Review Article

Thailand nutrition in transition: situation and challenges of maternal and child nutrition

Pattanee Winichagoon PhD

Institute of Nutrition, Mahidol University, Thailand

Double burden of malnutrition (DBMN), the coexistence of under- and overnutrition in the same population, is an emerging public health concern in developing countries, including Thailand. This paper aims to review the maternal and child nutrition situation and trends as the country moved from a low-income to a middle-income country, using data from large scale national surveys. Protein-energy malnutrition and micronutrient deficiencies predominantly affected mothers and children prior to the 1980s. The situation greatly improved during the 1980s-1990s, with the implementation of multi-sectoral policies and programs focusing on poverty alleviation and primary health care. Economic development, improved access to health services and effective community-based nutrition programs contributed to these positive trends. However, the prevalence of low birth weight remained at 8-10%, while stunting and underweight declined to about 10% by the 1990s, with small change thereafter. The prevalence of anemia among pregnant women and children decreased by half and vitamin A deficiency is no longer a public health problem. Iodine deficiency, especially during pregnancy is still a major concern. As the country progressed in terms of economic and social development, overnutrition among women and children affected all socio-economic levels. Changes in lifestyles, food access and eating patterns are observed both in urban and rural areas. Although efforts have been made to address these challenges, harmonized policy and strategic programs that address DBMN in the complex social and economic environment are urgently needed. Early life undernutrition should be considered along with measures to address obesity and chronic diseases in children.

Key Words: mothers, children, early life, nutrition transition, Thailand

INTRODUCTION

Thailand is known for its successful nationwide community-based nutrition program implemented during the 1980s to mid-1990s.[1-3] By mid-1990, industrial development to boost economic growth took precedence over health and social welfare. The wave of globalization and developments in communication technology brought about rapid changes in the lives and well-being of the Thai people. Thailand enjoys the reputation as a success story in nutrition, having achieved marked reductions in protein-energy malnutrition and micronutrient deficiencies among children and women within two decades. The change in lifestyle from agricultural to non-agricultural industrial occupations (such as, food, garments, information technology (IT) factories) resulted in a shift from labor-intensive rural farm work activities to sedentary factory work or office clerical work. As in other rapidly industrializing countries, the rise of overnutrition and its consequent health effects changed the nutrition and health situation of the Thai people.

The aim of this paper is to examine the current nutrition situation using information from national nutrition and health surveys in Thailand, focusing on the status of children and women. It will also review the existence of both under- and over –nutrition and implications for policy and research for the country.

METHODS

Information on the prevalence and trends of key nutritional problems were obtained from nationally representative surveys. These are the national food and nutrition surveys (NNS series) and national health examination surveys (NHES series) and the multiple indicator cluster survey (MICS). Findings from relevant small scale studies (such as intervention studies) complemented the information obtained from nationwide surveys. Since the data used in this report were compiled from publications or reports which are available in the public domain, ethical clearance is not needed.

Sources of data

National Nutrition Survey

The National (Food and) Nutrition Survey (NNS) was first conducted in 1960 among military and civilian populations.[4] The sampling population consisted of households with children under 5 years old. All pregnant and lactating women in the same families or community were included.

Corresponding Author: Dr Pattanee Winichagoon, Institute of Nutrition, Mahidol University, Phutthamonthon 4 Rd, Salaya, Nakhon Pathom, Thailand, 73170.
Tel: 66-2-800-2380; Fax: 66-2-441-9344
Email: pattanee.win@mahidol.ac.th
Manuscript received 22 August 2012. Initial review completed 3 October 2012. Revision accepted 13 October 2012.
doi: 10.6133/apjcn.2013.22.1.17

Subsequent surveys were conducted approximately every 10 years.[5-7]

National Health Examination Survey

The first National Health Examination Survey (NHES) was conducted in 1991, focusing on the health status of the population above 15 years of age.[8] Health status and risk factors for non-communicable diseases (physical, biochemical and questionnaire) were reported in all NHES's. Data on children's nutritional status were limited in the first 3 surveys, but were more extensive in the fourth NHES.[9-11] In this latest survey, the food consumption and dietary intakes (using 24-h recalls and food frequency questionnaires) of different age groups, as well as child anthropometry, feeding practices and urinary iodine excretion (UIE) of children aged 1-14 years old were included.[12,13]

Multiple Indicator Cluster Survey

The Multiple Indicator Cluster Survey (MICS) was conducted by the National Statistics Office with support from UNICEF.[14] This survey provided additional data on maternal and child nutrition, focusing on child health and nutritional status and child feeding.

