EPIDEMIOLOGIE DE L'AVITAMINOSE A AU NIGER

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I. Introduction

Un programme d'assistance médico-nutritionnelle a été organisé conjointement en juillet 1974 par la Ligue des Sociétés de Croix-Rouge, le Programme des Nations-Unies pour le Développement et le Gouvernement du Niger en vue de venir en aide à la population locale touchée par la famine consécutive à la sécheresse. Ce programme visait à compléter le programme de distribution gratuite de vivres en répondant de façon plus spécifique et rationnelle aux besoins nutritionnels des groupes vulnérables (enfants en dessous de 10 ans, femmes enceintes ou allaitantes...).

Grâce à l'amélioration des distributions alimentaires et à une saison des pluies favorable en 1974, les activités de réhabilitation nutritionnelle des cas de marasme ont pu très rapidement être complétées par la lutte contre certaines carences spécifiques et par un effort d'éducation nutritionnelle adaptée aux besoins de la population.

La prévalence élevée de xérophtalmie menant à la cécité rapportée à plusieurs reprises en Inde et au Bengla-Desh chez des enfants réfugiés bénéficiant de cette assistance médico-nutritionnelle au Niger nous a incités à entreprendre une enquête sur les taux sérologiques de rétinol dans les groupes de populations du Niger.

Très peu de données épidémiologiques existent quant à la prévalence de la xérophtalmie dans les pays de la région du Sahel, comme l'a démontré l'enquête mondiale sur la prévalence de la xérophtalmie menée en 1964 par Oomen. Les restrictions alimentaires imposées aux populations nomades et sédentaires par la sécheresse ont contribué à l'appauvrissement du régime en rétinol (produits laitiers,...) et en carotènes (verdure et feuilles comestibles). L'assistance internationale a par ailleurs trop souvent fourni des produits de remplacement pauvres en vitamines tel que le lait écrémé en poudre non enrichi.

Durant les dernières années de nombreux rapports fragmentaires tendent à indiquer une augmentation de la prévalence de lésions oculaires irréversibles, chez les jeunes enfants. Ces lésions ont souvent pu être associées avec des épisodes de malnutrition sévère et/ou de rougeole.

Une enquête rapide effectuée au Niger dans quelques camps de réfugiés Peuhls dans la région de Tchin Tabaraden (Vuylsteke, juillet 1974) avait relevé jusqu'à 10 p. cent de xérophtalmie parmi les jeunes enfants examinés.

Au camp de réfugiés installé à Hamdallaye, 18 enfants de 3 à 9 ans sur un échantillon de 45 présentaient des lésions xérophtalmiques.

Une enquête de dépistage, menée dans les dispensaires ruraux et les écoles, indique une prévalence de lésions oculaires (xérosis, tache de Bitot, kératomalacie) oscillant entre 38 et 42 p. cent en milieu nomade du Nord, 25 à 30 p. cent au Sud du Pays et 25 à 28 p. cent dans les écoles suburbaines et urbaines de Niamey (A. D. Stabile-Wolcan : données non publiées).

Ces données, quoique très fragmentaires et récoltées dans des conditions qui ne sont pas à l'abri de toute critique, n'en étaient pas moins alarmantes. Les autorités publiques et les responsables du programme d'assistance se devaient de reconsidérer les priorités d'intervention à la lumière des faits nouveaux : diminution marquée de la malnutrition protéino-calorique et indices d'une carence sérieuse en vitamine A.

Il a été dès lors décidé de mener une enquête sérologique dans la population touchée par le programme d'assistance afin de réunir le minimum d'information nécessaire pour juger de l'utilité éventuelle d'une distribution de doses massives de vitamine A.

II. **Méthodes**

Le sang prélevé à l'ombre en veinules sous vide a été centrifugé sur place et le plasma expédié par avion, à la température de 0 à 4 °C (glace fondante) et à l'abri de la lumière. Les déterminations ont été faites par le Département d'analyse des médicaments de l'Ecole de Pharmacie de l'Université Catholique de Louvain (Prof. R. Bouché).

Les taux plasmatiques de rétinol ont été déterminés par fluorométrie. Cette méthode permet de mesurer des taux inférieurs à 15 μg/100 ml. La préalbumine, de même que les taux de protéine porteuse (retinol-binding-protein, R B P) ont également été mesurés.

Un taux de rétinol entre 10 et 20 μg/100 ml a été considéré comme insuffisant. Un taux inférieur à 10 μg/100 ml indique une carence sévère en vitamine A.

Un échantillon de 158 enfants âgés de 3 à 12 ans (72 nomades et 86 sédentaires) et de 41 femmes enceintes ou allaitantes a été choisi dans les camps de réfugiés et dans des villages témoins.

Les conditions locales ont imposé des techniques d'échantillonnage différentes dans les camps d'éprouvés et dans les villages. Dans les camps, les listes nominatives dressées dans le cadre de la chimioprophylaxie du paludime ont été utilisées pour sélectionner un échantillon au hasard. Dans les autres localités, ceci n'a pas été possible, par suite des contraintes de temps et de personnel.

Cette enquête devait être menée avec les moyens réduits mis à la disposition du programme d'urgence et sans interférer avec son déroulement.

Au total, les taux sérologiques de rétinol et de carotène ont été déterminés chez 199 personnes d'Hamdallaye, camp et village, ainsi que d'autres localités du Niger (N'Guigmi, Ayorou, Tera).

III. **Résultats**

Les résultats obtenus (tableau 1, figures 1 et 2) ont relevé des taux inférieurs à 20 μg/100 ml chez 65 p. cent des sujets étudiés, et inférieurs à 10 μg/100 ml chez 27 p. cent.

On considère que l'hypovitaminose A constitue un problème de santé publique si 5 p. cent ou plus de l'échantillon présentent des taux sérologiques inférieurs à 10 μg/100 ml.

Les résultats semblent indiquer que l'hypovitaminose A doit être considérée comme un important problème dans cette population.

Par ailleurs, chez 48 personnes, les prélèvements de sang ont été répétés 8 à 15 jours après administration de la vitamine A. La comparaison des valeurs avant et après administration de vitamine A chez ces individus n'a pas révélé d'augmentation significative du taux moyen de rétinol, les moyennes observées étant de 22,2 $\pm$ 10,8 μg/100 ml (moyenne $\pm$ écart type) 1 à 2 mois avant administration de vitamine et de 22,1 $\pm$ 10,3 μ/100 ml 1 à 2 semaines après l'administration. De même, il n'a pas été observé de corrélation significative entre les taux individuels relevés avant et après administration de rétinol. Vingt-six sujets ont témoigné d'une augmentation du taux sérique de rétinol entre le premier et le second dosage, alors que 22 ont présenté soit un taux constant, soit une diminution, parfois prononcée (tableau 2, figure 3).

IV. **Discussion**

Les valeurs de rétinol plasmatique et de RBP qui ont été observées dans l'enquête préliminaire permettent de conclure indiscutablement à l'existence d'un problème de santé publique dont l'importance varie selon les groupes étudiés. L'importance du risque oculaire ne peut être cependant estimée de façon précise en l'absence d'enquêtes de prévalence menées sur des groupes représentatifs. L'observation de xérophtalmie chez un nombre non négligeable d'enfants confirme toutefois l'existence du problème sur le plan de la santé publique. Par ailleurs, les enfants choisis pour la détermination du rétinol plasmatique avaient dépassé l'âge auquel l'incidence de lésions oculaires est la plus élevée. On peut dès lors craindre que cette enquête ne masque une réalité plus grave.

La prévalence élevée de taux carentiels de rétinol plasmatique reflète très probablement la réduction de l'apport alimentaire en rétinol et carotènes suite à la sécheresse persistante dans le Sahel. Les pertes importantes (jusqu'à 80 p. cent) de bétail, source privilégiée de rétinol pour les enfants nomades dont l'alimentation était constituée de produits laitiers, et la raréfaction des feuilles (Baobab...) et végétaux riches en carotènes consommés sous forme de sauce accompagnant le mil ou le sorgho chez les sédentaires, expliquent en grande partie cette situation sérieuse.

