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Review Article

The Double Burden of Malnutrition Across the Lifecourse

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Introduction

Nutrition plays an important role in shaping health from pre-conception to old age. The life cycle of humans begins with conception (pregnancy), fetal development, infancy, childhood and adolescence, and ends with adulthood [1]. Fetal development is the period of maximal growth, there is no recovery for growth failure at this stage because the fetus depends not just on the mother's diet but also her reserves, hence, the need to supplement maternal diet during pregnancy with folic acid, vitamin D, iron, iodine, calcium [2]. The recommended protein intake during pregnancy is 60/day, carbohydrates should comprise 45-64% of daily calories while fat intake should comprise 20-35% of daily calories [3]. Recommended Dietary Allowance is the average daily level of intake sufficient to meet the nutrient requirements of nearly all (97-98%) healthy people [4] Infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health [5]. At 6 months, breast milk will no longer be sufficient to meet an infant's nutritional needs, hence, complementary feeding should be introduced [6] however, breastfeeding should continue until infant is at least 12 months of age [7].

Children require energy, high quality protein and about 40 essential nutrients e.g. potassium, calcium, phosphorus, Vitamin D, zinc. Adolescents require increased energy, protein and essential minerals such as calcium, iron, zinc for pubertal growth spurt. Adults need nutrition for tissue maintenance unlike infants and children who require nutrition for growth and development, hence, they require less energy and protein intake. The simultaneous burdens of overnutrition and undernutrition is termed the double burden of nutrition [8]. The simultaneous presence of undernutrition and overnutrition represents a paradox in global public health [9]. Though there has been various efforts by countries to combat the double burden of malnutrition, about 150.8 million children are stunted, 50.5 million are wasted and 38.3 million are overweight with a total of 2.01 billion overweight and obese adults [10]. This fact suggests that undernutrition early in life contributes to an increased propensity for over nutrition in adulthood [11]. By 2020, an estimated two-thirds of the global burden of disease will be caused by chronic non-communicable diseases, most of which are related to diet [12]. Countries that presently have higher prevalence of undernutrition will be at higher risk for an increased prevalence of obesity in the next decades [13].

In general, poor dietary intake has been linked to a number of diseases and chronic conditions [14]. Lack of sufficient diet intake adversely affects the functional capacity of the body [15]. Undernutrition- the insufficient intake of energy and nutrients to meet an individual's needs to maintain good health [16]- makes children more vulnerable to disease and death. Optimizing nutrition early in life- including the 1000 days from conception to a child's second birthday- ensures the best possible start in life, with long-term benefits. Low-birth weight infants (>2.5kg) are at risk for developing cardiovascular diseases [17], impaired glucose tolerance and non-insulin dependent diabetes [18] when they become adults. Poor nutrition during childhood is also a risk factor for osteoporosis development in later life [19]. An individual with childhood malnutrition, consequently exposed to overnutrition later in life is susceptible to pulmonary abnormalities, urinary incontinence and cataract [20]. Nutrition during childhood influences brain development, growth and muscle mass, body composition and metabolic programming of glucose, lipids, protein hormone/receptor/gene [21].

Overnutrition, also referred to as hyperalimentation is a form of malnutrition in which the intake of nutrients is oversupplied, an amount that exceeds that required for normal growth, development and metabolism [22]. Later obesity (age 7) has been linked to development of metabolic syndrome, type 2 diabetes [23], gallbladder disease, osteoarthritis and poorer mental outcomes [24] and cancer [25]. Childhood obesity is strongly linked to morbidity and mortality during adulthood [26,27]. Various factors have been attributed to the double burden of malnutrition, some include behavioural, social and demographic, environmental and biological factors [28]. A survey of low and middle income countries suggests that war, lack of democracy, food security, urbanization and economic growth are responsible for the double burden of malnutrition [29]. Other factors include policy, food availability

of different foods and cultural or religious practices. Four broad categories of policies most directly affect food environment and diets, they include- food transformation and consumer demand policy, market and trade systems policy, agricultural production policy and consumer purchasing power policy [30].