RESULTS

Country demographic and economic status

Thailand has a population of about 64 million people as of 2010[15] with a relatively high literacy rate of >90%. The population is projected to decline in the next two decades. The successful family planning program in the country resulted in the latest population growth rate of 0.8 %. In 2009, fertility rate was 1.6%, with a birth rate of 13.87 children per 1000 population. Annually, there have been about 800,000 births. The proportion of children under 5 years old is 6% of the total population. In 2010, the proportion of elderly was 12%. This number is projected to rise to 16% by 2020. Life expectancy at birth is 70 and 78 years old for males and females, respectively.

According to World Bank criteria, national economic development since the 1990s raised the country ranking in economic terms to a middle-income country. Economically, Thailand had a record annual growth rate of 9% during 1985-1995. Since the Asian economic crisis in 1997, Thailand has recovered with an annual growth rate of 5-7 %. The GDP per capita was USD 8,500 as of 2010, and 15 provinces with the lowest GDP were all in the northeastern region.[16]

Maternal and child malnutrition – Thailand success story

Since 1982, the nationwide implementation of Thailand's Poverty Alleviation Plan (PAP) in conjunction with Primary Health Care (PHC) has led to improved access and quality of health care even in rural poor areas.[19] Explicitly formulated interventions for maternal and child nutrition resulted in significant declines in malnutrition among mothers, infants and children under five. Reduction in mortality and morbidity due to common infections such as diarrhea and respiratory illness was also achieved. Currently, these rates are much lower than those in most developing countries.

Using data from MICS, Limwatananon *et al*, (2010)[20] examined the equality of various health indicators relating to mothers and children. They observed that stunting and teenage pregnancy concentrated among the poor, whereas incidences of diarrhea and respiratory infections were similar regardless of socioeconomic status. Child immunization and family planning services were equitably distributed across socioeconomic groups. A slight but negligible gap was observed between the poor and the rich in terms of coverage of prenatal care and child delivery by skilled personnel. Overall, the coverage of prenatal care and child delivery services was >95%, and the urban-rural gap for several health and health care indicators was quite small. This finding indicates that achievements made during the earlier two decades have been sustained.

Protein-energy malnutrition in women and children

Low birthweight (LBW)

In the 1980s, the prevalence of LBW in Thailand was about 12%, with some geographical differences.[22] The prevalence of LBW declined throughout 1990-2000 and has remained at 8-9%.[23,14] Data from MICS 2006, which included 98.7% of babies weighed at birth, showed that LBW prevalence was 9.2% with no significant difference by residential area and maternal education. There was a slight difference between poor and rich households (10% vs 8.5%, respectively). In some remote areas, very high prevalences of LBW (i.e., 20-25%) were observed.

In a cohort study, Isranurug *et al* (2007) reported that maternal age (<20 and >35 y; RR = 1.85, 95% CI:1.47-2.33), maternal height (<145 cm; RR = 2.29, 95% CI: 1.57-3.34) and pregnancy weight gain (<10 kg, RR = 1.67, 95% CI: 1.24-2.26) were significant contributors to LBW.[24] Thirteen percent of mothers in this study were teenagers. Teenage mothers had higher rates of LBW (15.5%) compared to older mothers (8.8%).[25] Due to uncertainty in gestational estimation, lack of data on pre-pregnancy weight to accurately determine weight gain during pregnancy, and increased prevalence of teenage pregnancy, further investigation into the potential causes of low birth weight should be done to identify appropriate interventions.

Protein-energy malnutrition among children under five

Figure 1 presents the trend of stunting, wasting and underweight among children under five since 1987. Based on NCHS references or WHO growth standards, the prevalences of stunting and underweight have substantially declined since 1987, but remained at 10-12% for stunting and 10-15% for underweight during the past two decades. Wasting has been relatively low (5%) and no severe malnutrition among young children has been reported as a public health problem since the late 1980s. Despite the economic crisis that hit Thailand in 1997, rates of both stunting and underweight did not increase.[26] The prevalence of low birth weight increased slightly (from 8.2% in 1996 to 8.7% in 1998). There was a slight upward trend in school child underweight prevalence (14.9% in 1997), but this level decreased to 12.5% in the subsequent year.

