mu\text{mol/L}$). Significant correlations existed between serum selenium and serum zinc ($r = 0.216$; $P < 0.001$), serum retinol ($r = 0.273$; $P < 0.001$), urinary iodine ($r = -0.110$; $P = 0.014$), haemoglobin ($r = 0.298$; $P < 0.001$), and haematocrit ($r = 0.303$; $P < 0.001$). Mean (SD) dietary selenium intake was 46 (22) $\mu\text{g/d}$. Children with low serum selenium concentrations had a lower mean selenium intake than those with high serum selenium concentrations (38 ± 17 vs. $51 \pm 24 \mu\text{g/d}$; $P < 0.010$). In conclusion, there appears to be no risk of selenium deficiency among these northeast Thai children.

Lin PY, Bui Thi Nhung, Nguyen Cong Khan, Sarukura N, Kunii D, Sakai T, Kassus A, Yamamoto S. Effect of Vietnamese common diet on postprandial blood glucose level in adult females. *J Nutr Sci Vitaminol (Tokyo)*. 2007 Jun; 53:247-52.

To elucidate the effect of a typical Vietnamese diet including a high content of white rice on postprandial blood glucose levels, the present study was designed. Thirty healthy female subjects with a similar body mass index, 10 each in their twenties, forties and sixties, were recruited. Four meals with a similar protein energy percentage (13-15%) but different energy ratios of fat and carbohydrate (FC ratio) and vegetable contents were provided by cross-over design. Meal A was designed according to the commonly consumed diet in Vietnam. The FC ratio was 14:71 and 84 g of carbohydrate was from rice. Meal B contained carbohydrate in a lower ratio than

D3.2 Annotated bibliography of food consumption information in the five SEA countries

meal A by fat replacement and its FC ratio was 30:57. Meal C was similar to meal A except lacking vegetables. The energy of meal A, B and C was about 2.1 MJ. Meal D was designed to match the amount of carbohydrate and fat within A and B, respectively. The FC ratio of meal D was 26:61 and the energy was about 2.4 MJ. Fasting blood glucose was measured before consumption of a test meal. Postprandial blood glucose was measured every 30 min for 2h. Areas under the curve (AUC) were calculated to compare the glycemic response among the four test meals. There was no significant difference in AUC among the four test meals in the subjects in their twenties. In the subjects in their forties, the AUC of meal A tended to be lower than that of meal C ($p = 0.07$). In the subjects in their sixties, the AUC of meal A was significantly higher than that of meal B ($p < 0.001$). Glycemic responses showed a significant relationship with age ($r = 0.26$, $p < 0.01$); however, there was no association between glycemic responses and BMI ($p = 0.20$). Dietary fat ratios were inversely associated with glycemic responses ($r = -0.28$, $p < 0.01$). In conclusion, the diet with about 70% energy from carbohydrate which is commonly consumed by Vietnamese may increase glycemic response, especially in elderly people and dietary vegetables may be beneficial to prevent such an increase in glycemic response.

Linpisarn S, Tienboon P, Promtet N, Putsyainunt P, Santawanpat S, Fuchs GJ (1996). Iron deficiency and anaemia in children with a high prevalence of haemoglobinopathies: implications for screening. *Int J Epid* 25(6): 1262-66.

Background. Haemoglobin (Hb) concentration is used as a sole test for iron deficiency anaemia (IDA) in most developing countries since most anaemia is believed to be due to iron deficiency and confirmatory testing is generally unavailable. Yet the validity of this approach in regions where haemoglobinopathies are endemic has not been documented. *Methods.* Haemoglobin and serum ferritin (SF) were measured in 559 Northern Thai children aged 6 months to 13 years of age. The sensitivity of SF to identify iron deficiency was also assessed in a subsample of children with low or low normal Hb and normal SF by testing the Hb response to a trial of oral iron. *Results.* While anaemia was common (27%), IDA constituted 19% and none of all anaemia in preschool and school age children, respectively ($P < 0.002$). Iron depletion was similarly more prevalent in younger children ($P < 0.0002$). Children with IDA were younger ($P < 0.001$) and the anaemia more severe ($P < 0.0001$) compared to those with non-IDA. Of anaemic children with normal SF values who received a therapeutic trial of iron, only 6% responded with an increase in Hb of $\geq 1\text{g/dl}$. *Conclusions.* For populations such as ours most anaemia is not due to iron deficiency and a single Hb determination is therefore not acceptable for a presumptive diagnosis of IDA.

Matulesy PF, Asumi R, Thamrin MH, Husaini, Angeles TI, Kariadi D, *Southeast Asian J Trop Med Public Health*. 1992;23 Suppl 3:3-16. Nutrition situation in metropolitan Jakarta. SEAMEO-TROP MED, Faculty of Medicine, University of Indonesia

Jakarta is the capital and biggest city of Indonesia with a total population of 10 million. The National Census Office revealed a rapid increase in population through 1985 to 1990. This rapid increase has brought many devastating effects on various aspects of life such as housing, food stock and food production, health and environmental conditions, education, socio-economic and cultural life and political stability. All of these factors contribute to malnutrition in the city as well as in the country as a whole. Data obtained from the Municipal Health Offices showed an unsatisfactory health status having a crude birth rate (CBR) of 2.80%; crude death rate (CDR) of 0.68%; and family size of 5.5. Undernutrition among under-five children still is alarming with a prevalence of 27.91%. Anemia also afflicts a great number of pregnant mothers (70%) and preschool children (38.6%). Nutrition problems are worst in urban areas with their high population density; moderate and severe PEM is 5.63% in urban areas compared with 3.7% moderate PEM and no PEM in rural areas. Jakarta is experiencing rapid urbanization. The presence of slums, air and water pollution in city is a paramount factor leading to poor environmental conditions. The existing health system cannot keep pace with the increasing occurrence of infectious diseases brought about by these unfavorable conditions. Unemployment and underemployment as well as rising costs of foodstuffs cause inadequate food availability at the household level. Due to the grinding poverty experienced by the low socio-economic groups, female workers occupy almost one-third of Indonesia's labor force, hence inadequate care is given to children. All these are factors aggravating the nutritional problems in the country.

Miyoshi M, Phommasack B, Nakamura S, Kuroiwa C. Nutritional status of children in rural Lao PDR: who are the most vulnerable? *Eur J Clin Nutr*. 2005 Jul;59(7):887-90.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

A cross-sectional study was undertaken to assess the nutritional status of children aged 3-15 y in remote villages of Lao PDR. Study sites were chosen from two provinces: Luang namtha (north) and Sekong province (south). All the sampled 1075 children were measured for anthropometry, following the standard methods. Dietary intake, morbidity and socio-economic data were obtained by interviews with parents. This study confirmed the high prevalence of growth retardation among children, as well as persistent food insecurity in the remote areas of Lao PDR. Prevalence of stunting was 74.1% in Luang namtha and 62.6% in Sekong province, with school-aged children being worse-off than under-five ones. Children's diets were inadequate in quality as well as in quantity, with very limited availability of rice and other food items throughout the year. Our findings also suggest the negative outcomes of government's development programme were often overlooked, and that more attention should be paid on the fragile living conditions in the resettlement villages, especially for the ethnic minority.

Mongkolchat A, Thinkhamrop B, Mo-Suwan L, Chittchang U, Choprapawon C (2010). Prevalence and incidence of child stunting from birth to two years of life in Thai children: based on the prospective cohort study of Thai children (PCTC). *J Med Assoc Thai* 93 (12): 1368-78

Objective: To determine the percentages of prevalence and incidence in child stunting at birth, 6, 12, 18, and 24 months of age and to investigate the association between factors and child stunting outcome. *Material and Method:* The Prospective Cohort Study of Thai Children (PCTC) was carried out during 2000-2002, data from five districts were examined, and anthropometric measurements were performed by the physician and research assistants. WHO's growth reference standard year 2005 was used. *Results:* Four thousand two hundred forty five children were included at the start of the present study of which 3,898 were in the final analysis. The prevalence in child stunting presented an increasing percentage at birth, 6, 12, 18, and 24 months was 6.0, 6.9, 9.5, 14.6, and 16.6%, and incidence indicated decreasing at birth, 6, 12, 18, and 24 months was 6.0, 4.3, 4.1, 5.2, and 3.2% respectively. The GEE analysis showed that gender, mother height, mother education, income, and Nan-Hill Tribe areas were significantly correlated with child stunting ($p < 0.001$). *Conclusion:* Finding from the present study indicates that to reduce child stunting in Thailand in early infant's life, early nutritional interventions and quality antenatal care are vital.

Nakamori M, Ninh NX, et al. (2009). "Nutritional status of lactating mothers and their breast milk concentration of iron, zinc and copper in rural Vietnam." *Journal of Nutritional Science and Vitaminology*: 338-345.

Breast milk is considered to be the best nutrient source for infants. However, nutritional compositions of breast milk in developing countries, especially among malnourished women, have not been fully investigated. This study aimed to assess nutritional status and nutrient composition of breast milk in lactating mothers in rural Vietnam. Sixty breast-feeding mothers at 6 to 12 mo postpartum, free from any medical disorder and/or medication, and not pregnant were randomly selected in Yen The, Bac Giang, Vietnam. Their nutritional status, breast milk concentration and dietary intakes were assessed. Among the study participants, anaemia (39.0%) and low serum zinc concentration (55.4%) were frequently observed. Dietary assessment revealed lower intakes of iron (10.2±2.5 mg/d) and zinc (10.4±2.2 mg/d) than estimated requirements. The breast milk concentration of iron, zinc and copper was 0.43±0.15 mg/L, 0.56 (0.37, 0.82) mg/L and 0.19±0.05 mg/L, respectively. The breast milk concentration of iron, zinc and copper was not correlated to the serum concentration or dietary intakes. In conclusion, we uncovered a high prevalence of anaemia and zinc deficiency in lactating mothers in rural Vietnam. The findings demonstrate a low breast milk zinc concentration among the participants, but need further investigation.

Nguyen Cong K, West CE, de Pee S, Bosch D, Phuong HD, Hulshof PJ, Khoi HH, Verhoef H, Hautvast JG. The contribution of plant foods to the vitamin A supply of lactating women in Vietnam: a randomized controlled trial. *Am J Clin Nutr*. 2007 Apr; 85:1112-20.

Background: More information is needed on the efficacy of carotenoids from plant foods in improving vitamin A status. *Objective:* We aimed to quantify the efficacy of provitamin A-rich vegetables and fruit in improving vitamin A status. *DESIGN:* Breastfeeding women in 9 rural communes in Vietnam were randomly allocated to 1 of 4 groups: the vegetable group (n = 73), which ingested 5.6 mg beta-carotene/d from green leafy vegetables; the fruit group (n = 69), which ingested 4.8 mg beta-carotene/d from orange or yellow fruit; the retinol-rich

D3.2 Annotated bibliography of food consumption information in the five SEA countries

group (n = 70), which ingested 610 microg retinol/d from animal foods and 0.6 mg beta-carotene/d; and the control group (n = 68), which ingested 0.4 mg beta-carotene/d. Meals of groups 1, 2, and 4 contained <30 microg retinol/d. Lunch and dinner were provided 6 d/wk for 10 wk. RESULTS: Mean (95% CI) changes in serum retinol concentrations of the vegetable, fruit, retinol-rich, and control groups were 0.09 (0.03, 0.16), 0.13 (0.07, 0.19), 0.25 (0.17, 0.33), and 0.00 (-0.06, 0.06) micromol/L, respectively. Mean (95% CI) changes in breast-milk retinol concentrations were 0.15 (0.04, 0.27), 0.15 (0.02, 0.28), 0.48 (0.32, 0.64), and -0.06 (-0.21, 0.09) micromol/L, respectively. According to these findings, the equivalent of 1 microg retinol would be 12 microg beta-carotene (95% CI: 8, 22 microg) for fruit and 28 microg beta-carotene (17, 84 microg) for green leafy vegetables. Thus, apparent mean vitamin A activity of carotenoids in fruit and in leafy vegetables was 50% (95% CI: 27%, 75%) and 21% (7%, 35%), respectively, of that assumed. *Conclusion:* The bioavailability of carotenoids from vegetables and fruit is less than previously assumed.

Nguyen Cong K, Le Danh T, et al. (2007). "Reduction in childhood malnutrition in Vietnam from 1990 to 2004." *Asia Pacific Journal of Clinical Nutrition* **16**(2): 274-278.

Reduction in childhood malnutrition in Vietnam between 1990 and 2004 was assessed using data from 5 national surveys. The prevalence of malnutrition, including stunting, declined significantly for underweight from 45% in 1990 to 26.6% in 2004. While the average reduction was 1.3% per year in the period from 1990 to 2000, it was 1.8% per year in the period from 2000 to 2004. The prevalence of stunting declined from 56.5% in 1990 to 30.7% in 2004, with an average reduction of 2% per year in the period from 1990 to 2000 and 1.5% per year in the period from 2000 to 2004. There were clear differences in the decrease in malnutrition prevalence between urban, rural and mountainous areas, the reduction being highest in the urban regions and lowest in the mountainous areas. Regression analysis showed that the nutrition status of the child is positively related to better household living conditions and to the educational level of the father, but not the mother. Stunting is higher in children whose parents are farmers and higher in households with more children. Stunting prevalence is lower in households with safe water access and hygienic toilets. In future, the dramatic reduction in childhood malnutrition as seen in the period 1990 to 2004 might not continue. More comprehensive approaches will be needed to lower childhood malnutrition in Vietnam further.

Nguyen Cong K, Nguyen Xuan N, et al. (2007). "Sub clinical vitamin A deficiency and anaemia among Vietnamese children less than five years of age." *Asia Pacific Journal of Clinical Nutrition* **16**(1): 152-157.

The objective of the study was to assess the prevalence of sub clinical vitamin A deficiency and anaemia in Vietnamese children. For this, a cross-sectional survey was conducted in 40 villages (clusters) of four ecological regions in Vietnam during Apr-May 2001. In total 1657 children less than 5 years old were included by a cluster random sampling method. The prevalence of sub clinical vitamin A deficiency (serum retinol <0.70 micro mol/L) was 12.0% and the prevalence of anaemia (haemoglobin <110 g/L) was 28.4%. In the children under 6 months the prevalence of sub clinical vitamin A deficiency was 35.1% whereas the prevalence of anaemia in this group was as high as 61.7%. The prevalence of children with both sub clinical vitamin A deficiency and anaemia was 6.1%. Sub clinical vitamin A deficiency and anaemia prevalence differed significantly across the regions, with highest prevalence in the Northern Mountainous areas for vitamin A deficiency and in the Northern Mountainous area and Mekong River Delta for anaemia. It is concluded that sub clinical vitamin A deficiency and anaemia are still important public health problems in Vietnam. Sustainable strategies for combating vitamin A deficiency and nutritional anaemia are needed and should concentrate on target groups, especially infants and malnourished children in high risk regions.

Nguyen Cong K, Phan Van H, et al. (2010). "Relationship of serum carotenoids and retinol with anaemia among pre-school children in the northern mountainous region of Vietnam." *Public health nutrition* **13**(11): 1863-1869.

Objective: To characterize the relationship between serum carotenoids, retinol and anaemia among pre-school children. *Design:* A cross-sectional study was conducted in two groups: anaemic and non-anaemic. Serum levels of retinol, alpha -carotene, beta -carotene, beta -cryptoxanthin, lycopene, lutein and zeaxanthin were measured in the study subjects. *Setting:* Six rural communes of Dinh Hoa, a rural and mountainous district in Thai Nguyen Province, in the northern mountainous region of Vietnam. *Subjects:* A total of 682 pre-school children, aged 12-72 months, were recruited. *Results:* Geometric mean serum concentrations of carotenoids (micro mol/l) were 0.056 for alpha -carotene, 0.161 for beta -carotene, 0.145 for beta -cryptoxanthin, 0.078 for

D3.2 Annotated bibliography of food consumption information in the five SEA countries

lycopene, 0.388 for lutein and 0.075 for zeaxanthin. The mean levels of Hb and serum retinol were 108.8 g/l and 1.02 micro mol/l, respectively. The prevalence of anaemia and vitamin A deficiency was 53.7% and 7.8%, respectively. After adjusting for sex and stunting, serum retinol concentrations (micro mol/l; OR=2.06, 95% CI 1.10, 3.86, P=0.024) and total pro-vitamin A carotenoids (micro mol/l; OR=1.52, 95% CI 1.01, 2.28, P=0.046) were independently associated with anaemia, but non-pro-vitamin A carotenoids (micro mol/l; OR=0.93, 95% CI 0.63, 1.37, P=0.710) were not associated with anaemia. *Conclusions:* Among pre-school children in the northern mountainous region of Vietnam, the prevalences of vitamin A deficiency and anaemia are high, and serum retinol and pro-vitamin A carotenoids are independently associated with anaemia. Further studies are needed to determine if increased consumption of pro-vitamin A carotenoids will reduce anaemia among pre-school children.

Nguyen PH, Nguyen Cong K, Nguyen TD, Le Bach Mai, Bern C, Flores R, Martorell R. Intestinal helminth infections among reproductive age women in Vietnam: prevalence, co-infection and risk factors. *Southeast Asian J Trop Med Public Health*. 2006 Sep; 37:865-74.

Intestinal helminth infections are a significant public health problem for Vietnamese women, but prevalence and risk factor data are scarce. The objectives of this paper were to (1) determine the prevalence of helminth infections among women; (2) investigate interactions among intestinal helminth species in individuals and (3) identify risk factors that contribute to intestinal helminth infections. In a nationwide survey conducted in 1995, 9550 households in 53 provinces were covered using a stratified two-stage cluster survey. Stool specimens were examined by Kato-Katz technique. Of 5,127 women, 76% were infected with one or more helminth species, 36% with hookworm, 59% with *Ascaris lumbricoides* and 28% with *Trichuris trichiura*. *A. lumbricoides* and *T. trichiura* were more likely to be concurrent than expected by chance. There was significant interaction between prevalence and intensity of infection in all three species. All three helminth species were more common in certain ecologic zones than others. Hookworm infection was associated with farming [Odd ratio (OR) = 2.1] and lack of a closed latrine (OR = 2.0), *A. lumbricoides* with use of untreated feces as fertilizer (OR = 1.2) and co infection with *T. trichiura* (OR = 2.1) and *T. trichiura* with *A. lumbricoides* co-infection (OR = 2.1). Our findings suggest that reproductive-age women, especially rural farmers, should be included among the high priority groups for helminth control programs through mass chemotherapy and improving sanitation.

Nguyen Van N, Nguyen Cong K, et al. (2008). "Micronutrient deficiencies and anaemia among preschool children in rural Vietnam." *Asia Pacific Journal of Clinical Nutrition* 17(1): 48-55.

The prevalence of trace elements deficiencies, vitamin A deficiency, anaemia, and their relationships were investigated in a cross sectional study involving 243 children aged from 12 to 72 months in rural Vietnam. Serum levels of copper, zinc, selenium and magnesium were determined by inductively coupled plasma mass spectrometer and that of retinol by high performance liquid chromatography. Haemoglobin concentration in whole blood was measured by the cyan-methaemoglobin method. The prevalence of deficiencies in zinc, selenium, magnesium, and copper was 86.9%, 62.3%, 51.9%, and 1.7%, respectively. On the other hand, 55.6% were anaemic and 11.3% had vitamin A deficiency. Deficiency in two or more micronutrient was found in 79.4% of the children. Parameters associated significantly with anaemia were selenium deficiency (OR 2.80 95% CI 1.63-4.80, p=0.0002) and serum retinol <1.05 micro mol/L (OR 1.83, 95% CI 1.10-3.05, p=0.021). Magnesium deficiency (OR 3.09 95% CI 1.36-7.03) was found to be a risk factor for zinc deficiency and vice versa. The results indicate that micronutrient deficiencies are prevalent among preschool children in Vietnam. In addition, the results also demonstrate a strong relationship between selenium deficiency and anaemia. Clearly, sustainable strategies are urgently required to overcome the problems in the country.

Nguyen Van N, Nguyen Cong K, et al. (2006). "Serum levels of trace elements and iron-deficiency anaemia in adult Vietnamese." *Biological Trace Element Research* 111(1/3): 1-9.

This study was aimed at assessing the serum levels of vitamin A, copper, zinc, selenium, and iron among adult Vietnamese with and without iron-deficiency anaemia. Blood was collected from adult Vietnamese living in the midland of northern Vietnam. 123 subjects in the age range 20-60 yr were included in the study. Anaemia, where the concentration of haemoglobin in whole blood is less than 120 g/litre in females and 130 g/litre in males, was found in 30% (37/123) of the study population. The levels of vitamin A and selenium in the sera of anaemic subjects (n=37) were significantly lower than that in non-anaemic group (n=86). On the other hand, no

D3.2 Annotated bibliography of food consumption information in the five SEA countries

significant differences were observed in the concentrations of copper and zinc between the two groups. This study was the first to show serum levels of trace elements in adult Vietnamese, providing useful baseline information for further studies.

Pasricha, S. R. and B. A. Biggs (2010). "Undernutrition among children in South and South-East Asia. (Special Issue: Special indigenous health issue.)." *Journal of Paediatrics and Child Health* **46**(9): 497-503.

Undernutrition remains a major public health problem among children living in Asia. Although the burden is maximal among poorer, rural and Indigenous communities, the problem affects the majority in many Asian countries, especially in South Asia. In order to prevent the pervasive consequences of undernutrition, strategies that address this burden are required. Successful implementation of strategies may be limited by the complex aetiology of undernutrition, including the political setting. Rising food insecurity because of climate change, land use for biofuel production and the recent global financial crisis threaten to exacerbate childhood malnutrition. In this review, we describe the burden of undernutrition among Asian children and discuss contributing factors and potential solutions.

Pasricha S-R, Caruana SR, et al. (2008). "Anaemia, iron deficiency, meat consumption, and hookworm infection in women of reproductive age in northwest Vietnam." *American Journal of Tropical Medicine & Hygiene* **78**(3): 375-381.

Iron deficiency anaemia poses an important public health problem for women of reproductive age living in developing countries. We assessed the prevalence of iron deficiency and anaemia and associated risk factors in a community-based sample of women living in a rural province of northwest Vietnam. A cross-sectional survey, comprised of written questionnaires and laboratory analysis of hemoglobin (Hb), ferritin, transferrin receptor, and stool hookworm egg count, was undertaken, and the soluble transferrin receptor/log ferritin index was calculated. Of 349 non-pregnant women, 37.53% were anaemic (Hb < 12 g/dL), and 23.10% were iron deficient (ferritin < 15 ng/L). Hookworm infection was present in 78.15% of women, although heavy infection was uncommon (6.29%). Iron deficiency was more prevalent in anaemic than non-anaemic women (38.21% versus 14.08%, $P < 0.001$). Consumption of meat at least three times a week was more common in non-anaemic women (51.15% versus 66.67%, $P = 0.042$). Mean ferritin was lower in anaemic women (18.99 versus 35.66 ng/mL, $P < 0.001$). There was no evidence of a difference in prevalence (15.20% versus 17.23%, $P = 0.629$) or intensity (171.07 versus 129.93 eggs/g, $P = 0.412$) of hookworm infection between anaemic and non-anaemic women. Although intensity of hookworm infection and meat consumption were associated with indices of iron deficiency in a multiple regression model, their relationship with haemoglobin was not significant. Anaemia, iron deficiency, and hookworm infection were prevalent in this population. Intake of meat was more clearly associated with haemoglobin and iron indices than hookworm. An approach to addressing iron deficiency in this population should emphasize both iron supplementation and deworming.

Persson V, Hartini TN, Greiner T, Hakimi M, Stenlund H, Winkvist A. Vitamin A intake is low among pregnant women in central Java, Indonesia. Source Section for International Maternal and Child Health, Department of Women's and Children's Health, Uppsala University, Sweden. viveka.persson@sida.se *Eur J Clin Nutr.* 2000 May;54 Suppl 2:S43-51.

From 1996-1998, a longitudinal study on nutritional status during pregnancy was carried out in Purworejo District, Central Java, Indonesia. Dietary intake was assessed in each trimester using six 24-hour recalls, and analyzed cross-sectionally among 493 women. The proportion of women below the Indonesian RDI for vitamin A (700 RE) ranged from 83% in the first trimester to 76% in the third. Regardless of total vitamin A intake, plant sources contributed 64-79% in all three trimesters. The contribution from animal and fortified sources was generally lower throughout pregnancy for those with low education compared to those with high education. Significant risk factors for having a low vitamin A intake (FAO/WHO basal RDI, 370 RE) in the second and third trimesters were fewer than six years of education, low socio-economic status, a low energy intake, and a low vitamin A intake in the previous trimester. Home gardening and chicken-raising were not positively associated with vitamin A intakes. Given the large percentage of women with inadequate vitamin A intakes, further strategies are needed to increase the vitamin A intake of all pregnant women in this area.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Phengxay M, Ali M, et al. (2007). "Risk factors for protein-energy malnutrition in children under 5 years: study from Luangprabang province, Laos." *Paediatrics International* 49(2): 260-265.

Background: Laos is one of the poorest countries in which chronic malnutrition is highest. The aim of the present study was to determine the prevalence of and to identify risk factors associated with protein-energy malnutrition (PEM) in children under 5 years of age in Luangprabang province, Laos. *Methods:* This cross-sectional study was undertaken from March to May 2004. Anthropometric measurements of 798 children were done and data were transformed into height-for-age, weight-for-age and weight-for-height ratios. Mothers were also interviewed with a semi-structured questionnaire. Anthropometric data were entered into Nutstat in Epi-Info 2000 and transferred to SPSS for analysis. *Results:* There was a high prevalence of stunting, underweight and wasting, that is, 54.6%, 35%, and 6% respectively. It was also noted that children aged 12-23 months and Khmu ethnic children had a higher prevalence of stunting (65% and 66%) and underweight (45% and 40%), respectively. However, it was also found that boys were more prone to be stunted and underweight. Furthermore, restricted intake of meats, vegetables during illness, and low maternal education were main risk factors for child malnutrition in the study area. *Conclusion:* Socioeconomic-demographic factors, low maternal education, poor nutrition knowledge for mother and feeding practices for sick children are affecting children's health regarding stunting and underweight. It is recommended that an improvement in societal infrastructure, better maternal education and nutrition are needed to address the child malnutrition issue.

Phimmasone K, Douangpoutha I, Fauveau V, Pholsena P. Nutritional status of children in the Lao PDR. *J Trop Pediatr.* 1996 Feb;42(1):5-11.

The results of the first nationally representative survey of nutritional status of children in the Lao PDR, focusing on the assessment of protein-energy malnutrition are described. Among children under 5 years of age, the prevalence of stunting (children of short stature, below -2 Z-scores height-for-age) is 48 per cent, which is classified by WHO as a 'very high' prevalence, greater than the average of developing countries in the world and in South-East Asia. The prevalence of wasting (children too thin, below -2 Z-scores weight-for-height) is 10 per cent, also 'very high', and slightly greater than the average of South-East Asian children. The prevalence of children underweight (below -2 Z-scores weight-for-age) is 44 per cent, again 'very high' and significantly greater than the average of developing countries in the world and in South-East Asia. Significant differences are observed in the prevalence of both stunting and wasting when comparing subgroups of children: urban children are less stunted and wasted than rural children, children of the lowland majority less than children of ethnic minorities, and children whose mothers had completed primary education less than children whose mothers had never been to school. Girls are less malnourished than boys, but not significantly so. Similar prevalence of stunted and underweight children are noted when comparing with the results of a national survey made in the Lao PDR 10 years ago, although the sampling was not the same.

