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Malnutrition, a Global Problem

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Abstract. Malnutrition is a general term for medical conditions caused by an inadequate diet and poor nutrition. Hunger and malnutrition are among the major difficulties confronting many countries around the world. Malnutrition can be caused by several factors, such as the sharp increase in population (current world population is approximately 6,800,000,000), poor distribution of foods, lack of access to highly nutritious foods, and most important, lack of knowledge about healthy diets. Malnutrition can lead to other problems, such as reduced school attendance, learning capacity, spread of HIV/AIDS, malaria and other diseases, and it can have a negative effect on a nation's development. The objectives of this study are: 1) to review the occurrence of global malnutrition, and 2) to discuss potential solutions to this challenging problem. For example, over three billion people are affected with micronutrient malnutrition in the developing world. Lack of micronutrient components such as iodine, zinc, vitamin A and iron can lead to maternal mortality, diseases such as HIV, and other problems. Over 146 million children under five are underweight and children often die because of malnutrition. There are many challenges to overcome malnutrition, and to provide food security for people. UNICEF, WFS and other organizations are trying to help malnourished children by sending food aid, but this is not enough, and there are still many places in which food security does not exist. According to the FAO organization, food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious foods to meet their dietary needs. So, to develop and distribute nutritious, widely available, low cost foods, which can be consumed by many people around the world is of great importance.

Keywords. *Developing Countries, Food, Hunger, Malnutrition.*

Introduction

Global malnutrition can be caused by several factors, such as the sharp increase in population. The current world population is approximately 6,809,972,000 (figure 1), and this is estimated to increase up to approximately 7,570,215,444 by 2020. Global population has doubled during the last 45 years, but the quantity of food product per capita has been declining since 1984 (Pimental and Wilson, 2004). Another factor causing malnutrition is the poor distribution of foods and lack of access to highly nutritious foods. For more illustration, developing countries, in which malnutrition is more prevalent, may receive less food from the total value added after a trade reform, because the food industry resembles a successive oligopoly with producers from developing countries at the first stage of food chain (Swinnen, 2007). The concept of food inadequacy, as defined by WHO 6th survey, is very close to the concept of under nutrition. Hunger and malnutrition are among the major difficulties confronting many countries around the world. Hunger and poverty are frequently associated with malnutrition and other forms of ill-health. For more illustration, FFP (Food for Peace) has issued policies and procedures for monitoring evaluation food aid in both food supply and distribution in developing countries (Lincoln et al, 2008). Still, studies show that 53% of all deaths in young children are attributed to underweight (De Onis, et al, 2004). About 24,000 people die every day from hunger or hunger-related causes. Although, according to the World Health Organization Standards, children have shorter duration of treatment, greater rates of recovery and fewer deaths in cases of malnutrition. Still, reports show that childhood malnutrition remains a public health problem world-wide. Malnutrition also can cause issues in hospitalized patients. In most cases of cancer, patients die because of malnutrition rather than the cancer itself. In a study of 430 unselected patients hospitalized in internal medicine, 10% exhibited of malnutrition, while 20% were of at risk of malnutrition (Isanak et al, 2009). Humans require at least 49 nutrients to meet their metabolic needs, but today over three billion people are afflicted with micronutrient malnutrition and numbers are increasing (Welch and Graham 2004). Thus in order to reduce this major global issue, effective solutions must be developed. Today the problem with malnutrition is not the lack of the food, but it is the poor distribution of the food and also lack of knowledge about healthy diets. Key issue in the community management of acute malnutrition includes scaling up intervention in real health systems and effectiveness trials to address additional factors that could determine success or failure. Thus, to develop nutritious, low cost foods, which can be consumed by many people around the world is of great importance. Thus the objectives of this study are: 1) to review the occurrence of global malnutrition, and 2) to

discuss potential solutions to this challenging problem. Despite efforts to reduce and prevent malnutrition in different parts of the world, malnutrition still is a major issue.

What is Malnutrition?

Malnutrition and hunger are close terms but not the same, hunger happens because of food shortage, food poverty and food deprivation. Food shortage happens when the amount of food supply in an area is not sufficient for the whole population in that area, food poverty refers to the situation in which households cannot obtain enough food to meet the needs of all their members and food deprivation happens when an individual does not consume or absorb enough food energy (Marchione, 1999). Malnutrition is defined as under nutrition that is caused by a deficit. It is a problem that often defies good solutions. Malnutrition has many roots, such as inadequate food supplies, limited purchasing power, poor health conditions, and incomplete knowledge about nutrition (Berg, 1987). Malnutrition can have negative effects on national development, as well. Researchers have calculated the costs of inadequate diet and related illnesses on physical development, learning ability, capacity to work, behavior and well-being of large segments of populations. When nutritional needs of a population or population subgroup are not completely met, some form of malnutrition emerges, usually among the most helpless and vulnerable individuals. The results are underweight children, anemic mothers, marasmic babies, scurvy, beriberi, pellagra, vitamin A deficiency blindness, and other deficiency syndromes.

