

Covid-19 and Nutrients

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ABSTRACT

Covid-19 (Corona virus disease of 2019) is creating havoc in the world. It has resulted in overburdening of health systems, has detrimental effects on income, food systems, social systems and world economies. Covid-19 infection and the subsequent lockdown in many countries including India are likely to produce collateral damage to jobs, housing, and migration and of course nutrition. As per global statistics this year, one in nine persons is hungry and one billion people world over do not have enough food to eat. Estimates show that 135 million people have been hungry before the pandemic and by the end of 2020; the figure is likely to be 265 million.

As of now, when no effective vaccine or drug is available to combat the disease; the world is left to fight this disease with two weapons. The first is social distancing of two meters, repeated hand washing for twenty seconds with soap and water and face cover with face shield. The second weapon is our healthy immune system. Good health adds life to years and years to life. Immunity depends on various factors, one of which is nutrition. Nutrition is the backbone of good health.

Keywords: Covid-19; Nutrients; Infections; Immune system

RELATIONSHIP BETWEEN INCOME AND FOOD INTAKE

It is a well-known fact that adequate nutritional intake is an important investment in human welfare. By and large, higher economic growth has positive impact on nutritional status. There exists a statistically significant relationship between nutritional intake and economic growth. The impact of real food prices on calorie intake is significant in short run. GDP is a major variable for calorie intake. Some scientists opine that there is a puzzling relationship between consumption expenditure, income and calorie intake. Calorie intake in rural India has declined by 10% over a period from 1983 to 2004. However, urban decline is a little less, may be due to availability of cheap junk street food in urban locations. Rising incomes enabled populations to diversify dietary patterns and resultant consumption of high calorie, fat, sugary salty foods. GDP growth of India has been 6.1% in 2018, 4.2% in 2019 and 1.9% in 2020. Fitch rating slashed India's economic growth prediction to 0.8% for the year April 2020 to March 2021. Part of this probably is the effect of the Covid-19 pandemic and subsequent

lock down. Consumer spending has fallen to 0.3% from 5.5% a year back. This is twice the 2009 recession. In 2018, people from lowest income quintile from India spent 35.1% of income on food whereas in the highest quintile, food expenditure was 8.2%. USA spends 6.4% on food. So, if the food prices increase by 20%, the effect on the lowest quintile will be disproportionately high. The average calorie consumption of Indian adult is 2360 Kcal per day. India is 126th in rank amongst all nations, while USA is the highest at 3800 kcal consumption per day. Following the pandemic in India, data was released by Ministry of Consumer Affairs on food prices. It showed that barring cereals, cost of all other food items has increased three times in April 2020. Prices of pulses are likely to increase due to unavailability of labor to peel the lentils.

ASSOCIATION OF INCOME LOSS AND FOOD INTAKE

Some workers have studied the effect of decrease or increase of income and food consumption. Studies from developed countries suggest a positive impact of wealth on health, but it is more complex in developing countries [1]. Jha, in 2009 observed that

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low wages lower people's ability to afford nutrition rich food. This undermines people's productivity and results in low wages; continuing the vicious cycle. There exists an inverted U shaped relationship between household income and calorie intake. Income elasticity differs for different foods. Thus for every 1% drop in income, fat intake decreases by 0.149%, protein by 0.127 and carbs by 0.122. The same is true for iron and Zinc, the fall being 0.135% and 0.130%. It is negligible for sodium (0.012) and potassium (0.1). This food inelasticity is observed much more in poor than in the rich population. Gaiha has concluded that the fall is even more [2]. He has found rural and urban difference too. Thus for every 1% decrease in income, food intake decreases by 0.753% for fats, 0.438 for proteins, and 0.418 for carbohydrates in rural areas. This effect is much less pronounced in urban area 0.462 for fats, 0.254 for proteins and 0.24 for carbohydrates. So, if the income becomes less by 20%, fat intake will decrease by 15%, protein by approximately 9% and carbohydrates by 8% (Table 1).

Table 1: Gaiha et al. results are based on pooled NSSO data 1993-2009.

	Urban	Rural
Calorie	0.24	0.418
Protein	0.254	0.438
Fat	0.462	0.753
	Urban	Rural
Calorie	0.24	0.418
Protein	0.254	0.438

This relation between income elasticity and food intake shows that some degree of increase in malnutrition is inevitable during Covid-19 pandemic. Besides drop in income during lock down, there have been many issues related to supply chain breakdown, unavailability of some food items like fruits, green vegetables, migration of workers on foot for miles together, transport limitation, closure of shops and increase in food prices. Seasonal variation on availability of food with summer approaching will compound the issue further.