Puysuwan, Chavasit V, Sungpuag P, Hediger D, Punvichai T. Feasibility and use of vitamin A-fortified vegetable oils among consumers of different socioeconomic status in Thailand. *Food and Nutrition Bulletin*, 28 (2), pp. 181-188.

Background. Vitamin A losses in fortified vegetable oils can differ, depending upon the cooking and distribution conditions of a country. *Objective.* To determine vitamin A losses in different vegetable oils during transportation, cooking, and storage among consumers of different socioeconomic status. *Methods.* Soybean, rice bran, and palm oils were fortified with vitamin A palmitate at 267 µg/15 mL. The oils were packaged in 5-L metal cans and 250-mL polyethylene terephthalate (PET) bottles and then stored under light and dark conditions. Unopened and opened bottles were stored for 13 and 4 weeks, respectively. Fortified palm oil also was bulk transported in trucks and packaged in 1-kg polypropylene bags that were closed with rubber bands. Vitamin losses were measured after cooking at 120° and 170°C for 5 and 10 minutes in iron, aluminum, Teflon, and glass pans. *Results.* Vitamin A losses of oils in PET bottles stored under light conditions were 20% to 25% at the 5th week and became greater than 80% after 13 weeks, whereas losses under dark conditions and in metal containers were less than 15%. Loss during bulk transportation was 25%, with no change in peroxide value. Losses in opened bottles after 4 weeks under light conditions were 50% to 90% based on the degree of oil unsaturation; however, losses under dark conditions were less than 5%. Losses after cooking at 120° and 170°C for 10 minutes were less than 5% and 15%, respectively. The type of pan did not affect the amount of loss. The peroxide values of oils in bottles increased during storage under light conditions. *Conclusions.* Fortification of

D3.2 Annotated bibliography of food consumption information in the five SEA countries

vegetable oils with vitamin A for consumers of different socioeconomic status is feasible; however, light protection is needed for better stability.

Putthakeo P, Ali M, Ito C, Vilayhong P, Kuroiwa C. Factors influencing breastfeeding in children less than 2 years of age in Lao PDR. *J Paediatr Child Health*. 2009 Sep;45(9):487-92. Epub 2009 Aug 21.

This study aimed to investigate the prevalence of, and factors influencing, exclusive breastfeeding (EBF) at 6 months and continued breastfeeding (CBF) at 2 years. **METHODS:** Between January and February 2007, a cross-sectional study was conducted using a semi-structured questionnaire in 40 villages in the Vientiane capital and the Vientiane province of Lao PDR. A total of 400 mothers with children less than 2 years old were recruited by multistage random sampling. Based on the 1991 World Health Organization Breastfeeding Indicators, children were classified into three groups, 6-23-month-old children for assessing EBF at 6 months, 12-15-month-old children for CBF at 1 year and 20-23-month-old children for CBF at 2 years. **RESULTS:** The prevalence of EBF at 6 months and CBF at 2 years were 19.4% (n= 283) and 18.6% (n= 43), respectively. Some of the factors influencing EBF at 6 months in a univariate logistic regression model included: location of residence, (OR: 19.19, 95% CI 6.96-57.01), ethnicity (OR: 3.15, 95% CI 1.63-6.08), encouragement of the child's father (OR: 9.03, 95%CI 1.21-67.57) and inter-spousal communication (OR: 5.20, 95% CI 2.34-11.56). A majority of the mothers (75.0%) had watched television advertisements for infant formula from Thailand, and 48.4% reported that they wanted to buy formula milk after having watched them. **CONCLUSION:** This study showed a low prevalence of EBF at 6 months in the studied area in Lao PDR. Some of the factors that had a strong impact on EBF at 6 months included: location of residence, ethnicity, father's involvement, early breastfeeding plan, Mother's Card in antenatal care and television advertisement. There may be opportunities for government to review a range of policies relating to paternal involvement, antenatal care and formula advertising that could help to improve EBF rate.

Rajatanavin R. (2007). "Iodine deficiency in pregnant women and neonates in Thailand." *Public health nutrition* 10(12a): 1602-1605.

Objective: To present data on the relationship between the concentration of thyroid-stimulating hormone (TSH) in whole blood or serum from neonates and the concentration of iodine in their mother's urine collected at birth to contribute to the contention that the recommended iodine intake during pregnancy should be increased. *Design and Setting:* Data were provided by current programmes of neonatal screening of congenital hypothyroidism in Bangkok and rural areas of Thailand. *Subjects:* A total of 5144 cord serum samples were collected in 2003 and measured for TSH concentrations. Paired samples of blood and urine were collected in 2000 from 203 infants and their mothers and from 1182 infant-mother pairs in 2002-03 in six rural provinces. Iodine was measured in the urine and TSH was measured in cord serum. *Results:* The urinary iodine concentration of mothers in rural Thailand is adequate, with a median of 103 micro g l⁻¹. However, in 2000, the median urinary iodine concentration of mothers in Bangkok was only 85 micro g l⁻¹. The concentration of TSH in whole blood collected on filter paper from neonates was not sensitive enough to be used as a monitoring tool for iodine nutrition in the neonates, as there was no relationship with the concentration of iodine in the urine of the children's mothers. This was in contrast to the concentration of TSH in serum collected from cord blood. *Conclusions:* Several conclusions were drawn from this data: (1) Neonatal TSH screening using whole blood collected from a heel prick at 3 days of age is not sensitive enough to assess the iodine nutrition of neonates; (2) Neonatal TSH screening using cord sera can be used to assess iodine nutrition in neonates; (3) The optimum median maternal urinary iodine concentration in Thailand appears to be 103 micro g l⁻¹; (4) The criteria proposed by WHO, UNICEF, and ICCIDD to assess iodine nutrition using data on neonatal TSH concentrations should be reassessed; and (5) Neonatal TSH screening can be effectively performed by collecting cord serum in district hospitals in Thailand.

Ramli, K. E. Agho, et al. (2009). "Prevalence and risk factors for stunting and severe stunting among under-fives in North Maluku province of Indonesia." *BMC Paediatrics* 9: 64.

Background: Adequate nutrition is needed to ensure optimum growth and development of infants and young children. Understanding of the risk factors for stunting and severe stunting among children aged less than five years in North Maluku province is important to guide Indonesian government public health planners to develop nutrition programs and interventions in a post conflict area. The purpose of the current study was to assess the

D3.2 Annotated bibliography of food consumption information in the five SEA countries

prevalence of and the risk factors associated with stunting and severe stunting among children aged less than five years in North Maluku province of Indonesia. *Methods:* The health and nutritional status of children aged less than five years was assessed in North Maluku province of Indonesia in 2004 using a cross-sectional multi-stage survey conducted on 750 households from each of the four island groups in North Maluku province. A total of 2168 children aged 0-59 months were used in the analysis. *Results:* Prevalence of stunting and severe stunting were 29% (95%CI: 26.0-32.2) and 14.1% (95%CI: 11.7-17.0) for children aged 0-23 months and 38.4% (95%CI: 35.9-41.0) and 18.4% (95%CI: 16.1-20.9) for children aged 0-59 months, respectively. After controlling for potential confounders, multivariate analysis revealed that the risk factors for stunted children were child's age in months, male sex and number of family meals per day (≤ 2 times), for children aged 0-23 months, and income (poorest and middle-class family), child's age in months and male sex for children aged 0-59 months. The risk factors for severe stunting in children aged 0-23 months were income (poorest family), male sex and child's age in months and for children aged 0-59 months were income (poorest family), father's occupation (not working), male sex and child's age in months. *Conclusion:* Programmes aimed at improving stunting in North Maluku province of Indonesia should focus on children under two years of age, of male sex and from families of low socioeconomic status.

Rassamee Sungthong R, Mo-suwan L, Chongsuvivatwong V, Geater AF, (xxxx). Once Weekly Is Superior to Daily Iron Supplementation on Height Gain but Not on Hematological Improvement among Schoolchildren in Thailand.

Intermittent iron supplementation has been suggested as a replacement for daily iron supplements for reducing anemia in developing countries. The effects of once weekly and daily iron supplementation on hemoglobin (Hb), serum ferritin (SF), prevalence of anemia, weight and height are compared in this study. Primary schoolchildren ($n = 397$) from two selected schools in the Hat Yai rural area, southern Thailand, were recruited in 1999. All children received Albendazole and then randomly received ferrous sulfate (300 mg/tablet) either daily or weekly, or a placebo for 16 wk. The average increase in Hb was not significantly different between the daily (mean \pm SD; 6.5 \pm 6.0 g/L) and weekly (5.7 \pm 6.3 g/L) groups. However, the average increase in SF was greater ($P < 0.01$) in the daily (mean \pm SD; 39.8 \pm 30.3 μ g/L) than the weekly (13.4 \pm 17.3 μ g/L) group. All cases of iron deficiency anemia were abolished in both daily and weekly groups, whereas no reduction in prevalence occurred in the placebo group. Height gain was greater in children who received weekly (mean \pm SD; 2.6 \pm 0.9 cm) than in those who received daily iron (mean \pm SD; 2.3 \pm 0.8 cm), ($P < 0.01$). Weight gain, weight-for-age and height-for-age were not significantly different among the intervention groups. It is concluded that a weekly iron dose is more effective than a daily dose in height.

Rathavuth H, Rathmony H, (2007). "Economic inequality and undernutrition in women: multilevel analysis of individual, household, and community levels in Cambodia." *Food and Nutrition Bulletin* 28(1): 59-66.

Many people in developing countries are still struggling to emerge from the realm of extreme poverty, where economic improvements tend to benefit a small, affluent group of the population and cause growing inequality in health and nutrition that affects the most vulnerable groups of the population, including women and children. This study examined how household and community economic inequality affected nutritional status in women, using information on 6922 non-pregnant women aged 15 to 49 yr included in the 2000 Cambodia Demographic and Health Survey. Nutritional status was defined with the use of the body-mass index (BMI). BMI < 18.5 kg/m² is defined as undernourishment. The household wealth index was calculated from household ownership of durable assets and household characteristics. Community wealth was an average household wealth index at the community level. Household and community economic inequalities were measured by dividing the wealth index into quintiles. The effects of household and community economic inequality were estimated by multilevel analysis. Independently of community economic status and other risk factors, women in the poorest 20% of households were more likely to be undernourished than women in the richest 20% of households (RR = 1.63; $P = .008$). Variation was also seen among communities in the nutritional status of women. Age, occupation and access to safe sources of drinking water were significantly associated with women's nutritional status. Results indicated that improving household income and creating employment opportunities for women, in particular poor women, could be a key to improving the nutritional status of women in Cambodia.

Pruenglampoo, S, Mangklabruks, A, Leelapat, P, Chamnong, K, Muenkonkeaw, C, Suntranon, A, Sae-tang, S,

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Chaisri, A, Sirihora, M, Visrutaratna, S. (2009). Assessment of iodine status among preschool children in two districts Chiang-mai province, Thailand. *Annals Nutr Metab* 55: 594.

Iodine deficiency disorders (IDD) is a public health problem around the world. This study aimed to assess the iodine status among preschool children in Muang and Om Koi districts of Chiang Mai province, Thailand. Casual urine samples were collected from 679 children aged 3 to less than 6 years in child day care centers in Muang (n=491) and Om Koi (n=188) districts. Urinary iodine concentration (UI) was analyzed by microplate method and interpreted using WHO criteria. The median of UI among children in Muang and Om Koi districts were 240.1 µg/L and 112.8 µg/L respectively. Results showed that iodine intake among preschool children in Muang district were more than adequate whereas those in Om Koi district was adequate. However, IDD may still be a public health problem in Om Koi district since 21.2 % of preschool children had UI <50 µg/L.

Semba RD, de Pee S, et al. (2003). "Risk factors for night blindness among women of childbearing age in Cambodia." *European journal of clinical nutrition* 57(12): 1627-1632.

Objective: To characterize risk factors for night blindness among non-pregnant women of childbearing age, a group recently recognized to be at high risk of vitamin A deficiency in some developing countries. *DESIGN:* Case-control study. *Setting:* The study included >15 000 households in National Micronutrient Survey of Cambodia conducted in 2000. *SUBJECTS:* The prevalence of night blindness among 13 358 non-pregnant women was 2.0%. A total of 328 non-pregnant women with night blindness were matched by province with 1009 non pregnant women without night blindness. *Methods:* Univariate and multivariate logistic regression models were used to estimate odds ratios (ORs) as estimates of the relative risk of factors associated with night blindness. *Results:* In a final model, materials in the wall of the house (OR 1.4, 95% confidence interval (CI) 0.9-2.0), land ownership < or =0.5 hectares (OR 1.4, 95% CI 1.0-1.9), night blindness in last pregnancy (OR 44.5, 95% CI 29.2-67.8), parity >3 (OR 1.5, 95% CI 1.0-2.1), diarrhoea within the last 2 weeks (OR 1.9, 95% CI 1.3-2.8), maternal body mass index <18.5 (OR 1.8, 95% CI 1.2-2.7), and lack of consumption of vitamin A-rich animal foods in the last 24 h (1-60 retinol equivalents (RE) OR 1.1, 95% CI 0.7-1.6; > or =60 RE, OR 0.7, 95% CI 0.4-1.0) were associated with night blindness among non-pregnant women. *Conclusions:* Women of childbearing age in Cambodia with low socioeconomic status, low consumption of vitamin A-rich animal foods, a history of night blindness during the previous pregnancy, parity >3, malnutrition, and diarrhoea have a higher risk of night blindness. *Sponsorship:* United States Agency for International Development (442-G-00-95-00515-00).

Sirikulchayanonta C, Madjupa K, et al. (2004). "Do Thai women of child bearing age need preconceptional supplementation of dietary folate?" *Asia Pacific Journal of Clinical Nutrition* 13(1): 69-73.

Recent studies in western countries have indicated that women with low serum folate before pregnancy have greater risk of giving birth to babies with neural tube defects, and preconceptional folate supplementation has been recommended to prevent such defects. To determine whether Thai women needed folate supplementation before pregnancy, we carried out a cross-sectional study from September 2001 to January 2002. The objectives were to determine serum folate levels among women of child-bearing age and their relationship to dietary folate intake. One hundred and sixty-five apparently healthy, volunteer women aged 15-45 years were recruited from the Family Planning Clinic, Mother and Child Hospital, Health Promotion Centre, Region I, Bangkok. Data on general characteristics, nutritional status and dietary folate intake were recorded while venous blood was drawn for serum folate analysis. Results showed that 65.5% of the study group had low dietary folate intake, that 18% had low serum folate, and that there was a significant correlation between dietary intake and serum level ($r=0.68$, $P<0.001$). There were also significant correlations between serum level and body mass index, ($r=0.13$, $P<0.001$). However, there were no significant associations between serum level and age, educational level, occupation, family income, or duration vegetables were stored in the refrigerator before consumption. In conclusion, there is preliminary evidence that some pregnant Thai women may have sufficiently low serum folate levels to put their babies at risk. We recommend further study on a larger scale to confirm whether folate supplementation is needed for Thai women at child bearing age. In the interim, it may be wise for obstetricians to measure serum folate in pregnant women to determine whether folate supplementation is required.

Souphanthong K, Siriphong B, et al. (2000). "Community based intervention of iron deficiency anaemia in females and iodine deficiency disorders in school children in Lao PDR." *Southeast Asian Journal of Tropical Medicine &*

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Public Health 31 Suppl 2: 32-40

Under the supervision of the central and local health authorities, a pilot project was conducted in four villages in the Luangprabang Province, Lao PDR. The objective of the project was to test different regimes to supplement females with oral iron preparations to reduce iron deficient anaemia (IDA) and control iodine deficiency disorders (IDD) in school children. Compared with iron sulphate tablets, iron fumerate tablets were well accepted and good compliance results were achieved. Haemoglobin concentration improved only in the group of females taking iron fumerate tablets. The goitre rate decreased from approximately 90% to about 45% for school children, regardless of whether iodine salt were used by their families or whether iodine capsules were used to treat the children. The latter attempt was hampered by the fact that also in the control village iodine fortified salt was used. This was due to a governmental attempt to control IDD nation-wide. Therefore, also in the control village a significant decrease in the goitre rate was observed.

Suega K, Dharmayuda TG, et al. (2002). "Iron-deficiency anaemia in pregnant women in Bali, Indonesia: a profile of risk factors and epidemiology." *Southeast Asian Journal of Tropical Medicine & Public Health* 33(3): 604-607.

Iron-deficiency anaemia in pregnant women is a serious public health problem especially in tropical countries. The aim of this study was to assess the prevalence of iron-deficiency anaemia in pregnant women in Bali and determine the risk factors for anaemia. A cross-sectional study was conducted among 1,684 pregnant women in 42 villages in Bali that were selected by probabilistic/proportional-to-size sampling technique. Two ml of venous blood were collected for haemoglobin estimation using an automatic haematology analyser (Technician H-I), and serum ferritin examination using immunofluorescent technique. The WHO criterion for anaemia in pregnancy was applied and serum ferritin < 20 microg/l as cut-off point for iron deficiency. Data regarding risk factors were gathered using pre-designed questionnaires. The prevalence of iron-deficiency anaemia in pregnant women was 46.2%; most of the cases of anaemia were mild. The risk factors for anaemia identified in this study were: length of gestation; level of education; antenatal intake of iron pills. Given the high prevalence of iron-deficiency anaemia in pregnant women in Bali, preventive measures, e.g. iron supplementation, the iron fortification of food, and health education, should be encouraged.

Sukrat B, Suwathanapisate P, et al. (2010). "The prevalence of iron deficiency anaemia in pregnant women in Nakhonsawan, Thailand." *Journal of the Medical Association of Thailand* 93(7): 765-770.

Objective: To determine the prevalence of iron deficiency anaemia in pregnant women and the prevalence of thalassemia in both the anaemic and non-anaemic group. *Material and Method:* At the first antenatal visit, blood was obtained for complete blood count. If haemoglobin < 11 g/dl or haematocrit < 33%, serum ferritin was performed. The authors used definition of anaemia from CDC and WHO to determine the prevalence of anaemia in pregnant women. Iron deficiency anaemia was defined by anaemia from CDC or WHO criteria in accordance with serum ferritin less than 30 mg/L. Cases of abnormal thalassemia screening were followed by haemoglobin electrophoresis and polymerase chain reaction (PCR) for diagnosis of alpha thalassemia 1 (SEA and Thai-deletion type). The data was analysed by descriptive fashion and presented as mean, percentage, and standard deviation. *Results:* Five hundred nineteen pregnant women were recruited. The prevalence of anaemia from WHO (Haemoglobin < 11 g/ dl), WHO (Haematocrit < 33%), and CDC criteria were 14.1, 9.8, and 10.6% respectively. The prevalence of iron deficiency anaemia was 6.0, 4.6, and 4.8% in the same order. The prevalence of thalassemia was 39.7% in the anaemic group and 24.4% in the non-anaemic group. *Conclusion:* The WHO criteria (Haemoglobin < 11 g/dl) gave the highest prevalence of anaemia and iron deficiency anaemia during pregnancy (14.1% and 6.0%). The prevalence of thalassemia in the anaemic group (39.7%) was higher than non-anaemic group (24.4%).

Suharno D, West CE, Muhilal, Logman MH, de Waart FG, Karyadi D, Hautvast JG. Am J Clin Nutr. 1992 Dec;56(6):988-93. Indonesia. Cross-sectional study on the iron and vitamin A status of pregnant women in West Java, Indonesia. *Source* Ministry of Health RI, Jakarta Pusat,

A cross-sectional study of the prevalence of iron and vitamin A deficiency in normal pregnant women in West Java, Indonesia, was carried out. Of the 318 women studied, 49.4% were anemic and, according to multiple criteria, 43.5% had iron-deficiency anemia, 22.3% had iron-deficient erythropoiesis, and 6.6% had iron depletion. Serum retinol values revealed that 2.5% of the pregnant women were vitamin A deficient and 31% had marginal vitamin A status. The relative dose-response test carried out on 45 women showed that 4 (8.9%)

D3.2 Annotated bibliography of food consumption information in the five SEA countries

had deficient vitamin A liver stores. After gestational stage, parity, and subdistrict were adjusted for, serum retinol concentrations were significantly positively associated ($P < 0.01$) with hemoglobin concentrations, hematocrit, and serum iron concentrations. The suboptimal vitamin A status associated with nutritional-deficiency anemia suggests that pregnant women in the area should be supplemented not only with iron but also with vitamin A. This proposal should be tested in an intervention study.

Suthutvoravut, U., Winichagoon, P, Chongviriyaphan, N, Taechangam, S, Tantracheewathorn, S, Katesomboon, S (2009). Prevalence of iron deficiency and related factors among Thai infants aged 9-12 months. *Annals of Nutrition and Metabolism* 55: 686.

The aim of this study was to determine iron status, prevalence of iron deficiency (ID) and iron deficiency anemia (IDA), and related factors among Thai infants. The cross-sectional study of 207 healthy infants aged between 9-12 months and their parents were conducted at well baby clinics of Ramathibodi Hospital and Vajira Hospital during February - October 2008. Their general characteristics, socio-economic status, nutritional status, feeding modes, and dietary intake were determined. Blood samples were analyzed for hemoglobin (Hb), hematocrit (Hct), mean cell volume (MCV), and serum ferritin (SF) as indicators of iron status. The mean values of Hb, Hct, MCV, and SF of infants were 11.7 ± 0.9 g/dl, $35.0 \pm 2.6\%$, 73.7 ± 5.8 fl, and 33.9 ± 26.1 ng/dl, respectively. The prevalence of anemia, ID, and IDA were 22.2%, 4.4%, and 3.9%, respectively. Related factors of iron status were maternal education, maternal occupation, financial status, low birth weight, prolonged breastfeeding, and low meat intake. Multiple logistic regression analysis indicated that low birth weight, prolonged breastfeeding and low meat intake significantly related to iron depletion, ID, and IDA. Infants with these risk factors should be screened for anemia and iron status.

Tantracheewathorn S, Lohajaroensub S, (2005). Incidence and Risk Factors of Iron Deficiency Anemia in Term Infants. *J Med Assoc Thai* 88(1): 45-51.

Objective: To compare the incidence of iron deficiency anemia (IDA) between breast-fed (BF) and formula-fed (FF) infants and to identify the risk factors of IDA in these infants. *Design:* Cohort study. *Material and Method:* A study of 140 full-term infants (70 BF and 70 FF) was conducted at BMA Medical College and Vajira Hospital from February 2002 to November 2003. All infants were followed at the age of 1, 2, 4, 6, 9 and 12 months for growth and developmental assessment. Blood samples were analyzed for hemoglobin (Hb), hematocrit (Hct) and mean corpuscular volume (MCV) at 9-12 months; and infants with $Hb < 11.0$ g/dl were further investigated for the cause of anemia. *Results:* The mean values of Hb, Hct, MCV and serum ferritin of BF infants were 10.8 g/dl, 32.8%, 70.9 fl and 16.7 ng/ml respectively, which were significantly lower than those of FF infants (11.4 g/dl, 35.1%, 73.3 fl, and 36.9 ng/ml, $p < 0.05$). Anemia was found in 27 BF infants (38.6%) compared with 10 FF infants (14.3%). The incidence of IDA in BF infants was significantly higher than FF infants (25.7% vs 2.9%, $p < 0.001$). Risk factors of IDA included low birth weight, breastfeeding and inadequate complementary food (adjusted RR (95% CI): 3.1(1.1-9.1), 6.3(1.5-25.0), 7.7(2.8-20.0), respectively). *Conclusion:* IDA is more prevalent in BF than FF infants. Risk factors of IDA are low birth weight, breastfeeding and inadequate complementary food. Prevention of IDA in infants should be achieved through adequate iron-rich complementary food and screening for Hb or Hct at 9-12 months of age in high risk infants.

Thi Thu Hien VN, Thi Lam, et al. (2009). "Folate and vitamin B12 status of women of reproductive age living in Hanoi City and Hai Duong Province of Vietnam." *Public health nutrition* 12(7): 941-946.

The aim of this study was to assess the folate and vitamin B12 status of a group of Vietnamese women of reproductive age and to estimate rates of neural tube defects (NTD) based on red blood cell (RBC) folate concentration. Participants were a representative sample of non-pregnant women (15-49 yrs) living in Hanoi City ($n = 244$) and Hai Duong Province ($n = 245$). RBC folate, plasma vitamin B12 and plasma holotranscobalamin (holoTC), a sensitive indicator of vitamin B12 status, were determined. Mean (95% CI) concentration of RBC folate, plasma B12 and plasma holoTC were 856 (837, 876) nmol/l, 494 (475, 513) pmol/l and 78 (74, 82) pmol/l, respectively. Only 3 and 4% of women had plasma B12 and holoTC concentration indicative of deficiency. No woman had an RBC folate concentration indicative of deficiency (< 317 nmol/l). Only 47% of women had an RBC folate concentration ≥ 905 nmol/l. Accordingly, the NTD rate in these regions of Vietnam is predicted to be 14.7 (14.2, 15.1) per 10 000 pregnancies. In conclusion, there was no evidence of folate and vitamin B12 deficiency among this population of Vietnamese women. However, suboptimal folate

D3.2 Annotated bibliography of food consumption information in the five SEA countries

status may be placing 3 out of 5 women at increased risk of NTD. Reductions in NTD rates are still possible and women would benefit from additional folic acid during the periconceptional period from either supplements or fortified foods.

Tienboon P, Wangpakapattanawong P (2007). "Vitamin A status of the minority ethnic group of Karen hill tribe children aged 1-6 years in Northern Thailand." *Asia Pacific Journal of Clinical Nutrition* 16(1): 158-162.

Vitamin A deficiency (VAD) is the most common cause of child-hood blindness in the developing world. It is estimated that by giving adequate vitamin A, in vitamin A deficient populations, child mortality from measles can be reduced by 50%, and mortality from diarrheal disease by 40%. Overall mortality in children 6-59 months of age can be reduced by 23%. This paper reported results from a study of vitamin A status and malnutrition of the minority ethnic group of Karen hill tribe children aged 1-6 years in the north of Thailand. All children aged 1-6 years (N=158; 83 boys, 75 girls) from the three Karen villages (Mae Hae Tai, Mae Yot, Mae Raek) of Mae Chaem district in the north of Thailand were studied. The Karen is the largest mountain ethnic minority ("hill tribe") group in Thailand. All children were examined by a qualified medical doctor and were assessed for their vitamin A intakes using 24 hours dietary recall. Thai food composition table from Ministry of Health, Thailand were used as references. The results were compared with the Thai Recommended Dietary Allowances. Children aged 1-3 years and 4-6 years were separately analysed due to the differences in Thai Recommended Dietary Allowances between the two age groups. A whole blood of 300 micro L was obtained by "fingerstick" for determination of serum vitamin A. Community or village's vitamin A status was assessed by using Simplified Dietary Assessment (SDA) method and Helen Keller International (HKI) food frequency method. Descriptive statistics were used to analyse the data. All families of the study boys and girls had income lower than the Thailand poverty line (US \$ 1,000/year). On average, 63% of children from Mae Hae Tai village, 1.5% of children from Mae Yot village and none of children from Mae Raek village had serum vitamin A <0.7 micro mol/L which indicated VAD. All boys and only girls from Mae Raek village consumed vitamin A more than the Thai RDA but girls from Mae Hae Tai village and Mae Yot village consumed vitamin A less than the Thai RDA. Both boys and girls from Mae Raek village and also girls from Mae Yot village consumed vitamin A more than the Thai RDA. Using SDA and HKI methods to assess vitamin A status of the villages to see whether VAD is a village's nutritional problem, it was found that all children from the three villages were at risk of VAD. In order to improve vitamin A status of the Karen children in Mae Chaem district, recommendations were made as follow: (1) increased use of fat and oil, particularly in areas with high risk of VAD; (2) more general work with Karen communities on how children's diets might be improved in a culturally acceptable manner, so as to bring vitamin A consumption closer to recommended allowance level.

