

IMPORTANCE OF DIET AND DIETARY INFLUENCES ON HEALTH EFFECTS IN SCHOOL AND COLLEGE STUDENTS: A SERIOUS AND GROWING GLOBAL PROBLEM

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ABSTRACT

To develop to their optimal potential, it is vital that children are provided with nutritionally sound diets. Diet and exercise patterns during childhood and adolescence may spell the difference between health and risk of disease in later years. Everyone agrees that adequate nutrient intake is important to all living things. Without food or water, life on earth would cease to exist. In the field of medical health, some gains have been made in meeting maternal and child nutritional needs. There is great community awareness regarding the importance of meeting the nutritional needs of the developing foetus, child and adults. Behavioural problems such as hyperactivity, learning disabilities, mental illness, aggressive and antisocial behaviour, and juvenile delinquency have been purportedly linked to the potential influence of foods or nutrients. Subtle differences in behaviour can occur with physiologic variation in food intake. Components of foods can also be used as drugs. Starvation can impair neuronal maturation and can have lasting effects upon behaviour and intellectual performance. The extent of starvation's impact upon the brain depends upon whether under nutrition occurred during a critical phase in brain development. Short-term fasting has small, but significant, effects upon intellectual performance. Tryptophan, tyrosine, and choline in the diet are used as precursors for neuronal synthesis of serotonin, dopamine and norepinephrine, and acetylcholine, respectively. It is likely that the brain's sensitivity to certain components of the diet exists to permit monitoring of food intake by the central nervous system. Tryptophan, tyrosine, and choline may be useful in treatment of humans with sleep disorders, pain depression, mania, hypertension, shock, or dyskinesia. Food additives may exacerbate hyperactive symptoms in a small proportion of children with attention deficit disorder. This review mainly attempts to describe the intake food should provide the basis for effective food and nutritional surveillance strategies along with promote healthy eating habits.

KEYWORDS: Nutrition, assessment, school children, Under-nutrition, mental illness, medical health, tryptophan, diet.

INTRODUCTION

To develop to their optimal potential, it is vital that children and adolescents are provided with nutritionally sound diets. Diet and exercise patterns during childhood and adolescence may spell the difference between health and risk of disease in later years. Different stages of the life cycle dictate differing nutrient needs. Without food or water, life on earth would cease to exist. Adequate nutrient intake is important to all living things¹. Nutrition is a major component of good health and plays a critical role in disease prevention, chronic disease management, and health promotion². Deficiencies and imbalances of nutrients are particularly prevalent among the elderly, resulting not only in increased risk of illness and impaired outcome from it, but also reduced quality of life³. Malnutrition contributes directly or indirectly to more than 60% of 10 million child deaths each year⁴. In the developing world, 43% of the children are stunted and 9% are wasted⁵. In India, the National Family Health

Survey I & II reported that both chronic and acute under nutrition was high in many states⁶. This results in decreased scholastic performances, lower IQ levels, poor psychosocial development, decreased cognitive functions and reduced adult size leading to decreased economic productivity⁷. Provision of sufficient nutrients and energy to meet metabolic needs for optimal functioning of the body constitutes what one refers to as a 'nutritionally-adequate' diet. In the development and maintenance of top physical performance, diet plays a vital role, a fact recognised long before nutrition became a science of its own. Despite intense interest and effort in research related to optimal performance, the dietary regime to support such achievements requires a level of nutrition knowledge and practice that may not be present⁸. Many common health problems can be prevented or alleviated with a healthy diet. Healthy eating is associated with reduced risk for many diseases, including the three leading causes of death: heart disease, cancer, and

stroke. Healthy eating in childhood and adolescence is important for proper growth and development and can prevent health problems such as obesity, dental caries, and iron deficiency anemia. Children in India are suffering from visual problem and this is mainly in urban areas due to inadequate intake of leafy vegetables. Young people is going to work place usually without breakfast, latter that causes serious gastric problem. Healthy Nutrition is the best remedy to keep away from disease and disorders. Specific micro (i.e. vitamins and trace metals) or macronutrient (i.e. protein or cholesterol) replenishment or supplementation may be beneficial. In the New Mexico Ageing Process Study, older women with protein intake higher than the mid-range of 0.8-1.2g/kg of body weight appeared to have fewer health problems than those with protein intake < 0.8g/kg⁹. Women with higher cholesterol intake (351-668 mg) also tended to have fewer health problems than those with low cholesterol intakes. There appears to be some evidence with regards to the benefits of vitamin supplementation on cognitive function and ulcer healing. Nutritional frailty refers to the disability that occurs in old age due to the rapid, physiological, unintentional loss of Body weight (anorexia of ageing) and sarcopenia^{10,11}.

