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Strengthening Partnerships, Results, and Innovations in Nutrition Globally

Nutrition of Adolescent Girls and Women of Reproductive Age in Low- and Middle-Income Countries: Current Context and Scientific Basis for Moving Forward

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The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project is a five-year USAID-funded cooperative agreement to strengthen global and country efforts to scale up high-impact nutrition practices and policies and improve maternal and child nutrition outcomes. The project is managed by JSI Research & Training Institute, Inc., with partners Helen Keller International, The Manoff Group, Save the Children, and the International Food Policy Research Institute.

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ACRONYMS

AGA	adequate for gestational age
AI	adequate intake
BMI	body mass index
CHERG	Child Health Epidemiology Reference Group
CVD	cardiovascular disease
EAR	estimated average requirement
FAO	Food and Agriculture Organization
FAS	fetal alcohol syndrome
GBD	global burden of disease
GDM	gestational diabetes mellitus
IOM	Institute of Medicine
INCAP	Instituto de Nutrición de Centroamérica y Panamá.
IUGR	intrauterine growth restriction
LBW	low birthweight
LMIC	low- and middle-income countries
MDG	Millennium Development Goal
MUAC	mid-upper arm circumference
NIDDM	non-insulin dependent diabetes mellitus
PAHO	Pan American Health Organization
RNI	reference nutrient intake
SGA	small for gestational age
SPRING	Strengthening Partnerships, Results, and Innovations in Nutrition Globally
UNICEF	United Nations Children's Fund (formerly the United Nations International Children's Emergency Fund)
WHO	World Health Organization
WRA	women of reproductive age

EXECUTIVE SUMMARY

It has long been recognized that the nutritional and health status of a woman before and/or during early pregnancy affects physiologic adjustment to pregnancy and the condition of the periconceptional environment for the embryo, and ultimately the fetal environment. Periconceptional problems, such as low prepregnancy maternal weight, severe iodine deficiency, and folate deficiency, negatively affect pregnancy outcomes. The recognition that early life nutrition affects health in later years, and that in most cases the moment of conception cannot be predicted, has led practitioners and researchers to advocate for a life-cycle approach to nutrition (Horton and Lo 2013). However, comprehensive research is needed to identify optimal practices for improving the nutritional status of adolescent girls and women, before and during pregnancy and during lactation, both for the child and for the woman.

USAID's Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project, along with the Pan American Health Organization (PAHO/WHO), have identified a need for a core set of key practices (similar to those developed for young children), that characterize the diet and feeding practices associated with good nutrition among adolescent girls, women, and pregnant and breastfeeding women. This paper is one of two papers commissioned to provide the relevant scientific and programmatic background to begin to address this goal. This paper summarizes existing information on the current nutritional status of adolescent girls, women of reproductive age (WRA), and pregnant and lactating women in low- and middle-income countries (LMIC). This represents a fundamental first step toward identifying key principles for improving the nutritional status of adolescent girls and women throughout their reproductive years.

The authors reviewed an extensive body of literature to characterize maternal anthropometric status and micronutrient deficiencies, drawing from those cited in the series on nutrition published by *The Lancet* in 2013 and in *The Global Burden of Disease, Injuries, and Risk Factor* study (2013*)*. Noting the lack of any other compilation of studies on the dietary intake, the authors conducted a systematic literature review to identify studies of dietary intakes of adolescent girls, WRA, and pregnant and lactating women.

The findings revealed many changes in the nutritional status of adolescent girls and WRA in LMIC. The prevalence of underweight among women has been reduced and is less than 10 percent globally—except in South Asia. The prevalence of overweight and obesity has risen and approaches 50 percent in many regions. Concomitantly, the prevalence of risk factors for chronic disease has risen, indicating that greater percentages of women will enter pregnancy with underlying chronic diseases and are therefore at high risk. Within this environment of change, however, deficiencies of vitamin A, iron, and iodine persist.

Although there are different levels of evidence for specific age groups and for specific regions, the results pointed to a common set of inadequacies in dietary intake (iron, zinc, vitamin A, vitamin C, calcium) regardless of age and reproductive stage. Given the diminished problem of underweight and increasing problem of overweight, efforts are need to identify effective means of facilitating weight loss. Attention must be given throughout the continuum of care—for adolescent girls and WRA—on achieving and maintaining a healthy diet and eating practices.

INTRODUCTION

There is growing international consensus on the need to improve maternal nutrition and health, focusing on the first 1,000 days in the life of a child, setting a course for optimal growth, development, and short-term and long-term survival. It has long been recognized that the nutritional and health status of a woman before and/or during early pregnancy affects physiologic adjustment to pregnancy and the condition of the periconceptional environment for the embryo, and ultimately the fetal environment. Periconceptional problems, such as low maternal prepregnancy weight, severe iodine deficiency, and folate deficiency, negatively affect pregnancy outcomes, and comprehensive research is still needed to evaluate other aspects of periconceptional nutritional status. This research must then be applied to identify effective programs models for improving maternal nutrition during the periconceptional, gestational, and postpartum periods.

Ultimately, the recognition that early life nutrition affects health in later years, and that the moment of conception cannot be predicted in most cases, a life-cycle approach is needed. The significance of looking at nutrition over the life course is highlighted in the most recent series on maternal and child nutrition published in *The Lancet* (Horton & Lo 2013). New findings from this series specifically identify adolescent girls as a group especially vulnerable to the effects of undernutrition. As adolescence is a period of rapid growth, some argue that the potential exists for height catch-up during this time for children stunted in early childhood. However, this catch-up could be achieved only through marked improvements in nutritional and health status as well as by delayed pregnancy. Ninety percent of adolescents in the world live in low- and middle-income countries (LMIC), where adolescent pregnancy is three times higher than in high-income countries (Black et al. 2013a). Adolescent pregnancy has been shown to carry a greater risk for complications and stunting of a girl's growth while leading to higher risk of poor perinatal outcomes. Thus, a key component of an effective life-cycle approach is to explicitly incorporate the improvement of adolescent girls' nutrition before the first pregnancy.

The 2013 *Lancet* series touched on successful delivery strategies and the need for multisectoral platforms for nutritional interventions while outlining case studies where countries have improved nutritional status by "adopting an approach targeting the whole of society" (Black et al. 2013b). It also identified adolescent girls as a key priority group for the first time, highlighting the life-cycle approach with women of reproductive age (WRA) and mothers needing to be at the center of nutritional interventions. However, it also called for more evidence from programs with good designs, strong implementation, and rigorous evaluations (Black et al. 2013b).

USAID's Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project, along with the PAHO, have identified a need for a core set of key practices (similar to those developed for young children) that characterize the diet and feeding practices associated with good nutrition among adolescent girls, women, and pregnant and breastfeeding women. For these specific target groups, there is a need to probe deeper into the evidence and experience in order to recommend key issues and practices, identify key indicators for measuring improvements and progress, identify gaps in evidence and experience, and suggest future research priorities.

This paper is one of two papers commissioned to provide the relevant scientific and programmatic background to begin to address this goal. This paper focuses on the scientific literature (through literature searches or key summary documents) to report current understanding of: a) the dietary intake and practices of adolescent girls, women and mothers in LMIC; b) nutritional status as characterized by height, body mass index (BMI), and classifications of underweight, normal, overweight, and very overweight; c) specific micronutrient deficiencies known to adversely affect health in general and during pregnancy); d) the recommended content of preconceptional, antenatal, and/or postpartum nutrition care; and e) the efficacy of approaches to achieve and maintain good nutritional status.

METHODS

For each section, a literature search was conducted to identify relevant articles. Given the recent publication of *The Lancet* nutrition series and *The Global Burden of Disease, Injuries, and Risk Factor* study (2013*)*, relevant information was pulled from these sources to characterize maternal anthropometric status and micronutrient deficiencies. Because of the lack of compilations of studies of dietary intakes, we conducted a systematic literature review to identify studies of dietary intakes of adolescent girls, WRA, and pregnant and lactating women. Recognizng that Lee et al. had recently completed a review of literature on diet during pregnancy (2012), we chose to focus on more recent studies not included in that review.

FINDINGS

NUTRITIONAL STATUS LANDSCAPE OF ADOLESCENT GIRLS AND WRA

Anthropometric Status

It has long been recognized that the anthropometric status of a woman at the beginning of her pregnancy influences its outcome. The earliest synthesis of these data was by Kramer in 1987, and since then, multiple reports have extended the information base. Important characteristics of women assessed using anthropometry include height, prepregnancy weight, and BMI (BMI=weight (kg)/height $(m)^2$). Within emergency or extremely low-resource settings, mid-upper arm circumference (MUAC) has also been recommended during pregnancy as a surrogate for prepregnancy BMI.

Height

Although the height of a woman is often considered a reflection of her genetic potential, as noted by Kramer (1987), height in resource-poor settings is better conceptualized as the outcome of an unquantifiable mixture of her own growth experiences during childhood, her own genetic potential, and her mother's height and nutritional status during pregnancy (which affected the child's prenatal growth). Kramer documented that shorter maternal stature was associated (albeit in a non-causal manner) with increased risk of delivery with intrauterine growth restriction (IUGR), but did not contribute to gestational duration or preterm delivery (< 37 completed weeks gestation). Shorter maternal stature is known to be associated with increased complications during delivery, including prolonged labor and cesarean delivery. Here, shorter stature is assumed to be a surrogate for small pelvic size and risk of cephalopelvic disproportion. Although the risk relation is known to be a gradient, some countries have designated cesarean delivery or referral for institutional delivery as standard of care for women shorter than a predefined cut-point.

Surveys have documented maternal stature in LMIC countries, and the most recent compilation of data has been reported by Kozuki et al. (2015) as part of work of the Child Health Epidemiology Reference Group (CHERG), funded by the United Nations Children's Emergency Fund (UNICEF). Shown in Table 1 are the distributions of stature among WRA who have given birth (mothers), by World Health Organization (WHO) Millennium Development Goals (MDGs) region. Also shown is the distribution of heights of adult women in the United States (for which the distribution of adult height is presumed to be largely driven by genetic potential). Data from the United States are shown to demonstrate that we expect a small percentage of women to be < 155 cm (< 5'1") tall and an even smaller percentage to be < 145 cm (4'9") tall. Thus, a reasonable public health goal is to reduce the proportion of women with short stature to levels approximated by the United States population as a means of preventing pregnancy- or delivery-related complications attributable to short stature.

As shown, the prevalence of short stature (< 155 cm) reaches 70 percent in South Asia and Southeast Asia, with the prevalence of women < 145 cm tall about 10 percent. In other regions, the prevalences are lower but still range from 20 percent to 42 percent, compared to 14 percent in the United States. It should be noted that Kozuki et al. (2015) also provide data on maternal height by subregions and detail the data on maternal stature available by country.

The focus of the report by Kozuki et al. (2015) is: a) to document the prevalence of short stature among WRA globally; b) to document the risk relation between short maternal stature and the delivery of a baby small for gestational age (SGA) at term, preterm but adequate for gestational age (AGA), or preterm-SGA. Risk of these outcomes, compared to delivering a baby term-AGA, was highest for those < 145 cm and on the order of 52 to 200 percent excess risk compared to women at least 155 cm tall. An important caveat to this work is the fact that the risk relation is graded, meaning that there are additional reductions in risk as maternal stature increases > 155 cm.

Body Mass Index

Whereas earlier work examined the associations of low absolute weight with poor pregnancy outcomes, including preterm delivery and having a baby born of low birth weight (LBW < 2500g), later work utilized BMI to describe the relative thinness or corpulence of women entering pregnancy. Black et al. (2013a) reported changes between 1980 and 2008 in the prevalence of the four BMI categories among women 20 to 49 years of age by region (Figure 1). Overall, it is clear that changes have occurred in maternal BMI over the three decades. The prevalence of maternal underweight has declined in each region and is < 5 percent in all regions except in Asia and Africa, where it remains between 10 and 20 percent. Although the prevalence of maternal underweight has declined in all regions, about 40 to 60 percent of women in each region remain of normal BMI. The greatest changes have occurred in the prevalence of overweight and obesity in each region, with dramatic increases in the prevalence of BMI > 25 kg/m^2 in Latin America and the Caribbean and Oceania over the time period. As shown, in these regions, about 50 percent of women were estimated to be overweight or obese in 2008. Unless there are strong differences in fecundity by maternal BMI, the distributions reflect the distributions of maternal prepregnancy BMI, which set the framework for many recommendations for dietary intake and weight gain during pregnancy. Table 2 presents the regional estimates of each of the four BMI categories for women 20+ years in 2013 (for methodology and estimates of overweight and obese, Finucane et al., 2011; for estimates of underweight, G. Stevens on behalf of WHO, October 2014; and the difference between the two providing estimates of normal BMI).

Do girls between 15 and 20 years of age have a different distribution of (preconceptional) BMI? Few direct data answer this question for LMIC. However, some estimates are available (Table 2) for girls < 20 years as part of the Global Burden of Disease (GBD) assessment (Ng et al. 2014; see Finucane et al. 2011 and Stevens et al. 2012 for methodology). In general, the estimated prevalence of overweight in girls < 20 years ranges from 3 to 5 percent in South and Southeast Asia to a high of 22.8 percent in the Andean countries of South America. Interestingly, the majority of the estimated prevalence across LMIC is between 9 and 18 percent, which is consistent with the estimates for Europe (12.4 to 15.6 percent) and high-income countries, including the United States (9.9 to 16 percent). Further, the prevalence of overweight in girls < 20 years is about half that of women 20+ years of age in the same region. There is less connection between the prevalence of obesity between the age groups. Despite the > 20 percent prevalence of obesity of among adult women in some LMIC regions (i.e., Latin America and the Caribbean; North Africa and the Middle East; Oceania; and Southern Africa), the prevalence of obesity among girls < 20 years is generally low: 2.6 to 9 percent in Asia; 2.9 to 7.4 percent in Africa; 6.4 percent in Oceania; 4.5 to 8.8 percent for Latin America and the Caribbean; 10.2 percent for North Africa and the Middle East. Ng and colleagues also report that since the 1980s, the prevalence of overweight in girls in LMIC has been increasing steadily, while the prevalence of obesity has remained relatively flat/constant (2014). Unfortunately, estimates of underweight among girls < 20 years are not available at this time, but it is likely that the estimates are only somewhat higher than those of women 20+ years (Table 2).

The data in Figure 2 also provide evidence of a strong increase in the prevalence of overweight and an increase in obesity after age 20, with plateaus for overweight among women in LMIC at about 45 years of age and for obesity at age 50 to 55. It is likely that these trends are related to some degree to postpartum weight retention among women, highlighting the need to include the postpartum period in any strategy for healthy weight promotion among women.

In summary, the BMI status of adolescent girls and women in LMIC has changed over time, and average BMI has increased between 1980 and 2008. The majority of adolescent girls are of normal weight (BMI < 25 kg/m^2), but because the prevalence of overweight has been rising, interventions are needed to promote appropriate dietary intakes; to reinforce healthy eating habits for weight maintenance; and to develop programs for achieving healthy weights. Among women over 20 years of age, depending on the region, the average woman is either normal weight, or overweight or obese, and the data suggest that focusing on women between the ages of 20 and 50 is important to prevent the rise in overweight and obesity that is currently observed. Although it may be true that the average woman entering pregnancy is underweight in some regions within some countries (e.g., in South Asia and Eastern Africa), current data suggest that across LMIC, the majority of adolescent girls and women entering pregnancy will be of normal or overweight BMI status. It is important that programs with nutritional counseling of women during pregnancy provide recommendations appropriate for the majority of women as well as specialized instruction for those who are underweight or obese.

Micronutrient Deficiencies

As part of the work of researchers involved in the GBD study and the CHERG, a synthesis of the problems of anemia, severe anemia, vitamin A deficiency, iodine deficiency, and zinc deficiency in LMIC has been reported for WRA (Black et al. 2013a; Andersson et al. 2009; Stevens et al. 2014; Wessells and Brown 2014). These are summarized by region in Tables 3 and 4. As shown, micronutrient deficiencies remain of concern among WRA in LMIC and highlight the continued need for interventions.

Folic acid fortification programs have been implemented in many countries to increase folic acid intakes to ensure adequate folate status in women during the periconceptional period and likely prevent spina bifida and anencephaly. Surveys conducted in LMIC do not usually assess folate status, but investigators have compiled and reported data on the effective dose and coverage of folic acid fortification programs to identify countries and regions at risk (Youngblood et al. 2012). The effectiveness of folic acid fortification programs is high in the Americas, with the exception of Venezuela, Nicaragua, Paraguay, Suriname, Guyana, French Guiana, and Dominican Republic (Figure 3). The situation is worse in the rest of the regions of the world, because many areas do not have programs, or the effectiveness of their programs is likely modest. It is concerning that of the four LMIC with 2.8 million births or more per year (i.e., India, Indonesia, Brazil, and DRC), only one—Brazil—has a strong folic acid fortification program.

Interest in assessing vitamin D status globally has been growing, and research has suggested that ensuring adequate vitamin D status of mothers and newborns may be important for pregnancy outcomes and child survival. Presented in Figure 4 are the results of a recent compilation of studies on vitamin D status by region. Although few studies have been conducted in LMIC, the results suggest that consideration of vitamin D status before, during, and after pregnancy (lactation) is warranted.

Dietary Intake and Practices

Adequate nutrition during pregnancy is essential for maternal and infant health outcomes, and pregnant women are vulnerable to nutrient deficiencies because of the high nutrient demands. Women may not consume diets that are sufficient in energy, macro and micronutrients because of socioeconomic constraints and food insecurity, low food access, specific dietary patterns, cultural beliefs or practices and/or lack of knowledge regarding eating for health during pregnancy. A review of maternal diet published in 1990 (McGuire and Popkin) identified that pregnant women in developing countries had insufficient energy intakes, and as reported by Black et al. (2008; 2013a) and in the prior sections, maternal micronutrient malnutrition is relatively prevalent. Our analysis of current trends in girls' and women's underweight, overweight, and obesity in LMIC suggests that both excess energy intake and insufficient energy intake are problems for some women in some regions.

When maternal nutrient intakes are inadequate prior to pregnancy, deficits need to be made up to restore nutritional status while meeting the enhanced requirements to maintain the pregnancy and provide for the fetus. Some maternal nutritional deficiencies, such as folate deficiency, must be addressed prior to pregnancy because inadequate intakes of folic acid heighten the risk of spina bifida and anencephaly. Addressing other deficiencies prior to pregnancy, such as iodine and iron deficiencies, may create an optimal environment for appropriate physiologic adjustments to pregnancy, and help address requirements later in pregnancy. For these reasons, it is important to consider the adequacy of dietary intakes of women prior to pregnancy. It must also be said that concerns about diet quality do not disappear after delivery; indeed, the nutritional demands of lactation are significant. Therefore, to address concerns regarding diet quality, we conducted reviews to identify studies of dietary intake of four beneficiary groups: 1) nonpregnant adolescent girls; 2) WRA; 3) pregnant women (regardless of age); 4) lactating women (regardless of age).

Nonpregnant Adolescent Girls and WRA

For the review of adolescent girls, we focused on the dietary intake of girls from LMIC in Africa, the Eastern Mediterranean, South East Asia, the Western Pacific, and the Americas. This review revealed a lack of widely generalizable data on the nutrient intakes and eating patterns of adolescent girls in LMIC. Many studies conducted on this population have small sample sizes and focus on specific groups of adolescent girls that are not necessarily nationally representative. However, given the limited amount of data available on this population, the data synthesized by this review provide important insight into the nutrient intakes and eating patterns of adolescent girls in LMIC.

As can be seen in both Figure 5 and Table 5, the majority of energy intakes are low, with almost all falling below 9.43 MJ/d, an estimate of adolescent girls' energy needs, calculated with the mean of the available mean/median weights of adolescent girls in the studies reviewed and using standard techniques for estimating energy needs of children and adolescent girls (WHO, FAO, and United Nations University 2001). Energy intakes vary both within and between regions and are relatively higher in the Eastern Mediterranean, Africa, and the Americas than in the Western Pacific and South East Asia. Although such low energy intakes seem at odds with the apparent trend toward increased prevalence of overweight and obesity, the consistently low mean/median energy intakes from these studies could be explained, at least in part, by the fact that poor and marginalized populations, who are more likely to be undernourished, are often the focus of research.

In terms of macronutrients, both commonalities and differences exist among regions (Figures 6–8 and Table 5). A common trend across regions is that fat and carbohydrate intake, as a percentage of energy, are inversely related. In general, this means that as fat intake rises above the range recommended by the Food and Agriculture Organization (FAO) and WHO—15 to 30 percent of energy—carbohydrate intake falls below the range of 55 to 75 percent of energy (FAO and WHO 2003). This is seen in the Americas, in the Eastern Mediterranean, and in the Western Pacific regions, where fat intakes are above recommended levels in many studies. In Southeast Asia, the range of intakes is greater, with fat intake varying from 3 to 39 percent of energy and carbohydrate intake varying from 30 to 75 percent of energy. In Africa, the percentage of energy from fats and carbohydrates tends to remain within the ranges recommended by the FAO/WHO. As for protein intakes as a percentage of energy, they generally fall within the 10 to 15 percent range recommended by the FAO/WHO (FAO and WHO 2003). However, as was the case with fat and carbohydrate intake, greater variation is seen with respect to percentages of energy intake from protein in Southeast Asia, where it ranges from 8 to 18 percent. Although the studies included in this review provide critical data on the nutrient intake of girls in LMIC, more studies are needed to understand the topic comprehensively. This is particularly true for evaluating the intake of micronutrients, as some regions are completely lacking in studies that assess adolescent girls' intakes of certain micronutrients (Figures 9–20 and Tables 6 and 7). When the data currently available are used to compare micronutrient intakes to the estimated average requirements (EAR) of the FAO/WHO (WHO and FAO 2004), it is clear that inadequate intakes of numerous micronutrients are common among adolescent girls in LMIC. Prevalence of inadequacy of iron, calcium, zinc, folate, and vitamin D is above 50 percent in most studies (Figures 9–13). Prevalence of inadequacy of thiamine and riboflavin intakes (Figures 14–15) is also generally above 50 percent. Despite variability in the prevalence of inadequacy across micronutrients examined, in one or ore studies the intakes of all micronutrients included in this review are below the EAR (AI for vitamin D and RNI for iron)

Cereal-based diets, with low consumption of nutrient-dense foods, characterize adolescent girls' intakes across regions (Dapi et al. 2011; Ponka and Fokou 2011; Veiga et al. 2013; Dahifar et al. 2006; Ahmed et al. 1998; Chiplonkar and Kawade 2012; Liu et al. 2013). However, at the same time, the consumption of energy-dense and sugary foods in urban areas is increasing among adolescent girls in LMIC (Bourne et al. 1993; Kruger, Kruger, and Macintyre 2006; Colucci et al. 2012; Rodriguez-Ramirez et al. 2009; Aounallah-Skhiri et al. 2011; Kelishadi et al. 2004; Lopez et al. 2012; Gupta et al. 1998; Shin et al. 2013), reflecting the nutrition transition among adolescents as well as adults in LMIC.

As discussed, we also conducted a literature review to describe the energy and nutrient intakes of WRA (Figures 21–36, Tables 8–10). Energy intakes are still low in many studies (Figure 21, Table 8), although they are slightly higher among WRA than among adolescent girls. The trend in intakes is the same among adolescents from all regions, with the energy intakes of WRA in the Americas, Eastern Mediterranean, and Africa being relatively higher than those in Southeast Asia and the Western Pacific. With respect to macronutrient intakes (Figures 22–24 and Table 8), the inverse relationship between energy intakes from fat and carbohydrate and the high proportion of energy from fat are the same as seen with adolescent girls, although the percentages of energy from macronutrients for WRA appear to vary to a greater degree. Similarities between the micronutrient intakes of WRA and adolescent girls in LMIC also exist (Figures 25–36, Tables 9–10). The micronutrients of greatest concern are slightly different for WRA, but the dietary intakes of iron, calcium, zinc, folate, vitamin D, thiamin, and riboflavin are all low (Figures 25–31). Thus, nonpregnant adolescent girls face the same essential issues as WRA: an imbalanced macronutrient intake, with relatively high fat intakes, inadequate micronutrient intakes, and consumption of nutrient-poor foods.

Overall, nonpregnant adolescent girls and WRA do not appear to have dietary intake concerns distinct from one another, and it is likely that a common set of dietary indicators can be developed or utilized to monitor programs promoting healthy eating.

Pregnant Women

Lee and colleagues published a review of dietary intakes of pregnant women in LMIC in 2012; therefore, we conducted a review limited to studies that were published subsequent to that review or not included in it. We also reorganized the information according to the five WHO regions (i.e., Africa, the Eastern Mediterranean, the Western Pacific, South East Asia, and the Americas), with the results presented in Figures 37–52 and Tables 11–13. The additional studies did not alter the conclusions of the 2012 review.

Trends in nutrient intakes and dietary habits of nonpregnant adolescent girls and WRA are also evident among pregnant women. Energy intakes are relatively higher in the Americas and the Eastern Mediterranean than in Southeast Asia, the Western Pacific, and Africa. Percentages of energy from carbohydrates and fat are inversely related across all regions (Figures 39 and 40, respectively), and protein intakes remain generally stable and within the 10 to 15 percent range recommended by FAO/WHO, although varying somewhat across regions and relatively high in the Western Pacific (Figure 38). Intakes of iron and folate (Figures 41 and 44), followed by intakes of calcium and zinc (Figures 42–43), are most frequently below the EAR. As discussed previously for nonpregnant adolescent girls and WRA, the diets of pregnant women in LMIC are cereal based.

A separate yet important component of dietary intake is the consumption of alcohol, which puts the baby at risk of fetal alcohol syndrome (FAS), involving both structural and neurodevelopmental sequelae (Youngblood et al. 2012). Globally, it is estimated that 5 to 10 percent of all pregnancies are at risk for alcohol-related birth defects. FAS prevalence varies worldwide, with the number of cases ranging from a low of 2 to 7 per 1,000 live births in the United States to a high of 90 per 1,000 live births in South Africa's Western Cape.

Lactating Mothers

To better understand the nutritional landscape for lactating women in LMIC, we conducted a literature review of their dietary intakes. Although the number of studies on this population's energy and nutrient intakes is limited, the data available are shown in Figures 53–68 and Tables 14–16. Given the increased energy demands of lactation, energy intakes among lactating women in LMIC are relatively low, especially in Southeast Asia. In terms of macronutrient intakes, percentages of energy from protein tend to fall within the recommended 10 to 15 percent range, although they do vary somewhat among regions. As was seen with adolescent girls, WRA, and pregnant women, percentages of energy from fat and carbohydrates among lactating women appear inversely related, with both being variable within and among regions. Lactating women do not appear to obtain as high a proportion of their energy from fats, however, with as many studies reporting percentages of energy from fat below the recommended 15 to 30 percent range. Consequently, ensuring an appropriate balance of macronutrient intakes in this population is important.

Both Figures 57–68 and Tables 15–16 demonstrate that low intakes of micronutrients are a matter of concern for lactating women in LMIC across regions. The results of the majority of studies indicate prevalence of inadequacy of above 50 percent of numerous micronutrients, including calcium (Figure 58), zinc (Figure 59), folate (Figure 60), thiamine (Figure 62), niacin (Figure 64), and vitamin B6 (Figure 67). Intakes below the respective EARs were seen for all micronutrients reviewed. In the case of iron, it is also important to note that although many studies have shown intakes above the EAR during lactation, women are not necessarily meeting their iron requirements. Due to inadequate iron intakes prior to and during pregnancy, noted previously, women need to build up their iron stores during the postpartum period. It is crucial that postpartum care focus on ensuring that both macronutrient and micronutrient requirements are met for lactating women in LMIC.

In summary, a rich body of literature exists on aspects of dietary intake for adolescents, WRA, and women during pregnancy, but there is a relative lack of literature on the dietary intakes of women during lactation and on adolescents' micronutrient intakes. Overall, the studies indicate similarities in the dietary profiles across target groups—an important consideration for intervention design and messaging.

Physical Activity

Physical activity, a major driver of energy expenditure, explains a significant portion of differences in energy intake across individuals. Maintaining an active lifestyle at any age has health benefits (cardiovascular, metabolic, and mental), regardless of weight. Recommended levels of physical activity are 60 min/day for adolescents and 30 min/day for adults. A systematic review of the literature on adolescents by Ferreira de Moraes et al. (2013) indicated that prevalence of inadequate physical activity (< 60 min/day) ranged from 19 to 91 percent across countries (median 80 percent), with higher rates of inactivity among girls. In a more comprehensive review reporting the prevalence of inactivity by age globally, Hallal et al. (2011) indicated that 32 percent of adults age 15 and up and 80 percent of adolescents age 13 to 15 are considered inactive. Women are generally less active than men. Among women age 15 and up, prevalence of inactivity varied widely across countries within regions: from 6 to 41 percent in Southeast Asia; from 10 to 65 percent in the Western Pacific; from 11 to 72 percent in sub-Saharan Africa; from 15 to 73 percent in Europe; from 40 to 76 percent in the Middle East; and from 17 to 70 percent in the Americas. Although prevalence of inactivity increases with age, it appears relatively stable from age 15 to 30 years and again from age 30 to 45 years; this is true for both walking (5 min for 5 d/wk) and for moderate/intense levels of activity (3+d/wk). Thus, an important component of intervention strategies to improve the health and wellbeing of girls and WRA is the promotion of both healthy eating and an active lifestyle.

EVIDENCE FOR PRECONCEPTIONAL, ANTENATAL, AND POSTPARTUM NUTRITION ACTIONS

In the prior section, we outlined the status of adolescent girls and WRA to set the context for guidelines for improving nutritional status prior to, during, and after pregnancy. The life-cycle approach argues for development and implementation of a continuum of care, and researchers have recently begun to delineate components or frameworks for building that care, both in developed countries (Zive and Rhee 2014) and in LMIC (Ramakrishnan et al. 2012). To further develop this structure, we first discuss the goal of improving maternal stature over the life cycle, then present goals for each of the three points in the care continuum, and, finally, evaluate the nature of the scientific evidence for improving the nutritional status of adolescent girls and WRA.

Improving Maternal Height over the Life Cycle

Because final adult height is influenced by environmental factors affecting growth over the growth period (prenatal through about 18 years of age), it is modifiable as a risk factor for poor pregnancy outcomes, albeit over the long term. Secular increases in adult height have been documented, and it is accepted that changes in diet and disease have brought about these increases over time. It has been argued that centuries ago, the development of agricultural practices emphasizing cereal grain consumption as well as infections due to crowding led to reductions in adult stature (Larsen 2003). Data from studies during the last century have demonstrated increases in adult stature in many countries progressing from middle to upper income status (e.g., Martorell and Zongrone 2012; Stein et al. 2009). Analyses of the growth of descendants of a supplementation trial in Guatemala by the Instituto de Nutrición de Centroamérica y Panamá (INCAP) have documented that nutritional intervention during pregnancy and early childhood can increase adult stature of women, but that the ultimate gain is offset somewhat by an earlier age of menarche and perhaps a shortened time to bone closure (Martorell 2010; Ramakrishan et al. 1999). Addo et al. (2015), analyzing data from five prospective cohorts, compared the contribution of pre- and postnatal growth among girls and boys to their offspring size and found that early nutritional improvements in both parents will likely improve offspring size, with the matrilineal relationship figuring most strongly. Using data from the INCAP longitudinal study, Graff et al. (2010) showed that improvements in girls' early nutrition led to increased years of schooling and to delays in age at first pregnancy; intergenerational improvements in outcomes may proceed through social as well as biologic pathways.

It has been suggested that delaying the age at first pregnancy will facilitate maximal attainment of height, allowing for linear growth instead of fetal (Rah et al. 2008). Studies in the United States suggest that specialized nutritional management can facilitate adolescents' linear growth during pregnancy, but this topic has not been researched thoroughly in low-resource settings. Whether broad-based nutritional interventions implemented beyond early childhood can positively affect final adult stature (and/or reduce short stature) is a question for research.

Preconceptional Care

The goal of preconceptional care is to improve the health and wellbeing of adolescent girls and women for their own sake (with respect to their health over both the short and the long term) and in case they become pregnant. Because only a fraction of women and girls can become pregnant at any time and because pregnancies are largely unplanned, broad-based programs are needed to obtain coverage during the preconceptional period. However, in some settings, it is reasonable to target newly married women and women who have recently given birth as those most likely to conceive within, for example, the next year. There are three approaches to programs in this area: first, generalized wellbeing or lifestyle interventions to promote healthy eating and an active lifestyle, largely to reduce and prevent obesity and chronic disease risk; second, as a component of pregnancy preparation for those planning pregnancy; and finally, postpartum care to either improve the health of the newly delivered woman and/or prepare her for the next pregnancy (so-called interpregnancy care).

Nutrition goals for the preconception period include: 1) achieve normal weight; 2) maintain or improve diet quality as a lifestyle goal (e.g., adequate intakes of calcium, iron, vitamin C, vitamin A, folic acid, whole grains, and vegetables and fruits); 3) maintain or improve physical activity levels; 4) prevent or treat anemia and achieve adequate iron stores; 5) maintain sufficient iodine intake to avoid thyroid disorders; 6) maintain sufficient vitamin A intake to maintain retinol concentrations; 7) ensure folic acid intake of 400 ug per day; 8) reduce alcohol intake. Each of these components is discussed below.