Tienboon P, Unachak K (2003). Iron deficiency anaemia in childhood and thyroid function. *Asia Pacific J Clin Nutr* 2003;12 (2): 198-202.

Studies in animals and adults have indicated iron deficiency anaemia to be associated with altered thyroid hormonemetabolism. The aim of the present study was to determine the effect of iron deficiency anaemia on the thyroid function of young children. Concentrations of thyroxine (T4) and triiodothyronine (T3), free thyroid hormones (fT4 and fT3), thyroxine binding globulin (TBG), and thyroid stimulating hormone (TSH) were measured in the basal state and in response to an intravenous bolus of thyrotropin releasing hormone (TRH) in nine children one to three years of age with iron deficiency anaemia (IDA) before and after treatment with oral iron. The results of the anaemic children were also compared to basal and stimulated concentrations of thyroid hormones, TBG, and TSH of eight iron sufficient, age matched children. Seven of the IDA and 6 of the control children were male. The mean haemoglobin (Hb) and serum ferritin (SF) in the IDA children at baseline were 93 g/L (range 81-102) and 6 µg/L (range 1-12) which increased to 121 g/L (range 114-129) and 54 µg/L (range 19-175), respectively, after a mean of 2.3 months (SD 0.5) of iron therapy. In the control group, mean Hb and SF were 125 g/L (range 114-130) and 51 µg/L (range 24-144), respectively. The basal values of TBG and thyroid hormones of the IDA children before and after iron treatment were not different from the control children. Similarly, there was no statistical difference in the thyroid hormones in the IDA children before compared to after resolution of the anaemia. Compared to the control children, the TSH response over time to TRH, TSH area under the curve (TSHAUC), and the peak TSH value after stimulation were all lower in the IDA children both before and after resolution of anaemia, but the differences were not significant. Iron therapy and resolution of anaemia had no effect among the IDA children. The time to reach the peak TSH concentration was longer in the

D3.2 Annotated bibliography of food consumption information in the five SEA countries

IDA children ($P = 0.08$) than the control children before iron therapy. While the time to peak TSH decreased upon resolution of the anaemia, the difference was not significant. There was no effect of Hb concentration, age, or anthropometry with TSH, TSHAUC, or time to peak TSH after TRH stimulation in the IDA children before treatment. Normal thyroid function was preserved in these children with iron deficiency anaemia, however three of nine children had minor abnormalities of hypothalamic pituitary function. These results indicate that hypothyroidism is unlikely to be a major cause of impaired psychomotor development or growth in young children with iron deficiency anaemia.

Thurlow RA, Winichagoon P, Green T, Wasantwisut E, Pongcharoen T, Bailey KB, Gibson RS (2005). Only a small proportion of anemia in northeast Thai schoolchildren is associated with iron deficiency. *Am J Clin Nutr* 82:380–7.

Background: Iron deficiency is assumed to be the major cause of anemia in northeast Thailand, but other factors may be involved. *Objective:* We determined the prevalence of anemia among schoolchildren in northeast Thailand and the role of hemoglobinopathies, selected micronutrient deficiencies, and other factors in hemoglobin status. *Design:* Blood samples were collected from 567 children aged 6–12.9 y attending 10 primary schools for the determination of a complete blood count and hemoglobin type [Hb AA (normal hemoglobin), Hb AE (heterozygous for Hb type E), and Hb EE (homozygous for Hb type E)] and the measurement of serum ferritin, transferrin receptor, retinol, vitamin B-12, and plasma and erythrocyte folate concentrations. Children with a C-reactive protein concentration ≥ 10 mg/L ($n = 12$), which indicated infection, were excluded. *Results:* The prevalence of anemia was 31%. Age, hemoglobin type, and serum retinol were the major predictors of hemoglobin concentration. Hb AA and Hb AE children with anemia had lower ($P < 0.01$) hematocrit, mean cell volume, and serum retinol values than did their nonanemic counterparts; no significant differences in serum ferritin were found by hemoglobin type. Only 16% ($n = 22$) of the anemic Hb AA and Hb AE children were iron deficient. Hb AA and Hb AE children with a serum retinol concentration < 0.70 $\mu\text{mol/L}$ ($n = 14$) had a significantly higher geometric mean serum ferritin concentration than did those with a retinol concentration ≥ 0.70 $\mu\text{mol/L}$ ($P < 0.009$); no significant difference in transferrin receptor concentrations was found between these 2 groups. *Conclusions:* Hemoglobinopathies, suboptimal vitamin A status, and age were the major predictors of hemoglobin concentration. The contribution of iron deficiency to anemia was low, and its detection was complicated by coexisting suboptimal vitamin A status.

Thurlow RA, Winichagoon P, Pongcharoen T, Gowachirapant S, Boonpradern A, Manger MS, Bailey KB, Wasantwisut E, Gibson RS. Risk of zinc, iodine and other micronutrient deficiencies among school children in North East Thailand. (2006) *Eur J of Clin Nut*, 60 (5), pp. 623-632.

Introduction: Micronutrient deficiencies during childhood can contribute to impairments in growth, immune competence, and mental and physical development, and the coexistence of several such deficiencies can adversely affect the efficacy of single micronutrient interventions. *Objective:* To assess the prevalence of zinc and iodine deficiency and their interrelationships with vitamin A deficiency and anemia and associations with socio-economic status, hemoglobin type, and anthropometry in a cross-sectional study. *Setting:* A total of 10 primary schools in North East Thailand. *Methods:* Non-fasting venipuncture blood samples and casual urine samples were collected from 567 children aged 6–13 years. Anthropometric measures and serum zinc, albumin, C-reactive protein and urinary iodine, are reported here and integrated with published data on vitamin A, anemia, and socio-economic status. *Results:* Of the children, 57% had low serum zinc and 83% had urinary iodine levels below the 100 mg/l cutoff. Suboptimal serum zinc and urinary iodine concentrations may result from low intakes of zinc and iodized salt. Significant risk factors for low serum zinc were serum retinol < 1.05 mmol/l and being male. Those for urinary iodine < 100 mg/l were height-for-age score < 4 median and being female. For serum retinol < 1.05 mmol/l, risk factors were low hemoglobin, low serum zinc, and < 9 years, and for low hemoglobin indicative of anemia risk factors were < 9 years, AE hemoglobinopathy, and serum retinol < 1.05 mmol/l. Of the children, 60% were at risk of two or more coexisting micronutrient deficiencies, most commonly suboptimal urinary iodine and low serum zinc. *Conclusion:* The findings emphasize the need for multimicronutrient interventions in North East Thailand.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Tuntipopipat S, Judprasong K, Zeder C, Wasantwisut E, Winichagoon P, Charoenkiatkul S, Hurrell R, Walczyk T. Chili, but not turmeric, inhibits iron absorption in young women from an iron-fortified composite meal. (2006) *Journal of Nutrition*, 136 (12), pp. 2970-2974.

Chili and turmeric are common spices in indigenous diets in tropical regions. Being rich in phenolic compounds, they would be expected to bind iron (Fe)³ in the intestine and inhibit Fe absorption in humans. Three experiments were conducted in healthy young women (n = 10/study) to assess the effect of chili and turmeric on Fe absorption from a rice-based meal containing vegetables and iron fortified fish sauce in vivo. Iron absorption was determined by erythrocyte incorporation of stable isotope labels (⁵⁷Fe/⁵⁸Fe) using a randomized crossover design. Addition of freeze-dried chili (4.2 g dry powder, 25 mg polyphenols as gallic acid equivalents) reduced Fe absorption from the meal by 38% (6.0% with chili vs. 9.7% without chili, P = 0.0017). Turmeric (0.5 g dry powder, 50 mg polyphenols as gallic acid equivalents) did not inhibit iron absorption (P = 0.91). A possible effect of chili on gastric acid secretion was indirectly assessed by comparing Fe absorption from acid soluble [⁵⁷Fe]-ferric pyrophosphate relative to water soluble [⁵⁸Fe]-ferrous sulfate from the same meal in the presence and absence of chili. Chili did not enhance gastric acid secretion. Relative Fe bioavailability of ferric pyrophosphate was 5.4% in presence of chili and 6.4% in absence of chili (P = 0.47). Despite the much higher amount of phenolics in the turmeric meal, it did not affect iron absorption. We conclude that both phenol quality and quantity determine the inhibitory effect of phenolic compounds on iron absorption.

Trinh LTT, Dibley M, (2007). "Anaemia in pregnant, postpartum and non-pregnant women in Lak district, Daklak province of Vietnam." *Asia Pacific Journal of Clinical Nutrition* 16(2): 310-315.

Objective: To determine anaemia prevalence and related factors in pregnant women (PW), post-partum women (PPW) and non-pregnant women (NPW) in a remote mountainous district. *Methods:* A cross-sectional survey was conducted in 2001. All PW, all PPW within 6 months of delivery and a random number of NPW equivalents to the number of PW in each commune were selected. Haemoglobin (Hb) was measured using Hemocue method. Mild anaemia was defined as Hb=7 g/dL-11 g/dL in PW, and 8 g/dL-12 g/dL in NPW and PPW. Severe anaemia was defined as Hb<7 g/dL in PW, and <8 g/dL in NPW and PPW. Pregnancy status was determined using urine pregnancy test and calculation of expected menstruum. *Results:* There were 901 women surveyed: 281 PW, 348 PPW and 272 NPW. More than half (58%) were anaemic: 54% mild and 4% severe. Mean Hb was 11.1g/dL. More PPW had anaemia (62%; OR=1.4; 95%CI=1.1-2.1 compared to NPW) than NPW (54%) and PW (53%). Other related factors were being BoY, Ede and Koho ethnics (OR=2.7; 95%CI=1.4-5.0 compared to Kinh ethnic), having primary education or lower (OR=1.5; 95%CI=1.1-2.1 compared to secondary education or higher). Among PW, being pregnant during the third trimester increased anaemia (OR=2.2; 95%CI=1.3-3.8 compared to being pregnant during the second trimester). Among PPW, women aged 30 or older were more anaemic (OR=1.7, 95%CI=1.1-2.9 compared to women aged 20-29). *Conclusion:* Anaemia prevalence was very high. Interventions should be focused on PPW, PW during the last trimester, minority ethnic women, low-educated and older women.

Udomkesmalee E, Dhanamitta S, Yhoun-Aree J, Rojroongwasinkul N, Smith JC, Jr (1990). Biochemical evidence suggestive of suboptimal zinc and vitamin A status in schoolchildren in Northeast Thailand. *Am J Clin Nutr* 52: 564-7.

Data are accumulating that support the hypothesis that inadequate zinc nutrition will result in an impairment of vitamin A utilization. Therefore, zinc and vitamin A status were assessed in 283 schoolchildren aged 7-13 y in Northeast Thailand. More than one-fourth had serum vitamin A concentrations < 0.86 µmol/L, with a mean (± SD) concentration of 1.06 ± 0.31 µmol/L compared with 1.26 ± 0.02 µmol/L for US children of similar age. Seventy percent had low serum zinc concentrations, < 10.7 µmol/L. Twenty-three percent of the children exhibited both low serum zinc and vitamin A concentrations. The mean concentration of retinol-binding protein (RBP) was lower for children in this study compared with healthy Thai children in Bangkok, 22.5 ± 6.6 vs 25.3 ± 6.0 mg/L, respectively. Serum zinc and RBP were significantly correlated (p < 0.001) whereas vitamin A and zinc were not correlated. These data suggest that a high proportion of rural schoolchildren in Northeast Thailand are at risk of inadequate zinc and/or vitamin A nutrition.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Viengsakhone L, Yoshida Y, Harun-Or-Rashid M, Sakamoto J. Factors affecting low birth weight at four central hospitals in Vientiane, Lao PDR. *Nagoya J Med Sci.* 2010 Feb;72(1-2):51-8. Department of Healthcare Administration, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan. moviengsakhone@yahoo.com

The purpose of this study was to determine the factors affecting low birth weight (LBW) at four central hospitals in Vientiane, the capital city of Lao PDR. We collected data from 235 mothers with LBW babies and 265 with babies of normal birth weight (NBW) who had delivered them at four central hospitals from March to June of 2008. Among the mothers of LBW babies, 84.7% were aged 18-35 years, 7.7% aged < 18 years, and another 7.7% aged > 35 years, while the corresponding figures among those with NBW babies were 97.7%, 1.1%, and 1.1%, respectively. The mothers in a low income group earning < 1 million Kips (1 USD = 8,700 Kips) per month numbered 68.9% for the LBW group and 15.1% for the NBW group. We estimated both odds ratios (ORs) and 95% confidence intervals (CIs) to explore associations between LBW outcomes and related factors. Significant associations with LBW were found for delivery at age < 18 years (OR = 8.6, 95% CI = 2.4-30.7), monthly family income < 1 million Kips (OR = 13.9, 95% CI = 8.8-21.9), physical labor during pregnancy (OR = 5.0, 95% CI = 3.1-8.1), and first child birth (OR = 2.2, 95% CI = 1.5-3.3). Mothers with an inadequate level of knowledge regarding healthy pregnancy practices were at 10.1 times higher risk of developing LBW babies (95% CI = 6.7-15.2). Mothers lacking adequate nutritional practices were more prone to deliver LBW babies with an OR of 8.9 (95% CI = 5.6-14.3). The ORs of LBW babies for those factors were high among Lao mothers. Improving a mother's knowledge of and practice for a healthy pregnancy needs to be emphasized to reverse these LBW trends

Wasantwisut E, Winichagoon P, Chitchumroonchokchai C, Yamborisut U, Boonpradern A, Pongcharoen T, Sranacharoenpong K and Russameesopaphorn W (2006). Iron and zinc supplementation improved iron and zinc status, but not physical growth, of apparently healthy, breast-fed infants in rural communities of northeast Thailand. *J Nutr* 136: 2405–2411.

Iron deficiency is prevalent in children and infants worldwide. Zinc deficiency may be prevalent, but data are lacking. Both iron and zinc deficiency negatively affect growth and psychomotor development. Combined iron and zinc supplementation might be beneficial, but the potential interactions need to be verified. In a randomized, placebo-controlled trial using a 2x3 factorial design, 609 Thai infants aged 4–6 mo were supplemented daily with 10 mg of iron and/or 10 mg of zinc for 6 mo to investigate effects and interactions on micronutrient status and growth. Iron supplementation alone increased haemoglobin and ferritin concentrations more than iron and zinc combined. Anemia prevalence was significantly lower in infants receiving only iron than in infants receiving iron and zinc combined. Baseline iron deficiency was very low, and iron deficiency anemia was almost nil. After supplementation, prevalence of iron deficiency and iron deficiency anemia were significantly higher in infants receiving placebo and zinc than in those receiving iron or iron and zinc. Serum zinc was higher in infants receiving zinc (16.7 ± 5.2 mmol/L), iron and zinc (12.1 ± 3.8 mmol/L) or iron alone (11.5 ± 2.5 mmol/L) than in the placebo group (9.8 ± 1.9 mmol/L). Iron and zinc interacted to affect iron and zinc status, but not hemoglobin. Iron supplementation had a small but significant effect on ponderal growth, whereas zinc supplementation did not. To conclude, in Thai infants, iron supplementation improved hemoglobin, iron status, and ponderal growth, whereas zinc supplementation improved zinc status. Overall, for infants, combined iron and zinc supplementation is preferable to iron or zinc supplementation alone.

West, K. P., Jr. (2002). "Extent of vitamin A deficiency among preschool children and women of reproductive age." *J Nutr* 132(9): Supplement, 2857S-2866S.

Knowledge of the extent of vitamin A (VA) deficiency (D) is critical for identifying high-risk populations and mobilizing resources for prevention. Yet, all estimates are necessarily imperfect, often based on assumptions in the absence of data. In 1995, the World Health Organization estimated 254 million children to be VA-deficient and 2.8 million to have xerophthalmia. Subsequently, estimates were changed to 75-140 million and 3.3 million, respectively. Although both sets are consistent with a problem of enormous magnitude, the discrepancies also created uncertainty. The present analysis indicates there are ~127 million and 4.4 million preschool children with VAD (serum retinol <0.70 micro mol/L or displaying abnormal impression cytology) and xerophthalmia, respectively. More than 7.2 million pregnant women in the developing world are VA-deficient (serum or breast-milk vitamin A concentrations <0.70 micro mol/L), and another 13.5 million have low VA status (0.70-1.05 micro

D3.2 Annotated bibliography of food consumption information in the five SEA countries

mol/L); >6 million women develop night blindness (XN) during pregnancy annually. Roughly 45% of VA-deficient and xerophthalmic children and pregnant women with low-to-deficient VA status live in South and Southeast Asia. These regions harbour >60% of all cases of maternal XN, three fourths of whom seem to live in India. Africa accounts for 25-35% of the global cases of child and maternal VAD; about 10% of all deficient persons live in the eastern Mediterranean region, 5-15% live in the Western Pacific and ~5% live in the Region of the Americas. VA prophylaxis seems to be preventing the number of deficient preschool children from increasing while probably reducing rates of blindness and mortality. Greater effort is needed to assess and prevent VAD and its disorders, particularly among pregnant and lactating women.

Zimmermann, MB, Winichagoon, P, Gowachirapant, S, Hess, SY, Harrington, M, Chavasit, V, Lynch, SR and Hurrell, RF (2005). Comparison of the efficacy of wheat-based snacks fortified with ferrous sulfate, electrolytic iron, or hydrogen-reduced elemental iron: randomized, double-blind, controlled trial in Thai women. Am J Clin Nutr 82:1276-82.

Although elemental iron powders are widely used to fortify cereal products, little data exist on their efficacy in humans. *Objective:* We compared the efficacy of wheat-based snacks fortified with ferrous sulfate, electrolytic iron, or hydrogen-reduced iron in Thai women with low iron stores. *Design:* A double-blind intervention was conducted in 18-50-y-old women ($n=330$) randomly assigned into 4 groups to receive either no fortification iron or 12 mg Fe/d for 6 d/wk for 35 wk as ferrous sulfate, electrolytic iron, or hydrogen-reduced iron in a baked, wheat-flour-based snack. Snacks were not consumed with meals, and consumption was monitored. At baseline, 20 wk, and 35 wk, hemoglobin status and iron were measured and the groups were compared. *Results:* Between baseline and 35 wk, geometric mean serum ferritin (SF) increased significantly in all 3 groups receiving iron ($P < 0.01$), and geometric mean serum transferrin receptor (TfR) decreased significantly in the groups receiving ferrous sulfate and electrolytic iron ($P < 0.05$). Calculated mean (\pm SD) body iron stores increased from 1.5 ± 2.8 to 5.4 ± 2.9 mg/kg in the ferrous sulfate group, from 1.5 ± 3.5 to 4.4 ± 3.6 mg/kg in the electrolytic iron group, and from 1.3 ± 3.2 to 3.2 ± 4.3 mg/kg in the hydrogen reduced iron group ($P = 0.01$ for all 3 groups) but did not change significantly in the control group. *Conclusions:* Ferrous sulfate, electrolytic iron, and hydrogen reduced iron, fortified into wheat-based snacks, significantly improved iron status. On the basis of the change in body iron stores during the 35-wk study, the relative efficacy of the electrolytic and hydrogen-reduced iron compared with ferrous sulfate was 77% and 49%, respectively.

No abstracts were received for the following references:

Krittaphol W, Bailey KB, Pongcharoen T, Winichagoon P, Gibson RS. Low zinc, iron, and calcium intakes of Northeast Thai school children consuming glutinous rice-based diets are not exacerbated by high phytate. (2006) Int J Food Sci Nutr, 57 (7-8), pp. 520-528.

Maleevong, K., Wasantawisut, E., Pattaraarchachai, J., Durongdej, S., Pradipasen, M., Sinawat, S. Development of Screening Indicators for Ranking Areas at Risk of Vitamin A Deficiency in Thailand. (2004) Journal of the Medical Association of Thailand, 87 (2), pp. 150-157.

Ramakrishnan, U. (2002). "Prevalence of Micronutrient Malnutrition Worldwide." Nutrition Reviews 60(5): 46-52.

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National Health Examination Survey, Health System Research Institute (2010). Report of the fourth health examination survey in Thailand, 2008-9. Ekplakorn, W, ed. The graphic system, Ltd. (Thai) (www.nheso.or.th)

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National Statistical Office, Ministry of Information and Communication Technology and UNICEF Thailand (2006). Monitoring the situation of children and women. Thailand Multiple Indicator Cluster Survey, December 2005 – February 2006.

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D3.2 Annotated bibliography of food consumption information in the five SEA countries

Survey 2003. (Thai)

Question 2: Which foods are common in a typical diet of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam?

Bhoopat, L., P. Rojnuckarin, et al. (2010). "Low vegetable intake is strongly associated with venous thromboembolism in Thai population." *Blood Coagulation & Fibrinolysis* **21**(8): 758-763.

Recent studies have demonstrated a much higher incidence of venous thromboembolism (VTE) among Asian patients compared with previous studies. This study aims to determine dietary and behavioural factors that may have contributed to this increase. A case-control study was conducted. Cases were objectively confirmed VTE between 2006 and 2009 at King Chulalongkorn Memorial Hospital. Patients with underlying cancer, antiphospholipid syndrome and arterial thrombosis were excluded. Controls were age and sex-matched healthy volunteers. Food consumption was assessed using a food frequency questionnaire modified from the Thailand National Health Examination Survey III previously validated in the Thai population. There were 97 cases and 195 controls. The mean age was 54.6 years and 70% were women. VTE patients consumed significantly less vegetable, fish and spicy food compared with normal individuals with an odds ratio (OR) for venous thrombosis of 3.74 [95% confidence interval (CI) 2.24-6.26, $P < 0.001$], 2.05 (95% CI 1.24-3.41, $P = 0.005$) and 2.30 (95% CI 1.29-4.11, $P = 0.01$), respectively. Additionally, thrombosis was associated with overweight (OR 2.1, 95% CI 1.21-3.62, $P = 0.002$), obesity (OR 3.1, 95% CI 1.46-6.74, $P = 0.001$) and oestrogen uses (OR 3.7, 95% CI 1.05-13.2, $P = 0.02$), but not with smoking or lack of exercise. A multivariate analysis showed that low vegetable consumption (OR 3.74, 95% CI 1.85-7.55, $P < 0.001$), female hormones (OR 5.80, 95% CI 1.51-22.22, $P = 0.011$) and body mass index (BMI, $P = 0.048$) were independently associated with VTE. Low vegetable intake, hormonal use and high BMI are the risk factors for non-cancer-related VTE in Thai population.

Budi, S., D. W. Giraud, et al. (2000). "Food sources of vitamin B-6 of a group of Indonesian children." *Journal of Food Quality* **23**(3): 293-304.

Food sources of vitamin B₆, commonly consumed by 77 children aged 8-9 yr in Bogor, West Java, Indonesia, were analysed for total vitamin B₆ contents using *Saccharomyces ovarian*. Values were compared with those of the USDA Nutrient Database for Standard Reference. Samples analysed belonged to the groups, starch foods, meat, fish, egg, milk, legume, vegetable and fruit. Total vitamin B₆ values for these foods (mg/100 g) were significantly lower than USDA database values. Mean vitamin B₆ intakes of the subjects calculated using analysed values (0.57 ± 0.26 mg/day) were significantly lower ($P < 0.0001$) than mean vitamin B₆ intakes calculated using USDA database values (0.97 ± 0.31 mg/day). Mean differences between intakes calculated by the 2 methods were about 70%. The contribution of vitamin B₆ from plant foods (52%) was similar to that of animal sources (48%). Estimation of vitamin B₆ intake using analysed values of the local foods more accurately represented actual intakes than database values.

Bulan, P. (1996). *Symposium on changing dietary intake and food consumption (Thailand country report)*, Kasetsart Univ., Bangkok (Thailand). Inst. of Food Research and Product Development. IFRPD Research report 1992-1995. Raingan phonngan wichai pracham pi 2535-2538. Bangkok (Thailand). 1996. 246 p. p. 233-234.

The significant growth experienced in Asia and the Pacific region during the past two decades has contributed to a general improvement in the standard of living and has, to some extent, enhanced the nutritional condition of the population. The improved living standard together with the rapid development of the food industry has also expanded people's choice of food and altered consumption patterns, particularly, in the higher income group. More people, for instance, are now taking less cereals and more meat, eggs, fruits, fish, milk and other non-starchy food items. Also, many people are now consuming processed foods as food processing technology facilitates the manufacture of a wider variety of foods. The changes in dietary habits, however, have led to a noticeable increase in nutritional imbalance. For example, people these days tend to consume more fat and less carbohydrates. This tendency points to the need to have a clearer picture of the food supply and consumption situation, which will be useful in reviewing food and nutrition policies and programs. Accordingly, a regional survey was conducted in 1993 in APO member countries. The results of the survey were presented and deliberated upon at a follow-up symposium held in Japan from 13 to 20 December 1994. In addition, resource papers on related topics from selected experts were discussed. The highlights of the regional report, individual country studies and resource papers are documented in the present volume.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Chan, S. S. L., E. L. Ferguson, et al. (2007). "The concentrations of iron, calcium, zinc and phytate in cereals and legumes habitually consumed by infants living in East Lombok, Indonesia." *Journal of Food Composition and Analysis* 20(7): 609-617.

There is a paucity of analysed data on contents of minerals and phytate in Asian complementary foods. Thus, cereals and legumes (n=27) consumed by Indonesian infants were analysed for iron, zinc and calcium using flame Atomic Absorption Spectrophotometry and for phytate using high performance liquid chromatography (HPLC). Results (per 100 g dry weight) showed unfortified cereals had lower concentrations of zinc (1.5-3.2 mg/100 g vs. 3.2-5.8 mg/100 g), iron (0.3-5.4 mg/100 g vs. 2.9-17.4 mg/100 g), calcium (5-48 mg/100 g vs. 41-926 mg/100 g) and phytate (hexa- and penta-inositol phosphates; 70-246 mg/100 g vs. 177-1042 mg/100 g) than legumes and lower phytate: mineral molar ratios. Tempe had the lowest concentration of phytate (236-366 mg/100 g vs. 763-1042 mg/100 g), and the lowest molar ratios of phytate: zinc (6.3-12.6 vs. 14.3-21.1) and phytate: iron (1.6-4.0 vs. 5.0-11.3) compared to other soybean products. Milling increased concentrations of iron and calcium in rice (1.2 vs. 0.4 mg/100 g, p=0.002; and 8.1 vs. 5.1 mg/100 g, p=0.029, respectively); but reduced zinc (1.6 vs. 1.7 mg/100 g, p=0.013). Boiling increased calcium concentrations in rice and rice flour (5.1-16.7 mg/100 g, p=0.004; and 8.1-31.4 mg/100 g, p<0.001, respectively); whereas frying decreased iron concentrations in tempe (13.3-6.1 mg/100 g, p=0.038). When expressed per infant portions, fortified cereals and tempe were the best sources of zinc, iron, and calcium, because of their relatively high mineral and low phytate contents.

