Food for Health

By: Prof K. Sivapalan
Associate Professor in Physiology
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Introduction

Today many people see food as a source of ill health rather than a source of good health, pleasure and vitality. The question whether we live to eat or eat to live could not be clearly answered as both alternatives are correct. Doctors tend to look at food as medicine to be consumed at measured doses but patients find it very difficult to follow the instructions because they could not overcome the basic sensation of hunger and urge to eat as others in the family. Yet others consider tuition, work or their business more important and they eat only when time is available. For many people food is a routine bother.

Pathogenesis of Chronic Nutritional Illnesses

All the adverse effects of food remain associations and exact mechanism of the causation of ill health remains to be scientifically established. Some theories have been developed to suggest the possible mechanisms.

One possible mechanism for carcinogenesis is conversion of nitrites found in preservatives into nitrosamines which are carcinogens. Aflatoxins of the fungus infected food substances are another source. Intestinal and colonic cancers are related to bile acid dehydration by anaerobic bacteria in the intestines due to lack of fibers resulting in prolonged transit time due to small, hard stool (Tayler P, 2001).

Atherosclerosis is another diet related lesion responsible for several health problems. According to one theory, High LDL levels and Low HDL levels are associated with this lesion. Following injury of endothelium, monocytes enter the intima and become macrophages and generate free-radicals. The free-radicals oxidize the LDL which is deposited from where the pathological processes begin. According to another theory, endothelial injury results in thrombosis which undergoes lipid degeneration after getting incorporated into intima. A third theory suggests that vascular smooth muscle is stimulated by a mitogen and proliferates after migration into intima, which becomes the source of the lesion where lipids are deposited. The common indicator of the above risks is the blood cholesterol.

Biochemically, High levels of Low Density Lipoprotein and intermediate density lipoprotein and low levels of High Density Lipoprotein are associated with development of Athetomatus lesions in the blood vessels which intern affects blood supply to various organs including heart and brain which result in defects in structure and function of those organs.

Changes in endocrine function also are associated with abnormalities in metabolism predisposing to atheroma, obesity and diabetes. Low levels of insulin and high levels of glucocorticoid [stress hormone] are the prime associates. It is well known that insulin reduces blood lipid and glucose levels and that the corticoids increase them by altering the metabolism. The effects of rapid changes in blood levels could be different from overall 24 hour secretion on the metabolism as well as on the integrity of the glands that secrete them. In addition to the blood levels of these hormones, tissue sensitivity to these hormones also changes and contributes to metabolic abnormalities.

Relationship of chronic illnesses to food

Last year we heard about the relationship of food to chronic illnesses at the presidential address (V, 2008). The key points expressed are,

- Susceptibility to chronic diseases - 30 % genetic, rest by other factors.
- The risk of developing chronic diseases begins in fetal life. Preventive measures must be taken at all stages of life.
- Lower birth weight is associated with mental and physical deficiencies.
- High birth weight is associated with obesity and related illnesses.
- Obesity is associated with energy rich diets [snaking, binge-eating, eating out] and physical inactivity
- Cardiovascular diseases are associated with saturated fatty acids when they are more than 10% of the dietary energy. Trans-fatty acids which are hydrogenated products of unsaturated fatty acids may be associated high risk. Polyunsaturated fatty acids are safe. [Excess polyunsaturated fatty acids can become toxic to body.
- Dietary fiber reduces risk of chronic diseases.
- Salt consumption less than 5g/day reduces risk of hypertension
- Diabetes is linked to fat intake and food with high glycaemic index.
- Cancer is associated with alcohol and food at high temperature. Preserved meat is associated with colorectal cancer. High intake of fiber, folate, and calcium reduce risk of cancer.

Effects of Meal Frequency

The effect of meal frequency on obesity has been a controversy for a long time. Some scientists say that nibbling [many small meals] is associated with low weight gain and that gorging [few large meals] is associated with overweight and obesity on the basis of surveys conducted which suggested inverse relationship between skin fold thickness and overweight (Stunkard A J, 1955), (Fabry P, 1964). Others maintain that the meal frequency is not related to overweight based on the results of their survey (Morgan K J, 1983).

