MEDICAL PRACTICE

Occasional Review

Some Diseases Characteristic of Modern Western Civilization*

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A number of diseases of major importance are characteristic of modern Western civilization. These diseases are rare or unknown in communities who have deviated little from their traditional way of life, and a rise in their frequency follows adoption of Western customs. Available evidence suggests that all these diseases were rare or uncommon even in the Western world a century ago and that they are rare or unknown in undomesticated animals. Some appear or increase in frequency within a few years of exposure to a new environmental factor, others not until several decades later. The diseases to be considered in this connexion are listed below, with indications of their prevalence and importance as causes of death and morbidity in Britain and the U.S.A., countries which represent the type of civilization with which these diseases are most closely associated.

Diseases in the Western World

NON-INFECTIVE DISEASES OF THE LARGE BOWEL

Appendicitis is one of the commonest abdominal emergencies. It has been estimated that over 300,000 appendices are removed yearly in the United States. *Diverticular disease* is the commonest disorder of the large bowel and has been reported to be present in over a third of subjects over the age of 40 and in up to two-thirds of those over 80 years of age.[1 2] *Benign tumours* have been reported to be present in one-third of all necropsies on patients over the age of 20.[3] *Cancer of the large bowel* is, after bronchial carcinoma, the most common cause of death from cancer. It has been estimated that over 46,000 people would die from this form of cancer in the United States and that over 76,000 new cases would be recorded in 1972.[4] *Ulcerative colitis* has been reported to have a prevalence of about 80 per 100,000 population in Britain.[5]

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COMMON VENOUS DISORDERS

Varicose veins have been estimated to effect 10-17% of all adults.[6–9] According to Alexander,[10] over half of all urbanized Western people would develop varicose veins if they lived long enough. *Deep vein thrombosis* is believed to occur in 20-30% of all surgical patients and in over 40% of those undergoing major surgery.[11 12] *Pulmonary embolism* is responsible for over 2,500 deaths a year in Britain[13] and is believed to occur to some extent in half of all the patients who develop ileofemoral thrombosis.[14] *Haemorrhoids* are believed to be present to some degree in nearly half of all people over the age of 50.

DISEASES ASSOCIATED WITH CHOLESTEROL METABOLISM

These include *coronary heart disease*, which is the commonest cause of death, and *gall stones*, which are found at over 10% of all necropsies.[15]

OBESITY AND DIABETES

Over 40% of the people in Britain are said to be overweight, and obesity has become so common in the United States that a

variety of intestinal bypass operations are now being recommended for its relief.

It has been estimated that in affluent societies 3-10% of the population eventually develop known diabetes but that a much greater proportion have the disease undetected.[16]

HIATUS HERNIA

Zeppa and Polk[17] and Polk[18] found hiatus hernia in one of five in 35,000 patients undergoing radiological examination of the upper gastrointestinal tract.

OTHER DISEASES

There are a number of other diseases, such as thyrotoxicosis, pernicious anaemia, rheumatoid arthritis, multiple sclerosis, and coeliac disease, which are common in the Western world but rare in developing countries, but they are not discussed here since no acceptable explanation has yet been suggested for their geographical distribution.

RACIAL DISTRIBUTION

It is of particular significance that the prevalence of most of these diseases is now comparable in the white and coloured communities in the United States. The incidence of fatal pulmonary embolism, which is very rare in Africa, is actually higher in American Negroes than in whites.[19] In the few conditions where the prevalence is still lower in Negroes than in whites—for example, ulcerative colitis—it is much closer to that in white Americans than to that in Africans.

The Contrast in Developing Countries

All these diseases are rare or unknown in communities who still adhere to their traditional way of life. Many published reports have been confirmed by replies to questionnaires from, and by personal interviews with, doctors representing over 200 hospitals in developing countries in Africa and Asia. The rarity in these communities of diverticular disease[20-22]; appendicitis[23 24]; bowel cancer[25]; adenomatous polyps[21 26]; ulcerative colitis[27-29]; varicose veins, deep vein thrombosis, pulmonary embolism, and haemorrhoids[30]; and hiatus hernia[31] has been documented. Cleave *et al.*[32] and Trowell[27], from an extensive survey of the literature and personal experience, drew attention to the rarity of these diseases in less economically developed communities.