Weight Maintenance, Weight Gain, and Weight Loss

Over the past decades, women's average BMI increased, while the proportions of girls and women who are of normal weight, overweight, or obese has increased and the proportion of those who are underweight has declined. Interventions are needed to reduce both the prevalence of underweight and the prevalence of overweight and obesity.

Underweight: The cut-off of 18.5 kg/m^2 to identify underweight originates from the literature on adult chronic energy insufficiency (Ferro-Luzzi et al. 1992). Unlike young children, adolescents and adults have an ability to adapt their lifestyle (i.e., their physical activity) to maintain a BMI under conditions of food insecurity, in terms of energy insufficiency. Some individuals with BMI < 18.5 kg/m^2 (in particular, adolescents) are healthy, being physically active and consuming diets consistent with sufficiency. However, the probability that a person has insufficient energy intake (with malnutrition causing the low BMI) increases as BMI decreases; among females, the likelihood of amenorrhea increases dramatically when BMI is less than 16 kg/m^2—a clear signal of an adverse nutritional state. The discussion is focused on energy insufficiency, but attention needs to be placed on the entire nutritional picture—the whole diet—with the twin goals of increasing food security and improving energy and nutrient intakes.

It is logical to conclude that increased energy intake (via consumption of nutrient-dense foods) *ceteris paribus* would lead to weight gain and eventually to the achievement of a normal BMI. Therefore, the question is how to obtain increased energy intakes, through education and behavior change or through direct provision of foods. To our knowledge, no randomized controlled trials have directly tested either strategy to help underweight girls or women develop a normal BMI over time. There are a few examples of nutrition education interventions directed at adolescent girls and/or their caregivers in LMIC or at WRA in general, but most are focused solely on reducing micronutrient deficiencies. Nutrition education and counseling directed to mothers and caregivers have demonstrated efficacy for increasing energy and nutrient intakes and reducing growth faltering of young children from birth through 5 years, but it remains to be explored whether healthier eating habits and body weight are more likely over the long term given this early intervention. Interventions to improve preconceptional BMI have focused exclusively on reducing BMI among overweight and obese women. Thus, overall this remains an important area for research.

Overweight and Obesity: As shown, the prevalence of overweight among girls and WRA in LMIC is an emerging problem. The risk of overweight and obesity is associated with risk for chronic disease, including diabetes, dyslipidemia, and high blood pressure. Results from the GBD report have shown increases in LMIC in age-adjusted mean fasting plasma glucose and the prevalence of non-insulin-dependent diabetes mellitus (NIDDM), in age-adjusted mean blood pressure, and in age-adjusted mean total cholesterol (Danaei et al. 2011a; Danaei et al. 2011b; Farzadfar et al. 2013). What this means for pregnancy and antenatal care is that a greater percentage of women will have underlying health issues that may lead to pregnancy complications and that require appropriate management. Although the extent to which weight normalization will reduce these accompanying health risks is not quantified, it is likely to be a marginal benefit of achieving a normal weight in general and in the event of pregnancy.

Few studies have evaluated the efficacy of different intervention strategies to reduce overweight and obesity before pregnancy *per se*. However, a vast literature explores strategies for losing weight. An examination of that literature is beyond the scope of this review; however, the key components of weight loss and maintenance are caloric restriction, increased physical activity, self-monitoring, and behavior therapy (Table 17, adapted from Phelan et al. 2011). Importantly, Phelan et al. (2011) report that focusing on key behaviors such as TV watching or reducing soft drinks are only moderately effective and should be combined with the key components of weight-loss programs listed in Table 17 and that approaches involving education alone are known to be non-effective (and, in fact, constitute the control group when evaluating other intervention strategies).

Improve Diet Quality as a Lifestyle Goal

As noted above, specific recommendations regarding energy intake could be made as part of preconceptional care to either increase body weight or reduce body weight to normalize BMI. Regardless of BMI status, there is a need to improve diet quality, which in this context is defined as a diet providing recommended macronutrient distributions and adequate amounts of micronutrients. Specifically, and as noted in the the section on Dietary Intake and Dietary Practices (see page 7), the intakes of several key nutrients are known to be deficient in the diets of adolescents and women in LMIC: calcium, iron, iodine, folic acid, vitamin A and C.

In many countries, guidelines for healthy eating seek to improve the quality of individuals' dietary intakes, mostly for the purpose of improving long-term health and wellbeing and preventing chronic disease (USDA 2005; WHO 1998; WHO 2004). Thus, although dietary intake analyses indicate specific nutrient intake insufficiencies, recommendations do not reflect specific food items within the local diet but rather components of a dietary pattern that should lead individuals to meet the recommended nutrient levels. Common principles include: 1) consume a variety of fruits and vegetables; 2) choose whole grains over refined grains; 3) choose low-fat foods and those with unsaturated fats; 4) consume low-fat meats, and choose plant sources of protein; 5) limit salt intake; 6) consume alcohol in moderation.

Four points should be noted. First, although consumption of dairy products, particularly those that are low in fat or fat-free, is recommended in the United States, this recommendation is absent from the 2004 WHO guidelines. Second, there is no recommendation with respect to folic acid intakes (e.g., choosing dietary sources and fortified food products). Third, the recommendation to limit salt intake is concerning, given that iodized salt is the principal means of ensuring sufficient iodine intake, as described by Campbell et al. (2012). Coordinated action is needed to reduce salt intake and reformulate iodation levels to maintain iodine intakes given lower salt intakes. Fourth, iron deficiency and anemia remain public health concerns among women, and the recommendations do not address dietary approaches to improve iron intakes, leaving anemia control among girls and women to other nondietary measures (e.g., supplements) or to diet-related measures (e.g., auto-fortification and fortification).

It has been mentioned that educational efforts to improve diet quality do not affect weight loss and the achievement of a healthy weight, but if these recommendations are followed, will they result in greater dietary quality? Systematic reviews of interventions in this area, whether they involve home- or school-based interventions directed at families of young children or youth, remark on some changes in knowledge and intake (increased fruit intake being the most often cited) but find that the degree of change is not high and the methodological quality of many of the studies is relatively low (Showell et al. 2013; Langford et al. 2014; Cutler et al. 2010; Auld et al. 2014; Moore et al. 2009). Many of the studies focused on obesity prevention or weight loss, whereas another recent literature review (Rees et al. 2014) suggested that advice given to adult men and women to increase fruit, vegetable, and fiber intake within the context of preventing cardiovascular disease (CVD) can elicit greater changes and that these changes can have clinical significance. Some, but not all, of the studies reviewed were conducted among adults with CVD, suggesting that the greater effectiveness may not be wholly explained by the salience of the participants' risk for CVD and desire for preventive measures. These studies were also considered to be of higher overall scientific quality, and given the heterogeneity of the results overall, it is not known the extent to which better study design or better content and delivery of advice led to the greater observed dietary changes, which ultimately increased diet quality.

Lead an Active Lifestyle

As noted, maintaining an active lifestyle has benefits mental, cardiovascular, and metabolic health, regardless of weight, and promoting physical activity before pregnancy is important—first because recommendations are to continue physical activity during pregnancy but not to start a new regimen at that time; and, second, because women typically decrease their activity level during pregnancy. Heath et al. (2012), as part of a series in *The Lancet* on physical activity promotion, concluded that there are multiple effective approaches to improving physical activity levels in adolescents and adults. Behavioral and social support approaches can be effective in the community, at work sites, and in school settings. A Cochrane review found that school-based interventions to improve physical activity have shown some degree of success in changing behaviors (Dobbins et al. 2013). Environmental and policy approaches have been recommended to create and improve access to places for physical activity (Heath et al. 2012).

Antenatal Care

In the previous section, we focused on documenting the scientific literature regarding interventions to optimize the nutritional status of girls and women for themselves and for the early conceptus, in the event of pregnancy. Here we follow with the provision of nutritional care for women during pregnancy. Because a significant body of research has focused on the provision of supplements (e.g., for iron/folic acid and multiple micronutrients), we choose to focus here on three other key areas: promoting appropriate gestational weight gain; healthy eating; and staying physically active.

Gestational Weight Gain

Appropriate weight gain during pregnancy is key to a healthy pregnancy outcome for both the mother and the baby. Inadequate weight gain may not support the growth of the fetus, leading to IUGR—that is, birth weight that is small for gestational age (< 10^{th} percentile of birth weight for gestation reference). Excess weight gain may lead to problems associated with gestational diabetes, macrosomia (birth weight > 4000 g) and related complications, some delivery complications, and difficulties during lactation. In 1990, the Institute of Medicine (IOM 1990) published recommended guidelines for weight gain during pregnancy based on a mother' prepregnancy BMI, explicitly recognizing that women with lower BMI would achieve a healthier pregnancy outcome with higher gestational weight gains than those of women with normal BMI and that women entering pregnancy overweight or obese achieved healthier outcomes with lower weight gains that women of normal weight. In 2009, the IOM (2009) released an updated report in which they changed the BMI categories and further specified the range of recommended pregnancy weight gains for obese women. In the earlier report, the panel had advised that pregnant adolescents gain in the upper end of the recommended ranges, but this advice is not part of the revised guidelines. The 2009 recommendations are: 12.7–18.2 kg (BMI < 18.5 kg/m^2); 11.4–15.9 kg (BMI 18.5–24.9 kg/m^2); 6.8–11.4 kg (BMI 25.0–29.9 kg/m^2); 5.0–9.1 kg (BMI ≥ 30 kg/m^2). Because gestational weight gain generally follows a steady increase after the first trimester (during which 0.5–2 kg are gained), recommended rates of weight gain for the second and third trimesters are 0.45 kg/wk (0.45–0.6) among those with a prepregnancy BMI of <18.5; 0.45 kg/wk (0.36–0.45) among those with a prepregnancy BMI of 18.5–24.9; 0.27 kg/wk (0.23–0.32) among those with a prepregnancy BMI of 25.0–29.9; and 0.23 kg/wk (0.18–0.27) 25.0–29.9 among those with a prepregnancy BMI of ≥ 30..

These recommendations, although for the U.S. population, were meant to have global reach. A survey undertaken by Scott et al. (2014), with responses from 66 of the 195 countries reviewed, found that 59 countries had a formal or informal policy guiding weight gain during pregnancy. Most countries surveyed had recommendations specific to maternal BMI, and most followed the IOM guidelines (Table 18). Many countries in the LAC region follow a weight gain guideline developed in the region. It should also be noted that the recommended range of weight gain in India (10 to 12 kg) is relatively narrow and does not take into account prepregnancy maternal BMI.

Multiple studies of gestational weight gain, mostly conducted in developing countries, have identified that only 30 to 50 percent of women gain within the recommended ranges for their BMI. Although women with low BMI may gain less than recommended, what is most commonly observed is that normal, overweight, or obese women who enter pregnancy tend to gain more than the upper limit of the recommendations. Although there are limited studies of gestational weight gain in developing country settings, the rise in BMI among women in their 20s and 30s (described above and in Stevens et al. 2014) suggests that it is likely that women are gaining more than the recommended amounts during pregnancy and then retaining that weight postpartum.

Weight gain during pregnancy is not the same as weight gain outside of pregnancy. Pregnancy weight gain comprises the products of conception and maternal tissue accretion and results from multiple factors. But because only some of these fall under direct maternal control, it is relevant to question how women achieve a target amount of total gestational weight gain over a roughly 6- to 7-month period, and what inputs during the antenatal period enhance the likelihood of gaining within the recommended total weight gain range.

In developing this report, we found no studies conducted among underweight women identifying strategies to help them gain the recommended 12.7 to 18.2 kg, suggesting a need for further research, particularly within resource-limited settings, where the proportion of women with prepregnancy BMI may be greater than 3 to 5 percent (e.g., in South Asia and eastern sub-Saharan Africa).

In contrast, multiple studies have been conducted to identify strategies to limit weight gain to within the recommended ranges among normal, overweight, and obese women, and several systematic reviews have consolidated the evidence on their effectiveness over the past few years (Campbell et al. 2011; Gardner et al. 2011; Tanentsapf et al. 2011; Oteng-Ntim et al. 2012; Thangaratinam et al. 2012; Brown et al. 2012; Hill et al. 2013; Agha et al. 2014). Most of these studies were small (< 100 women per group) and of low to moderate quality (but improving); the overall impact on limiting or reducing gestational weight gain was shown to be detectable but limited. Importantly, the review by Tanentsapf et al. (2011) argues that reductions can be achieved with dietary interventions alone (i.e., with no physical activity component), and the review by Brown et al. (2012) highlighted that goal setting may be beneficial but that interventions with stronger theoretical designs are needed. Hill et al. (2013) suggest that theory-based approaches do not appear to be more successful than those that have no theoretical basis, but that evidence supports approaches involving education, motivational interviewing, self-monitoring, and providing rewards for targets met.

An interesting review by Phelan et al. (2011) consolidated the lessons learned about weight control outside of pregnancy (Table 17) and used that as a lens for evaluating the success of interventions to limit gestational weight gain during pregnancy. More successful strategies to limit gestational weight gain during pregnancy were shown to incorporate components known to be effective outside pregnancy: caloric restriction and structured meal plans; behavior therapy; body-weight monitoring; diet monitoring; and continued patient–provider contact.

It is important that most interventions promoting optimal pregnancy weight gain were evaluated by comparing average weight gains of women in the intervention versus women in the control group and not by evaluating whether the interventions resulted in greater proportions of women gaining within the recommended ranges for their BMI. Thus, it is critical to design studies to test whether strategies are efficacious in helping women achieve the recommended total weight gain during pregnancy. Finally, it should be noted that whereas earlier systematic reviews found no evidence of improvements in outcomes associated with interventions to reduce weight gain, later reviews (with additional studies) are beginning to detect positive effects on health outcomes for both mother and baby.

Healthy Eating During Pregnancy

Women's energy and nutrient requirements do not rise during early pregnancy, but do increase during the second and third trimesters (i.e., 14 weeks onward). For the average woman, with normal BMI, an extra 340 to 450 kcal/day are needed to meet estimated energy requirements over this time period, over and above the energy requirements determined by the woman's age, weight, height, and physical activity level (IOM 2009; see also Widen and Siega-Riz 2010). Among interventions to restrict energy intake to limit gestational weight gain, researchers have calculated energy intakes in terms of recommended kilocalories per kilogram of early-pregnancy or prepregnancy weight, adjusting the recommended number of kilocalories according to BMI: 36 kcal/kg for normal-weight women, 18 to 25 kcal/kg for overweight and obese women, and 15 kcal/kg for morbidly obese women (Phelan et al. 2011).

It is likely that an extra 340 to 450 kcal/d for pregnancy is less than the amount perceived necessary by many women and health care practitioners. The extra micronutrients also needed to support a healthy pregnancy may not be met unless shifts in eating patterns are made, or specific nutrient-rich food choices are added to the diet. These would include foods rich in iron, calcium, and folic acid, in addition to other vitamins and minerals known to be deficient in the population. Guidelines for healthy eating do not differ for nonpregnant and pregnant women (Table 19). Across guidelines for healthy eating during pregnancy, a micronutrient supplement is recommended to provide additional iron and other nutrients.

Gestational diabetes mellitus (GDM) represents a significant morbidity during pregnancy that poses risks for both mother and fetus. Multiple studies have been conducted to address whether specific dietary patterns will prevent GDM, reduce excess weight gain in women with GDM, or prevent complications from GDM; as summarized by Han et al. (2013), a wide variety of dietary modifications have been investigated as management strategies for GDM, but these studies have generally been small and thus lacking potential for demonstrated effectiveness. Studies of dietary advice to prevent GDM using low glycemic load diets have also been summarized (Tieu et al. 2008) and show no effect on GDM incidence but some evidence for lower mean birth weight and ponderal index in the newborns. Exercise is also known to positively impact insulin resistance, but as detailed in Han et al. (2012), interventions involving exercise alone do not appear to affect the incidence of GDM.

Staying Physically Active During Pregnancy

Although staying physically active is recommended during pregnancy, research in developed countries generally suggests that women become more sedentary during pregnancy. Researchers have studied various approaches to keeping women active during pregnancy, utilizing behavior change techniques (including goal setting, monitoring, and feedback), structured exercise plans, and the like. A systematic review by Currie et al. (2013) summarized the findings, showing the quality of the studies to be low and the techniques used to promote exercise and physical activity varying greatly across studies; most of those with adequately reported results found increased physical activity in the intervention groups.

Postpartum Care

The multiple components to effective postpartum care can be grouped into four categories or goals: maintenance of good nutrition; postpartum weight loss; supporting physical activity; sustaining healthy changes for the long term.

Maintenance of Good Nutrition

The first goal is to support the maintenance of good nutrition, to ensure that mothers consume a healthy diet not only for themselves but also to ensure that they meet the increased nutritional demands of lactation. It is broadly understood that breastmilk volumes are not compromised by maternal undernutrition. Maternal diet and/or status is known to affect breastmilk concentrations for some macro and micronutrients but not for others. Randomized controlled trials have demonstrated that provision of a nutrient to a deficient mother will increase the concentration of that nutrient in her breastmilk (e.g., vitamin A) if the concentration is affected by maternal diet/status; these studies are not enumerated here. We identified no studies on the promotion of healthy eating during the postpartum period among women in LMIC to enhance wellbeing or improve breastmilk nutrition composition. Studies have included dietary components as part of interventions to reduce postpartum weight retention (see below). Promotion of healthy eating during this time period is also important for three reasons. First, it is increasingly recognized that in some settings, the maternal plate is the infant's "first plate." Second, it is an avenue to promote healthy eating for the next pregnancy, which may occur within the year. Third, over the long term, it may influence family eating patterns.

Getting Back to a Healthy Weight

The second goal for postpartum care relates to the weight gained during pregnancy. Although the literature reviews of the dietary intakes of adolescent, girls, WRA, and pregnant and lactating women suggest that for many women in LMIC, energy intakes are not in excess, it is also clear that the prevalence of overweight and obesity has been increasing among these populations in LMIC and that excessive gestational weight gain is also becoming more common. Despite the energy costs of lactation increasing total energy expenditure among breastfeeding women postpartum, in the face of high BMIs and excess gestational weight gain, it is likely that many women in LMIC need support to lose the weight that they gained during pregnancy and to attain a healthy weight.

Amorim, Adegboye, and Linne (2013) conducted a systematic review of diet and exercise as weight reduction strategies for women following childbirth. They concluded that interventions involving diet alone or diet plus exercise facilitated weight loss among women postpartum, but that interventions involving exercise alone were not effective. Importantly, no adverse effect on breastfeeding performance was detected. Berger, Peragallo-Urrutia, and Nicholson (2014) conducted a systematic review of randomized control trials in which they looked at nutrition and exercise interventions on weight loss postpartum. They were unable to determine the effectiveness of nutrition-only trials due to insufficient evidence, and they found the evidence for exercise-only interventions inconclusive. However, they did conclude that interventions that combine nutrition and exercise seem to be effective at causing weight loss. Thus, to help women lose weight postpartum, it appears that a combination of diet and physical exercise support should be provided. In their review of weight policies for women across countries, Phelan et al. (2011) noted that few countries had stated policies for postpartum care and weight management, a fact also reported by Scott et al. (2014). Thus, an important area for policy work is the inclusion of policies and practices for weight management as part of postpartum care.

Promoting Physical Activity

Regardless of the role that physical activity has on postpartum weight loss, it is an important component of postpartum care. In their systematic review discussed above, Amorim, Adegboye, and Linne (2013) stated that although the evidence they analyzed did not indicate that physical exercise was important to weight loss, the inclusion of exercise as an intervention component of postpartum weight reduction strategies may be advisable for other health reasons, such as improved cardiovascular fitness. Physical activity has a number of important health benefits. In a review of the international guidelines for physical activity following pregnancy by Evenson et al. (2014), improved mood, maintenance of cardiorespiratory fitness, and reduced depression were listed as some of the potential benefits of postpartum physical activity. Consequently, physical activity should be supported postpartum independent of weight-loss strategies. However, Evenson et al. (2014) found that only five countries, all high-income, had guidelines on postpartum physical activity. Thus, policies are needed to address the need for physical activity as a component of postpartum care.

Supporting Existing Healthy Behaviors

Although it is imperative that postpartum care focus on good nutrition, appropriate weight loss strategies, and physical activity, it is also important that healthy behaviors that were initiated before or during pregnancy be supported after pregnancy in order to maintain these positive lifestyle changes. Comprehensive approaches are needed to ensure the effectiveness of the care continuum.

SUMMARY

The purpose of this review was to set the stage for delineating the steps for the development of a continuum of nutrition care for girls and women in LMIC over the preconception, pregnancy, and lactation periods. We provided an overview of the status of girls and women in LMIC and an assessment of the scientific literature informing the development of specific care components, regardless of whether the studies informing the literature were conducted among women in LMIC.

The data suggest that the nutritional status of women has shifted over time. Prevalence of underweight among women has declined and among those over age 20 is 3 to 5 percent throughout most of the world, with the exception of South and Southeast Asia and Central and eastern sub-Saharan Africa, where prevalence is 15 to 25 percent. This is not to say that prevalence is not much higher in some regions within countries, but it is noteworthy that for programs attempting to help women achieve a normal BMI for their own health and for a pregnancy that may occur, the focus will be on weight loss rather than on weight gain. This is a shift in world view for nutrition programs.

Our review of the dietary intakes of girls and women during all three periods revealed that the concerns regarding the adequacy of dietary intakes did not vary by age or whether the girls or women were in the preconception, pregnancy or postpartum period. There are gaps in our information regarding some nutrient intakes in some regions; it is particularly important to note the relatively low number of studies of lactating mothers. Because of the salience of nutritional problems across the time periods, there is likely a common set of principles for healthy eating among women over the reproductive age range. Examples of these have been provided in the text and tables.

Micronutrient deficiencies remain a concern among girls and women during pregnancy, and although data outside of pregnancy are limited, it is likely that such problems exist then as well. Efforts to reduce weight among girls and women to achieve a normal BMI need to promote nutrient-dense foods (i.e., good food sources of problem nutrients) so that efforts to lose weight do not exacerbate nutrient deficiencies.

The literature of studies testing strategies for health promotion as part of the three phases of care is growing. As shown, much of the focus of this work has been on achieving healthy weight (i.e., on weight loss outside of pregnancy), reducing gestational weight gain (to prevent excess gain), and reducing postpartum weight retention. Key components involve behavioral changes in diet and physical activity. Although demonstrated efficacy of the approaches is elusive, specific components have been identified as key: 1) education; 2) motivational interviewing; 3) self-monitoring; 4) rewards for progress. With respect to education, the provision of structured meal plans (to limit energy and maintain or increase diet quality) and/or structured exercise plans have been identified as important. It was also noted that few efficacy studies in this area have been conducted among women in LMIC. Thus, further research is needed to understand how best to promote healthy eating and weight among girls and women in LMIC. Given that the key components identified above are drivers of programs to improve infant and young child feeding, it can be argued that the principles are transferable and that research to identify key messages and styles of counseling, monitoring, and evaluation could lead to the development of effective program strategies.

It is worth noting that in addition to specific work on identifying the content of nutrition and physical activity education, policy work is needed in two areas. Given the nature of the health promotion agenda proposed here outside of pregnancy and the implicit focus on chronic disease prevention, linkages among agencies or sectors

focused on reproductive health and those focused on chronic disease prevention should be forged. Second, given the relative lack of policies in LMIC on nutrition as a component of reproductive care, and the loosely identifiable continuum of care models found in LMIC, policy work needs to be strengthened. The results of research to identify the nutrition components of care need to be placed within a care system operating through a continuum of care model. Although one might argue that programs involving preconceptional girls and women are best placed outside of this model, several results of this review identify the lack of focus on care for postpartum women and argue for policy work to strengthen antenatal and postpartum care for women.

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TABLES AND FIGURES

Table 1. Prevalence of Short Maternal Stature by UN MDG Region and Among Adult Women in the United States (Counterfactual). Source: Kozuki et al. (2015)

UN MDG region	< 145 cm	145 < 150 cm	150 < 155 cm	≥ 155 cm
Oceania	2.3	8.5	16.8	72.4
Eastern Asia	2.0	7.8	22.6	67.7
Western Asia	1.3	7.2	22.3	69.1
SE Asia	8.9	23.6	35.8	31.6
South Asia	10.7	24.6	33.2	31.5
Caucasus & Central Asia	0.7	3.7	15.3	80.2
Northern Africa	1.5	5.4	17.7	75.5
Sub-Saharan Africa	2.6	7.0	18.8	71.6
Latin America & Caribbean	4.8	13.0	24.1	58.1
US (NHANES)	0.6	3.0	9.7	86.7

Table 2: Distribution of BMI Status of Girls and Women in 2013, by MDG Region (Ng et al. 2014)

Region	Girls 5 to 20 y			Women 20+ years			
	BMI < 25 kg/m^2	BMI 25-30 kg/m^2	BMI 30+ kg/m^2	BMI < 18.5 kg/m^2	BMI < 25 kg/m^2	BMI 25-30 kg/m^2	BMI 30+ kg/m^2
Asia							
Central	79.4	14.7	5.9	5.1	39.7	33.2	22.0
East	84.3	10.9	2.8	12.7	60.2	22.2	4.9
South	93.8	3.6	2.6	23.7	53.8	17.3	5.2
Southeast	86.3	4.7	9.0	14.4	57.3	20.7	7.6
SS Africa							
Central	85.4	9.9	4.7	18.1	56.2	17.2	8.5
Eastern	88.0	9.1	2.9	17.7	55.2	18.3	8.8
Southern	76.9	15.7	7.4	2.4	33.9	26.7	37.0
Western	87.7	9.1	3.2	10.3	55.2	22.6	11.9
LA & Carib.							
Andean	72.8	22.8	4.4	3.3	30.0	43.3	23.4
Tropical	75.7	16.8	7.5	3.9	37.3	37.9	20.9
Southern	73.6	17.6	8.8	2.6	44.4	29.4	23.6
Central	74.5	18.0	7.5	2.4	44.4	31.2	22.0
Caribbean	80.1	13.3	6.6	5.1	44.5	25.9	24.5
N Africa & ME	**72.1**	**17.7**	**10.2**	**3.3**	**31.2**	**31.6**	**33.9**
Oceania	**77.1**	**16.5**	**6.4**	**3.9**	**44.6**	**31.5**	**20.0**
High Y							
Asia Pacific	87.4	9.9	2.7	12.0	67.0	16.4	4.2
N America	70.9	16.1	13.0	1.2	38.3	28.0	32.5
Austral-Asia	76.0	16.4	7.6	1.8	41.5	26.9	29.8
Europe							
Western	78.0	15.6	6.4	3.5	48.9	26.6	21.0
Eastern	81.2	12.4	6.4	3.6	38.6	30.8	27.0
Central	79.7	14.0	6.3	5.9	43.7	29.7	20.7

See Finucane et al. 2011 and Stevens et al. 2012 for methodology; country level estimates of overweight and obesity and time trends from 1980 to 2008 are reported in Stevens et al. 2012. Estimates for underweight were provided by WHO (G.Stevens 2014), and estimates for normal are calculated by difference.

Table 3: Prevalence of Micronutrient Deficiencies among Adult Women and During Pregnancy

Region	Vitamin A deficiency among pregnant women[1]		Insufficient iodine intake in general population[22]	Inadequate zinc intake in general population[33]
	Night blindness (%)	Serum retinol < 0.70 umol/L (%)	Urinary iodine concentration < 100 ug/L (%)	Zinc available < EAR (%)
Globe	7.8	15.3	28.5	17.3
Africa	9.4	14.3	40.0	17.1-25.6
Americas & Caribbean	4.4	2.0	13.7	6.4-17.0
Asia	7.8	18.4	31.6	7.8-29.6
Europe	2.9	2.2	44.2	9.6

Table 4. Prevalence of Anemia in Women of Reproductive Age and During Pregnancy, by Region (Source: Stevens et al. 2013)

Region	Nonpregnant women 15-49 y		Pregnant women 15-49 y	
	Anemia (%)	Severe Anemia (%)	Anemia (%)	Severe Anemia (%)
High-income countries	16	0.5	22	0.2
Central/Eastern Europe	22	0.5	24	0.3
North Africa/Middle East	33	1.0	31	0.4
Africa				
Central/East	48	2.2	56	1.8
Southern	28	1.2	31	0.4
Eastern	28	1.4	36	1.2
Asia				
Southeast	21	0.5	25	0.4
South	47	2.4	52	1.3
LA & Caribbean				
Southern/Tropical	18	0.7	31	0.5
Andean/CA/Caribbean	19	0.7	27	0.3
Globe	29.0	1.1	38	0.9

[1] Reported in WHO (2009) and in Black et al. (2013).
[2] Reported in Andersson et al. (2012) and in Black et al. (2013).
[3] Reported in Wessells and Brown (2012); see also Wessells et al. (2012).