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Experiments on Rats

Since human experiments in this field had to be carried out over long periods to obtain any meaningful results which involved inevitable errors, scientists turned to animal experiments. The closest animal to resemble human metabolism that could be used for laboratory experiments is the rat. Several experiments were carried out by varying the number of meals by way of limiting the access to food, tube feeding and intermittent starvation. In limited access, the rats could access food only at times prescribed by the investigators and this method had no control over the amount of food consumed. Tube feeding can control meal time and amount given but sudden filling of stomach and by passing the mouth may not be physiological. Intermittent

starvation is feeding ad-libitum on alternative days and starving on other days. This is not considered to be acceptable form of changing meal frequency by other researchers. (Sivapalan K, 1987). Unfortunately these experiments resulted in all possible conclusions by different researchers: increased, decreased and no change in energy expenditure and body fat. The problems included inability to control intake and energy expenditure calculated as difference between energy intake and body energy content.

The Department of Physiology at the University of Leeds developed a system for accurate measurement of all three components of the energy balance equation: energy expenditure, energy intake and change of body energy store. At the end of the experiment, balancing the equation was considered to be crucial to prove accuracy. I undertook to study the effects of meal frequency in rats using this system (Sivapalan K, 1987).

An important requirement for studying the effects of a fixed amount of food in varying numbers of meals was a method to feed rats precisely controlled amounts of food at predetermined times. This was achieved by developing a technique to infuse a liquid diet through permanently fixed gastric cannula. There were for cages each housing two rats each. The cages were in an environmental room with fixed temperature and humidity and fixed 12 hour light and dart cycles. The only external intrusion in the room would be the experimenter once a day to maintain the pumps and the cages. No unfamiliar person would enter the room and the familiar person [experimenter] entering would disturb the rats minimally.

A liquid diet was prepared to provide all needed nutrients in correct proportion. Initially, the rats were given this food ad-libitum for about ten days and the intake was measured. Then the gastric cannulae were implanted and the rats continued with ad-libitum feeding. Then all rats were given infusion of the liquid diet in 11 meals to resemble their normal feeding pattern. After two days the rats stopped consuming orally. Then they were given the 11 meal infusion for 10 days and then the pattern of feeding rats in 3 cages was altered to one, two and four meal per day for 15 days at the end they were killed and body energy content determined. Two experiments were carried out with adult rats.

Another two experiments were conducted in young growing rats. Rats in two cages were given eleven meals and two meals for the other rats. One meal was omitted because of fear of inability of small stomach not accommodating entire food in one meal. The total amount infused was increased daily to match growth based on consumption of rats of the same batch kept in normal cages in the same room and intake measured.

The results of the above experiments indicated that meal frequency did not influence energy expenditure and body fat in adult as well as young growing rats. This leaves any observed changes in body fat by other investigators to the actual total consumption and not to the energy expenditure change due to frequency of meal (Sivapalan K, 1987).

Human experiments:

Even though animal experiments can be performed to get accurate results, these findings have to be confirmed by human experiments. In one experiment, children in three schools were involved: one school gave three meals, the second five meals and the third gave seven meals per day but the amount of food eaten was not controlled (Fabry P, 1966). Another experiment involved ten university students who got diets with same energy content in one or six meals per day for 36 days (Young C M, 1972). The results showed no difference between the groups but it is not convincing enough because of short duration. Another experiment was conducted on six male university students with two or eight meals for four weeks (Wadhwa P S, 1973). An extensive review, after considering measurements of energy expenditure of human subjects and weight reduction regimes, concludes that there is no relationship between meal frequency and energy expenditure and body fat content (France Bellisle, 1997).

Childhood Obesity

Stature and weight of 4370 German children ages 5 to 6 years were determined in six Bavarian (Germany) public health offices during the obligatory school entry health examination in 2001/2002. An extensive questionnaire on risk factors for obesity was answered by their parents. The prevalence of obesity decreased by number of daily meals: three or fewer meals, 4.2%; four meals, 2.8%; and 5 or more meals, 1.7%. These effects could not be explained by confounding due to a wide range of constitutional, socio-demographic, and lifestyle factors (Toschke A M, 2005).

