

INTRODUCTION

This review tracks the life cycle impacts of undernutrition in the developing world, especially in the low income countries of the Asia-Pacific region. After highlighting the dynamics of cause and consequence, it considers interventions: first from an efficacy perspective, then with regard to large scale effectiveness. Another paper¹ focuses on the problem of overnutrition. These papers were prepared under the Asian Development Bank (ADB) – International Food Research Institute (IFPRI) Regional Technical Assistance Project RETA 5824 on Nutrition Trends, Policies and Strategies in Asia and the Pacific.

Undernutrition may be indicated by foetal growth retardation, low body mass index (BMI), stunting, wasting, underweight, anaemia, and micronutrient deficiencies. Five major nutrition problems in developing countries, with a special emphasis on Asia, are reviewed here: low birthweight (LBW); early childhood growth failure; anaemia; iodine deficiency disorders (IDD); and vitamin A deficiency (VAD). For each of these, the nature of the problem, its prevalence, distribution, consequences and causes, are discussed; followed by a review of the efficacy of key nutrition interventions. The effectiveness of large scale programmes is then reviewed, and the process for selecting and prioritizing options discussed.

A nutrition intervention is defined here as one that has the prevention or reduction of undernutrition as at least one of its primary objectives. Such interventions are usually intended to have an impact on the main immediate causes of undernutrition, namely, inadequate dietary intake, poor caring practices, and disease. These determinants are strongly interrelated in a synergistic cycle (Figure 1).

The interventions reviewed here are primarily community-based, although they may or may not be community-driven. They include: breastfeeding promotion; growth monitoring and promotion; communication for behavioural change (CBC), including improved complementary feeding, supplementary feeding, and micronutrient supplementation. Nutrition interventions through health services are also reviewed

briefly. Fortification of essential foods, an approach to micronutrient deficiency, and approaches to improve household food security are also discussed in separate papers^{2,3}. Maternal and child care in the region have also been reviewed⁴ and only highlights are reiterated here.

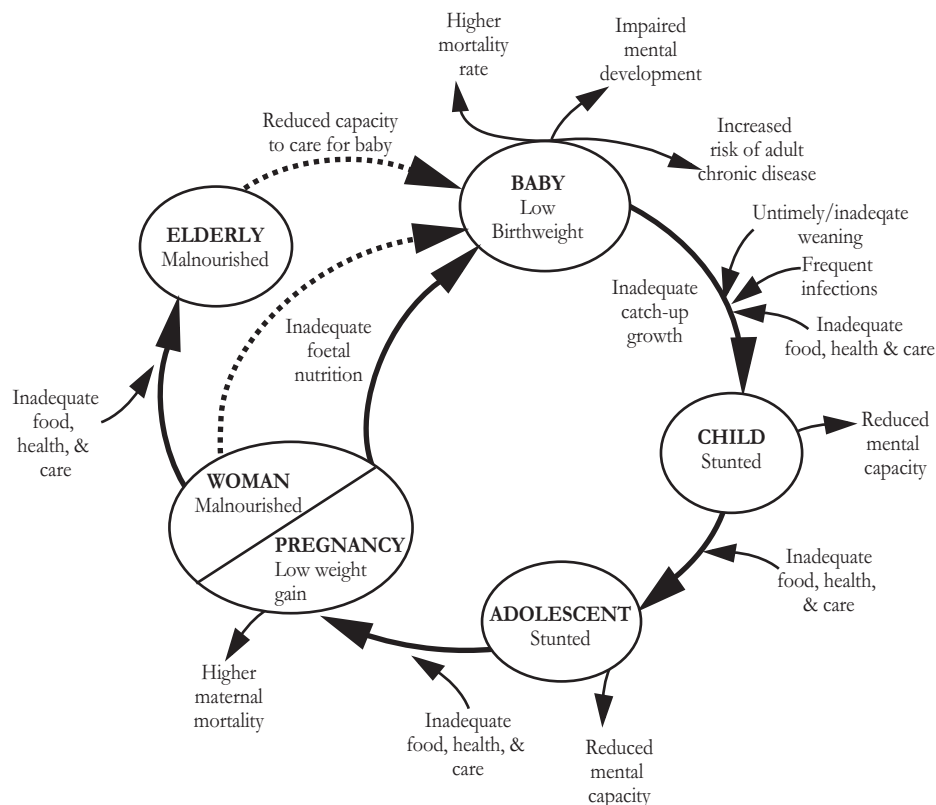
The starting point of this review is a description of the nutrition situation in developing countries, especially in Asia. It concludes with a series of guidelines for maximizing the effectiveness of large scale interventions. Specific issues of coverage, targeting, intensity, programme design, implementation, management, monitoring, evaluation and institutional capacity development are not covered, as these have been dealt with elsewhere^{5,6,7}.