Chandrapanond, A., Ratchatasilpin, A, and Tansuphasiri, S. (1972). Dietary survey of preschool children and expectant women in Soongnern District, Nakorn Rajsima Province, Thailand. *Am J Clin Nutr* 25(7): 730-735.

A nutritional survey of the dietary intakes of preschool children and pregnant women was conducted in a rural Thai village. The dietary intakes of individuals were weighed and recorded during a 3-day observation period. From this data, the average diet for each age group was calculated, reconstituted, and the biochemical analyses performed. This methodologic approach to a field survey allowed a tremendous saving in the time and cost of analyses while providing a much more accurate indication of the actual intake of the preschool children. As is well known this information is simply lost when dietary surveys are based on family intakes. The results of the survey showed that the diets consumed were inadequate in calories and many nutrients and that this was reflected in the physical condition of the children.

Chatlert Pongchaiyakul, C, Charoenkiatkul, S, Kosulwat, V, Rojroongwasinkul, N and Rajatanavin, R (2008). Dietary calcium intake among rural Thais in northeastern Thailand. *J Med Assoc Thai* 91 (2): 153-8.

Objectives: The present study examined the amount and relative contribution of calcium from the habitual diet among rural Thais. *Material and Method:* Calcium intake was assessed using 3-day food records and interviewer-administered quantitative food-frequency questionnaire, containing 73 food items. *Results:* The authors recruited 436 healthy participants (181 men and 255 women), between 20 and 85 years of age. Averaged daily calcium intake among men and women were 378.6 and 265.6 mg, respectively. Sixty-seven percent of men and eighty seven percent of women had less dietary calcium intake than half of the recommended level (<400 mg/day) whereas only 6 and 3% had an intake more than 800 mg/day. The major food sources of dietary calcium was glutinous rice (32 percent) followed by small animals with edible bones (31 percent) and fresh and fermented fish (20 percent). Dairy products and vegetables constituted only 8 and 5% of dietary calcium, respectively. *Conclusion:* The habitual diet among rural Northeast Thais does not meet the recommended calcium intake level. To promote more consumption of dairy products and locally-available calcium-rich foods would be beneficial to prevent osteoporosis among this population.

Chatlert Pongchaiyakul, C, Kosulwat, V, Charoenkiatkul, S, Chailurkit, L, Rojroongwasinkul, N and Rajatanavin, R (2008). The association of dietary calcium, bone mineral density and biochemical bone turnover markers in rural Thai women. *J Med Assoc Thai* 91 (3): 295-302

Objective: To investigate the relative contribution of dietary calcium intake on bone mineral density (BMD) and biochemical bone turnover markers in rural Thai women. *Material and Method:* A cross-sectional investigation was designed in 255 rural Thai women. Usual dietary calcium intake was determined by 3-day food records and quantitative food-frequency questionnaire. BMD was measured by DXA. The three markers for bone turnover

D3.2 Annotated bibliography of food consumption information in the five SEA countries

event: serum total alkaline phosphatase, serum N-mid osteocalcin and type I collagen C-telopeptide, including serum calcium and were determined in 125 women in the present study. *Results:* An average daily calcium intake in the present study was 265 mg/day. Two hundred and thirty three out of 255 women (87%) consumed dietary calcium less than half of the recommended value and only 3% of women (n = 7) had calcium intake > 800 mg/day. After controlling certain parameters: age and body mass index, women who consumed higher amount of dietary calcium had significantly higher BMD at all sites. Moreover, highly increased bone turnover markers were observed in those with lowest quartile calcium intake. Women with osteopenia and osteoporosis were older, lower BMI, consumed less calcium and had significantly higher values of all biochemical bone turnover markers than those who had normal BMD. *Conclusion:* The present study showed that a habitual diet of the rural Thai population might not provide enough calcium as needed for bone retention and for prevention of bone loss in the following years. Modification of eating pattern by promotion of increased consumption of locally available calcium rich food may be beneficial for prevention of osteoporosis among this population.

Chen, P. P., S. Wongsiri, et al. (1998). "Honey bees and other edible insects used as human food in Thailand." *American Entomologist* 44(1): 24-29.

A general survey was conducted of the insect-eating habits of the Thai people, especially inhabitants of northern and eastern Thailand. A review of the current status of the nutrition, sociology, marketing and gastronomy of eating insects is presented. About 55 insect taxa are listed. Four recipes for cooking honey bee (*Apis*) larvae and brood comb are given at the end of the paper.

Dien le N, Thang NM, Bentley ME. *Asia Pac J Clin Nutr.* 2004;13(1):40-7.. Food consumption patterns in the economic transition in Vietnam. Nutrition Centre, 180 Le Van Sy street, Phu Nhuan District, Ho Chi Minh City, Vietnam.

This paper investigated Vietnamese food consumption patterns, in terms of food quantity and total energy intake, and examined how these food patterns differ by demography and socio-economic status for the Vietnamese. Data used in this paper were from the Vietnam Living Standards Survey national cross-sectional study in 1997-1998. Descriptive and regression analyses identified different food consumption patterns among 5,999 participating households. Results showed that the traditional diet in Vietnam is high in carbohydrates and low in fat; together with unaccounted eating-out foods, these dietary patterns may contribute to the population's low energy intake. The regression models identified place of residence, family income, household size, education of the head of household, ethnicity, and ecological region to be significantly associated with energy intake. Socio-economic and demographic status must be considered in developing national strategies and implementing plans of action to improve nutrition.

de Pee, S., C. E. West, et al. (1998). "Orange fruit is more effective than are dark-green, leafy vegetables in increasing serum concentrations of retinol and beta-carotene in schoolchildren in Indonesia." *American Journal of Clinical Nutrition* 68(5): 1058-1067.

The objectives of this study were to quantify the effectiveness of dietary retinol sources, orange fruit, and dark-green, leafy vegetables in improving vitamin A status, and to test whether orange fruit is a better source of vitamin A and carotenoids than are leafy vegetables. Anaemic schoolchildren aged 7-11 y (n = 238) in West Java, Indonesia, were randomly allocated to 1 of 4 groups to consume 2 complete meals/d, 6 d/wk, for 9 wk: 1) 556 retinol equivalents (RE)/d from retinol-rich food (n = 48); 2) 509 RE/d from fruit (n = 49); 3) 684 RE/d from dark-green, leafy vegetables and carrots (n = 45); and 4) 44 RE/d from low-retinol, low-carotene food (n = 46). Mean changes in serum retinol concentrations of the retinol-rich, fruit, vegetable, and low-retinol, low-carotene groups were 0.23 (95% CI: 0.18, 0.28), 0.12 (0.06, 0.18), 0.07 (0.03, 0.11), and 0.00 (-0.06, 0.05) micromol/L, respectively. Mean changes in serum beta-carotene concentrations in the vegetable and fruit groups were 0.14 (0.12, 0.17) and 0.52 (0.43, 0.60) micromol/L, respectively. Until now, it has been assumed that 6 microg dietary beta-carotene is equivalent to 1 RE. On the basis of this study, however, the equivalent of 1 RE would be 12 microg beta-carotene (95% CI: 6 microg, 29 microg) for fruit and 26 microg beta-carotene (95% CI: 13 microg, 76 microg) for leafy vegetables and carrots. Thus, the apparent mean vitamin A activity of carotenoids in fruit and in leafy vegetables and carrots was 50% (95% CI: 21%, 100%) and 23% (95% CI: 8%, 46%) of that assumed, respectively. This has important implications for choosing strategies for controlling vitamin A deficiency. Research should be directed toward ways of improving bioavailability and bioconversion

D3.2 Annotated bibliography of food consumption information in the five SEA countries

of dietary carotenoids, focusing on factors such as intestinal parasites, absorption inhibitors, and food matrices.

Egger, R. J., E. H. Hofhuis, et al. (1991). "Food intake and socioeconomic status in children in Northeast Thailand." *Tropical and Geographical Medicine* 43(1/2): 42-50.

To assess the food intake and to evaluate the relation between socioeconomic status (SES) and food consumption to north-eastern Thai children, a dietary survey was carried out among 108 urban and rural 3 to 8-year-olds in Sakon Nakhon province. Energy and nutrient intakes were assessed by the 24 h recall method and calculated with local food consumption tables. Urban children consumed significantly more eggs and products containing animal proteins than rural children. In urban areas the percentage uses of meat, eggs and fruit was significantly higher than in rural areas; fish was consumed more frequently in rural areas. As compared with the FAO/WHO RDA (Recommended Daily Allowances) all children showed a very inadequate supply of energy, calcium, iron (except urban children), vitamin A, thiamine, riboflavin and niacin. The mean daily protein intake was almost equal to or higher than the calculated requirements. Children of lower socioeconomic background showed a lower fat intake, a lower contribution of fat to the energy intake, and a higher contribution of carbohydrates to the energy intake than children from families with a higher SES. Results show that nutrient intakes far below recommended intakes are common among these north-eastern Thai children, and that much more emphasis needs to be given to increase the energy or food intake rather than the protein content of their grossly inadequate diets. *Additional abstract:* To assess the food intake and to evaluate the relationship between socioeconomic status (SES) and food consumption of north-eastern Thai children a dietary survey was carried out among 108 urban and rural children aged 3-8 years in Sakon Nakhon province. Energy and nutrient intakes were assessed by the 24-h recall method and calculated with local food consumption tables. In urban areas the percentage of users of meat, eggs and fruit was significantly higher than in rural areas; fish was consumed more frequently in rural areas. As compared with the FAO/WHO RDA (recommended daily allowances) all children showed an inadequate supply of energy, calcium, iron (except urban children), vitamin A, thiamine, riboflavin, and niacin. The mean daily protein intake was almost equal to or higher than the calculated requirements. Children of lower socioeconomic background showed a lower fat intake, a lower contribution of fat to the energy intake, and a higher contribution of carbohydrates to the energy intake than children from families with a high SES. [This study shows that nutrient intakes far below recommended intakes are common among the examined north-eastern Thai children and that more emphasis needs to be given to increase energy intakes.]

Gross, R., W. Schultink, et al. (1993). "Fish consumption and nutrition in Indonesia: Are fishermen better off?" *Entwicklung-und-laendlicher-Raum (Germany)* 27(3): 13-15.

Fish is a physiologically valuable food source. Two surveys in different Indonesian rural communities showed that fish is the principal animal food source and eaten most frequently in fishermen's households. However, in spite of the high level of fish consumption, the nutritional status of fishermen's children was significantly worse than the nutritional status of children of civil servants or farmers. This situation can be related to insufficient intake of other foodstuffs but also to other factors such as health service usage, high rate of illiteracy, and a poor environmental hygiene situation in fishery households compared to other sectors of the population.

Ha Huy, K. and G. Tu (1995). "Use of food intake and body mass index (BMI) in the assessment of adult nutritional status in Viet Nam including a maternal-child analysis." *Asia Pacific Journal of Clinical Nutrition* 4(2): 220-224.

Chronic energy deficiency (CED) is prevalent in Vietnamese adults with an average percentage of about 40%. Food intake and body mass index (BMI) measurements were used to assess Vietnamese adult nutritional status. During 1981-1985, wt. and heights of 12 800 adults were recorded in different age groups and regions of Vietnam. During 1987-1989, a second study of 12 789 households (urban, rural, mountainous) recorded household food consumption during 3 consecutive days. No significant differences in total calorific intake between regions were found. Percentage of lipid energy and animal protein to total protein was higher in urban populations. Rice was the main cereal of the diet; intake of other cereals, tubers, beans and nuts rich in lipid was low. Intake of meat, fish, eggs and fat was higher in urban areas. Mean value of BMI in the 26-40 yr age group was 19.7 kg/m² and decreased thereafter with increasing age, except in urban areas. The change in the BMI curve distribution varied among adults living in rural, urban and mountainous areas. There seemed to be a relationship between the BMI of mothers and the nutritional status of their children <5 yr. Some findings

D3.2 Annotated bibliography of food consumption information in the five SEA countries

revealed a relationship between maternal BMI and birth wt. and between CED and health status. The proposed cut-off point of Ferro-Luzzi-James in the classification of CED was applied to data from Vietnam. [From En summ.]

Hartini, T. N., A. Winkvist, et al. (2003). "Food patterns during an economic crisis among pregnant women in Purworejo District, Central Java, Indonesia." *Food & Nutrition Bulletin* 24(3): 256-267.

A cross-sectional study was conducted between 1996 and 1998. Six 24-hour recalls were performed during the second trimester of pregnancy among 450 women in Purworejo District, Central Java, Indonesia. The objectives of the study were to assess the food intake and food pattern among pregnant women before and during the economic crisis. Before the crisis, rich women had the highest intakes of animal foods, fats and oils, and sugar. Food intake among the urban poor and the rural landless poor subgroups was influenced by the emerging economic crisis. Although the price of rice increased, the intake of rice also increased among all subgroups. Rural poor women with access to rice fields increased their intake of rice and decreased their intake of non-rice staple foods ($p < .05$). There were significant decreases in the consumption of chicken by rich women and rural poor women with access to rice fields ($p < .05$). Rice was a strongly inferior good and remained an important supplier of energy, protein, and carbohydrate. Nuts and pulses were important suppliers of calcium and iron, and vegetables were an important supplier of vitamin A. Rich women increased their intake of nuts and pulses, vegetables, fats and oils, and sugar when their intake of rice increased ($p < .05$). The food patterns were based on rice, nuts and pulses, and vegetables, i.e., plant food. All but the rich women decreased their intake of nutritious foods such as meat, chicken, and fruits. The intake of nuts and pulses and of vegetables increased, whereas the intake of cooking oil and sugar remained constant.

Huong Thi, L., I. D. Brouwer, et al. (2007). "Suitability of instant noodles for iron fortification to combat iron-deficiency anaemia among primary schoolchildren in rural Vietnam." *Food and Nutrition Bulletin* 28(3): 291-298.

Anaemia is a significant public health problem among schoolchildren in Vietnam. Food fortification is considered one of the most sustainable long-term strategies to control Fe-deficiency anaemia in Vietnam. The success of a food-fortification programme depends on the choice of the food vehicle. The aim of this study was to identify an appropriate vehicle for Fe fortification to be used in a school-feeding programme aimed at improving the Fe and anaemia status of schoolchildren in rural Vietnam. Children aged 6-8 yr in 2 primary schools in Tam Nong District, Phu Tho Province, and their parents were included in this study. The study consisted of 3 sub studies: a food-consumption study with 24-h recalls of 2 non consecutive days; a food beliefs study, with focus group discussions, a pile-sorting test, and a food attributes and differences exercise; and a food-acceptance study using noodles and biscuits fortified with NaFeEDTA. Results showed that the average number of meals consumed daily was 3.2 \pm 0.4, and the average intakes of energy and Fe were 1218 \pm 406 kcal and 7.5 \pm 4.0 mg, respectively. Compared with biscuits and instant rice soup, instant noodles were consumed more frequently and in larger portion sizes and are more acceptable as children's food in the culture of the local people. The Fe level of the fortified product did not affect the mean consumption of noodles, but a higher level of Fe was associated with a lower mean consumption of biscuits ($P < 0.05$). The production process did not affect the NaFeEDTA level in noodles; however, during preparation at least 70% of the Fe is leaked into the soup. It is suggested that instant noodles are a suitable vehicle for Fe fortification for use in school-based intervention to improve Fe-deficiency anaemia among primary schoolchildren in rural Vietnam.

Jackson, DA, Imong, SM, Wongsawadji, L, Silprasert, A, Preunglampoo, S, Leelapat, P, Drewett, RF, Amatayakul, K and Baum, JD (1992). Weaning practices and breast-feeding duration in Northern Thailand. *Brit J Nutr* 61:149-164.

Current infant feeding guidelines recommend exclusive breast-feeding until the infant is about 4 months old to reduce the risks of early termination of breast-feeding, undernutrition and infection. In many societies, however, supplementary foods are given well before 4 months of age. The present paper describes weaning practices, factors associated with early supplementation and the effects of supplementation on duration of breast-feeding in a random sample of sixty northern Thai breast-fed infants studied prospectively from birth to 2 years of age. Composition of supplementary foods, energy and protein intake from supplements and changes in the supplementary diet with increasing infant age are also described. Rice-based foods were given from soon after birth; 81% of the sample had received

D3.2 Annotated bibliography of food consumption information in the five SEA countries

supplements by 6 weeks of age. Early supplementary feeding was significantly associated with rural residence, large household size, maternal employment in agriculture and maternal age. Girls and infants with lower birth weights tended to be supplemented earlier. Despite early feeding of supplements, breastfeeding was prolonged, with median duration of 12 months. Early introduction of supplements and quantity of supplements consumed in the first 3 months were not associated with duration of breastfeeding. However, mothers who gave infant formula as the first supplementary food stopped breastfeeding slightly earlier, as did younger mothers living in households with more children.

Jirapinyo, P, Narumon Densupsoontorn, N, Wiraboonchai, D, Vissavavejam, U, Tangtrakulvachira, T, Chungsomprasong, P, Thamonsiri, N and Wongarn, R (2008). Fatty Acid Composition in Breast Milk from 4 Regions of Thailand. *J Med Assoc Thai* 91 (12): 1833-8.

Background: DHA contents in breast milk varied upon maternal dietary intakes. *Objective:* To study DHA contents in breast milk in Thai lactating women from four different regions of Thailand. *Material and Method:* 20 mL of hind milk from 40 lactating women from Bangkok, Chantaburi, Tak, and Surin were collected and analyzed for fatty acids contents by gas chromatography. Dietary intake of lactating women after delivery until the present study was assessed by a food frequency questionnaire. Then, the average DHA intake was estimated from the diets by using the reference data. *Results:* DHA contents in breast milk of mothers from Surin were higher than those from other areas. There were no correlations between history of DHA intake and DHA contents in breast milk. *Conclusion:* DHA contents in breast milk vary from region to region of the country. Local dietary intake and genetics might explain this contrast.

Jensen, R. and D. M. Peppard, Jr. (2007). "Food-buying habits in Hanoi." *SOJOURN: Journal of Social Issues in Southeast Asia* 22(2): 230-254.

One common but increasingly threatened source of fresh fruits and vegetables in Hanoi is roving street vendors. These vendors are mostly rural women who come to work in Hanoi's informal sector because agricultural income alone is insufficient. As Vietnam continues the transition from a planned to a market-oriented economy, the availability of other more modern sources of food and government policy to eliminate their presence on the streets pose a threat to the informal sector incomes of these women. We analyse these threats using the results of a survey of food-buying customers about various ways and places to buy food in Hanoi.

Kajadphai-Taungbodhitham, A. (2007). "Composition of ready cooked foods sampled in southern Thailand." *Asia Pacific Journal of Clinical Nutrition* 16(supp 1): 52-57.

This study investigated the nutrient composition of ready cooked foods commonly consumed in southern Thailand. Four samples of fourteen types; eight curry dishes, one sweet and sour curry, a soup dish, one stir-fried curry, one stir-fried dish and two single plate dishes were each purchased from 4 different shops around Hat Yai district. The edible part was blended and analysed for its nutrients content per 100 g edible portion. Cassia curry, Thai noodle salad, Ark shell curry and Fermented fish gut dish were a good source of vitamin B₁ (145 micro g), vitamin C (2.20 mg), calcium (0.23 g) and iron (6.07 mg), respectively. Moisture, ash, fat, protein and carbohydrate were high in Mung bean noodle soup (92.6 g), Fermented fish gut dish (4.1 g), Cassia curry (9.9 g), Stingray stir-fried curry (16.7 g) and Thai noodle salad (24.2 g). Results also showed that the main ingredients and cooking process determined the nutritional values of the foods. A new set of 4 samples of Round noodle in southern curry was purchased, each separated into its edible components and nutrient values estimated using the Thai single ingredient databases. Their nutrient content was also calculated using the data of similar food obtained from this study. Considerable differences amongst the values from the 2 sets of calculation were observed. Problems inherent in using the single ingredient databases were highlighted. This work demonstrates a need to create a food composition database of whole cooked meals ready for serving that reflects real life consumption.

Kardjati, S., J. A. Kusin, et al. (1983). "Food consumption of rural women in East Java, Indonesia." *Nutrition Reports International* 28(6): 1341-1349.

Extract: Foods eaten by mothers during 1 day were weighed during surveys conducted in rural areas of East Java. The sample consisted of 474 non-pregnant, non-lactating mothers, 515 lactating mothers and 119

D3.2 Annotated bibliography of food consumption information in the five SEA countries

pregnant mothers. Energy and nutrient intakes were very low and of the same range in the 3 subgroups of mothers, indicating that mothers do not eat more when requirements increase. Contrary to expectation habitual intakes were better in Madura with a low agricultural potential as compared with the fertile regency Sidoarjo. However, weight-for-height of mothers in Sidoarjo is comparable with that in Madura.

Kazuo Tomisaka, Jimaima Lako, Chizuko Maruyama, Nguyen Thi Lan Anh, Do Thi Kim Lien, Ha Huy Khoi, Nguyen Van Chuyen. Dietary patterns and risk factors for Type 2 diabetes mellitus in Fijian, Japanese and Vietnamese populations. *Asia Pacific J Clin Nutr* (2002) 11(1): 8-12

Diabetes mellitus is now a serious and increasing problem in Asian countries, where dietary patterns have shifted toward Westernized foods and people are becoming more sedentary. In order to elucidate the relationship of dietary habits to the development of diabetic risk factors, the dietary patterns of 200 Fijian, 171 Japanese and 181 Vietnamese women of 30-39 years of age were investigated using 3 day-24 h recall or dietary records. Anthropometric measurements and glycosuria tests were also conducted. The dietary trends of Fijians and Japanese have changed drastically in the past 50 years, while Vietnamese have been minimally influenced by Western dietary habits. The mean 24 h dietary intake showed that Fijians had the highest energy intake. Energy intake from fat was only 13% for Vietnamese, but over 30% for Japanese and Fijians. Percentage of body fat was higher in Vietnamese than in Japanese, though there were no significant differences in body mass index (BMI). In the overweight and obese women, Vietnamese had higher abdominal obesity than Japanese. The prevalence of obesity (BMI > or = 30 kg/m²) was 63.0% for Fijians, 1.8% for Japanese and 1.1% for Vietnamese. Glycosuria testing yielded the most positive cases among Fijians. Dietary transition and dietary excess appear to be potential risk factors for diabetes in Fijian women

Khan NC, Tue HH, Mai le B, Vinh le G, Khoi HH. Secular trends in growth and nutritional status of Vietnamese adults in rural Red River delta after 30 years (1976-2006). *Asia Pac J Clin Nutr*. 2010;19(3):412-6.

In order to assess secular trends in growth of the Vietnamese population following a period of rapid economic growth, a follow-up study on physical growth and nutritional status of adults was carried out in a rural section of the Red River delta, Vietnam 30 years after the original study. The initial study in 1976 found that average height and weight of Vietnamese adults was similar to data collected by French experts Huard and Bigot in 1938. Hence, no noticeable secular trends were observed in almost 40 years. However, the 2006 follow-up study revealed a positive secular trend in growth of adults, aged 16-60 years. The average increased rate in height of males was up to 1.1 cm/decade in the age group 26-40 years and up to 2.7 cm/decade in the age group 16-25 years. Nutritional status, as indicated by body mass index, increased in both sexes and in all age groups between 1976 and 2006. In 2006, average dietary intake of fat and animal protein was higher than that found in 1976. The percentage of energy from fat in the diet increased from 6% in 1976 to 16% in 2006. This study shows that Vietnam is entering the nutrition transition period.

Klunklin, S. and K. Channoongmuang (2006). "Snack consumption in normal and undernourished preschool children in north-eastern Thailand." *Journal of the Medical Association of Thailand* 89(5): 706-713.

Objective: A cross-sectional study was conducted in a rural area of the north-eastern region in Thailand. The study aimed to investigate factors influencing nutritional status and to explore the pattern of snack consumption. *Material and methods:* Subjects were 85 normal and 85 undernourished pre-school children with ages ranging from 2-6 years old. The authors collected demographic data including socio-economic status and family background by using an interview administered questionnaire. A 5-day food record was used to evaluate nutritional intake. *Results:* The results indicated that children in both groups preferred crispy snacks between breakfast and lunch. Energy, protein, fat, carbohydrate, calcium and sodium intake derived from snacks and overall intake were significantly lower in undernourished children than those in normal children (p-value < 0.01). The results indicated that energy intake in pre-school malnourished children (2-3 years) as percentage of recommended daily allowance was lower than the recommended level. High sodium intake was observed in the presented study children and the results supported the observation that snack foods contribute to excessive sodium intake. *Conclusions:* The present results have highlighted the impact of snack consumption. Programmes aimed at increasing nutritional knowledge and information for parents and guardians are important. Furthermore, promotion of nutritious snack consumption among children is important.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Kosulwat, V. (2002). "The nutrition and health transition in Thailand." *Public health nutrition* 5(1A): 183-189.

Objective: To explore and describe the nutrition and health transition in Thailand in relation to social and economic changes, shifts in food consumption patterns and nutritional problems, as well as morbidity and mortality trends. *Design:* This report reviews the nutrition and health situation and other related issues by compiling information from various reports and publications from several sources. Yearly statistics and reports from the National Statistical Office were used as well as data from the Food and Agriculture Organization (FAO) and national surveys on the nutrition and health situation of the Thai population. *Results:* Thailand has undergone social and economic transitions during the past three decades and is approaching the post-demographic transitional period. These are evidenced by an increase in life expectancy at birth of the population, and declines in the total fertility and infant mortality rates. The economic structure has also moved from agricultural to industrial. Industrial growth has surpassed that of the agricultural sector as indicated by a steady rise in the share of the industrial sector in the gross domestic product, which is greater than that of other sectors. At the same time, results from several nation-wide surveys indicate that the food consumption pattern of the population has changed considerably; Thai staples and side dishes are being replaced by diets containing a higher proportion of fats and animal meat. A shift in the proportion of expenditure on food prepared at home and that expended on purchased, ready-to-eat food, in both rural and urban settings, gives another reflection of the change in food consumption of the Thai population. The prevalence of overweight and obesity among children and adolescents has increased dramatically during the past 20 years and is more pronounced in children from private schools and urban communities than in those from public schools or rural areas. Among adults, results from two national surveys in 1991 and 1996 indicated that the problem of overweight and other risk factors for cardiovascular disease have increased significantly. In considering the overall causes of death among the Thai population, the leading causes are diet-related chronic degenerative diseases. Diseases of the circulatory system have become the number one cause of death in Thailand and cancer has ranked as the number three cause of death since the late 1980s. *Conclusions:* The rapid changes in food intake and lifestyle patterns in Thailand clearly demonstrate a significant impact on the shifting pattern of disease burden of the population. These changes should be monitored carefully and must be reversed through appropriate behaviour modification and the promotion of appropriate eating practices and physical activities. [References: 34]

Kuhnlein, H. V., B. Erasmus, et al. (2009). *Indigenous peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health*, Cent. for Indigenous Peoples' Nutr. & Environment (CINE), McGill Univ., Ste. Anne de Bellevue, Que., Canada. Fax (1) 514 398 1020. E-mail harriet.kuhnlein@mcgill.ca.