Another study which involved 8459 children concluded that children who watched more television, ate fewer family meals, and lived in neighborhoods perceived by parents as less safe for outdoor play were more likely to be persistently overweight. Children who had aerobic exercise and opportunities for activity were not associated with a greater likelihood of weight problems (Gable S, 2007).

Relationship of meal frequency to blood parameters

An experiment was conducted on seven men with average age of 39.6 years over two weeks given three meals or seventeen snacks per day containing identical nutrients and energy (Jenkins DJ, 1989). As compared with the three-meal diet, the nibbling diet reduced fasting serum concentrations of total cholesterol, low-density lipoprotein cholesterol, and apolipoprotein B by a mean (+/- SE) of 8.5 +/- 2.5 percent (P less than 0.02), 13.5 +/- 3.4 percent (P less than 0.01), and 15.1 +/- 5.7 percent (P less than 0.05), respectively. Although the mean blood glucose level and serum concentrations of free fatty acids, 3-hydroxybutyrate, and triglyceride were similar during both diets, during the nibbling diet the mean serum insulin level decreased by 27.9 +/- 6.3 percent (P less than 0.01) and the mean 24-hour urinary C-peptide output decreased by 20.2 +/- 5.6 percent (P less than 0.02). In addition, the mean 24-hour urinary cortisol excretion was lower by 17.3 +/- 5.9 percent (P less than 0.05) at the end of the nibbling diet than at the end of the three-meal diet. The blood glucose, serum insulin, and C-peptide responses to a

standardized breakfast and the results of an intravenous glucose-tolerance test conducted at the end of each diet were similar.

In normolipidaemic individuals increasing meal frequency from three to six or more meals daily over a period of several weeks appeared to be associated with reduced levels of total and LDL-cholesterol, possibly due to reduced cholesterol synthesis or enhancement of reverse cholesterol transport. However, in non-obese individuals with polygenic hyperlipidaemia and non-insulin-dependent diabetes, altered meal frequency did not confer similar benefits (Mann J, 1997)

In a review of intermittent fasting, three experiments were cited which indicated beneficial effects of alternative day fasting by the way of weight reduction and increased insulin sensitivity in non-obese individuals (Alan Aragon, 2007). Experiments on rats have given better results.

In an experiment on healthy obese women, regular eating was associated with lower energy intake, ($P < 0.01$), greater postprandial thermogenesis ($P < 0.01$), and lower fasting total cholesterol (4.16 compared with 4.30 mmol/L; $P < 0.01$) and LDL (2.46 compared with 2.60 mmol/L; $P < 0.02$). Fasting glucose and insulin values were not affected by meal pattern, but peak insulin concentrations and area under the curve of insulin responses to the test meal were lower after the regular than after the irregular meal pattern ($P < 0.01$ and 0.02, respectively) (Farshchi H R, 2005).

The influence of reduced meal frequency without a reduction in energy intake on glucose metabolism in normal-weight, healthy male and female subjects was investigated in one study. The study was a randomized crossover design, with two 8-week treatment periods (with an intervening 11-week off-diet period) in which subjects consumed all of their calories for weight maintenance distributed in either 3 meals or 1 meal per day (consumed between 4:00 pm and 8:00 pm). Energy metabolism was evaluated at designated time points throughout the study by performing morning oral glucose tolerance tests and measuring levels of glucose, insulin, glucagon, leptin, ghrelin, adiponectin, resistin, and brain-derived neurotrophic factor (BDNF). Subjects consuming 1 meal per day exhibited higher morning fasting plasma glucose levels, greater and more sustained elevations of plasma glucose concentrations, and a delayed insulin response in the oral glucose tolerance test compared with subjects consuming 3 meals per day. Levels of ghrelin were elevated in response to the 1-meal-per-day regimen. Fasting levels of insulin, leptin, ghrelin, adiponectin, resistin, and BDNF were not significantly affected by meal frequency. Subjects consuming a single large daily meal exhibit elevated fasting glucose levels and impaired morning glucose tolerance associated with a delayed insulin response during a 2-month diet period compared with those consuming 3 meals per day. The impaired glucose tolerance was reversible and was not associated with alterations in the levels of adipokines or BDNF. (Carlsona O, 2007)

In a food restriction trial, one-half of the boxers consumed two daily meals (600 kcal each), and the other one-half consumed six daily meals (200 kcal each). Both groups showed a similar amount of weight loss, but boxers eating 600 kcal twice daily lost more muscle and less fat than those eating 200 kcal six times daily (Toschke A M, 2005).

