S U M M A R Y

SUMMARY

It is well known that adequate nutrition is essential for growth and well being. The effects of nutritional deficiencies and excesses may vary in the severity of their consequences at different ages and in different physiological conditions. In this country different regions not only differ in geographic and environmental factors but also differ considerably with regard to dietary patterns and the nutrients derived from the diets.

The present studies were undertaken at Trivandrum (Kerala) where the dietary pattern differs from other regions with regard to several features. These include the consumption of tapioca by the poor which lowers the protein content of the diets and of generous quantities of coconut oil and of fish and other animal foods such as beef by nonvegetarians in the high income group which account for the relatively high consumption of protein in their diets. The amount and type of fat consumed and the food sources of fats consumed such as coconuts, coconut oil, beef by the upper class and the negligible or poor consumption of these commodities by the poor contribute not only to differences in fat content but also with regard to poly-unsaturated fatty acids and tocopherol.

A satisfactory intake of food energy derived from fats may be critical for the steroid hormone synthesis,

efficient lipid transport and deposition in the fetus and for the growth of the accessory tissues not to speak of the transfer of fatty acids particularly essential fatty acids to the fetus.

In addition the diets in Kerala are marginally deficient in magnesium content mainly due to differences in the mineral content of water which is soft. The staples used are mainly rice and tapioca, which are also low in magnesium. Pregnancy is associated with a decrease in magnesium showing a great demand for magnesium.

Since the diets of the poor in Kerala as those elsewhere are poor in fat, the study was primarily designed to investigate whether the poor pregnant women in Kerala are able to achieve a satisfactory increase in serum lipids, and if not what are the consequences of their failure to do so.

A similar question arises regarding magnesium deficiency which is also critical as it plays a key role in many enzyme processes and tissue synthesis. The reports of a fall in magnesium levels during pregnancy further emphasises the question as to the adequacy of magnesium status during pregnancy in areas such as Kerala where the diets are already poor in magnesium. Hence the present studies

were carried out on serum lipids and magnesium in pregnant and parturient women in relation to the gestational period in the former and birth weights in latter. Additional investigations were also made on related parameters such as blood haemoglobin and serum vitamin E in these women.

The changes in levels of serum constituents in pregnant women differ from the non pregnant with the progress of pregnancy. In the case of total cholesterol, phospholipid, triglyceride and vitamin E the changes are greater where as the changes are less in haemoglobin and magnesium levels. The post-partum values are comparable to term values in the case of cholesterol, phospholipd and vitamin E and are reversed in the case of other parameters investigated. The appreciable increase in serum lipid constituents and the vitamin E are consistent with their greater involvement with growth and development of fetus. Decrease in maternal hemoglobin and magnesium levels during pregnancy is more evident in the low income group than in the high income group, suggesting the role of nutrition in the maintenance of satisfactory pre and post natal levels and a risk to the fetal growth.

Similar comparisons are made in relation to income status. Even in the non pregnant state the values for the

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blood and serum constituents are lower in the low income group than in the high income group, suggesting that poor women start their pregnancy with a lower nutritional status and although the gap is bridged to some extent during pregnancy it persist throughout. The persistance of differences in mean values appears to be due to the possibility, an appreciable proportion of women in the lower income group fail to achieve the expected increases whereas majority manage to do so inspite of a low plane of nutrition; a fact probably made possible by efficient adaptation mechanisms which are known to operate during pregnancy.

The studies on parturient mothers and their infants pointed to a relation between birth weights and maternal serum cholesterol levels and lower serum magnesium levels in mothers and prematurity. This also suggests that maternal nutritional status with regard to these two parameters poses hazards to fetal growth. Thus these two parameters may serve as indicators of pregnant women at risk and of fetal growth retardation. While cholesterol may be a general indicator magnesium may perhaps be more relevant in areas with marginal magnesium deficiency in the diet.

Undernutrition is the major problem in the developing countries which is well known to affect the growth and development of the population. However, due to urbanisation

and industrialization along with the advent of affluence in some segments of the population, other problems of health due to overnutrition have also begun to appear altering the nutritional and biochemical profile particularly in the affluent sections of the adult population. Also factors which are critical at one stage of life (eg. high serum lipids during pregnancy) may not be conducive at other stages (eg. the elderly). While satisfactory levels of serum lipids during pregnancy are found to be critical for satisfactory gestation performance, high levels of serum lipids during aging are associated with a number of degenerative diseases such as hypertension, atherosclerosis, and so on.