TABLEAU 1

Proportions d'individus dont le rétinol sérique est en dessous d'un seuil donné

	Nomades			Sédentaires				Femmes			Total général
	Enfants < 5 ans	Enfants > 5 ans	Total	Enfants < 5 ans	Enfants > 5 ans	Enfants âge non précisé	Total	Nomades	Sédentaires	Total	
Nombre de personnes testées	16	56	72	5	42	39	86	27	14	41	199
% en dessous de 20 µg	37,5	39,3	38,9	60	92,8	84,6	87,2	63	71,4	65,8	65,3
% en dessous de 10 µg	12,5	16,1	15,3	20	16,6	58,9	36	18,5	50	29,3	27,1

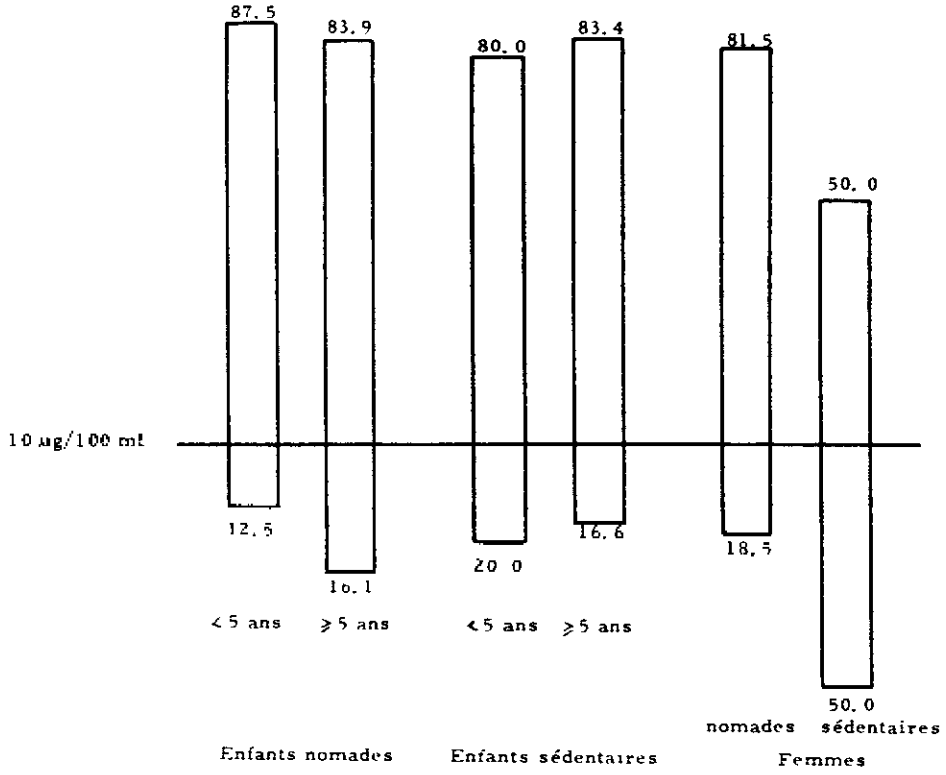

Figure 1.

Proportion d'individus dont le rétinol sérique est en dessous d'un seuil donné.

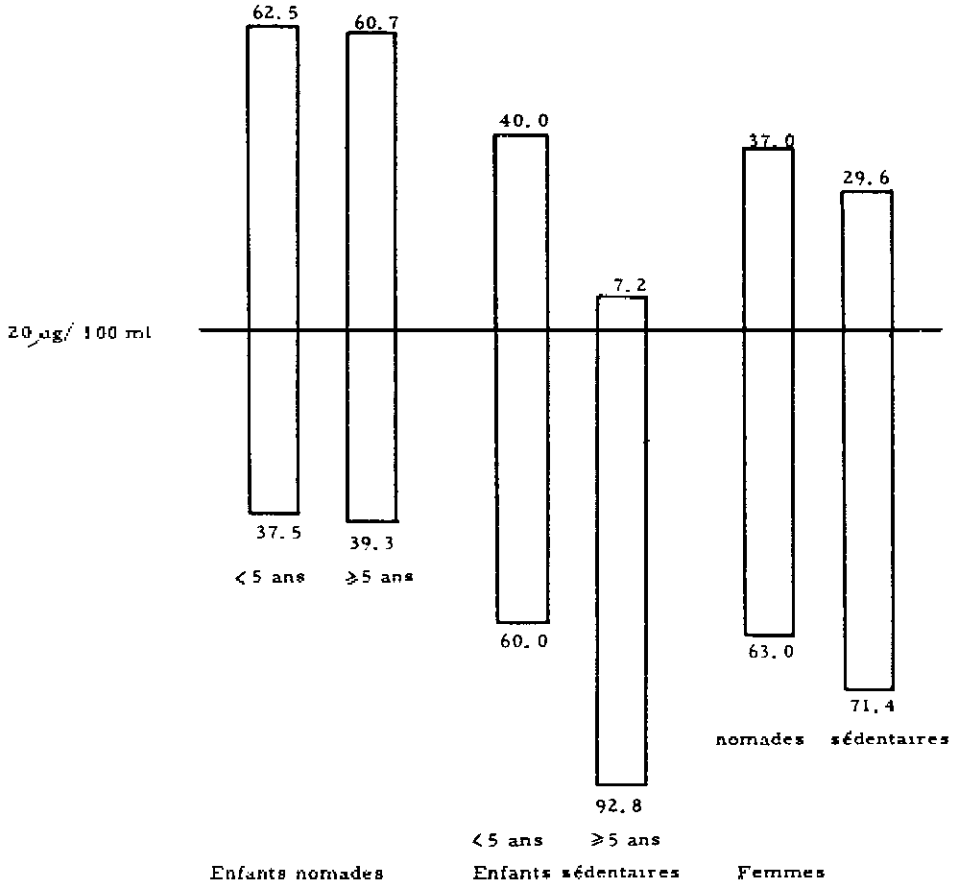

Figure 2.

Proportion d'individus dont le rétinol sérique est en dessous d'un seuil donne.

TABLEAU 2

Taux moyens plasmatiques de rétinol avant et après administration de vitamine A d'après taux initiaux

Groupes d'après taux initiaux	Nombre de sujets	Taux moyen avant rétinol	Taux moyen après rétinol
< 20 µg/100 ml	25	14,2	22,1
20 - 29 µg/100 ml	13	24,1	17,3
30 + µg	10	39,9	28,6
Total	48	22,2	22,1

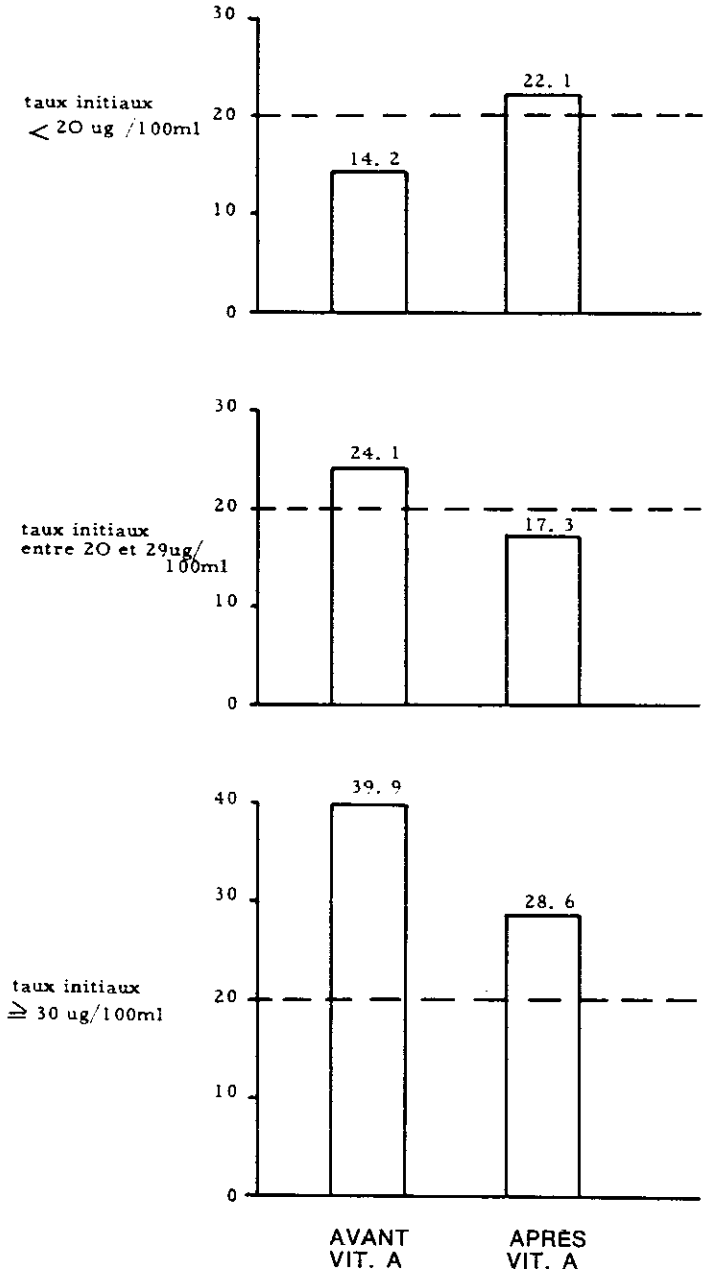

Figure 3.

Taux moyens plasmatiques de rétinol
avant et après administration de vitamine A suivant taux initiaux.

