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## EDITORIAL

### THE INFLUENCE OF DIETARY FAT ON PLASMA LIPIDS

The view is today held to an increasing extent that the incidence of atheroma and coronary thrombosis is linked with the serum-cholesterol level, and that both are influenced by the quantity of fat in the diet. This view is based on epidemiological data concerning different national and social population-groups and the results of large-scale studies of diets and plasma lipids, and is supported by clinical and laboratory studies of individual subjects. A protagonist of the doctrine is Professor Ancel Keys, of the University of Minnesota, whose travels through the world in pursuance of his researches on the subject brought him last year to South Africa, where he worked for some weeks at Cape Town in Professor Brock's Clinical Nutrition Research Unit, in cooperation with the staff of the Unit, on the variations in these factors that are exhibited by the different ethnic groups in this country.

The researches in Cape Town were continued by Dr. Bronte-Stewart and his colleagues,[1,2] who showed that the widely differing inter-racial incidence of coronary heart-disease was associated with a parallel difference in mean serum-cholesterol levels, and that within each racial group these levels were highest in the highest economic plane and bore a parallel relationship to the intake of food rich in fat *of animal origin*. There was no correlation, they said, with the intake of vegetable fat.[2] There are, however, differences beside those of fat content in the diets of people in different economic planes in the various ethnic groups, and Bronte-Stewart *et al.* have found it necessary to make individual clinical and laboratory studies into the effects of various foodstuffs on the serum-cholesterol level under controlled conditions. A preliminary report on these researches has now been published.[3]

The studies reported were carried out on a few volunteers in whom the serum cholesterol (and its $\beta$-lipoprotein element) were measured as changes were made in their controlled diet—chiefly in its fat content. In Bantus accustomed to a low-fat diet and actually on a low-fat, low-protein and cholesterol-free diet,

## VAN DIE REDAKSIE

### DIE INVLOED VAN DIE DIEETVET OP DIE PLASMA-LIPIEDE

Dit word vandag meer en meer geglo dat daar 'n verband is tussen die voorkoms van slagaarvervetting en kroonslagaartrombose, en die serumcholesterolstand, en dat albei siektes deur die hoeveelheid vet in die dieet beïnvloed word. Hierdie mening is gegrond op die epidemiologiese gegewens aangaande verskillende nasionale en sosiale bevolkingsgroepe en die uitgebreide studies van diëte en plasma-lipiede, en word gesteun deur kliniese en laboratoriumstudies wat op indiwiduele persone gemaak is. Professor Ancel Keys van die Universiteit van Minnesota is 'n voorstander van hierdie mening. Sy reise om die wêreld in verband met sy navorsing op hierdie gebied het hom verlede jaar na Suid-Afrika gebring, en hy het 'n paar weke lank in Professor Brock se Clinical Nutrition Research Unit in Kaapstad saam met die personeel van die eenheid navorsingswerk gedoen op die veriasies wat die verskillende etniese groepe in hierdie land in hierdie faktore vertoon.

Dr. Bronte-Stewart en sy medewerkers[1,2] het die navorsing voortgesit, en het bewys dat die wyd-uiteenlopende rasseverskil in die voorkomssyfer van kroonslagaar-hartsiekte in verband staan met 'n ooreenstemmende verskil in die gemiddelde serum-cholesterolstande; dat, binne elke rassegroep, die cholesterolstande die hoogste was by die mees gegoede sosiale stande, en dat dit in verhouding ooreenstem met die eet van voedsel ryk aan vette van *dierlike oorsprong*. Hulle kon geen wederkerige verhouding insake die inname van plantvette vasstel nie.[2] Daar is egter ook ander verskille behalwe dié van die vetinhoud in die diëte van mense van verskillende ekonomiese stande in die verskillende etniese groepe, en Bronte-Stewart *et al.* het dit noodsaaklik gevind om indiwiduele kliniese en laboratoriumstudies te maak van die uitwerking van die verskillende voedselsoorte op die serum-cholesterolstand onder beheerde toestande. 'n Voorlopige verslag oor hierdie navorsing het nou verskyn.[3]