Under nutrition is generally divided into protein-energy malnutrition and protein malnutrition. Protein-energy malnutrition, which also known as protein-calorie malnutrition (PCM), is more prevalent in developing countries. It may be due to inadequate food intake or as a result of other illnesses. PCM can cause marasmus which is a disease in which child is fretful and skinny, body weight may be reduced to less than 80% of the normal weight. Children between 12 to 36 months old are especially at risk since they are the most vulnerable to infection, and infection can be one of the reasons causing PCM (Alleyne et al, 1977). The other form of malnutrition, which is protein malnutrition, can cause another health problem called Kwashiorkor. In this disease, the both hair and skin lose their pigments, also the skin becomes scaly, anemia and edema happen as well.

Treatment of severe malnutrition is a slow process requiring great care. Initial efforts should be directed at correcting fluid and electrolyte abnormalities and infections. The second phase of treatment is directed at repletion of protein, energy and micronutrients. Patients, once treated subsequently, require close follow up.

Although food systems are changing, food production is more industrial than are before, there are greater availability and diversity of food, but still access to this food is by no means universal. Thus, worldwide malnutrition continues to be a significant problem, especially among children. Poverty, natural disasters, political problems, and war all contribute to this condition.

Problems caused by Malnutrition

Besides the most visible effect of malnutrition (mortality), in addition to human suffering, hunger and malnutrition have other negative effects on cognitive development, growth and health. Malnutrition has negative secondary effects which can cause problems such as: reduced capacity to access markets and resources, reduced school attendance, learning capacity. Studies show that Iodine deficiency can cause the decrease of average IQ (FAO, 2009). Other problem with malnutrition is spread of HIV/AIDS, malaria and other diseases. HIV currently affects 33 million people. The disease interacts negatively with malnutrition (FAO, 2005). Poor nutrition and food insecurity can cause increase in rate of HIV. Hunger and malnutrition alter people's behavior and weaken their bodies and immune systems which lead to the increase of vulnerability to HIV/AIDS. Hunger can drive women into dangerous sexual relationships, which cause increase risk of infection. Among those who have already been infected with HIV, malnutrition increases vulnerability to infection (WFS, 2005). On the other hand, HIV infection can lead to nutritional deficiencies through decreased food intake. Malnutrition also can cause in less education and employment for women and girls. Malnutrition, early in life is linked to deficits in children's intellectual development that persist in spite of schooling and impair their learning ability. High levels of malnutrition among children suggest that there will also be long-term deficits in mental and physical development that can leave children ill-prepared to take maximum advantage of learning opportunities in school (WFS, 2005).

Impaired maternal and infant health is another negative effect of malnutrition. Malnutrition commonly affects all groups in a community, but infants and young children are the most vulnerable because of their high nutritional requirements for growth and development. Maternal mortality rates are calculated as death per 100,000 births, extending from 28 weeks of pregnancy to 6 weeks postpartum (Tomkins, 2001). Studies have shown the relationship between vitamin A deficiency and causes of maternal mortality (Tomkins, 2001). Malnutrition can cause in increase of child mortality because a malnourished mother is likely to give birth to a low-birth-weight baby susceptible to disease and premature death, which only further

undermines the economic development of the family and society and continues the cycle of poverty and malnutrition (Darnton-Hill et al, 2005).

Beside protein and energy malnutrition problems, micronutrient malnutrition also can have negative effects. Maybe it is thought that micronutrient deficiencies cannot cause as much death like protein and energy malnutrition, but studies show that deficiency of vitamin A, Zinc and Iron has led to deaths of 3.6 million children under five years old (The State of the World's Children, 1998). Vitamin A is recognized as a major factor in reducing mortality from infection diseases in developing countries (Faisel and Pittrof, 2000). Insufficient vitamin A intake can cause blindness and contributes to infections and death. Vitamin A deficiency can increase the risk of mortality and mother-to-child HIV transmission (Cohen et al, 2008). Iron deficiency is a public challenge which has a negative impact on national productivity with losses of up to 20% of the gross domestic product in worst affected countries. Iron deficiency in pregnancy is causing as many as 20 million babies per year to be born mentally impaired (Hill, et al, 2005). It is responsible for half of the global prevalence of anemia, which affects about half of all pregnant women. Anemic mothers are more likely to deliver premature babies with low birth weights and to have babies who die as newborns (Cohen et al, 2008). Thus vitamin deficiencies are less threatening to life but they can lead to the severe functional impairment of broad segments of the population.