On peut se demander dans quelle mesure ces taux faibles de rétinol témoignent d'une insuffisance d'apport de vitamine A dans l'alimentation. On connaît la relation complexe qui lie la mobilisation du rétinol au niveau du foie à la synthèse de protéines. Le rétinol entreposé dans le foie n'est libéré que sous forme d'un complexe protéinique, une molécule de rétinol étant attachée à une molécule de protéine porteuse (RBP). (Glover *et al.*, 1974; Matsamitsu Kanaï *et al.*, 1968.)

Les expériences sur rats et les études cliniques chez l'homme ont démontré que dans les déficiences protéiniques, et tout particulièrement le kwashiorkor, les taux plasmatiques de rétinol, donc du complexe rétinol-RBP ou holo-RBP (Arroyave *et al.*, 1961; Muhilal H. *et al.*, 1974; Ingenbleek *et al.*, 1975), en dépit d'une administration parentérale massive de vitamine A, les taux plasmatiques de rétinol et les signes associés de xérophtalmie restent inchangés tandis que la réalimentation thérapeutique sans apport supplémentaire de vitamine A amène une amélioration parallèle des taux de protéines sériques et de rétinol circulant. La cause s'est révélée être un défaut fonctionnel de la mobilisation du rétinol hépatique par synthèse insuffisante de RBP. *Le facteur limitant dans ces cas est la carence en protéines porteuses*, principalement RBP, suite à l'alimentation déficiente en acides aminés.

Une fois ces derniers fournis par une diète calorique et protéinique adéquate, la production hépatique de protéines augmente et les taux de retinol-binding-protein et de pré-albumines s'élèvent.

Dans cet échantillon, les cas de malnutrition protéino-calorique ont été exclus. Par ailleurs, l'apport en protéines était satisfaisant, une alimentation de complément riche en protéine étant distribuée depuis plusieurs mois aux enfants ainsi qu'aux femmes enceintes allaitantes.

Sur le plan ethnique, l'analyse séparée des résultats pour les nomades et les sédentaires fait cependant apparaître une différence frappante. Les taux moyens sont plus élevés chez les nomades, réfugiés ayant bénéficié dans les camps d'une assistance alimentaire systématique durant plusieurs mois, que chez les villageois sédentaires résidant dans leur milieu ethnique habituel.

Ces différences trouvent une explication pour le moins partielle dans la concentration de l'assistance sur les nomades plus spécialement éprouvés par la sécheresse. Cette assistance extérieure a, à la longue, créé une situation médicale et nutritionnelle comparativement privilégiée dans les camps de réfugiés nomades par rapport aux villages sédentaires environnants (de Ville de Goyet, 1975).

Ceci a pu être clairement démontré concernant le camp d'Hamdallaye, d'où proviennent la majorité des sujets nomades testés dans cette étude par les quelque 4.000 mesures anthropométriques (circonférence brachiale, poids, taille) effectuées dans les différents camps nomades et villages sédentaires (Jeannée et de Ville de Goyet). L'alimentation supplémentaire fournie pendant de nombreux mois aux groupes vulnérables par le programme d'urgence comprenait, entre autres, un minimum quotidien de 10 g d'huile de palme rouge dont la teneur en carotènes spécialement élevée a été controlée à diverses reprises.

L'interprétation des taux plasmatiques de rétinol constatés après administration orale d'une dose élevée de vitamine A est plus complexe. Les

quelques rares études des *variations dans le temps du taux de rétinol plasmatique lors d'expériences sur sujets carencés* démontrent que les taux augmentent fortement dans les heures qui suivent l'administration et se maintiennent pour des durées minimales de 8 à 10 semaines (Srikantia; Pereira). De façon inattendue, dans cette enquête, la moyenne des taux observés n'a pas accusé d'élévation une ou deux semaines après administration massive de vitamine A. De plus, certains enfants ont témoigné d'une diminution des taux plasmatiques.

Des erreurs dans la manipulation des échantillons ou des fautes de technique d'analyse peuvent être raisonnablement exclues. Un soin particulier a été apporté au marquage des tubes de prélèvement et à l'établissement des listes nominatives. De nombreux prélèvements de contrôle ont été répétés et inclus sans avertissement dans les échantillons à analyser ce qui permet d'écarter ce facteur.

On ne peut incriminer une détérioration des perles de vitamine A en milieu tropical. L'analyse d'un lot de perles a révélé un contenu moyen de 205.000 U.I.

Une résorbtion insuffisante de vitamine A ne constitue pas une hypothèse à retenir. Aucun enfant ne présentait de signes infectieux aigus. Bien que la prévalence d'infestations intestinales ait probablement été élevée, une rétention d'environ 30 p. cent de la dose administrée soit 66.000 U.I. fournit un apport appréciable comparé aux réserves hépatiques optimales d'un enfant. Soit 200.000 U.I. (Suthuvoravoot; Underwood).

L'absence de RBP par carence protéique peut également causer une absence de réponse à des fortes doses de vitamine A. Cependant une défaillance de la synthèse hépatique de RBP ne se remarque que dans les cas de kwashiorkor. Les 37 enfants étudiés ne présentaient aucun signe de MPC sévère, les enfants marasmiques ou malnourris étant réhabilités dans un centre spécial.

Une carence en vitamine E ou en zinc peut, pour certains auteurs, (Bauernfeind *et al.*, 1974; Mc Laren, 1969) interférer avec la libération normale du complexe RBP-rétinol. Les perles de vitamine contenaient cependant une dose suffisante de vitamine E (40 U.I.). L'apport alimentaire de Zn n'a pas été étudié.

Le manque de coopération et le refus d'ingestion de la dose administrée peuvent être exclus, vu le contrôle strict exercé sur les enfants lors du programme de distribution. Les médecins chargés de la supervision n'ignoraient pas qu'un contrôle sérologique serait effectué.

Cette discordance reste donc inexpliquée.

V. **Conclusion**

Sur le plan local et à court terme, ces résultats, aussitôt communiqués ont conduit à la mise sur pied d'un vaste programme d'administration d'une dose orale de 200.000 U.I. à tous les groupes vulnérables, enfants en dessous de 12 ans, femmes enceintes ou allaitantes. Pour les enfants de 6 mois à 1 an, la dose a été réduite à 100.000 U.I. Sur une population à risque de quelque 30.000 personnes dans les régions d'implantation des équipes

nutritionnelles, 22.758 personnes ont reçu une dose prophylactique de vitamine A.

Cette enquête a également mis en évidence le paradoxe d'une situation nutritionnelle franchement meilleure chez les nomades réfugiés que dans la population résidente des zones d'accueil. Il est clair que souvent l'assistance alimentaire pourrait être répartie de façon plus judicieuse. Lorsque ses résultats ne sont pas évalués périodiquement, cette assistance risque de se concentrer ou de se prolonger indûment en faveur de groupes de populations particuliers, et au détriment d'autres qui, pour n'avoir point été les victimes du désastre, n'en deviennent pas moins ceux qui finissent par en pâtir davantage.

A plus long terme, ces résultats posent le problème de l'administration répétée de doses massives de vitamine A aux groupes de populations les plus vulnérables. Ceci a été discuté au Colloque « Nutrition et Développement » organisé à Niamey en avril 1975 par le Centre de Recherche sur l'Epidémiologie des Désastres. Il est certain qu'une campagne d'administration massive de rétinol, tel qu'elle a été suggérée dans plusieurs pays, ne peut être qu'une mesure transitoire. L'épidémiologie de l'avitaminose A procède d'un mécanisme complexe. Abstraction faite d'un apport insuffisant en acides aminés nécessaires à la synthèse de la protéine porteuse, la carence en vitamine A ne résulte pas tant d'un déficit alimentaire immédiat que d'un épuisement des réserves hépatiques constituées par l'enfant au stade fœtal et durant la lactation. En quelque sorte, l'avitaminose A chez un enfant peut provenir d'un apport alimentaire insuffisant chez sa mère pendant la gestation, ou même, par le truchement des réserves hépatiques maternelles, avant la conception.

Ceci indique que seules une éducation nutritionnelle appropriée et la réorientation éventuelle des habitudes alimentaires, voire des modifications dans la production vivrière, peuvent résoudre le problème à long terme.

En tout état de cause, l'efficacité des mesures de prévention de l'avitaminose A doit être évaluée en prenant les lésions oculaires comme indicateur. Ceci suppose la mise en place d'un système simple de surveillance épidémiologique des troubles oculaires et la récolte des données pertinentes (prévalence par âge, incidence par âge dans les cohortes successives) dans les populations exposées.

Sur le plan international, il est impérieux que le lait en poudre fourni au titre d'assistance nutritionnelle soit enrichi en rétinol. La poudre de lait écrémé non enrichi doit être considérée comme un facteur favorisant la cécité chez l'enfant. Il est inconcevable que les appels lancés aux pays donateurs par les organismes internationaux, en particulier par l'UNICEF, pour que le lait soit enrichi en rétinol, restent, à quelques rares exceptions près, plus longuement inentendus.