OCCURRENCE OF MALNUTRITION

NFHS 4 data on malnutrition showed that 34% of fewer than 5 children are stunted, 36% underweight and 25% wasted (9% severely wasted) in the State of Maharashtra. This will increase by 10% to 15% even if there is a drop in income by 20%. Anemia may increase by 2.7%.

One study interprets that COVID-19 pandemic may result in health system disruption, collapse and decrease in access to food which will further result in increase in child and maternal deaths.

In the least severe scenario (coverage reductions of 9.8%-18.5% and wasting increase of 10% over 6 months would result in 2,53,500 additional child deaths and 12,200 additional maternal deaths and in most severe scenario (coverage reductions of 39.3%-51.9% and wasting increase of 50% over 6 months would result in 11,57,000 additional child deaths and 56,700 additional maternal deaths [3].

The increase in wasting prevalence would account for 18%-23% of additional child deaths and reduced coverage of antibiotics for pneumonia and neonatal sepsis and of oral rehydration solution for diarrhea would together account for around 41% of additional child deaths [4-8].

LIKELY INTERVENTIONS REQUIRED

Governments will have to take immediate action to prevent increase

in malnutrition in children. Global nutrition report 2020 reveals that 30% of health expenditure is on non-communicable diseases like diabetes, hypertension, 9.6% on reproductive health, 1.3% on immunization, 16% on infectious diseases and only 0.7% on nutritional deficiencies. This will have to be altered in favor of nutrition.

Covid-19 crisis has made it clear that inequality is a maker and marker of malnutrition. In developing countries it is a health, economic, social and nutrition crisis. It is seen that undernourished people have weak immune system and may get severe Covid disease. Similarly, those who have poor metabolic health like diabetes and obesity show worse outcomes. Nutritional resilience is very essential for Covid-19 combating mechanisms. This is the link between public health and equity as nutritional resilience is compromised in weaker sections, women, and children, the poorer and marginalized communities.

Effect of lockdown will probably result in fall in vitamin D levels in adults and children. In one study nearly 70% of Indian population is seen to have Vitamin D deficiency. This will be exaggerated during lockdown, particularly so in children, pregnant and lactating mothers and senior citizens.

Supply chain disruption can result in unavailability of perishable items like green vegetables, fruits, milk and eggs. In fact shortage of some of these is already felt in many areas. This will have two effects. Lockdown for people is like going on a long sea voyage and the analogy is sailors becoming vitamin C deficient on ships sailing in the 17th century. Thiamine deficiency may produce mental issues. Increase in depression, insomnia, fear, loneliness and suicidal tendencies may be seen [9,10].

OTHER FACTORS THAT MAY AFFECT NUTRITION

We have analyzed the direct effect of economic worsening on nutrition. However, there are other factors that also affect nutrition indirectly. During Covid-19 pandemic lock down, immunization services were severely affected. Its effects, especially failure of measles vaccination may result in outbreaks of measles and subsequent malnutrition. Malnutrition is responsible or is a contributory factor to more than 60% of deaths of children below 5 years. Diarrhea and pneumonia are the major causes. Covid-19 can produce mild respiratory illnesses in children and also seen to produce Kawasaki like inflammatory diseases. Effects of all these can be profound on child's nutritional status as well as mortality.

Issue of domestic abuse in children while in lock down has been reported but is yet to be fully studied. That can compromise nutrition.

CAN GOOD NUTRITION ENHANCE IMMUNITY?

We have already seen the effect of Covid-19 on nutrition and likely development of malnutrition, deficiencies of vitamins and micronutrients, exaggeration of existing ones resonating with time of lock down, availability of supplies etc.

As we know a child with severe acute malnutrition has 9 times the risk of death from any illness compared to a normal child. Malnutrition predisposes the child to infections and delays recovery. In return recurrent infections like diarrhea promulgate the vicious cycle of infection and malnutrition.

Infections increase the demand of several nutrients. Nutrition is a crucial factor in modulating immune response. Optimum

nutritional status protects against many diseases. Calder has highlighted the importance of optimum nutritional status that offers protection against viral infections. Wu provided evidence that nutritional supplements reduced damage to the lungs from corona virus and other lung infections.