Occurrence of Malnutrition

Malnutrition is a complicated topic, and has become a major problem in different countries all around the world, especially when it comes to micro nutrient malnutrition. It can be realized that almost all of the countries are suffering from this type of malnutrition which can be referred to as hidden malnutrition. Table 1 summarizes information about various countries from different regions. As shown in the table, African countries, in general, are in serious condition, as these countries are suffering more from malnutrition and hunger, and their GDP per capita is lower than other countries in the table. These African countries are in serious need of help in order to reduce the rate of acute malnutrition and undernourishment. On the other hand, as it can be seen from the table, there are Asia pacific countries and Middle Eastern countries which are in a better situation, but still need help in order to prevent the increase of hunger and malnutrition in these countries. The GDP per capita in some of these countries is higher than others, so problems with malnutrition may be because of the poor system for distribution of food.

Potential Solutions

Different programs and potential solutions have been suggested as answers to the problem of malnutrition. But most of these are long-term solutions which can be done in a long period of time. Programs such as development in agriculture and rural areas of developing countries, increase in access to the food by solving interred problems, can help balance food distribution and population growth. All of these solutions can be effective after a period of time. But, needs for short-term solutions are increasing. Although malnutrition is closely linked to a country's level of economic development, nutrition improvement doesn't need to wait for that development. The last three decades brought a radical change in the nutritional situation for many developing countries (Schmidhuber and Shetty, 2005). Energy supply increased swiftly and one of the most important reasons for such an improvement was the shift towards more industrialized agriculture. But, because of the sharp increase in the world population, to make a balance between distributions of energy is a challenge.

Today micronutrient malnutrition has become more concerning than other types of malnutrition; to find a solution for this problem is of great importance. Over three billion people are currently micronutrient malnourished (Welch and Graham, 2004). Widespread micronutrient malnutrition is well documented; vitamin A deficiency, iodine deficiency disorders and iron deficiency anemia are the most widely recognized ones. So, reduction of these deficiencies would be a great help in solving the problems caused by malnutrition. For more illustration, daily supplementation of cereal food staples zinc has been shown to reduce infant mortality by 70%; vitamin A supplementation can reduce child mortality by 25-35% (Tomkins, 2001). The impact of micronutrient malnutrition early in life can lead to lower cognitive abilities, reduction in educational progress, etc. Thus, developing micronutrient-enriched foods, especially cereals, would be a powerful intervention tool that targets the most vulnerable people.

At low levels of income, meeting energy needs is the most basic concern for an individual. Staple foods such as starchy roots, rice, wheat and coarse grains often provide the cheapest source of energy. So, the diet of the poor is largely cereal-based. Cereals are a cheap and available source of energy which can provide far more energy and protein per capita in the developing world than does any other class of foods (Khush, 2001). However, although cereals satiate hunger and supply protein, the consumption of micronutrients actually decreases when cereals replace more nutrient-dense food, as a result of milling and refining, the iron, zinc and other nutrients can be lost. As Table 2 shows, some nutrients are lost as a result of milling,

since normally bran and husk can be used in food staples. Fortification is one means of combating these losses, for both macro and micro nutrient deficiencies. Fortification of cereals can be done with use of different sources which are rich in vitamins and minerals. These sources can be alternative flours, such as nontraditional flours or even co-products from the production of other materials in industry (Pourafshar, 2010). To know the source of the material which is going to be used as a fortifying material, would be a help in the selection of the type and quantity of vitamin and minerals to add to the products. Fortification of cereal grains and cereal products may be one of the most effective ways of the many different forms of nutrition intervention.

Conclusions

The world population is increasing at an alarming rate, and the world is facing extremely serious problems with hunger and malnutrition. There are many children who are suffering from lack of food, and dying as a result of malnutrition. So, urgent action is needed, especially in some countries. To help these countries by sending them food supplies is not the entire solution. In order to reduce this serious problem, more effective solutions are needed. One way to decrease the problem of malnutrition, especially micronutrient-malnutrition, is to produce fortified food staples, which can be consumed by the majority of people in those countries. Fortification of cereal-based foods would be a great help to reach this goal, since cereals are the most highly consumed food products around the world. Cereals are a cheap source of energy, and are available for almost everyone.

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Table 1. Rates of malnutrition, undernourishment, and hunger in different regions of the world.