Historical Emergence

Available evidence suggests that most of these diseases were rare even in the Western world before the present century and that the prevalence of each has greatly increased during the past 50 years. Obesity became prevalent at an earlier date, but evidence from art and literature indicates that it was rare in the common man in Europe before the late eighteenth century.[33] The emergence of diabetes as a clinical problem is more difficult to assess but it was well recognized in the last century.

A rapid rise in frequency of pulmonary embolism seems to have occurred in the first quarter of this century,[34] from which it may be inferred that deep vein thrombosis was uncommon half a century ago. Diverticular disease[20] and coronary heart disease[35] became prominent only after the first world war. The frequency of appendicitis was apparently rising steeply at the turn of the century.[24]

It is highly significant that in the case of appendicitis,[36 37] diverticular disease,[38] cancer,[39 40] polyps of the large bowel,[41] and coronary heart disease[42] the prevalence in the Negro community some 30 years ago was much less than that among whites, whereas there is no appreciable difference in incidence in the two population groups today.

Rise in Incidence with Changing Environment

The prevalence of these diseases in populations of developing countries appears to relate to the extent of their departure from traditional patterns of life. In Africa and Asia most if not all these diseases first appear or become common in the upper socioeconomic groups and in urbanized communities. In Africa this has been evident in the case of appendicitis,[23 43] ischaemic heart disease,[44] diabetes,[32 45] obesity,[32 33] gall stones,[46] varicose veins, venous thrombosis, and haemorrhoids,[30 43] all of which are more prevalent in the more Westernized communities.

Available information suggests a rapid rise in the incidence of these diseases in Japan since the 1939-45 war, particularly in urban communities. In the case of many of these diseases an increase in incidence has been observed among Japanese who have emigrated to Hawaii relative to that recorded in Japan. Stemmermann[47] estimated that adenomatous polyps of the large bowel are three times as common in the Hawaiian Japanese and that bowel cancer is at least seven times as common. Diverticular disease and ischaemic heart disease are also much more prevalent in Hawaiian Japanese, but deep vein thrombosis and hiatus hernia are still very rare in both countries.

Relation between Diseases

Many diseases characteristic of modern Western civilization are not only associated geographically but are also frequently found associated with one another in individual patients. Some have been recorded, but other associations which have not been specifically looked for may well exist. These diseases have also been related to one another in their time of emergence as important clinical entities, both historically in the Western world and, more recently, in developing countries. Moreover, the order in which the frequency of each rises in different communities following the adoption of a Western pattern of life appears to be relatively constant, and it is suggested that this reflects both the intensity of and the time of exposure to some new environmental factor which in time results in the appearance of clinical disease.

All the effects of a common cause tend to be associated with one another, each being most common where the causative factor is maximum and being rare or absent where the cause is minimal. All the effects of related causes will also tend to be associated. Conversely the recognition that certain diseases are more or less consistently related to one another suggests the possibility that they may be different results of common or related causes.[26 48]

A Possible Common Causative Factor

Epidemiological evidence indicates that environmental factors must be primarily responsible for the diseases being considered. It is therefore in the environment with which these diseases are related, both in their geographical distribution and chronological emergence, that clues to their causation must be sought. A carcass in the African bush is most easily discovered by locating the readily recognized and constantly associated telltale vultures. The same approach could be profitably followed in medical research, though it is often precluded by narrow specialization which does not encourage the following of guide lines provided by other fields of medical practice. Since a common cause can be suspected for diseases constantly associated with one another it seems wise, once such associations are

recognized, to search first for the cause of the disease that can be more readily investigated, and I propose to start with the non-infective diseases of the large bowel.

The main environment of intestinal mucosa is the faecal content of the bowel, and in the colon and rectum this is largely determined by the undigested fibre in the diet. This is not digested by alimentary enzymes, so that it is scarcely altered during its passage through the small intestine. It is degraded partially by bacteria in the large bowel. Careful attention must therefore be paid to any changes in diet in the Western world towards the end of the last century which preceded the rise in incidence of non-infective diseases of the bowel and the changes now taking place in developing countries. Particular notice must be taken of alterations in fibre intake.