Table 5. Mean/Median Intakes of Energy and Macronutrients, and Percentage of Daily Energy Intake from Macronutrients in Nonpregnant Adolescents, by Region

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Africa	Cameroon	Dapi 2011	119	9.62*[1]	57±19[1]	76±24[1]	317± 104[1]	10±2[1]	31±8[1]	59±8[1]
	Cameroon [A]	Ponka 2011	98	4.63*[1]	27.80[1]			10.06*[1]		
	Senegal	Benefice 2001	40	11.22*[1]	85±21[1]	61±24[1]	448± 156[1]	13[1]	20[1]	67[1]
	South Africa	Bourne 1993	61	6.38*[1]	49±36[1]	51±39[1]	219±91[1]	13.1± 5.0[1]	28.3± 10.0[1]	63.7± 12.3[1]
	South Africa	Kruger 2006	642	7.40*[1]		52.7± 31.7[1]			27.1[1]	
	South Africa	Rankin 2011	55	9.22*[1]						
	South Africa	Zingoni 2009	42	11.21*[1]						
Americas	Brazil [A]	Andrade 2003	173	12.18* [6]		88.7 [6]			27.44*[6]	
	Brazil	Castro 2009	386	8.52*[4]		79.7± 2.7[4]			34.4± 0.5[4]	
	Brazil	Colucci 2012	383	9.18*[6]						
	Brazil [A]	Dunker 2005	279	7.18*[1]	66.48*[1]	70.22*[1]	203.99*[1]	15.51*[1]	36.87*[1]	47.61*[1]
	Brazil	Fonseca 1998	208	10.23*[1]		96[1]	301[1]		35.37*[1]	49.28*[1]
	Brazil	Lopes 2013	259	12.38*[6]	99 (93, 106) [6]	128 (123, 133) [6]	373 (361, 384) [6]	13.39*[6]	38.95*[6]	50.44*[6]
	Brazil	Martinez 2013	49	9.21*[1]						
	Brazil	Pereira 2010	100	8.29*[1]	74±23[1]	64±28[1]	278±98[1]	14.95*[1]	29.09*[1]	56.16*[1]
	Brazil	Peters 2009	71	8.84*[4]	76.8±2.8 [4]			14.54*[4]		
	Brazil	Slater 2003	40	7.25*[1]	66.12± 28.10[1]	67.87± 30.60[1]	210.89± 78.22[1]	15.27*[1]	35.27*[1]	48.71*[1]
	Brazil [A]	Veiga 2013	3377	7.92*[6]	72[6]	59[6]	268[6]	15.22*[6]	28.07*[6]	56.66*[6]
	Brazil	Verly Junior 2010	133	7.93*[1]	67.4± 38.4[1]	69.8± 37.0[1]	245.7± 119.2[1]	14.24*[1]	33.19*[1]	51.92*[1]
	Costa Rica	Irwig 2002	78	11.4± 3.2[1]	83.7*[1]	94.7*[1]	383.9*[1]	12.3± 1.9[1]	31.3± 5.6[1]	56.4± 6.2[1]
	Costa Rica [A]	Monge-Rojas 2005	131	8.12*[1]	57.2*[1]	70.0*[1]	308.2*[1]	11.80*[1]	32.49*[1]	63.58*[1]
	Ecuador [A]	Castro Burbano 2003	302	7.27*[1]	66.9*[1]	51.4*[1]	251.4*[1]	15.41*[1]	26.6*[1]	57.89*[1]
	Mexico [B]	Rodriquez-Ramirez 2009	4312	6.58*[2]	45.6 (28.9) [2]	48.3 (35.7) [2]	239.0 (139.0) [2]	11.61*[2]	27.67*[2]	60.85*[2]

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Eastern Mediterranean	Iran[A]	Azizi 2001	244	9.04*[1]	64[1]	77[1]	313[1]	11.86*[1]	32.10*[1]	57.99*[1]
	Iran[A]	Kelishadi 2004	1000	7.33*[1]	56.7*[1]	41.1*[1]	288.4*[1]	12.96*[1]	21.14*[1]	65.92*[1]
	Iran	Mahmoodi 2001	410	7.57*[1]	53.2± 23.0			11.76*		
	Iran[A]	Mirhosseini 2009	301	7.93*[1]	70[1]	68[1]	254[1]	14.78*[1]	32.31*[1]	53.64*[1]
	Morocco	Lopez 2012	192	8.03*[1]	56±14[1]	65±22[1]	261±66[1]	11.6± 1.2[1]	30.0± 5.9[1]	58.4± 5.7[1]
	Tunisia	Aounallah-Skhiri 2011	587	13.56*[4]	101.38**[4]	131.50**[4]	423.34**[4]	12.52*[4]	36.54*[4]	52.28*[4]
South East Asia	Bangladesh	Ahmed 1998	384	6.13*[1]	48±18[1]	39±17[1]	231±75[1]	13±2.8[1]	24±7.3[1]	63±8.7[1]
	Bangladesh	Kabir 2010	65	6.26*[1]	68.0± 26.0[1]	25.0± 7.0[1]	250.0± 65.0[1]	18.19*[1]	15.05*[1]	66.89*[1]
	Bangladesh	Khan 2005	509	5.48± 1.46[1]	31.7± 10.6[1]	23.2± 5.6[1]	244± 77.4[1]	9.69*[1]	15.95*[1]	74.56*[1]
	Bangladesh[A]	Tetens 2003	100	7.4[4]						
	India[A]	Banerjee 2011	33	5.33[6]						
	India[A]	Chaturvedi 1996	941	5.56*[1]	42.6[1]			12.83*[1]		
	India	Choudhary 2003	270	6.74*[1]						
	India[A]	Chiplonkar 2012	172	5.65*[4]	29.2[4]	43.9[4]		8.66*[4]	29.29*[4]	
	India[A,C]	Chugh 2001	130	5.36*[1]	41.3[1]	41.3[1]	178.5[1]	12.90*[1]	29.02*[1]	55.74*[1]
	India[A]	Dholpuria 2007	55	5.68*[1]	39.7[1]	58.5[1]	102.5[1]	11.70*[1]	38.80*[1]	30.21*[1]
	India	Gupta 1998	148	5.75*[1]	40.8*[1]	59.6*[1]	159.6*[1]	11.9±2[1]	39.1±7[1]	46.5± 13[1]
	India	Gupta 2010	453	7.78*[1]	51.0[1]	73.0[1]	243.0[1]	11.0[1]	35.3[1]	52.5[1]
	India	Kadam 2011	80	5.88*[1]	27.7±8.3[1]	43.2± 12.1[1]		7.89*[1]	27.67*[1]	
	India [A,C]	Kapil 1993	66	6.25*[1]	48[1]	61[1]	188[1]	12.87*[1]	36.80*[1]	50.40*[1]
	India	Kawade 2012	630	5.75*[1]	30.4±9.6[1]			8.86*[1]		
	India	Nagi 1995	120	5.30*[4]	39.7± 0.90[4]			12.54*[4]		
	India [A]	Sanwalka 2010	200	5.53*[2]	44.0[2]			13.32*[2]		
	India	Tupe 2009	173	6.79*[1]	36.4± 11.8[1]	46.1± 15.5[1]		8.98*[1]	25.60*[1]	
	India	Venkaiah 2002	1290	7.76[1]	47.61[1]	24.77[1]		10.28*[1]	12.03*[1]	
	Nepal	Chandyo	86	7.09*[6]	46 (42, 49)[6]	13 (12, 15)[6]		10.86*[6]	6.91*[6]	

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
		2007								
	Sri Lanka [A]	Hettiarachchi 2006	497	4.93[1]	29.0[1]	4.4[1]		9.45*[1]	3.36*[1]	
	Thailand [D]	Kwanbunjan 2008	57	7.13*[1]	46.8*[1]	30.1*[1]	310.7*[1]	11.0± 1.4[1]	15.9± 6.0[1]	73.0± 6.5[1]
Western Pacific	China	Cai 1990	271	8.57*[1]	60.5±4[1]	73±6[1]	282±12[1]	11.97*[1]	32.49*[1]	55.79*[1]
	China	Du 2001	1248		50[1]					
	China	Li 2013	112	8.27*[1]						
	China[A]	Lin 2003	289	7.27[1]	60.14[1]			13.86*[1]		
	China[A,E]	Ma 2007	4692	7.86*[1]						
	China	Xia 2011	168	7.99*[1]	71.54± 25.21[1]	45.91± 23.11[1]	302.34± 110.23[1]	14.99*[1]	21.65*[1]	63.36*[1]
	China	Zhang 2012	1186	7.42*[1]						
	China	Zhou 2005	186	7.34***[1]	49.9*[1]	20.4*[1]		11.4± 2.3[1]	10.5± 3.6[1]	
	Korea[A]	Cho 2010	620	8.14*[1]	69.95[1]	52.96[1]		14.39*[1]	24.51*[1]	
	Korea	Park 2004	245	8.37*[1]	75.6± 49.5[1]	57.8± 29.7[1]	297± 103[1]	14.8± 5.6[1]	25.2± 7.1[1]	60.1± 8.2[1]
	Malaysia	Cynthia 2013	219	6.97*[1]	69.62± 30.61[1]	58.37±2 9.58[1]	214.24± 83.23[1]	16.80± 4.35[1]	30.88± 8.03[1]	52.16± 9.44[1]
	Malaysia	Foo 2004	91	6.17*[1]	53.9± 11.3[1]	34.1± 8.7[1]	259.1± 17.2[1]	14.7± 1.8[1]	20.6± 3.5[1]	64.8± 4.3[1]
	Malaysia	Nurul-Fadhilah 2013	132	9.01*[1]						
	Malaysia[A]	Zalilah 2006	317	8.36*[4]	74[4]	74[4]	259[4]	14.83*[4]	33.37*[4]	51.90*[4]
	Philippines	Cheong 1991	20	7.15*[1]	61.0± 11.9[1]			14.29*[1]		
	Philippines	Kuzawa 2003	307	5.62*[4]		37.6± 2.0[4]			22.5± 0.0[4]	
	Philippines	Magbuhat 2011	60	7.05*[1]	57.2± 31.7[1]	55.5± 30.3[1]	265.4± 102.9[1]	13.59*[1]	29.66*[1]	63.04*[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90), [10] Geometric Mean (95%CI), [11] Range, * Unit conversions or % energy calculations were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. *** Energy intake was given adjusted by body weight, so calculations were made to obtain absolute energy intake using mean weight, given in the paper. [A] Weighted means were taken. [B] Of the 4312 girls in this study, 1.4% are pregnant and 0.2% are pregnant and breastfeeding. [C] Data is of affluent girls. [D] Data is for girls 9–16 years of age. [E] Data is of girls 9–18 years of age.

Table 6. Mean/Median Intakes of Vitamins in Nonpregnant Adolescents, by Region

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
Africa	Cameroon	Dapi 2011	119	956±554[1]	117±92[1]		0.6±0.2[1]	1.3±1.1[1]
	Cameroon [A]	Ponka 2011	98	348.09[1]				
	South Africa	Bourne 1993	61	452±948[1]	150±106[1,B]		0.83±0.53[1]	3.2±9.5[1]
	South Africa [A]	Schutte 2003	373	404.26[1]	155.96[1,B]			
Americas	Brazil	Almeida Dantas 2010	25		692.1 (575.3, 832.6) [10]			
	Brazil [A]	Andrade 2003	173	3406*[6]				
	Brazil	Bigio 2013	90		403.5 (374.7, 432.3) [6]			
	Brazil	Lopes 2013	259	691 (642, 741) [6]				
	Brazil	Martini 2013	265			2.81±1.27[1]		
	Brazil	Pereira 2010	100	604±577[1]				
	Brazil	Peters 2009	71			3.0 (2.6, 3.3) [6]		
	Brazil	Slater 2003	40	608.28± 830.23[1]				
	Brazil	Steluti 2011	58		415 (394, 437)[10]			4.31 (4.10, 4.53) [10]
	Brazil [A]	Veiga 2013	3377	332[2]				3.8[2]
	Brazil	Verly Junior 2010	133	500±1974[1]	450±227[1]	3.7±9.3[1]	1.3±0.7[1]	4.7±15.2[1]
	Brazil	Vitolo 2007	429		133±100 [1,B]			
	Costa Rica	Monge-Rojas 2001	156	544 (626) [2]	237 (150) [2]	7 (8) [2]	1.4 (0.7) [2]	2.1 (1.7) [2]
	Mexico [C]	Rodriquez-Ramirez 2009	4312	410.3 (429) [2]	190.6 (127.5) [2]			
	Mexico	Valdez Lopez 2012	130	934±1422[1] [1]	246±348[11,B]			4.33±4.92[1]
Eastern Mediterranean	Egypt	Amr 2012	75			12.5±5.4[1]		
	Iran	Dahifar 2006	414			2.98*[1]		
	Iran	Mahmoodi 2001	410		146.7± 94.1[1]			
	Lebanon [A]	Salamoun 2005	207			3.13*[1]		
	Tunisia	Aounallah-Skhiri 2011	587		579.78** [4]			7.77** [4]

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
South East Asia	Bangladesh	Ahmed 1998	384	960±1492[1]			0.8±0.3[1]	
	Bangladesh	Kabir 2010	65	1530.0± 420.0[1]				
	Bangladesh	Khan 2005	509	308.9±432.9[1]			0.8±0.2[1]	
	India [A]	Chaturvedi 1994	93	509.81[1]				
	India [A]	Chiplonkar 2012	172	------ [D]	56.5[4,B]		0.39[4]	
	India [A,E]	Chugh 2001	130	424.6[1]			0.96[1]	
	India	Khadilkar 2007	50			0.1 (0.1, 0.8) [7]		
	India	Nagi 1995	120	369.1±11.51 [4]				
	India	Tupe 2009	173	------ [D]	79±30 [1,B]		0.571*[1]	
	India	Venkaiah 2002	1290	255.62[1]			1.07[1]	
	Thailand [F]	Kwanbunjan 2008	57		75.5±27.0[1]			
Western Pacific	China	Cai 1990	271	469±5.8[1]			1.1±0.02[1]	
	China	Du 2001	1248			1.05[1]		
	China [A]	Lin 2003	289	407.6[1]				
	China	Xia 2011	168	----- [G]			0.86±0.30 [1]	
	China	Zhang 2012	1186	685±534[1]				
	Korea [A]	Cho 2010	620	647.12[1]			1.27[1]	
	Korea	Park 2004	245	615±441[1]	203±103[1]			
	Malaysia	Cynthia 2013	219	516.59± 334.51[1]				
	Malaysia	Foo 2004	91	519.9±176.9[1]			0.6±0.2[1]	
	Philippines	Magbuhat 2011	60	393±487[1]			1.93±6.60 [1]	

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90), [10] Geometric Mean (95%CI), [11] Range, * Unit conversions or % energy calculations were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. *** Energy intake was given adjusted by body weight, so calculations were made to obtain absolute energy intake using mean weight, given in the paper. [A] Weighted means were taken. [B] Of the 4312 girls in this study, 1.4% are pregnant and 0.2% are pregnant and breastfeeding. [C] Data is of affluent girls. [D] Data is for girls 9-16 years of age. [E] Data is of girls 9-18 years of age.

Table 6, continued

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5 (ug)	Vitamin B7 (ug)	Vitamin C (mg)
Africa	Benin	Alaofe 2007	50						56.0±54.1[1]
	Cameroon	Dapi 2011	119	0.5±0.6[1]	0.5±0.3[1]	8.7±4.6[1]			70±82[1]
	South Africa	Bourne 1993	61	0.92± 0.70[1]	0.86±0.68[1]	9.4±5.6[1]			53±106[1]
	South Africa[A]	Schutte 2003	373				3.43[1]	16.61[1]	
Americas	Brazil[A]	Andrade 2003	173						418.7[6]
	Brazil	Azevedo 2010	30						77.6[2]
	Brazil	Slater 2003	40						64.28± 81.43[1]
	Brazil	Steluti 2011	58	1.43 (1.37, 1.50)[10]					
	Brazil[A]	Veiga 2013	3377						72.8[2]
	Brazil	Verly Junior 2010	133	1.3±0.8[1]	1.5±1.1[1]	30.7± 17.3[1]	3.5±2.6[1]		120±543[1]
	Costa Rica	Monge-Rojas 2001	156	1.2 (0.7)[2]	1.3 (0.9)[2]	14.9 (8.3)[2]			83 (75)[2]
	Mexico[C]	Rodriquez-Ramirez 2009	4312						68.7 (86.1)[2]
	Mexico	Valdez Lopez 2012	130	2.44±8.32[1]	2.15±1.53[1]				65.5±82.0[1]
Eastern Mediterranean	Tunisia	Aounallah-Skhiri 2011	587						157.09**[4]
South East Asia	Bangladesh	Ahmed 1998	384		0.5±0.3[1]	14±5.3[1]			43±55[1]
	Bangladesh	Kabir 2010	65						75.6±32.7[1]
	Bangladesh	Khan 2005	509		0.4±0.3[1]	12.7±4.1[1]			32.9±46.9[1]

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5 (ug)	Vitamin B7 (ug)	Vitamin C (mg)
	India [A]	Chiplonkar 2012	172		0.21[4]	8.6[4]			27.1[4]
	India [A,E]	Chugh 2001	130		1.29[1]	8.16[1]			59.2[1]
	India	Kawade 2012	630						25.6±14.5[1]
	India	Nagi 1995	120						31.8±1.40[4]
	India	Tupe 2009	173		0.275*[1]				25±14[1]
	India	Venkaiah 2002	1290		0.818[1]	11.46[1]			37.58[1]
	Nepal	Chandyo 2007	86						42 (42, 56)[6]
Western Pacific	China	Cai 1990	271		0.83±0.07[1]				65.5±7[1]
	China	Xia 2011	168		0.83±0.21[1]	14.12± 6.18[1]			73.21± 36.33[1]
	China	Zhang 2012	1186						104±63.6[1]
	Korea [A]	Cho 2010	620		1.16[1]	14.70[1]			87.47[1]
	Korea	Park 2004	245	2.00± 0.92[1]					77.6± 70.1[1]
	Malaysia	Cynthia 2013	219						74.97± 70.59[1]
	Malaysia	Foo 2004	91		1.0±0.3[1]	17.4±3.8[1]			71.8± 30.8[1]
	Philippines	Cheong 1991	20						29.6±15[1]
	Philippines	Magbuhat 2011	60		2.43±4.02[1]	15.3±8.2[1]			49±87[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90), [10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. [A] Weighted means were taken. [B] Folate was given as folic acid, but was obtained from dietary data. [C] Of the 4312 girls in this study, 1.4% are pregnant and 0.2% are pregnant and breastfeeding. [D] Data is available for B-carotene. [E] Data is of affluent girls. [F] Data is for girls 9-16 years of age. [G] Data is available for retinol.

Table 7. Mean/Median Intakes of Minerals in Nonpregnant Adolescent Girls, by Region

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
Africa	Benin	Alaofe 2007	50	16.4±7.4[1]		
	Cameroon	Dapi 2011	119	16±9[1]	4.9±2.2[1]	463±353[1]
	Cameroon [A]	Ponka 2011	98	12.10[1]	7.53[1]	
	Senegal	Benefice 2001	40	36±14[1]		54±37[1]
	South Africa	Bourne 1993	61	7±4[1]	6.8±5.1[1]	335±223[1]
	South Africa [A]	Schutte 2003	373	8.06[1]	7.55[1]	
Americas	Brazil [A]	Andrade 2003	173	19.37[6]		1167[6]
	Brazil	Azevedo 2010	30	10.6[2]		
	Brazil [A]	Dunker 2005	279	9.2[1]		573.4[1]
	Brazil [A]	Goldberg 2009	69			480.2[2]
	Brazil	Lopes 2013	259	10.7 (10.2, 11.2) [6]		531 (503, 559) [6]
	Brazil	Martini 2013	265			596.7±242.1[1]
	Brazil	Pereira 2010	100	10±4[1]		567±325[1]
	Brazil	Peters 2009	71			659.0 (596.0, 721.9) [6]
	Brazil	Slater 2003	40	9.09±4.18[1]		481.30±301.13[1]
	Brazil [A]	Veiga 2013	3377	10.4[2]	9.6[2]	468[2]
	Brazil	Verly Junior 2010	133	12.0±6.7[1]	10.0±5.9[1]	548±456[1]
	Colombia	Agudelo 2003	236	5.4±2.2[1]		
	Costa Rica	Monge-Rojas 2001	156	9.8 (5.6) [2]	7.0 (3.9) [2]	472 (328) [2]
	Mexico [B]	Rodriquez-Ramirez 2009	4312	9.9 (6.6) [2]	6.4 (3.9) [2]	739.6 (556) [2]
	Mexico	Valdez Lopez 2012	130	17.3±10.5[1]	6.3±4.9[1]	910±509[1]
	Panama	Fernandez-Ortega 2008	180			314±225[1]
	Venezuela	Palacios 2007	50			1110.5±567.3[1]
Eastern Mediterranean	Egypt	Amr 2012	75			647.9±167.7[1]
	Iran	Dahifar 2006	414			360±350[1]
	Iran	Mahmoodi 2001	410	17.6±8.6[1]	6.5±2.7[1]	570.1±331.4[1]
	Lebanon	Dib 2005	124			516±229[1]
	Lebanon	El Hage 2009	200			839.3±303.4[1]
	Lebanon [A]	Salamoun 2005	207			743[1]
	Tunisia	Aounallah-Skhiri 2011	587	21.7** [4]	9.7** [4]	843.8** [4]
[illegible]	Bangladesh	Ahmed 1998	384	10±7.0[1]		399±294[1]

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	Bangladesh	Kabir 2010	65	28.8±12.2[1]		
	Bangladesh	Khan 2005	509	7.9±7.1[1]		212.0±205.6[1]
	India [A]	Chaturvedi 1994	93	13.29[1]		
	India [A]	Chiplonkar 2012	172	7.2[4]	3.6[4]	238[4]
	India [A,C]	Chugh 2001	130	10.06[1]		595.1[1]
	India	Gupta 2010	453	13.5[1]	6.4[1]	859.0[1]
	India [A]	Harinarayan 2008	79			296[4]
	India	Kadam 2011	80	5.6±2.6[1]	2.8±1.3[1]	200±66[1]
	India	Kawade 2012	630	6.9±2.3[1]	3.6±1.2[1]	289±146[1]
	India	Khadilkar 2007	50			449 (356, 538) [7]
	India	Nagi 1995	120	12.6±0.33[4]		557.0±19.08[4]
	India	Sahu 2009	121			211±158[1]
	India [A]	Sanwalka 2010	200			635[2]
	India	Tupe 2009	173	9.1±3.3[1]	4.8±1.8[1]	283 (165) [2]
	India	Venkaiah 2002	1290	22.13[1]		455.26[1]
	Nepal	Chandyo 2007	86	7.6 (6.9, 8.3) [6]		
	Sri Lanka [A]	Hettiarachchi 2006	497	11.5[1]	0.51[1]	
Western Pacific	China	Cai 1990	271	22.2±1.2[1]		584±63[1]
	China	Du 2001	1248			360[1]
	China	Li 2013	112			701±234[1]
	China [A]	Lin 2003	289	14.9[1]		
	China [A,D]	Ma 2007	4692		8.6 [2]	
	China	Qin 2009	191	20.6±7.4[1]		
	China	Xia 2011	168	24.88±4.90[1]	11.22±4.97[1]	483.64±231.45[1]
	China	Zhang 2012	1186	19.1±7.1[1]	13.2±5.4[1]	781±303[1]
	Korea [A]	Cho 2010	620	11.40[1]		506.64[1]
	Korea	Park 2004	245	10.2±4.6[1]	8.32±4.32[1]	555±275[1]
	Korea	Shin 2013	101			355.3 [1]
	Malaysia	Cynthia 2013	219	18.03±11.34[1]		429.88±205.02[1]
	Malaysia	Foo 2004	91	10.0±2.9[1]		320.0±124.6[1]
	Philippines	Cheong 1991	20	11.6±2.4[1]		
	Philippines	Magbuhat 2011	60	14.0±10.8[1]		473±309[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90),
[10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. [A] Weighted means were taken. [B] Of the 4312 girls in this study, 1.4% are pregnant and 0.2% are pregnant and breastfeeding. [C] Data is of affluent girls. [D] Data is of girls 9-18 years of age.

Table 8. Mean/Median Intakes of Energy, and Macronutrients and Percentage of Daily Energy Intake from Macronutrients in Nonpregnant Women of Reproductive Age, by Region

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Africa	Burkina Faso	Huybregts 2009	176	8.35*[2]	58.9 (33.5) [2]	30.3 (25.7) [2]		11.7 (3.2)[2]	12.7 (8.8)[2]	
	Ethiopia	Alemayehu 2011	58	3.88*[2]	19.9 (7.9) [2]	9.4 (5.3) [2]	211.9 (60.8)[2]	8.60*[2]	9.12*[2]	91.53*[2]
	Ethiopia	Ferro-Luzzi 1990	22	8.47*[1]						
	Gambia	Dominguez-Salas 2013	30	7.66*[10]	53.5*[10]	41.5*[10]	310.6*[10]	11.7[10]	20.4[10]	67.9[10]
	Ghana	Nti 2008	400	8.23*[1]	43.9±17.3[1]			8.9*[1]		
	Kenya	Gewa 2009	42	4.61*[1]	31±18[1]	17±12[1]	217± 110[1]	11.26*[1]	13.90*[1]	78.84*[1]
	Kenya	Neumann 2013	225	7.38*[1]						
	Kenya [A]	van't Riet 2002	254	5.86[1]	34.2*[1]	33.0*[1]		9.77*[1]	21.21*[1]	
	Malawi	Hallund 2008	24	7.5 (5.4) [2]	35 (24) [2]	17 (23) [2]		7.82*[2]	11 (7) [2]	
	Mali	Kennedy 2010	102	8.60*[1]	58±26[1]	73±35[1]	310± 112[1]	11.29*[1]	31.97*[1]	60.34*[1]
	Nigeria	Adams-Campbell 1993	77	10.63*[1]	75.6*[1]	104.4*[1]	323.9*[1]	12[1]	37[1]	51[1]
	Nigeria	Adelekan 1997	108	7.16*[1]	42.26± 9.48[1]	43.04± 12.05[1]		9.9*[1]	22.64*[1]	
	Nigeria [A]	Ene-Obong 2001	30	5.7[1]	45.8[1]			13.46*[1]		
	Nigeria	Oguntona 1998	35	7.55[1]	56.25[1]	85.90[1]	290.75[1]	12.48*[1]	42.88*[1]	64.50*[1]
	South Africa	Bourne 1993	364	6.42*[1]	56±33[1]	49±33[1]	214± 95[1]	14.5± 4.8[1]	27.0± 11.2[1]	62.0± 15.3[1]
	South Africa [A]	Joffe 2012	263	10.74*[2]	85.9*[2]	93.1*[2]	336.0*[2]	13.39*[2]	32.65*[2]	52.38*[2]
	South Africa [A]	Wolmarans 1999	251	5.68[2]	45.8*[2]	54.2*[2]	165.9*[2]	13.50*[2]	34.75*[2]	48.90*[2]
	Uganda [A]	Jariseta 2012	957	8.52*[1]	51.92**[2]	34.23**[2]		10.21*[2]	15.14*[2]	
mericas	Brazil [A]	Anselmo 1992	56	7.79*[1]	75*[1]			16.13*[1]		
	Brazil	Bion 2008	68	7.98*[1]	77.5±20.4[1]	63.3±19.2[1]	258.5± 74.2[1]	16.3[1]	30.1[1]	54.3[1]
	Brazil [A]	Bonomo 2003	161	12.51*[1]	110.0*[1]	93.6*[1]	433.1*[1]	14.73*[1]	28.19*[1]	57.98*[1]

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	Colombia	Dufour 2002	48	8.85± 2.8[1]	61.0± 21.2[1]	46.7± 22.9[1]	374.5± 114.5[1]	11.6± 1.8[1]	19.2± 4.8[1]	71.5± 5.3[1]
	Colombia	Reyes 2012	201	9.26*[1]	84.48± 34.26[1]	64.15± 29.45[1]	339.91± 123.94[1]	15.27*[1]	26.09*[1]	61.44*[1]
	Honduras	Holden 2002	231	5.91*[1]	59.2± 22.3[1]	48.4± 22.8[1]	176.3± 66.3[1]	16.78*[1]	30.87*[1]	49.98*[1]
	Mexico	Black 1994	71	9.94± 2.32[1]	69±16[1]			11.63*[1]		
	Mexico [A]	Cepeda-Lopez 2011	621	6.26*[1]						
	Mexico	Flores 1998	~7809	7.14*[1]	63.1±34.1[1]	45.6±25.4[1]	252±136[1]	15.2[1]	25.7[1]	59.3[1]
	Mexico	Romieu 1997	159	7.80*[1]	64±16[1]	61±18[1]	268± 65[1]	13.74*[1]	29.47*[1]	57.54*[1]
	Mexico	Samano 2013	126	9.32*[1]	71±25[1]	91±36[1]	292±118[1]	12.76*[1]	36.82*[1]	52.49*[1]
Eastern Mediterranean	Iran [A]	Azadbakht 2013	411	9.63*[1]	92[1]	74[1]	312[1]	16.01*[1]	28.97*[1]	54.28*[1]
	Iran [A]	Azizi 2005	340	8.66*[1]						
	Iran [A]	Bakhtiyari 2013	966	9.35*[1]	94.91[1]	77.26[1]		17.00*[1]	31.14*[1]	
	Iran [A]	Haghighatdoost 2012	410	9.57* [1]	91.3*[1]	74.1*[1]	317.0*[1]	15.98*[1]	29.17*[1]	55.47*[1]
	Iran [A]	Mirmiran 2006	381		59[1]	73[1]	305[1]			
	Iran [A]	Salehpour 2012	85	8.22*[1]	70[1]	52[1]	305[1]	14.26*[1]	23.83*[1]	62.12*[1]
	Iran [A]	Shaneshin 2012	187	9.55*[1]						
	Jordan	Al-Hourani 2007	57	5.24*[1]	39.3±40.8[1]	45.7±13.9[1]	174.2± 40.8[1]	12.2±2.2[1]	32.8±6.7[1]	55.8±6.4[1]
	Lebanon	Al Khatib 2006	470	7.23*[1]						
	Morocco	Rguibi 2006	249	7.61*[1]			267.1± 72.0[1]			58.8± 7.7[1]
South East Asia	Bangladesh	Hels 2003	182	9.5±0.2[4]						
	Bangladesh [A]	Islam 2003	66	6.62*[1]						
	Bangladesh [A]	Lividini 2013	478	7.86*[1]						
	Bangladesh [A]	Tetens 2003	74	8.0[4]						
	Bangladesh	Yakes 2011	196	7.78*[8]	47.4*[8]	16.9*[8]	379.2*[8]	10.2 (9.3, 11.1) [8]	8.2 (4.9, 12.8) [8]	81.6 (76.7, 86.3) [8]
	Bangladesh	Zeitlin 1992	322	5.43*[1]	32.4[1]			10.00*[1]		
	India [A]	Agrahar-	362	8.75*[4]	56.82[4]	14.12[4]		10.87*[4]	6.08*[4]	

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
		Murugkar 2004								
	India	Arya 2006	47	7.05[*1]	48.2± 12.3[1]	54.2± 25.3[1]	244.6± 72.9[1]	11.7± 1.8[1]	28.2± 9.8[1]	58.7± 9.5[1]
	India [A]	Ghosh 2003	255	9.79[*1]	58.84[1]			10.06[*1]		
	India	Ghosh-Jerath 2013	209	6.19[*1]	51.7[1]	12.9[1]		13.99[*1]	7.86[*1]	
	India [A]	Gopaldas 2002	180	10.76[* 1]	69.25[1]			10.78[*1]		
	India	Gupta 2010	176	7.25[*1]	45.0[1]	71.1[1]	225.0[1]	10.3[*1]	36.9[*1]	52.0[*1]
	India [A]	Kabeerdoss2012	56	5.64[*2]	31[2]	21.1[2]		9.21[*2]	14.10[*2]	
	India	Mittal 2006	150	4.41[*1]						
	India	Murty 1994	200	6.41[*1]	43[1]			11.23[*1]		
	India	Pathak 2003	288	6.55[*1]	48.6±27.5[1]			12.42[*1]		
	India	Schmid 2006	220	11.16[*1]	66.6[*1]	29.6[*1]	526.3[*1]	10± 0.01[1]	10± 0.03[1]	79± 0.03[1]
	India	Singh 2009	409	6.86[*1]	54.9[1]	31.8[1]		13.41[*1]	17.47[*1]	
	India	Thankachan 2007	100	5.83[*1]	40.66[1]	30.44[1]	238.68[1]	11.68[*1]	19.67[*1]	68.54[*1]
	Nepal	Chandyo 2007	293	8.31[*6]	54 (52, 56) [6]	17 (15, 19) [6]		10.89[*6]	7.71[*6]	
	Thailand [A]	Kwanbunjan 2008	126	7.86[*1]	50.0[*1]	25.2[*1]	362.6[*1]	10.65[*1]	12.08[*1]	77.26[*1]
	Thailand [A]	Omori 2002	89	9.70[1]	42.7[1]			7.37[*1]		
Western Pacific	China	Chen 2012	58	5.99[*4]	80.1±3.5[4]	64.3± 2.5[4]	136.8± 6.8[4]	22.39[*4]	40.44[*4]	38.24[*4]
	China	Li 2013	371	9.27[*1]						
	China	Liu 2012	928	7.23[*2]	42.2[2]	82[2]	194[2]	9.78[*2]	42.77[*2]	44.97[*2]
	China	Liu 2013	1267		41.04[1]					
	China	Qin 2009	1033	8.79[*1]						
	China	Yang 2000	318	7.98[*1]	52.5±1.8[1]			11.02[*1]		
	China	Zhang 2008	186	7.71[*1]	54.3[1]	33.4[1]	331.4[1]	11.79[*1]	16.31[*1]	71.94[*1]
	China [A]	Zhang 2010	1888	7.86[*1]						
	Fiji	Rush 2001	20	8.71[*1]	67.6[*1]	48.6[*1]	343.4[*1]	13[1]	21[1]	66[1]
	Korea	Yoon 2013	12341	6.83[*4]						
	Malaysia	Gan 2011	343	6.80[*1]	60.7± 23.4[1]	59.2± 21.2[1]	214.0± 72.7[1]	14.9± 3.3[1]	32.8± 5.7[1]	52.8± 6.6[1]

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	Malaysia [A]	Ismail 2012	58	7.12*[1]	63.6*[1]	61.7*[1]	230.3*[1]	14.96*[1]	32.65*[1]	54.16*[1]
	Malaysia	Khor 2006	383	5.87*[1]	54.8± 24.5[1]	45.0± 28.0[1]		15.63*[1]	28.89*[1]	
	Malaysia	Mohamad-pour 2012	169	4.99*[1]						
	Malaysia [A]	Shariff 2005	200	6.23*[1]	47.8[1]	44.8[1]	221.0[1]	12.84*[1]	27.08*[1]	59.37*[1]
	Malaysia	Shimbo 1996	49	8.03*[1]	62.2± 26.9[1]	59.2± 18.5[1]	284.0± 76.5[1]	12.98*[1]	27.79*[1]	59.25*[1]
	Mongolia [A]	Ohno 2005	106	7.71*[1]	56.2[1]	49.6[1]	286.7[1]	12.20*[1]	24.23*[1]	62.26*[1]
	Papua New Guinea [A]	Shack 1990	56	10.65*[1]	59[1]			9.28*[1]		
	Philippines [A]	Angeles-Agdeppa 2003	61	7.43*[1]	61.7[1]	36[1]	295[1]	13.90*[1]	18.25*[1]	66.48*[1]
	Philippines [A]	Cheong 1991	60	6.77*[1]	66.4[1]			16.44*[1]		
	Vietnam	Nguyen 2013	4983	9.19*[1]	82.0± 29.0[1]	48.7± 22.9[1]	356.1± 98.3[1]	14.94*[1]	19.96*[1]	64.86*[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90),
[10] Geometric Mean (95%CI), [11] Range, * Unit conversions or % energy calculations were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. [A] Weighted means were taken.