This book on the food systems of Indigenous People seeks to define and describe the diversity in food system use, nutrition and health in 12 rural case studies of Indigenous Peoples in different parts of the world. Following an introductory section (Why are Indigenous Peoples' food systems important and why do they need documentation?), the book is organized into 12 chapters which present each of the individual case studies in turn. Individual chapters are as follows: Back to the future - using traditional food and knowledge to promote a healthy future among Inuit (pp. 9-22); The Nuxalk food and nutrition program, Coastal British Columbia, Canada - 1981-2006 (pp. 23-44); Gwich'in traditional food for health - Phase 1 (pp. 45-58); Traditional food system of an Awajun community in Peru (pp. 59-81); Ingano traditional food and health - Phase 1, 2004-2005 (pp. 83-108); Documentation of the traditional food system of Pohnpei (pp. 109-138); Traditional food systems of Indigenous Peoples - the Ainu in the Saru River Region, Japan (pp. 139-157); Thailand - food system and nutritional status of indigenous children in a Karen community (pp. 159-183); Traditional food system of Dalit in Zaheerabad Region, Medak District, Andhra Pradesh, India (pp. 185-208); The Bhil food system - links to food security, nutrition and health (pp. 209-229); The Maasai food system and food and nutrition security (pp. 231-249); and The Igbo traditional food system documented in four states in Southern Nigeria (pp. pp. 251-281). A 15-pp. species index, which lists Indigenous Peoples' food systems species by scientific name, and a 15-pp. subject index are also included, together with a 36-pp. photographic section that includes a selection of photographs representing each of the groups studied.

Kusama, K., D. S. Nguyen Trung Le, et al. (2005). "Reproducibility and Validity of a Food Frequency Questionnaire among Vietnamese in Ho Chi Minh City." *Journal of the American College of Nutrition* 24(6): 466-473.

Objective: Our objective was to assess the reproducibility and validity of a food frequency questionnaire (FFQ)

D3.2 Annotated bibliography of food consumption information in the five SEA countries

among individuals living in Ho Chi Minh City, Vietnam. *Methods*: A total of 116 food items in our FFQ were selected by ranking food items according to their contribution to the population intake of nutrients, based on multiple 24-hour recalls (24HRs) from 144 participants in July 2001. The FFQ was validated by using three 24HRs for 118 men and women in Ho Chi Minh City, Vietnam in August 2002. The reproducibility of the FFQ was assessed by repeated administration at 7 +/- 3.4 days. *Results*: The reproducibility study showed that Spearman correlation coefficients, adjusted for energy intake, ranged from 0.47 to 0.72, and that weighted kappa values ranged from 0.42 for lipid to 0.65 for potassium. In the validation study, correlation coefficients, adjusted for energy intake, between the FFQ and the 24HRs ranged from 0.16 (calcium) to 0.45 (retinol). The proportion of subjects classified by the FFQ into the same third as determined by the 24HRs was between 42% and 62%. *Conclusions*: This food frequency questionnaire measured the usual intake of major nutrients for Vietnamese adults living in Ho Chi Minh City and its urban area, where dietary patterns are similar to those of the Vietnamese population.

Kusin, J. A., S. Kardjati, et al. (1984). "Measured food intake and nutritional status of pre-school children in rural East Java, Indonesia." *Nutrition Reports International* 30(3): 651-660.

Extract: Food intakes of children, ages 0-5 years and their nutritional status were measured in rural areas of East Java. Breastfeeding is still the rule, but complementary foods are introduced from as early as the first month. There is a close relationship between energy and nutrient intake of mothers and children, indicating that low food availability is one of the causal factors of low consumption. However, feeding habits were such that children were not always given part of the side dishes. Moreover, breastfed toddlers received less food than the non-breastfed age-mates. From a nutritional point of view, growth faltering from the third month and the high percentage of wasting at age 0-3 years are mainly due to the inadequacy of weaning foods, both in quantity and in quality.

Kusin, J. A., H. S. Parlindungan Sinaga, et al. (1981). "The preschool child in Suka Village, North Sumatera. I. Feeding practices and measured food intake." *Paediatrica Indonesiana* 21(7-8): 147-160.

The primary objective of a prospective study conducted over the July 1976-August 1977 period, as part of the joint project of the University of North Sumatra, Medan and the University of Amsterdam, was to determine the duration of prevention against hypo-vitaminosis A by 1 oral dose of 300,000 IU vitamin A. At 3-month intervals children were examined critically, fresh stool specimens were analysed on the presence of parasite ova and protozoa, blood specimens were collected for analysis of protein and vitamin A status. Anthropometric measurements were scheduled at monthly (weight, height) and 6 monthly intervals (upper arm circumference and skinfolds). A dietary history was taken at the start of the study. Food consumption was measured separately. In this discussion only the dietary aspects of the study were reported. Families with children age 0-5 years in Suka Village, North Sumatra, were included in the prospective study. Child feeding practices were recorded by interview (dietary history and 24 hour recall method for types of food eaten) and by observation during home visits. For the 1st period 59 children, age 1-4 years, were chosen at random from the total number of children in the respective age group. In the 2nd period in 39 of the same children and in 13 of their older siblings food weighing was repeated. As in most rural areas in Indonesia infants were put to the breast after birth and breastfeeding was continued for about 2 years. After the 1st year the percentage of children breastfed dropped gradually. Exclusive breastfeeding was practiced by most mothers during the 1st 5 months. Few mothers supplemented her own milk with fresh cow's milk or milk formula. The 1st supplementary food given to the infant was almost exclusively rice in different consistencies. After 1 year of age fish was introduced. At age 2 children were given part of the family diet composed of rice, fish, and some vegetables mainly of the non-leafy type. In 2 seasons food consumption of the 59 children was weighed. The habitual diet was somewhat low in energy (65-98% of RDI), ample in protein (108-158% of RDI) but inadequate in calcium (36-86% of RDI), iron (44-48% of RDI), retinol equivalents (26-44% of RDI) and riboflavin (34-41% of RDI). The inadequacy of the diet was primarily due to improper use of available foods, cultural habits, and mother's permissiveness towards the child. In this village nutrition and health education along with improved child care can make a contribution to the diversification and improvement of the preschool child's diet.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Lamxay V, de Boer HJ, Björk L. Traditions and plant use during pregnancy, childbirth and postpartum recovery by the Kry ethnic group in Lao PDR. Department of Systematic Biology, Evolutionary Biology Centre, Uppsala University, Uppsala, Sweden.

Background: Activities and diet during the postpartum period are culturally dictated in many Southeast Asian cultures, and a period of confinement is observed. Plants play an important role in recovery during the postpartum period in diet and traditional medicine. Little is known of the Kry, a small ethnic group whose language was recently described, concerning its traditions and use of plants during pregnancy, parturition, postpartum recovery and infant healthcare. This research aims to study those traditions and identify medicinal plant use. *Methods:* Data were collected in the 3 different Kry villages in Khammouane province, Lao PDR, through group and individual interviews with women by female interviewers. *Results:* A total of 49 different plant species are used in women's healthcare. Plant use is culturally different from the neighboring Brou and Saek ethnic groups. Menstruation, delivery and postpartum recovery take place in separate, purpose-built, huts and a complex system of spatial restrictions is observed. *Conclusions:* Traditions surrounding childbirth are diverse and have been strictly observed, but are undergoing a shift towards those from neighboring ethnic groups, the Brou and Saek. Medicinal plant use to facilitate childbirth, alleviate menstruation problems, assist recovery after miscarriage, mitigate postpartum haemorrhage, aid postpartum recovery, and for use in infant care, is more common than previously reported (49 species instead of 14). The wealth of novel insights into plant use and preparation will help to understand culturally important practices such as traditional delivery, spatial taboos, confinement and dietary restrictions, and their potential in modern healthcare.

Le Thi Hop, Le Bach Mai & Nguyen Cong Khan. The National Institute of Nutrition, Hanoi, Vietnam. Trends in Food Production and Food Consumption in Vietnam during the Period 1980-2000. Malaysian journal of nutrition. March 2003, Volume 9 No. 1

During the last ten years much attention has been paid to improving the health and nutritional status of the Vietnamese people. In 1995, the Government of Vietnam ratified the National Plan of Action for Nutrition (NPAN) for the period 1995-2000. Poverty reduction was one of the basic social policies given special attention. Several programs have been implemented in Vietnam by different sectors and ministries in an attempt to improve food intake and the nutritional status of the people. The implementation of the first NPAN (1995-2000) and other intervention programs to improve food production and consumption in Vietnam during the last decade have been successful. Trends showing improvement in the production of main foods during the last decade have been observed. The populations dietary intake has clearly improved in terms of both quality and quantity with the consumption of foods such as meats, fish, fat oils, and ripe fruits being much higher compared to 1987. The prevalence of child malnutrition during the last decade shows a marked decrease.

Le Thi, H. (2003). "Programs to improve production and consumption of animal source foods and malnutrition in Vietnam." Journal of Nutrition 133(11S-II): 4006S-4009S.

The objective of this paper is to review programs to improve production of animal source foods in Vietnam, emphasizing the VAC ecosystem and trends in undernutrition during past decades. The food consumption surveys of the Vietnamese population in 1985 showed that food intake was inadequate, especially animal protein. Most protein came from rice; the consumption of meats, beans and fish was negligible. During the last 10 y, much attention was paid to improving the health and nutritional status of the Vietnamese people. Many programs were implemented in Vietnam to improve the food intake and nutritional status of the people, and especially the intake of animal source foods. The VAC system is a traditional type of farming for Vietnamese people. The aim of VAC is to provide diversified agricultural products to meet the complex nutritional demands of man. Based on the scientific fundamentals of VAC, many different models of VAC have been developed at a national level. The intervention programs to improve production and consumption of animal source foods, and the VAC ecosystem in Vietnam during the last decade have been successful. The population's dietary intakes have clearly improved in terms of both quality and quantity. The consumption of staple foods in 2000, including meats, fish, fats and oils, and ripe fruits was much higher compared to 1987. The prevalence of undernutrition in children <5 y old, and of chronic energy deficiency (CED) in women of reproductive age, has been remarkably reduced.

Lipoeto, N. I., Mmedsci, et al. (2001). "Contemporary Minangkabau food culture in West Sumatra, Indonesia." Asia

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Pacific Journal of Clinical Nutrition 10(1): 10-16.

Diet has a strong relationship with food culture and changes in it are likely to be involved in the pathogenesis of newly emergent degenerative diseases. To obtain in-depth opinions about the food culture of Minangkabau people, focus group discussions were conducted in a Minangkabau region, represented by four villages in West Sumatra, Indonesia, from January to March 1999. The members of the discussion groups were principally women aged from 35 to 82 years old. Minangkabau culture is matriarchal and matrilineal which accounts for female gender dominants in the discussions. Rice, fish, coconut and chilli are the basic ingredients of the Minangkabau meals. Meat, especially beef and chicken, is mainly prepared for special occasions; pork is not halal and therefore not eaten by Muslim Minangkabau people; and for reasons of taste preference and availability, lamb, goat and wild game are rarely eaten. However, rendang, a popular meat dish, has been identified as one of the Minangkabau food culture characteristic dishes. Vegetables are consumed daily. Fruit is mainly seasonal, although certain kinds of fruit, such as banana, papaya and citrus, can be found all year around. Coconut has an important role in Minangkabau food culture and is the main source of dietary fat. While almost all food items consumed by the Minangkabau can be cooked with coconut milk, fried food with coconut oil is considered to be a daily basic food. Desiccated coconut is also used as a food ingredient on about a weekly basis and in snack foods almost every day. Although there have been no changes in food preparation and there is a slight difference in taste preference between the young and the old generations, there has been a dramatic shift in food preferences, which is reflected in the changing percentage of energy consumed over the past 15 years. The traditional combination of rice, fish and coconut in Minangkabau culture goes back hundreds of years, long before the emergence of the degenerative diseases of the newer economies, and is likely to offer food security and health protection to the Minangkabau for as long as the lifestyle remains traditional. Whether or not a recent increase in energy intake from fat and the quality of fat may contribute to the shift of disease pattern is fundamentally important for the Minangkabau, it seems unlikely the traditional use of coconut and its products was a health issue. Moreover, it was clear from the focus group discussions that the use of coconut encouraged the consumption of fish and vegetables.

Matsuda-Inoguchi, N., S. Shimbo, et al. (2000). "Nutrient intake of working women in Bangkok, Thailand, as studied by total food duplicate method." *European journal of clinical nutrition* 54(3): 187-194.

52 non-smoking and non-habitually drinking adult women in Bangkok participated in the study. The participants offered 24 h food duplicates and peripheral blood samples, and underwent clinical examination including anthropometry. The duplicates were subjected to nutritional evaluation taking advantage of the Thai food composition tables (FCTs), and analysed for eight nutrient elements by inductively coupled plasma mass spectrometry (ICP-MS). The participants took 1630 kcal from 55 g protein (63% from animal sources), 57 g lipid (mostly from vegetable oil), and 224 g carbohydrate (60% from rice) daily. Nutrient intake at lunch was as large as that at dinner. About a half of the women had insufficient energy intake (i.e. <80% RDA) whereas 4% had an excess (>120%). Protein intake was sufficient in most cases, whereas lipid intake was in excess in more than a half of the women, Ca, Fe, Mg, Zn and possibly P intakes were below the RDA values in many participants. FCT-based estimates agreed well with the ICP-MS measures in cases of Fe and Ca but tended to be greater than the measures by 50% with regard to P. Lunch as substantial as dinner for Thai urbanites. There was a marked dependency on rice as an energy source. Whereas protein intake is generally sufficient, the intake of Ca (and to a lesser extent Fe) was insufficient in a majority of the study participants.

Nititham, S., S. Srianjata, et al. (1999). "Dietary intake of phytate, zinc and calcium of self-selected diets of Ubon Ratchathani and Bangkok subjects, Thailand." *Journal of the Medical Association of Thailand* 82(9): 855-861.

The dietary intakes of phytate, zinc and calcium of volunteers in Ubon Ratchathani (northeast Thailand) and Bangkok metropolitan were studied. The selected subjects were 10 men and 10 women from each area. The daily diets were collected for 5 consecutive days using duplicate portion technique. The diets were blended, aliquoted, mixed, freeze-dried and homogenized. Phytate was analysed by using ion exchange coupled with colorimetric method. Zinc and calcium were analysed by atomic absorption spectrophotometer. The total intakes of phytate were 1104.8 +/- 965.2 and 1139.3 +/- 481.1 mg/day for males and females in Ubon Ratchathani, 1304.7 +/- 956.2 and 997.1 +/- 435.1 mg/day for males and females in Bangkok. The zinc intakes were 20.0 +/- 8.8, 12.7 +/- 4.6, 7.7 +/- 1.8 and 6.1 +/- 1.2 mg/day for males and females in Ubon Ratchathani and for males and females in Bangkok, respectively. The calcium intakes were 524.6 +/- 259.9, 379.9 +/- 111.4

D3.2 Annotated bibliography of food consumption information in the five SEA countries

for males and females in Ubon Ratchathani and 366.5 +/- 150.5, 286.7 +/- 68.7 mg/day for males and females in Bangkok. The calculated phytate/zinc molar ratios were 7.5, 3.9 for males and females in Ubon Ratchathani and 16.2 and 17.5 for males and females in Bangkok. This study indicated that subjects from Bangkok have a phytate/zinc ratio higher than those in Ubon Ratchathani and higher than 12. This may affect the availability of some micronutrients such as zinc, calcium and iron. The daily intakes of zinc and calcium in these two groups were low compared to Thai RDA.

Nguyen Cong Khan, Mai LB, Minh ND, Do TT, Ha Huy Khoi, West CE, Hautvast JG. Intakes of retinol and carotenoids and its determining factors in the Red River Delta population of northern Vietnam. *Eur J Clin Nutr.* 2008 Jun;62:810-6.

Objective: To describe the household intakes of retinol and carotenoids and social economic factors determining their intakes. *SUBJECTS:* Data on a total of 1001 households (771 in rural areas and 230 in urban areas) were used in the analyses. Interviewed person was household food preparer. *Results:* Mean (s.d.) intake of carotenoids was 4178 (3154) microg/capita/day in rural and 4208 (3408) microg/capita/day in urban areas and intake of retinol was 101 (275) microg/capita/day in rural and 201 (470) microg/capita/day in urban areas. Multivariate analyses show that the subjects in households with four or more members consume about 700 microg carotenoids less compared to households with less than three members. Households with a higher expenditure (fourth quartile) consumed about 100 microg retinol/day more than those with a lower expenditure (first quartile). *Conclusion:* Carotenoids from plant food sources is the main source of vitamin A intake of the population and its main determinants are household expenditure and size of household. Food fortification and dietary diversification with special emphasis on promotion of consumption of animal foods should be key strategies for overcoming vitamin A deficiency in Vietnam.

Nguyen Cong Khan, Pham Van Hoan. Vietnam recommended dietary allowances 2007. *Asia Pac J Clin Nutr.* 2008;17 Suppl 2:409-15.

It has been well acknowledged that Vietnam is undergoing a nutrition transition. With a rapid change in the country's reform and economic growth, food supply at the macronutrient level has improved. Changes of the Vietnamese diet include significantly more foods of animal origin, and an increase of fat/oils, and ripe fruits. Consequently, nutritional problems in Vietnam now include not only malnutrition but also overweight/obesity, metabolic syndrome and other chronic diseases related to nutrition and lifestyles. The recognition of these shifts, which is also associated with morbidity and mortality, was a major factor in the need to review and update the Recommended Dietary Allowances (RDA) for the Vietnamese population. This revised RDA established an important science-based tool for evaluation of nutrition adequacy, for teaching, and for scientific communications within Vietnam. It is expected that the 2007 Vietnam RDA and its conversion to food-based dietary guidelines will facilitate education to the public, as well as the policy implementation of programs for prevention of non-communicable chronic diseases and addressing the double burden of both under and over nutrition.

Nutrition Bureau, Department of Health, Ministry of Public Health (2010). Magnesium and zinc in Thai foods. <http://nutrition.anamai.moph.go.th/temp/main/view.php?group=3&id=67>.

Zinc and magnesium are important essential minerals in human health. The role of them involved in metabolic processes such as cofactor of many enzymes, protein synthesis, RNA and DNA synthesis. Their deficiency have been associated with several chronic diseases including cardiovascular disease, diabetes mellitus etc. Furthermore, zinc and magnesium are related to insulin resistance which is caused in metabolic syndrome. In this study, we determined zinc and magnesium content in 30 foods from 5 different groups (vegetable, fish, meat, dairy and dairy products, legume). The result showed that the highest of zinc and magnesium contents are goat meat and soy bean (4.57 and 219.65 mg/ 100g, respectively). However, legume was good source of zinc and magnesium because it has high content of these elements.

Ogle, B. M., D. Ha Thi Anh, et al. (2001). "Micronutrient composition and nutritional importance of gathered vegetables in Vietnam." *International Journal of Food Sciences and Nutrition* 52(6): 485-499.

This article presents the nutrient composition and nutritional contribution of naturally occurring vegetables (NOV) in 4 villages in Vietnam. The frequency of consumption and quantities eaten were evaluated within the

D3.2 Annotated bibliography of food consumption information in the five SEA countries

overall diet of 101 (during flood period) and 110 (during rainy season) women in the Mekong Delta and of 103 women in the Central Highlands (rainy season). The concentrations of Ca, Fe and Zn were analysed in 28 species, and presence of tannins and phytic acid in 19 species. Pro-vitamin carotenoids were determined in 11 species. Over 90% of the women consumed NOV, and they contributed 43, 72 and 75% (Central Highlands, Mekong rainy and Mekong flood period, respectively) of the total quantities of vegetables eaten. Aquatic species such as *Pometia aquatica* and *Limnocharis flava*, and terrestrial vegetables such as *Schismatoglottis calyptrata*, were among the most commonly consumed vegetables. They were eaten in mean daily quantities exceeding 50 g and had high concentrations of Ca, Fe and beta-carotene. Other major aquatic vegetables included the stems of *Eleocharis* sp., *Nelumbo nucifera* and *Nymphaea lotus*, all of which were used as salad vegetables and had relatively low nutrient density. The problems of assessing the current role of NOV due to lack of data on intakes in the context of the overall diets, as well as data on their composition, are addressed.

Ogle, B. M., M. Johansson, et al. (2001). "Evaluation of the significance of dietary folate from wild vegetables in Vietnam." *Asia Pacific Journal of Clinical Nutrition* 10(3): 216-221.

Data on the overall dietary folate intakes among high-risk groups in poor countries is very limited. Vegetables are considered good sources but the evaluation of their contribution is hampered by the lack of data on folate concentrations in many traditional foods. Data on the analysis of folate concentrations in 16 wild vegetables used in the Mekong Delta and the Central Highlands in Vietnam and an evaluation of the relative importance of different foods in folate intakes of women is presented. Vegetable samples were collected in four study villages, blanched and frozen samples were transported to Sweden for analysis. Freeze-dried samples were analysed for total folate quantification using a commercial radio protein binding assay. Daily folate intakes among women were estimated from 7-day food frequency interviews with 213 women. The folate concentration in the vegetable samples ranged from 10 to 96 micro g/100 g. The mean estimated daily folate intake among the 213 women in the study areas was 251 micro g. Vegetables contributed approximately one-third of the daily folate intake, of which 72% and 42%, respectively, in the two regions was from wild vegetables. A majority of the women (87%) got some dietary folate from wild vegetables and nearly one-third had mean daily folate intakes of > 50 micro g from such hidden food sources. The evaluation of dietary folate is complicated by data gaps in food composition tables, the unreliability of existing food data, variations between methods used for folate analysis and limited understanding of the bioavailability of food folate.

Ogle, B. M., D. Nguyen Nhut Xuan, et al. (2001). "The contribution of wild vegetables to micronutrient intakes among women: an example from the Mekong Delta, Vietnam." *Ecology of Food and Nutrition* 40(2): 159-184.

No previous dietary intake study in Vietnam has focused on contemporary use of wild vegetables (Rau dai). In this study the contribution of such gathered vegetables to micronutrient intake of women was investigated in two villages in the Mekong Delta, Vietnam. Dietary assessments (24-h recall and repeated 7-day FFQ) were conducted on 110 and 101 women, respectively, in the rainy season as well as the flood period. Twenty aquatic and terrestrial wild vegetables were recorded in the dietary assessments. Popular wild species were among the most frequently used vegetables, used alternatively with home-cultivated or commercial vegetables. Wild plants contributed 81% and 63%, respectively, of the daily intake of vegetables during the flood period and rainy season. They made important contributions to the intake of carotene, vitamin C, calcium and iron. We conclude that there is a need to pay specific attention to the role of wild vegetables especially in the diets of the rural poor.

Omori, K. and L. P. Greksa (1996). "Dietary patterns and dietary adequacy of highland Pwo and Sgaw Karen of northwest Thailand." *Ecology of Food and Nutrition* 35(3): 219-235.

Dietary patterns, dietary adequacy and anthropometric indices of nutritional status of preschool children and their mothers from either the Pwo or Sgaw Karen tribal populations of northwest Thailand were compared. Data were collected during 3 measurement periods (post-harvest, pre-harvest, harvest). Results are discussed in terms of demographic, social and economic characteristics of households, meal patterns and food preparation, gathering and hunting of wild foods, dietary adequacy, and indices of nutritional status. Superior nutritional status was observed amongst the Sgaw population, which was concluded to be due to greater contact with modern society and a higher socioeconomic status.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Pongchaiyakul, C., S. Charoenkiatkul, et al. (2008). "Dietary calcium intake among rural Thais in Northeastern Thailand." *Journal of the Medical Association of Thailand* 91(2): 153-158.

Objective: The present study examined the amount and relative contribution of calcium from the habitual diet among rural Thais. *Material and method:* Calcium intake was assessed using 3-day food records and interviewer-administered quantitative food-frequency questionnaire, containing 73 food items. *Results:* The authors recruited 436 healthy participants (181 men and 255 women), between 20 and 85 years of age. Averaged daily calcium intake among men and women were 378.6 and 265.6 mg, respectively. Sixty-seven percentage of men and eighty seven percentage of women had less dietary calcium intake than half of the recommended level (< 400 mg/day) whereas only 6 and 3% had an intake more than 800 mg/day. The major food sources of dietary calcium was glutinous rice (32 percentage) followed by small animals with edible bones (31 percentage) and fresh and fermented fish (20 percentage). Dairy products and vegetables constituted only 8 and 5% of dietary calcium, respectively. *Conclusion:* The habitual diet among rural Northeast Thais does not meet the recommended calcium intake level. To promote more consumption of dairy products and locally-available calcium-rich foods would be beneficial to prevent osteoporosis among this population.

Roemling C, Qaim M. Obesity trends and determinants in Indonesia. *Asia Pac J Clin Nutr.* 2006;15(3):350-6.

Obesity is becoming a serious issue in many developing countries, with negative implications for economic growth and human wellbeing. While previous micro level studies on obesity have mostly used cross-section data, we analyze trends and determinants with panel data from Indonesia. Over the past 20 years, obesity has increased remarkably in Indonesia across all population groups, including rural and low income strata. The problem is particularly severe among women. Panel regressions confirm that changing food consumption patterns, coupled with decreasing physical activity, directly contribute to this trend. From a policy perspective, nutrition awareness and education campaigns, combined with programs to support leisure time exercise especially for women, seem to be most promising to contain the obesity pandemic.

Satheannopkaro, W., W. Aekplakorn, et al. (2009). "Fruit and vegetable consumption and its recommended intake associated with socio-demographic factors: Thailand National Health Examination Survey III." *Public health nutrition* 12(11): 2192-2198.

Objective: To examine the fruit and vegetable consumption in Thailand, the percentage of Thais meeting recommended intakes and the association with socio-demographic factors. *Design:* Cross-sectional survey with a stratified, three-stage, cluster probability sampling design. *Setting:* Community-dwelling men and women participating in the Thailand National Health Examination Survey III. *Subjects:* A total of 39 290 individuals aged ≥ 15 years were interviewed using a questionnaire to obtain information on socio-demographic characteristics and fruit and vegetable consumption. Daily fruit and vegetable consumption was estimated through the use of a short semi-qualitative FFQ. *Results:* Overall, participants had average frequencies of fruit and vegetable consumption equal to 4.56 and 5.97 d/week, respectively. Average daily number of servings of fruit, vegetables and fruit plus vegetables were 1.46, 1.78 and 3.24, respectively. Intake amounts of fruit, vegetables and fruit plus vegetables varied by marital status and region, and were lower among males (except for vegetable intake), those of older age, those with low educational attainment, those with low monthly household income and those living in a rural area. Only 1/3, 1/4 and 1/4 of the population consumed the recommended ≥ 2 , ≥ 3 and ≥ 5 servings/d for fruit, vegetables and fruit plus vegetables. Socio-demographic factors related to meeting the recommended intake of ≥ 5 servings/d for fruit plus vegetables included being female (OR = 1.13) and household income $\geq 50,000$ Baht/month (OR = 1.66). *Conclusions:* The amounts of fruit and vegetables consumed by Thai participants were far below the level of current recommendations. Public education and campaigns on adequate consumption of fruits and vegetables should be targeted more towards low socio-economic groups.