Dietary Changes 1860-1960

During the years 1860-1960 fat consumption increased by less than 50% and sugar consumption more than doubled.[49] Though the greatest reduction in quantity of fibre consumed occurred during the eighteenth century, the proportionate fall between 1880 and 1960 was more than 90%. Robertson[50] estimated that the fibre content of white flour in 1860 was between 0·2 and 0·5% and that the amount of fibre supplied daily in bread was between 1·1 and 2·8 g. With bread consumption halved and the fibre content of white flour reduced to between 0·1%[50] and 0·01-0·04%[51] the daily fibre intake in bread is now reduced to about a tenth of the pre-1860 level. In addition porridge oats, which have a high fibre content, have been largely replaced by packaged cereals, some of which are poor in fibre.

Changes from Traditional Food

The first change in traditional food is usually the addition of sugar. This is followed by substituting white bread for part of the less processed cereals customarily eaten. Lubbe[52] showed that the greatest alterations in diet associated with a change from rural to urban life in South Africa are an increase in sugar and meat consumption and a fivefold reduction in consumption of fibre.

Effect of Fibre on Intestinal Behaviour and Content

Since epidemiological evidence appears to point an incriminating finger at the lack of fibre in food it is essential to investigate the effect of this on intestinal content and behaviour. It has been shown that intestinal transit times and stool weights and consistency are closely related to the content of fibre in food. Average transit times vary from some 35 hours in African villagers on a high-residue diet to over 70 hours in English volunteers on a low-residue diet. In the latter subjects transit times commonly exceed 100 hours. Stool weights and consistency are inversely related to transit times and often average 400-500 g of soft, unformed stool daily on high-residue diets and under 150 g of firm, formed stool on low residue diets. Communities on mixed diets, such as Indians, more Westernized Africans, and English vegetarians, have stool weights and intestinal transit times intermediate between the two extremes.[25 53-56]

It seems probable that the removal of the few grammes of cereal fibre that remained in Western diets until about a century ago, part of which may be attributed to changes in milling techniques introduced between 1850 and 1890, could have been the last straw breaking the camel's back. This contention is supported by the evidence that in formerly constipated patients bowel habit can be restored and stools altered from hard to soft by restoring to the diet as little as 2 g of cereal fibre daily in the form of unprocessed bran.[57] (A heaped dessertspoonful of bran contains rather more than a gramme of fibre.)

Non-infective Diseases of the Large Bowel

Diverticular Disease.—There is strong evidence that diverticular disease is the direct result of raised intraluminal pressures consequent on a low-residue diet.[58-60] Not only is this disease virtually unknown in all communities examined on a high-residue diet and common in those who over a generation ago adopted a low-residue diet[20] but it can be produced experimentally in animals put on a fibre-free diet.[61] It can in most cases be successfully treated in man by restoring as little as 2 g of cereal fibre to the diet.[57]

Appendicitis.—This disease has likewise been attributed to raised intraluminal pressures beyond an obstruction due to faecalith or muscular contraction.[23] Alterations in faecal bacteria resulting from changes in intestinal content or from faecal arrest may be a contributory factor.[32]

Cancer.—The high incidence of cancer in Europe and North America has been attributed to carcinogens produced by the action on bile acids in the colon, of bacteria that are particularly prevalent in the faeces of Western nations.[62] Hill *et al.*[63] believe that increased fat in Western diets alters not only the bacterial composition but also the concentration of bile acids in the faeces. Whether or not fat is the responsible dietary constituent the faecal arrest resultant on a low-residue diet will not only provide more time for bacterial proliferation and their degrading of bile acids but will result in carcinogens so formed being concentrated in a small faecal mass and retained for a prolonged time against the intestinal mucosa.[25 64 65]