Cross-sectional and longitudinal studies consistently showed that the prevalence of stunting increased after the

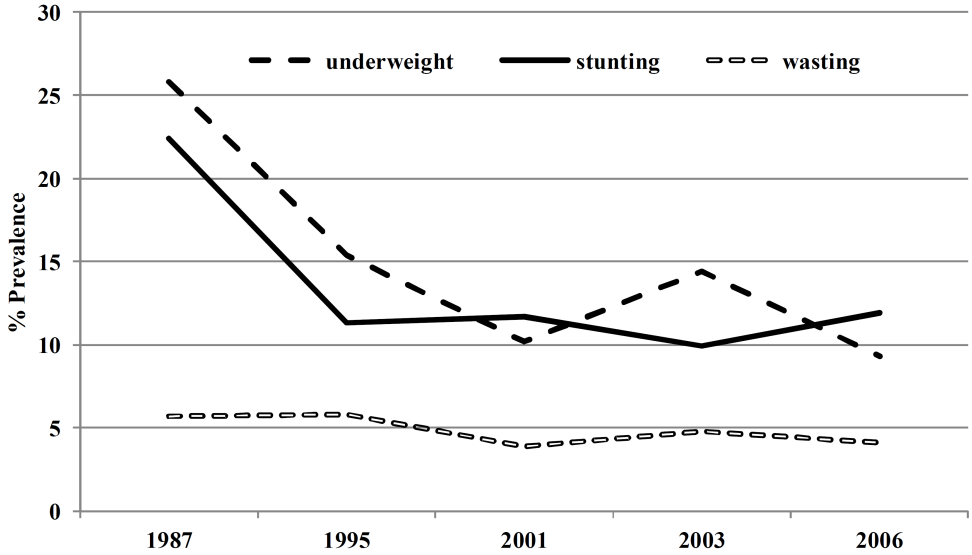

Figure 1. Trend of nutritional status of children under five in Thailand based on national representative surveys using NCHS growth reference or WHO growth standard. Sources: 1. Thailand Demographic and Health Survey 1987[27]; 2. National Nutrition Survey, Thailand 1995[6]; 3. Holistic Development of Thai children, 2001[28]; 4. National Nutrition Survey, Thailand 2003[7]; 5. Multiple Indicator Cluster Survey, Thailand 2006.[14]

first six months and was highest at 24 months of age.[14,29] The MICS showed that the highest stunting prevalence was at age 12-23 months, and there were no gender differences. A similar pattern was reported in a cohort study of Thai children from four geographical districts and Bangkok.[29] Children were weighed every 6 months during the first two years of age. The prevalence of stunting based on WHO growth standards rose from birth to six months (i.e., 6% to 6.9%), and increased rapidly at 12, 18 and 24 months (i.e., 9%, 14.6%, and 16.8%, respectively).[29] It was speculated that low breastfeeding rates after the first year and poor hygiene related to early provision of foods and drinks could have explained this pattern.

Infant and young child feeding practices

Breastfeeding. For most Thai mothers, breastfeeding is the mode of feeding infants right after birth. The MICS (2006) reported that about 85% of mothers breastfed their babies within one day of birth.[14] However, the rate of exclusive breastfeeding was only 7.6% for 3 months and 5.4% for 6 months. After 6 months, less than half (42.6 %) of the babies received solid or semi-solid food in addition to breast milk. Breastfeeding drastically declined in the second year, i.e., 31.6% and 18.7% of mothers breastfed at 12-15 months and 20-23 months, respectively.

The most recent child health survey showed that the rate of exclusive breastfeeding for 6 months was 7.1% while that for 3 months was 31%.[13] Water was customarily given to babies along with breast milk as it was perceived necessary in the hot climate of Thailand. Factors that contributed to unsuccessful breastfeeding were inadequate breast milk, mother's working status, and traditional practices that accompanied the early introduction of semi-solid and solid food. Maternal nutrition was generally improved with the high coverage of prenatal care, and food taboos and traditional practices of withholding nutritious foods appeared to be disappearing.[7]

A study in a university hospital child care unit in northern Thailand found that working mothers were less likely to breastfeed and the duration of breastfeeding was shorter. Seventy five percent of mothers who participated in the study were employed.[30,31] Only eighteen percent of employed women had a job which can be done at home. The majority of working women spent about 10 hours away from home. Among non-working women, the prevalence of breastfeeding at 3, 6, and 12 months postpartum was 94%, 86%, and 66%, respectively. Among working mothers, breast feeding prevalences for the same period were 72%, 46% and 25%, respectively.

Complementary feeding. In terms of complementary feeding, a large survey indicated that the introduction of solid foods and powdered milk occurred at an average age of 4 months.[13] In a child cohort study in 4 districts,[29] rice and banana were habitually given to infants within the first few months (Mo-suwan, L and Chittchang U, unpublished report). The timing of introduction of different foods varied by location. Rice and animal source foods were both introduced at around 4 months of age in Bangkok and in the northern district town. In the other four areas (all rural), rice was given early but animal food sources were delayed until the babies were 6 months to one year old.