Table 9. Mean/Median Intakes of Vitamins in Nonpregnant Women of Reproductive Age, by Region

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
Africa	Burkina Faso	Huybregts 2009	176	123.0 (160.5) [2]	215.4 (206.4) [2]		0.75 (0.65) [2]	
	Gambia	Dominguez-Salas 2013	30		131.7 (69.2 251.5) [10]			2.7 (0.4 21.0) [10]
	Ghana	Nti 2008	400	1608 (100, 4017) [3]			0.8±0.3[1]	
	Kenya	Gewa 2009	42	307±341[1]				
	Malawi	Hallund 2008	24	749 (749) [2]				
	Mali	Kennedy 2010	102	358±295[1]	131±82.5[1]		1.0±0.5[1]	1.5±1.0[1]
	Nigeria	Adams-Campbell 1993	77	3004 [1]		1.134 [1]		
	Nigeria [A]	Ene-Obong 2001	30	----- [B]			0.78[1]	
	Nigeria	Oguntona 1998	35	1256.0[1]			1.01[1]	
	South Africa	Bourne 1993	364	558±1141[1]	155±131 [1,E]		0.85±0.53[1]	3.6±8.7[1]
	Uganda [A]	Jariseta 2012	957	417.49**[2]	426.93**[2]		1.24**[2]	0.32**[2]
	Brazil	Almeida Dantas	335		622.5 (595.3,			

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
		2010			650.9) [10]			
	Brazil	Ferreira 2008	400		220.1[1]			
	Brazil	Sato 2010	31		154[1]			
	Colombia	Reyes 2012	201	----- [C]	472.67± 199.19[1]		1.68±0.65[1]	
	Honduras	Holden 2002	231	775.26*[1]	292.1± 152.0[1]		1.0±0.4[1]	1.4±1.8[1]
	Mexico [A]	Mejia-Rodriguez 2007	2257	355.8[2]	218.9[2]			1.6[2]
	Mexico	Romieu 1997	159	760±452[1]	202±106[1]		1.2±0.3[1]	7±4.5[1]
	Mexico	Samano 2013	126			4.9*[1]		
	Mexico	Torres-Sanchez 2006	130		404.0 [2]			3.7[2]
Eastern Mediterranean	Iran	Abdollahi 2008	557		198.3 (185.4 211.3) [6]			2.6 (1.9, 3.2) [6]
	Iran [A]	Azadbakht 2013	411	963[1]	146[1]		1.52[1]	4.4[1]
	Iran [A]	Bakhtiyari 2013	966	622.87[1]	262.01[1]	3.89[1]	0.71[1]	2.01[1]
	Iran [A]	Haghighatdoost 2012	410	947[1]		2.0[1]		4.9[1]
	Iran [A]	Salehpour 2012	85			0.46[1]		
	Lebanon	Al Khatib 2006	470		275.8± 216.2[1]			3.2±6.1[1]
South East Asia	Bangladesh	Bloem 1996	7318	511±575[1]				
	Bangladesh	Hels 2003	182	347±52[4]				
	Bangladesh	Zeitlin 1992	370	798±70 [4]				
	India [A]	Ghosh 2003	255		100.76[1,E]			
	India	Ghosh-Jerath 2013	209	45 (4, 1503) [3]	55.21 [1,E]		1.99 [1]	
	India [A]	Gopaldas 2002	180	267[1]				
	India	Pathak 2004	225		49.2±20.1[1,E]			
	India	Schmid 2006	220	233±331[1]				
	India	Singh 2009	409	649 [1]	178 [1,E]			
	India	Thankachan 2007	100	259.08 [1]	164.84 [1]		0.82 [1]	1.10 [1]
	Indonesia	de Pee 1998	600	335 (63, 750) [9]				
	Thailand [A]	Kwanbunjan 2008	126		77.0[1]			
	Thailand [A]	Omori 2002	89	569.0[1]			0.75[1]	
	Thailand	Sirikulchayanont a 2004	165		172±58[1]			

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
Western Pacific	China	Chen 2012	58	255±85[4]	286.8± 15.8[4]		1.2±0.07 [4]	
	China	Liu 2012	928	341.2[2]			0.3[2]	
	China	Woo 2008	220			0.9 (0.9, 1.0) [6]		
	China	Zhang 2008	186	136.1[1]	176.7[1,E]		1.3[1]	
	China [A]	Zhao 2009	1003		197.9[6]			
	Malaysia	Gan 2011	343	803.2± 751.5			0.74±0.44	
	Malaysia [A]	Ismail 2012	58	1456.5[1]				
	Malaysia	Khor 2006	383	838±970[1]	227.2± 142.6[1]		0.7±0.5[1]	10.2±64.2[1]
	Malaysia [A]	Mohamadpour 2012	169	395.81[1]				
	Malaysia [A]	Shariff 2005	200	651.4[1]				
	Malaysia	Shimbo 1996	49	626.5± 397.3[1]			0.83±0.39[11]	
	Mongolia [A]	Ohno 2005	106	671[1]			0.85[1]	
	Philippines [A]	Angeles-Agdeppa 2003	61	830[1]				
	Vietnam	Laillou 2013	579			0.15 [1]		

Table 9, continued

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
Africa	Burkina Faso	Huybregts 2009	176	0.87 (0.57) [2]	0.24 (0.25) [2]	7.7 (5.8) [2]			9.7 (14.4) [2]
	Gambia	Dominguez-Salas 2013	30	0.92 (0.49, 1.75) [10]	0.30 (0.08, 1.18) [10]				
	Ghana	Nti 2008	400		0.6±0.3[1]	10.8±2.5[1]			
	Ethiopia	Alemayehu 2011	58						2.92 (2.19) [2]
	Kenya	Gewa 2009	42		0.73±0.40 [1]				67±62[1]
	Malawi	Hallund 2008	24						228 (157) [2]
	Mali	Kennedy 2010	102	1.2±0.5[1]	0.8±0.4[1]	10.6±6.5[1]			62.6±34.5 [1]
	Nigeria	Adams-Campbell 1993	77						297 [1]
	Nigeria [A]	Ene-Obong 2001	30		0.42[1]	7.4[1]			37.7[1]
	Nigeria	Oguntona 1998	35						31.8[1]
	South Africa	Bourne 1993	364	0.92± 0.62[1]	0.84±0.57 [1]	12.2±8.0[1]			42±84[1]

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
	Uganda [A]	Jariseta 2012	957	2.34**[2]	0.98**[2]	13.46**[2]			117.71**[2]
Americas	Brazil	Sato 2010	31						91[1]
	Colombia	Reyes 2012	201	2.59±0.98[1]	2.49±0.99[1]	22.90±8.64[1]			281.28±144.87[1]
	Honduras	Holden 2002	231	1.0±0.4[1]	1.2±0.7[1]	15.0±8.1[1]			29.6±34.1[1]
	Mexico	Black 1994	71						49±32[1]
	Mexico [A]	Mejia-Rodriguez 2007	2257	1.1[2]					36.8[2]
	Mexico	Romieu 1997	159		1.1±0.3[1]	11±3[1]			78±48[1]
	Mexico	Samano 2013	126						156±93[1]
	Mexico	Torres-Sanchez 2006	130	2.0 [2]	1.94 [2]				
Eastern Mediterranean	Iran [A]	Azadbakht 2013	411						141[1]
	Iran [A]	Bakhtiyari 2013	966	1.08[1]	0.76[1]	10.81[1]			62.57[1]
	Iran [A]	Haghighatdoost 2012	410	1.6[1]	2.2[1]	25.1[1]			171[1]
South East Asia	Bangladesh	Hels 2003	182						96±5.6[4]
	India [A]	Agrahar-Murugkar	362						68.49[4]
	India	Ghosh-Jerath 2013	209		0.72 [1]	17.29 [1]			6 (0, 72) [3]
	India [A]	Gopaldas 2002	180						29[1]
	India	Thankachan 2007	100	1.19 [1]	0.80 [1]	9.71 [1]			70.41[1]
	India	Schmid 2006	220						24.7±32.3[1]
	Nepal	Chandyo 2007	293						48 (45, 52) [6]
	Thailand [A]	Omori 2002	89		0.33[1]	17.32[1]			31.7 [1]
Western Pacific	China	Chen 2012	58		1.3±0.10 [4]	21.4±0.85[4]			68.3±3.98[4]
	China	Liu 2012	928		0.7[2]				101[2]
	China	Zhang 2008	186		0.6 [1]	10.7[1]			65.8 [1]
	Malaysia	Gan 2011	343		0.97±0.69[1]	8.5±6.9[1]			46.5±45.4[1]

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
	Malaysia	Khor 2006	383	1.2±0.7[1]	1.1±0.8[1]	9.0±5.3[1]			56.4±65.4[1]
	Malaysia [A]	Shariff 2005	200						24.7[1]
	Malaysia	Shimbo 1996	49		1.18±0.50[1]	7.84±4.29[1]			72.5±74.9[1]
	Mongolia [A]	Ohno 2005	106		1.35[1]	11.1[1]			74[1]
	Philippines [A]	Angeles-Agdeppa 2003	61						35 [1]
	Philippines [A]	Cheong 1991	60						47.1[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90)
[10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. [A] Weighted means were calculated. [B] Data on retinol intake is available. [C] Data on retinol and B-carotene is available. [E] Folate was given as folic acid, but was obtained from dietary data.

Table 10. Mean/Median Intakes of Minerals in nonpregnant Women of Reproductive Age, by Region

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
Africa	Burkina Faso	Huybregts 2009	176	38.0 (25.7) [2]	12.6 (7.5) [2]	458.6 (620.7) [2]
	Gambia	Sawo 2013	28			350±164 [1]
	Ghana	Nti 2008	400	26.3±7.8[1]		595.3±477.0[1]
	Ethiopia	Alemayehu 2011	58	25.94 (7.73) [2]	5.26 (2.33) [2]	322 (152) [2]
	Kenya	Gewa 2009	42	12.2±8.2[1]	5.3±3.0[1]	275±248[1]
	Malawi	Hallund 2008	24	22 (18) [2]		620 (562) [2]
	Mali	Kennedy 2010	102	16.1±8.8[1]	10.2±5.8[1]	444±318[1]
	Nigeria	Adelekan 1997	108	25.21±10.84[1]		
	Nigeria	Adelekan 1998	61	17.20±12.81[1]		
	Nigeria	Adams-Campbell 1993	77	15.64 [1]		545[1]
	Nigeria [A]	Ene-Obong 2001	30	18.9[1]		528.7[1]
	Nigeria	Oguntona 1998	35	10.22[1]		579.3[1]
	South Africa	Bourne 1993	364	7±4[1]	7.7±6.2[1]	337±221[1]
	Uganda [A]	Jariseta 2012	957	13.66**[2]	7.31**[2]	352.80**[2]

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
Americas	Brazil [A]	Bezerra 2002	37			479 [1]
	Brazil	Sato 2010	31	12.4[1]		475[1]
	Colombia	Reyes 2012	201	14.58±5.75[1]		383.06±325.53[1]
	Honduras	Holden 2002	231	11.6±4.4[1]	7.1±3.0[1]	
	Mexico	Black 1994	71	27±7[1]		
	Mexico [A]	Cepeda-Lopez 2011	621			662[1]
	Mexico [A]	Mejia-Rodriguez 2007	2257	8.1[2]	5.9[2]	
	Mexico	Romieu 1997	159	15.5±4[1]	5.0±2.3[1]	893±248[1]
	Mexico	Samano 2013	126	11±4[1]	14±6[1]	761±290[1]
Eastern Mediterranean	Iran [A]	Azadbakht 2013	411	13[1]	9.2[1]	
	Iran [A]	Bakhtiyari 2013	966	15.35[1]		822.86[1]
	Iran [A]	Haghighatdoost 2012	410	14.9[1]	9.1[1]	1145[1]
	Iran [A]	Salehpour 2012	85			774[1]
	Lebanon	Al Khatib 2006	470	13.2±9.4[1]		
South East Asia	Bangladesh	Hels 2003	182	15±0.8[4]		435±20[4]
	Bangladesh [A]	Islam 2001	66			31.4[1]
	India [A]	Agrahar-Murugkar 2004	362	27.26[4]		360.29[4]
	India [A]	Ghosh 2003	255	14.26[1]		
	India	Ghosh-Jerath 2013	209	20.5[1]		254[1]
	India [A]	Gopaldas 2002	180	19.5[1]		534.8[1]
	India	Gupta 2010	176	12.3[1]	5.9[1]	649.0[1]
	India [A]	Kabeerdoss 2012	56			219[2]
	India	Murty 1994	200	15.4[1]		
	India	Pathak 2003	288		6.0±2.3[1]	

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	India	Pathak 2004	225	14.8±7.7[1]		
	India	Schmid 2006	220	17.3±7.15[1]		
	India	Singh 2009	409	25.3[1]		
	India	Thankachan 2007	100	9.45[1]		590.56[1]
	India	Zargar 2007	28			284.4*[1]
	Indonesia	Green 2008	126			270 (239, 302) [6]
	India [A]	Harinarayan 2008	572			299[4]
	Nepal	Chandyo 2007	293	8.6 (8.2, 9.0) [6]		
	Nepal	Chandyo 2009	379		8.6±3.3[1]	
	Thailand [A]	Omori 2002	89	7.2[1]		188.0[1]
Western Pacific	China [A]	Chen 2005	168	23.5[1]		
	China	Chen 2012	58	21.6±0.9 [4]	14.49±0.68 [4]	404±19 [4]
	China	Li 2013	371			845±344
	China	Liu 2012	928	17.8[2]	8[2]	
	China	Qin 2009	1033	23.9±9.5[1]	11.2±3.2[1]	
	China	Woo 2008	220			506 (481, 532) [6]
	China	Yang 2000	318	25±19[1]	6.9±1.9[1]	425±207[1]
	China	Zhang 2008	186	21.5[1]	8.8[1]	282.0[1]
	Malaysia	Gan 2011	343	17.2±10.4		471.7±313.1
	Malaysia	Green 2008	378			386 (353, 420) [6]
	Malaysia [A]	Ismail 2012	58		4.8[1]	
	Malaysia	Khor 2006	383	14.4±10.6[1]		386±322[1]
	Malaysia [A]	Shariff 2005	200	12.4[1]		293.7[1]
	Malaysia	Shimbo 1996	49	12.5±5.1[1]		347.8±172.9[1]

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	Mongolia [A]	Ohno 2005	106	6.3[1]		545[1]
	Philippines [A]	Angeles-Agdeppa 2003	61	12.7[1]		450*[1]
	Philippines [A]	Cheong 1991	60	11.9[1]		
	Vietnam	Laillou 2013	579			428.63[1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90)
[10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. ** Nutrient values given were adjusted for energy intake, so calculations were made to give absolute values for nutrients. [A] Weighted means were calculated.

Table 11. Mean/Median Intakes of Energy, and Macronutrients, and Percentage of Daily Energy Intake from Macronutrients in Pregnant Women, by Region

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Africa	Burkina Faso	Huybregts 2009	218	8.8[2]	60.3[2]	27.9[2]	401.0*[2]	11.0[2]	12.7[2]	76.3[2]
	Ethiopia	Abebe 2008	99	3.98[2]	15.5[2]	7.7[2]	231.2[2]	6.52*[2]	7.28*[2]	97.19*[2]
	Ghana	Nti 2002	30	11.84[1]	50.6[1]			7.16*[1]		
	Kenya	Kamau-Mbuthia 2007	716	8.6[1]	59.3[1]	51[1]	350[1]	11.5[1]	22.0[1]	68.5[1]
	Kenya	Neumann 2013	152	6.04*[1]						
	Malawi	Ferguson 1995	60	6.59*[2]	50.6 [2]	13.9 [2]		12.86*[2]	7.95*[2]	
	Malawi	Gibson 1998	152	6.1[2]	46.9[2]	15.2[2]	287[2]	12.7[2]	9.3[2]	78[2]
	Malawi	Gibson 2011	141	6.10*[1]	47.7[1]	15.3[1]	292[1]	13.10*[1]	9.46*[1]	80.22*[1]
	Malawi	Nyambose 2002	184	7.1[1]	55.1[1]	17.9[1]	345.3[1]	12.5[1]	9.1[1]	78.4[1]
	Nigeria [A]	Oguntona 2002	30	5.72*[1]	39.4[1]	20.8[1]	237.1[1]	11.53*[1]	13.69*[1]	69.38*[1]
	Seychelles	Bonham 2009	273	8.9[1]	81.2[1]	85.9[1]	274[1]	15.4[1]	36.3[1]	48.2[1]
	South Africa	Kesa 2005	315	8.43[1]	73.2[1]	62.3[1]	292.5[1]	14.5[1]	27.7[1]	57.8[1]
	South Africa	Mostert 2005	46	7.76[1]	66.8[1]	55.5[1]	306.2[1]	13.4[1]	25.1[1]	61.5[1]
	Tanzania	Changamire 2014	6889	8.83*[1]	53[1]	59[1]	344[1]	10[1]	24[1]	67[1]

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Americas	Argentina	Malpeil 2013	164	6.27*[1]	55[1]			14.69*[1]		
	Argentina	Marin 2002	1218	9.12*[1]	80.6*[1]	79.7*[1]	290.9*[1]	14.8[1]	32.9[1]	53.4[1]
	Brazil	Barbieri 2013	72	8.54*[2]	83[2]	62[2]	270[2]	16.27*[2]	27.35*[2]	52.94*[2]
	Brazil	Buss 2009	578	11.62[1]						
	Brazil	Castro 2006	276	12.10*[1]	87.6[1]	75.0[1]	447[1]	12.13*[1]	23.36*[1]	66.04*[1]
	Brazil	Hoffmann 2013	712	14.05[2]						
	Brazil	Lacerda 2007	408	12.67*[1]	100[1]	71[1]	496[1]	13.21*[1]	21.11*[1]	65.54*[1]
	Brazil	Martins 2011	82	8.05*[6]						
	Brazil	Rodrigues 2008	222	14.26*[6]	141.7[1]	92.4[1]	497.3[1]	16.64*[1]	24.42*[1]	58.40*[1]
	Colombia	Dufour 1999	20	9.9[1]	63.46[1]	48.3[1]	437.8[1]	10.4[1]	17.8[1]	71.8[1]
	Colombia	Reyes 2012	201	9.89*[1]	90.16[1]	67.88[1]	365.52[1]	15.26*[1]	25.86*[1]	61.88*[1]
	Ecuador	Weigel 1991	74	11.15[1]	96.73[1]	84.98[1]	386.5[1]	14.3[1]	28.4[1]	57.3[1]
	Guatemala	Fitzgerald 1993	52	8.69[1]	63[1]			12.14*[1]		
	Mexico	Avendano-Badillo 2009	160	9.77[1]						
	Mexico	Flores 1998	519	7.40*[1]	65.0[1]	45.7[1]	260[1]	14.7[1]	24.8[1]	60.5[1]
	Mexico [A]	Herrera-Suarez 2008	54	9.87*[1]		67[1]			25.58*[1]	

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	Mexico	Mejia-Rodriguez 2012	873	7.03*[2]						
	Mexico	Parra 2002	146	12.52[1]	92.72[1]	103.43[1]	414.71[1]	12.5[1]	31.4[1]	56[1]
	Mexico	Parra-Cabrera 2010	1364	14.38[1]		99.1[1]			25.97*[1]	
	Mexico	Ramos Hernandez 2005	112	9.07[2]	70[2]	72[2]	310[2]	12.9[2]	29.9[2]	57.2[2]
	Mexico	Tovar 1996	24	10.42*[1]	89.0[1]	78.0[1]	380.0[1]	14.30*[1]	28.20*[1]	61.07*[1]
	Peru	Sacco 2003	288	9.18[2]	62[2]	42[2]	375.5[2]	11.7[2]	17.8[2]	70.6[2]
	Venezuela [A]	Pena 2003	75	7.84*[1]	64.5[1]	54.9[1]	292.5[1]	13.78*[1]	26.49*[1]	62.5*[1]
Eastern Mediterranean	Egypt	Abdel-Megeid 2010	640	13.04[1]	63.02[1]			8.09*[1]		
	Egypt	Kirksey 1994	50	8.48[1]	64[1]	54[1]		12.64*[1]	24.00*[1]	
	Iran	Ebrahimi 2013	308	9.51*[1]	78.2[1]			13.77*[1]		
	Iran	Esmaillzadeh 2008	284	10.97[1]	70.3[1]	58.2*[1]	445.2*[1]	12[1]	20[1]	68[1]
	Iran [A]	Fard 2004	180	10.89*[1]	111*[1]	78*[1]	363*[1]	17.08*[1]	27.08*[1]	55.85*[1]
	Iran [A]	Hossein-Nezhad 2011	113	10.71*[1]						
	Iran	Kaseb 2002	22	10.83[1]	77[1]			11.91[1]		
	Iran	Kazemian 2013	150	10.18*[1]	71.0[1]	93.9[1]	183.7[1]	11.68*[1]	34.77*[1]	30.23*[1]
	Iran	Khoushabi 2010	500	7.5[1]	70.7[1]			15.79*[1]		
	Iran	Sabour 2006	449	13.71*[1]	94.25[1]			11.51*[1]		
	Jordan	Bawadi 2010	700	10.9[1]	90.5[1]	104.84[1]	320.84[1]	13.9[1]	36.24[1]	49.23[1]
	Morocco	Belgnaoui 2006	155	12.34[1]	104.1[1]			14.13[1]		
	Pakistan	Hassan 1991	200	8.01*[1]	59.4[1]	74.5[1]	263.0[1]	12.42*[1]	35.05*[1]	54.99*[1]
	Pakistan	Zobairi 1998	150	6.27[1]						

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	Tunisia [A]	Denguezli 2009	350	11.31[*1]	90.83[1]	75.95[1]	413.61[1]	13.45[*1]	25.31[*1]	61.25[*1]
South East Asia	Bangladesh	Alam 2003	252	6.13[1]						
	Bangladesh [A]	Alam 2010	499		45.5[1]	11.0[1]	319[1]	12.53[*1]	6.8[*1]	87.8[*1]
	Bangladesh [A]	Islam 2001	60	7.47[1]						
	India [A]	Agarwal 2002	3700	7.00[*1]	55.0[1]			13.16[*1]		
	India	Agrahar-Murugkar 2004	78	10.24[1]	61.7[1]	13.4[1]		10.09[*1]	4.93[*1]	
	India	Andersen 2003	30	8.6[1]	50[1]	41[1]	369[1]	9.8[1]	18[1]	72.2[1]
	India	Borazjani 2013	156	8.73[*1]	63.33[1]	57.91[1]	328.95[1]	12.74[1]	25.02[1]	62.68[1]
	India	Dahiya 2002	120	9.10[*1]	65[1]			11.97[*1]		
	India	Dwarkanath 2009	510	8.17[2]	62[2]	56.7[2]	342[2]	11.7[2]	24[2]	64.3[2]
	India [A]	Garg 2006	100	3.64[1]	26.55[1]			12.07[*1]		
	India	Gautam 2008	114	6.5[1]	47.1[1]			12.14[*1]		
	India	Hutter 1996	186	7[1]	46.5[1]			10.94[*1]		
	India [A]	Jood 2002	90	9.57[*1]	36[1]	29[1]		6.30[*1]	11.42[*1]	
	India	Kapil 2002	120	9.1[1]	65[1]			11.97[*1]		
	India	Khoushabi 2010	500	7.47[1]	56.2[1]			12.60[*1]		

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	India	Lohia 2009	122	4.27*[1]	22.3[1]	31.6[1]	153[1]	8.75*[1]	27.88*[1]	60.00*[1]
	India	Murty 1994	100	6.69*[1]	45[1]			11.27*[1]		
	India [A]	Nayar 1998	51	4.79*[1]	37.6[1]			13.14*[1]		
	India	Panwar 1998	90	7.99[1]	59.6[1]	59.1[1]		12.49*[1]	27.88*[1]	
	India	Pathak 2003	151	6.23*[1]	39.8[1]			10.70*[1]		
	India	Pathak 2004	283	6.39[1]						
	India	Rao 2001	609	7[1]	43.5[1]	32.4[1]	302.2*[1]	10.4[1]	17.2[1]	72.3[1]
	India	Sachdeva 1994	33	7.17*[1]	48.4[1]			11.30*[1]		
	India	Singh 2009	384	6.4[1]	52.3[1]	28.5[1]		13.68*[1]	16.78*[1]	
	Indonesia	Hartini 2003	235	7.9*[1]	46[1]	44[1]	327[1]	9.7[1]	21[1]	69.3[1]
	Indonesia	Launer 1991	743	6.70*[1]	42.6[1]	17.4[1]		10.65*[1]	9.79*[1]	
	Indonesia	Persson 2001	406	8.07*[1]	47.9[1]	43.1[1]	340[1]	9.95*[1]	20.13*[1]	70.58*[1]
	Indonesia [A]	Wijaya-Erhardt 2011	222	5.05*[1]	34.96[1]	31.14[1]	186.73[1]	11.60*[1]	23.24*[1]	61.93*[1]
	Thailand	Jaruratanasirikul 2009	236	7.8[1]	72[1]	62[1]	225[1]	16.5[1]	32[1]	51.5[1]
	Thailand	Piammongkol 2004	166	5.4[1]	48.91[1]	20.19[1]	227.1[1]	15.2[1]	14.1[1]	70.7[1]
	Thailand	Sukchan 2010	400	5[1]	37.1[1]	38.9[1]	177.6[1]	12.3[1]	29[1]	58.8[1]
	China	Cheng 2009	1420	9.8[1]	63.4[1]	57[1]	391.2[1]	10.9[1]	22[1]	67.1[1]

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	China	Gao 2013	192	9.79*[1]	69.4[1]	105.7[1]	281.5[1]	11.87*[1]	40.69*[1]	48.16*[1]
	China	Jing 2010	300	9.15*[1]	78.04[1]	49.24[1]	360.86[1]	14.28*[1]	20.27*[1]	66.03*[1]
	China	Lagiou 2011	243	13.90*[1]						
	China [A]	Liu 2011	36	8.18[1]	63.3[1]			12.96*[1]		
	China	Ma 2002	163	9.3[1]	97.4[1]	45.87[1]	347.6[1]	17.8[1]	18.8[1]	63.4[1]
	China [A]	Ma 2007	310	9.64[2]						
	China	Peng 2009	102	7.86[1]						
	China	Sun 1990	63	10.13*[1]	79.3[1]	73.3[1]	360[1]	13.11*[1]	27.27*[1]	59.53*[1]
	China	Wang 2000	77	8.93*[1]	86.9*[1]	76.8*[1]	275.7*[1]	16.3[1]	32.4[1]	51.7[1]
	China	Yang 2000	1397	8.35[1]	56.2[1]	66.5*[1]	289.1*[1]	12[1]	30[1]	58[1]
	China	Yang 2006	36		78.4[1]					
	China	Zhang 2010	265	8.98[1]	78.1[1]	63.04[1]	314.3[1]	14.6[1]	26.6[1]	58.8[1]
	China [A]	Zhang 2013	123	11.6[1]	112.9[1]	110.4[1]	334.7[1]	16.30*[1]	35.86*[1]	48.31*[1]
	Korea	Lee 2013	1090	7.66*[1]	70.88*[1]	48.58*[1]	280.78*[1]	15.5[1]	23.9[1]	61.4[1]
	Malaysia [A]	Hashim 1994	161	7.00*[1]						
	Malaysia	Loy 2011	121	8.55*[2]	83.9[2]	54.6[2]	306.4[2]	16.43*[2]	24.06*[2]	60.02*[2]
	Palau	Pobocik 2000	25	8.6[2]	104.4[2]	65.7[2]	267.1[2]	19.5[2]	27.1[2]	53.3[2]

[1] Mean, [2] Median, [A] Weighted means were taken. * Unit conversions or % energy calculations were made.

Table 12. Mean/Median Intakes of Vitamins in Pregnant Women, by Region

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg) (B1)	Vitamin B12 (ug)
Africa	Burkina Faso	Huybregts 2009	218	117.6[2]	217.5[2]		0.8[2]	
	Ghana	Nti 2002	30				1.9[1]	
	Kenya	Kamau-Mbuthia 2007	716	1187[1]	317[1]			
	Malawi [A]	Huddle 1998	71	2526[2]				
	Malawi	Nyambose 2002	184	442.5[1]	201.3[1]			
	Nigeria [A]	Oguntona 2002	30	2360[1]	183[1]			
	Seychelles	Bonham 2008	273	506[1]	224[1]		1.2[1]	5.2[1]

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg) (B1)	Vitamin B12 (ug)
	South Africa	Mostert 2005	46	574.2[1]	194.5[1]			
	Tanzania [A]	Petraro 2013	7248		186.5[1]			3.7[1]
Americas	Argentina	Malpeli 2013	164	407[1]	78.7[1]			
	Brazil	Barbieri 2013	72	704[2]			1.3[2]	
	Brazil	Castro 2006	276	918*[1]				
	Brazil	Sato 2010	30		229[1]			
	Brazil	Villar 2002	91	1134[2]				
	Colombia	Reyes 2012	201		508.87[1]		1.78[1]	
	Ecuador	Weigel 1991	74	1043.45[1]			1.96[1]	
	Mexico	Mejia-Rodriguez 2012	873	665.1[2]	277.6[2]			0.8[2]
	Mexico	Ramos Hernandez 2005	112	1187[2]	138[2]		1.3[2]	
	Mexico	Tovar 1996	24	1311.0[1]			2.1[1]	
	Peru	Sacco 2003	288	605.5[2]	234.5[2]		0.9[2]	
	Venezuela [A]	Pena 2003	75	1446[1]	84.7[1]		1.1[1]	3.4[1]
Eastern Mediterranean	Egypt	Abdel-Megeid 2010	640		447.1[1]			
	Egypt	Hussein 2009	84					2.7[1]
	Egypt	Kirksey 1994	50	531[1]	350[1]		1.1[1]	2[1]
	Iran	Ebrahimi 2013	308	1072.48[1]	217.57[1]	1.1[1]		
	Iran	Esmaillzadeh 2008	284	511.2[1]	160.7[1]		2.05[1]	1.82[1]
	Iran [A]	Hossein-Nezhad 2011	113			2.29[1]		
	Iran	Kazemian 2013	150	790.4[1]		5.0[1]		
	Iran	Sabour 2006	449			2.26[1]		
	Jordan	Bawadi 2010	700	551.2[1]	365.9[1]			

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg) (B1)	Vitamin B12 (ug)
	Morocco	Belgnaoui 2006	155		423.8[1]		1.6[1]	
	Pakistan	Hassan 1991	200	467.4[1]			1.27[1]	
South East Asia	Bangladesh	Lee 2008	200	732.5[2]				
	India	Andersen 2003	30	156[1]				
	India	Dahiya 2002	120		203[1]		1.77[1]	
	India [A]	Garg 2006	100	260.5[1]				
	India	Gautam 2008	114		152.2[1]			
	India [A]	Jood 2002	90				0.86[1]	
	India	Kapil 2002	120	188[1]	203[1]		1.8[1]	
	India	Panwar 1998	90		199.3[1]		1.3[1]	
	India	Pathak 2004	283		51.4[1]			
	India [A]	Sachan 2005	207			0.41[1]		
	India	Singh 2009	384	843[1]	172[1]			
	Indonesia	Hartini 2003	235	462[1]				
	Indonesia	Persson 2001	406				0.79[1]	
	Thailand	Jaruratanasirikul 2009	236	718[1]			0.5[1]	
	Thailand	Piammongkol 2004	166	2628[1]			0.45[1]	
	Thailand	Sukchan 2010	400	2366.5[1]			0.7[1]	
Western Pacific	China	Cheng 2009	1420	572[1]	265.9[1]		1.4[1]	
	China	Gao 2013	192	757.5[1]			0.81[1]	
	China	Ma 2002	163	598.7[1]			1.78[1]	
	China	Peng 2009	102	1030.08[1]			0.85[1]	
	China	Sun 1990	63	826[1]			1.51[1]	
	China [A]	Wang 2010	77			4.05[1]		

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg) (B1)	Vitamin B12 (ug)
	China	Yang 2006	36	756[1]				
	China	Zhang 2010	265	797.1[1]	324.9[1]		0.89[1]	
	Malaysia	Loy 2011	121	959.0[2]			1.6[2]	
	Palau	Pobocik 2000	25	591.6[2]	175.2[2]		1.9[2]	2.8[2]

Table 12, continued

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
Africa	Burkina Faso	Huybregts 2009	218	0.8[2]	0.2[2]	7.3[1]			10.7[2]
	Ethiopia	Abebe 2008	99						2.2[2]
	Ghana	Nti 2002	30		1.45[1]	18.4[1]			39[1]
	Kenya	Kamau-Mbuthia 2007	716						110[1]
	Malawi	Gibson 1998	152						94[2]
	Malawi	Nyambose 2002	184						137.4[1]
	Seychelles	Bonham 2009	273	1.8[1]	1.6[1]				138[1]
	South Africa	Mostert 2005	46	0.87[1]		10.94[1]			34.7[1]
	Tanzania	Petraro 2013	7248	0.93[1]					69.07[1]
Americas	Brazil	Barbieri 2013	72	1.0[2]	1.7[2]	17[2]			65[2]
	Brazil	Castro 2006	276						401[1]
	Brazil	Sato 2010	30						189[1]
	Brazil	Zentner 2008	55						106.3[1]
	Colombia	Reyes 2012	201	2.72[1]	2.72[1]	23.34[1]			300.96[1]
	Ecuador	Weigel 1991	74		1.91[1]	22.76[1]			217.63[1]
	Mexico	Mejia-Rodriguez 2012	873	1.2[2]					
	Mexico	Parra 2002	146						330.22[1]

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
	Mexico	Ramos Hernandez 2005	112		1.6[2]				137[2]
	Mexico	Tovar 1996	24	2.2[1]	2.3[1]	31.5[1]			280.4[1]
	Peru	Sacco 2003	288		1.85[2]	21[2]			150.5[2]
	Venezuela [A]	Pena 2003	75		1.45[1]	17.65[1]			104.25[1]
Eastern Mediterranean	Egypt	Abdel-Megeid 2010	640		1.70[1]				
	Egypt	Kirksey 1994	50	1.3[1]	1.1[1]	27[1]			61[1]
	Iran	Ebrahimi 2013	308						120.22[1]
	Iran	Esmaillzadeh 2008	284	1.29[1]	1.16[1]	23.86[1]			51.7[1]
	Iran	Kazemian 2013	150						90.1[1]
	Jordan	Bawadi 2010	700	1.3[1]					197.2[1]
	Morocco	Belgnaoui 2006	155						127.6[1]
	Pakistan	Hassan 1991	200		0.88[1]	12.04[1]			47.0[1]
	Pakistan	Janjua 2008	540						286.5[1]
South East Asia	Bangladesh [A]	Islam 2001	60						45.15[1]
	India	Agrahar-Murugkar 2004	78						70.5[1]
	India	Andersen 2003	30		0.6[1]				30[1]
	India	Dahiya 2002	120		1.28[1]	12.7[1]			101[1]
	India [A]	Garg 2006	100						23.67[1]
	India	Gautam 2008	114						40.6[1]
	India [A]	Jood 2002	90		1.03[1]	12.6[1]			2.9[1]
	India	Kapil 2002	120		1.3[1]				101[1]
	India	Panwar 1998	90		1.4[1]	15.4[1]			17.2[1]
	Indonesia [A]	Wijaya-Erhardt 2011	222						48.96[1]

Region	Country	Author, Year	Sample Size	Vitamin B6 (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B5	Vitamin B7	Vitamin C (mg)
	Thailand	Jaruratanasirikul 2009	236		1.3[1]	17[1]			71[1]
	Thailand	Piammongkol 2004	166		0.94[1]	16.23[1]			119.91[1]
	Thailand	Sukchan 2010	400		1.3[1]	9.8[1]			251.7[1]
Western Pacific	China	Cheng 2009	1420		0.9[1]	12.2[1]			106.3[1]
	China	Gao 2013	192		1.19[1]				104.3[1]
	China	Ma 2002	163		0.95	15.94[1]			46.1[1]
	China	Peng 2009	102		1.5[1]	17.9[1]			102.5[1]
	China	Sun 1990	63		1.03[1]	18.3[1]			95[1]
	China	Yang 2006	36		1.22[1]				105[1]
	China	Zhang 2010	265		1.06[1]	31.49[1]			109.58[1]
	Korea	Kim 2011	715						136.6[1]
	Malaysia	Loy 2011	121		2.0[2]	15.9[2]			121.2[2]
	Palau	Pobocik 2000	25	2.14[2]	1.2[2]	24.2[2]			114.8[2]

[1] Mean, [2] Median, [A] Weighted means were taken. * Unit conversions were made.