Polyps.—The close association between cancer and polyps, not only in geographical distribution[26] but also in anatomical and age distribution, and in their tendency to be associated in individuals,[66] together with the fact that they can both be produced by the same experimental means,[67 68] suggests that thay are merely differing manifestations of the same common cause.[25 69]

Ulcerative Colitis.—The close association between this disease and bowel cancer both geographically and in individual patients suggests some common aetiological factor. The commonly accepted explanation of a mere cause-and-effect relationship fails to account for the rarity of this condition in all known areas where the incidence of bowel cancer is low.[25]

Venous Disorders related to Faecal Arrest

Since a fibre-deficient diet has been shown to be closely related to the non-infective diseases of the large bowel the possibility first suggested by Cleave[70] that other associated diseases may also be causally related to fibre lack must be considered. Not only does faecal arrest result in raised intraluminal pressures, also in raised intra-abdominal pressures while straining to evacuate hard stools. These unnatural pressures could well be responsible for the following diseases, which are associated epidemiologically with low-residue diets.

Varicose Veins.—It is well known that raised intra-abdominal pressures are readily transmitted down the superficial leg veins after the valves have become incompetent. An impulse detected on coughing is the classical clinical test for valve failure. Such pressures, which can exceed 200 mg Hg,[71] must therefore be sustained by the valves when competent, and they may well be the cause of their failure and thus initiate the process which leads to varicosities.[30]

Deep Vein Thrombosis.—It seems unlikely that venous changes resulting from valve incompetence would be confined to the visible superficial veins. Changes in the deep muscle plexuses with consequent venous stagnation that might predispose to thrombosis during enforced recumbency could account for the high incidence of deep vein thrombosis in the lower limb in communities with a corresponding high incidence of varicose veins. Though stool consistency is held to be of prime importance the squatting position adopted for defaecation in all but Western countries is believed to be an additional factor protect-

the veins in the leg against abdominal pressures. When the valves have become incompetent a cough impulse readily detected when standing is not transmitted in the squatting position.

Haemorrhoids.—It has been postulated that haemorrhoids are also the result of transmitted intra-abdominal pressures. The observation that the frequency of haemorrhoids in developing countries always appears to rise before that of varicose veins or deep vein thrombosis could be explained on the grounds that the haemorrhoidal veins lack the initial protection afforded to the leg veins both by their valves and by their occlusion when squatting.[30]

Hiatus Hernia and Faecal Arrest

The close epidemiological relationship between hiatus hernia and a low-residue diet could well be accounted for by the raised intra-abdominal pressures consequent on such a diet. Constrictive clothing and adiposity have been considered to be causes of increased intra-abdominal pressures contributing to hiatus hernia, but these must cause insignificant pressure change compared with straining at stool.

Diseases associated with Cholesterol Metabolism

CORONARY HEART DISEASE

The geographical distribution of ischaemic heart disease is very similar to that of diverticular disease. The former has been observed often without the latter, but not the reverse. Once again a common causative factor linking not only these diseases but also other diseases of economic development must be sought.

Trowell,[72 73] who drew attention to the close geographical relationship between intake of dietary fibre, serum cholesterol, and ischaemic heart disease, reinterpreted certain dietary experiments planned for different purposes to show that serum cholesterol levels rose or fell while diminishing or increasing the amount of fibre consumed. Communities such as the Masai in East Africa, who adapted to a low fibre diet from time immemorial, are exceptions. These people metabolize their cholesterol differently.[74] The mechanisms whereby dietary fibre influences serum cholesterol levels are open to question, but there is evidence that more bile acids are excreted in the large stools characteristic of an unrefined diet.[75] Reabsorption of bile acids is thus reduced. Moreover, it seems likely that absorption of ingested cholesterol is reduced in the presence of a high fibre content in the faeces.[76]

It is, of course, admitted that many other factors almost certainly contribute to the development of ischaemic heart disease. It is merely suggested that a fibre-depleted diet may be an important factor which has been overlooked.

GALL-BLADDER DISEASE

Gall-bladder disease is not known to occur geographically in the absence of gall stones and the two are closely associated clinically. Cholesterol stones, the most frequent variety in the Western world, are in part dependent on the ratio of cholesterol to bile acids in the bile. It may well be that alterations in cholesterol metabolism associated with changes in dietary fibre are among the factors that influence gall-stone formation.