Sawasdivorn S, Wanthanaphuti P, Pue-arun S, Juansang S (2008). Situation of baby bottle use: is it suitable to recommend weaning by the age of one year? *J Med Assoc Thai.* 91(Suppl 3):S128-35. **BACKGROUND:**

Inappropriate baby bottle use is associated with many adversely health affects such as dental caries, refuse to eat etc. International pediatric institutes suggest weaning by the age of 1 year To establish a practical recommendation for Thai children, needs situation analysis. *Objective:* To determine the percentage of baby bottle use including late night feeding, behavior contributing to baby bottle addiction and chance of adverse

D3.2 Annotated bibliography of food consumption information in the five SEA countries

health effects. *Materials and methods:* A cross sectional descriptive study was performed in well child clinic at QSNICH during November 2003-December 2007. One thousand thirty-eight caretakers from 13 groups of children age 1 month-4 years were randomly included. Questionnaires were used and analyzed by SPSS program. *Results:* A total of 1,038 caretakers were interviewed. Parents comprised 70% of the caretakers. Children aged 1-2 years, 2-3 years, and 3-4 years, are found to remain on the bottle feeding constituted 92%, 70% and 42% respectively and remain on the night feeding comprised 70%, 50%, and 37% respectively. And more specifically, children at the age of six month have night feeding up to 85%. The weaning ages from the bottle were widely distributed, the earliest was one year (1%), the mean age was 2.5 years (SD = 0.612), the mode was at the age of two years (13%). Forty-six percent of children age 6 month-4 years received a bottle to sleep with 34% of caretakers offering bottle feeding when the child just moved the body. After bedtime mouth care, 48% of children were back to bottle-feeding. Eighteen percent of children age 2-4 year who were bottle fed were getting more milk volume than recommended with the maximum amount of 56 ounces a day. Fifty-six percent of children at 2 years and 70% at 4 years, received bottle-feeding more frequently than recommended with the maximum of 11 times a day. Eighty-eight percent of the caretakers did not know the recommended age of weaning. *Conclusion:* The children in this study still use baby bottle and have night feeding far beyond the recommended age including the practice of bottle to sleep, returning to bottle after dental care which will lead to addiction and adverse health affect. The age at which the children can quit and the realization of caretakers of when to quit are scattered. *Suggestion:* Recommendation should be at the age of one year but be flexible to more half a year to the age of 1 omega year, with encourage appropriate using and preparation to the weaning process.

Sengchanh Kounnavong et al. Effect of daily versus weekly home fortification with multiple micronutrient powder on haemoglobin concentration of young children in a rural area, Lao People's Democratic Republic: a randomised trial. *Nutrition Journal* 2011

Background: Multiple micronutrient deficiencies, in particular iron deficiency anaemia (IDA) is a severe public health problem in Lao People's Democratic Republic (Lao PDR). Because of the practical difficulties encountered in improving the nutritional adequacy of traditional complementary foods and the limitations associated with the use of liquid iron supplementation for the treatment and prevention of IDA in infants and young children, recently, home-fortification with multivitamins and minerals sprinkles was recommended. This study aims to compare the effect of twice weekly versus daily supplementation with multivitamins and minerals powder (MMP) on anaemia prevalence, haemoglobin concentration, and growth in infants and young children in a rural community in Lao PDR. *Methods:* A randomized trial was conducted in six rural communities. Children aged 6 to 52 months (n = 336) were randomly assigned to a control group (n = 110) or to one of two intervention groups receiving either two sachets per week (n = 115) or a daily sachet (n = 111) of MMP for 24 weeks; 331 children completed the study. A finger prick of blood was taken at baseline, at week 12, and again at week 24 to determine haemoglobin concentration. Anthropometric measurements were taken every 4 weeks. The McNemar test was used to assess within group differences at three time points in the study subjects with anaemia and one-way ANOVA was used to assess changes in mean haemoglobin concentration in the treatment groups. *Results:* MMP supplementation resulted in significant improvements in haemoglobin concentration and in the reduction of anaemia prevalence in the two treatment groups compared with the control group (p <0.001). The severely to moderately anaemic children (Hb <100 g/L) on daily supplementation recovered faster than those on twice weekly supplementation. MMP was well accepted and compliance was high in both treatment groups. Overall, the improvement in the weight for age Z-score was very small and not statistically significant across the three study groups. *Conclusions:* MMP supplementation had positive effects in reduction of anaemia prevalence and in improving haemoglobin concentration. For severely to moderately anaemic children, daily MMP supplementation was more effective in improving haemoglobin concentration and reducing anaemia prevalence. A longer intervention period is probably needed to have a positive effect on growth.

Sengchanh Kounnavong et al. Anemia and its Related Factors in Preschool-Aged Children in the Southern Rural Lao People's Democratic Republic. *Tropical Medicine and Health (TMH)*, 2012.

Anemia is a severe public health problem in the Lao People's Democratic Republic (PDR). Consequently, a new control strategy to reduce the burden of anemia has been introduced for preschool-aged children (6-52

D3.2 Annotated bibliography of food consumption information in the five SEA countries

months). The objective of this study was to assess the current prevalence of anemia and its related factors in preschool-aged children in southern rural Lao PDR. A population-based cross-sectional study was carried out in six communities in Songkhone district, Savannakhet province, in February 2009.

As a result, the prevalence of anemia was found to be 48.9% (95% confidence interval (CI), 43.5–54.3), although most cases were mild. A multiple logistic regression analysis indicated that there was no protective effect of breastfeeding against anemia. The anemia prevalence was higher: in children aged 6–23 months (Odds Ratio (OR) = 1.73, 95% CI, 1.02–2.90) than in older children; among children in large families (6 or more members) (OR = 1.96, 95% CI, 1.17–3.29); and in three remote villages with relatively difficult access to markets (OR = 3.01, 95% CI, 1.25–7.47). In Lao PDR, improvement of food practices and home-fortified food supplementation interventions are essential, high-risk groups should be targeted, and a long-term health education program that aims to modify food habits is needed. Furthermore, in settings where iron deficiency is not the only cause of anemia, combining an iron supplement with other measures is necessary. *Key words:* Anemia, prevalence, potential factors, preschool-aged children, Lao PDR

Speek, A. J., S. Speek-Saichua, et al. (1988). "Total carotenoid and beta -carotene contents of Thai vegetables and the effect of processing." *Food Chemistry* 27(4): 245-257.

Total carotenoid and beta -carotene contents of 55 vegetable products and fruits commonly consumed in north-eastern Thailand were estimated by spectrophotometry and high-performance liquid chromatography. The vitamin A activities, as retinol equivalents, were calculated using the *in vivo* conversion factors of WHO. Values were, in general, markedly lower than those in the Thai Food Composition Table of 1978. Leaf vegetables contained considerably more carotenoids than tuberous vegetables and fruits. The distribution of carotenoids over leaves and stalks was determined. The carotenoids of a plant were deposited mainly in the leaves which, in general, have a higher relative beta -carotene content than the stalks. The average losses of vitamin A activity as a result of local processing, i.e., cooking, frying, fermenting, sun-drying followed by cooking, were 14, 24, 29, 44 and 60%, respectively.

Speek, A. J., S. Speek-Saichua, et al. (1991). "Determination of macronutrient and micronutrient levels in Thai foods: an evaluation of the Thai food composition table." *Food Chemistry* 40(3): 251-262.

Reliability of the current (1978) Thai Food Composition Table was estimated by determining contents of crude fat, total carbohydrate, protein, calcium, iron, vitamin A activity, vitamin B 1, vitamin B 2 and niacin of 8 food groups (rice and cereals, fruit, meat, eggs, vegetables, fish, dessert and poultry), each composed of related foods. Composition of each group was proportional to the contribution of individual foodstuffs to the average daily intake of children aged 3-8 living in north-eastern Thailand. The groups covered approx. 95% of their daily intake. Foods were prepared according to traditional local habits prior to weighing, mixing and analysis. Within the rice/cereals group - contributing 63% to the daily food intake of the children - all nutrient levels calculated using the 1978 Thai Food Composition Table (TFT) were higher than those measured, whereas most of the TFT-based values were below measured values in the groups meat and fish. Intakes by Thai children - when using TFT values - of fat, total carbohydrate, protein, energy and vitamin B 2 are considerably overestimated (10-35%), while intakes of iron, vitamin A-active compounds, vitamin B 1 and niacin are highly overestimated (56-243%); intake of calcium is underestimated by 16%. The rice/cereals group contributes most to the overestimations except for vitamin A activity. Overestimation of intake of the latter nutrient originates primarily from the fruit group. Underestimation of calcium intake originates mainly from the fish group. It is recommended that the Thai Food Composition Table be revised by analysing processed foods with classical methods for macronutrients and with more selective analytical methods for micronutrients.

Suthasupa, P. (1982). Thai government's role in meeting the basic human need for food. *Occasional Paper, Institute of Southeast Asian Studies, Singapore. 1982. 67, x + 76pp.*

The study examines the present state of food production, consumption and distribution in Thailand; identifies factors affecting food production and consumption patterns; discusses the role of the Thai government in influencing the system of meeting basic human needs for food; evaluates government performance in terms of influencing production output, pricing policy, consumption patterns, child mortality and the incidence of malnutrition. Recommendations are made, including changes in pricing policy beneficial to farmers and greater emphasis on achieving food self sufficiency rather than favouring export crops.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Tantipopipat, S., A. Boonpradern, et al. (2010). "Dietary intake of spices and herbs in Habitual northeast Thai diets." Malaysian Journal of Nutrition 16(1): 137-148.

Spices and herbs are rich in polyphenols and widely used in habitual diets in the tropical regions. To elucidate their effects on human health, intake of the portion of spices and herbs from habitual diets should be determined. Consumption patterns were determined from 24-hour records or recalls of 181 men and 370 women in Khonkaen and Ubon Ratchathani provinces, representing upper and lower northeast Thailand. There was a slight variation in dishes, but twelve spices/herbs were commonly used in the two areas. The amounts of spices/herbs in the four most common dishes (Somtum, Jaew, Pon and Kang-Nor-Mai) were estimated by weighing ingredients before and after cooking. The average amount of spices/herbs consumed was 4.9, 26.1, 14 and 11 g/meal, contributing 36.6, 43.1, 20.6 and 29.8 mg polyphenols/meal for Somtum, Jaew, Pon and Kang-Nor-Mai, respectively. Chili was common in all recipes, with an average amount of 8.3-27.5 mg polyphenols/meal. In conclusion, habitual northeast Thai diets contain several spices/herbs and a substantial amount of polyphenols was commonly consumed.

Thang, N. M. and B. M. Popkin (2004). "Patterns of food consumption in Vietnam: effects on socioeconomic groups during an era of economic growth." European journal of clinical nutrition 58(1): 145-153.

Objective: To identify if the nutritional status and improvements in Vietnam during the 1990s applied equally to the key vulnerable population groups (poor, rural, and ethnic minority) as it did to the non-poor—largely in the urban areas. *Design:* This study used cross-sectional analyses in the context of inequalities occurring in the diets of the poor and non-poor that accompanied economic improvements during the Vietnam Doi Moi period. *Setting:* During the Doi Moi period in Vietnam. *Subjects:* A cross-sectional analysis was conducted on data using 23 839 individuals (4800 households) from the Vietnam Living Standard Survey (VLSS) in 1992-1993 and 28 509 individuals (6002 households) from the Vietnam Living Standard Survey in 1997-1998. Analysis for changes in food consumption was conducted on 17 763 individuals (4305 households) that were included in both surveys. *Intervention:* None. *Results:* After initiation of Doi Moi in 1986, the average Vietnamese person reached the dietary adequacy of 2100 kcal per day per capita in the early 1990s, but this did not improve during the next decade. The structure of diet shifted to less starchy staples while proteins and lipids (meat, fish, other protein-rich higher fat foods) increased significantly. Although the gap in nutrient intake between the poor and the non-poor decreased, the proportion of calories from protein- and lipid-rich food for the poor is lower than for the non-poor. The VLSS data showed that the increase of protein and lipid foods in total energy structure over the 5 y between the VLSS studies for poor households was 0.43% (CI=0.33, 0.53) and 0.47% (CI=0.41, 0.54) lower, respectively, than for non-poor households ($P<0.0001$). Inequalities compared to the non-poor were also found in both quantity and quality of food consumption. For example, poor households consumed (quantity) 127 kcal/day (CI=119, 135) less from meat, and 32 kcal/day (CI=27, 38) less from fats than non-poor households ($P<0.0001$), and the proportion of calories consumed (quality) by poor households was 5.8% (CI=5.4, 6.1) less from meat and 0.96% (CI=1.2, 0.7) less from fats than by non-poor households ($P<0.0001$). *Conclusions:* Although the key vulnerable groups—rural, poor, and minority populations—showed improvements in diet, there still remains an inequity between these groups and the non-poor of the population. In particular, the vulnerable groups consumed less of their daily consumption from the desirable high-quality proteins of animal foods and fats, and more from cereals and other starches—lagging the better-off populations in desired composition.

Tantipopipat, S., Zeder, C., Siriprapa, P., Charoenkiatkul, S. Inhibitory effects of spices and herbs on iron availability. (2009) International Journal of Food Sciences and Nutrition, 60 (SUPPL. 1), pp. 43-55.

Viseshakul, D., V. N. Songla, et al. (1982). "Rice consumption of Hilltribe people of Northern Thailand." Journal of the Medical Association of Thailand 65(3): 133-139.

Vy, T. (1971). "Nutritional value and composition in foodstuffs of the diet of the Vietnamese rural adult." American Journal of Clinical Nutrition 24(1): 38-40.

The purpose of this note is to report the results of a nutrition survey in the countryside of the Republic of Vietnam. In addition to the table that indicates the caloric value and the composition of the diet in nutrients, we present two tables that give the composition of this diet in foodstuffs. We think that although the former

D3.2 Annotated bibliography of food consumption information in the five SEA countries

enables us to appreciate the quality of the diet, the latter gives us the information necessary for a better comprehension of the socioeconomic aspects of the nutrition of the country and facilitates the search for realistic methods of improving it.

Dietary and socio-economic factors associated with beriberi in breastfed Lao infants

Ann. Trop. Paediatrics 2003

A case-control study was conducted to investigate the dietary and socio-economic factors associated with beriberi in infants attending three public hospitals in Vientiane, Lao PDR. Forty-three breast-feeding infants with a median (range) age of 3 (1-9) months were admitted with beriberi. This was defined as the presence of signs of congestive heart failure or shock in the absence of fever or other signs of sepsis, hypovolaemia or cardiac abnormalities, with rapid clinical improvement following parenteral thiamine. Subjects were matched by age and diet to 43 breast-feeding healthy control infants. Compared with control mothers, mothers of infants with beriberi had significantly less diet diversity ($p < 0.001$), soaked glutinous rice for significantly longer or were more likely to pour off excess water from non-glutinous rice ($p = 0.006$), had fewer years of schooling ($p < 0.05$), were more likely to report that income was inadequate for basic needs ($p < 0.001$), to perform hard physical labour ($p < 0.01$) and to be married to farmers ($p < 0.01$). Clinically significant thiamine deficiency in breastfed infants in Lao relates to methods of preparing rice, the food selected by lactating mothers and the family's socio-economic status.

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D3.2 Annotated bibliography of food consumption information in the five SEA countries

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Wanaratna, L., Sinawat, S., Wasantavisuthi, E., Thaineua, V. The prevalence of inadequate vitamin A nutriture in preschool children of north and northeast Thailand. (1997) *Journal of the Medical Association of Thailand* 80 (3), pp. 139-146.

Zulfianto, N. A. (1988). Comparative study on food consumption and nutritional status of rice-based and coffee-based households in East Java, Indonesia, College, Laguna (Philippines). Oct 1988. 167 leaves.

Question 3: Which food out of a typical diet of children under 5 and women in reproductive age in Cambodia, Indonesia, Lao PDR, Thailand and Vietnam are not very common but are still interesting for the food composition table because it contains a high concentration of a particular nutrient?

(2008). "Golden Rice 2. (Nutritional and safety assessments of foods and feeds nutritionally improved through biotechnology: case studies)." *Comprehensive Reviews in Food Science and Food Safety* 7(1): 92-98.

Golden Rice 1 was developed to help control vitamin A deficiency (VAD). To construct Golden Rice 2, the phytoene synthetase gene (*psy*) from maize and the carotene desaturase gene (*crtl*) from *Erwinia uredovora* were inserted into rice. Evaluation of phytoene synthase (the rate limiting step in carotenoid biosynthesis) from several plant sources led to the identification of the *psy* gene from maize as the most efficacious source, resulting in the greatest accumulation of total carotenoids and beta -carotene. Golden Rice 1 contains about 1.6 micro g of total carotenoids per gram of dry weight of grain. Golden Rice 2 contains as much as 37 micro g total carotenoids per gram of dry weight of grain, of which 31 micro g/g is beta -carotene. While the quantity of beta -carotene is high, its bioavailability is unknown. Golden Rice 2 was developed with the expectation that it could make a major contribution to the vitamin A requirement. It is conservatively estimated that a breastfed 1- to 2- y-old child could derive 60% of the of U.S. recommended dietary allowance (RDA) from the consumption of approximately 70 g of uncooked Golden Rice 2; an average serving size for a child this age in Thailand, for example, is 160 g. The higher level of beta -carotene raises the possibility that Golden Rice 2 may help reduce many of the deaths attributed to VAD (Hess and others 2005). Biofortified rice with high levels of beta -carotene is in an early stage of development. The published data provide a description of the DNA construct introduced into rice and report the concentrations of both total carotenoids as well as that of the 5 major carotenoids present in representative transgenic rice plants. The safety assessment of Golden Rice 2 follows generally accepted international guidelines. Beta-carotene biosynthesis is a peripheral biosynthetic pathway that diverts very small amounts of biosynthetic precursors from plant metabolism and would, thus, not be expected to produce major changes in composition. Hence, the safety assessment can be targeted to the impact of the insertion on cellular carotenoids and other metabolically related compounds. Plant phenotype, seed weight, and germination were not affected by the presence of the genetic modification. Apart from safety concerns, there exists an urgent need for studies to evaluate the efficacy of this product as a bioavailable source of beta -carotene in animals and humans. Proof of efficacy would allow Golden Rice 2 to be widely distributed. Appropriate safety assessments are needed and should at least include (1) characterization of the inserted DNA, (2) determination of the composition according to OECD consensus documents, (3) analysis of the carotenoid metabolite pool, and (4) evaluation of the efficacy of this product as a source of beta -carotene (although it is not related to safety). The safety of carotene desaturase gene (*crtl*) and its products from *E. uredovora* requires characterization because it has no history of safe use in foods.

Bautista, O. K., K. Suraphong, et al. (1988). "Traditional vegetables of ASEAN." *ASEAN Food Journal* 4(2): 47-58.

Important or commonly used vegetable food plants of South East Asia, their nutrient composition and use are summarized. Vegetables covered are arranged into 3 groups: plants used mainly as vegetables, including sweet potato, winged bean and amaranth; conventional vegetables with other edible parts, such as leaves of sweet potatoes, squash or certain legumes; and plants commonly grown for other purposes with some parts utilized as vegetables, including banana, papaya, bamboo, cassava, bean sprouts and coconut hearts.

de Boer H, Lamxay V. Plants used during pregnancy, childbirth and postpartum healthcare in Lao PDR: a comparative study of the Brou, Saek and Kry ethnic groups. *J Ethnobiol Ethnomed*. 2009 Sep 8;5:25.

Background : In many Southeast Asian cultures the activities and diet during the postpartum period are culturally dictated and a period of confinement is observed. Plants play an important role in recovery during the postpartum period in diet, traditional medicine, steam bath and mother roasting (where mother and child placed on a bed above a brazier with charcoal embers on which aromatic plants are laid). This research focuses on the use of plants during pregnancy, parturition, postpartum recovery and infant healthcare among three ethnic groups, the Brou, Saek and Kry. It aims to identify culturally important traditions that may facilitate

D3.2 Annotated bibliography of food consumption information in the five SEA countries

implementation of culturally appropriate healthcare. *Methods:* Data were collected in 10 different villages in Khammouane province, Lao PDR, through group and individual interviews with women by female interviewers. *Results:* A total of 55 different plant species are used in women's healthcare, of which over 90% are used in postpartum recovery. Consensus Analysis rejects the hypothesis that the three ethnic groups belong to a single culture for postpartum plant use, and multidimensional scaling reveals non-overlapping clusters per ethnic group. *Conclusion:* Medicinal plant use is common among the Brou, Saek and Kry to facilitate childbirth, alleviate menstruation problems, assist recovery after miscarriage, mitigate postpartum haemorrhage, aid postpartum recovery, and for use in infant care. The wealth of novel insights into plant use and preparation will help to understand culturally important practices such as confinement, dietary restrictions, mother roasting and herbal steam baths and their incorporation into modern healthcare.

Bohme, M. and I. Pinker (2007). "Investigation regarding the potential for cultivation of indigenous vegetables in Southeast Asia." *Acta Horticulturae* **752**: 179-185.

Asia can be considered as a main gene centre for vegetables. In countries like Vietnam, vegetables and spicy herbs are obligatory compounds of the daily diet. They are reported to provide a high amount of vitamins and bioactive substances. Nevertheless, indigenous vegetables (IVs) are underestimated concerning their nutritional and economical value in their home countries and under-utilised so far. Due to the rural organisation of the society, native leafy vegetables in tropical regions of South-East-Asia are cultivated mainly in home gardens. With growing urban population and increasing living standard, there is rising demand for high quality vegetables. Therefore, there is high need to introduce these vegetables in more intensive production systems to stabilise and extend the production, as well as to improve and guarantee the quality of these products. This paper gives an overview about indigenous leafy vegetables, solanaceous, cucurbits and legumes with high nutritional value and economical potential in Southeast Asia particularly Vietnam. Since some years we collected information about IVs in these regions and made first attempts to select and cultivate few of these species. Based on our investigations we started to develop a database providing information about the native vegetables used in Southeast Asia. From our point of view there is a lack in evaluation and breeding of different vegetable genotypes leading to a lack of species and cultivars for intensive and sustainable production. Introducing IVs in production systems could also reduce the high risk for genetic erosion in the actual high diversity and could use the genetic potential of the landraces.

Burke, D. S., C. R. Smidt, et al. (2005). "Momordica cochinchinensis , Rosa roxburghii , wolfberry, and sea buckthorn-highly nutritional fruits supported by tradition and science." *Current Topics in Nutraceutical Research* **3**(4): 259-266.

Most diets in developed nations fall far short of recommended fruit and vegetable, and thus key nutrient, intake. Momordica cochinchinensis (gac), indigenous to Southeast Asia, contains high concentrations of lycopene and beta-carotene. In Vietnam, gac is prized by natives for promoting longevity and vitality. In a supplementation trial among Vietnamese children, gac increased serum vitamin A levels more than synthetic beta-carotene. Rosa roxburghii (cili), native to southwest China and traditionally used to combat stress and aging, is very rich in vitamin C and other phytonutrients. In humans, cili enhanced immunity and raised erythrocyte superoxide dismutase (SOD). Lycium chinense (wolfberry), also of Chinese origin, and traditionally used for longevity, wellness, and vision, is very rich in highly utilizable zeaxanthin. In animals, wolfberry showed immune modulating and antioxidant actions, and in humans, significantly increased blood SOD. Hippophae rhamnoides (sea buckthorn), native to Siberia and the Himalayas and traditionally used to expel phlegm and promote digestion, was shown in animals to have liver-protective and antioxidant activity. In humans, sea buckthorn greatly increased the dietary intake of flavonoids and vitamin C, and showed cardiovascular benefits. Thus, due to their nutritional value, intake of these fruits may greatly enhance the diets healthfulness.

Cerny, K., D. Q. Hoa, et al. (1981). "The winged bean (*Psophocarpus tetragonolobus*/L./DC) as major source of protein in infant nutrition." *Courrier du Centre International de l'Enfance* **31**(2): 121-134.

Mature winged bean (*Psophocarpus tetragonolobus*) seeds were given as a main source of protein to healthy well-nourished Czech infants and malnourished Vietnamese infants and young children. In a 10-week feeding trial the experimental diet of winged bean seeds and rice enriched with 10% skimmed milk powder, vegetable oil and sugar fortified with vitamins and minerals had an efficacy over 90% of that of the control diet with

D3.2 Annotated bibliography of food consumption information in the five SEA countries

skimmed milk as the main protein source. Eight 3-day metabolic balance studies of nitrogen, calcium and lipids were made in 6 healthy Vietnamese infants given each of those 2 diets in turn. Apparent retention of N increased significantly after 8 weeks. Phytates and oxalates caused a significant difference in Ca intake in the experimental diets; apparent retention of Ca as a percentage of intake was significantly higher after 8 weeks of adaptation. Despite a higher excretion of fat a considerable proportion of long-chain saturated fatty acids, including behenic acid, was absorbed from the experimental diet. It was believed that winged beans were a valuable source of good-quality protein acceptable as a weaning food.

Charunuch, C., T. Kritsana, et al. (2006). "Production of healthy protein and snack foods for small-scale industry from full fat soy flour. (Supplement Issue: Agro-industry)." *Kasetsart Journal, Natural Sciences* 40(Supp.): 101-107.

This paper examines the potential of using full fat soybean flour to produce healthy protein and snack foods, and describes a newly developed machine called "village texturizer", which was used for the production of these foods. Data on the colour, odour, taste, texture, water holding capacity (for the protein product only), and nutritive value of the developed food products are summarized. The optimum processing conditions for the production of protein foods with more acceptable shape, colour and texture were: high full fat soybean flour (100%), pressure of 5 bar and temperature of 180 degrees C; for snack foods, the optimum conditions were 20% full fat soybean flour, pressure of 7 bar and temperature of 150 degrees C. It is concluded that full fat soybean flour-based protein and snack foods are sensory acceptable and nutritious, thus providing consumers in Thailand with alternative healthy foods.

Chittchang, U., S. Jittinandana, et al. (1999). "Recommending vitamin A-rich foods in southern Thailand." *Food and Nutrition Bulletin* 20(2): 238-242.

Thailand is classified by the World Health Organization as a country with a moderate level of subclinical vitamin A deficiency. In 1992 the eruption of infant exophthalmia in the country's lower region led to the universal distribution of vitamin A capsules among infants (50,000 I for those <6 months old, 100,000 I for those 6-12 months old) and pre-school children (200,000 I) in high-risk areas every 6 months. Since then, no new cases of exophthalmia have arisen. The universal distribution programme covered the period 1992 to 1998. However, to control the problem and prevent it from reoccurring once capsule distribution is discontinued, a food-based strategy for the prevention of vitamin A deficiency is being undertaken in southern Thailand. This strategy has two components: recommendation of vitamin A-rich food recipes for consumption by pregnant women, and development of vitamin A-rich snacks targeted at children. Both of these components have been adopted and successfully promoted by the Health Promotion Centre (Region 12) in southern Thailand as part of public special events, regular counselling, and education programmes, and as micro-level income-generation projects by community women's groups.

Chotiboriboon, S., S. Tamachotipong, et al. (2009). Thailand: food system and nutritional status of indigenous children in a Karen community. H. V. Kuhnlein, B. Erasmus and D. Spigelski. Rome, Indigenous peoples' food systems. Food and Agriculture Organization of the United Nations (FAO): 2009 2159-2183.