Effects of skipping breakfast

Several studies have been undertaken to investigat the effects of skipping breakfast and a review of the studies had summarised the results (Alan Aragon, 2007). Children and adolescents who eat breakfast consumed more daily calories but they were less likely to be overweight. Children who consistently ate breakfast tended to have superior nutritional profiles. While cognitive effects are inconsistent in well-nourished children, breakfast skipping degrades mental performance in malnourished children. Overall, the evidence points to regular breakfast consumption improving cognitive function, test grades, school attendance, memory, and nutrient status.

Skipping breakfast decreased post-meal insulin sensitivity and increased LDL-cholesterol, despite a high (6-a-day) meal frequency in lean subjects. Breakfast is also associated with improved results of special memory task and word recall, better short term memory and recalling a story read aloud.

Of the participants who maintained a weight loss of at least 13.6 kg (30 lb) for at least one year, 2313 subjects (78%) eat breakfast every day. Only 114 subjects (4%) reported skipping breakfast.

Summary of the effects of increasing meal frequency

The benefits of reducing portion and increasing frequencies of meals are summarized in a review (Tanya, 2009) as follows:

Lower total cholesterol levels in clinical experiments
Lower total cholesterol levels in population studies
Cholesterol synthesis was reduced
Low-density lipoprotein (ldl) cholesterol ("bad" cholesterol) reduction
Lower levels of apolipoprotein b ("very bad" stuff)
Reduced insulin secretion
The lower insulin levels
Depressed glucose levels
Increased bile acid secretion
Suppressed free fatty acids levels
Reduced serum uric acid levels (risk factor for coronary heart disease)
Increased urinary uric acid excretion
Reduced adipose tissue enzyme levels
Reduced fluctuations in satiety

Hunger Hormone

According to Bio-medicine (website), Ghrelin, a hormone produced by the stomach, is named for the Hindi word for growth. According to past studies it rises just before eating and falls after a meal and can make people so ravenous they eat nearly a third more food than usual. Dr. David E. Cumming from the Puget Sound Health Care System in Seattle, suggested that

drugs that suppress this hormone could curb appetite and may cut rates of obesity and related problems such as type 2 diabetes and other chronic disorders.

A team of investigators measured levels of ghrelin in the blood of 10 obese individuals before and after a 5-month weight loss program, in 6 adults who had lost weight after gastric bypass surgery, and in 10 normal-weight adults. After surgery, the patients had lower levels of the hormone compared with both normal-weight people and obese people who lost weight by dieting. The surgery appears to inhibit the production of ghrelin, thereby contributing to long-term weight loss. The finding may help explain why people undergoing surgery feel less hungry between meals, even though their intake of food has dropped dramatically.

Effects of Dietary Fiber

In a study on the effects of dietary fiber, forty-three healthy volunteers were randomly assigned to two diet protocols. Both regimens were based on low-fat, low-cholesterol diets but one included high soluble fiber intake and the other included high insoluble fiber intake. All participants spent four months on each regimen with a two-month break on a low cholesterol diet. By the fourth week of both regimens, blood lipid levels reached their lowest points. LDL and HDL levels fell by approximately 4.9% for those on the soluble fiber diet and by approximately 3.4% on the insoluble fiber diet. Male patients had greater reductions in total and LDL cholesterol levels on the soluble fiber diets. The results suggest that a diet high in soluble fiber and low in fat and cholesterol can help reduce levels of low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol in the blood (Hegele, 1993).

Effects of a dietary portfolio

A diet that contains many different foods that can lower blood cholesterol may be as effective as treatment with a group of drugs called statins, according to a study of 46 people. One-third ate a diet high in plant sterols, soy protein, fiber, and almonds. One-third ate a basic low-fat diet and took lovastatin, and the remainder just ate a low-fat diet. Both lovastatin and the comprehensive diet were more effective than a basic low-fat diet in lowering blood cholesterol levels (Jenkins, 2003).