The fourth health examination survey (2008-9) showed that meat, fish and egg are key protein sources for children aged 2-5 years.[12] Soybean milk was commonly consumed but pulses and nuts were not frequently eaten. Consumption of fruits and vegetables was low. The median intakes of vegetables among the age groups 1-3 years and 4-5 years were 20 and 30 g, respectively for boys, and 7 and 16 g, respectively for girls. Fruit intakes were quite low, with a median of <1 g/day for all age and gender groups. In addition, per capita intakes of fat and protein as percentage of total energy intakes showed an increasing trend (Figure 2a). Various national nutrition surveys since 1986 showed that preschool children's percentage energy consumption from fat has been consistently above 20%, percentage energy consumption from pro-

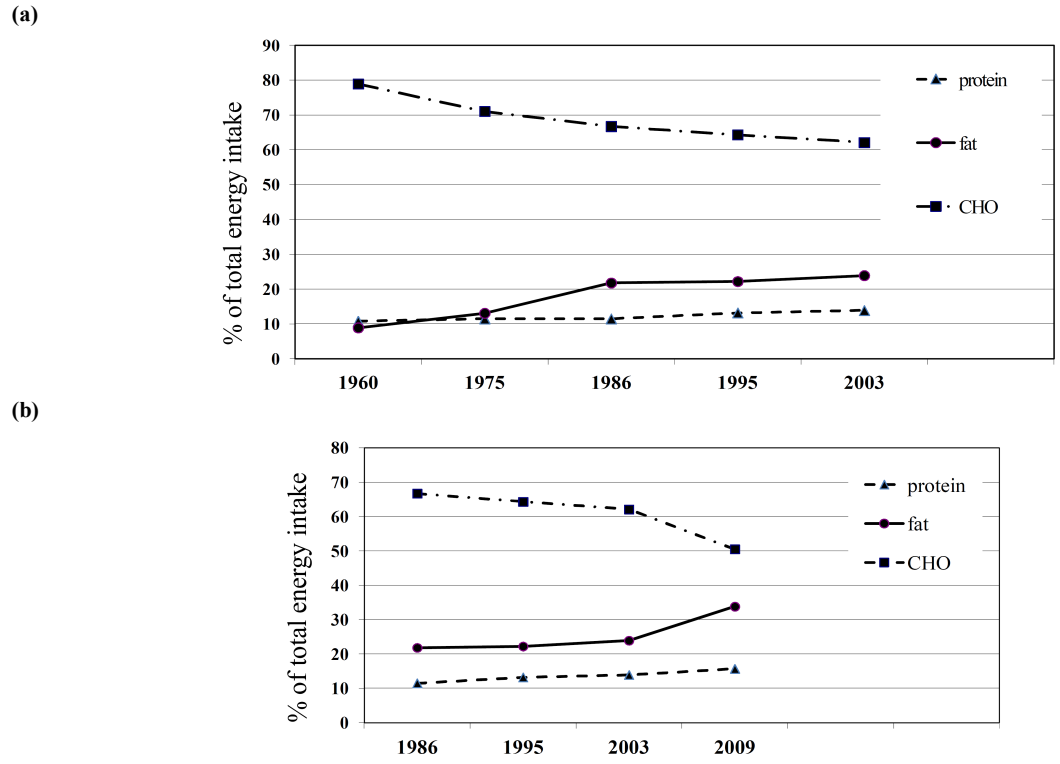

Figure 2. Percent of caloric distribution of macronutrient (protein, fat and carbohydrates) intakes in Thai diets (a) per capita; (b) preschool children from: 1960-2009. Sources: 1. National nutrition survey, ICNND, 1960 [4]; 2. Per capita intakes are from National Nutrition surveys (1975, 1986, 1995 and 2003)[5-7] for most surveys, except NNS5 (2003) which was for 15-59 year olds; Intakes of preschool children from National Nutrition surveys (1975, 1986, 1995, 2003) and National Health Examination survey (2008-9).[12]

tein increased only in the NHES4 (2008-9), and percentage energy consumption from carbohydrates decreased markedly (Figure 2b).[5-7, 12]

Micronutrient deficiencies

Iron deficiency and anemia

Anemia due to iron deficiency has been identified as a major public health problem in Thailand, and listed as a priority nutritional problem to be tackled in all national nutrition policies.[2]Iron and multivitamin supplementation is the main strategy to address maternal anemia.[32] Increased access to prenatal care and iron supplements helped improve the coverage and compliance to iron supplementation during pregnancy. Anemia prevalence in pregnant and lactating women declined from about 40% in 1986 (NNS3) to approximately 15% in 1995 (NNS4).[5,6] However, in 2003 (NNS5), the prevalence of anemia increased to 26% and 30% in pregnant and lactating women, respectively, while anemia among reproductive age women was 18.6% (Figure 3).[7]