IMPORTANCE OF DIET

Many nutrients are essential for life, and an adequate amount of nutrients in the diet is necessary for providing energy, building and maintaining body organs, and for various metabolic processes. People depend on nutrients in their diet because the human body is not able to produce many of these nutrients or it cannot produce them in adequate amounts. Nutrients are essential to the human diet if they meet two characteristics. First, omitting the nutrient from the diet leads to a nutritional deficiency and a decline in some aspect of health. Second, if the omitted nutrient is put back into the diet, the symptoms of nutritional deficiency will decline and the individual will return to normal, barring any permanent damage caused by its absence. Generally the nutrients have three function. Provide energy, promote growth and development and regulate body functions. Two types of nutrients required for maintaining normal life. These are micronutrients and macronutrients.

Micronutrients

Micronutrients are the vitamins and minerals that are required in microgram quantities by the human body for it to function correctly. All the required micronutrients should be available from a balanced diet, which includes vegetables/fruit, cereals, dairy produce and eat/pulses. Micronutrients must be obtained from food sources as they can't be synthesized by the body, although some may be stored for long periods of time.

Macronutrients

Macronutrients are required for the growth and production of energy for the body. Macronutrients constitute the bulk of the food we eat. The macronutrients are proteins, carbohydrates and fats. The dietary intake pattern of the general population in many Asian and American countries reflects that they are often deficient in many nutrients, especially essential vitamins, minerals, and omega-3 fatty acids¹². A notable feature of the diets of patients suffering from mental disorders is the severity of deficiency in these nutrients¹². Supplements containing amino acids have also been found to reduce symptoms, as they are converted to neurotransmitters which in turn alleviate depression and other mental health problems¹³. On the basis of accumulating scientific evidence, an effective therapeutic intervention is emerging, namely nutritional supplement/treatment. Although further research needs to be carried out to determine the best recommended doses of most nutritional supplements in the cases of certain nutrients, psychiatrists can recommend doses of dietary supplements based on previous and current efficacious studies and then adjust the doses based on the results obtained by closely observing the changes in the patient¹³. When we take a close look at the diet of depressed people, an interesting observation is that their nutrition is far from adequate. They make poor food choices and selecting foods that might actually contribute to depression. Recent evidence suggests a link between low levels of serotonin and suicide¹⁴. It is implicated that lower levels of this neurotransmitter can, in part, lead to an overall insensitivity to future consequences, triggering risky, impulsive and aggressive behaviors which may culminate in suicide, the ultimate act of inwardly directed impulsive aggression. As reported in several studies, the amino acids tryptophan, tyrosine, phenylalanine, and methionine are often helpful in treating many mood disorders including depression^{15,16}. When consumed alone on an empty stomach, tryptophan, a precursor of serotonin, is usually converted to serotonin. Hence, tryptophan can induce sleep and tranquility. This implies restoring serotonin levels lead to diminished depression precipitated by serotonin deficiencies¹⁷. Tyrosine and sometimes its precursor phenylalanine are converted into dopamine and norepinephrine¹⁸. Dietary supplements containing phenyl alanine and/or tyrosine cause alertness and arousal. Methionine combines with adenosine triphosphate (ATP) to produce S-adenosylmethionine (SAM), which facilitates the production of neurotransmitters in the brain^{19, 20}. The need of the present paradigm is, more studies shedding

light on the daily supplemental doses of these neurochemicals that should be consumed to achieve antidepressant effects. Researchers attribute the decline in the consumption of omega-3 fatty acids from fish and other sources in most populations to an increasing trend in the incidence of major depression.

DIET AND DISEASES

Majority of Asian diets are usually also lacking in fruits and vegetables, which further lead to mineral and vitamin deficiencies. The most common nutritional deficiencies seen in patients with mental disorders are of omega-3 fatty acids, B vitamins, minerals, and amino acids that are precursors to neurotransmitters²¹⁻²⁵.

Carbohydrates

Carbohydrates are naturally occurring polysaccharides and play an important role in structure and function of an organism. In higher organisms (human), they have been found to affect mood and behaviour. Eating a meal which is rich in carbohydrates triggers the release of insulin in the body. Insulin helps let blood sugar into cells where it can be used for energy and simultaneously it triggers the entry of tryptophan to brain. Tryptophan in the brain affects the neurotransmitters levels. serotonin and tryptophan that promote the feeling of well being, is triggered by carbohydrate rich foods. It is suggested that low glycemic index (GI) foods such as some fruits and vegetables, whole grains, pasta, etc. are more likely to provide a moderate but lasting effect on brain chemistry, mood, and energy level than the high GI foods - primarily sweets - that tend to provide immediate but temporary relief.