REFERENCES

Arroyave, G. *et al.* (1961) : Serum and liver vitamin A and lipids in children with severe protein malnutrition. Amer. J. Clin. Nutr., **9**, 180-185.

Bauernfeind, J. C., Newmark, H. & Brin, M. (1974) : Vitamin A and E nutrition via intramuscular or oral route. Amer. J. Clin. Nutr., **27**, 234-253.

Glover, J., Jay, C. & White, G. H. (1974) · Distribution of retinol-binding protein in tissues. Vit. Horm., **32**, 215-235.

Ingenbleek, Y. *et al.* (1975) : The role of retinol-binding protein in protein-calorie malnutrition. Metabolisme, **24**, 633-641.

McLaren D. S (1969) : Conclusions. Symposium : The metabolic function of vitamin A. Amer. J. Clin. Nutr., **22**, 1135-1138.

Ligue des Sociétés de la Croix Rouge (1975) : Programme conjoint d'assistance médico-nutritionnelle à la République du Niger — juillet-décembre 1974.

Masamitsu Kanai, Amiran Raz & Goodman, D. S. (1968) : Retinol-binding protein : The transport protein for vitamin A in human plasma. J. Clin. Invest., **47**, 2025-2044.

Muhilal, H. & Glover, J. (1974) : Effects of dietary deficiencies of protein and retinol on the plasma level of retinol-binding protein in the rat. Br. J. Nutr., **32**, 549-558.

Oomen, H. A. P. C., McLaren, D. S., Escapini, H. (1964) : A global survey on xerophthalmy. Trop. & Geog Med., **16**, 271.

Pereira, S. M & Almas Begum (1969) : Prevention of vitamin A deficiency. Amer. J. Clin. Nutr. **22**, 858-862.

Pereira, S. M. & Almas Begum (1971) : Failure of a massive single oral dose of vitamin A to prevent deficiency. Archives Disease in Childhood. **46**, 525-527

Srikantia, S. G. & Vinodini, R. (1970) : Effect of a single massive dose of vitamin A on serum and liver levels of the vitamin. Amer. J. Clin. Nutr., **23**, 114-118.

Suthutvoravoot, S. & Olson, J. A. (1974) : Plasma and liver concentrations of vitamin A in a normal population of urban Thai. Amer. J. Clin. Nutr., **27**, 883-891.

Underwood, B. A. (1974) : The determination of vitamin A and some aspects of its distribution, mobilization and transport in health and disease. World Rev. Nutr. & Dietetics, **19**, 123-172.

DISCUSSION

H. A. P. C. Oomen : The only thing I would like to point out in this respect is that serum levels in vitamin A are not a good parameter, certainly not for individuals and as to groups it's often difficult to say. The evidence that a massive dose of vitamin A is active not only in children in a normal state of nutrition, but also malnourished children, comes from studies in India and Indonesia. It may be so that in a child with diarrhoea and malnutrition only a lower percentage is absorbed than in a normal child, which is about 60 per cent of the dose which has been administered, maybe 40 per cent, even 30 per cent, but anyway that's enough to protect it for a period of several months.

H. L. Vis : A-t-on la moindre idée de la consommation en graisses chez les sujets que vous venez de décrire ? Quelle est la proportion d'énergie consommée sous forme de graisses chez les populations sédentaires ? L'apport lipidique doit être plus important chez les nomades du fait qu'ils boivent du lait.

C. de Ville de Goyet : Chez les populations nomades qui recevaient l'assistance de la Croix Rouge l'apport était constitué uniquement en huile de palme et c'était le seul apport vu qu'ils étaient pratiquement dépendants de l'assistance extérieure. Chez les sédentaires, je crois que M. Camara est mieux au courant.

I. Camara : C'est difficile de dire exactement la quantité de graisse consommée par la population sédentaire. Tout ce que je peux vous dire c'est que généralement quand la situation alimentaire est normale, les gens consomment de l'huile d'arachide. Dans le contexte du programme conjoint il se trouvait qu'il y avait cette difficulté où il n'y avait pratiquement rien du tout, donc ni des céréales et encore moins de l'huile d'ara-

chide. En ce moment la consommation de graisses, vraiment je suis incapable de vous dire.

H. L. Vis : En Afrique Centrale (Rwanda, Burundi) où existe l'avitaminose A, la consommation de graisses ne représente que 4 à 5 p. cent de l'apport énergétique total.

Dans les régions où vous décrivez de l'avitaminose, y a-t-il un problème de lithiases vésicales ?

I. Camara : Je ne sais pas si c'est lié à cela ou pas, mais effectivement on ne trouve pas mal de lithiases vésicales.

B. B. Waddy : I have had some experience of Peulh cattle people in a much more favoured area of Nigeria, where there was plentiful grazing and no sign of malnutrition among the local farming « sédentaires ». There was some evidence, though no actual proof, of night blindness in growing Peulh children in that area. I think, therefore, that A avitaminosis in the Peulh is not attributable solely to famine conditions.

M. F. Lechat : This is probably not an acute famine condition. But it gives an exemple of how famine or disasters can amplify the conditions already prevailing in the ecological context.

C. de Ville de Goyet : Je voudrais préciser un point que le Dr Lechat mentionnait. L'administration de vitamine A n'est pas une chose aussi aisée qu'on peut le croire. C'est-à-dire administrer une perle à 25.000 personnes dans des camps de réfugiés est une chose qui demande de la réflexion et une prise de décision mûrement réfléchie. La conclusion, comme a dit le Dr Lechat, c'est qu'on développe actuellement grâce aux diapositives du Dr Oomen un moyen d'enseigner les médecins qui se rendent en période d'urgence à déchiffrer les lésions ophtalmiques au lieu d'utiliser les dosages de retinol.

M. F. Lechat : I agree on the value of retinol dosages to assess vitamine A deficiency and risk of blindness in the population. But we also recognize that a valid survey would require much larger samples and more representative populations. However, this is a good support for decision-making when you are obliged to face a situation and take remedy without delay. We already knew that there was probably a deficiency in vitamine A. The Government was probably already sold to the idea of a large-scale distribution of retinol. But you increase your chance of making a decision in the right direction in carrying on such a limited survey. It makes you feel more confident. And probably it makes the donor agencies more confident too, and also helps to convince the local medical staff which at times is faced with other problems and does not see it as a priority.

LESSONS FOR EPIDEMIOLOGY FROM THE ETHIOPIAN FAMINES

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In his 1960 Godkin lectures on Science and Government, Lord Snow initiated a famous and still continuing controversy about the Allied bombing policy in the Second World War (Snow, 1962). Many who have read the various accounts of the origin of strategic bombing are troubled not by the scientific aspects of the decision, but by the fact that the killing of civilians was discussed in terms of economics and not ethics. That the value of human life is monetary, and the true meaning of death, the disruption of the war effort, is an aspect of war that many apparently do not like to consider.

In our studies on disaster epidemiology we have been struck by an analogous refusal to think about the social implications of death. Scientists and laymen alike write of famine as if the word were a synonym for death by starvation. At an extreme the definition is so stretched that phrases like « endemic », « chronic », or « permanent » famine have been used to describe the nutritional manifestations of underdevelopment.

This woolly equation may make good journalism, but it makes bad science. Unfortunately it is so ingrained that, of the very few studies that have been made on famine epidemiology, most have concentrated in fact on the epidemiology of famine-induced malnutrition (Davis, 1971; Center for Disease Control, 1973). This is undoubtedly an important topic but it does not approach the real problem any more than a study of battle injuries casts light on the nature of war.

If we wish to discuss causes, we must first admit that the disease is social. In studying famine it must be realised that famine is the disease and malnutrition the symptom, as it is of underdevelopment or indeed of bad food habits.

This may sound suspiciously like sociological posturing, but we are by no means suggesting that famine epidemiology should make way for the development economist. Far from it. The social sciences have contributed very little to the study of famine because, while they see it as a single phenomenon, they do not see it as a unique one. Perhaps misled by the commonality of disease patterns in both underdevelopment

(*) On leave of absence from the Nuffield Institute of Comparative Medicine.

and famine, development economics seems to adhere to a conventional wisdom in which famine is seen as the extreme of a continuum of underdevelopment, measurable simply by poverty.

This is a simplification that seeks to equate ice with cold water. For although famine is a manifestation of poverty — a low economic temperature — there is a freezing point at which it develops, a point characterised by a change in state that clearly separates famine from extreme poverty. Famines are distinct. Traditional chronicles are as unequivocal about recording famines as they are in recording wars, even in a nation like Abyssinia, where poverty and malnutrition were endemic (Pankhurst, 1966). The modern African famines suggest a corollary to this : that there is no transition between even the worst sort of normal year, and the famine. They are different not only in severity but in kind.

This is because the famine year is neither characterised by poverty nor even death, but by social disruption. Miserable though it is, chronic poverty in traditional societies, is a situation to which considerable social, psychological and physiological adaptation has occurred. Only when these mechanisms of cultural homeostasis are no longer able to cope, does the situation shift into famine.