Die gerapporteerde studies was uitgevoer op 'n paar vrywilligers by wie die serum-cholesterol (en sy $\beta$-lipoproteïene-bestanddeel) gemeet was by elke verandering—hoofsaaklik insake die vet-inhoud—wat in hulle beheerde dieet gemaak is. By Bantoes wat aan 'n vet-arm dieet gewoond is, en wat by die proefneming 'n vet- en proteïen-arm, cholesterol-vry dieet moes hou,

the addition for a few days of 100 g. a day of beef dripping (tallow), or of butter, or of egg-fat (10 eggs a day) produced an increase in serum cholesterol (mainly an increase in β-lipoprotein). When the addition consisted of 100 g. a day of ground-nut oil or sunflower-seed oil, which contain a high proportion of unsaturated fatty acids (particularly linoleic acid), instead of an increase a decrease occurred in the serum cholesterol (and β-lipoprotein). A similar addition of *hydrogenated* ground-nut oil, however, resulted in an increase in these plasma lipids. Olive oil appeared to take an equivocal or intermediate position in its effect on the plasma lipids.

In 2 Europeans, who were actually suffering from coronary disease and were on a diet rich in animal fat, to which they were accustomed, and were giving a high serum-cholesterol figure, the addition of 100 g. of sunflower-seed oil or ground-nut oil produced a marked fall in serum-cholesterol (and in β-lipoprotein), which at once reverted to its original higher level when the addition was discontinued. In various experiments the addition of sunflower-seed oil caused this fall notwithstanding that the addition involved an increase in the total amount of fat that was being administered, and notwithstanding that there was no reduction of protein or cholesterol in the diet.

When sunflower-seed oil was fractionated into a saturated and an unsaturated portion, the addition to the diet of the saturated fraction produced an increase in the cholesterol figures, and of the unsaturated fraction a decrease (in a Bantu subject).

The addition to the diet of eggs, which, beside fat, contain protein and cholesterol, was very potent in raising the serum-cholesterol level in the Bantu subjects when the eggs were eaten boiled, but when they were scrambled or fried in sunflower-seed oil the increase in serum cholesterol was wholly or partly avoided.

Pilchard oil and seal oil, which contained a high proportion of unsaturated fatty acids, acted similarly to the vegetable oils in producing a fall in the serum-cholesterol level when added to the controlled diet.

These results reinforce the view that different natural fats and oils have different effects on the level of serum cholesterol, and that the variation is associated with the difference in the proportion of saturated and unsaturated fatty acids in their composition. The suggestion that certain unsaturated fats in the diet are not merely neutral in relation to plasma lipids, but have actually a positive action which leads to a reduction in the serum-cholesterol level, is of particular interest in view of the suggestion made by H. M. Sinclair[4] that the increase in recent years in coronary heart-disease is causally associated with a relative deficiency of certain unsaturated fatty acids such as linoleic and

is dit bevind dat die serum-cholesterolstand (hoofsaaklik die β-lipoproteïen) verhoog is deur die byvoeg oor 'n paar dae van 100 g. bees-braaivet (harde vet) of van botter, of van eiervat (10 eiers per dag). Toe die bygevoegde voedsel egter vervang is deur 100 g. grondboontjie- of sonneblomsaadolie daagliks (wat 'n hoë gehalte van onversadigde vetsure, veral lynoliesuur, bevat), was daar in plaas van 'n vermeerdering inderdaad 'n vermindering in die serum-cholesterol (en β-lipoproteïene). 'n Soortegelyke byvoeging van *hidrogeneerde* grondboontjie-olie het egter 'n vermeerdering van hierdie plasma-lipiede tot gevolg gehad. Olyfolie het blykens die proefnemings 'n onsekere of intermediêre uitwerking op die plasma-lipiede.