Region	Country	Population ¹	GDP per capita ²	Major Crops ³	Rate of Acute Malnutrition ⁴	Hunger Index ⁵	% of Population Undernourished ⁶
Asia-Pacific	China	1,334,470,000	4000-9000	Cotton, Rice, Wheat	–	Moderate	5-19
	India	1,173,350,000	2000-4000	Cotton, Rice, Wheat	More than 15%	Alarming	20-34
	Myanmar	50,020,000	1000-2000	Rice	More than 10%	Alarming	35
	Nepal	29,331,000	1000-2000	Rice	More than 10%	Serious	5-19
	Pakistan	168,109,500	2000-4000	Rice, Cotton	More than 10%	Alarming	20-34
	North Korea		1000-2000	Rice	More than 4%	Serious	35
	Sri Lanka	20,238,000	2000-4000	Rice	–	Serious	20-34
America and Caribbean	Colombia	45,204,000	9000-14000	Cotton	–	Moderate	5-19
	Haiti	10,033,000	4000-9000	–	–	Serious	35
Central and Eastern Europe	Tajikistan	6,952,000	2000-4000	Wheat, Barley, Cotton	–	Serious	35
Eastern and Southern Africa	Angola	18,498,000	4000-9000	–	More than 10%	Serious	35
	Burundi	8,303,000	0-1000	–	More than 4%	Serious	35
	Eritrea	5,073,000	1000-2000	Sesame seed	More than 15%	Extremely Alarming	35
	Ethiopia	79,221,000	0-1000	Wheat, Maize	More than 10%	Extremely Alarming	35
	Kenya	39,802,000	1000-2000	–	More than 4%	Alarming	20-34
	Madagascar	19,625,000	2000-4000	Maize, Potato, Rice	More than 15%	Alarming	35
	Malawi	15,263,000	0-1000	Potato, Maize	More than 4%	Serious	20-34
	Mozambique	22,894,000	0-1000	Cassava	More than 4%	Alarming	35
	Somalia	9,133,000	0-1000	Sesame seed	More than 10%	No Data	No Data
	Uganda	32,710,000	1000-2000	–	More than 4%	Serious	5-19
	Zambia	12,935,000	1000-2000	Maize	More than 4%	Alarming	35
	Zimbabwe	12,523,000	0-1000	Cotton, Maize	More than 4%	Alarming	35
Middle East	Afghanistan	28,150,000	0-1000	Wheat	More than 4%	No Data	35
	Iran	74,196,000	14000-24000	Wheat, Barley	–	Low	2.5-4
	Iraq	30,747,000	2000-4000	Wheat	More than 4%	No Data	No Data
	Palestine	3,761,646		–	–	Low	No Data
	Sudan	39,154,490	4000-9000	Sorghum	More than 15%	Serious	20-34
	Yemen	23,580,000	2000-4000	Sorghum	More than 15%	Alarming	35
West and Central Africa	Chad	11,274,106	1000-2000	Millet, Sorghum	More than 15%	Extremely Alarming	20-34
	Congo		4000-9000	Cassava	More than 4%	Serious	20-34
	Guinea	10,069,000	1000-2000	Rice	More than 10%	Serious	20-34
	Guinea-Bissau	1,611,000	0-1000	Cashew nuts, Rice	More than 10%	Alarming	No Data
	Liberia	3,476,608	0-1000	Rice	More than 4%	Alarming	35
	Mauritania	3,291,000	1000-2000	Rice, Sorghum	More than 15%	Serious	5-19

(Sources: 1. <http://www.wikipedia.org>, 2. <https://www.cia.gov/library/publications/the-world-factbook/geos/us.html> , 3. <http://faostat.fao.org>, 4. <http://www.doctorswithoutborders.org>, 5. <http://www.graphics.thomsonreuters.com>, 6. <http://www.restlessbeings.org>).

Table 2. Composition of flour and bran in different grains (from Kent and Evers, 1994).

Material		Protein (%)	Fat (%)	Ash (%)	Fiber (%)	Carbohydrate (%)
Wheat (85% Extraction)	Flour	12.5	1.5	0.92	0.33	–
	Bran	11.1	3.7	6.1	13.5	–
Rye (85% Extraction)	Flour	7.5	1.6	1.0	0.8	–
	Bran	14.0	3.2	4.2	5.0	–
Barley	Flour	11.3	1.9	1.3	0.8	85.4
	Husk	1.6	0.3	6.2	37.9	53.9
Oats	Flour	14.2	7.9	2.0	1.1	73.4
	Husk	1.4	0.4	4.5	37.8	0.9
Maize	Dry Milling Flour	8.1	1.5	0.7	1.0	88.7
	Wet Milling Flour	0.8	0.07	0.1	–	99.0

Table 3. Nutrient compositions of different flours (from various market sources).