During the period 1986-2003, the prevalence of anemia among children under five declined even though no supplementation program was implemented. It could only be speculated that the reduction of common infections due to effective implementation of primary health care programs, deworming, and improved diets may have contributed to this improvement. Recent field intervention studies on micronutrients showed that iron deficiency only contributes 10-25% of anemia in Thailand.[33-35]Other factors, namely, hemoglobinopathy and marginal vitamin A deficiency were also significantly associated with haemoglobin in children.[33]

Iodine deficiency

Data on urinary iodine excretion indicated that iodine intakes may be inadequate in some populations, specifi-

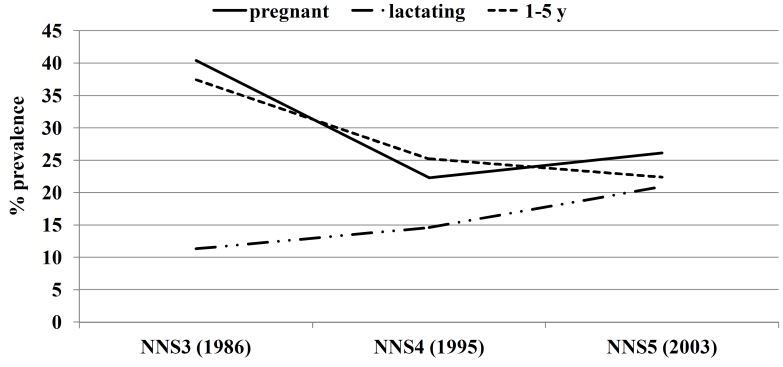

Figure 3. Prevalence of anemia among pregnant & lactating women and children under five. Sources: National Nutrition survey, 1986, 1995 and 2003.[5-7]

Table 1. Distribution of urinary iodine excretion (UIE) among preschool children and children aged 1-14 years

UIE, µg/L / Age, y	Prevalence, %					
	≤ 20	20-49	50-99	100-199	200-299	≥300
Preschoolers, years						
Boys 1	0.08	4.8	17.2	37.5	19.0	21.5
Boys 2-5	1.66	4.2	15.9	41.8	15.7	20.6
Girls 1	0.62	2.5	21.6	35	19.9	20.4
Girls 2-5	1.31	3.94	25.6	33.1	20.6	15.5
Age groups, years						
1	0.8	4.5	16.6	39.4	17.5	21.1
2-5	1	3.2	23.5	34.1	20.3	18.1
6-9	1.3	6.5	27	36.9	16.6	11.8
9-14	1.5	7.2	33.4	36.7	12.6	8.6

Source: The Fourth National Health Examination Survey, NHES4, Child Health, 2008-9.[13]

cally, pregnant women. Cyclical monitoring of urinary iodine excretion (UIE) of pregnant women utilizing prenatal services is conducted regularly (5 years for each round, with a sampling of 15 provinces/year). Almost half of the women examined had low UIE. In 2001, the first round of cyclical monitoring showed that over 40% of pregnant women had UIE <100 µg/L. The next round of monitoring (2006-2009), using the WHO new recommended cut-off for pregnancy (median <150 µg/L), showed that the prevalence of UIE below median was >50%.[36] A study among matched pairs of pregnant women and school-age children in central Thailand showed that pregnant women had lower median [range] UIE (108 [11–558] µg/L) compared to their school-aged children (200 [25–835]µg/L).[37] Another study using neonatal thyroid stimulating hormone (TSH) indicated that iodine deficiency disorder (IDD) is highly prevalent among pregnant women in Thailand.[38]

The most recent data collected in 2008-2009 showed that median UIE levels of children aged one year and 2-5 years old were 190 and 178 µg/L, respectively and the distribution appeared to be skewed towards high UIE values (Table 1).[13] The prevalence of UIE <100 µg/L among girls aged 1-5 years was 24.5-31%, slightly higher than that for boys (i.e.,~22%). The prevalence of UIE >200 µg/L was 30-40% for both boys and girls. A shift in distribution of UIE was observed wherein the prevalence of UIE <100 µg/L increased with age, while the prevalence of UIE >200 µg/L decreased with age. It is possible that young children who attended day care centers and primary schools received lunch and milk programs which used or contained iodized salt. Furthermore, iodization of drinking water in these schools in some areas may have provided higher amounts of iodine to young children.