To promote nutrition and health among Indigenous Peoples in Thailand and other developing countries, it is essential to understand their food systems and related behaviours and practices. This chapter describes the process and results of a preliminary participatory research between a group of interdisciplinary researchers and community members in Sanephong, a small Karen village in western Thailand. Many interdisciplinary methods were used, i.e. standard anthropometric methods, biochemical assessments, focused ethnographic study, focus group discussion, in-depth interviews and 24-hour recalls. Key results indicate that the food system was, in general, favourable. Three hundred and eighty-seven traditional food species were identified. Eight species of those were high in minerals and vitamins, according to portion size consumed. However, an improvement in nutritional status and health was necessary for children and mothers. The overall nutritional status of children suggested acute and chronic malnutrition problems: 20 percentage stunting (n=37), 14 percentage underweight (n=26), 5 percentage thin (n=9) and 1 percentage overweight (n=2). Mean energy intakes of the children did not meet the Thai Dietary Reference Intake (DRI): 58 percentage of the Thai DRI in 6 to 11 months, 50 percentage in 1 to 2 years, 56 percentage in 2 to 5 years, and 69 percentage in 5-12 years. For children 2-12 years, dietary vitamin A, vitamin C and fat intakes were inadequate. Iron intakes were low among most children (mean at 29 percentage Thai DRI in 1 to 2 years, 35 percentage in 2 to 5 years and 42 percentage in 5 to 12 years). Thus, it is

D3.2 Annotated bibliography of food consumption information in the five SEA countries

recommended that the improvement of nutrition and health in this indigenous community should be built upon their available food sources, with the possible exception of iron-rich foods. The promotion of available good sources of iron is one strategy to prevent anaemia. Iron supplementation can also be used. Promoting culturally appropriate childcare practices, as well as better mother and child interaction, are also essential.

Dang, D. H., M. H. Hoang, et al. (2006). "Use of Vietnamese seaweed for food, medicine and as biofertilizers."

Vietnam has a coastline of approximately 3,260 km, and the climate varies from subtropical in the northern part to tropical in the southern part of the country. Therefore, it has an abundance of algal flora, with the total number of species estimated to be nearly 1000 spp., of which 638 species of seaweed have been identified (229 Rhodophyta, 123 Phaeophyta, 145 Chlorophyta, 76 Cyanophyta). Traditional harvesting and utilization of seaweeds by Vietnamese coastal people has occurred for over one hundred years. Some of the major economically important seaweed groups can be used for food (human and animal), as material for industry, traditional medicine and bio fertilizers/manures. In this paper, the authors analysed some representative seaweeds of Vietnam included green, brown and red algae. The proximate compositions as ash, protein, lipid, carbohydrate, fatty acids, vitamins, pigments, macro and micro-elements were compared among the different species examined. The present study provides evidence that Vietnamese seaweeds are very rich in protein, lipids (especially polyunsaturated fatty acids), vitamins, pigments, and macro-and micro-elements, and can be used as food to prevent hyperlipidaemia, as vegetable and as a functional food. *Porphyra crispata*, *P. suborbiculata*, *P. vietnamensis*, *Gracilaria asiatica*, and *G. euclumoides* are eaten as raw vegetables, or pickles, or prepared for jellies or soups. In southern and Central Vietnam, *Gracilaria* or *Gelidiella* species are simmered with added acid and then filtered and cooled into a jelly, known as 'xu xoa'. *Gracilaria euclumoides* is used as an ingredient for soft candy. *Gracilaria* is also cultured in Vietnam. *Ulva* sp. is gathered along the coast of central Vietnam. It is fried with pork or beef and also used an ingredient for soup. The *Sargassum* drink known as 'Tra rong bien' is very popular, and its stalls are frequently seen not only in Southern Vietnam but also in the Central cities such as Nha Trang, Buon Ma Thuot, Tuy Hoa and Quang Ngai. *Sargassum* species are used as traditional medicine, an influence of Chinese culture. *Laminaria* is used as an ingredient for 'Chi', particularly in Southern Vietnam. *Laminaria* species do not grow in Vietnam, which is located in subtropical to tropical zones. *Sargassum* spp. are used for treating goitre or ailments due to iodine diseases. *Ulva lactuca* and *U. reticulata*, the name more common species on the coast from central to southern Vietnam, are sold for use as traditional medicines. In industry, *Gracilaria* spp., *Hypnea* spp., *Sargassum* spp., and *Kappaphycus* spp. are sources of material of agar, carrageenan, and alginate processing. Furthermore, in agriculture, many species of seaweed (mainly brown algae) such as *Sargassum* spp. and *Turbinaria* spp. are used as bio fertilizers and manure for crops of sweet potato, onion, garlic, and grain. In recent years, the production of fertilizers using manure and *Sargassum* has developed rapidly in Vietnam.

Darunee, P. and P. Niramol (2009). "Nutritional quality and a prospected functional food ingredient of Thai lotus (*Nelumbo nucifera*) seed."

Nutritional qualities of fresh and dried lotus (*Nelumbo nucifera*) seed, both white (Hindu) and red (East Indian) in Chiang Rai were determined to provide lotus seed nutritional information and to find out the possibility of using lotus seed as a functional food ingredient. The results showed that both lotus seed cultivars contained high protein (30 percentage), carbohydrate (60 percentage), dietary fibre (18 percentage), ash (5 percentage), but low fat content (2.7 percentage) than that of Indian and Chinese cultivars. Lotus seed also had high calcium and unsaturated fatty acid, particularly linoleic acid and oleic acid, while the former was non-detectable in Indian lotus seed. TPC and antioxidant activity in lotus seed decreased and vitamin C became non-detectable after drying. In addition, it was found that the most acceptable formula contains 10 percentage lotus seed flour cookie. Moreover, the lotus seed flour increased nutritional value (protein, carbohydrate, ash and dietary fibre) of butter cookie but decreased in the fat content. This suggests the potential of the lotus seed flour as an alternative source of nutrition and functional ingredient.

de Pee, S., C. E. West, et al. (1995). "Lack of improvement in vitamin A status with increased consumption of dark-green leafy vegetables." *Lancet* 346(8967): 75-81.

There is little evidence to support the general assumption that dietary carotenoids can improve vitamin A status. We investigated in Bogor District, West Java, Indonesia, the effect of an additional daily portion of dark-

D3.2 Annotated bibliography of food consumption information in the five SEA countries

green leafy vegetables on vitamin A and iron status in women with low haemoglobin concentrations (< 130 g/L) who were breastfeeding a child of 3-17 months. Every day for 12 weeks one group (n = 57) received stir-fried vegetables, a second (n = 62) received a wafer enriched with beta-carotene, iron, vitamin C, and folic acid, and a third (n = 56) received a non-enriched wafer to control for additional energy intake. The vegetable supplement and the enriched wafer contained 3.5 mg beta-carotene, 5.2 mg and 4.8 mg iron, and 7.8 g and 4.4 g fat, respectively. Assignment to vegetable or wafer groups was by village. Wafers were distributed double-masked. In the enriched-wafer group there were increases in serum retinol (mean increase 0.32 [95% CI 0.23-0.40] $\mu\text{mol/L}$), breastmilk retinol (0.59 [0.35-0.84] $\mu\text{mol/L}$), and serum beta-carotene (0.73 [0.59-0.88] $\mu\text{mol/L}$). These changes differed significantly from those in the other two groups, in which the only significant changes were small increases in breastmilk retinol in the control-wafer group (0.16 [0.02-0.30] $\mu\text{mol/L}$) and in serum beta-carotene in the vegetable group (0.03 [0-0.06] $\mu\text{mol/L}$). Changes in iron status were similar in all three groups. An additional daily portion of dark-green leafy vegetables did not improve vitamin A status, whereas a similar amount of beta-carotene from a simpler matrix produced a strong improvement. These results suggest that the approach to combating vitamin A deficiency by increases in the consumption of provitamin A carotenoids from vegetables should be re-examined.

Englberger, L., R. B. H. Wills, et al. (2006). "Carotenoid content and flesh colour of selected banana cultivars growing in Australia." *Food and Nutrition Bulletin* **27**(4): 281-291.

Background: The problems of vitamin A deficiency and chronic diseases have emerged in recent years in some countries in the Micronesian region. These problems are associated with the dietary shift towards imported processed foods and lifestyle changes. Research in the Federated States of Micronesia indicates that yellow- and orange-fleshed banana cultivars contain significant levels of provitamin A carotenoids. *Objective:* To identify further banana cultivars that may be promoted to alleviate vitamin A deficiency among children and women and chronic disease problems among adults. *Methods:* Ripe fruit of banana cultivars growing in Australia (sourced mostly from a field research collection) were assessed for carotenoid content and flesh colour. Ten cultivars with yellow or yellow/orange flesh colour (including common cultivars of Southeast Asia and the Pacific Islands) were selected and compared with two cream-fleshed cultivars, including Williams, of the Cavendish group, the most commonly marketed banana worldwide. Carotenoid content was analysed by high-performance liquid chromatography (HPLC). Flesh colour was analysed by HunterLab colorimetry. *Results:* The yellow/orange-fleshed Asupina (a Fe'i banana) contained the highest level (1,412 micro g/100 g) of trans beta-carotene, the most important provitamin A carotenoid, a level more than 20 times higher than that of Williams. All 10 yellow or yellow/orange-fleshed cultivars (Asupina-, Kirkirnan, Pisang Raja, Horn Plantain, Pacific Plantain, Kluai Khai Bonng, Wain, Red Dacca, Lakatan, and Sucrier) had significant carotenoid levels, potentially meeting half or all of the estimated vitamin A requirements for a non-pregnant, non-lactating adult woman within normal consumption patterns. All were acceptable for taste and other attributes. The cream-fleshed cultivars had minimal carotenoid levels. There was a positive significant correlation between carotenoid content and deeper yellow/orange coloration indicators. *Conclusions.* These yellow- or yellow/orange-fleshed carotenoid-rich banana cultivars should be considered for promotion in order to alleviate vitamin A deficiency and chronic disease in susceptible target communities and to provide variety and enjoyment as exotic fruits in both developing and industrialized countries.

Fisinin VI, Papazyan TT, et al. (2009). "Producing selenium-enriched eggs and meat to improve the selenium status of the general population." *Critical Reviews in Biotechnology* **29**(1): 18-28.

The role of selenium (Se) in human health and diseases has been discussed in detail in several recent reviews, with the main conclusion being that selenium deficiency is recognised as a global problem which urgently needs resolution. Since selenium content in plant-based food depends on its availability from soil, the level of this element in food and feeds varies among regions. In general, eggs and meat are considered to be good sources of selenium in human diet. When considering ways to improve human selenium intake, there are several potential options. These include direct supplementation, soil fertilisation and supplementation of food staples such as flour, and production of functional foods. Analysing recent publications related to functional food production, it is evident that selenium-enriched eggs can be used as an important delivery system of this trace mineral for humans. In particular, developments and commercialisation of organic forms of selenium have initiated a new era in the availability of selenium-enriched products. It has been shown that egg selenium

D3.2 Annotated bibliography of food consumption information in the five SEA countries

content can easily be manipulated to give increased levels, especially when organic selenium is included in hen's diet at levels that provide 0.3-0.5 mg/kg selenium in the feed. As a result, technology for the production of eggs delivering approximate to 50% (30-35 µg) of the human selenium RDA have been developed and successfully tested. Currently companies all over the world market selenium-enriched eggs including the UK, Ireland, Mexico, Columbia, Malaysia, Thailand, Australia, Turkey, Russia and the Ukraine. Prices for enriched eggs vary from country to country, typically being similar to free-range eggs. Selenium-enriched chicken, pork and beef can also be produced when using organic selenium in the diet of poultry and farm animals. The scientific, technological and other advantages and limitations of producing designer/modified eggs as functional foods are discussed in this review.

Moreno-Black G, Watanaakanan, Somnasang P, Thamathawan S, Brozvosky P (1996). Non-domesticated food resources in the marketplace and marketing system of northeastern Thailand. *J Ethnobiology* 16(1): 99-117

Non-domesticated and semi-domesticated food resources are an important part of the traditional lifestyle in northeastern Thailand. These plants and animals, gathered for a wide variety of purposes, are increasingly being sold in the local markets and becoming a part of the commercial exchange system. Early morning markets in this region were surveyed throughout the year in order to: 1) document the prevalence and seasonal variation of non-domesticated food resources; 2) determine which non-domesticated food resources are important sources of income for the local people; and 3) identify factors that impact the marketing of these items. We found that a wide variety of non-domesticates were sold at the markets including plants, mushrooms, algae, fish, insects, birds, mammals, reptiles, amphibians, and crustaceans. Seasonal variation in availability and diversity was found. Plants, insects, amphibians, and crustaceans were most common and diverse during the hot season, while fish diversity and abundance was highest during the rainy season. Very few species were found to predominate and market variability was high. Cultural and social changes that are related to the use of non-domesticates as sources of income are also discussed.

Gershon J. (1983). "Fighting malnutrition with home-grown vegetables." *Span* 26(3): 101-102.

Preliminary results are discussed of trials of home vegetable gardens developed for climatic conditions in Thailand, Indonesia and the Philippines. Sixteen vegetable sources of Ca, Fe and pro-vitamin A are listed and advice given on daily dietary needs, for a family of 5 persons, of Ca, Fe, and vitamins A and C. Full details of crop yields from the gardens are available from the author.

Ghane SG, Lokhande VH, et al. (2010). "Indigofera glandulosa Wendl. (Barbada) a potential source of nutritious food: Underutilized and neglected legume in India." *Genetic Resources and Crop Evolution* 57(1): 147-153.

Indigofera glandulosa Wendl., (Barbada) belongs to the family Leguminosae, subfamily-Papilionoidae and tribe Indigoferae is widely distributed as weed in India, Indonesia and North Australia. It is an annual herb or sub-shrub growing along roadside and open grassland areas. The plant produce seeds rich in valuable food ingredients such as proteins, carbohydrates, essential amino acids and vitamins. The plant is described as nourishing food for human beings and is believed to possess the qualities of a tonic in Indian medicine. It is highly palatable forage legume; green plants are generally appreciated by domestic animals. Environmentally, it is utilized for the nitrogen enrichment in degraded soil, as the roots produce nodules fixing atmospheric nitrogen. It can be grown in dry regions, therefore appears to drought resistant and at low cost. The plant species remains unexploited although it has high forage and nutritious value. The meagre information on *I. glandulosa* lead us to explore this neglected and underutilized species to utilize it as food for human beings, forage for animals and for nitrogen enrichment of the soil. The seed viability and seed germination data revealed seed dormancy associated with the hard and impermeable seed coat and it could be overcome by treating the seeds with concentrated sulphuric acid for 10-15 min thus improving the seed germination percentage up to 75%. The result of the present investigation provides preliminary information on agronomical and morphological traits related to yield and biomass production of *I. glandulosa* from its natural habitat. In addition the detailed survey about taxonomic characters, distribution, cultivation and utilization of *I. glandulosa* has been documented. © Springer Science+Business Media B.V. 2009.

Haas J, Beard J, et al. (2006). "Enhanced rice reduces iron deficiency." *Appropriate Technology* 33(1): 24-25.

A study documented a breakthrough in the battle against iron deficiency. Specifically, religious sisters in ten

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Catholic convents in the Philippines volunteered to maintain the discipline to eat IR68144-3B-2-2-3 three times a day, day in and day out for nine months. The experimental, iron-dense variety of rice used, IR68144-3B-2-2-3, was developed and grown at the International Rice Research Institute (IRRI) and then tested by the international team of researchers. This variety has 400-500% more iron, after processing and cooking, than varieties that are commercially available in the Philippines. Through biofortification, plant breeders are developing staple foods with higher levels of essential micronutrients. Overall, the study demonstrated that iron-biofortified rice can raise levels of stored iron in the body and can significantly contribute to reducing micronutrient malnutrition.

Handajani S. (2001). "Indigenous mucuna tempe as functional food." *Asia Pacific Journal of Clinical Nutrition* **10**(3): 222-225.

The aim of the present study was to obtain the nutritive and bioactive compounds of mucuna tempe and the consumer preference of its formulated snack. The tempe was made traditionally from mucuna pruriens seeds using 'ragi tempe' as inoculants. Proximate, vitamin, mineral and dietary fibre analysis was done using the methods of the Association of Official Analytical Chemists, isoflavone was analysed using high performance liquid chromatography (HPLC) with an RP-18 column and a UV detector. The preference test was done using scoring methods by trained panellists. The study demonstrates that compared with soybean tempe, mucuna tempe had a higher dietary fibre level, but lower vitamin E content. The mucuna tempe contains 31.5% protein, 7.3% fat, 3.0% ash, 58.1% carbohydrate and 9.1% fibre. It contains 0.551 mg/L isoflavone aglucone; daidzin is the highest, followed by Factor II (6,7,4 trihydroxy isoflavone) that is much higher than that of soybeans tempe. These are much higher isoflavone aglucone contents than found in soybeans tempe. The preference score for a 20% mucuna tempe-based snack was not significantly different compared with control or with the preference score for a 10% soybean tempe-based snack. This preliminary study needs to be followed by both in vitro and in vivo studies.

HartiniTNS, Padmawati RS, et al. (2005). "The importance of eating rice: changing food habits among pregnant Indonesian women during the economic crisis." *Social Science & Medicine* **61**(1): 199-210.

This article presents qualitative and quantitative research findings on food habits of pregnant Indonesian women in relation to the economic crisis that arose in 1997. Between 1996 and 1998, dietary intakes were estimated for 450 pregnant women in Central Java. Between January and June 1999, four focus group discussions, 16 in-depth interviews and four non-participant observations were held with women, two in-depth interviews were held with traditional birth attendants, and four with midwives. Women were categorized as urban or rural, rich or poor, and according to rice field ownership. The women reported that before the crisis they bought more foods and cooked more meals and snacks. During the crisis, cooking methods became simpler and cooking tasty foods was more important than cooking nutritious foods. This involved using plenty of spices and cooking oil, but reducing the use of expensive nutritious foods. The herbal drink jamu was drunk by 15% of pregnant women; its consumption was lower during than before the economic crisis. Twenty-six percentage of the women avoided certain foods due to food taboos, and most of these women avoided beneficial foods; this phenomenon decreased during the crisis among the rich and the rural, poor, landless women. In spite of increased prices for rice, women did not decrease their rice consumption during the crisis because rice was believed to have the highest value for survival, to provide strength during pregnancy and delivery, and to be easier to store and cook. Finally, children and husbands had highest priority in being served food, and women were the last to eat.

Hong DD, Hien HM, et al. (2007). "Seaweeds from Vietnam used for functional food, medicine and bio fertilizer." *Journal of Applied Phycology* **19**(6): 817-826.

Several Vietnamese seaweed species have economic importance as food for humans, as industrial materials, as ingredients in traditional medicine, and as bio fertilizers. The nutritional values of nine representative Vietnamese seaweed species were analysed. In this report, all of the species studied are rich in proteins, lipids (especially polyunsaturated fatty acids), vitamins, pigments, and macro- and micro-elements. The effect of the physiological activities of the green alga, *Ulva reticulata*, on hepatic fatty acid metabolism were examined in mice. The results indicate that Vietnamese seaweeds are abundant and have high quality materials for industrial and agricultural purposes.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Khan NC, Mai LB, et al. (2008). "Development and validation of food frequency questionnaire to assess calcium intake in postmenopausal Vietnamese women." *Journal of Nutritional Science and Vitaminology*: 124-129.

This study was done to develop a Food Frequency Questionnaire (FFQ) for assessing calcium intake in Vietnamese based on data from the National Nutrition Survey in 2000. From the data, a total of 36 calcium-rich food items were selected for the FFQ by ranking food items according to their contribution to the population intake of nutrients. The FFQ was validated in 140 postmenopausal women by comparing estimates of calcium intake from the FFQ with those from multi-pass 24 h recalls. The results showed that the Pearson correlation coefficient between the 2 methods was 0.84 (p<0.001), and that the weighted kappa value was 0.44. Cross-classification analysis indicated that 82.1% of subjects were classified into the same or adjacent quartile by both methods. No subject was grossly misclassified by the FFQ. There is no significant difference of calcium intake between the 2 methods (by paired t test, p<0.05). A reproducibility study also presented good correlation between 2 administrations of the FFQ, with Pearson correlation coefficient being 0.93 (p<0.001) and weighted kappa value being 0.67. In conclusion, this FFQ is useful and reliable for estimating calcium intake in population-based epidemiological studies in postmenopausal Vietnamese women.

Khounnorath S, Chamberlain K, Taylor AM, Soukaloun D, Mayxay M, Lee SJ, Phengdy B, Luangxay K, Sisouk K, Soumphonphakdy B, Latsavong K, Akkhavong K, White NJ, Newton PN. Clinically unapparent infantile thiamin deficiency in Vientiane, Laos. *PLoS Negl Trop Dis*. 2011 Feb 22;5(2):e969.

Background: Beriberi occurs in Vientiane, Lao PDR, among breastfed infants. Clinical disease may be the tip of an iceberg with subclinical thiamin deficiency contributing to other illnesses. Thiamin treatment could improve outcome. *Methodology/Principal findings:* A cohort of 778 sick infants admitted during one year without clinical evidence of beriberi were studied prospectively and erythrocyte transketolase assays (ETK) performed. Biochemical thiamin deficiency was defined both in terms of the activation coefficient (α >31%) and basal ETK activity <0.59 micromoles/min/gHb. Of the 778 infants, median (range) age was 5 (0-12) months, 79.2% were breastfed, 5.1% had α >31% and 13.4% basal ETK<0.59 micromoles/min/gHb. Infants \geq 2 months old had a higher frequency of biochemical markers of thiamin deficiency. Mortality was 5.5% but, among infants \geq 2 months old, mortality was higher in those with basal ETK<0.59 micromoles/min/gHb (3/47, 6.4%) than in those with basal ETK \geq 0.59 micromoles/min/gHb (1/146, 0.7%) (P=0.045, relative risk=9.32 (95%CI 0.99 to 87.5)). Multivariate regression analysis indicated that infant age \geq 2 months and fewer maternal years of schooling were independently associated with infant basal ETK<0.59 micromoles/min/gHb. *Conclusions/significance:* Clinically unapparent thiamin deficiency is common among sick infants (\geq 2 months old) admitted to hospital in Vientiane. This may contribute to mortality and a low clinical threshold for providing thiamin to sick infants may be needed.

Iyengar GV, Kawamura H, Parr RM, Miah FK, Wang JX, Dang HS, Djojsubroto H, Cho SY, Akher P, Natera ES, Nguyen MS. *Appetite*. 2012 Mar 5;58(3):1005-1013. [Epub ahead of print]

Source Nutritional and Health-Related Environmental Studies Section, IAEA, Vienna, Austria.

Erratum in Food Nutr Bull. 2002 Dec;23(4):431. Nguy, Mong Sinh [corrected to Nguyen, Mong Sinh].

In view of the limited data available from the Asian region on the daily intake of nutritionally essential trace elements, a study was taken up, as part of a coordinated research project of the International Atomic Energy Agency, to estimate the daily dietary intake and organ content of some selected trace elements of importance in radiation protection, and also in nutrition. Nine Asian countries--Bangladesh, China, India, Indonesia, Japan, South Korea, Pakistan, Philippines, and Vietnam--which represented more than 50% of the world's population, participated in this study. Analysis of about 700 diet samples was carried out for four major (calcium, potassium, magnesium, and sodium) and eight trace (chromium, cobalt, copper, iron, iodine, manganese, selenium, and zinc) elements using nuclear and other sensitive analytical methods employing neutron activation analysis (NAA), inductively coupled plasma mass spectrometry (ICP-MS), inductively coupled plasma atomic emission spectrometry (ICP-AES), and atomic absorption spectrometry (AAS) techniques. These samples consisted of the total cooked diet, market basket, duplicate diets, and 225 staple foods. Emphasis was placed on the quality assurance and harmonization of the sampling techniques to ensure quality data. Significant inter- and intra-country variations in daily dietary intake of various trace elements were observed. The maximum inter-country variation was observed for iodine intake (factor of more than 45), being highest for Japan and

D3.2 Annotated bibliography of food consumption information in the five SEA countries

lowest for Pakistan. For iron, an important trace element, the variation between the intakes was by a factor of four being lowest for Vietnam and highest for Pakistan.

Ogle BM, Ho Thi T, et al. (2003). "Food, feed or medicine: the multiple functions of edible wild plants in Vietnam." *Economic Botany* 57(1): 103-117.

Many of the edible wild plants that are included in local food baskets have both therapeutic and dietary functions. Such medicinal foods have been part of Eastern medicinal theories since ancient times and have recently received attention in the USA and Europe within the fields of functional foods, nutra-ceuticals and phytic-nutrients. This paper provides an example from Vietnam of the continued use of a multitude of edible wild vegetables. Vietnamese traditional medicine also holds an important position within the health care system and many of the plants that are used have both dietary and medicinal functions. Using a combination of qualitative and quantitative techniques (Rapid Rural Appraisal and Food Frequency Questionnaires), information on over 90 species of edible wild plants was obtained from 4 villages in the Mekong Delta and the Central Highlands. Approximately a third of the plants also had therapeutic roles, forty percentage were used also as livestock feeds and one fifth were used as food, livestock feed or medicine. From a nutrition viewpoint, it is important to pay attention to this group of traditional foods for several reasons. Their direct nutritional contribution is often significant but neglected. Very little is known about the health benefits of regular consumption of small quantities of medicinal foods and an important medicinal role of traditional plant medicines may be the contribution of small quantities of trace minerals and vitamins. The parallel functions as livestock feeds make animal products more accessible to poor households and help improve the quality of their diets.

Olney DK, Talukder A, et al. (2009). "Assessing impact and impact pathways of a homestead food production program on household and child nutrition in Cambodia." *Food and Nutrition Bulletin* 30(4): 355-369.

Impact of a homestead (garden) food production programme in Cambodia on household cultivation and consumption of micronutrient-rich foods was studied, together with effects on maternal and child health and nutrition (intake of micronutrient-rich foods, anthropometric parameters, haemoglobin and anaemia prevalence). 2 cross-sectional surveys (baseline and endline) were used to assess differences between intervention (n = 300) and control (n = 200) households. Pathways of impact of the programme on maternal and child health and nutrition were examined. Households were similar at baseline in socio-demographic characteristics, but more intervention households owned animals, earned income from homestead food production, and produced and consumed micronutrient-rich foods. At endline, some of these differences had widened; more intervention households produced and consumed more vegetables, had higher dietary diversity and lower prevalence of fever among children aged <5 yr. In the intervention group, more children consumed more eggs and more mothers consumed micronutrient-rich food more frequently than in the control group. Greater household production of fruits and vegetables was associated with greater household dietary diversity, which was associated with dietary diversity among mothers and children. It is concluded that the Cambodian homestead food production programme increased household production and consumption of micronutrient-rich foods and maternal and child intake (or frequency of intake) of some of these foods although weaknesses in evaluation design did not allow firm conclusions to be drawn about programme impacts. Analysis of impact pathways showed that household-level benefits from the programme did not translate into significant improvements in maternal and child health and nutrition. It is suggested that careful redesign and renewed assessment of the programme would enhance potential to improve maternal and child health and nutrition outcomes.

Pham Van T, Berger J, et al. (2003). "Regular consumption of NaFeEDTA-fortified fish sauce improves iron status and reduces the prevalence of anaemia in anaemic Vietnamese women." *American Journal of Clinical Nutrition* 78(2): 284-290.