Table 13. Mean/Median Intakes of Minerals in Pregnant Women, by Region

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
Africa	Burkina Faso	Huybregts 2009	218	39.9[2]	13[2]	493.9[2]
	Ethiopia	Abebe 2008	99	27.1[2]	5[2]	479[2]
	Gambia	Prentice 1993	75			404[1]
	Ghana	Nti 2002	30	8.95[1]		917.2[1]
	Kenya	Kamau-Mbuthia 2007	716	16.1[1]	9.4[1]	441[1]
	Malawi	Ferguson 1995	60	14.8[2]	6.2[2]	296[2]
	Malawi	Gibson 1998	152	14.8[2]	9[2]	415[2]
	Malawi	Gibson 2011	141	15.0[1]	9.0[1]	534[1]
	Malawi	Nyambose 2002	184	12.8[1]	6.6[1]	699.1[1]
	Nigeria [A]	Oguntona 2002	30	11.1[1]	12.1[1]	690.7[1]

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	Seychelles	Bonham 2009	273	9.4[1]	8.5[1]	931[1]
	South Africa	Kesa 2005	315	9.7[1]		
	South Africa	Mostert 2005	46	9.6[1]	8.1[1]	354.8[1]
	Tanzania	Petraro 2013	7248	8.0[1]		
Americas	Argentina	Malpeli 2013	164	7.5[1]	6.2[1]	354[1]
	Argentina	Marin 2002	1218	15.0[1]		
	Argentina	Martin de Portela 1998	113	10.8[1]		
	Argentina	Zeni 2003	39			524[2]
	Brazil	Barbieri 2013	72	8[1]	10[1]	607[1]
	Brazil	Bezerra 2002	36			396[1]
	Brazil	Castro 2006	276	16.5[1]		774[1]
	Brazil	Lacerda 2007	408	15.5[1]		819[1]
	Brazil	Rocha 2012	50			613.80[1]
	Brazil	Sato 2010	30	13.6[1]		633[1]
	Brazil	Zentner 2008	55	16.9[1]		420[1]
	Colombia	Reyes 2012	201	15.47[1]		461.95[1]
	Ecuador	Weigel 1991	74	18.49[1]		928.5[1]
	Guatemala	Fitzgerald 1993	52		11.3[1]	727[1]
	Mexico	Avendano-Badillo 2009	160			1037.13[1]
	Mexico	Ramos Hernandez 2005	112	15.7[2]	5.3[2]	1047[2]
	Mexico	Tovar 1996	24	30.0[1]		1327.0[1]
	Peru	Sacco 2003	288	12.45[2]	11.7[2]	464.5[2]
	Venezuela [A]	Pena 2003	75	18.15[1]	10.75[1]	615.5[1]
Me dit err	Egypt	Abdel-Megeid 2010	640	14.5[1]	9.4[1]	

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	Egypt	Darwish 2009	503			879.1[1]
	Egypt	Kirksey 1994	50	12.6[1]	9.4[1]	356[1]
	Iran	Behboudi-Gandevani 2013	1033	16.9[1]		8.9[1]
	Iran	Ebrahimi 2013	308	17.6[1]	9.62[1]	968.5[1]
	Iran	Esmaillzadeh 2008	284	13.5[1]	10[1]	644.8[1]
	Iran [A]	Hossein-Nezhad 2011	113			869.3[1]
	Iran	Karandish 2005	339			644[1]
	Iran	Kazemian 2013	150	33.8[1]	11.2[1]	1022.7[1]
	Iran	Khoushabi 2010	500	16.1[1]	10.6[1]	544[1]
	Iran	Sabour 2006	449			816.28[1]
	Jordan	Bawadi 2010	700	13.5[1]	8.9[1]	1017.7[1]
	Morocco	Belgnaoui 2006	155	17.2[1]	10.4[1]	832.3[1]
	Pakistan	Hassan 1991	200	13.5[1]		471.4[1]
	Pakistan	Janjua 2009	540	23.1[1]		747.1[1]
South East Asia	India	Agrahar-Murugkar 2004	78	18[1]		442.7[1]
	India	Andersen 2003	30	10[1]		523[1]
	India	Dahiya 2002	120	20[1]		1441[1]
	India [A]	Garg 2006	100	8.29[1]		434.4[1]
	India	Gautam 2008	114	15[1]		
	India	Goswami 2000	29			345[1]
	India	Hutter 1996	186	23.8[1]		294.3[1]
	India [A]	Jood 2002	90	10.2[1]		704[1]
	India	Kapil 1999	109	14.6[1]		
	India	Kapil 2002	120	20[1]		1441[1]

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	India	Khoushabi 2010	500	17.9[1]	8.5[1]	775.6[1]
	India	Kumar 2009	543			324.4[1]
	India	Lohia 2009	122	8.9[1]		
	India	Murty 1994	100	17.1[1]		
	India	Panwar 1998	90	19.6[1]		803.1[1]
	India	Pathak 2003	151	10.7[1]		
	India	Pathak 2004	283	15[1]	5.4[1]	
	India [A]	Sachan 2005	207			747[1]
	India	Sahu 2009	139			214[1]
	India	Singh 2009	384	24.2[1]		
	Indonesia	Hartini 2003	235	14[1]		360[1]
	Indonesia	Persson 2001	406			369[1]
	Indonesia [A]	Wijaya-Erhardt 2011	222	7.25[1]		
	Nepal	Makhoul 2012	3509	13.2[1]		
	Thailand	Jaruratanasirikul 2009	236	16[1]	3.5[1]	690[1]
	Thailand	Piammongkol 2004	166	22.06[1]		281.74[1]
	Thailand	Sukchan 2010	400	17.6[1]		493.2[1]
Western Pacific	China	Cheng 2009	1420	23.2[1]	8.9[1]	453.7[1]
	China	Gao 2013	192	18.7[1]	11.2[1]	602.1[1]
	China [A]	Liu 2011	36			482[1]
	China	Ma 2002	163	24.36[1]	18.99[1]	620.76[1]
	China [A]	Ma 2007	310		10.87[2]	
	China	Peng 2009	102	22.1[1]	13.5[1]	842.6[1]
	China	Sun 1990	63	32.0[1]		674[1]
	China [A]	Wang 2010	77			714[1]
	China	Yang 2000	1397	28.8[1]	7.4[1]	450.5[1]
	China	Yang 2006	36	26.6[1]		

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
	China	Zhang 2010	265	8[1]	15.7[1]	600.4[1]
	Korea	Lee 2011	918		9.9[1]	
	Korea	Lee 2013	1090			593.0[1]
	Malaysia	Loy 2011	121	20.1[2]		820.5[2]
	Palau	Pobocik 2000	25	13.5[2]	7[2]	469.5[2]

[1] Mean, [2] Median, [A] Weighted means were taken. * Unit conversions were made.

Table 14. Mean/Median Intakes of Energy, Macronutrients and Percentage of Daily Energy Intake from Macronutrients in Lactating Women, by Region

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
Africa	Cameroon	Engle-Stone 2014	246			66 (68) [2]				
	Ethiopia	Haileslassie 2013	60	8.50*[2]	61 (22) [2]			12.01*[2]		
	Ghana	Addo 2011	70	12.31*[1]	126±75[1]	87±43[1]		17.14*[1]	26.63*[1]	
	Kenya [A]	Kigutha 1995	24	9.56*[1]	65[1]	48.5[1]		11.38*[1]	19.11*[1]	
	Kenya	Neumann 2013	138	7.32*[1]						
	Malawi	Hallund 2008	20	8.2 (2.4) [2]	46 (23) [2]	30 (28) [2]		9.39*[2]	13 (12) [2]	
	South Africa	Kesa 2005	315	8.51*[1]	76.24±25[1]	61.95±22.3[1]	294.37±64.2[1]	14.99*[1]	27.41*[1]	57.89*[1]
	South Africa	Mostert 2005	46	8.41*[1]	73.9±43.0[1]	48.4±24.8[1]	384.4±113.0[1]	14.71*[1]	21.67*[1]	76.50*[1]
	South Africa	Papathakis 2012	142	8.16*[1]	44.5±15.0[1]	56.8±19.7[1]	292±84.8[1]	9.3±1.8[1]	25.7±6.0[1]	65.0±6.1[1]
Americas	Brazil	Castro 2006	276	8.71*[1]	64.5±21.4[1]	55.2±24.0[1]	336±113[1]	12.40*[1]	23.87*[1]	64.58*[1]
	Brazil	da Cunha 2005	77	7.60*[1]	70±32[1]	69±31[1]	218±89[1]	16.3±5.8[1]	34.1±9.0[1]	49.5±10.1[1]
	Brazil	Lacerda 2007	308	9.12*[6]	76 (73, 79)[6]	52 (50, 55) [6]	350 (334, 336) [6]	13.98*[6]	21.52*[6]	64.37*[6]
	Brazil	Piperata 2007	23	7.37*[1]	47±13[1]	29±16[1]	330±114[1]	10.68*[1]	14.83*[1]	75.00*[1]
	Guatemala	Casterline 1997	113		72.7 (23.5-196.3)[3]					

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	Mexico	Caire-Juvera 2007	60	9.73^{*1}	89 ± 60^{1}		291 ± 126^{1}	15.31^{*1}		50.06^{*1}
	Mexico	Flores 1998	~783	7.73^{*1}	62.4 ± 32.0^{1}	39.8 ± 24.0^{1}	301 ± 163^{1}	13.9^{1}	20.8^{1}	65.3^{1}
Eastern Mediterranean	Egypt	Rahmanifar 1993	41	9.2 (7.11-13.39)[3]						
	Iran	Ayatollahi 2004	266	9.42^{*3}	78 ± 14^{1}			13.87^{*1}		
	Iran	Mahdavi 2010	182	10.01^{*1}						
	Iran [A]	Nikniaz 2013	75	9.57^{1}	63.5^{1}	61.9^{1}	363.9^{1}	11.11^{*1}	24.37^{*1}	63.65^{*1}
	Sudan	Nyuar 2010	60	8.32^{*1}	74.7 ± 14.1^{1}	37.6 ± 10.6^{1}	357 ± 56^{1}	15.4 ± 1.9^{1}	18.5 ± 4.4^{1}	67.2 ± 6.1^{1}
South East Asia	Bangladesh [A]	Alam 2003	199	7.30^{*1}						
	Bangladesh [A]	Islam 2003	65	7.27^{*1}						
	Bangladesh	Yakes 2011	259	7.94^{*5}	47.9^{*5}	16.0^{*5}	390.5^{*5}	10.1 (9.2, 11.0)[5]	7.6 (4.4, 11.8)[5]	82.3 (77.6, 87.1)[5]
	India [A]	Agrahar-Murugkar 2004	295	9.68^{4}	62.61^{4}	12.10^{4}		10.83^{*4}	4.71^{*4}	
	India	Murty 1994	110	6.93^{*1}	46^{1}			11.12^{*1}		
	India	Singh 2009	400	7.03^{*1}	57.2^{1}	33.5^{1}		13.62^{*1}	17.95^{*1}	
Western Pacific	China	Chen 2012	196	9.55^{*4}	126.2 ± 2.7^{4}	96.8 ± 2.3^{4}	234.9 ± 5.8^{4}	22.12^{*4}	38.18^{*4}	41.17^{*4}
	China	Ding 2010	40	9.50^{*1}	78.7 ± 39.7^{1}	87.9 ± 35.2^{1}		13.87^{*1}	34.85^{*1}	
	China [A]	Ma 2007	470	9.92^{*1}						
	China [A]	Qian 2010	120	8.75^{*2}	116.5^{2}	51.8^{2}	290^{2}	22.30^{*2}	22.31^{*2}	55.52^{*2}
	China [A]	Ruan 1995	35	10.98^{1}	76^{1}	93^{1}	370^{1}	11.59^{*1}	31.91^{*1}	56.42^{*1}

Region	Country	Author, Year	Sample Size	Energy (MJ)	Daily Intake in Grams (g)			% Daily Energy Intake		
					PRO	FAT	CHO	PRO	FAT	CHO
	China	Wan 2010	52			104.93[1]	369.26[1]		34.56[1]	54.05[1]
	China	Xiang 2005	23	8.44*[1]	58.6±3.5[1]	47.5±5.0[1]	341.9±15.5[1]	12[1]	21[1]	68[1]
	China[A]	Yang 2000	1043	10.12[1]	69.0[1]			11.41*[1]		
	Lao	Barennes 2009	300	11.30*[1]	102±39[1]	30±45[1]	575*[1]	15.11*[1]	10.00*[1]	85.19*[1]
	Philippines	Guillermo-Tuazon 1992	40	8.71±1.96[1]						
	Philippines	Quinn 2012	117	5.93*[1]	67.3*[1]	29.9*[1]	225±102[1]	19±5.0[1]	19±13[1]	63.51*[1]
	Vietnam	Nakamori 2009	59	8.45*[1]	73.1±19.1[1]			14.49*[1]		

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Mean (P5, P95), [6] Mean (95%CI), [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90) [10] Geometric Mean (95%CI), [11] Range, * Unit conversions or % energy calculations (and vice versa) were made. [A] Weighted means were taken.

Table 15. Mean/Median Intakes of Vitamins in Lactating Women, by Region

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
Africa	Cameroon	Engle-Stone 2014	246	346 (755) [2]				
	Ethiopia	Haileslassie 2013	60	194 (225) [2]			0.8 (0.5) [2]	
	Ghana	Addo 2011	70	2540±1330[1]			1.28±0.76[1]	
	Kenya [A]	Kigutha 1995	24	934[1]			2.5[1]	
	Malawi	Hallund 2008	20	753 (1065) [2]				
	South Africa	Papathakis 2012	142	247±318[1]	234±108[1]	1.5±1.9[1]	0.89±0.3[1]	1.7±3.4[1]
Americas	Brazil	Azeredo 2004	35	321±182[1]	308±162[1]			6.0±14.5[1]
	Brazil	Castro 2006	276	630.3*[1]				
	Brazil	da Silva Ribeiro 2010	86	1490.6±1283.2[1]				
	Guatemala	Casterline 1997	113		241.9±111.1[1]			3.90±12.00[1]
	Mexico	Caire-Juvera 2007	60	2204± 4615[1]	312±304[1]			
Eastern Mediterranean	Egypt	Aziz 2005	62					4.17±0.74[4]
	Egypt [A]	Rahmanifar 1993	41	578[1]			1.29[1]	

Region	Country	Author, Year	Sample Size	Vitamin A (ug RAE)	Folate (ug DFE)	Vitamin D (ug)	Thiamin (mg)	Vitamin B12 (ug)
	Iran [A]	Nikniaz 2013	75	509.2[1]				
South East Asia	Bangladesh	Ahmed 2003	120	443.8±388.8[1]				
	India	Singh 2009	400	748[1]	178[1,C]			
Western Pacific	China	Chen 2012	196	1146±129[4]	470.0±18.8[4]		1.6±0.05[4]	
	China	Ding 2010	40	667±690[1]			0.99±0.61[1]	
	Lao	Barennes 2009	300	----- [B]			0.8±0.5[1]	

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI) , [7] Median (Range), [8] Mean (P5, P95), [9] Mean (P10, P90), [10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. [A] Weighted means were calculated. [B] Data is available for retinol. [C] Folate was given as folic acid, but was obtained from dietary data.

Table 16. Mean/Median Intakes of Minterals in Lactating Women, by Region

Region	Country	Author, Year	Sample Size	Iron (mg)	Zinc (mg)	Calcium (mg)
Africa	Ethiopia	Haileslassie 2013	60	118 (208) [2]	9.2 (3.0) [2]	662 (325) [2]
	Gambia	Prentice 1993	124			387±93[1]
	Gambia	Sawo 2013	20			367±186[1]
	Ghana	Addo 2011	70	36.2±16.7[1]	19.0±13.5[1]	1320±1090[1]
	Kenya[A]	Kigutha 1995	24	24[1]		956[1]
	Malawi	Hallund 2008	20	27 (13) [2]		622 (562) [2]
	South Africa	Kesa 2005	315	10.50±4.0[1]		
	South Africa	Mostert 2005	46	10.0±6.0[1]	9.2±8.3[1]	254.2±163.0[1]
	South Africa	Papathakis 2012	142	7.8±2.5[1]	5.9±2.0[1]	263±139[1]
Americas	Brazil	Azeredo 2004	35	11.2±5.2[1]	10.6±5.0[1]	
	Brazil	Castro 2006	276	12.6±4.1[1]		527±235[1]
	Brazil	Lacerda 2007	308	11.7 (11.2, 12.2) [6]		516 (485, 548) [6]
	Mexico	Caire-Juvera 2007	60	16.1±13.4[1]	11.6±8.4[1]	1636±1910[1]
Eastern Mediterranean	Egypt [A]	Rahmanifar 1993	41	16.8[1]	10.5[1]	428[1]
	Iran	Ayatollahi 2004	266	13±4[1]		1054±282[1]
	Iran	Mahdavi 2010	182	11.8±8.2[1]	5.31±2.3[1]	
	Iran [A]	Nikniaz 2013	75		9.0[1]	
South East Asia	Bangladesh[A]	Islam 2001	65			35.5[1]
	India [A]	Agrahar-Murugkar 2004	295	16.72[4]		323.69[4]
	India	Murty 1994	110	16.6 [1]		

	India	Singh 2009	400	28.6 [1]		
Western Pacific	China	Chen 2012	196	34.8±1.0 [4]	20.4±0.59 [4]	595±22 [4]
	China	Ding 2010	40	22.2±9.55 [1]	10.9±5.33 [1]	493±405 [1]
	China [A]	Ma 2007	470		10.9 [2]	
	China [A]	Qian 2010	120	30 [2]	16.5 [2]	817 [2]
	China [A]	Yang 2000	1043	37 [1]	8.2 [1]	507 [1]
	Lao	Barennes 2009	300	14.2±6 [1]		436±257 [1]
	Vietnam	Nakamori 2009	59	10.2±2.5 [1]	10.4±2.2 [1]	515.0±188.8 [1]

[1] Mean±SD, [2] Median (IQR), [3] Mean (Range), [4] Mean±SE, [5] Median (P5, P95), [6] Mean (95%CI) , [7] Median (Range). [8] Mean (P5, P95), [9] Mean (P10, P90), [10] Geometric Mean (95%CI), [11] Range, * Unit conversions were made. [A] Weighted means were taken.

Table 17. Evaluation of Key Components of Weight-Loss Programs in Nonpregnant Women (from Phelan et al. 2011)

Highly effective
• Calorie prescription (1200–1500 kcal/d or 1000 kcal/d less than baseline) • Meal replacements/structured meal plan • High physical activity goals (60–90 min/day) • Daily self-weighing of body weight • Daily monitoring of food intake • Behavior therapy (goal setting, monitoring, feedback, stimulus control, problem-solving) • Continued patient–provider contact (≥2/month)
Moderately effective if used in combination with strategies listed above
• Macronutrient alteration • Eating breakfast • Reducing television viewing • Moderate physical activity alone (30 min/day, 5 days/week) • Social support • Cognitive strategies • Motivational interviewing
Not effective
• Body image, body acceptance • Education alone

Table 18. Gestational Weight Gain Recommendations in Countries Surveyed (Source: Scott et al. 2014)

Country	Recommendations by pre-pregnancy BMI category*					
	<18.5 kg/m^2	18.5-24.9 kg/m^2	25-29.9 kg/m^2	30-34.9 kg/m^2	35-39.9 kg/m^2	>40 kg/m^2
United States	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	**5 - 9**	**5 - 9**	**5 - 9**
Bulgaria	*12 - 18*	*11 - 16*	*7 - 11*	**5 - 9**	*5 - 8*	*5 - 8*
Ghana	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	*5 - 10*	*5 - 10*	*5 - 10*
Italy	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	**5 - 9**	**5 - 9**	**5 - 9**
Canada	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	**5 - 9**	**5 - 9**	**5- 9**
Nicaragua	*12.7 - 18.1*	*11.3 - 15.9*	*6.8 - 11.3*	*5 - 9.1*	None given	None given
Denmark	*13 - 18*	10 - 15	8 - 10	*6 - 9*	*6 - 9*	*6 - 9*
Poland	**12.5 - 18**	*11.4 - 15.9*	*6.5 - 11.4*	7 (upper limit)	7 (upper limit)	7 (upper limit)
Romania	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	7 - 11.5	7 - 11.5	7 - 11.5
Switzerland	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	7 (upper limit)	7 (upper limit)	7 (upper limit)
Brazil	**12.5 - 18**	**11.5 - 16**	**7 - 11.5**	7 (no range)	7 (no range)	7 (no range)
Paraguay	**12.5 - 18**	11.5 - 14	**7 - 11.5**	*6 - 8*	None given	None given
Iran	12 - 18	9 - 14	**7 - 11.5**	6 (no range)	6 (no range)	6 (no range)
China	14 - 15	12 (no range)	7 - 8	7 - 8	7 - 8	7 - 8
Croatia	14 (upper limit)	12 (upper limit)	10 (upper limit)	8 (lower limit)	6 (lower limit)	4 (lower limit)
Cuba	9.45 - 17	8.6 - 15.9	7.5 - 14	5.4 - 12.9	5.4 - 12.9	5.4 - 12.9
Japan	9 - 12	7 - 12	individual	individual	individual	individual
Portugal	6 - 12	5 - 10	5 - 7	5 - 7	5 - 7	5 (no range)
Russia	12 (no range)	12 (no range)	10 (no range)	10 (no range)	8 (no range)	8 (no range)
	Recommendations by BMI at a specific gestational age chart					
Argentina	Country-specific guideline chart					
Bolivia	Rosso and Mardones†					
Chile	Atalah, et al.§					
Ecuador	Rosso and Mardones†					
Guatemala	Atalah, et al.§					
Honduras	Country-specific guideline chart					
Peru	Rosso and Mardones†					
Uruguay	Atalah, et al.§					
	Other recommendations not based on body size					
Burma	1 kg per month from month 5 of gestation to term					
France	Average gain around 12 kg					
India	10 - 12 kg					
Oman	Client materials recommend gaining 9 15 kg					
Vietnam	9 - 12 kg					
South Africa	Formal recommendation that women should not be given a guideline for weight gain in pregnancy					

***Bolded text indicates that a weight gain recommendation exactly matches the IOM recommendations.** *Italicized text indicates that a weight gain recommendation falls within 1 kg of either side of the U.S. IOM recommendations.*

†Mardones F, Rosso P. A weight gain chart for pregnant women designed in Chile. Matern Child Nutr. 2005.

§Atalah E, Castillo C, Castro R, Aldea A. Proposal of a new standard for the nutritional assessment of pregnant women. Rev Med Chil. 1997.

Table 19. Recommendations for Healthy Eating for Women Inside and Outside of Pregnancy (USDA 2010 and from Widen and Siega-Riz 2011)

Recommendations outside of pregnancy	Recommendations during pregnancy		
Food	**Food**	**1st trimester**	**2nd-3rd trimesters**
Fruits 2 cups	Eat a variety of fruits	2 cups	2 cups
Vegetables 2 ½ cups	Vary your vegetables, get dark green or orange/yellow vegetables and beans	2 ½ cups	3 cups
Milk, low-fat 3 cups	Get calcium-rich foods, choose low-fat	3 cups	3 cups
Whole grains 6 oz	Choose whole grains	6 oz	8 oz
Lean meats, protein sources and legumes 6 oz	Choose lean protein and cooked dry beans	5 ½ oz	6 oz

Recommendations also include limited fats and oils and sweets (added sugars)

Figure 1. Change in BMI Status of Women 20-49 Years from 1980 (left) to 2008 (right) by Region (Source: Black et al. 2013)**.** Shown are the prevalences of underweight (BMI < 18.5 kg/m^2); normal (BMI 18.5—24.9 kg/m^2); overweight (BMI 25.0—29.9 kg/m^2); obese (BMI > 30.0 kg/m^2).

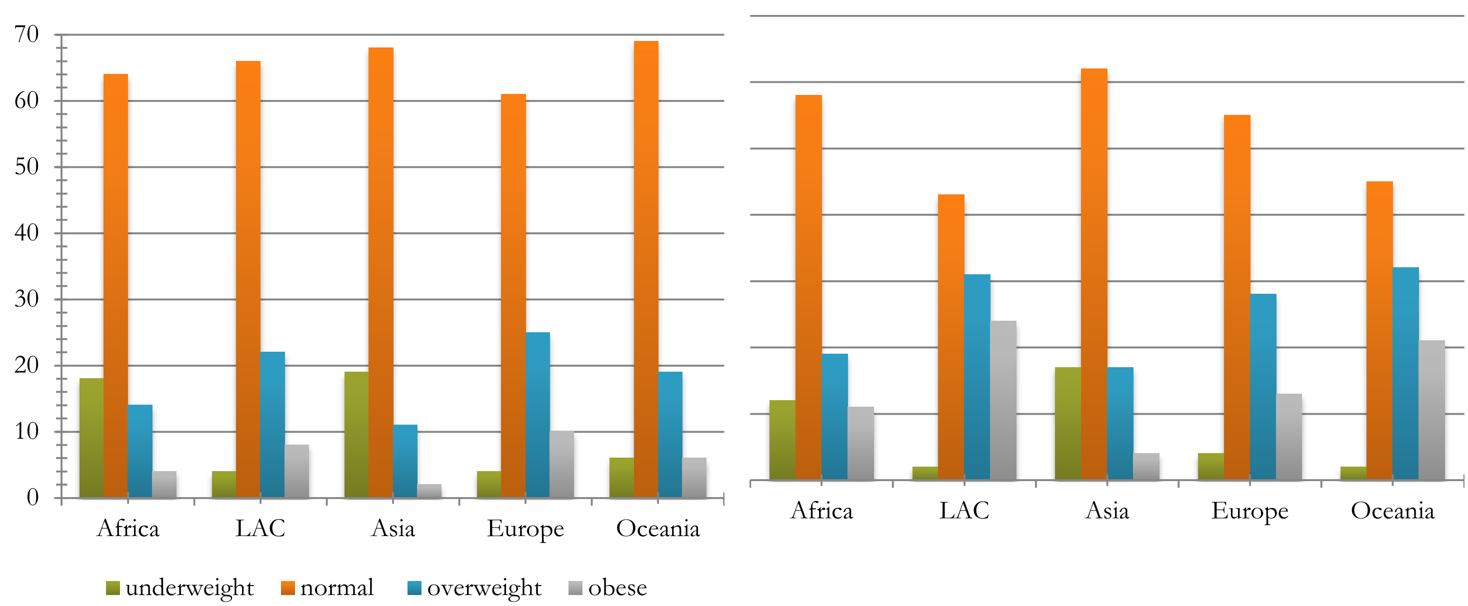


Figure 2. Estimated Prevalences of Overweight and Obesity for Men and Women in Developing and Developed Countries by Age (Source: Ng et al. 2014)

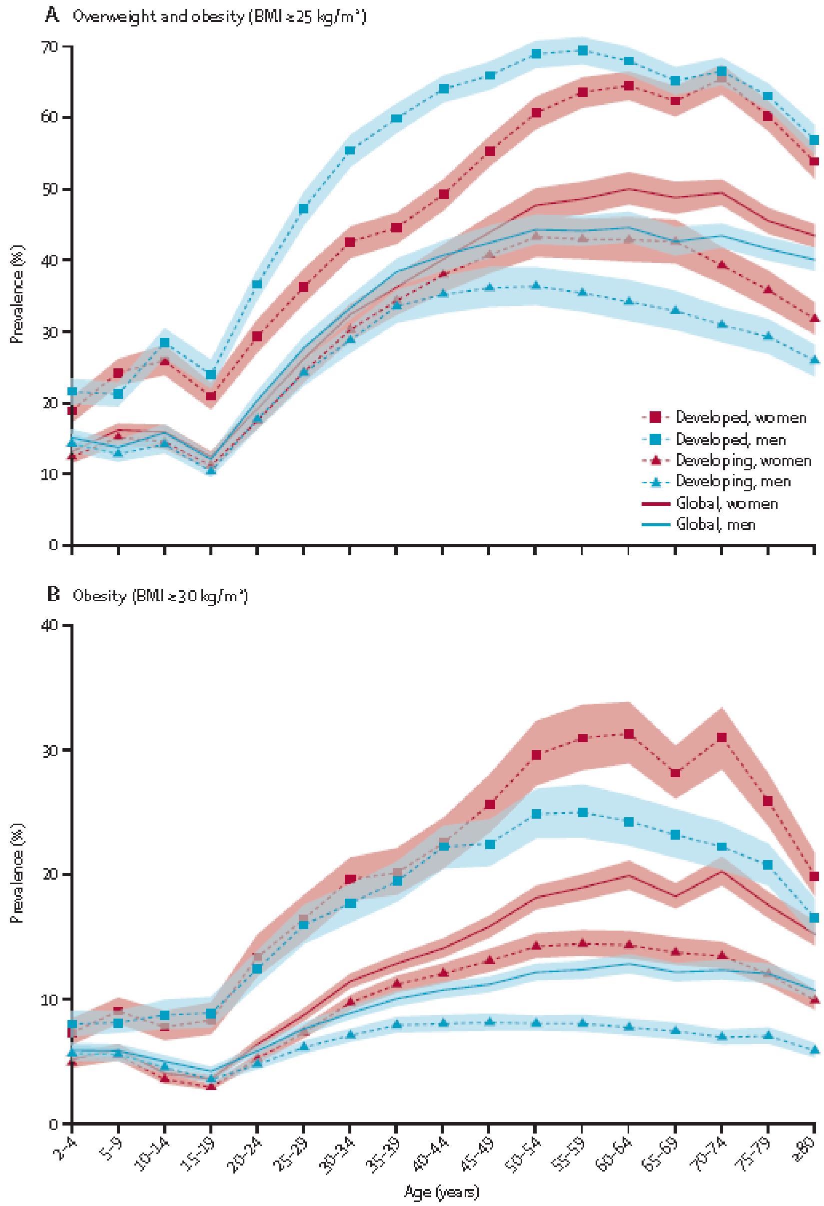


Figure 3. Status of Global Prevention of Folic-Acid Preventable Birth Defects, 2012 (Source: Youngblood et al. 2013)

