

DISCUSSION

Diet as a Means of Life Span Prolongation

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Abstract—The study provides a comparative analysis of the data obtained from scientific literature and from the author's research on a diet's effects on human health and life span. Moreover, the recommendations on a low-calorie diet as the most prospective method of life span prolongation were formulated.

WHO presented reports [1, 2] which summarize the results of numerous investigations of the influence of diet on human health over the last 20 years and permit certain regularities to be revealed. Thus, the fact that, in European countries, up to a half of all deaths involve persons below 65 years of age is caused by diseases connected, to a certain degree, with an improper diet.

Even though the manner in which excessive or insufficient nutrition results in pathology development is not known, it is possible, using the appropriate diet, to avoid various diseases which require great social expenses, lead to an early death, and deprive many people of valuable life, such as vascular insult, hypertension, ischemic heart disease, many kinds of cancer, diseases of the oral cavity, anemia, goiter, cirrhosis, diabetes, gallstone formation, obesity, and diseases of the locomotor system in older persons [1 - 8]. According to evaluations of WHO experts, the expenses for the treatment of these diseases are much higher than expenses necessary for their prevention [1].

GENERAL PRINCIPLES OF RATIONAL NUTRITION

Currently, in Europe, great attention is paid to the diseases associated with excessive nutrition. At the same time, a number of diseases are known to be caused by a deficiency of some elements in a diet. It was revealed that such connections exist between a deficit of fluor and caries; iodine and goiter; essential fats and diseases of the cardiovascular system; nutritional fibers and diseases of the gastrointestinal tract including cancer of the large intestine; calcium, fluor, vitamin D, and diseases of the locomotor system; and iron, folic acid, and anemia [1, 3, 5 - 15].

Many authors have noted that nutrition sufficient or excessive in calories may be often insufficient in relation to vitamin and mineral content which increases morbidity and decreases the mean life span [1, 2, 7, 9, 16 - 18]. A vitamin and mineral deficiency in a diet plays a specific role in older persons and, in cases, of a deviation from a healthy style of life [17, 19].

The authors analyzed the provision fruits and vegetables for Moscow inhabitants [20] and revealed that even during the months which are considered as the richest with fruits and vegetables, real consumption of virtually all fruit and vegetables is 1.5 - 2 times lower than the standard level. A deficiency of fruit and vegetable consumption leads to a vitamin deficiency. It insufficient intake of vitamins C, A, B₁, B₂, B₆, niacin, folic acid, and carotene was noted in Muscovites. These deficiencies may cause the increased incidence of hypertension disease, catarrhal diseases, atherosclerosis, intestinal cancer in Muscovites and, moreover, the decrease in overall resistance. Purposeful vitaminization may decrease the morbidity to 20 - 30%.

Thus the necessity to change the nutritional structure through lowering the content of fats, saturated fatty acids, sugars, salt and increasing nutritional fibers and vitamins is a matter of common knowledge [1, 2].

Some experts have more radical and, as we believe, very prospective ideas to increase the consumption of specific vitamins and microelements compared to current standards [4, 6, 11, 21 - 24]. The combination of these measures with significant decreases in overall nutritional caloric value leads not only to a decrease in morbidity, especially for diseases associated with aging, but also to a prolongation of the mean life span. This has been strongly supported by experiments on animals and humans [25, 37]. It was shown that valuable low-calorie diet decreases the aging rate and prevents the development of age-related pathology, such as diseases of the cardiovascular system, cancer, and renal diseases and permits the integrity of the immune system to be supported. The mechanism of this phenomenon is unknown, although there are some assumptions. The most prevalent speculation is based on the free radical theory of aging [7, 35, 38].

The low-calorie diet requires a certain carefulness in its practical use. Further research is needed, especially on its application in human nutrition. Particularly, it was noted that a high-fiber diet is potentially dangerous because it may cause the increasing cal-

cium and, as a result, the increase in osteoporosis risk [39, 40], and furthermore, the low-fat diet may promote aggressiveness [41].

THE PECULIARITIES OF LOW-CALORIE DIET USE

It may be concluded that the most effective way to improve health and to prolong life is a valuable low-calorie diet. Let us consider special features of this diet usage by the example of so-called H/L (High/Low) diet [42] starting from the publications which confirm this approach and deal with the specific problems of its practical use.

The main principle of valuable low-calorie H/L diet is a restriction of the daily calorie intake with maintenance of the valuable nutrient level, which is consistent with accepted physiological standards.

The use of a special computer program [43] permits the calculation of a diet on the basis of the optimization procedure where the following conditions submitted by Walford [42] serve as criteria: (1) caloric content in daily ration should be less than 1500 kcal; (2) the consistency between ration content and the physiological standards; (3) the fats caloric content should be 8 - 20% of total calorie intake; and (4) the protein content, 60 - 90 g. daily.

This method was approved and shown to prolong life span in experimental animals by 50% which corresponds to an increase in human life up to 150 - 160 years old.

This method implies a gradual achievement of the weight which corresponds to the maximal metabolic effectiveness, health, and life longevity. The weight, which is 10 - 25% lower than normal, was naturally suggested as an optimal human weight which corresponds to a nutritional regimen that excludes overeating.