Hence, while iodine intakes among children are adequate, low iodine levels among pregnant women is of serious concern since this is the critical period for fetal brain development. In 2010, the Ministry of Public Health (MOPH) implemented a new strategy for IDD, wherein iodine in addition to iron and other multi-vitamin/mineral supplements are given to pregnant women who attend the ante-natal clinic. For the general population, strategies include improved quality of iodized salt and legislation for iodine fortification of condiments (fish sauce and soy sauce).

Other micronutrient deficiencies

Vitamin A. Recent data indicate that vitamin A deficiency (VAD) is no longer a public health problem in Thailand. Food-based and holistic integrated nutrition programs may have contributed to the reduction of VAD. A survey in north and northeast Thailand found that the prevalence of marginal vitamin A deficiency among school and preschool children was 20%.[39,40] A recent study showed that 3% of school children had deficient serum vitamin A levels (<0.7 µmol/L) and 20% had low levels (<1.05 µmol/L). In the national nutrition survey (NNS5, 2003), only 2% of reproductive age women were found to have vitamin A deficiency.[8]

Zinc. It is not known whether zinc deficiency is a public health problem due to lack of appropriate indicators to define deficiency. The use of serum zinc concentration has been tentatively suggested by IZiNCG.[41] Two studies in infants and school children showed that 25% of young infants (4-6 months) and 57% of school-aged children (6-12 years) had serum zinc concentration in the deficient range.[35,42]

Remaining issues and emerging concerns in maternal and child nutrition

Early life nutrition, cognition and risk of diet related chronic disease in later life

Nutrition during the fetal period and throughout the first two years influences cognitive function and development of non-communicable chronic diseases in later life. Micronutrient deficiencies, namely iron, iodine and essential fatty acids, are shown to contribute to cognitive development and function, both in the short- and long-term.[43-46] A recent study in Thailand showed that growth in length during the prenatal and early infancy period significantly determined cognitive ability at 9 year.[47] The consequences of early life malnutrition (both under- and over-nutrition) include hypertension, diabetes and cardiovascular disease.[48-51] These issues are relevant to Thailand, as it transitioned from a low income country with a high prevalence of maternal and child undernutrition prior to the 1980s, to a more affluent country since the 1990s. This economic transition was accompanied by the reduction of severe maternal and child undernutrition, while stunting and subclinical multiple micronutrient deficiencies re-

Table 2. Prevalence of overweight/obesity by BMI and central obesity based on waist circumference among Thai adults

Indicators	Prevalence of overweight/obesity (%)						
	15-29	30-44	45-59	60-69	70-79	≥80	Total
BMI †							
Males	18.5	32.2	33.7	26.4	18.6	11.3	28.4
Females	20.6	44.2	50.6	43.1	31.3	13.9	40.7
Waist circumference							
Males ‡	11.6	17.4	23.3	23.3	20	13.4	18.6
Females §	26.5	43.9	54.9	53.3	45.1	28.6	45

Source: The Fourth National Health Examination Survey, NHES4, 2008-9.[11]
† ≥ 25 kg/m^2
‡ > 90 cm
§ > 80 cm

main. Optimal nutrition from fetus through the early years should be a national agenda.

Childhood obesity and metabolic syndrome

Childhood obesity is of increasing concern in Thailand. Large scale surveys conducted after 2000 showed that overweight and obesity prevalence is 8-20% among preschool children, and 5-16% among school-aged children.[52] The prevalence of overweight and obesity was higher among adolescents than among younger school-aged children. However, in these reports, different growth references (Thai or NCHS or WHO) and classification systems (either +2SD or >97 percentile as cut-offs) were used, making comparisons difficult. Using International Obesity Task Force (IOTF) criteria, the NHES4 (2008-2009) found that prevalences of overweight and obesity among preschool (2-4 years) and school-aged (6-14 years) children were comparable to those of developed countries in the region. Prevalence of overweight and obesity among pre-schoolers was 13.2% for both boys and girls; among school-age children, the prevalence was 16.7% for boys and 15.2% for girls.[13]

Data on the prevalence of the metabolic syndrome among overweight and obese children are limited. Nevertheless, Iamopas *et al* (2011)[53] found that 17% of 89 obese children attending a hospital in Bangkok had the metabolic syndrome. Another study from northeast Thailand reported the metabolic syndrome in 3.2% of overweight adolescents, aged 10-15 years.[54] Of concern, adiposity in school-aged children was inversely related to iron deficiency and reduced response to iron fortification.[55]