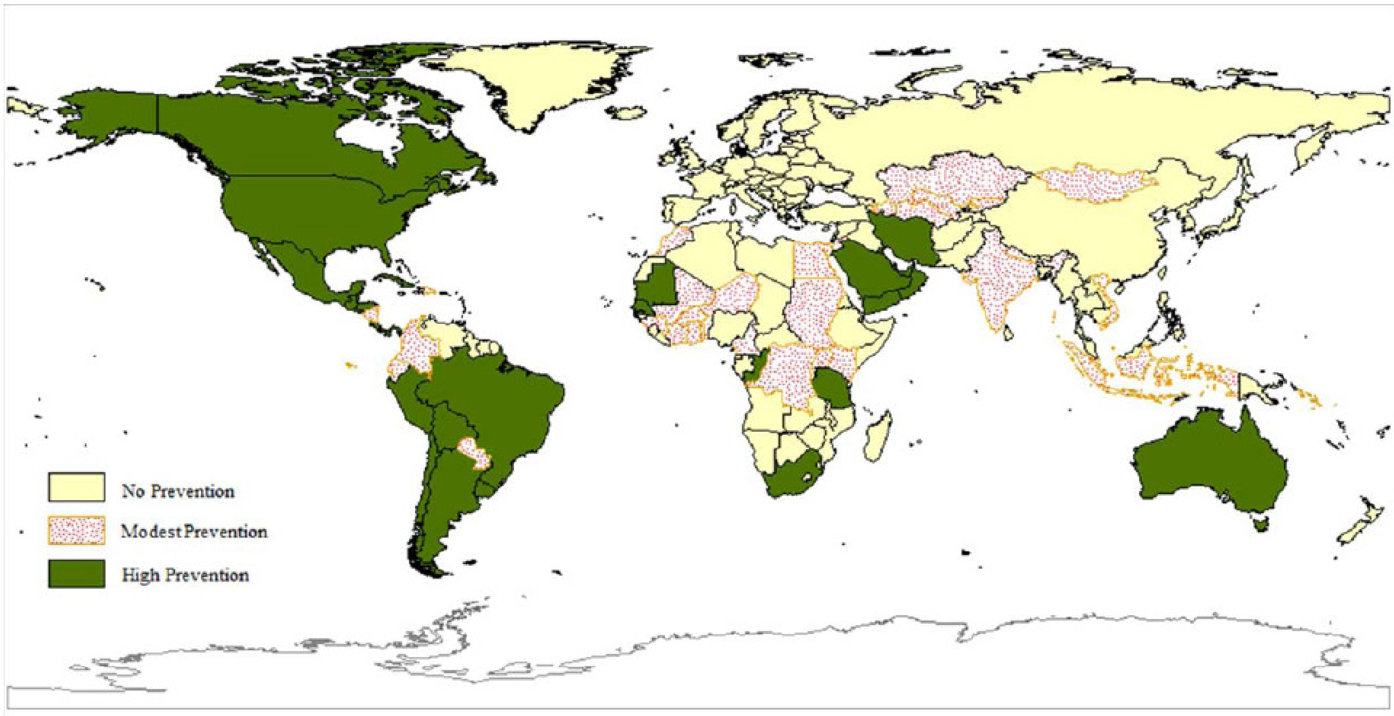


Figure 4. Studies of 25-Hydroxyvitamin D Mean/Median Values by Countries and Regions. Severe deficiency (red); insuffiency (yellow); repletion (green). (Source: Hilger et al. 2014; Bendik et al. 2014)

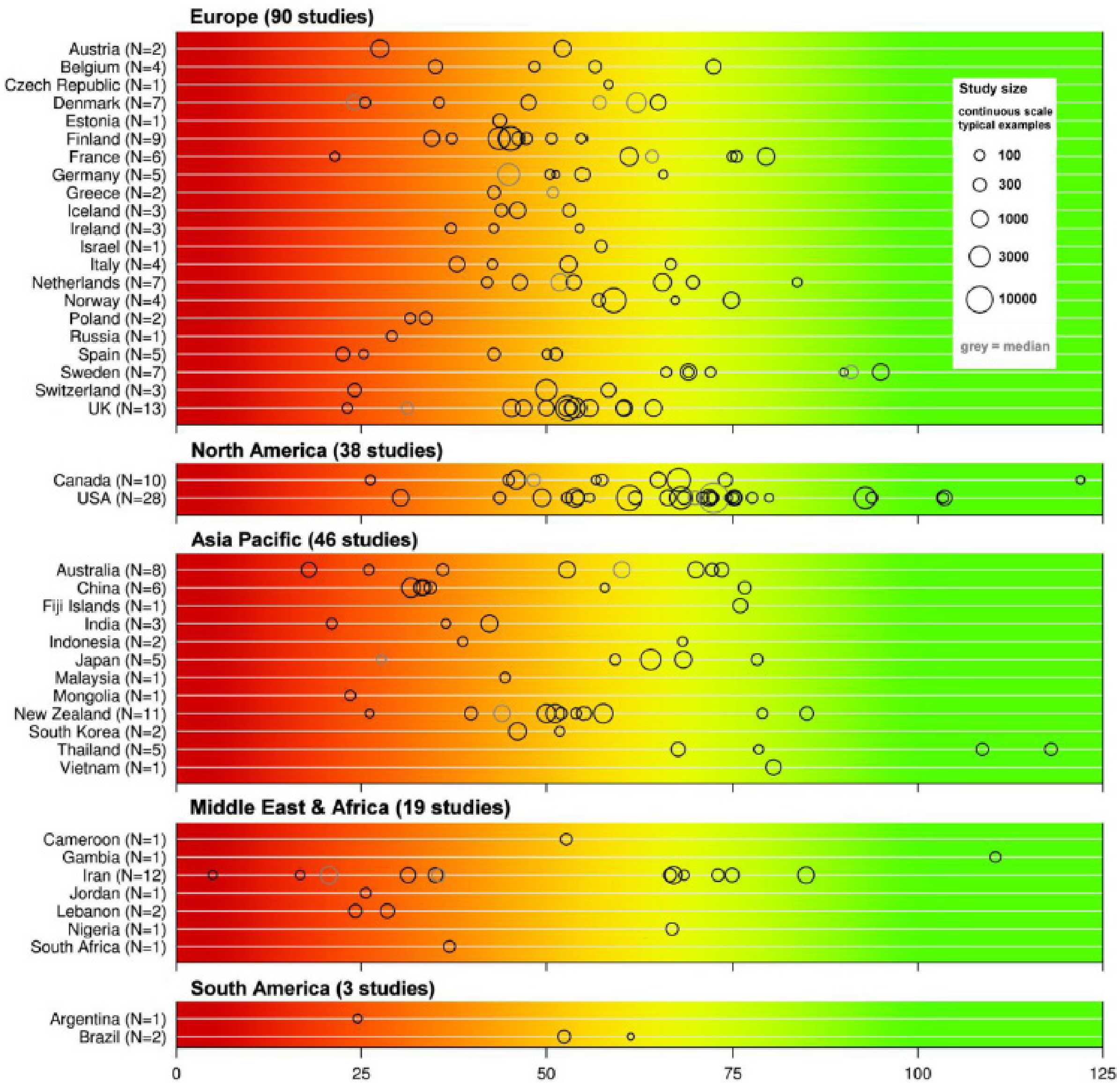


Figure 5. Mean/Median Energy Intakes of Adolescent Girls in LMIC, by Region.

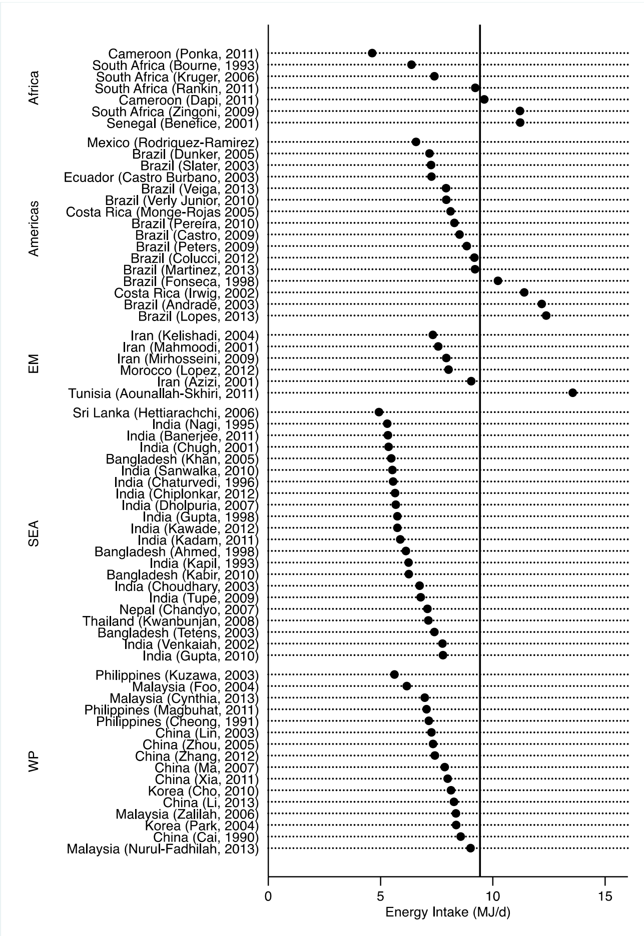
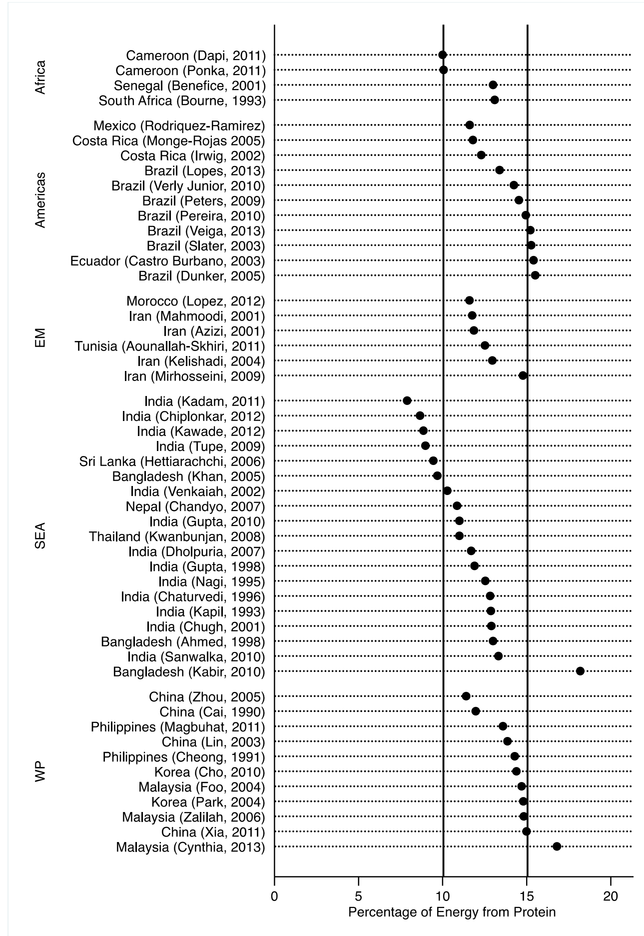


Figure 6. Protein Intakes as a Percentage of Energy of Adolescent Girls in LMIC, by Region.

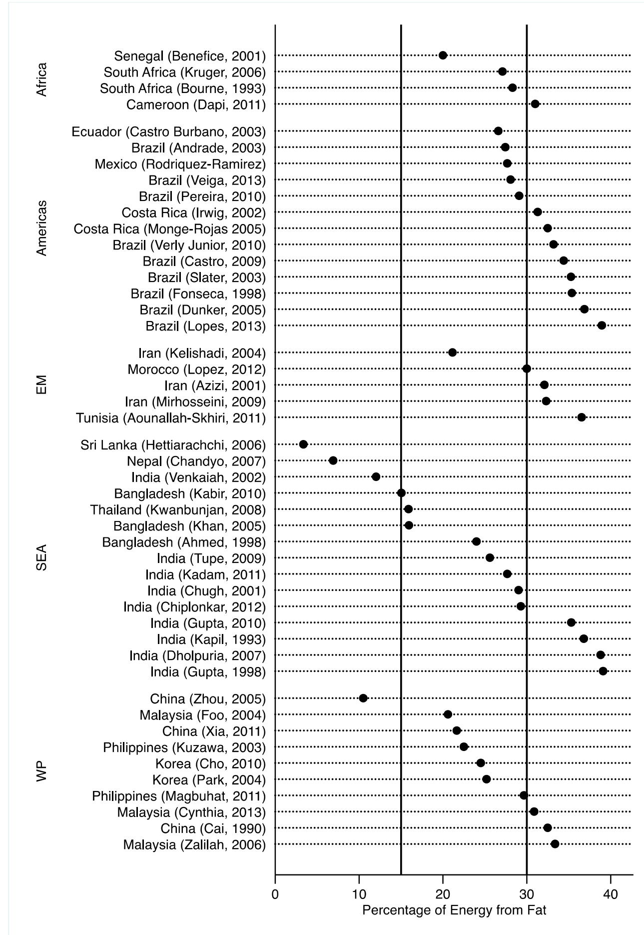


EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

The vertical reference line in Figure 5 represents the estimated mean energy requirement of the adolescent girls in the studies included in the review: 9.43MJ/d. The mean energy intake (line not shown) is 7.65MJ/d. The vertical reference lines in Figure 6 represent the FAO/WHO's recommended protein intakes as a percentage of energy: 10-15%.

Figure 7. Carbohydrate Intakes as a Percentage of Energy of Adolescent Girls in LMIC, by Region.

Figure 8. Fat intakes as a Percentage of Energy of Adolescent Girls in LMIC, by Region.



The vertical reference lines represent the ranges of recommended intakes by the FAO/WHO: 55-75% for carbohydrates and 15-30% for fat.
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 9. Mean/Median Intakes of Iron of Adolescent Girls in LMIC, by Region.

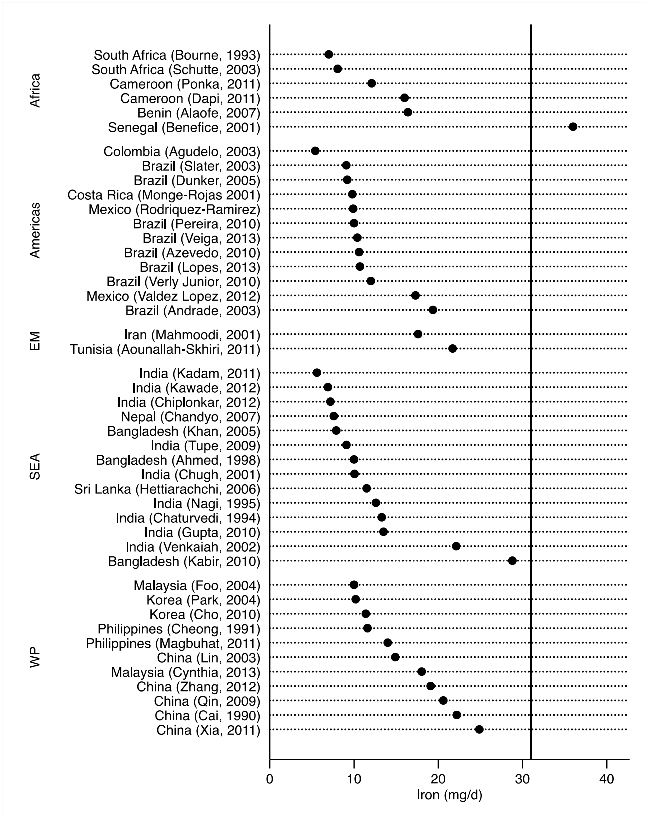
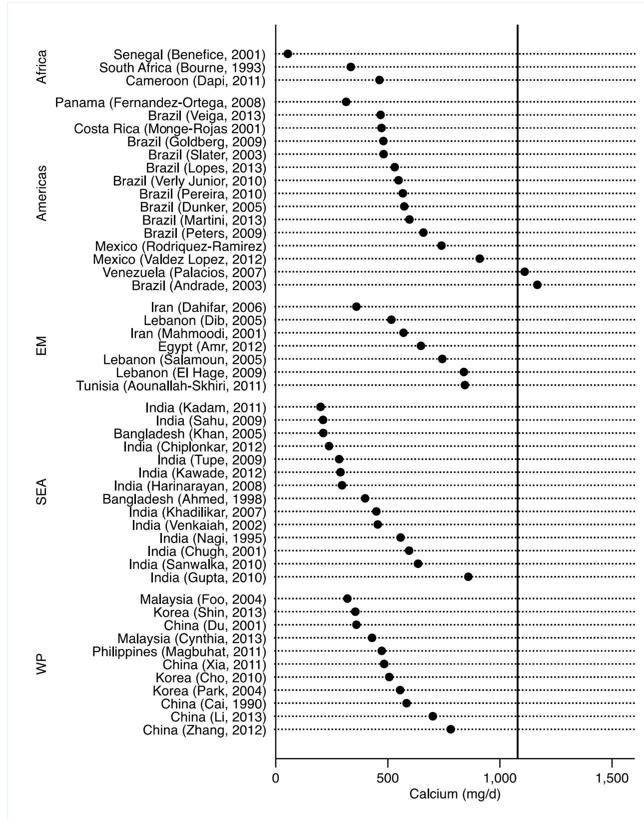


Figure 10. Mean/Median Intakes of Calcium of Adolescent Girls in LMIC, by region.



The vertical reference lines represent the FAO/WHO Recommended Nutrient Intake for iron (31.0mg/d) and the Estimated Average Requirement for calcium (1083mg/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 11. Mean/Median Intakes of Zinc of Adolescent Girls in LMIC, by Region.

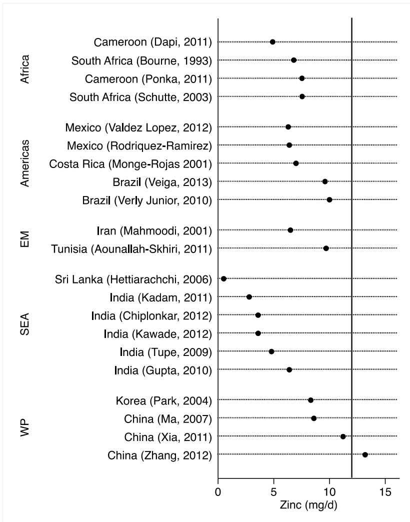


Figure 12. Mean/Median Intakes of Folate of Adolescent Girls in LMIC, by Region.

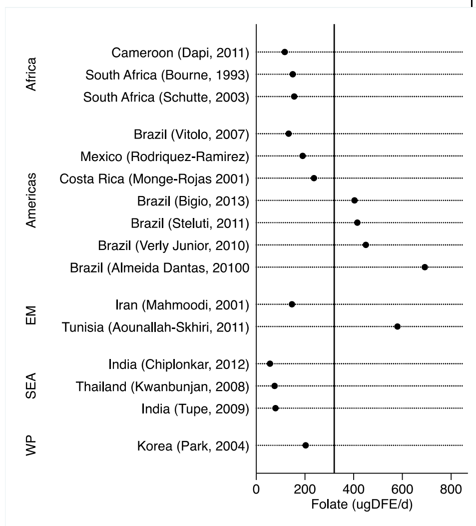
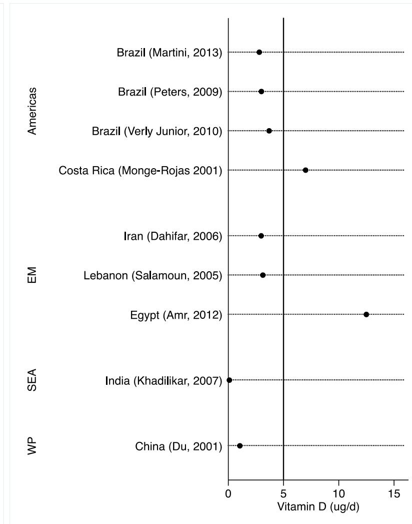


Figure 13. Mean/Median Intakes of Vitamin D of Adolescent Girls in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for zinc (12.0mg/d) and folate (320ugDFE/d) and the Adequate Intake for vitamin D (5ug/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 14. Mean/Median Intakes of Thiamine of Adolescent Girls in LMIC, by Region.

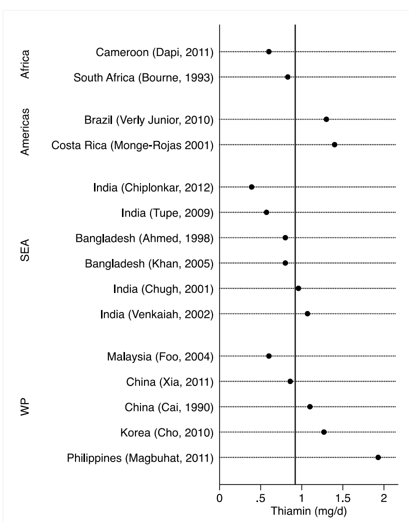


Figure 15. Mean/Median Intakes of Riboflavin of Adolescent Girls in LMIC, by Region.

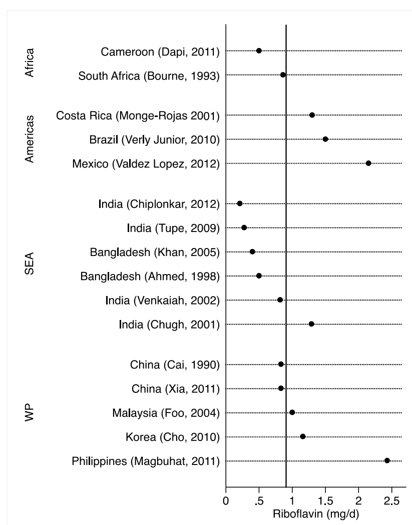
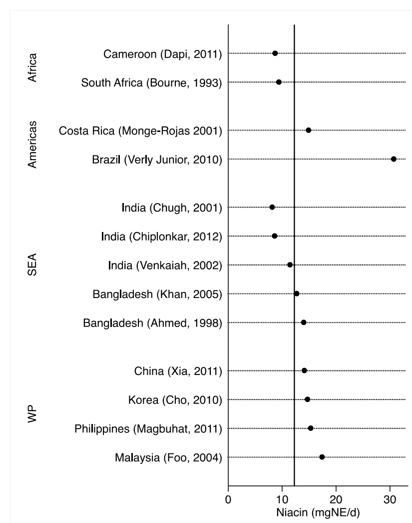


Figure 16. Mean/Median Intakes of Niacin of Adolescent Girls in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for thiamine (0.92mg/d), riboflavin (0.91mg/d) and niacin (12.3mgNE/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 17. Mean/Median Intakes of Vitamin A of Adolescent Girls in LMIC, by Region.

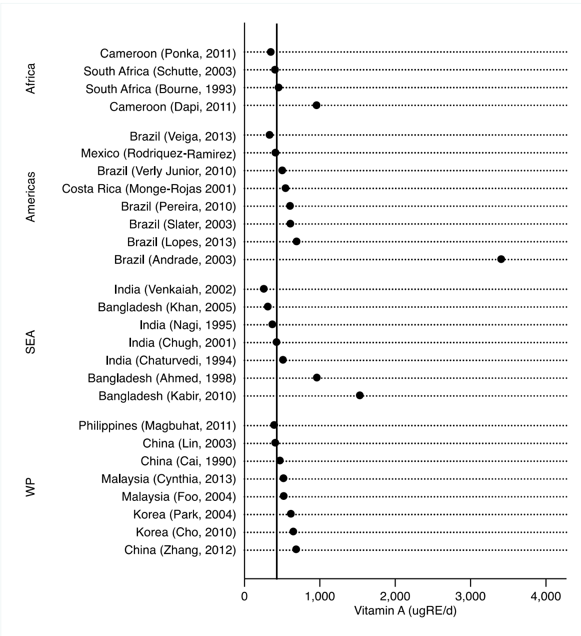
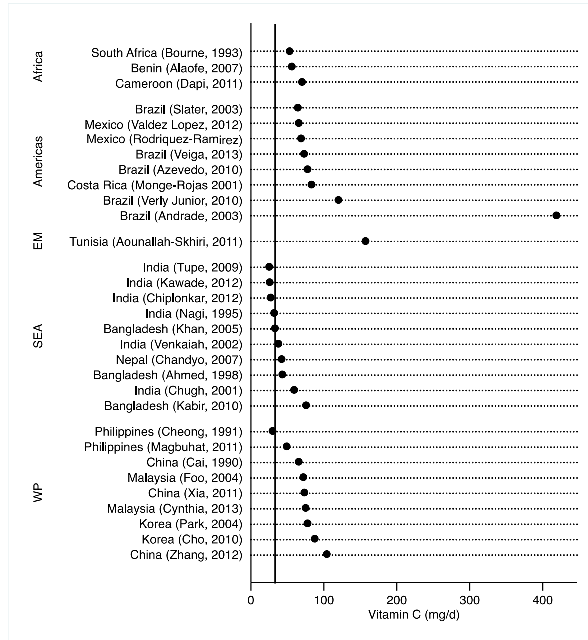


Figure 18. Mean/Median Intakes of Vitamin C of Adolescent Girls in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin A (429ugRE/d) and vitamin C (33.3mg/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 19. Mean/Median Intakes of Vitamin B6 of Adolescent Girls in LMIC, by Region.

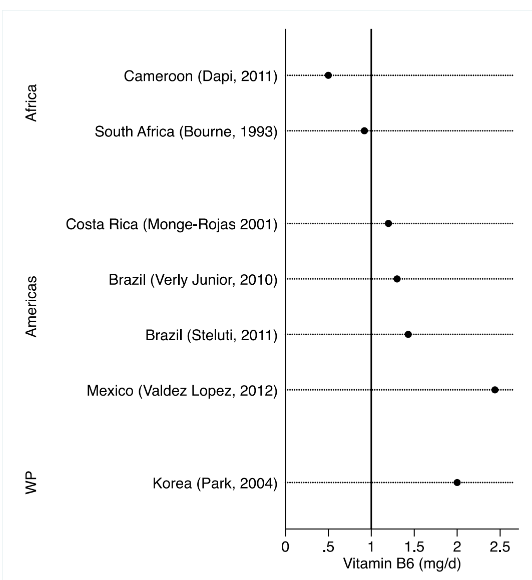
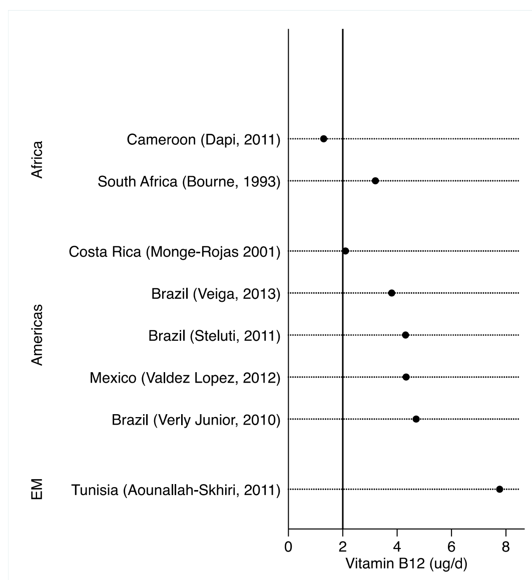


Figure 20. Mean/Median Intakes of Vitamin B12 of Adolescent Girls in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin B6 (1.0mg/d) and vitamin B12 (2.0ug/d).

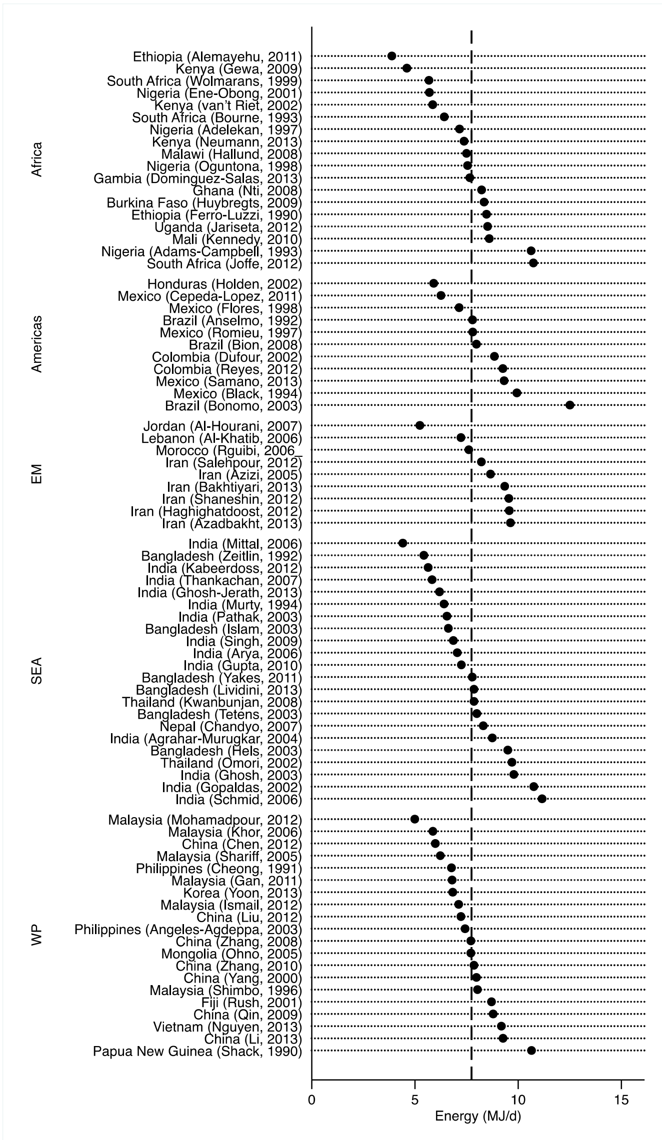
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 21. Mean/Median Energy Intakes of Women of

Figure 22. Protein Intakes as a Percentage of Energy of

Reproductive Age in LMIC, by Region.

Women of Reproductive Age in LMIC, by Region.



EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

The dashed vertical reference line represents the mean energy intake across studies (7.77MJ/d). The bold vertical reference lines represent the FAO/WHO's recommended protein intakes as a percentage of energy: 10-15%.

Figure 23. Carbohydrate Intakes as a Percentage of Energy of Women of Reproductive Age in LMIC, by Region.

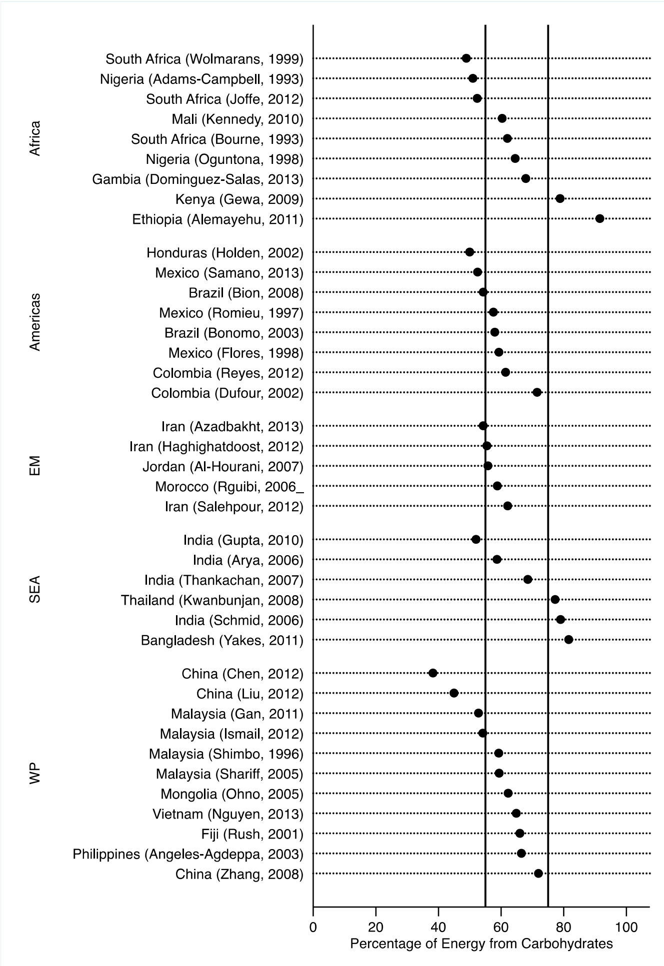
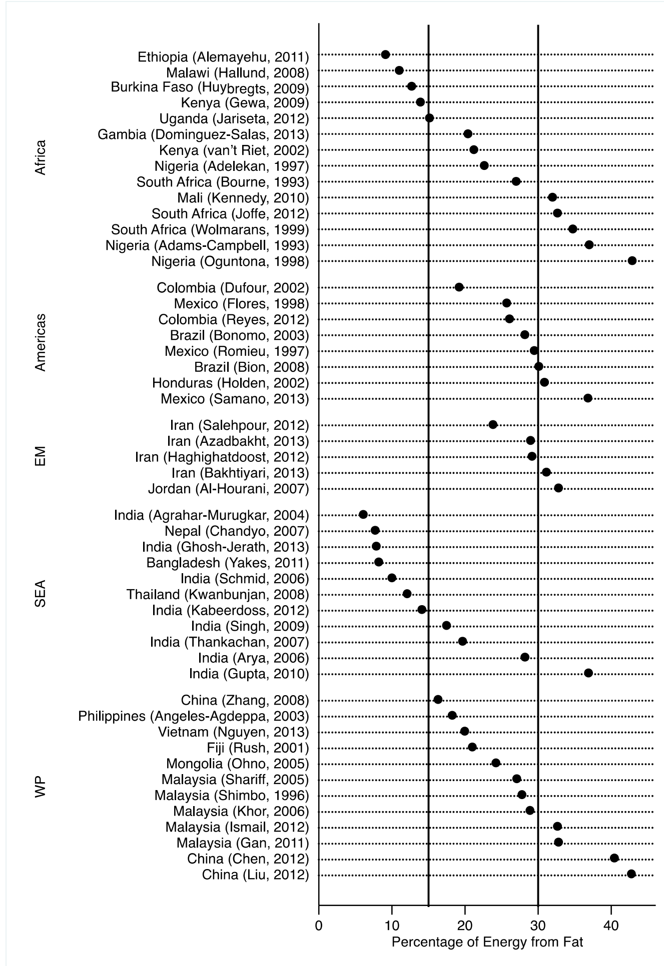


Figure 24. Fat Intakes as a Percentage of Energy of Women of Reproductive Age in LMIC, by Region.