Results of a systematic review by Ranil Jayawardena in 'Diabetes and metabolic syndrome' of April 2020 are conclusive evidences as narrated under

Vitamins as immune boosters

Vitamin A has an important role in regulating both humoral and cellular immune responses. Oral supplementation of vitamin A to infants has improved antibody response to measles vaccine and antirabies vaccine (Two doses of 100000 units of vitamin A on two days.) After supplementation of Vitamin A and D in deficient children, response to influenza vaccine was enhanced.

Vitamin D plays important role in modulating both innate and adaptive immune responses. Vitamin D deficiency results in increased susceptibility to acute viral respiratory infections specially influenza A B para influenza and respiratory syncytial virus (RSV). A number of clinical trials have shown that Vitamin D deficiency increases the risk of both upper and lower respiratory tract infections. However, there was no difference between high dose (2000 units daily) and low dose (400 units daily). A study on vitamin D supplementation in elders showed that it promoted higher TGF beta plasma levels suggesting lymphocyte polarization towards tolerogenic immune response. In one study 100000 units vitamin D per month was found to be superior to 12000 units per month in reducing ARI. It is likely that baseline levels of vitamin D are important. Vitamin D along with ribavirin (peg alpha 2 beta) gave better results in HCV infections than only ribavirin.

As we are in Covid-19 lockdown it is likely that incidence of vitamin D deficiency will increase. So, giving 60000 units of vitamin D every 10 days for two months will prove beneficial.

Vitamin E is an antioxidant and improves cellular and humoral immunity. Strangely, some studies have shown harmful effects of vitamin E on infectious diseases. Vitamin E in 200 units' daily dose did not have a significant improvement in lower respiratory infections in elderly. Vitamin E showed good response in chronic hepatitis b where liver enzymes came to normal on treatment. Vitamin E has not been tried in Covid-19 patients.

Vitamin C has action in immune potentiation. It is an essential factor for antiviral response against influenza A virus by increasing production of interferon alpha and beta. Action of Vitamin C in reducing common cold has not produced conclusive results. In Covid-19, studies on the use of interferon beta in preventing lung injury are ongoing. It may therefore be reasonable to think of beneficial effect of vitamin C in Covid-19, though there are no studies yet.

Micronutrient supplementation

Micronutrient deficiency suppresses immune function by affecting T cell mediated response and adaptive antibody response. Trace elements strengthen epithelial barriers, cellular and humoral responses. Low dose supplementation with Zinc and Selenium provides increased humoral antibody after influenza vaccine. Antibody titres were higher in the group that received 10-20 mg of Zn sulphate (in below one year and above respectively) and

selenium sulphide. Zn deficiency increased susceptibility to viral infections including HIV and HCV. Cytokine response IL 2, INF gamma increased in Zn group and was found beneficial. High doses of Zn (150 mg per day) enhance thymic function and output of CD 4 naïve T cells. In one study, Oral zinc 100 mg per day and arginine 4 g a day in elderly individuals given Flu vaccine gave inconclusive results.

Addition of Zn to treatment of children with pneumonia and diarrhea and improvement is well recognized.

Selenium has many pleotropic effects, anti-inflammatory and antioxidant. Low selenium produces low immune function, high mortality and decreased cognitive function. High Selenium has antiviral effects. Selenium in a dose of 50-100 mg per day improves immune function, cellular immunity but not humoral. Selenium was seen to rapidly clear polio virus in one study. However, mucosal Flu specific antibody was unaffected by Selenium.

Copper has crucial role in immunity by participating in development and differentiation of immune cells. Cu demonstrates antiviral properties in vitro.

Magnesium has important function in immunoglobulin synthesis, antibody dependent cytolysis. In vitro studies have shown Mg to have antiviral properties. As yet no RCTs are reported about its use in vivo.

Neutraceuticals

These are varied products that claim physiological benefits or protection against chronic diseases. They contain herbal products, dietary supplements, processed cereals, soups beverages. Some neutraceuticals help in enhancing immune function and provide relief in people infected with encapsulated RNA viruses like corona and Flu. Polyphenol enriched protein powder, plant stanol ester were seen to give benefits. But RCTs have not been conducted.

Probiotics and prebiotics-Lactobacillus, bifido bacterium strains have shown to reduce viral respiratory infections and their severity. Immune function also increased by altering gut microbiota.

Thus, the overall role of nutrition in Covid-19 protection seems promising.

We declare no conflict of interest

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