Possible Biological Mechanisms

An increased daily overall thermogenesis after consumption of more meals could be a potential explanation. However, there is an ongoing controversy regarding the role of this mechanism because studies on thermic food effects did not observe different thermogenesis between nibbling vs. gorging regimens.

According to one theory, the body shifts into a “starvation mode” when the body senses deprivation due to absence of meal for more than a few hours. Another mechanism potentially affecting the role of energy expenditure could be differing levels of physical activity between nibblers and gorgers.

A further possible mechanism might be the association between the number of meals consumed and insulin metabolism. Insulin is known to stimulate lipogenesis in arterial tissues

and enhances the growth and proliferation of arterial smooth muscle cells. The increased triglyceride synthesis in adipose tissue triggered by higher postprandial glucose and insulin levels might contribute to the higher prevalence of obesity among gorgers. The insulin spikes in gorgers will lead to a crash, where there is a tendency toward hypoglycemia (low blood sugar). Hunger pangs ensue and one invariably end up eating more than one otherwise would, often in the form of refined sweets. This sets up the vicious cycle of overeating and uncontrolled insulin secretions.

It appears that a diet consisting of a large amount of highly processed and refined high-carbohydrate foods such as breads, dry cereals, crackers, cookies, and cakes would lead to a rapid rise in blood sugar and an increased need for insulin. However, because the carbohydrate in such foods is absorbed too quickly, it can be expected that blood sugar would drop precipitously an hour or so after such a meal, which would trigger the release of glucagon and catecholamines. These hormones would increase the release of FFA from adipose tissue. Elevated FFA would then increase glucose intolerance. Consuming high-glycemic index foods in smaller, more frequent meals could diminish their metabolic insult. Alternatively, if foods with a lower glycemic index were consumed, which are digested and absorbed more slowly, there would appear to be less metabolic advantage to spreading those foods out over smaller, more frequent meals.

The absence of food causes the stomach to secrete ghrelin. It exerts its effects by slowing down fat utilization and increasing appetite. Without consistent food consumption, ghrelin levels remain elevated for extended periods of time, increasing the urge to eat.

During periods of caloric restriction, the body catabolizes muscle protein and converts it into glucose for use as an energy source. Increasing meal frequency attenuates the rate of muscle tissue breakdown. This allows maintenance of more lean body mass.

When rich, highly palatable foods are readily available, food consumption may be triggered by mealtime or pleasure and not necessarily because of hunger or the need for extra calories. It appears that human beings have not evolved physiological mechanisms to prevent overeating when rich, highly palatable foods are readily available.

Another potential advantage in eating smaller, more frequent meals is that stomach capacity is likely to shrink. Eating until one is uncomfortably full or "stuffed" is likely to increase stomach capacity over time. This could lead to the consumption of even larger meals and more metabolic stress.

<u>Vitamin D and Chronic illnesses</u>

A review (F, 2007) highlights the importance of vitamin D in preventing chronic illnesses in addition to its effects on bones and muscles. It is well known that Vitamin D deficiency can precipitate or exacerbate osteopenia and osteoporosis, cause osteomalacia and muscle weakness, and increase the risk of fracture. The discovery that most tissues and cells in the body have a vitamin D receptor and that several possess the enzymatic machinery to convert the primary circulating 25-hydroxyvitamin D to the active form, 1,25-dihydroxyvitamin D, has provided new insights into the function of this vitamin. Of great interest is the role it can play in decreasing the risk of many chronic illnesses, including common cancers, autoimmune diseases, infectious diseases, and cardiovascular and respiratory diseases.

A diet high in oily fish prevents vitamin D deficiency. Solar ultraviolet radiation (wavelength, 290 to 315 nm) penetrates the skin and converts 7-dehydrocholesterol to pre-vitamin D3, which is rapidly converted to vitamin D3. We are becoming "civilized" by covering the babies and children fully by clothes depriving them of vitamin D making them to be dependent on enriched formula to provide it. Most officers are becoming confined to air conditioned offices and do not get enough sun light and are at risk of deficiency of this vitamin and become susceptible to various illnesses.