Proteins

Proteins are made up of amino acids and are important building blocks of life. As many as 12 amino acids are manufactured in the body itself and remaining 8 (essential amino acids) have to be supplied through diet. A high quality protein diet contains all essential amino acids. Foods rich in high quality protein include meats, milk and other dairy products, and eggs. Plant proteins such as beans, peas, and grains may be low in one or two essential amino acids. Protein intake and in turn the individual amino acids can affect the brain functioning and mental health. Many of the neurotransmitters in the brain are made from amino acids. The neurotransmitter dopamine is made from the amino acid tyrosine and the neurotransmitter serotonin is made from the tryptophan¹⁴. If there is a lack of any of these two amino acids, there will not be enough synthesis of the respective neurotransmitters, which is associated with low mood and aggression in the patients. The excessive build-up of amino acids may also lead to brain damage

and mental retardation.

Omega-3 fatty acids

The brain is one of the organs with the highest level of lipids (fats). Brain lipids, composed of fatty acids, are structural constituents of membranes. It has been estimated that gray matter contains 50% fatty acids that are polyunsaturated in nature (about 33% belong to the omega-3 family), and hence are supplied through diet. In one of the first experimental demonstrations of the effect of dietary substances (nutrients) on the structure and function of the brain, the omega-3 fatty acids (specially alpha-linolenic acid, ALA) were the member to take part. polyunsaturated fatty acids (in particular omega-3) present in formula milks for infants (both premature and term) determines the visual, cerebral, and intellectual abilities²⁶.

Vitamins

B-complex vitamins

Nutrition and depression are intricately and undeniably linked, as suggested by the mounting evidence by researchers in neuropsychiatry. According to a study reported in Neuropsychobiology²⁷, supplementation of nine vitamins, 10 times in excess of normal recommended dietary allowance (RDA) for 1 year improved mood in both men and women. The interesting part was that these changes in mood after a year occurred even though the blood status of nine vitamins reached a plateau after 3 months. This mood improvement was particularly associated with improved vitamin B2 and B6 status. In women, baseline vitamin B1 status was linked with poor mood and an improvement in the same after 3 months was associated with improved mood. Thiamine is known to modulate cognitive performance particularly in the geriatric population²⁸.

Vitamin B12 (Cynocobalamin)

Clinical trials have indicated that Vitamin B12 delays the onset of signs of dementia (and blood abnormalities), if it is administered in a precise clinical timing window, before the onset of the first symptoms. Supplementation with cobalamin enhances cerebral and cognitive functions in the elderly; it frequently promotes the functioning of factors related to the frontal lobe, in addition to the language function of people with cognitive disorders. Adolescents who have a borderline level of vitamin B12 deficiency develop signs of cognitive changes²⁸.

Folate

It has been observed that patients with depression have blood folate levels, which are, on an average, 25% lower than healthy controls²⁹. Low levels of folate have also been identified as a strong predisposing factor of poor outcome with antidepressant therapy. A controlled study

has been reported to have shown that 500 mcg of folic acid enhanced the effectiveness of antidepressant medication. Folate's critical role in brain metabolic pathways has been well recognized by various researchers who have noted that depressive symptoms are the most common neuropsychiatric manifestation of folate deficiency. It is not clear yet whether poor nutrition, as a symptom of depression, causes folate deficiency or primary folate deficiency produces depression and its symptoms.

Minerals

Calcium

A recent study showed that selective serotonin uptake inhibitors (SSRIs) inhibit absorption of calcium into bones. In addition to this, the SSRIs can also lower blood pressure in people, resulting in falls which may lead to broken bones. Indiscriminate prescription of SSRIs by doctors and ingestion by patients at risk of depression or other mental health problems may put them at increased risk of fractures. Compounded by the fact that they may be aging and already taking other medications, may also predispose them to osteoporosis³¹.

Chromium

Many studies on the association of chromium in humans depression have been recorded which indicate the significance of this micronutrient in mental health³².

Iodine

Iodine plays an important role in mental health. The iodine provided by the thyroid hormone ensures the energy metabolism of the cerebral cells. During pregnancy, the dietary reduction of iodine induces severe cerebral dysfunction, eventually leading to cretinism.