Undernutrition Throughout the Life Cycle

Undernutrition often starts *in utero* and may extend throughout the life cycle. It also spans generations. Undernutrition occurs during pregnancy, childhood, and adolescence, and has a cumulative negative impact on the birthweight of future babies. A baby who has suffered intrauterine growth retardation (IUGR) as a foetus is effectively born malnourished, and has a much higher risk of dying in infancy. Survivors are unlikely to catch up significantly on this lost growth and are more likely to experience developmental deficits. Moreover, the consequences of being born malnourished extend into adulthood. Strong epidemiological evidence suggests a link between maternal and early childhood undernutrition and increased adult risk of various chronic diseases.

During infancy and early childhood, frequent or prolonged infections and inadequate intakes of nutrients (particularly energy, iron, protein, vitamin A, and zinc) may add to the contribution of IUGR to preschool underweight and stunting. Underlying such immediate causes will be inadequacies in one or more of the three main preconditions for good nutrition: food, care and health. Most growth failure occurs from

FIGURE 1: Undernutrition throughout the life cycle



Source: Adapted from ACC/SCN (2000) *Fourth Report on the World Nutrition Situation*. Geneva: ACC/SCN in collaboration with the International Food Policy Research Institute.

before birth until two to three years of age. A child who is stunted at five years of age is likely to remain stunted throughout life.

Apart from the indirect effects on the mother, micronutrient deficiencies during pregnancy have serious implications for the developing foetus. Iodine deficiency disorders may cause foetal brain damage or stillbirth. Folate deficiency may result in neural tube or other birth defects and preterm delivery, and both iron deficiency anaemia and vitamin A deficiency may have significant implications for the future infant’s morbidity and mortality risk, vision and cognitive development.

In adolescence, a second period of rapid growth may serve as a window of opportunity, albeit limited, for compensating for growth failure in early childhood. However, even if the child catches up some lost growth, the effects of early childhood undernutrition on cognitive development and behaviour may not be fully redressed. A stunted girl is likely to become a stunted adolescent and later a stunted woman. Apart from

direct effects on her health and productivity, adult stunting and underweight increase the chance that her children will be born with LBW. And so the cycle turns.