Relationship between sodium and blood pressure

An extensive review (Adrogue H J, 2007) has analyzed "Sodium and Potassium in the Pathogenesis of Hypertension". Main points from this review are given below.

Hypertension is the major risk factor for cardiovascular disease and is responsible for most deaths worldwide. Primary hypertension, also known as essential or idiopathic hypertension, accounts for as many as 95% of all cases of hypertension. Primary hypertension results from the interplay of internal derangements (primarily in the kidney) and the external environment. Sodium, the main extracellular cation, has long been considered the pivotal environmental factor in the disorder.

By contrast, potassium, the main intracellular cation, has usually been viewed as a minor factor in the pathogenesis of hypertension. However, available evidence indicates that potassium deficit has a critical role in hypertension and its cardiovascular sequelae. Primary hypertension and age-related increases in blood pressure are virtually absent in populations in which individual consumption of sodium chloride is less than 50 mmol [2.9g] per day. The International Study of Salt and Blood Pressure (INTERSALT), which included 10,079 subjects from 32 countries, showed a median urinary sodium excretion value of 170 mmol [9.9g] per day. Although individual sodium intake in most populations throughout the world exceeds 100 mmol [5.9g] per day, most people remain normotensive. It appears, then, that sodium intake that exceeds 50 to 100 mmol per day is necessary but not sufficient for the development of primary hypertension.

Population studies have shown an inverse relation of potassium intake to blood pressure, the prevalence of hypertension, or the risk of stroke. In clinical studies, a diet low in potassium (10 to 16 mmol per day) coupled with the participants' usual sodium intake (120 to 200 mmol per day) caused sodium retention and an elevation of blood pressure.

Studies have shown that increasing the potassium intake of hypertensive rats that were fed high sodium diets lowered blood pressure, reduced the incidence of stroke and stroke-related death, and prevented cardiac hypertrophy, mesenteric vascular damage, and renal injury.

Studies indicate that potassium supplementation can reduce the need for antihypertensive medication.

The physiological mechanism appears to be linked to excitability of vascular smooth muscles. Excess cellular sodium and deficit of cellular potassium causes smooth muscle contraction and hypertension. Another mechanism is associated with an endogenous "digitalis-like factor," which is identical to ouabain or a stereoisomer of ouabain, released by the adrenal glands and the brain in response to a high-sodium diet. There are high levels of digitalis-like factor in the plasma of approximately 40% of untreated patients with primary hypertension, and these levels correlate directly with blood pressure. Digitalis-like factor mediates sodium retention by increasing the activity and expression of the renal sodium pump.

A modified diet that approaches the high potassium: sodium ratio of the diets of human ancestors is a critical strategy for the primary prevention and treatment of hypertension. Weight loss with diets rich in fruits and vegetables has been attributed both to the low caloric density and to the high potassium content of these diets, which tend to increase the metabolic rate.

As compared with diets based on natural foods, diets based on processed foods are high in sodium and low in potassium. For example, two slices of ham (57 g) contain 32.0 mmol [1.9g] of sodium and 4.0 mmol of potassium, and a cup of canned chicken noodle soup contains 48.0 mmol of sodium [2.8g] and 1.4 mmol of potassium. Conversely, diets containing abundant fruits and vegetables are sodium-poor and potassium-rich. For example, an orange contains no sodium and 6.0 mmol of potassium, and a cup of boiled peas contains 0.3 mmol of sodium and 9.8 mmol of potassium. Isolated populations that eat natural foods have an individual potassium intake that exceeds 150 mmol per day and a sodium intake of only 20 to 40 mmol [2.3g] per day (the ratio of dietary potassium to sodium is >3 and usually closer to 10). By contrast, people in industrialized nations eat many processed foods and thereby ingest 30 to 70 mmol of potassium per day and as much as 100 to 400 mmol [5.9-23.4g] of sodium per day (the usual dietary potassium:sodium ratio is <0.4).

Human kidneys are poised to conserve sodium and excrete potassium. Prehistoric humans, who consumed a sodium-poor and potassium-rich diet, were well served by this mechanism.