Iron

Iron is necessary for oxygenation and to produce energy in the cerebral parenchyma (through cytochrome oxidase), and for the synthesis of neurotransmitters and myelin. Iron deficiency is found in children with attention-deficit/hyperactivity disorder. Iron concentrations in the umbilical artery are critical during the development of the foetus, and in relation with the IQ in the child; infantile anaemia with its associated iron deficiency is associated with disturbance in the development of cognitive functions. Research findings pointed out that twice as many women as men are clinically depressed. This gender difference starts in adolescence and becomes more pronounced among married women aged 25–45, with children. Furthermore, women of childbearing age experience more depression than during other times in their lives. These indicate the possible importance of iron in the aetiology of depression since its deficiency is known to cause fatigue and depression. Iron deficiency anaemia is associated,

for instance, with apathy, depression, and rapid fatigue when exercising.

Lithium

Lithium, a monovalent cation, was first discovered and defined by Johan August in 1817 while he did an analysis of the mineral petalite. The role of lithium has been well known in psychiatry. Half a century into its use, its choice for bipolar disorder with antimanic, antidepressant, and antisuicidal property. The therapeutic use of lithium also includes its usage as an augmenting agent in depression, schizoaffective disorder, aggression, impulse control disorder, eating disorders, ADDs, and in certain subsets of alcoholism³³. But adequate care has to be taken while using lithium, the gold standard mood stabilizer, in the mentally ill. Lithium can be used in patients with cardiovascular, renal, endocrine, pulmonary, and dermatological co morbidity. The use of lithium during pregnancy and lactation, in paediatric and geriatric population needs careful observation about its toxicity.

Selenium

In a large review, Dr. David Benton of the university of Wales identified at least five studies, which indicate that low selenium intake is associated with lowered mood status. Intervention studies with selenium with other patient populations reveal that selenium- improves mood and diminishes anxiety.

Zinc

Zinc participates among others in the process of gustation (taste perception). At least five studies have shown that zinc levels are lower in those with clinical depression. Furthermore, intervention research shows that oral zinc can influence the effectiveness of antidepressant therapy. Zinc also protects the brain cells against the potential damage caused by free radicals.

Several studies have revealed the full genetic potential of the child for physical development and mental development may be compromised due to deficiency (even subclinical) of micronutrients. When children and adolescents with poor nutritional status are exposed to alterations of mental and behavioural functions, they can be corrected by dietary measures, but only to certain extent. It has been observed that, nutrient composition of diet and meal pattern can have beneficial or adverse, immediate or long-term effects. Dietary deficiencies of antioxidants and nutrients (trace elements, vitamins, and nonessential micronutrients such as polyphenols) during aging may precipitate brain diseases, which may be due to failure for protective mechanism against free radicals. Micro-nutritional deficiencies and risks for poor child development. Psychosocial stimulation. Refers to the extent that the environment provides physical stimulation

through sensory input (e.g., visual, auditory, tactile), as well as emotional stimulation provided through an affectionate caregiver-child bond. Nutritional deficiencies and a lack of stimulation create a vicious cycle in which deprivation in one can result in further deprivation in the other.

For example,

A malnourished infant may show reduced psychomotor activity (e.g., the child is less likely to crawl and engage in creative play). As the child becomes more apathetic and less demanding, parents often provide less stimulation³³. The interaction between parent and child becomes less mutually rewarding, and ultimately their bond is threatened, opening the door for lifelong repercussions. The combination of malnutrition and a lack of psychosocial stimulation are particularly harmful. Improving both nutritional status and stimulation has an added impact on a child's development and recovery. Therefore nutritional and psychosocial interventions should be integrated.

Lack of iron: Iron plays an important role in cognitive development during fetal life. It is therefore crucial to prevent iron deficiency during pregnancy and the first years of life.

Lack of iodine: Iodine is required for cognitive development. Infants whose mothers were iodine deficient during pregnancy are at risk of brain damage that is irreversible³⁴. It is important that iodine deficiency is prevented during pregnancy and the first two years of life. Nutritional diet deficiencies and a lack of stimulation create a vicious cycle in which deprivation in one can result in further deprivation in the other.

CONCLUSIONS

This review suggested that there is a need to increase energy intake to match energy requirements. The introduction of energy-dense diets may help to reduce bulkiness which is common in Asian diets. Supplementation may not be necessary since the additional nutrients required will be present in the extra food eaten to meet energy needs, consistent with increased physical activities. It should also be stressed at this stage that nutritional conditioning, like physical conditioning is a continuous quest and that nutritionists/dietitians have a role to play in educating all. It is also highly recommended that more research be initiated to validate these initial findings and to help establish dietary guidelines for the school and college students.

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