It is generally agreed that in 1975 Ethiopia suffered a catastrophic famine. What made it so was not simply a given number of deaths. Best estimates of famine deaths amount to only 15 per cent of the normal yearly total for excess deaths due to underdevelopment (Miller *et al.*, 1975). What made it a famine was the shock and disruption in a localised area. Refugees fled from a limited rural area in Wollo province, where the food shortages were concentrated, to beg in the roadside towns. Rapidly these towns had more destitutes than employed. It was the turmoil along these roads that was filmed as the famine. It was the refugees along these roads who received the aid. And it was the impact of these refugees that finally precipitated a political coup.

Those who remained in rural areas were beyond the scope of emergency aid, and their life or death was, in the harshest terms, without significance.

There are in the roadside towns of Ethiopia established ways of dealing with a constant influx of people from the rural areas. They are refugees from food shortage and social and economic disruption. They become servants, labourers or prostitutes. The concentration of refugees in 1973 swamped these mechanisms, or made them inappropriate. This marked the real beginning of the famine. This crucial role of social maladaptation in the aetiology of famine not only differentiates it clearly from extreme underdevelopment but makes rapid urbanisation of development its nearest equivalent.

A second important misapprehension about famine concerns its equivalence with other types of disasters. The suddenness of geophysical catastrophes has been contrasted with the relatively slow onset of famine. We regard this view as mistaken and believe that in the recent African famines the speed of onset of starvation, as opposed to drought, was comparable to that of any other catastrophe. In time no doubt, elegant applications of catastrophe theory will be used to explain this, but in the meantime a qualitative explanation, based on the recent sub-Saharan droughts, can be advanced.

In these societies the food supply of the community depends essentially on local production, redistribution between rural regions being small. However the people are not subsistence farmers aloof from a market economy. Most families are involved in the buying and selling of food through local markets, with only surplus staples going to the urban centres.

In Ethiopia, as in the Sahel, likely crop yield and grazing potential are dictated primarily by a short period of rains, and the producer is able to form a view of likely yields or sustainable needs during this period. The small scale of the market makes for good spreading of rumours, and so a generally agreed estimate of yields becomes rapidly established with producers hoarding or selling as a relatively homogeneous group. Either the normal post harvest price fall occurs, or if hoarding is significant enough to reduce this, a panic-based price surge takes place, accelerated by the fact that hoarding and panic buying help to cause the very shortages which were feared.

For instance, we recorded market prices during the famine in Northern Wollo at Korem, Alamata and Kobbo markets (Seaman and Holt, 1974). Prices for staple grains rose rapidly during the first part of 1973, so that by the beginning of the rains, in the middle of the year, they had nearly doubled. They fell again with startling rapidity at the end of the rains, so that in September they had nearly returned to pre-famine levels. The causes of this drop cannot be found directly in the new harvest, which began in October 1973, nor in bulk food aid, which began at the end of the year. The main reason was almost certainly the release onto the market of stocks of grain by farming families and entrepreneurs once it was apparent that the new harvest would be reasonable. There was no evidence of the slower price fluctuations on which some of the recent discussions between United Nations Agencies on nutritional surveillance in these areas (W. H. O. 1976) have been based.

Our information on such markets is of course incomplete, and the above discussions are somewhat speculative. But this is the way in which catastrophes occur in other markets where the catchment is small and rumour important, as for example, the stock market surges and crashes (Sobel, 1969). Again in the United Kingdom over the last years a series of commodity famines have occurred where media coverage has been given to rumours of shortages of items such as sugar, and panic buying has caused both price escalation and a shortage of goods even though supply was adequate for normal demand. Television has been true to its McLuhanesque role of converting us if not to a global village, at least to a national one.

These remarks remain unproven here, although we shall develop them in full elsewhere. They illustrate the underlying presuppositions on which our discussion is based, and it is in the light of them that we present some of our detailed data on the famines in Ethiopia.

We have summarized elsewhere (Holt *et al.*, 1975; Seaman *et al.*, 1975) the epidemiology of the famines and repetition here would be gratuitous. What can be usefully done is to follow the relationship between information, starvation and relief aid, and to show how failures in the use of disaster epidemiology contributed not only to the tragedy in Wollo, but to the subsequent disaster in Harerge.

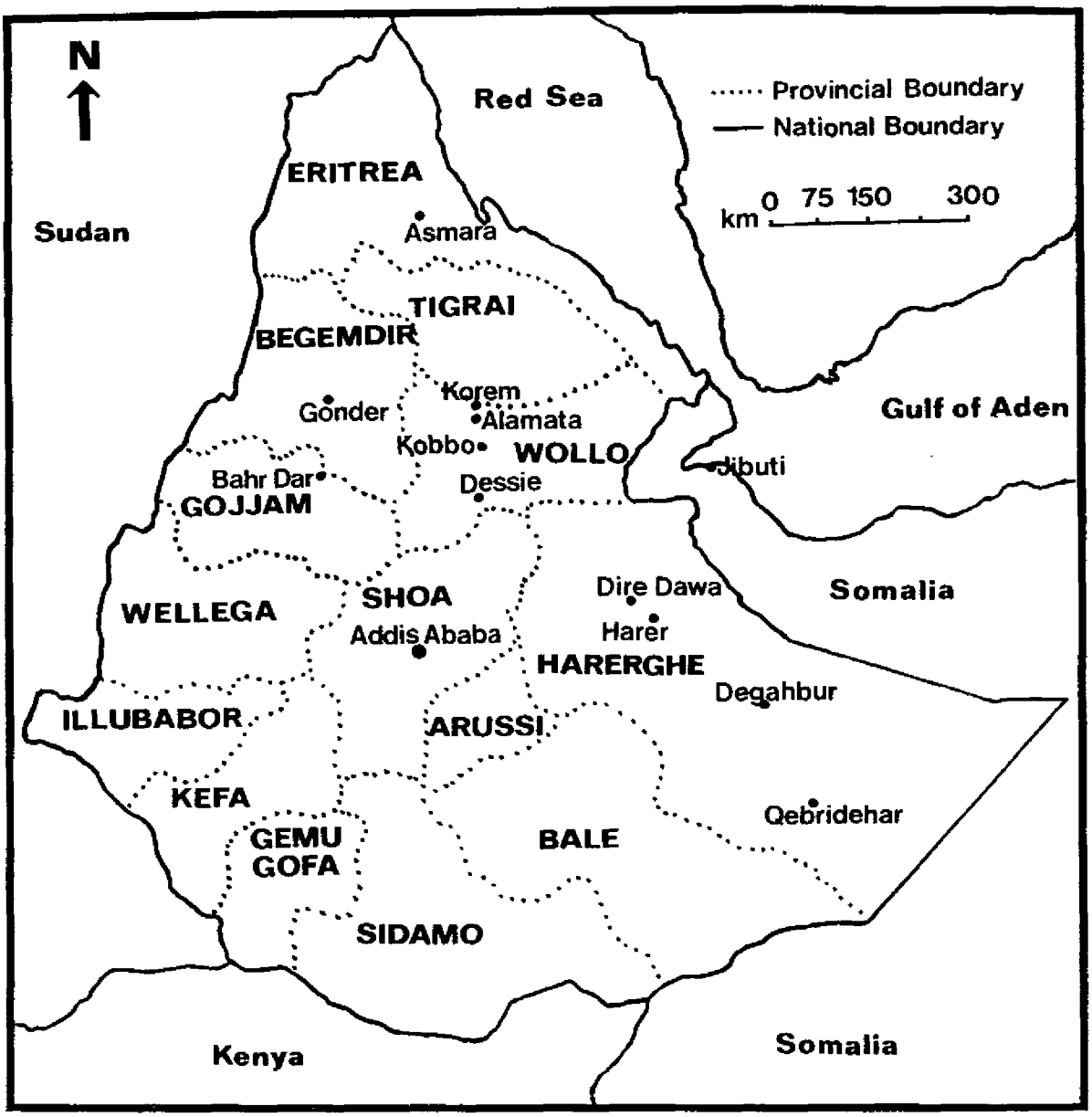

Figure 1.

Ethiopia showing main drought affected provinces.

Ethiopia presents extreme ecological contrasts. A high mountainous plateau running north-south divides the country in half, and forms the core of traditional Abyssinia. In the east and south, where the overall drought struck, from mid-1972 onwards, this densely populated agricultural highland area shelves steeply down to areas of lowland scrub and desert supporting a sparse nomadic population.

The topography is breathtaking, making for interesting tourism but poor communications, and the regions are isolated from one another, particularly the north-west highlands from the north-east. The rudimentary road system is orientated axially from Addis Ababa following the geography, accentuating the isolation of the regions and limiting large scale market flows to those via the capital city.