Relation to free radicals

There is another angle of looking at the beneficial effects of natural foods. Free radicles formed in the tissues are thought to be responsible to oxidize various cellular components leading to chronic illness and aging. The value of reducing substances such as vitamin C and other substances present in natural flavoring agents such as tamarind are being studied by some researchers.

Discussion

Health is defined as complete physical, mental and social well being. The present practice of dieting for physical well being appears to steal mental and social well being adding to stress resulting in physical harm or disobeying the doctor's advice leading to physical harm. Change in the pattern and the type of food eaten cannot be brought about by one prescription or for one member in a family. Further, food should be stress free, affordable, palatable and pleasurable habit.

The evidence that has been collected by the scientists suggests the following aspects of the food to be healthy:

- Foods prepared with highly polished, refined and energy dense material predispose to diet related illnesses but natural foods with high fiber content are healthy.
- Eating energy dense food divided into many meals is safer than eating them in one or two meals. But total energy consumed should not exceed the recommended total amount.
- Irregular meals and skipping meals are harmful. Intermittent fasting has some beneficial effect but such fasting should not be associated with energy demanding activities.

Skipping breakfast can not only be harmful but also affects mental performance and learning. Regular meals, more in number contribute to health.

- Instead of salt free diet, diets with low salt and high potassium should be recommended. Such diets can be tastier and pleasurable.
- Reducing substances in food may be also helpful by preventing free radical formation
- Recommended amounts of saturated and unsaturated fat, starch, protein, fiber, minerals and vitamins forms the balanced diet which could not be obtained in each and every meal. Eating variety of food substances containing the above could provide all required nutrients while maintaining the thrill of eating different food every time.
- Adequate vitamin D intake or synthesis by sunlight should be ensured

<u>JSA symposium on Food:</u>

The JSA recognized the importance of eating habits for wellbeing and the first theme seminar of the Association was on "Food and Food Habits" in 1992. The first speaker in the seminar analyzed the economical aspects (Nanthakumaran R, 1993). His recommendations could be summarized as follows:

- Reduce imported foods and improve local production
- Research and development should be geared towards crops suitable for local environment
- Forecasts on climatic conditions should be disseminated to producers
- Direct consumption of plant protein without converting it into animal protein is economical and should be encouraged
- Housewives and school children should be educated on consumerism and nutrition
- Ways of making quick or readymade food products with locally available food should be found
- Policy measures to be taken to influence the food habit depending on the availability of local foods

The second speaker (Chitravadivelu, 1993) analyzed the fisheries resources. He explained the gift of nature by availability of long cost line with coral reefs giving considerable fishing resources. He explained several ways of preserving fish: salting and drying, smoking, fermentation and cooking and drying. He recommended work towards changing the choice of fish and marine products to make the best of what are available and developing methods of preserving marine products.

The third speaker (Navaratnam R S, 1993) discussed food of animal origin, explained the problems in getting good quality meat without fly hazard and contamination and the risks of spread of diseases through meat if adequate precautions are not taken. His recommendation could be summarized as follows:

- Enhance production of adequate and good quality food of animal origin

- Strict enforcement of laws designed to ensure good quality food through slaughter house, transport, storage and handling.
- Establish facilities for food processing
- Establish proper facilities for proper storage, marketing and transport
- Action to even distribution among people especially collection and distribution of milk
- Educational programs for different groups involved in the food chain
- Efficient preservation and use of food

The fourth speaker (Nutritional Aspects of Food and Food Habits, 1993) analyzed the nutritional aspects and concluded that our traditional food was well balanced providing all necessary components and explained that we appear to have changed over to unhealthy food habits probably during the food shortage of Second World War and events leading thereon. He concluded that variety is the key of fulfillment of nutrient needs as well as the pleasure and satisfaction of good food.

The final speaker (Nachinarkinian C S, 1993) explained the unhealthy beliefs that lead to nutritional deficiencies and ill health. He concluded with recommendation of research into traditional foods and the medicinal properties of the ingredients used in food preparation.

Recommendation

Morning meal should be made compulsory to all. The food habit has to be changed by diet education, availability of appropriate food material, adequate time for eating by appropriate change in work and school schedules and compulsory play for all in the evenings in open sun.

Shall we eat to live and live to eat!

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