The vertical reference lines represent the ranges of recommended intakes by the FAO/WHO: 55-75% for carbohydrates and 15-30% for fat.
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 25. Mean/Median Intakes of Iron of Women of Reproductive Age in LMIC, by Region.

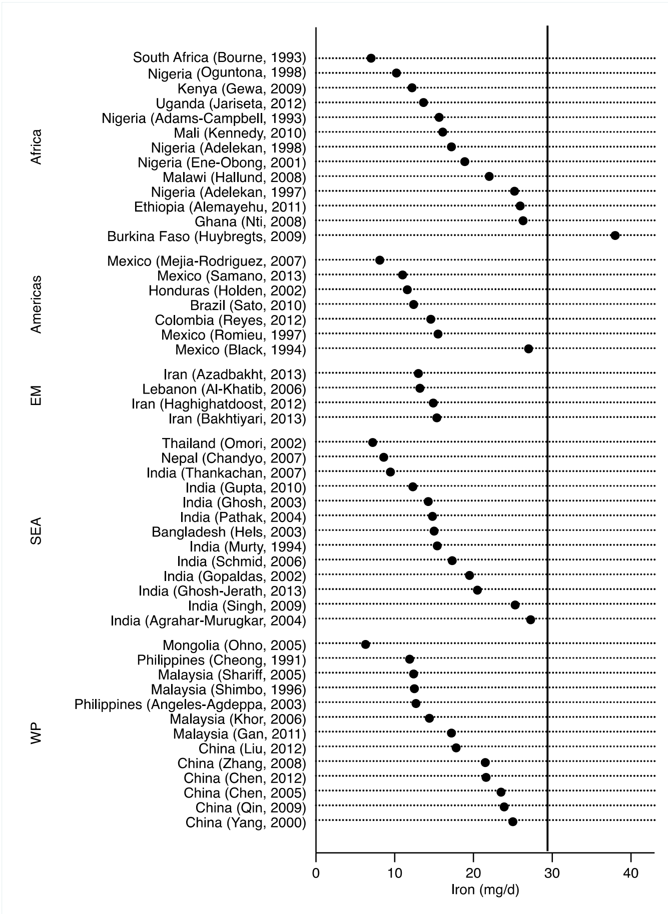
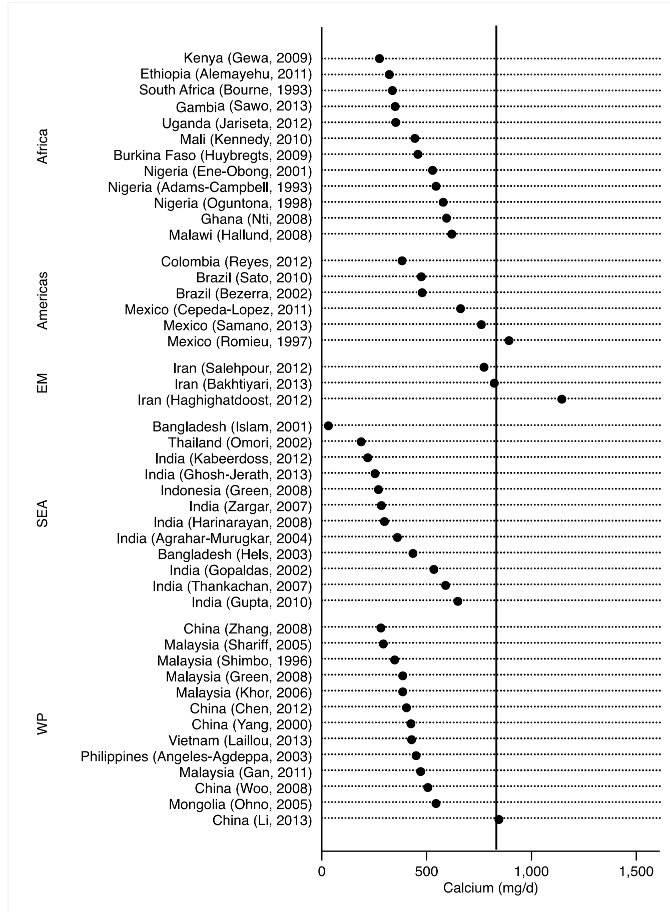


Figure 26. Mean/Median Intakes of Calcium of Women of Reproductive Age in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Recommended Nutrient Intake for iron (29.4mg/d) and the Estimated Average Requirement for calcium (833mg/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 27. Mean/Median Intakes of Zinc of Women of Reproductive Age in LMIC, by Region.

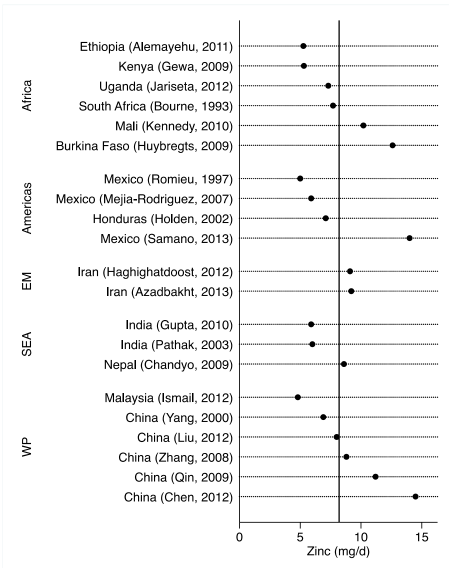


Figure 28. Mean/Median Intakes of Folate of Women of Reproductive Age in LMIC, by Region.

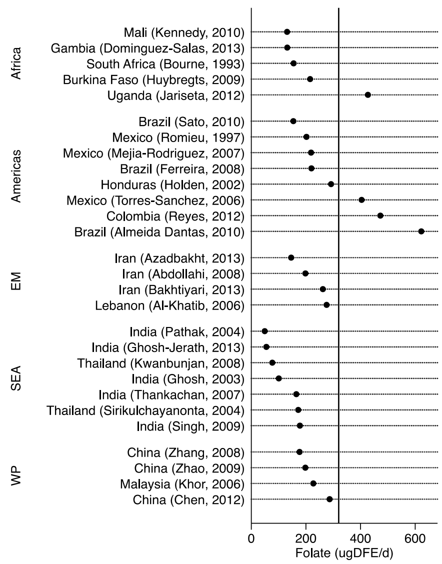
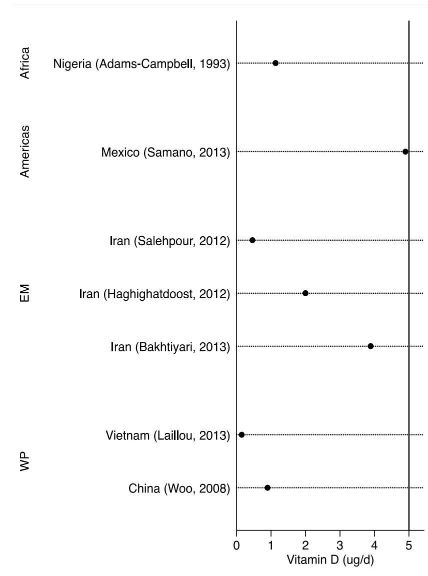


Figure 29. Mean/Median Intakes of Vitamin D of Women of Reproductive Age in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for zinc (8.2mg/d) and folate (320ugDFE/d) and the Adequate Intake for vitamin D (5ug/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 30. Mean/Median Intakes of Thiamine of Women of Reproductive Age in LMIC, by Region.

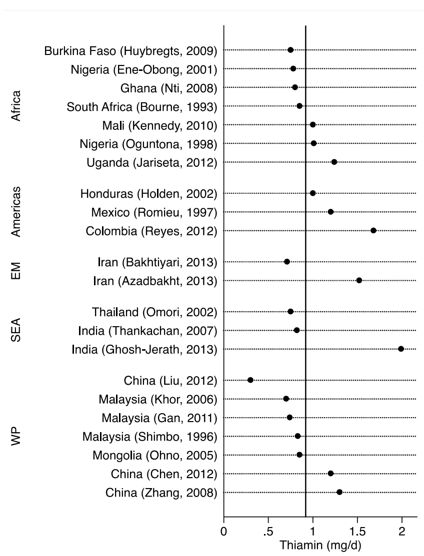


Figure 31. Mean/Median Intakes of Riboflavin of Women of Reproductive Age in LMIC, by Region.

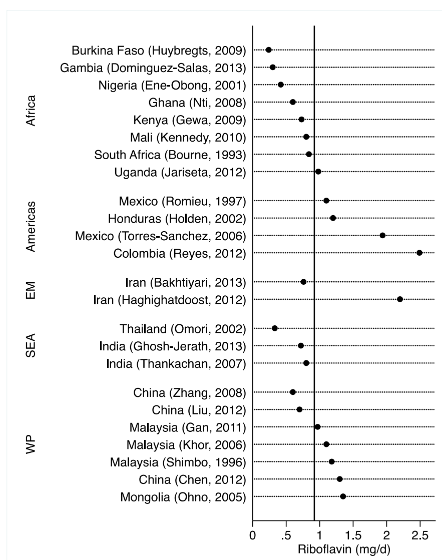
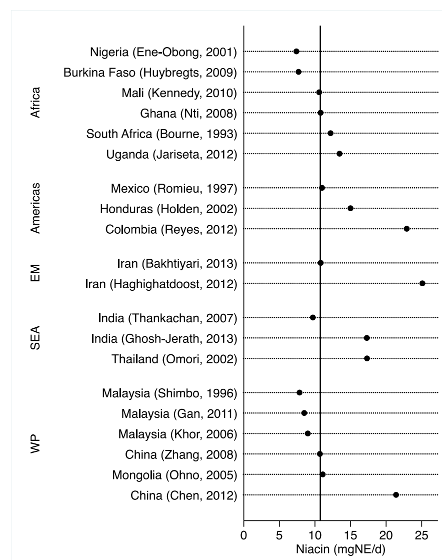


Figure 32. Mean/Median Intakes of Niacin of Women of Reproductive Age in LMIC, by Region.



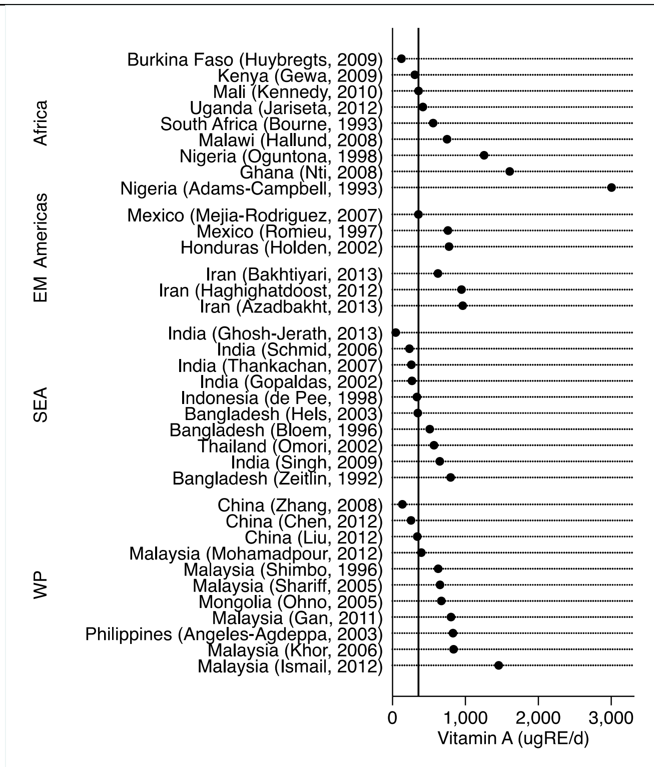
The vertical reference lines represent the FAO/WHO Estimated Average Requirements for thiamine (0.92mg/d), riboflavin (0.92mg/d) and niacin (10.8mgNE/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

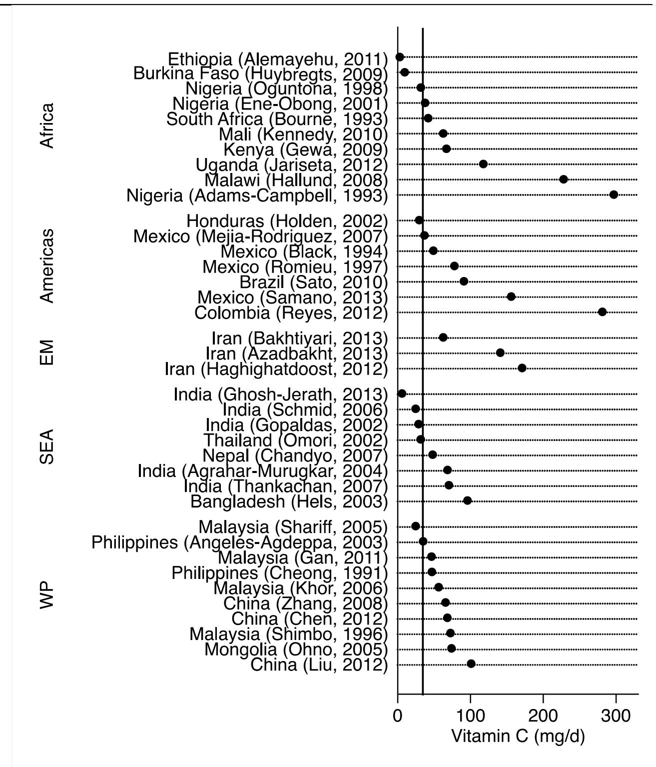
Figure 33. Mean/Median Intakes of Vitamin A of Women of

Figure 34. Mean/Median Intakes of Vitamin C of

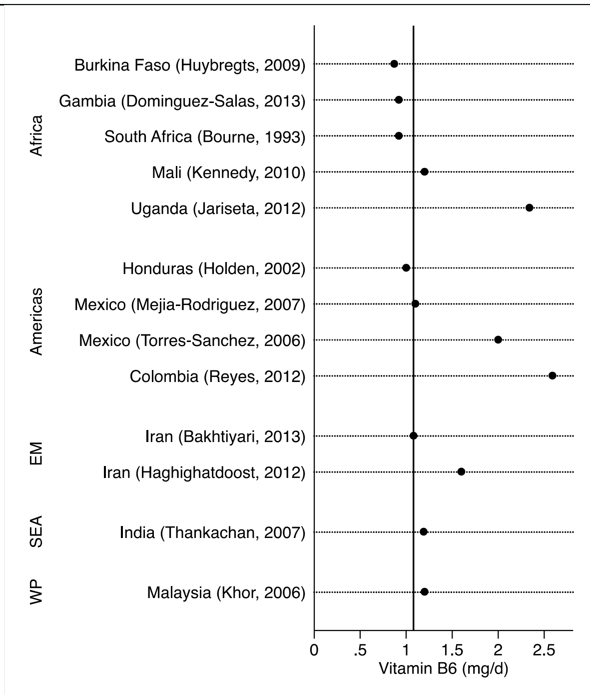
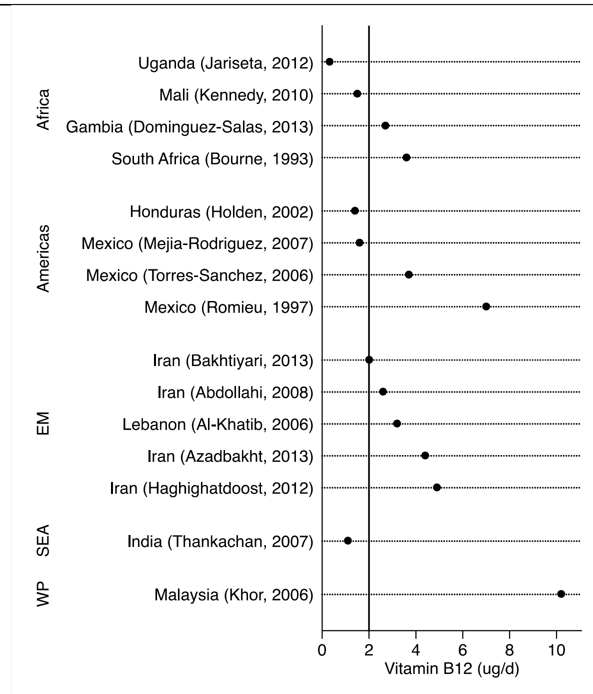
Reproductive Age in LMIC, by Region.



Women of Reproductive Age in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin A (357ugRE/d) and vitamin C (34.6mg/d).
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 35. Mean/Median Intakes of Vitamin B6 of Women of Reproductive Age in LMIC, by Region.	**Figure 36. Mean/Median Intakes of Vitamin B12 of Women of Reproductive Age in LMIC, by Region.**
	

The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin B6 (1.08mg/d) and vitamin B12 (2.0ug/d).
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 37. Mean/Median Energy Intakes of Pregnant Women in LMIC, by Region.

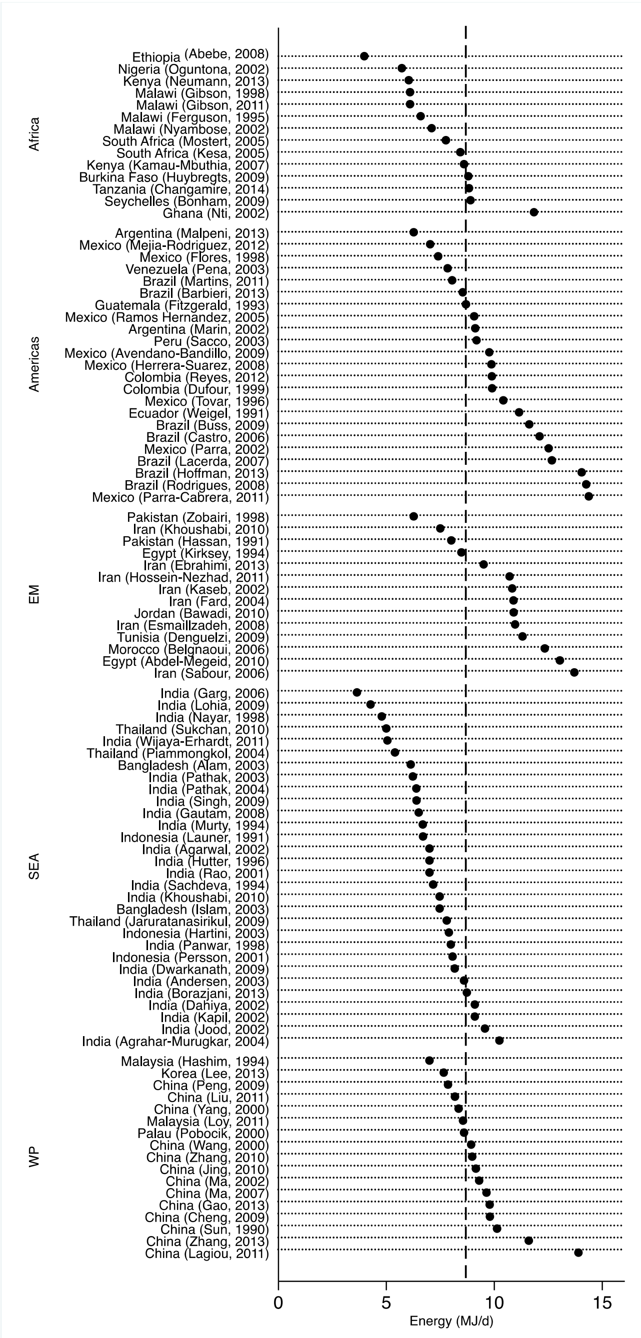
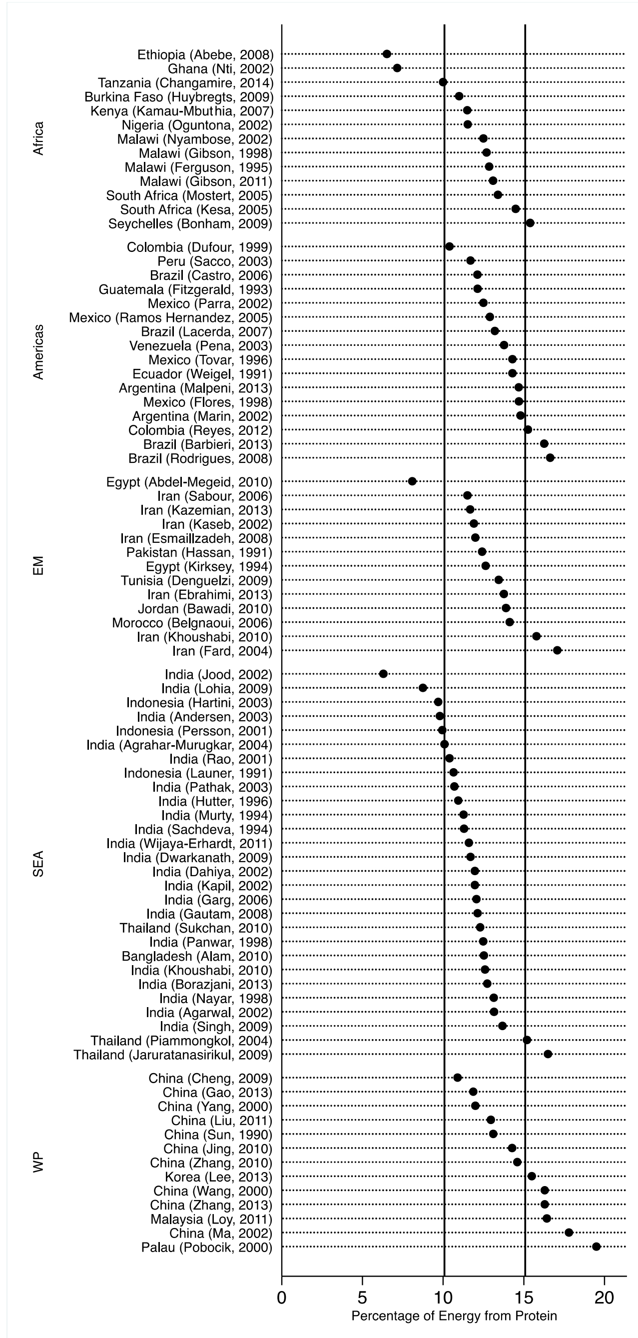


Figure 38. Protein Intakes as a Percentage of Energy of Pregnant Women in LMIC, by Region



EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

The dashed vertical reference line represents the mean energy intake across studies (8.74MJ/d). The bold vertical reference lines represent the FAO/WHO's recommended protein intakes as a percentage of energy: 10-15%.

Figure 39. Carbohydrate Intakes as a Percentage of Energy of Pregnant Women in LMIC, by Region

Figure 40. Fat Intakes as a Percentage of Energy of Pregnant Women in LMIC, by Region

The vertical reference lines represent the ranges of recommended intakes by the FAO/WHO: 55-75% for carbohydrates and 15-30% for fat.

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 41. Mean/Median Intakes of Iron of Pregnant Women in LMIC, by Region

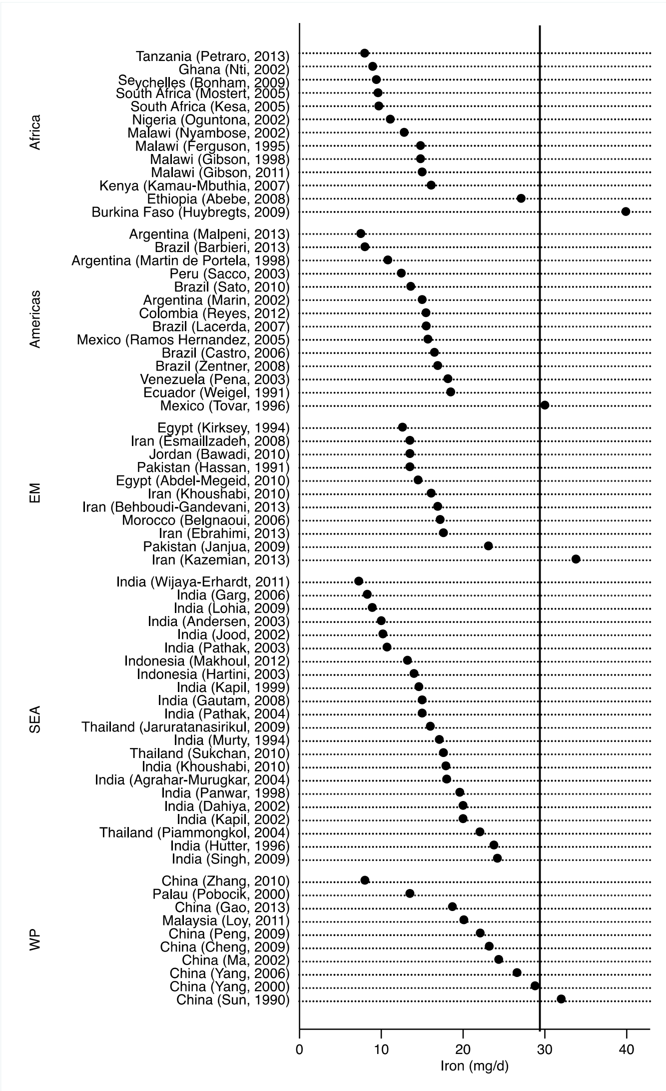
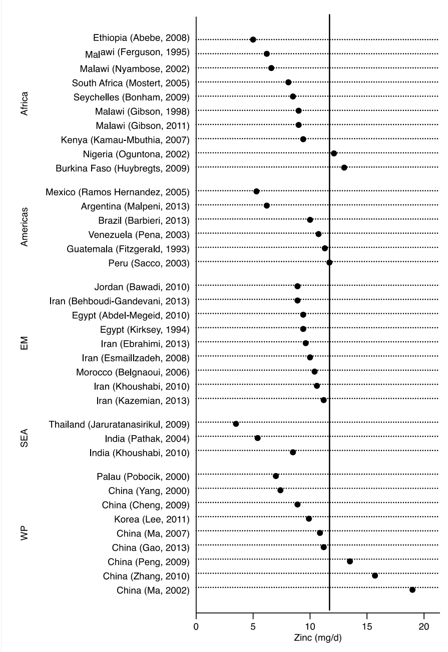


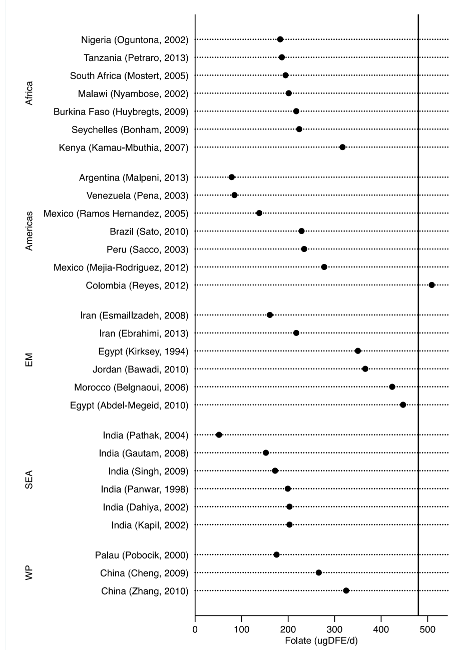
Figure 42. Mean/Median Intakes of Calcium of Pregnant Women in LMIC, by Region

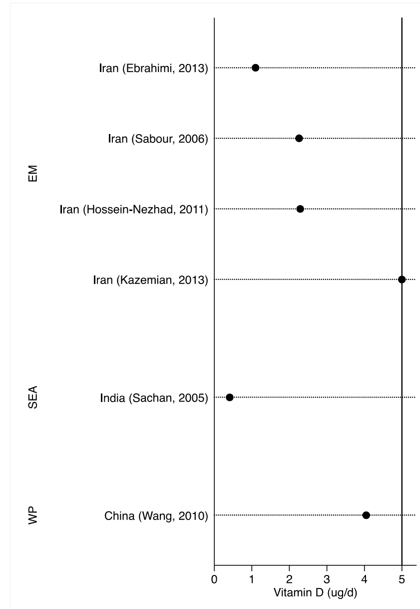
The vertical reference lines represent the FAO/WHO Estimated Average Requirements for iron (40.0mg/d) and for calcium (833mg/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 43. Mean/Median Intakes of Zinc of Pregnant Women in LMIC, by Region	**Figure 44. Mean/Median Intakes of Folate of Pregnant Women in LMIC, by Region**	**Figure 45. Mean/Median Intakes of Vitamin D of Pregnant Women in LMIC, by Region**



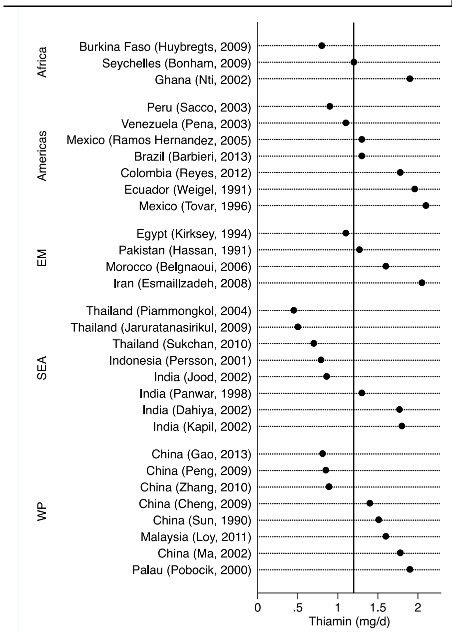


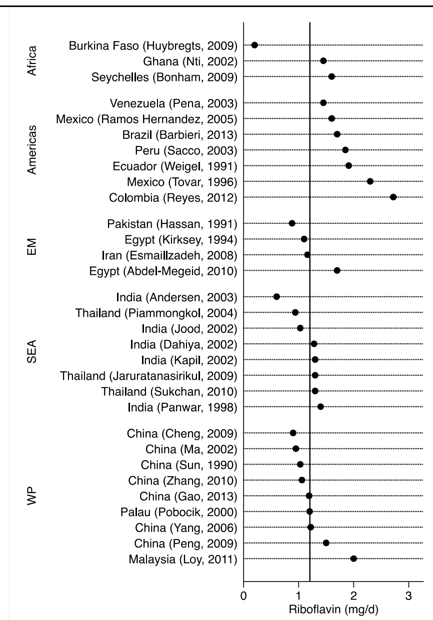


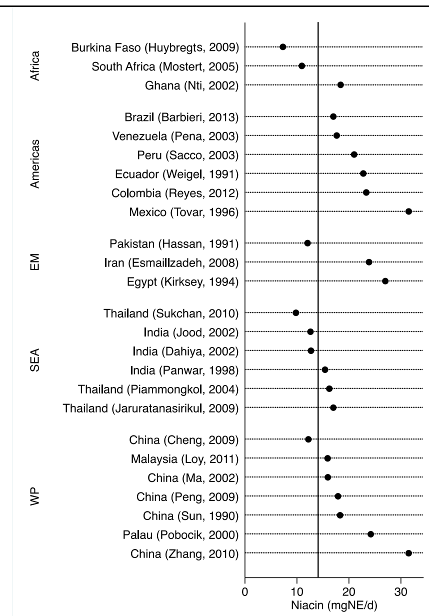
The vertical reference lines represent the FAO/WHO Estimated Average Requirements for zinc (11.7mg/d) and folate (480ugDFE/d) and the Adequate Intake for vitamin D (5ug/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 46. Mean/Median Intakes of Thiamine of Pregnant Women in LMIC, by Region	**Figure 47. Mean/Median Intakes of Riboflavin of Pregnant Women in LMIC, by Region**	**Figure 48. Mean/Median Intakes of Niacin of Pregnant Women in LMIC, by Region**







The vertical reference lines represent the FAO/WHO Estimated Average Requirements for thiamine (1.2mg/d), riboflavin (1.2mg/d) and niacin (14.0mgNE/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 49. Mean/Median Intakes of Vitamin A of Pregnant Women in LMIC, by Region