It has been suggested that both ischaemic heart disease[32 77] and gall-bladder disease[78] may be causally related to sugar intake. In this context Cleave's brilliant conception of an inverse relation between consumption of fibre on the one hand and of refined starch and sugar on the other is highly relevant.[32]

Obesity and Diabetes

Cleave attributes the association between various diseases of modern civilization to different aspects of the two complementary results of refining carbohydrate foods—excess consumption of energy in the form of sugar and refined starch on the one hand and fibre depletion on the other.[32 70] He attributes obesity to overconsumption of refined carbohydrate foods, and diabetes to overconsumption as well as the increased rate of absorption of these foods which results when concentrated starch and sugar are consumed. In these circumstances, he argues, the pancreas is inevitably overloaded, with consequent pathological changes in some people. This could explain why the incidence of diabetes rises with the years during which the pancreas is subjected to this unnatural strain.

Obesity is primarily a disease of modern Western man and is rare, particularly in rural situations, in developing countries. It is the commonest form of malnutrition in the West and known to be associated with many of the diseases referred to here.

Conclusion

The close association geographically, chronologically, and in individual patients between many diseases characteristic of modern Western civilization could be explained on the basis of a deficiency of undigested fibre, in particular cereal fibre, in food. This supposition is a modification of the original hypothesis of Cleave, whose work was the main stimulus which initiated the studies and considerations outlined above. His emphasis is placed on the potential dangers of excess sugar consumption, whereas the complementary result of carbohydrate refining—fibre depletion—has been emphasized here. I endorse Sir Richard Doll's assessment of this work in his foreword to *Diabetes, Coronary Thrombosis and the Saccharine Disease* by Cleave *et al.*[32] Referring to the possibility that the predictions made may be proved correct, he affirmed that "If only a small part of them do, the authors will have made a bigger contribution to medicine than most university departments or medical research units make in the course of a generation."

It is, of course, not suggested that in any of the diseases discussed fibre deficiency is a sole causative factor, merely that it may be one important factor. The associations between these diseases may be more or less close according to the part played by lack of fibre in the aetiology of each. Any hypothesis postulated to explain these diseases will be inadequate unless it accounts for (*a*) their geographical distribution, (*b*) their chronological emergence, and (*c*) their interrelationship.

If these observations can be further substantiated it may not be an exaggeration to predict that a return to a high-residue diet could have an effect on the health of Western nations as beneficial as would be the elimination of cigarette smoking.

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Contemporary Themes

Role of the School Eye Clinic in Modern Ophthalmology

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Summary

Routine sight tests for children at intervals throughout their school career are clearly important; three-quarters of those referred to the school eye clinics in this area had some ocular defect. It is probably no longer necessary for myopic schoolchildren to be treated by a consultant ophthalmologist after their initial examination.

Forty-five per cent. of children referred to the school eye clinics in this area were found to have squint and/or hypermetropic/anisometropic/astigmatic refractive errors. Priority should be given to this group because of the association of amblyopia with these conditions. Their treatment requires closer association with the hospital ophthalmic department, perhaps even complete unity. Transfer of children at present seen in the school eye clinic to a hospital-based "children's eye clinic" would also fit in with a unified health service administration structure and be better placed to indicate, evaluate, and control future developments towards the prevention of amblyopia.

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Introduction

School eye clinics are an integral part of the medical services provided for schoolchildren and yet the way they are run has hardly changed since their inception in 1910. The role of these clinics in the overall picture of the ophthalmic services probably varies from area to area.

The high birth rates in Northamptonshire draw attention to the medical problems of children, putting pressures on the resources (not least in manpower) available to deal with them. In the new town of Corby, as in other new towns, a high proportion of the population is in the preschool and school age groups. This is reflected in the patients seen in the hospital and local authority ophthalmic clinics where problems of refractive errors, squint, and amblyopia predominate. It became necessary to review the organization of the school eye clinic to decide on priorities. This gave a chance to review the place of this