Even before the famine, Ethiopia was amongst the poorest of nations. As Table I makes clear, it was underdeveloped even for the third world. Urbanisation was restricted : less than 10 per cent of the population living in settlements of 2,000 or over, and the society was overwhelmingly a traditional one with a slow rate of change. The economy was heavily

TABLE 1

A comparison of four indicators of the standard of living in the United Kingdom, Ivory Coast and Ethiopia *

	United Kingdom	Ivory Coast	Ethiopia
Population per physician	840	19,000	91,000
Annual per capita income	US $ 1,375	US $ 162	US $ 25
Electricity consumption per caput	3,359 Kw hrs	48 Kw hrs	9 Kw hrs
Telephones/1,000 pop	183	5	1

* Source : « The Comparative International Almanac » Morris L. Ernst, Macmillan (1969).

dependent on agriculture in which the vast majority of the population were employed, and our studies between 1969 and 1973 (Miller *et al.*, in press) showed that there was normally a pattern of low food intake and high infant and child mortality.

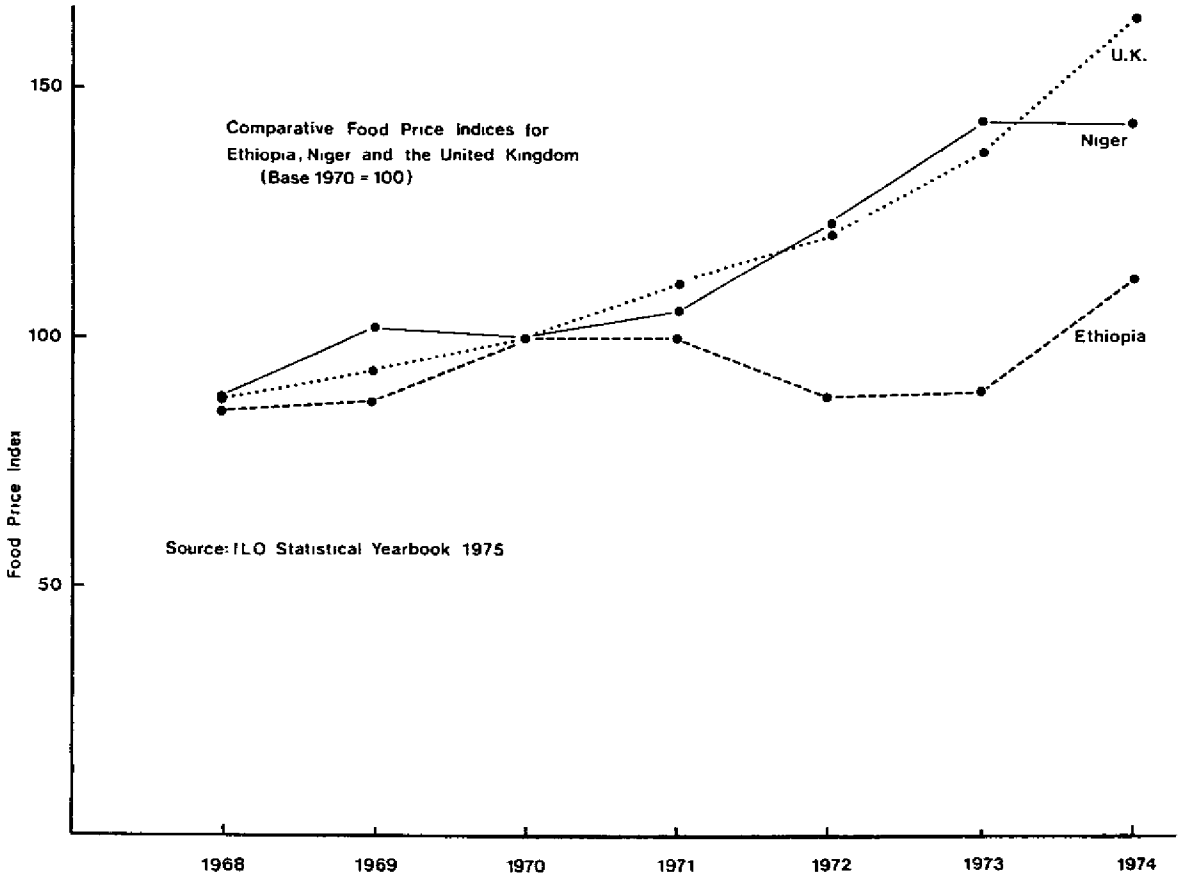

Figure 2.

In August 1973 the first reports were received in the West of a famine in Wollo and Tigre provinces of North Eastern Ethiopia. By early 1974 there were further reports of famine in Harerge province of South East Ethiopia and reports of famine there have continued until the present.

These famines were not national. There was little clear evidence of food shortage reflected in the market prices of food in the capital city, such changes as occurred being minor when compared to, say, famine-affected Niger or famine-free United Kingdom and were in part due to the rise in petrol prices at the time. Indeed, the very fact that Addis Ababa was able to rely for the bulk of its grain upon provinces (e.g. Begemdir, Gojam, Arussi, Sidamo) outside the main drought area in 1973 helped to insulate the people of the city from knowing what was happening in the north-east.

Two other favoured national indicators were also of no use in detecting the famine. Ethiopia's food exports actually rose during the famine period (Table 2), a rise that would have proven misleading to any global surveillance system which set store by them. But Ethiopia exports extremely little grain and the main export cash crops, coffee, haricot beans come principally from southern areas which were not badly affected in 1973 drought. Export took priority over internal redistribution.

TABLE 2

Exports of food by Ethiopia 1970-1974

	1970	1971	1972	1973	1974 *	
Coffee	71	81	83	76	63	kilotonnes
Pulses	51	64	78	142	217	kilotonnes
Oilseed and oilcake	74	69	140	133	112	kilotonnes
Animal products	33	37	67	94	75	millions of Ethiopian dollars
Total	262	272	330	421	565	millions of Ethiopian dollars

* Estimate based upon incomplete year.

Secondly, no food balance data were ready in time to predict famine. They are not ready yet and although it is not yet known whether the famine will be reflected in them, one can reasonably doubt that it will be. One hundred thousand people totally deprived of food would reduce the mean daily per caput food consumption in Ethiopia by 80 kcal (3.8 per cent). This small decrease would be undetectable when the « *normal* » value of 2,100 kcal/caput/day is derived from population figures with an uncertainty of at least 10 per cent and an arbitrary loss and wastage correction of 15 per cent. In the Niger famine of 1972-1973, the mean per caput calorie consumption is estimated to have fallen by only 50 kcal per day (Hack *et al.*, 1974). It is difficult to find an instance where famine has been accompanied by significant change in estimates of individual food consumption derived from national totals.

The main rains in the plateau areas of Ethiopia are from June to September. There are also spring rains between February and April which chiefly affect the higher altitudes, where in parts of the north-east they permit

10-20 per cent of the annual crop production. In 1972 the maintrains in the North East, and hence the harvest were poor. It happened that for the second year the Ministry of Agriculture had carried out a nationwide examination of crop production. By November 1972, the Government therefore had clear evidence that whilst the yields had been reasonable-to-good over much of the country's chief grain producing areas, the situation in eastern Wollo and Tigrai was potentially disastrous. The Government suppressed this information, and when the final, polished report was released as late as March 1973, predicting hunger for 250,000 people in Wollo, the document received only a restricted circulation. Table 3 is based on this report, and from it anyone should be able to detect at least a potentially serious situation in Wollo.

Possibly the numerous foreign agencies in Addis Ababa had no access to this information, although that would imply remarkable ineptitude. Perhaps they heard none of the reports of refugees on the main route north, although that suggests staggering insensitivity. It is even conceivable that they did not hear of the 1,000 refugees that the Red Cross were caring for in Addis Ababa in December 1972 (Annual report, Red Cross, 1974). All of these options seem implausible, and it may be that we do the agencies an injustice when we greet their failure to react with horrified derision. But they did not act and have never explained why.

By mid 1973 the famine was at its peak. Information about it is extremely scarce, and epidemiological data virtually non-existant. But it is clear that following the total famine of the rains in Spring 1973 considerable social disruption occurred. Not only agriculturalists but also pastoralists from the Danakil desert begun to flood into roadside towns during the first part of 1973. In May a number of rudimentary relief camps capable of housing, though not properly servicing, a maximum of 20,000 people were being set up in roadside district centres by voluntary town committees and field agents of the Ministry of Community Development. Meanwhile, the local markets had been dealt a final blow by the nearly total failure of the spring crop in the highlands and dealt a final blow to the local markets.

The crisis of starvation and death occurred from June to August 1973 when the relief camps, exceedingly ill-equipped with food, sanitation or medical services were overwhelmed by some three times the numbers they could shelter, and by August, at least 284,000 people had asked for help at administrative centres. What retrospective data is available suggests that a mortality due to famine ranges between a conservative estimate of 50,000 (Miller *et al.*, 1975) and an official estimate of 10,000 (Relief and Rehabilitation commission, 1975). At this time the population of Wollo was estimated to be 2.4 million of whom somewhat under one million lived in the principle drought area.