Studies were undertaken on the biochemical status of the elderly with special regard to serum lipid changes with age. Since aging is associated with several physiological and biochemical changes other parameters which are likely to be affected with age, dietary patterns life styles and affluence such as weight, height, somatic measurements and blood and serum paramters such blood glucose, lipids fractions (cholesterol, phospholipid and triglycerides) and serum magnesium were selected for the study. Sex and income differences with regard to these changes were also

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investigated, and these studies are presented in part-II of the thesis.

Data on heights and weights showed an increase in weight up to middle age in men where as in the women the increase continues even in the sixth decade. A similar pattern was not observed among the poor who maintain more or less constant weights.

The weight/height ratios obtained in this study are in agreement with the Asian studies reported. These ratios were higher in the high income group than among the poor, greater in men than in women and also increased with age. All these results are as expected.

Somatic measurements were made on adult men and women in both income groups. In men, in the low income group, chest, abdomen and mid-arm circumference were less than in the high income group. Moreover in the low income group sex differences with regard to chest, abdomen and the mid-arm circumference were not evident. Mid-arm circumference was found to correlate with body weights ('r' = 0.75 and 0.76 in men and women respectively). Men and women in the low income group, however, showed little perceptible change with regard to age.

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Blood glucose and serum lipids showed a progressive increase with age. In the case of blood glucose the increases are greater in men than in women, whereas with regard to lipids though initially men have higher levels of lipids with age these differences are obliterated. These increases were of a much smaller magnitude among the poor.

The fact that even in the low income group this small increase with age for blood glucose and serum lipids (cholesterol, phospholipid and triglyceride) occurs inspite of diets low in sugar and fat and a high level of physical activity is of interest and underlines the risk of cardiovascular disorders and diabetes even in this group.

Further χ^2 analysis on unit weight/height ratio for blood glucose showed no change in the younger age group where as in the middle aged group it showed a progressive rise with age.

Data on serum lipids in vegetarians and non-vegetarians showed that they are higher in non-vegetarians than in vegetarians. Serum lipid concentrations were found to increase with the frequency of consumption of coconut oil suggesting this to be a factor for hyperlipidemia. A similar association was found between serum lipid levels and

consumption of egg and beef. Also the serum lipid levels reached a peak at an early age in this population than reported elsewhere suggesting extensive nutrition education to these population for dietary modifications.

The studies on serum magnesium levels in the aging population showed no significant differences with age, sex or social class. However, the frequency distribution of the values for magnesium levels in the population showed that about 17% of these subjects studied, show serum magnesium levels below 1.8 mg/dl suggesting marginal deficiency of the mineral. More over in the middle aged subjects low serum magnesium levels were associated with higher levels of serum cholesterol. In the middle aged population serum cholesterol levels were found to be less in persons with high levels of serum magnesium.

In conclusion these studies suggest that poorly nourished women in Kerala manage to achieve the expected rise in serum lipids and vitamin E inspite of the diets being low in food energy, fats and tocopherols, suggesting the operation of adaptive mechanisms. However it appears that an appreciable proportion of these women fail to achieve this and such a failure may be expected to increase the risk of pre-maturity and fetal growth retardation in these subjects.

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Poorly nourished women in Kerala are also found to have reasonably satisfactory magnesium status inspite of the diets being marginally deficient in magnesium. However the low levels of magnesium in the mothers of prematures point to a role of magnesium in fetal growth retardation. More elaborate and systematic studies are required in this regard because of the involvement of this mineral in cellular metabolis.

In conclusion the study on aging indicates that hyperglycemia or hyper lipidemia associated with aging are not inevitable concommitants of the aging process and the degree of such changes can considerably be modified by dietary and environmental factors. The risk factors in Kerala associated with metabolic disorders such as diabetes mellitus and cardiovascular diseases are thos due to high consumption of beef and coconut oil and a marginal deficiency of magnesium. Habits die hard to bring about a change in the ingrained food habits and practices and to make this population aware of the hazards, extensive education is necessary. Also the government should plan to export the coconut oil and import less saturated fats is suggestive.