Type of Flour	Carbohydrate (%)	Protein (%)	Fat (%)	Fiber (%)
Amaranth	62.17-64	12.5-17.6	6.3-8.1	3.6-4.2
Arrowroot	88.15	0.3	0.1	3.4
Almond	6	6	14	3
Barley	85.4	11.3	1.9	0.8
Buckwheat	21	4	1	4
Corn	22	2	1	4
DDG	46	27-30	-	13
DDGS	39-46	27-34	-	5-11
Millet	22	3	1	4
Oat	16	4	2	3
Pea	9	4	1	4
Potato	83.8	6.9	0.34	5.9
Quinoa	21	4	2	4
Rice	8	3	1	4
Rye	21	4	1	7
Soy	9	7	4.5	4
Spelt	22	4	1	4
Tapioca	26	0	0	0
White Rice	80.13	5.95	1.42	2.4
Whole Wheat	72.57	13.7	1.87	12.27

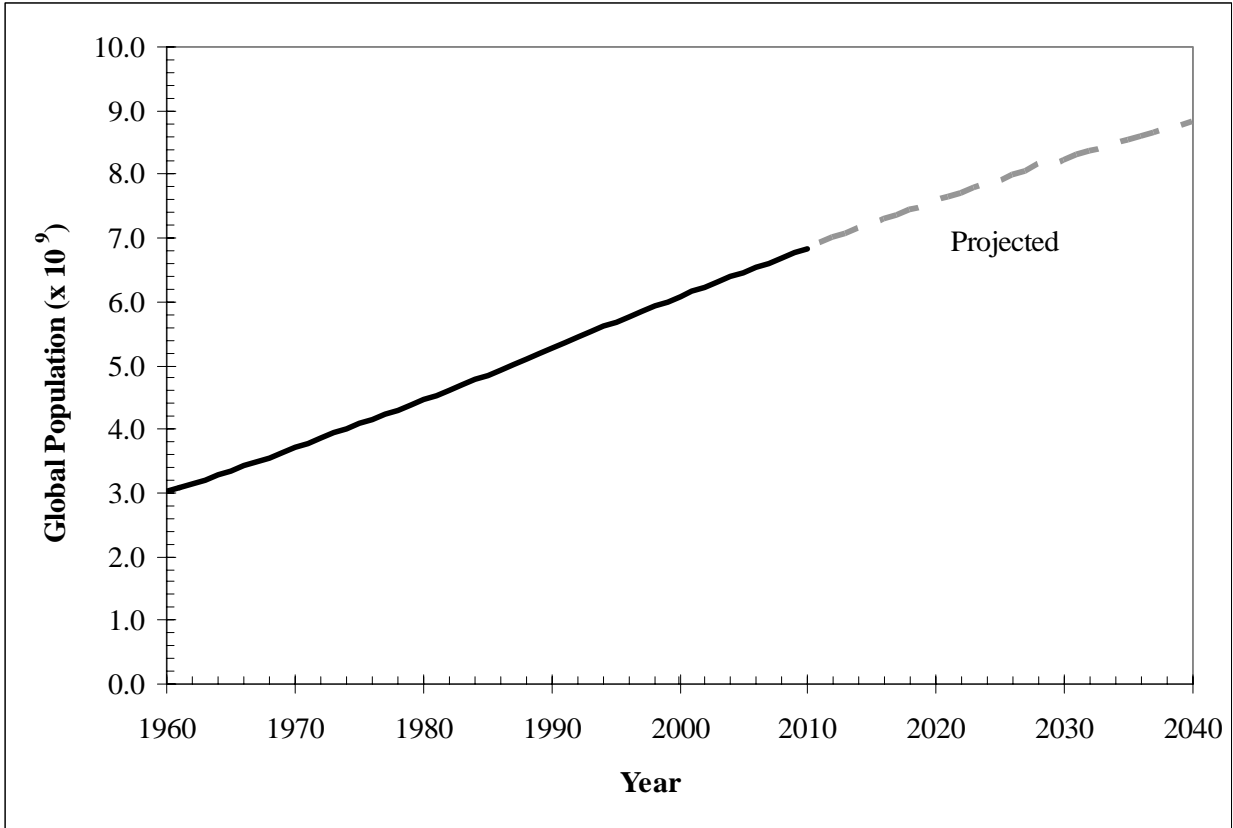


Figure 1. World population over time (from <http://www.npg.org>).