Research on Interventions to Combat Undernutrition

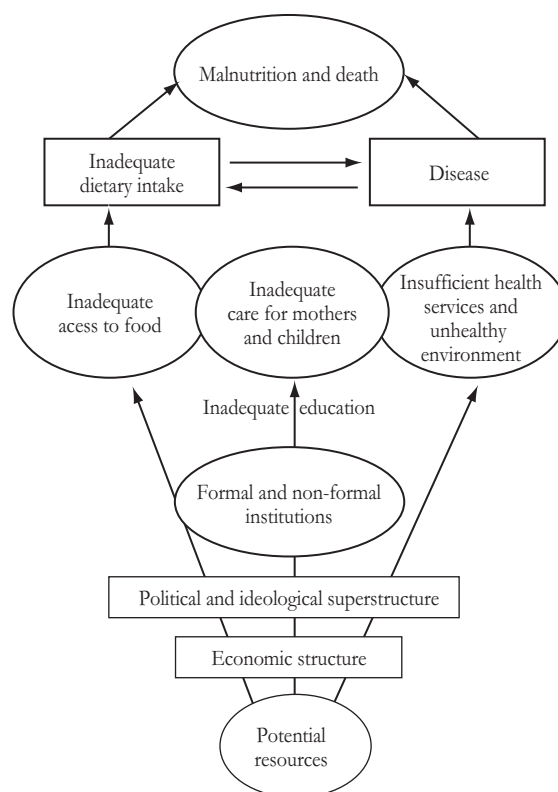
The research process through which interventions are designed to combat undernutrition is a dynamic and iterative step-by-step process as follows: i. describe the problem; ii. identify risk factors; iii. explore the context and identify the determinants; iv. select or formulate possible interventions; v. test interventions in carefully controlled double-blind efficacy trials; vi. formulate public nutrition interventions; vii. assess the efficacy of public nutrition interventions (e.g., through community-based trials); viii. assess the effectiveness of public nutrition interventions (e.g., at the national level); and ix. monitor the adequacy and impact of large scale, public nutrition interventions.

Not all of these steps are needed in every case, but it is important to realize that there is a big difference between steps vii and viii. Efficacy refers to the impact of an intervention under ideal conditions, when the components of the intervention (e.g., food supplements) are delivered directly to all individuals in the target group (i.e., 100% coverage). This is more likely to occur in research with a high level of supervision over delivery of the programme and the careful measurement of outcomes. Such trials demonstrate potential; i.e., what can optimally be achieved. Any new approach to controlling a particular nutrition problem should be subjected initially to efficacy trials, to determine whether a biological impact is actually possible in ideal conditions (step v). Only then should the ensuing steps be taken to introduce the intervention as part of a large scale programme. Effectiveness refers to the impact of an intervention under real world conditions, when programmes are scaled up to reach large populations. Small scale efficacy does not easily translate into large scale effectiveness and impact.

Conceptual Framework

The life cycle depicted in Figure 1 shows how various nutrition problems, causes, and consequences change and interact over time. To understand better what causes such problems, it is necessary to consider systematically the causes of undernutrition at different levels in society. The widely used food-care-health conceptual framework (Figure 2) illustrates these causes, and their interactions, at three levels: immediate, underlying, and basic. The synergistic interaction between the two immediate causes (inadequate dietary intake and disease) fuels a vicious cycle that accounts for much of the high morbidity and mortality in developing countries. Three groups of underlying factors contribute to inadequate dietary intake and infectious disease: household food insecurity, inadequate maternal and child care, and poor health services in an unhealthy environment. These underlying causes are, in turn, underpinned by basic causes that relate to the amount, control, and use of various resources⁸.

FIGURE 2: Causes of undernutrition in society



Source: UNICEF (1990) *Strategy for Improved Nutrition of Children and Women in Developing Countries*. New York: UNICEF.

This framework is used as an organizing principle for discussions of aetiology and approaches to remedial action. Nutrition-relevant interventions are also designed to impact at the underlying level to combat inadequacies in one or more of the main preconditions (food, care, and health) usually at the household and/or community levels.

Poverty is both a fundamental cause and an outcome of undernutrition. Economic losses from undernutrition include, as percentages of total losses from all causes: foregone human productivity, 10-15%;

foregone GDP, 5-10%; and losses in children's disability-adjusted life years (DALYs), 20-25%⁹. Not only is economic growth foregone, but it is foregone for the poor, who need it the most. Nutrition-fuelled economic growth promises to reduce income inequality. Moreover, improved nutrition is a particularly powerful antipoverty intervention because it can be achieved at low cost and it has a lifelong impact. In terms of a pro-poor, economic growth strategy that is sustainable, investment in nutrition is one of the best options.