Policies or programs that influence the supply and prices of agricultural products indirectly affect food choices and nutrient consumption, some programs may retire farmland, restricting commodity production and raising prices and some affect supplies through import restriction [31]. For instance, partial ban on rice importation in Nigeria in 2015, resulted in increase in price of imported rice [32]. People whose main carbohydrate source is rice may stop eating rice and this could lead to heart rhythm disorder [33]. In addition, availability and consumption of ultra-processed foods is strongly linked to obesity [34]. Dietary diversity is positively associated with nutrient adequacy in both children and adults [35-39] similarly, food variety score is associated with dual burden of malnutrition [40] therefore, eating variety of food from the main food groups is essential [41,42]. A more varied diet for young children is associated with increased chances of survival from diseases and better development [43]. For example, no or low consumption of sweet potatoes, papaya and other vegetables is associated with development of kwashiorkor in children [44], consumption of diet based on carbohydrates and proteins without fruit and vegetables resulted in scurvy [45] while maize consumption, particularly moldy maize is considered to be the specific cause of pellagra [46]. People who live in economically developed countries are more likely to be obese than their counterparts in developing countries [47].

Consideration of cultural practices is a pre-condition for ensuring appropriate dietary practices. In Kenya, Massai culture encourages introduction of blood, animal milk and bitter herbs to infants below six months, thereby militating against exclusive breastfeeding [48]. Similarly, some parents in South Eastern Nigeria do not give their children egg because it is believed that giving eggs will prompt children to steal, being very sweet while some do not eat a proteinous seed (ogbono) because their goddess uses it for purification [49]. In addition, women in Papua New Guinea are thought to be permanently in a "sickly" and "running" state because of recurring menstruation and they are therefore not allowed to eat fresh meat, juicy banana and all fruits of the forest of red colour [50]. Food restriction/taboo in some parts of Nigeria resulted in poor dietary intake, hence leading to malnutrition, overweight and obese body mass index [51]. Lizard eating is a taboo among communities in South East Brazil because of its resemblance to an alligator or snake [52]. Some food taboos among the Fulla in Gambia are strongly linked to protein-energy malnutrition [53].

Most religions have dietary rules such as fasting periods and food taboos that convey religious identity and intensity [54]. Some well-known examples of religious food taboos include the pork and alcohol taboo among Muslims and the Hindu beef taboo [55]. The catholic church considers it a mortal sin to eat meat on Good Friday-Friday before Easter Sunday [56]. Similarly, members of the Seventh day Adventist practice a strict vegetarian diet based on their belief in a holistic nature of mankind and that God should be honoured in eating and drinking [57]. The Jews have specific foods called "kosher" that they can eat while the restricted ones are called "treif", examples of kosher are sheep, cattle, goats and deer while treif include hare, pig and camel [58]. Overall, to solve the double burden of malnutrition, government could use educational policy measures to influence diet quality by emphasizing personal responsibility and choice through dietary guidelines, food labels, menu labelling and clinical counselling [59]. Similarly, Policy makers should formulate and use decision-making tools to identify actions that can improve food systems towards diet-quality goals [60], likewise, trade policy reforms aimed at improving employment opportunities and raising incomes could usefully be targeted at food insecure population groups [61]. On a societal scale, producing less food and processing food in ways that are lower in caloric density may decrease obesity in the society [62].

Compiling different food taboos and beliefs and discouraging those that are hazardous to health [63] through nutritional campaigns [64] is a way of tackling cultural and religious factors contributing to the double burden of malnutrition in order to encourage people to have changing attitudes that will promote adequate nutrition [65]. Agricultural extensionists and agronomists are the only professional groups in direct contact with the farm population in some countries, therefore, they should be trained to transfer their knowledge of nutrition to farmers, thus closing the gap between food availability and consumption [66]. In addition, promotion of food diversification through collaborative efforts of people working in agriculture, fishery, forestry, small animal husbandry, industry, marketing, communications, women's participation, home economics and nutrition is an effective way to ensure stable access and a sustainable food supply [67].

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