Maternal nutrition and diet related chronic disease

Type 2 diabetes. There is increasing evidence that the presence of gestational diabetes mellitus (GDM) and possibly, the intensity and duration of lactation are risk factors for developing type 2 diabetes among women in later adulthood.[56] However, no large scale study of GDM among Thai pregnant women has been done. Several hospital-based studies attempted to get estimates of GDM, especially among pregnant women who were defined as having high risk pregnancies. The incidence of GDM reported in various studies ranged from 2 to 7% of total pregnancies, or from 5 to 20% of pregnant women who were classified as having a high risk pregnancy or who were positive based on a glucose challenge test.[57-59] Studies differed in terms of the definitions used for high risk pregnancy and in the types of screening tests used for defining GDM. A cohort study in a hospital in northern Thailand reported that 3% of pregnant women had GDM. A follow up of these women after delivery showed there was a 3.7% probability of developing type 2 diabetes at 9 months, and an 18.9% probability of developing diabetes after 9 years.[60]

Obesity. It was observed that the prevalence of obesity among adult women was higher than among men (40.7% and 28.4%, respectively), using body mass index (BMI). The prevalence of central obesity measured by waist circumference was also higher among women than men (45% and18.6%, respectively) (Table 2).[11] It is speculated that weight retention as a result of pregnancy may partly contribute to obesity in later years, in addition to other risk factors. Adiposity in women was found to be related to lower iron absorption.[55]

DISCUSSION

Thailand has made significant progress in alleviating maternal and child undernutrition through its effective community-based nutrition programs. With rapid economic and social development, changes in the environment inevitably brought about new challenges in nutrition. Undernutrition, namely, stunting and micronutrient deficiencies continue to exist, though at a much lesser magnitude and severity compared to many developing countries. The rapid rise in obesity and diet-related non-communicable chronic diseases in both children and women is of concern. Figure 4 depicts the progression of the nutrition situation since the mid-1970s and the future challenges in maternal and child nutrition.

The present demographic and epidemiological transitions in Thailand create a challenge in terms of having to deal simultaneously with marginal nutritional deficiencies, common infections, and lifestyle-related chronic conditions. Households are now less likely to produce their own foods, as purchasing foods is becoming common even in rural areas. In urban or semi-urban settings, local fresh food markets are still widespread. However, increasing numbers of minimart stores and supermarkets in these areas indicate the changing pattern of food access, especially for processed foods. Ready-cooked foods from street vendors or daily markets are common sources of

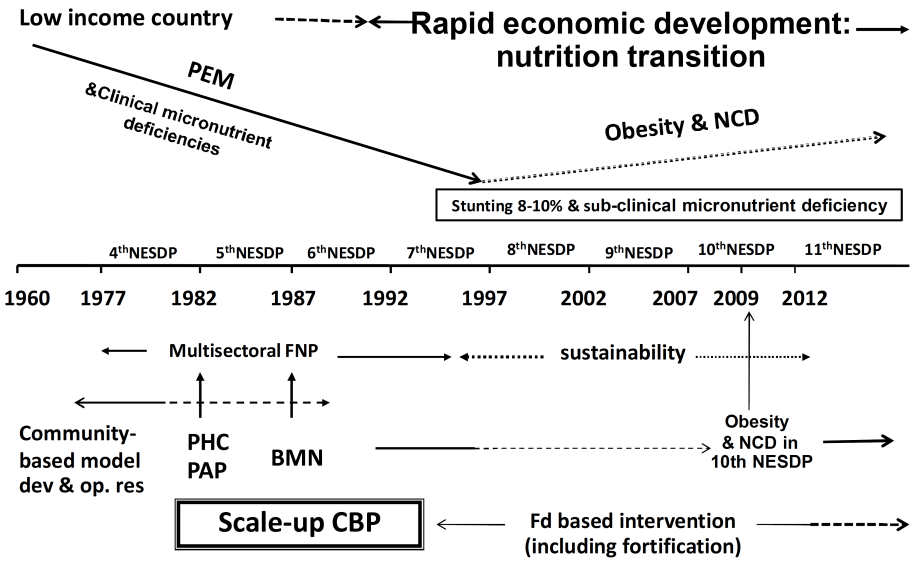

Figure 4. Diagrammatic presentation of dynamism of nutrition situation in transition, and food & nutrition and relevant policies/ programs during 1960s-2000s in Thailand. NESDP: National economic and social development policy/plan; PHC: primary health care; PAP: poverty alleviation plan; BMN: Basic minimum needs; CBP: community-based nutrition program; PEM: protein-energy malnutrition; NCD: non-communicable diseases.

family foods.[7] There has been increasing concern that freshly prepared street foods and processed foods contribute high levels of fat, sugar and salt in current Thai diets.