But in 1973, the main rains were good, and a reasonable harvest, in great contrast to that of the previous year, was under way. The government claimed that during 1973 it had been able to give out to farmers on a credit basis nearly 4,000 tonnes of seed grain. Whilst it is not clear how much of this was used as seed, it appears that some thousands of refugees had planted their land before leaving their villages, in the spring. From late August 1973 many survivors returned to their fields. An aerial survey conducted in November reported only one area of some 1,000 km^2 along the

eastern escarpment of Wollo which remained seriously denuded of crops (I. E. G. 1973). By the end of September, the numbers of relief camp inmates had dwindled to around 15,000 amongst whom not more than 10 per cent of the children were seriously mal-nourished. The starvation crisis was over, leaving in its wake massive social and economic problems. Thousands of families were split up by deaths, or by the outward migration of the men who sought work as labourers in the Awash and Setit Humera agricultural development schemes. Many farmers had sold or mortgaged their land. Livestock deaths had deprived pastoralists of any chance to continue their livelihood. It appears that the pastoralists continued to face the drought well into 1974; very few reached the roadside relief camps and they suffered out of all proportion to their numbers.

The contrast between the chronology of the famine and that of bulk food aid is startling. Government statistics (National Drought Relief Committee, 1973) indicate that up to November 1973 only 12,000 tonnes of grain were distributed to all areas by the government. This was mainly borrowed from Government grain stocks under guarantee from the World Food Programme and USAID. Some 6,500 tonnes only went to Wollo. Although this would theoretically have fed some 45,000 people over a nine-month period. Clearly the amount, timing and distribution was far from adequate to prevent the disaster. In contrast, between November 1973 and December 1974 Ethiopia received foreign relief grain donations of 126,000 tonnes, together with 11,000 tonnes of « rehabilitative foods » (Relief and Rehabilitation Committee, 1975). Wollo and Tigrai received 70 per cent of this, despite the fact that their problems were nearly over. Harerghe, where famine was at its height received only 8 per cent (*).

How did this happen ? There are two main reasons, and both imply a drastic failure in disaster epidemiology. The first was that in March 1973 when an emergency was at last declared in muted tones, both the Government and at least two major relief agencies miscalculated the severity and timing of the problem. The second was that from September 1973, when the crises had passed, the « hidden famine » in Wollo and Tigrai became an international media event, sustained by immense publicity about starvation in the agricultural areas.

For many months after the foreign medical teams arrived in September and October 1973, they remained bound to the population of the relief camps. It was not until March and April 1974 that some medical and nutritional assessment was made of rural populations at the same time as the modest and erratic beginning of grain distribution outside relief camps. Our own survey (Seaman *et al.*, 1974) covered the whole of one agricultural district in northern Wollo, to provide the baseline for a long-term medical programme for the Save The Children Fund. It showed that at this stage the nutritional status of the population, though generally low, was comparable to that we had measured amongst the population of a similar area elsewhere in the country during 1969-1972 « normal » years. (Miller *et al.*, in press). But ours was not a generally held view, and relief teams continued to behave as if the area was in the grip of a major and continuing famine. This was partly

(*) Total Development Assistance to Ethiopia in 1974 was 67 % above that in 1973. [Source . D. A. C. (Development Assistance Committee) Annual Reports. O. E C. D., Paris.]

due to the inertia which sustains any relief operation once it is under way, and partly to the fact that inexperienced foreign workers were unable and unwilling to recognise that malnutrition in Ethiopia was endemic rather than epidemic.

We have shown elsewhere (Miller *et al.*, 1975) that early action using locally available food stocks could have achieved what massive aid arriving too late signally failed to achieve at many times the cost : namely, the prevention of the death and disruption of famine. No-one is likely to deny that once the catastrophe had been allowed to happen, much long-term aid was needed for economic and social rehabilitation, and for ensuring the prevention of future disasters. It is doubtful, however that whether such ends could possibly be served by the exceedingly expensive food and medical aid that was sent in response to outdated media coverage of a famine emergency. The aid programme did help sustain the fixation of emotion and attention upon the north-east of the country and as contributed to a further tragedy, this time in the Ogaden rangelands of Harerge in the south-east.

For whilst the crops were maturing in the north, the crucial 1973 September/October rains had failed in the southern rangelands, and the Somali pastoralists who inhabit the area were losing large numbers of livestock as the harsh dry season began. Towards the end of 1973 there were rumours that a new famine had struck in Harerge. But, despite the fact that Ethiopia was now a focus of world concern, no-one investigated. It was not until May 1974 that the Ethiopian Relief and Rehabilitation Commission, was able to obtain sufficient resources from agencies for a proper survey of the area.

TABLE 3

Ethiopian crop production for the year 1972, relative to previous average production *

Province	Provincial subdistricts (per cent) reporting production			
	Above average	Average	Below average	Poor
Wollo	0	10	38	52
Tigrai	6	84	2	8
Eritrea	4	78	9	9
Begemder	6	84	2	8
Gojam	14	82	4	0
Harer	22	39	30	9
Arussi	5	70	15	10
Shoa	17	54	21	8
Welega	0	86	14	0
Ilubabor	22	64	14	0
Kaffa	33	45	22	0
Gemu-Gofa	6	82	12	0
Sidamo	22	78	0	0
Bale	82	9	9	0
All provinces	14	65	14	7

* From : Ethiopian Ministry of Agriculture, Final Report of Crop Condition Survey for the 1972-1973 Harvest. Addis Ababa : Imperial Ethiopian Government (1973).

The results of our survey (Seaman *et al.*, 1974) will, we hope remain a solitary classic of epidemiological futility. As in Wollo, surveys showed nutritional status to be poor but not unexceptional for Ethiopia. Clinical protein energy malnutrition was rare (0.6 per cent of children) as was pretibial oedema, which had a prevalence of 1.9 per cent of the children.

However, that some catastrophe had occurred was evidenced not only by the reports of local people, but, for example, by the under fives mortality rate (table 4). During the previous year this was virtually unchanged for agricultural peoples, but increased by about three fold amongst pastoralists. That this was associated with food shortage was indicated by the fact that the high mortality in pastoral groups was associated with a lower herd-size and a tendency to cluster along roads.

TABLE 4

Harerge Province : Mortality amongst under fives reported by different groups, for the year ending June 1974

Area	Pastoralists			Farmers	
	'Issa desert	North Ogaden	South Ogaden	Highlands	Marginal areas
Deaths/1,000 population 0-4.99 years	306	290	290	92	142

Moreover there had been a 200-300 per cent rise in grain prices in the small local markets where the herdsmen normally sold animals to buy grain. The reasons for this were mixed. There had been a decreased, but not disastrous harvest in the Harerghe highlands. Hoarding by nervous farmers and speculation by merchants had followed. Official restrictions on the movement of grain to the south established in previous years to combat the black market in grain to Somalia.

Grain purchases at Ogaden markets were not principally made by the small cultivating or roadside-town populations (some 5 per cent of the total population), but by pastoralists. The latter were particularly badly affected because they had sustained considerable livestock losses. Normally a heifer could be sold for about eight times its calorie value in grain, and grain so purchased makes up about half of the pastoralists' diet. Following rain failure in September 1973, lack of grazing caused pastoralists to attempt to sell as many animals as possible. Prices fell initially in response to this, and still further as the condition of animals deteriorated. As farmers and town people became less willing to buy, they fell lower still. By January 1974, animals were virtually valueless, and pastoralists were dependent on livestock herds which were dying. The Ogaden region of Harerge was hit by a famine caused by grain prices booming as animal prices slumped. The sub-normal but not disastrous February-March 1974 rains had provided enough grazing to stabilise the situation by the time of our survey. However, it was stabilized at a level where pastoralists' herds were reduced to numbers sufficient for subsistence *only* if grain and animal prices returned to pre-famine levels. At prices prevailing at the time of the survey, nomad herds had only 15 per cent of the pre-

famine purchasing power. The physiological and economic reserves of the population were exhausted and the situation was precarious. The possibility of a new famine depended essentially on whether the September 1974 rains failed. If the rains were good, economic and social recovery would occur. If the rains failed, a renewed and worse bout of famine was inevitable.

In July 1974 our recommendations referred, therefore, to the latter possibility. We felt that relief stocks should be built up, and the very limited stocks held already should not be dissipated before the event, although some 5,000 destitute people along the roads should, of course, continue to be helped. But commitment to stockpiling also meant a commitment to investment in greatly improved administration and transport. The logistical problems of feeding nomadic populations, whether in West or East Africa, have never been solved, whilst the dangers of depending on mass relief-camps are self evident. In addition, whether or not the rains failed, we suggested that some attempt should be made to stabilize the availability and price of grain on the markets. There were, by no means, simple solutions to any of these problems.