Fish sauce is consumed daily by a large proportion of the Vietnamese population and could therefore be a potentially useful food vehicle for Fe-fortification programmes. The efficacy of Fe-fortified fish sauce in improving the Fe status of anaemic women was investigated. In a randomized, double-masked study of 152 anaemic (haemoglobin concentration. of 81-119 g/l) women, a meal based on noodles or rice was served 6 days/wk with 10 ml fish sauce containing either 10 mg Fe as NaFeEDTA (Fe-fortified group) or no added Fe

D3.2 Annotated bibliography of food consumption information in the five SEA countries

(control group). Concentration of haemoglobin, serum ferritin (SF) and serum transferrin receptor (TfR) were measured at baseline and after 3 and 6 months. Results showed that after 6 months, haemoglobin and SF concentration were higher and TfR concentration was lower in the Fe-fortified group than in the control group (haemoglobin: 116.3 ± 8.7 (x ± s.d. compared with 107.6 ± 11.0 g/l, $P < 0.0001$); SF 30.9 (95% CI: 23.4, 40.6) compared with 14.6 (11.3, 19.0) µg/l, $P = 0.0002$; TfR: 7.2 (6.4, 7.9) compared with 9.0 (8.1, 9.9) mg/l, $P = 0.002$). The prevalence of Fe deficiency (SF < 12 µg/l or TfR > 8.5 mg/l) and Fe deficiency anaemia (Fe deficiency with haemoglobin < 120 g/l) was lower in the Fe-fortified group than in the control group (32.8% compared with 62.5% ($P = 0.0005$) and 20.3% compared with 58.3% ($P < 0.0001$), respectively). It is suggested that fortifying fish sauce with Fe by using a water-soluble, highly bioavailable compound (NaFe EDTA) is a promising strategy for combating Fe deficiency anaemia in Vietnam.

Pham Van T, Berger J, et al. (2005). "The Use of NaFeEDTA-Fortified Fish Sauce Is an Effective Tool for Controlling Iron Deficiency in Women of Childbearing Age in Rural Vietnam." *Journal of Nutrition* **135**(11): 2596-2601.

One cost-effective strategy for controlling iron deficiency is the fortification of staple foods or condiments with iron. We evaluated the effectiveness of fortifying fish sauce with NaFeEDTA for improving iron status in women of childbearing age in Vietnam in a double-blind intervention with randomization by village. All families in the selected villages were supplied with fish sauce that was either unfortified (Group C, 10 villages) or fortified with NaFeEDTA [9 mmol (500 mg) Fe/L, Group F, 11 villages] for 18 mo. The effect of fortification was assessed in the 576 women ($n = 288/\text{group}$) by measuring haemoglobin and serum ferritin (SF) at 6, 12, and 18 mo. Analysis of the group x time interaction using a repeated-measures test for each response demonstrated a significant effect of fortification on haemoglobin ($P = 0.039$) and log SF ($P < 0.0001$) in Group F with no significant changes in Group C. The prevalence of iron deficiency (SF < 12 [µg/L]) decreased from 22.3 to 4.0% and the prevalence of anaemia (haemoglobin < 120 g/L) from 24.7 to 8.5% in Group F with no significant changes in Group C. NaFeEDTA fortification of fish sauce is an effective method for reducing the prevalence of iron deficiency in women in Vietnam.

Ponzetta MT, Paoletti MG (1997). "Insects as food of the Irian Jaya populations." *Ecology of Food Nutrition* **36**(2-4): 321-346.

Insects and terrestrial invertebrates are presumed to have consistently contributed to the diet of our ancestors and it is estimated that 1386 insects are still adopted worldwide for human nutrition. As elsewhere in the tropical world, insects are a part of the diet of Irian Jaya populations. The distribution of insect food consumption on the western side of New Guinea island follows different patterns, according to the environment and to population subsistence economy. In the forest biome of the peripheral mountain areas, many different insect species are collected in small numbers, mainly by women and children. Insect collection occurs by chance but probably helps these subjects, the most vulnerable to possible food-shortages, to complement their diet with some extra proteins and fats. In the western lowlands, a complex cultural system is centered around the traditional staple: sago (Metroxylon sago and rumphii). The pit of this palm, which grows spontaneously in the swampy forest plains, contains a high amount of starch and is easily gathered by the local people. A beetle (*Rhynchophorus ferrugineus papuanus*) is strictly linked to the sago palm and oviposits especially on damaged or felled specimens. Villagers manage the sago palms in order to increase palmworm oviposition and to collect a consistent number of larvae about 6 weeks later. This ancient sago culture, favoured by an abundant and reliable resource, has developed a rich ceremonial life connected with sago larvae consumption. Ecologic, economic and cultural factors influencing the variety of insect consumption modalities are taken into account. The development of local, small-scale invertebrate breeding systems can contribute to the development of sustainable, renewable resources and protect tropical forests from degradation.

Raksakantong P, Meeso N, et al. (2010). "Fatty acids and proximate composition of eight Thai edible terri-colour insects." *Food Research International* **43**(1): 350-355.

Fatty acid composition and proximate analysis of eight terri-colour insects namely dung beetle (*Copris nevinsoni* Waterhouse), short tailed cricket (*Brachytrupes portentosus* Lichtenstein), june beetle (*Holotrichia* sp.), queen caste (*Oecophylla smaragdina* Fabricius), weaver ant (*Oecophylla smaragdina* Fabricius), termite (*Termites* sp.), longan stink bug (*Tessaratomia papillosa*), cicada (*Meimuna opalifera* Walker) were determined. Polyunsaturated fatty acid (PUFA) was the most predominant fatty acid found in all analysed insects, followed

D3.2 Annotated bibliography of food consumption information in the five SEA countries

by saturated fatty acid (SFA) and monounsaturated fatty acid (MUFA). The concentration of total PUFA ranged from 213 in cicada to 1514 mg/100 g in dung beetle. There were five PUFAs; 18:3n - 3, 20:3n - 6, 20:4n - 6, 20:5n - 3 and 22:6n - 3 detected in the insect samples. Two fatty acids, 20:3n - 6, and 20:4n - 6 were found in all analysed insects, while, 20:5n - 3 was only detected in dung beetle which lives in herbivore faeces, at concentration of 300 mg/100 g accounted for 13% of total fatty acid. The SFA content in ranged from 234 in termite to 733 mg/100 g in dung beetle. Only one MUFA, 18:1 was detected in the all analysed insects. The protein content of insects ranged from 37% in queen caste to 54% in dung beetle. The highest amount of carbohydrate (16%) was found in cicada. Lipid contents ranged from 5% in june beetle to 37% in queen caste, while ash contents of edible insects ranged from 2% in queen caste to 12% in june beetle. We suggest that the insect could be considered as a good nutritional food source especially for fat and protein.

Rice AL, Burns JB (2010). "Moving from Efficacy to Effectiveness: Red Palm Oil's Role in Preventing Vitamin A Deficiency." Journal of the American College of Nutrition: 302S-313S.

Vitamin A deficiency is one of the most widespread nutritional deficiencies worldwide. Hundreds of millions of children and tens of millions of women living in Sub-Saharan Africa and Southeast Asia are at particularly high risk of the adverse health consequences associated with this largely preventable condition. Red palm oil comes from oil palms that are traditionally grown in tropical regions of West Africa and are now cultivated on a large-scale commercial basis in Southeast Asia. Red palm oil is the richest naturally occurring source of beta-carotene, a carotenoid that the human body can convert into usable vitamin A (retinol). This paper reviews a series of key intervention studies designed to investigate the impact of using red palm oil-based interventions to improve vitamin A status. These included studies from Africa, Asia, and Latin America in which red palm oil was used (or proposed for use) (1) as a dietary supplement, (2) as an in-home fortificant, (3) to fortify foods used for distribution in targeted supplementary feeding programs, and (4) to fortify staple food products. Overall, the results suggest that red palm oil is highly efficacious in improving vitamin A status among populations at risk of vitamin A deficiency. The time has come to move beyond trials of biological efficacy and focus on conducting operational research projects, effectiveness trials, and cost-benefit analyses that will help expand the use of red palm oil in areas where it is likely to be well accepted but remains underutilized as a dietary source of provitamin A.

Roos N, Thorseng H, et al. (2007). "Iron content in common Cambodian fish species: Perspectives for dietary iron intake in poor, rural households." Food Chemistry **104**: 3.

Iron deficiency is the most widespread nutritional disorder in Cambodia. Sixteen Cambodian fish species were screened for iron, zinc and calcium contents. *Esomus longimanus* has a higher iron content (451 mg Fe/kg dry matter, SD = 155, n = 4) than other species. Iron pools were measured as inorganic iron (I-Fe) by the ferrozine method, haem-bound iron (H-Fe) by the acetone method and total iron (T-Fe) by atomic absorption spectrometry. I-Fe + H-Fe accounted for <50% of T-Fe in *E. longimanus*, indicating a pool of complex bound, probably high-molecular weight non-haem iron (Hm-Fe). In a field study, thirty rural women were interviewed about traditional use of *E. longimanus*; their cleaning and cooking practices were observed and the amounts of fish consumed were recorded and meal samples were collected for iron analysis. Calculations based on the iron content and a high bioavailability of Hm-Fe showed that a traditional fish meal, sour soup, covered 45% of the daily iron requirement for women.

Roos N, Wahab MA, et al. (2007). "Linking human nutrition and fisheries: Incorporating micronutrient-dense, small indigenous fish species in carp poly-culture production in Bangladesh." Food and Nutrition Bulletin **28**(2 SUPPL.): S280-S293.

Background. Fish and fisheries are important for the livelihoods, food, and income of the rural population in Bangladesh. Increased rice production and changing agricultural patterns have resulted in a large decline in inland fisheries. Implementation of carp pond poly-culture has been very successful, whereas little focus has been given to the commonly consumed small indigenous fish species, some of which are rich in vitamin A and minerals, such as calcium, iron, and zinc, and are an integral part of the rural diet. *Objective.* The overall objective of the research and capacity-building activities described in this paper is to increase the production, accessibility, and intake of nutrient-dense small indigenous fish species, in particular mola (*Amblypharyngodon mola*), in order to combat micronutrient deficiencies. The large contribution from small indigenous fish species

D3.2 Annotated bibliography of food consumption information in the five SEA countries

to recommended intakes of vitamin A and calcium and the perception that mola is good for or protects the eyes have been well documented. *Methods.* An integrated approach was conducted jointly by Bangladeshi and Danish institutions, linking human nutrition and fisheries. Activities included food-consumption surveys, laboratory analyses of commonly consumed fish species, production trials of carp-mola pond poly-culture, teaching, training, and dissemination of the results. *Results.* No decline in carp production and thus in income was found with the inclusion of mola, and increased intake of mola has the potential to combat micronutrient deficiencies. Teaching and training of graduates and field staff have led to increased awareness of the role of small indigenous fish species for good nutrition and resulted in the promotion of carp-mola pond poly-culture and research in small indigenous fish species. The decline in accessibility, increase in price, and decrease in intake of small indigenous fish species by the rural poor, as well as the increased intake of silver carp (*Hypophthalmichthys molitrix*), the most commonly cultured fish species, which is poor in micronutrients and not preferred for consumption, are being addressed, and some measures taken by inland fisheries management have been discussed. *Conclusions.* The successful linking of human nutrition and fisheries to address micronutrient deficiencies has relevance for other countries with rich fisheries resources, such as Cambodia and countries in the Lake Victoria region of Africa. © 2007, The United Nations University.

Setalaphruk C and Price LL (2007). Children's traditional ecological knowledge of wild food resources: a case study in a rural village in Northeast Thailand. *J Ethnobiology Ethnomedicine* 3:33-43.

Consuming wild foods is part of the food ways of people in many societies, including farming populations throughout the world. Knowledge of non-domesticated food resources is part of traditional and tacit ecological knowledge, and is largely transmitted through socialization within cultural and household contexts. The context of this study, a small village in Northeast Thailand, is one where the community has experienced changes due to the migration of the parental generation, with the children being left behind in the village to be raised by their grandparents. A case study approach was used in order to gain holistic in-depth insight into children's traditional ecological knowledge as well as patterns of how children acquire their knowledge regarding wild food resources. Techniques used during field data collection are free-listing conducted with 30 village children and the use of a sub-sample of children for more in-depth research. For the subsample part of the study, wild food items consisted of a selection of 20 wild food species consisting of 10 species of plants and 10 species of animals. Semi-structured interviews with photo identification, informal interviews and participatory observation were utilized, and both theoretical and practical knowledge scored. The sub-sample covers eight households with boys and girls aged between 10–12 years old from both migrant families and non-migrant families. The knowledge of children was compared and the transmission process was observed. The result of our study shows that there is no observable difference among children who are being raised by grandparents and those being raised by their parents, as there are different channels of knowledge transmission to be taken into consideration, particularly grandparents and peers. The basic ability (knowledge) for naming wild food species remains among village children. However, the practical in-depth knowledge, especially about wild food plants, shows some potential eroding.

Schmidt M, Lam NT, et al. (2010). Promoting neglected and underutilised tuberous plant species in Vietnam. *Looking east looking west: organic and quality food marketing in Asia and Europe.* R. Haas, M. Canavari, B. Snee, C. Tong and B. Anurugsa. Wageningen, Wageningen Academic Publishers: 183-193.

The re-introduction, management and promotion of neglected and underutilized species (NUS) is highly significant for food security. NUS is also significant to the agricultural diversification and generation of new market opportunities for agricultural products. The use of tuberous NUS in Vietnam is discussed.

Schmidt M, Wei W, et al. (2008). "Ambiguity in a trans-disciplinary stakeholder assessment of neglected and underutilized species in China, Cambodia, Thailand and Vietnam." *Biodiversity and conservation* 17(7): 1645-1666.

Neglected and Underutilized Crop Species (NUS) are grown primarily by traditional farmers in developing countries. They were once more widely grown but are today falling into disuse for a variety of agronomic, genetic, economic and cultural factors. While these crops continue to be maintained by socio-cultural preferences and use practices, most of them remain inadequately characterized and neglected by research and conservation. The aim of our work was to improve the agricultural portfolio by identifying promising neglected and underutilized species in China, Cambodia, north-eastern Thailand and Northern Vietnam. We began with

D3.2 Annotated bibliography of food consumption information in the five SEA countries

preparing a Masterlist containing 260 species, based on farmer interviews and literature review. After an initial pre-selection we identified 17 NUS for China, 13 for Cambodia, 12 for Thailand, and 22 for Vietnam as of highest priority. These NUS then underwent a multi-criteria and trans-disciplinary assessment involving 511 stakeholders such as scientists, farmers, NGOs and policy makers. Based on the assessment we identified the most promising NUS for each country. We also identified some limitations for the promotion of so-called priority NUS regarding to some substantial disagreement between the involved stakeholders. In China and Cambodia, for example, farmers judged the potential of NUS significantly lower than other stakeholders, and in Vietnam scientists and policy makers had substantially different opinions on NUS compared to farmers. Addressing these ambiguous views will be highly relevant to the development of an improved agricultural portfolio.

Sethi P, Kulkarni PR (1995). *Leucaena leucocephala*: a nutrition profile. *Food and Nutrition Bulletin* **16**(3): 224-237. *Leucaena leucocephala* belongs to the Leguminosae family and is one of the fastest-growing leguminous trees. Its foliage is used as animal feed, and its leaves and seeds are used as human food in Central America, Indonesia and Thailand. A nutritional profile of *L. leucocephala* is presented. Aspects considered include: nutritive value of *Leucaena* forage; chemical composition and nutritive value of *Leucaena* seeds; *L. leucocephala* as an animal (cattle, sheep, goats) feed; *Leucaena* as human food; mechanism of mimosine (the toxic, non-protein amino acid in *Leucaena*) toxicity; and possible solutions to mimosine toxicity.

Soukaloun D, Lee SJ, Chamberlain K, Taylor AM, Mayxay M, Sisouk K, Soumphonphakdy B, Latsavong K, Akkhavong K, Phommachanh D, Sengmeuang V, Luangxay K, McDonagh T, White NJ, Newton PN. Erythrocyte transketolase activity, markers of cardiac dysfunction and the diagnosis of infantile beriberi. *PLoS Negl Trop Dis*. 2011 Feb 22;5(2):e971. Wellcome Trust-Mahosot Hospital-Oxford Tropical Medicine Collaboration, Microbiology Laboratory, Mahosot Hospital, Vientiane, Lao People's Democratic Republic.

Background: Infantile beriberi is a potentially lethal manifestation of thiamin deficiency, associated with traditional post-partum maternal food avoidance, which persists in the Lao PDR (Laos). There are few data on biochemical markers of infantile thiamin deficiency or indices of cardiac dysfunction as potential surrogate markers. *Findings:* A case control study of 47 infants with beriberi and age-matched afebrile and febrile controls was conducted in Vientiane, Laos. Basal and activated erythrocyte transketolase activities (ETK) and activation (α) coefficients were assayed along with plasma brain natriuretic peptide, N-terminal pro-brain natriuretic peptide and troponin T. Basal ETK (and to a lesser extent activated ETK) and plasma troponin T were the only infant biochemical markers that predicted infantile beriberi. A basal ETK \leq 0.59 micromoles/min/gHb gave a sensitivity (95%CI) of 75.0 (47.6 to 92.7)% and specificity (95%CI) of 85.2 (66.3 to 95.8)% for predicting infantile beriberi (OR (95%CI) 15.9 (2.03-124.2); $p = 0.008$) (area under ROC curve = 0.80). In contrast, the α coefficient did not discriminate between cases and controls. Maternal basal ETK was linearly correlated with infant basal ETK (Pearson's $r = 0.66$, $p < 0.001$). The odds of beriberi in infants with detectable plasma troponin T was 3.4 times higher in comparison to infants without detectable troponin T (OR 3.4, 95%CI 1.22-9.73, $p = 0.019$). Detectable troponin T had a sensitivity (95%CI) of 78.6 (59.0 to 91.7) % and specificity (95%CI) of 56.1 (39.7 to 71.5) % for predicting infantile beriberi.

Suthasupa, P. and V. Ratianapanone (1982). Protein food production in Thailand: an evaluation of a project in two Lamphun villages. *Research Notes and Discussion Series, Institute of Southeast Asian Studies, Singapore*. 1982. 37, xi + 100pp.

The study evaluates the national food and nutrition programmes of Thailand, especially protein food production for consumption at the village level in Lamphun, with a view towards improving the effectiveness of such programmes in the future. The specific objectives of the project, upon which this report is based, are to promote local production of protein-rich and other nutritious foods and to educate the farm family in food and nutrition, especially the housewives and pregnant or lactating mothers. The study is divided into four sections. Section 1 provides an introduction to the significance of the food and nutrition problem in Thailand, and the objectives and methodology of the project. Section 2 examines the determinants of food habits of farm households in the survey villages, including ecological, structural, economic and cultural factors. Section 3 evaluates the Protein Food Production for Consumption Project. Section 4 presents some conclusions.

D3.2 Annotated bibliography of food consumption information in the five SEA countries

Thavarajah D, Thavarajah P et al. (2009). "Lentils (*Lens culinaris* Medikus Subspecies *culinaris*): A Whole Food for Increased Iron and Zinc Intake." *Journal of agricultural and food chemistry* **57**(12): 5413-5419.

Micronutrient malnutrition, the hidden hunger, affects more than 40% of the world's population, and a majority of them are in South and South East Asia and Africa. This study was carried out to determine the potential for iron (Fe) and zinc (Zn) biofortification of lentils (*Lens culinaris* Medikus subsp. *culinaris*) to improve human nutrition. Lentils are a common and quick-cooking nutritious staple pulse in many developing countries. We analysed the total Fe and Zn concentrations of 19 lentil genotypes grown at eight locations for 2 years in Saskatchewan, Canada. It was observed that some genetic variation exists for Fe and Zn concentrations among the lentil lines tested. The total Fe and Zn concentrations ranged from 73 to 90 mg of Fe kg⁻¹ and from 44 to 54 mg of Zn kg⁻¹. The calculated percentages of the recommended daily allowance (RDA) for Fe and Zn were within the RDA ranges from a 100 g serving of dry lentils. Broad-sense heritability estimates for Fe and Zn concentrations in lentil seed were 64 and 68%, respectively. It was concluded that lentils have great potential as a whole food source of Fe and Zn for people affected by these nutrient deficiencies. This is the first report on the genetic basis for Fe and Zn micronutrient content in lentils. These results provide some understanding of the genetic basis of Fe and Zn concentrations and will allow for the development of potential strategies for genetic biofortification.

Vuong LT (2000). "Underutilized beta-carotene-rich crops of Vietnam." *Food and Nutrition Bulletin* **21**(2): 173-181.

Solutions to micronutrient deficiencies that capitalize upon indigenous resources and foodstuffs offer a long-term mechanism for elevating the health status of disadvantaged people. In populations where intakes of animal foods are inadequate and food sources of retinol are not economically possible, efficient use of carotene-rich plants may prevent vitamin A deficiency. In Vietnam the gac (*Momordica cochinchinensis* Spreng) is an excellent source of beta-carotene (17-35 mg/100 g of edible portion). This gourd is familiar to indigenous people and is easy to grow. However, it has been underutilized because it is available only 3 months a yr, there have been no efforts to educate the at-risk population about its nutritional benefit, and research efforts in production or preservation techniques have been lacking. This paper describes the vegetable, compares its composition and nutritional value with that of familiar carotenoid-rich fruits and vegetables, details its traditional usage in preparing rice, and discusses the acceptance of this rice preparation (xoi gac) by Vietnamese children in their daily diet.

Vuong LT, Dueker SR, et al. (2002). "Plasma beta -carotene and retinol concentrations of children increase after a 30-d supplementation with the fruit *Momordica cochinchinensis* (gac)." *American Journal of Clinical Nutrition* **75**(5): 872-879.

Background: In rural Vietnam, vitamin A deficiency is a concern. Among the indigenous fruit and vegetables, *Momordica cochinchinensis* (gac) fruit has been identified as having the highest beta -carotene concentration. Locally, it is mixed with rice in a preparation called xoi gac. *Objective:* The purpose of this study was to assess this beta -carotene-rich rice preparation as a source of provitamin A for children in rural Vietnam [date not given]. *Design:* Preschoolers (n=185) participated in a 30-day controlled supplementation trial. Children with low haemoglobin concentrations were assigned to 1 of 3 groups: a fruit group, who received xoi gac that contained 3.5 mg beta -carotene per serving; a powder group, who received rice mixed with 5.0 mg synthetic beta -carotene powder; and a control group, who received rice without fortification. *Results:* The mean increase in plasma beta -carotene concentrations in the fruit and powder groups was significantly greater than that in the control group (P<0.0001). After supplementation, the mean plasma retinol concentration in the fruit group was significantly higher than that in the control (P=0.006) and powder (P=0.0053) groups. Among the children with initial haemoglobin concentrations ≤110 g/litre, the mean increase in haemoglobin concentrations in the fruit group was marginally higher than that in the control group (P=0.017), but was not significantly different from that in the powder group. *Conclusions:* beta -Carotene from xoi gac is a good source of provitamin A carotenoids. Severely anaemic children might particularly benefit from routine xoi gac consumption.

Vuong LT, King JC (2003). "A method of preserving and testing the acceptability of gac fruit oil, a good source of beta -carotene and essential fatty acids." *Food and Nutrition Bulletin* **24**(2): 224-230.

Gac fruit (*Momordica cochinchinensis*) is indigenous to Vietnam and other countries in South-east Asia. Its seed

D3.2 Annotated bibliography of food consumption information in the five SEA countries

pulp contains high concentrations of carotenoids, especially the provitamin A, beta -carotene. In northern Vietnam, gac fruits are seasonal and are mainly used in making a rice dish called xoi gac. The purpose of this study was to develop a method to collect and preserve gac fruit oil, to evaluate the nutritional composition of the oil, and to assess the acceptability of the gac oil by typical Vietnamese homemakers. One hundred women from Vietnam participated in training to learn how to prepare the fruits and operate the oil press [date not given]. The women also participated in a survey of gac fruit use and their habitual use of animal fat and vegetable oil. Among all the participants in the training and surveys, 35 women actually produced oil from gac fruits grown in the village, using manual oil presses and locally available materials. The total carotene concentration in gac fruit oil was 5700 micro g/ml. The concentration of beta -carotene was 2710 micro g/ml. Sixty-nine percentage of total fat was unsaturated, and 35% of that was polyunsaturated. The average daily consumption of gac fruit oil was estimated at 2 ml per person. The daily beta -carotene intake (from gac fruit oil) averaged approximately 5 mg per person. It was found that gac oil can be produced locally by village women using manual presses and locally available materials. The oil is a rich source of beta -carotene, vitamin E, and essential fatty acids. Although the beta -carotene concentration declines with time without a preservative or proper storage, it was still high after three months. The oil was readily accepted by the women and their children, and consumption of the oil increased the intake of beta -carotene and reduced the intake of lard.

Yeoh HH, Wong PFM (1993). "Food value of lesser utilised tropical plants." *Food-Chemistry (United Kingdom)* **46**(3): 239-241.

Protein contents, amino acid compositions and other nutritional and anti-nutritional factors in leaves of *Asystasia gangetica*, *Asystasia nemorum*, *Kaempferia galanga*, *Mentha arvensis* and *Piper sarmentosum* were determined. The analyses showed that these lesser utilised plants were rich in protein, had a good complement of amino acids, and a favourable amount of minerals, sugars, lipids and fibre. Furthermore, anti-nutritional factors, such as trypsin and chymotrypsin inhibitors, and cyanide, were not detected. Overall, these plants represented a potential food source with high protein content and good nutritive value. Fermented soyabean and vitamin C-rich fruit: a possibility to circumvent the further decrease of iron status among iron-deficient pregnant women in Indonesia.

Wijaya-Erhardt M, Muslimatun S, Erhardt JG. Public Health Nutrition: page 1 of 12

doi:10.1017/S1368980011000954 Public Health Nutr. 2011 May 24;1-12. [Epub ahead of print]

Objective: Increasing the consumption of Fe-rich foods and thus improving Fe bioavailability without significantly increasing diet cost is the most sustainable intervention for improving Fe intake. We assessed the effect of supplementary food consisting of fermented soyabean (tempeh) and vitamin C-rich fruit consumed during pregnancy on maternal iron deficiency (ID). *Design:* Pregnant women were randomly allocated by village into optimized diet and control groups. Supplementary food was given 6 d/week at home. The average weekly food provided comprised 600 g of tempeh, 30 g of meat, 350 g of guava, 300 g of papaya and 100 g of orange. Hb, ferritin and transferrin receptor (TfR) concentrations were measured at 12–20 and at 32–36 weeks of gestation. *Setting:* Thirty-nine villages in Indonesia. *Subjects:* Pregnant women (12–20 weeks of gestation, n 252). *Results:* At baseline, mean Hb, ferritin and TfR concentrations and body Fe concentration were within the normal range and did not differ between groups. At near term, mean Hb, ferritin and body Fe decreased, whereas mean TfR increased significantly in both groups. The mean changes in Fe status were similar in both groups. In Fe-deficient women, consumption of an optimized diet was associated with smaller decreases in Hb (1.02 (95% CI 0.98, 1.07) g/l; P=0.058), ferritin (1.42 (95% CI 1.16, 1.75) mg/l; P=0.046) and body Fe (2.57 (95% CI 1.71, 3.43) mg/kg; P=0.073) concentrations, compared with a state of no intervention. Fe-deficient women at baseline benefited more from supplementary food compared with Fe-replete women. *Conclusions:* Daily supplementary food containing tempeh and vitamin C-rich fruits during pregnancy might have positive effects on maternal ID.

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