It was recommended to reduce weight very gradually over four to six years, since rapid weight reduction is not stable and may be accompanied by negative health consequences. Excessive weight loss due to fat tissue, especially if the original weight was rather great, should not cause concern [44].

A man having an average height and normal constitution may begin to restrict the caloric intake content from 2000 kcal/day under maintenance of its valuable content. Accordingly, an average woman may begin to control it from 1800 kcal/day. A too rapid or slow weight decrease must be regulated by changes in calorie intake.

Fasting for 2.5 days every 5 - 6 weeks is not necessary, but a desirable feature. Occasional overeating in H/L diet is not significant. Only weekly or monthly balance is important here.

Age-specific physical exercises are recommended with moderate, but gradually increasing load. The effectiveness of physical activity and a low-calorie diet com-

bination for reducing body fat mass has been confirmed by many studies [45].

The maximal effect in H/L diet is achieved if it is used from a young age. However, this diet is not recommended for use until growth termination, since it may lead to a lower height by 6 - 8 inches. But this does not mean that children should consume excessive amounts of food. Consumption, in childhood, of empty calories, i.e., food having only energetic and gustatory features, that is, sweetness, will negatively affect their health in adult hood. Extrapolation of animal results suggests that a decrease in the daily excessive intake in child hood by 100 - 125 kcal results in life prolongation by 2.5 years.

It is necessary to eat valuable, whole, nonrefined food, including vegetables, fruits, nuts, groats, beans, milk, and fish upon changing to a H/L diet. Experiments with volunteers showed that under that diet they experienced complete satisfaction with food having a calorie content of about 1500 kcal/day while using refined and processed food they needed a much higher calorie intake, up to 3000 kcal/day. On average, the intake of nonnatural, refined food increased the calorie requirement by 25%.

It must be noted that an increase in calorie content and volume of food does not result automatically in diet valuability. Even well-provided Americans whose daily allowance is about 2400 - 3200 kcal for men and 1650 - 2150 kcal for women feeding have vitamin and mineral deficiency.

The H/L effect is illustrated by the following experiment carried out in Madrid [42]. One hundred and eighty men and women older than 65 years were divided into two equal groups. The daily allowance for one group was about 2300 kcal, while the other group received the same diet one day, but another day its intake was restricted to 885 kcal/day. After three years, it was shown that the total amount of days spent in the hospital was 219 days for the first group and 123 days for the second one. The mortality in the first group was twice as high compared to the second group.

The main feature of an H/L diet is a significant increase in some food component standards. It is connected with an additional H/L [42] principle formulated by its author: the nutrients amount in a ration must correspond to the maximal span of active life with the minimal morbidity and dysfunctions. Standards corresponding to this criterion were calculated extrapolating data obtained in studies on the geroprotecting effect of various factors on life span and morbidity in animals. Some results were confirmed by human nutrition studies. Taking into account the above principle, the standards and norms for various substances should be much higher than the official ones. For example, a much higher vitamin C and E intake is required for promotion of immune system and, accordingly, for a decrease in morbidity.

The requirement of valuability of an H/L diet is mainly caused by the fact that many nutritional elements irrespective of their function in the body, which is the subject of classic nutritional science, are the antioxidants which are well known as geroprotectors. They include vitamins C, E, B₁ carotenes, bioflavonoids, selenium, and sulfur-containing amino acids.

Experiments on animals have shown that an intake of antioxidants of significant amounts leads to a weight reduction by 10 - 15%, therefore, their positive effect on the body may be analogous to the H/L diet effect.

The main feature of an H/L diet is the concept of nutrient density. It means that every ration calorie must be rich in nutrients; e.g., diet must, as much as possible, meet the body's requirements in various nutritional elements through natural food components. It is purposeless to decrease calorie intake and to restrict the fat consumption together with an increase in vitamins and minerals by artificial preparations. The main causes are the following.

First, it is connected with the deficiency in our knowledge about food influence on health and the fact that many nutritional elements are insufficiently studied and not included in the nutritional standards. When a diet corresponds to the nutrient density concept, which means its richness with various food supplements, the probability that it has essential components not included into the standards is much higher than in a restricted diet supplemented by artificial components. Experiments on animals confirm this [25 - 37], showing that experimental cancer disorders occur two to three times more often with a synthetic diet than in a natural one.

Secondly, the manner in which essential components enter the body is very important. For example, the natural essential amino acids are assimilated 16 times better than in the case of an amino acid mixture.

CONCLUSION

It should be noted that the implementation of a country-wide, valuable low-calorie diet may lead to some global changes. First, it will result in a significant improvement in health and prolongation of life which, in turn, will result in demographic structure changes. Secondly, the nutritional structure changes will result in changes in food product manufacturing, which in its turn, will affect the agriculture. The nutritional structure change to a low-calorie, vegetable diet will lead to a possible decrease in meat and meat byproducts and, consequently, to the production of animal feed. It permits a decrease in the use of fertilizers and herbicides.

The implementation of a valuable low-calorie diet may have a special significance under ecologically unfavorable conditions and under conditions of increased psychological loads and stress.

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