Based on the review findings, recommended policy actions and research include the following:

1. With very high workforce participation rates of women, it is necessary to identify strategies to increase breast feeding practices in the workplace. Campaigns or nutrition education alone are clearly inadequate, but factors related to working conditions of women need to be more closely examined.
2. To address the issue of low birth weight, information on pre-pregnancy BMI or weight gain during pregnancy should be collected in routine health information systems or large scale surveys. High rates of prenatal attendance provide a good opportunity to obtain these needed data. Importantly, further investigation is needed regarding the contribution of teenage pregnancy and preterm delivery to the high rate of LBW.
3. To address protein-energy malnutrition among children under five, child feeding during the first 24 months should be examined. Special efforts must be given to understanding the "why" and "how" of stunting and underweight, as well as increased childhood obesity. Identifying determinants of the double burden of malnutrition among children in the context of rapid economic transition will lead to formulation of appropriate policy and interventions. Promoting healthy and optimal growth and development of Thai children should be the way forward.
4. Due to increased prevalence of anemia among pregnant and lactating women, a review of program efficiency and compliance to iron supplementation during pregnancy may be needed. In addition, food-based approaches and other public health strategies including health promotion should consistently include anemia as part of the program. An evaluation of other factors that contribute to anemia, such as, hemoglobinopathy and vitamin A deficiency should be undertaken.
5. With improved quality of the iodization program (salt and other condiments), it is critical to monitor UIE levels in children to ensure that iodine intakes remain in the optimal range, and that the risk of exposure to excessive iodine in the food supply remains low. Proper monitoring of iodized salt quality and of women's compliance to iodine supplementation during pregnancy should be conducted. Impacts of the new policy should be evaluated in children, women of reproductive age, and pregnant women.
6. Due to changes in lifestyles, food access and eating patterns both in urban and rural areas, harmonized policy and strategic programs that address DBMN in the complex social and economic environment are urgently needed.
7. In order to develop programs addressing maternal nutrition and diet related chronic disease, a longitudinal study is needed to elucidate the impacts of weight gain during pregnancy and weight retention after pregnancy on the occurrence of obesity and other non-communicable chronic diseases in later adulthood among women.
8. Early life undernutrition should be considered along with measures to address obesity and chronic diseases in children. Emerging evidence shows that early life nutrition contributes to the occurrence of obesity and chronic diseases in later life, suggesting intergenerational effects of poor nutrition. Thus, innovative policy and program approaches are needed that go beyond short term specific interventions. Long term prospective studies that elucidate the relationships among determinants of malnutrition and their impact on health and human capital in a country in transition such as Thailand will be very important.

ACKNOWLEDGEMENTS
This project was partially supported by the grant from the Office of Higher Education Commission and Mahidol University under the National Research University Initiative, Thailand. ILSI-SEA provided financial support for publication. I would like to thank Dr Sofia Amarra (ILSI-SEA) for editorial assistance of the manuscript.

AUTHOR DISCLOSURES
The author declares no conflict of interest.

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Review Article

Thailand nutrition in transition: situation and challenges of maternal and child nutrition

Pattanee Winichagoon PhD

Institute of Nutrition, Mahidol University, Thailand

轉型中的泰國營養狀況：婦幼營養的現況及挑戰

營養不良的雙重負擔(DBMN)，係指營養不足及營養過剩同時存在相同的族群，在發展中國家包含泰國，這是一個新近浮現的公共衛生問題。本篇文章使用大規模的國家性調查資料，回顧從低收入轉變為中等收入國家的過程中，婦幼營養的情況及趨勢。1980 年代之前，蛋白質熱量營養不良及微量營養素缺乏顯著地影響媽媽及幼兒。這個情況在 1980-1990 年代，因多部門政策及計劃致力於執行扶貧及初級健康照護而大幅的改善。經濟的發展，改善健康服務的可近性及有效率的社區基礎營養計畫造就這些正向趨勢。然而，1990 年代低出生體重的盛行率保持在 8-10%，生長遲緩及體重過輕下降至約 10%，爾後小幅度改變。懷孕婦女及兒童的貧血盛行率減少一半，而維生素 A 缺乏不再是公共衛生問題。碘缺乏，特別是懷孕期間，仍然是重要的關注點。當國家朝經濟及社會方面的發展前進，各個社經層面的婦女及兒童都受營養過剩的影響。在市鎮及鄉村地區都觀察到生活型態、食物可近性及飲食模式的改變。儘管已做出努力因應這些挑戰，針對複雜的社經環境中的 DBMN 問題，仍迫切需要一致性的政策及計畫。解決兒童肥胖及慢性疾病議題的同時，應考量幼兒期的營養不足。

關鍵字：母親、兒童、幼兒期、營養轉型期、泰國