By 2 Blankes wat inderdaad aan kroonslagaarsiekte gely het, en wat 'n dieet ryk aan diervette (waaraan hulle gewoon was) gehou het, en by wie die serum-cholesterolstand hoog was, het die byvoeging van 100 g. sonneblomsaad-olie of grondboontjie-olie 'n belangrike afname in die serum-cholesterol (en in β-lipoproteïne) bewerkstellig. Die verminderde serum-cholesterol het onmiddelik na sy vorige gehalte gestyg toe hierdie byvoeging gestaak is. By verskeie proefnemings het die byvoeging van sonnebloomsaad-olie hierdie daling veroorsaak nieteenstaande die feit dat die byvoeging 'n vermeerdering in die totale inname van vet beteken het, en dat die hoeveelheid proteïene of cholesterol in die voedselplan geensins verminder was nie.

Met die skei van sonneblomsaad-olie in versadigde en onversadigde dele, het die toevoeging van die versadigde deel tot die dieet van 'n Bantoe 'n toename in die cholesterol-syfers veroorsaak, en die toevoeging van die onversadigde deel het dit verminder.

Die byvoeg tot die dieet van eiers, wat behalwe vet ook proteïene en cholesterol bevat, het die serum-cholesterolstand by Bantoes belangrik vermeerder indien die eiers gekook was, maar toe dit as roereiers voorberei of in sonneblomsaad-olie gebak is, is die styging van die serum-cholesterol heeltemal of gedeeltelik vermy.

Sardynolie en robbe-olie, met 'n hoë verhouding van onversadigde vetsure, het dieselfde uitwerking gehad as die plantolies; toe hulle by die beheerde dieet gevoeg is, het die serum-cholesterolstand gedaal.

Hierdie resultate skraag die mening dat die verskillende natuurlike vette en olies verskillende uitwerkings op die serum-cholesterolstand het, en dat die variasie in verband staan met die verskil in die verhouding tussen die versadigde en die onversadigde vette in hul samestelling. Die voorstel dat sekere onversadigde vette in die dieet nie net neutraal is wat die plasma-lipiede betref nie, maar dat hulle inderdaad die serum-cholesterolstand positief kan verminder, is besonder belangrik met die oog op H. M. Sinclair[4] se onlangse bewering dat daar 'n oorsaak-verband is tussen die toename in die voorkomssyfer van kroonslagaarhartsiekte in die laaste jare en die betreklike tekort aan sekere onversadigde vetsure soos lynoliesuur en aragidoniese sure (wat respektiewelik 2 en 4 dubbel-bindings bevat) in die dieet van die gemeenskappe waar die siekte voorkom. Meer as 25 jaar gelede het Burr en Burr[5] aangetoon dat hierdie soort vetsuur, behalwe as

arachidonic acids (which respectively contain 2 and 4 double bonds) in the diet of affected communities. That this kind of fatty acid plays an essential role in animal metabolism in addition to merely supplying calories was shown by Burr and Burr[5] more than 25 years ago, and the suggestion that a dietary deficiency of it might be related to atherogenesis has been made before.[6]

Ancel Keys,[6] however, holds strongly that the evidence shows that atheroma is caused by an excess of total fats in the diet rather than by a deficiency of fats of a particular kind. He maintains for instance that in the USA, with its high incidence of coronary thrombosis, the *per capita* intake of linoleic acid is 'at least as high as that of many populations, as in Japan, who suffer relatively little from coronary heart-disease'.

The position, then, in regard to the role of dietary fats in relation to atheroma and coronary disease, seems today to be more uncertain than it was thought to be a few months ago. It then appeared that the factor responsible for a high incidence of the disease was a diet containing a high proportion of fats of any kind, and that the relatively simple remedy was to reduce this proportion. The results obtained by Bronte-Stewart and his collaborators now suggest that it is not merely the total quantity of fat in the diet that counts, but also the *kind* of fat that is eaten; that there are two classes of food fats, whose effects on plasma lipids are antagonistic to each other.[6] These authors emphasize the short-term nature of their experiments and the small number of subjects studied; and they refrain from wholly attributing coronary disease to any single cause.[3] Their results, however, are most suggestive and it is evident that the problems presented by this great and increasing cause of death cannot yet be regarded as finally solved. It seems that more information is needed about the physiological significance of the complex structures of the lipids found in biological materials and their importance in pathology.[7]