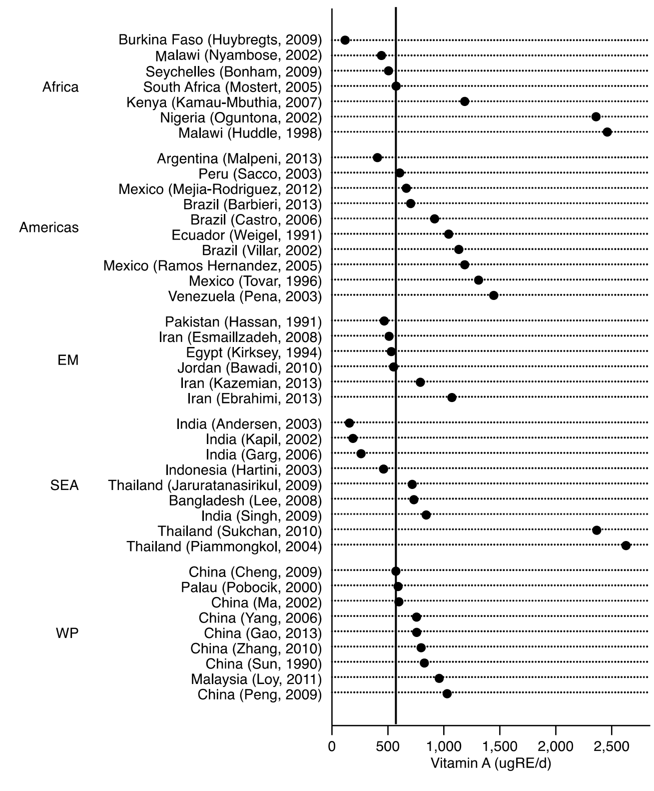
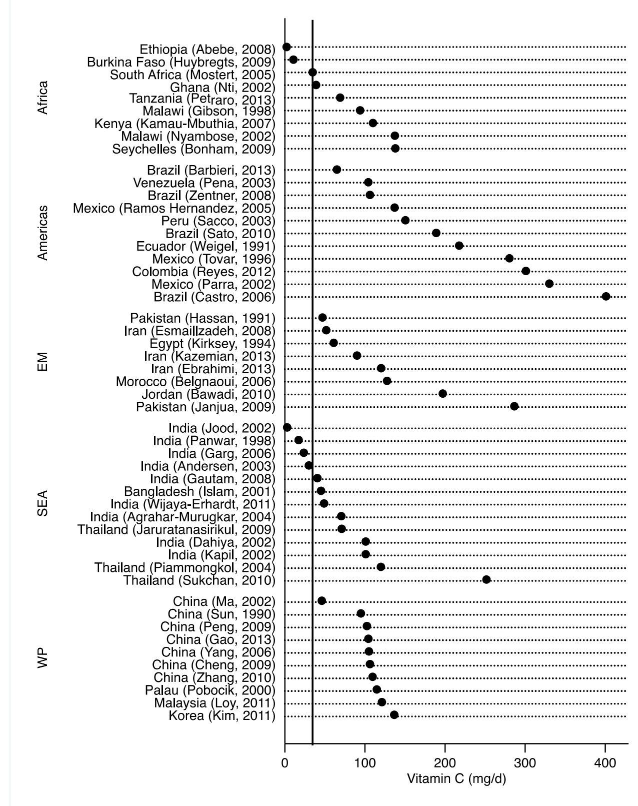


Figure 50. Mean/Median Intakes of Vitamin C of Pregnant Women in LMIC, by Region



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin A (571ugRE/d) and vitamin C (46.0mg/d). EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 51. Mean/Median Intakes of Vitamin B6 of Pregnant Women in LMIC, by Region

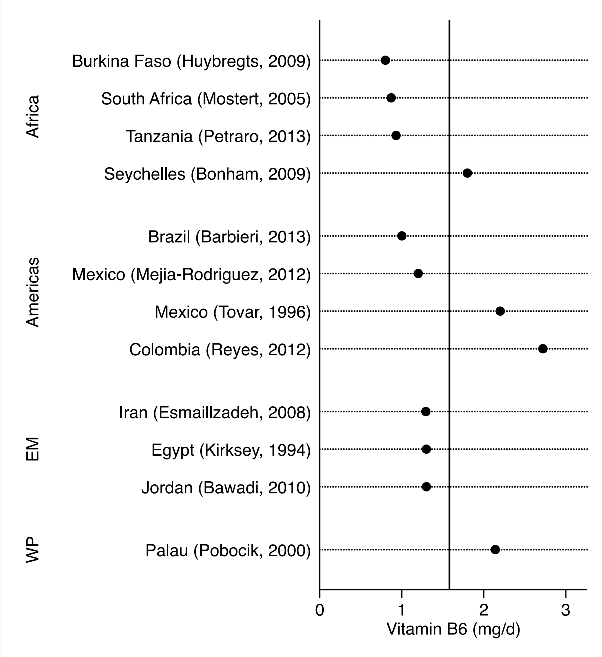
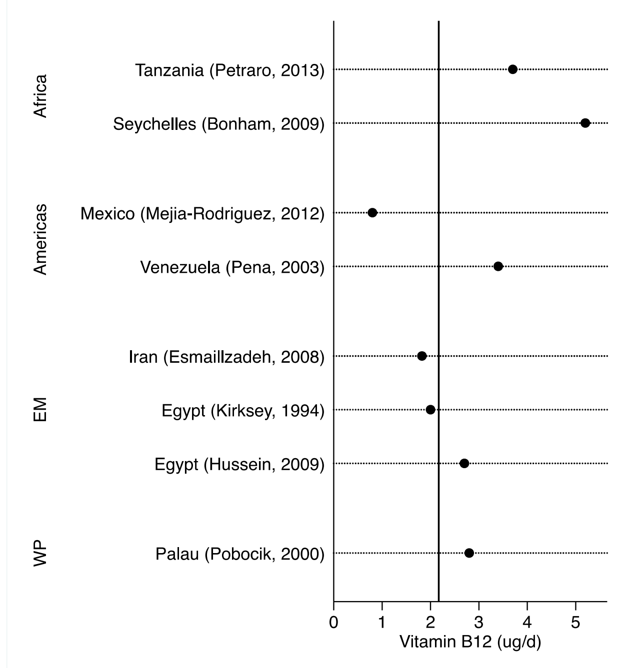
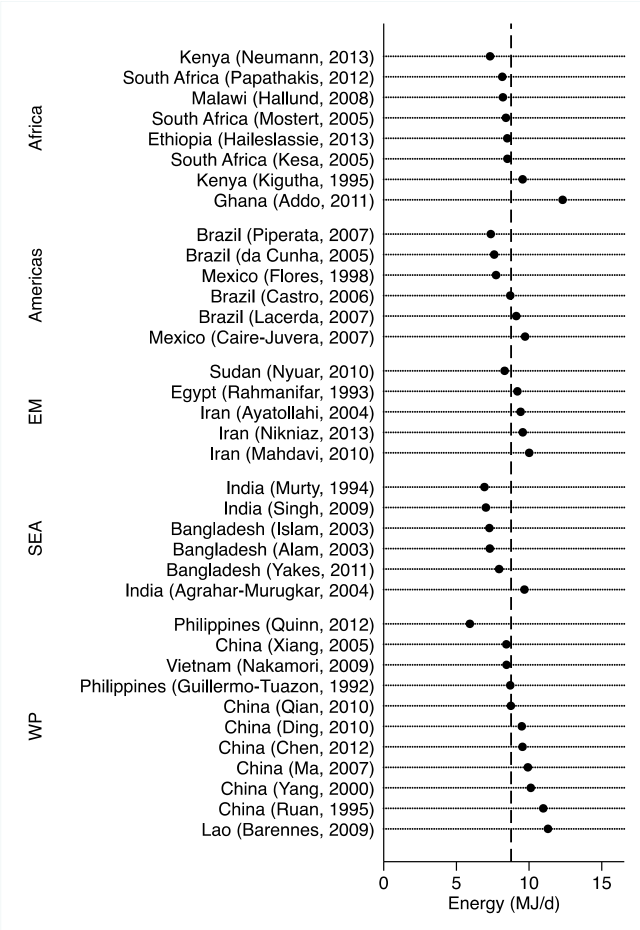
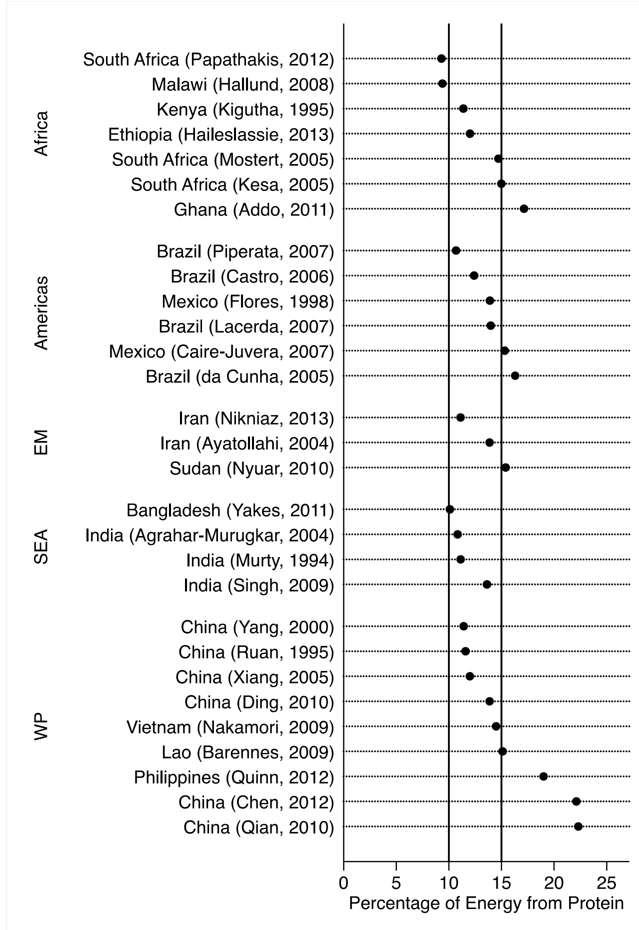


Figure 52. Mean/Median Intakes of Vitamin B12 of Pregnant Women in LMIC, by Region



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin B6 (1.58mg/d) and vitamin B12 (2.17ug/d).
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 53. Mean/Median Energy Intakes of Lactating Women in LMIC, by Region.	Figure 54. Protein Intakes as a Percentage of Energy of Lactating Women in LMIC, by Region.
	

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

The dashed vertical reference line represents the mean energy intake across studies (8.66MJ/d). The bold vertical reference lines represent the FAO/WHO's recommended protein intakes as a percentage of energy: 10-15%.

Figure 55. Carbohydrate Intakes as a Percentage of Energy of Lactating Women in LMIC, by Region.

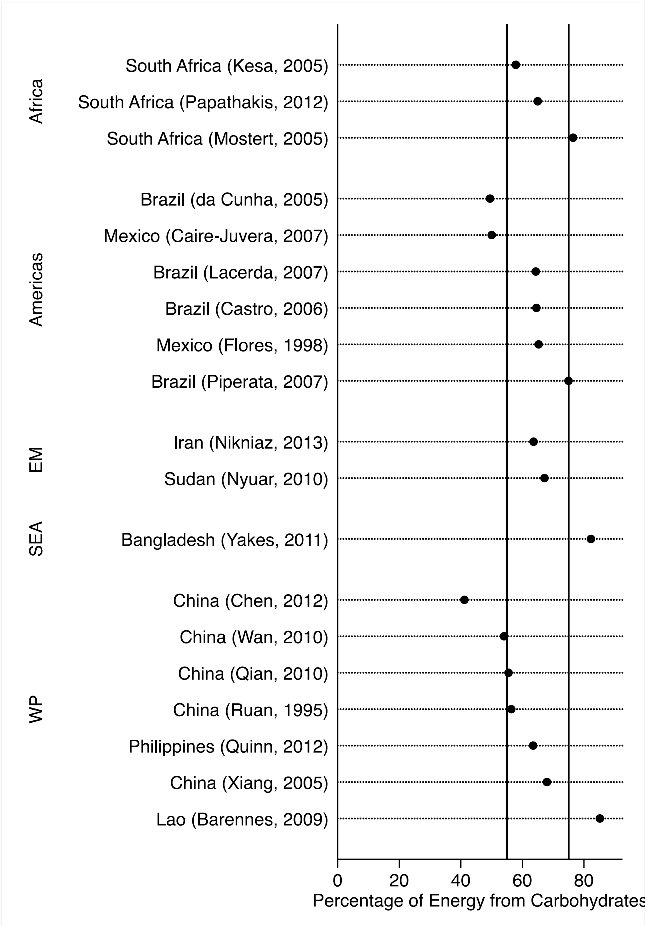
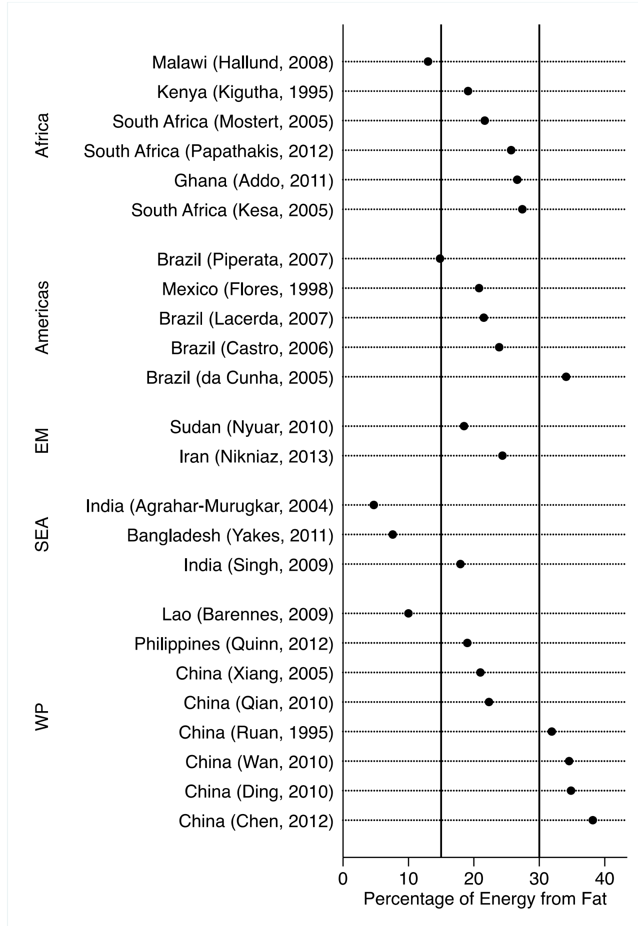


Figure 56. Fat Intakes as a Percentage of Energy of Lactating Women in LMIC, by Region.



The vertical reference lines represent the ranges of recommended intakes by the FAO/WHO: 55-75% for carbohydrates and 15-30% for fat.
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 57. Mean/Median Intakes of Iron of Lactating Women in LMIC, by Region.

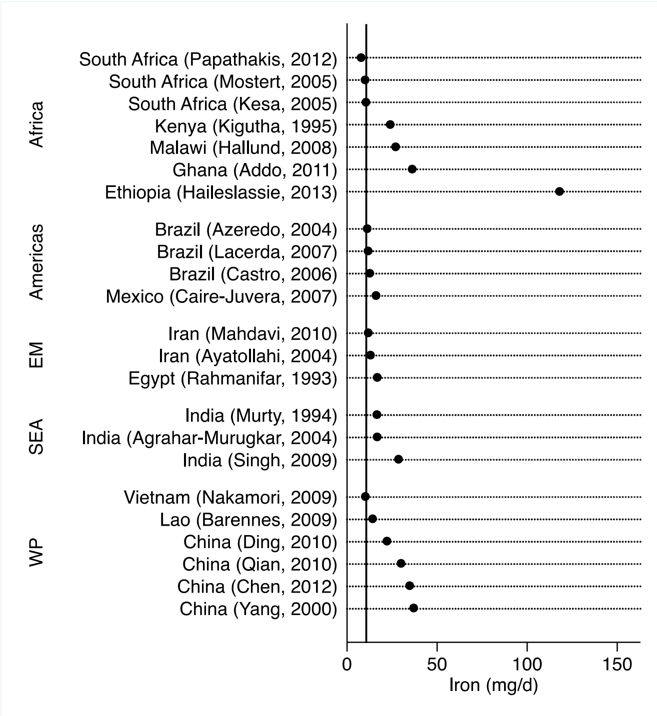
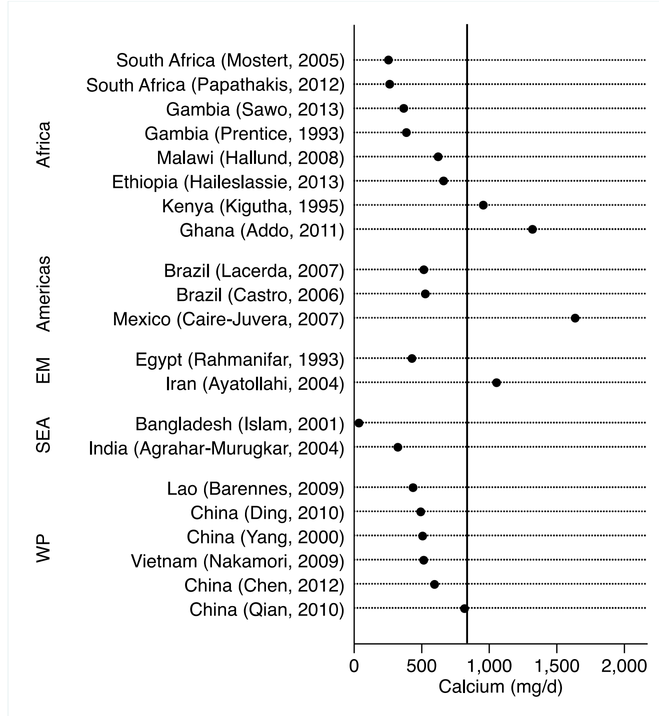


Figure 58. Mean/Median Intakes of Calcium of Lactating Women in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for iron (10.7mg/d) and for calcium (833mg/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 59. Mean/Median Intakes of Zinc of Lactating Women in LMIC, by Region.

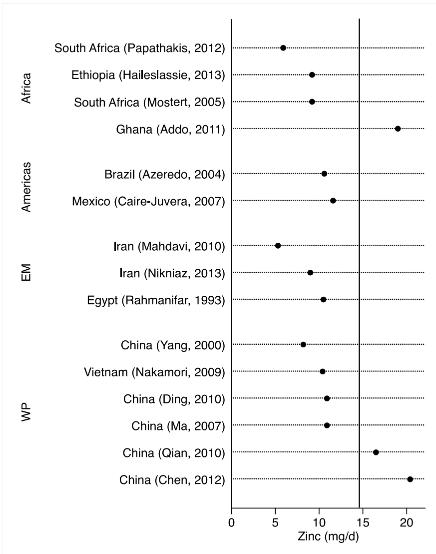


Figure 60. Mean/Median Intakes of Folate of Lactating Women in LMIC, by Region.

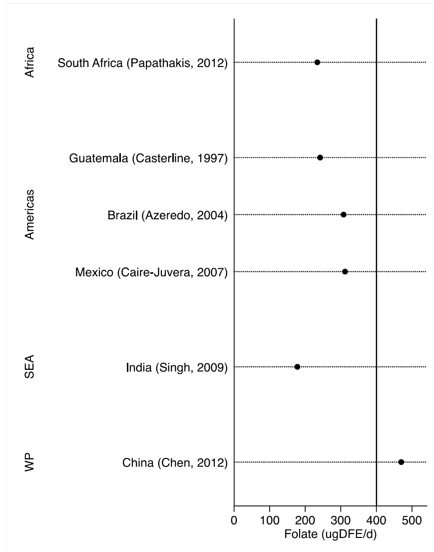
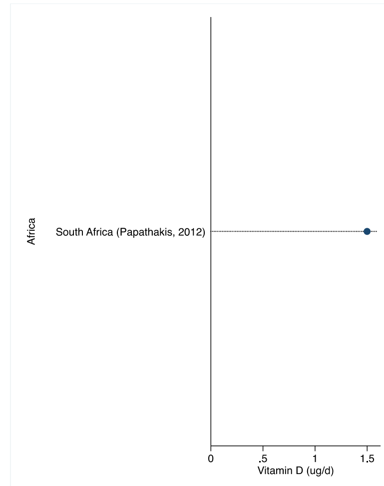


Figure 61. Mean/Median Intakes of Vitamin D of Lactating Women in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for zinc (14.6mg/d) and folate (400ugDFE/d). There is no vertical reference line for the Adequate Intake for vitamin D (5ug/d), as it is off of the graph.

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 62. Mean/Median Intakes of Thiamine of Lactating Women in LMIC, by Region.

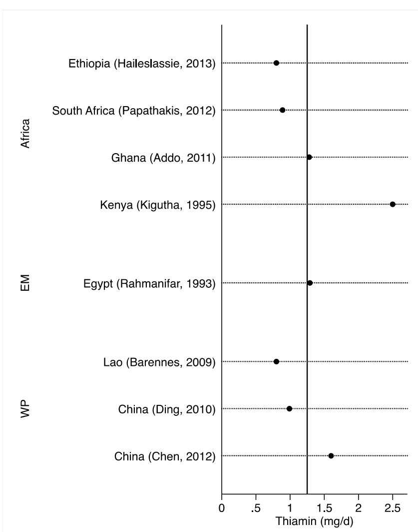


Figure 63. Mean/Median Intakes of Riboflavin of Lactating Women in LMIC, by Region.

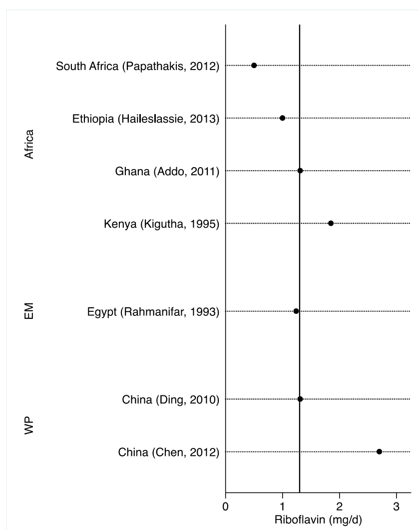
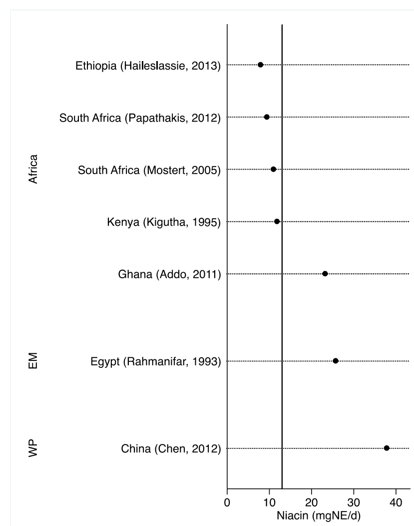


Figure 64. Mean/Median Intakes of Niacin of Lactating Women in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for thiamine (1.25mg/d), riboflavin (1.3mg/d) and niacin (13.1mgNE/d).

EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 65. Mean/Median Intakes of Vitamin A of Lactating Women in LMIC, by Region.

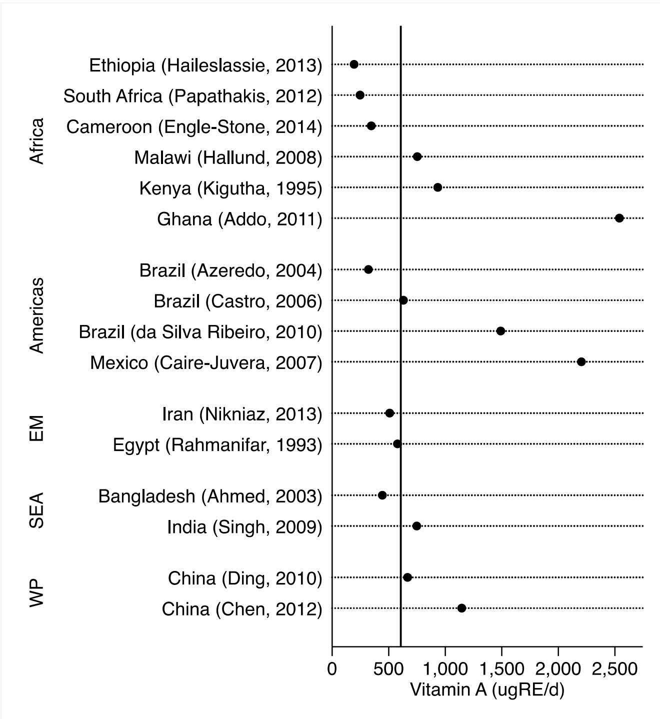
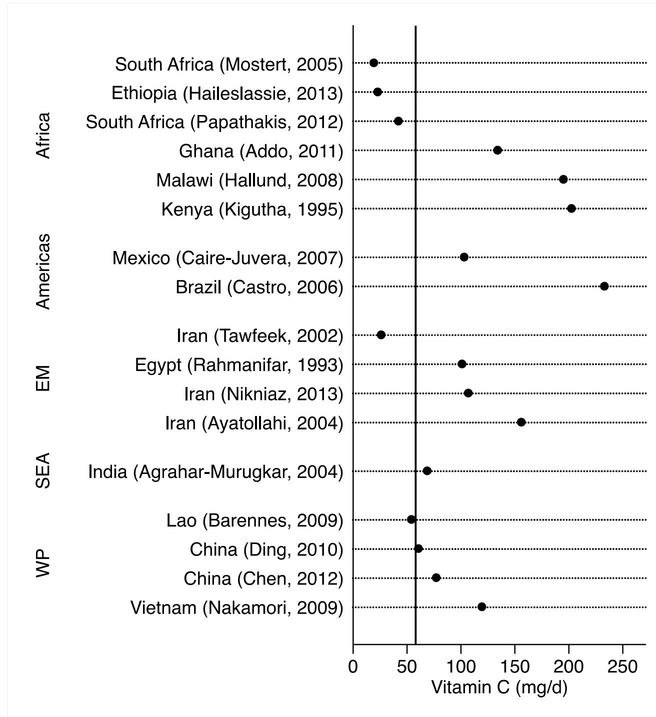


Figure 66. Mean/Median Intakes of Vitamin C of Lactating Women in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin A (607ugRE/d) and vitamin C (58.3mg/d).
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

Figure 67. Mean/Median Intakes of Vitamin B6 of Lactating Women in LMIC, by Region.

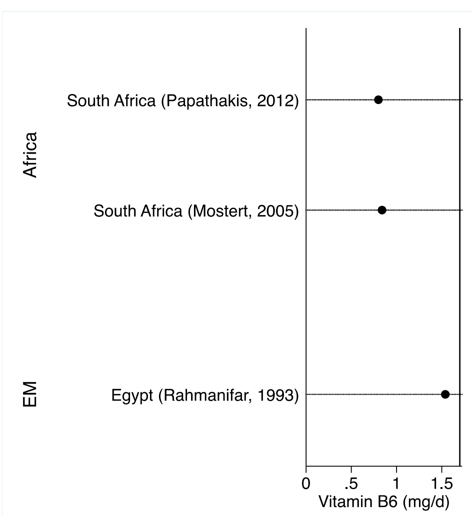
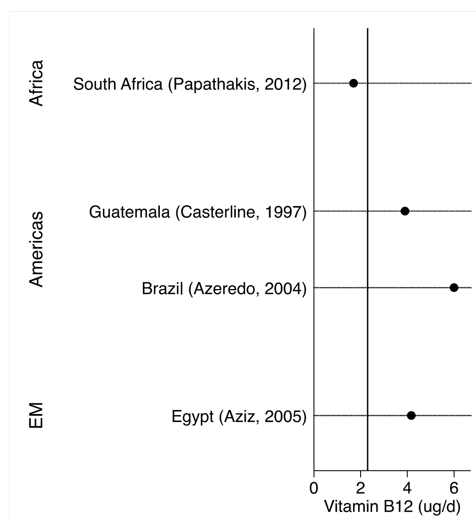


Figure 68. Mean/Median Intakes of Vitamin B12 of Lactating Women in LMIC, by Region.



The vertical reference lines represent the FAO/WHO Estimated Average Requirements for vitamin B6 (1.7mg/d) and vitamin B12 (2.3ug/d).
EM = Eastern Mediterranean; SEA = South East Asia; WP = Western Pacific

APPENDIX 1

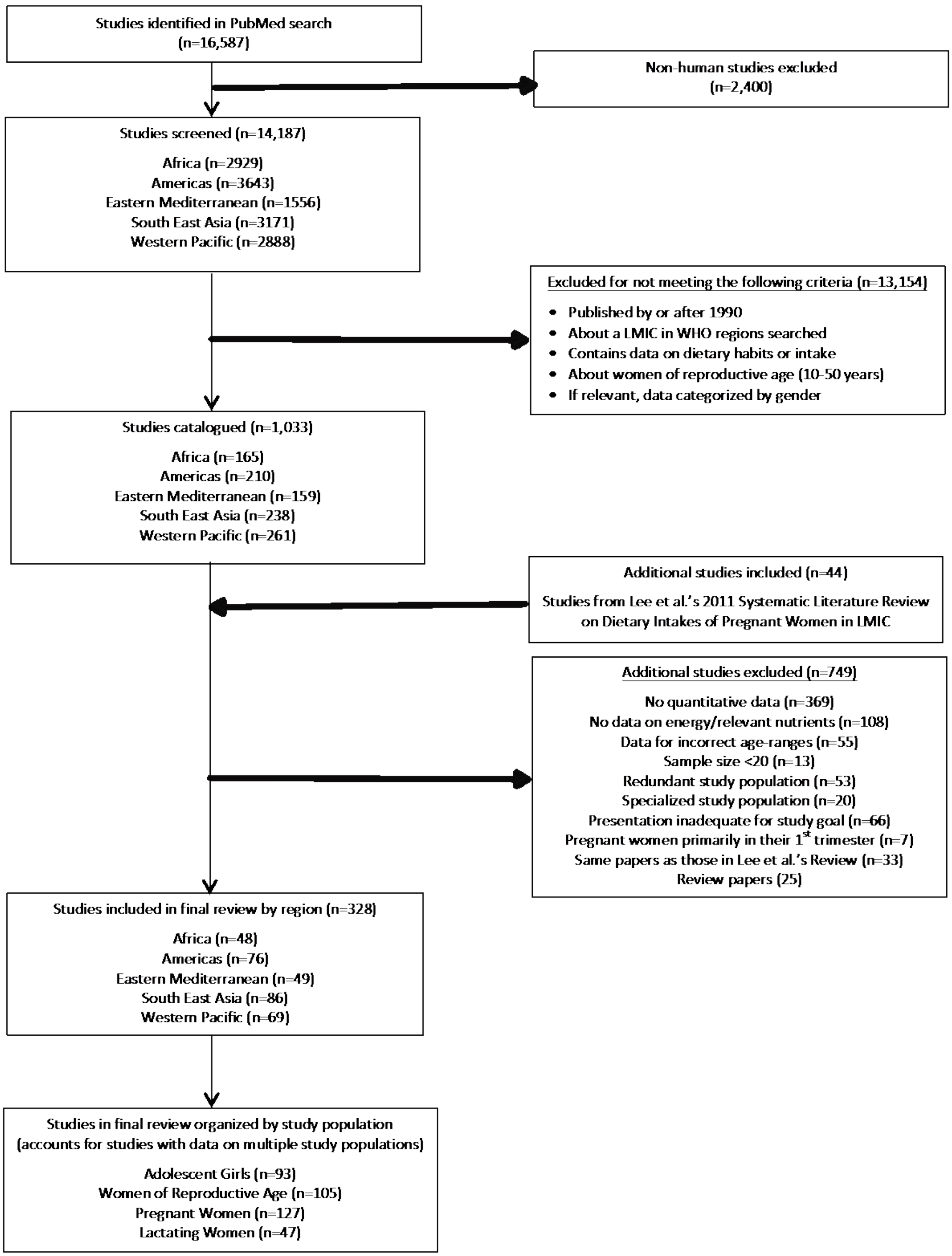
Search Terms Used for the Systematic Literature Review on the Dietary Intakes of Adolescent Girls, Women of Reproductive Age, and Pregnant and Lactating Women in Low- And Middle-Income Countries.

Population Terms	Dietary Terms	Geographical Terms
Adolescent	Diet	Africa
Adolescents	Dietary Habits	East Africa
Lactation	Dietary Intake	West Africa
Postpartum	Dietary Pattern	Sub-Saharan Africa
Preconception	Food Intake	Southern Africa
Pregnant	Nutrient Intake	*All LMIC in Africa**
Reproductive Age		South America
		Central America
		Latin America
		*All LMIC in the Americas**
		South East Asia
		South Asia
		*All LMIC in South East Asia**
		Western Pacific
		*All LMIC in the Western Pacific**
		Eastern Mediterranean
		*All LMIC in the Eastern Mediterranean**

* LMIC included in Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Cote d'Ivoire, Democratic Republic of Congo, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mozambique, Mauritania, Mauritius, Namibia, Niger, Nigeria, Republic of Congo, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe; in the Americas: Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Lucia, St. Vincent and the Grenadines, Suriname and Venezuela; in the Eastern Mediterranean: Afghanistan, Djibouti, Egypt, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Pakistan, Somalia, Sudan, Syrian Arab Republic, Tunisia and Yemen; in South East Asia: Bangladesh, Bhutan, Democratic Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste; and in the Western Pacific: Cambodia, China, Cook Islands, Fiji, Kiribati, Lao, Malaysia, Marshal Islands, Micronesia, Mongolia, Nauru, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu and Viet Nam.

APPENDIX 2

Flow Chart Depicting the Methodology of the Systematic Literature Review on the Dietary Intakes of Adolescent Girls, Women of Reproductive Age, and Pregnant and Lactating Women in Low- and Middle-Income Countries.



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