1. Bronte-Stewart, B., Keys, A. and Brock, J. F. (1955): Lancet, **2,** 1103.
2. Bronte-Stewart, B., Moodie, A. D., Antonis, A., Eales, L. and Brock, J. F. (1955): S. Afr. Med. J., **29,** 1151.
3. Bronte-Stewart, B., Antonis, A., Eales, L. and Brock, J. F. (1956): Lancet, **1,** 521.
4. Sinclair, H. M. (1956): *Ibid.*, **1,** 381.
5. Burr, C. O. and Burr, M. M. (1929): J. Biol. Chem., **82,** 587.
6. Keys, A. (1956): Lancet, **1,** 576.
7. Editorial (1956): *Ibid.*, **1,** 557.


bron van kalorieë, ook 'n essensiële rol in die dieremetabolisme speel, en nog vroeër is dit voorgestel dat 'n tekort daarvan in die dieet moontlik met die ontwikkeling van slagaarvervetting gekoppel kan word.[6]

Ancel Keys[6] is egter oortuig daarvan dat slagaarvervetting volgens deeglik bewese feite veroorsaak word deur 'n oormaat van die totale vetstowwe in die dieet, en nie soseer deur 'n tekort aan bepaalde soorte vette nie. Hy verklaar byvoorbeeld dat die per capita inname van lynoliesuur in die VSA met sy hoë voorkomssyfer van kroonslagaartrombose ,ten minste net so hoog is as dié van baie ander nasies, byvoorbeeld die Japanners, wat betreklik min aan kroonslagaarhartsiekte ly'.

Dit blyk dus dat die posisie insake die invloed van die dieetvette op vervetting en kroonslagaarsiekte vandag meer onduidelik is as wat ons 'n paar maande gelede gemeen het nie. Toe het ons gedink dat die faktor wat verantwoordelik is vir die hoë voorkomssyfer van hierdie siekte, 'n dieet met 'n groot hoeveelheid vette van alle soorte is, en dat dit betreklik maklik verhelp kan word deur die vermindering van die vetinname. Die uitslae van Bronte-Stewart en sy medewerkers se navorsing dui nou daarop dat dit nie bloot die totale hoeveelheid vet in die dieet is wat belangrik is nie, maar dat die *soort* vet wat geëet word ook van belang is; en dat daar twee soorte voedselvette is wie se uitwerking op die plasma-lipiede teenstrydig met mekaar is.[6] Hierdie skrywers benadruk die feit dat hulle navorsing oor 'n kort tydjie geskied het en dat hulle die proefnemings op 'n betreklik klein groep persone uitgevoer het. Hulle wil nie die ontwikkeling van kroonslagaarsiekte geheel en al aan 'n enkele oorsaak toeskryf nie.[3] Hulle resultate is egter veelseggend en dit is duidelik dat die probleme wat hierdie groot en steeds toenemende doodsoorsaak oplewer nog nie as finaal opgelos beskou kan word nie. Verdere inligting is nodig aangaande die fisiologiese belang van die ingewikkelde samestellings van die lipiede in biologiese stowwe, en aangaande hul belang in die patologie.[7]


1. Bronte-Stewart, B., Keys, A. en Brock, J. F. (1955): Lancet, **2,** 1103.
2. Bronte-Stewart, B., Moodie, A. D., Antonis, A., Eales, L. en Brock, J. F. (1955): S. Afr. T. Geneesk., **29,** 1151.
3. Bronte-Stewart, B., Antonis, A., Eales, L. en Brock, J. F. (1956): Lancet, **1,** 521.
4. Sinclair, H. M. (1956): *Ibid.*, **1,** 381.
5. Burr, C. O. en Burr, M. M. (1929): J. Biol. Chem., **82,** 587.
6. Keys, A. (1956): Lancet, **1,** 576.
7. Redaksie (1956): *Ibid.*, **1,** 557.