In the event, our report was curiously interpreted. Some agencies felt that no immediate starvation or deaths meant no danger of catastrophe. Others could not accept, given the high background rate of malnutrition exposed by the survey, that a famine did not then exist. For two such contradictory reasons our survey was ignored.

So when the September 1974 rains did fail, concerted relief procedures capable of dealing with the results had not been established. A new famine occurred, because it had not been prepared for. An emergency attempt was made to get grain and transport down to the Ogaden. It was not very successful and in the first months of 1975 the Ogaden suffered its second famine. In March 1975 the relief policy was changed from grain distribution to feeding only in relief camps, and by mid-April some 30,000 people, mainly women and children, had settled around the centres where camps were being organized. This was a number far greater than had been planned for. Reports from Oxfam cited a peak death rate of 150 children per day, contributed to by outbreaks of measles in some camps, and which had not fallen below 50 per day by early April. (Holt *et al.*, 1975).

We do not know what the April 1976 rains were like but by May fewer people were arriving at the camps. But the September rains appear to have failed again in this year, and the figures of numbers in relief camps for the last months of 1975 are quoted at 88,000 living in 19 centres.

In total then, in Ethiopia there were, between 1972 and 1975 an excess of at least 100,000 deaths due to starvation and associated diseases. They occurred in spite of massive injections of aid from overseas. The aid failed to prevent these deaths simply because it was, with few exceptions, too late.

The lessons for agencies and epidemiologists alike, lie in their fixation with starvation as if this represented the disease rather than the symptom. If both epidemiological practice and agency response take as a conceptual model of famine an equation which links drought with crop failure and animal deaths, and this in turn with human starvation, then their approach is bound to fail. For whilst starvation is a semantic prerequisite to the definition of famine, the genesis of catastrophe in

Ethiopia can, with hindsight, be traced back through several years of erratic rainfall. Starvation is a sudden and late event, and if epidemiologists continue to regard their role as being the definition of starved populations in anthropometric terms they will, with rare exceptions continue to arrive after the crisis has passed, and add to the pile of uninterpretable measurements of endemic malnutrition. A new approach, sensitive to the characteristic social and economic attributes of this type of catastrophe, is required. A mere reorientation of current attitudes, displayed in much of the new vogue for predisaster planning, is no substitute for the knowledge which alone can lead to an understanding of, and remedies for, food shortage ?

The second and perhaps more fundamental lesson from the Ethiopian famines is to be drawn from the behaviour of the donor agencies. These are beyond — and often appear immune to — the process of debate and innovation which guides, however erratically, technological change. If the agencies themselves often voice privately their conclusions that their failures lie in the inadequacies of the governments of the developing world, and the malfunctioning Global Food and Early Warning system, they may in part be correct. More centrally, they might ask themselves why the aid which was sent to Ethiopia arrived so late as to be near symbolic in its effect in relieving famine, in spite of the fact that, as we have shown, that there were clear warnings of impending starvation in both Wollo and Harerge. It is difficult to believe that the predictive data were not understood. So one must conclude that they were ignored. We do not know how far this was due to the fact that relief aid was merely part of a widely publicised media event triggered by one horrific but dated film of Wollo. Or how far it was due to the total lack of accountability of all the relief agencies for their actions.

We do know that until they realise both the need for timely and reliable information, and for action based on it, all famine epidemiology will remain an academic exercise of no practical use.

REFERENCES

Annual Report by Red Cross to the Christian Relief Committee, Mimeo, Addis Ababa (September 1974).

Center for Disease Control; « Nutritional Surveillance in Drought Affected Areas of West Africa (Mali, Mauretania, Niger, Upper Volta) August-September 1973 mimeo U. S. Public Health Service, Atlanta, September 1973, 36 pp.

Davis, L. E. (1971) : Epidemiology of Famine in the Nigerian Crisis : Rapid Evaluation of Malnutrition by Height and Arm Circumference in Large Populations, Am. J. Clin Nutr. **24**, 358-364.

Hack, H., Mackie, A., Bowden, M. Mosgaard, C. (November 1974) · Niger : Technical Team Report : prepared for Sahelian drought relief-food aid programme Mimeo. OSRO/FAO.

Holt, J. F. J., Seaman J & Rivers, J. P. W. (1975) : Famine Revisited. Nature **255**, 180-181.

Holt, J. F. J., Seaman, J. & Rivers, J. P. W. (1975) : The Ethiopian Famine of 1973-1974. 2 Harerge Province. Proc. Nutr. Soc.,**34**, 115A.

Imperial Ethiopian Government (1973) : A preliminary Assessment of the Requirements for the supplementary supply of Seed and Draft Oxen in the Drought Affected Areas of Tigre, Wollo and N. Shoa. (Crop Season 1966 E. C). Mimeo.

Miller, D. S., Holt, J. F. J. (1975) : The Ethiopian Famine, Proc. Nutr. Soc. **34**, 167 pp. 167-172.

Miller, D. S. *et al.* The Ethiopia Applied Nutrition Project Proc. Roy. Soc In Press.

National Drought Relief Committee. (November 1973) : The Drought Problem in Ethiopia. Mimeo. Imperial Ethiopian Government.

Pankhurst, R J. (1966) : Ethiopian Stud. **4**, 2.

Relief and Rehabilitation Commission (September 13, 1975) · 1 ½ Years of the Ethiopian Relief and Rehabilitation Commission.

Seaman, J. & Holt, J. F. J. (May 1974) : Survey Report on Raya and Kobbo Awraja, Wollo Province, Save the Children Fund, U. K. Addis Ababa.

Seaman, J. & Holt, J. F. J. (1975) : The Ethiopian Famine of 1973-1974. 1. Wollo Province Proc. Nutr. Soc. **34**, 114A.

Seaman, S., Holt, J F. J & Rivers, J. (June 1974) . Harerge under Drought. Ethiopian Relief and Rehabilitation Commission.

Snow, C. P. (1962) : Science and Government. The New American Library, New York.

Sobel, R. (1969) : Panic on Wall Street, Collier-MacMillan Ltd., London.

W. H. O./F. A. O./UNICEF Expert Committee : Methodology of Nutritional Surveillance. W. H. O. Technical Report Series nº 593, Geneva 1976.

DISCUSSION

W. Mohr : The deployment of the services of German aid organizations was made in the same area covered by the report of J. Rivers. The field service of physicians in the Province of Wolo was organized by myself. The group comprised six physicians of the Hamburg Institute of Tropical Diseases, two nurses, two laboratory assistants and eight medical students (of the clinical semesters) of the Medical Academy of Lubeck. A thorough selection of the members of the team was made in terms of health aspects and personal aptitudes. Initially such assignments were for a period of only two months, after which the team members were exchanged. Later assignments were lengthened to 3-5 months, as the short duration of earlier assignments had proved to be inexpedient.

Seven camps were established in several stages (viz. at Arabati, Hara, Ruga, Chiffra and a short time later at Kabe, Bora and Bati) in the Province of Wolo, which is partly mountaineous and in part forms the transition into the Danakil Desert. Each camp comprised a small hospital ward to accommodate grave cases, whilst the majority of patients received out-patient treatment. The number of hospitalized patients varied between 8 and 15, while between 80 and 120 outpatients were treated daily. During the rainy season outpatients numbered 50 to 60 per day. The Chiffra camp also provided medical services above all to the desert nomads, the group suffering most severely by the catastrophe.

The physicians had to work under extremely difficult conditions, particularly in the intial period. Diagnoses had to be established with very simple means. The attempt to set up a central laboratory service at Dessie failed due to the long distance to be covered, bad road conditions, and the impossibility of establishing a helicopter liaison service during bad weather conditions. In a large number of patients suffering from intumescence of spleen and liver the final cause of the phenomena remained unclarified. A large proportion of patients were found to suffer from acute diseases or disorders of the stomach and of the intestinal tract. During the initial period the number of children suffering from marasmus and kwashiorkor was very great, whilst the incidence of these disorders diminished considerably in the second half of the assignment.

During the rainy season many cases of pneumonia were treated, but also cases of tuberculosis as well as rheumatic disorders.

Relatively rarely we observed cases of leprosy in this area. Amongst other infectious diseases typhoid fever and recurrent fever had a major incidence, while in the camp of Bati also cases of typhus were observed.

A first epidemic outbreak of smallpox (variola vera) occurred in January, 1974; within eleven days some 2,010 persons were vaccinated, another 2,674 by early February. A second epidemic outbreak of smallpox occurred during March and April, with individual cases presenting until July, 1974. During the second smallpox outbreak a total of 7,089 persons were vaccinated with smallpox vaccine and BCG.

Apart from the medical and nursing services the members of the team had also to instruct the population. Houses and sickness wards were built, latrines erected, wells drilled, gardens were laid out for the production of vegetables, and above all roads had to be built to communicate with badly serviced areas. The distribution of food supplies was gratis, but was mostly made according to the principle of « Food for Work ». Apart from nursing of sick patients, the nurses also provided instructions to guide mothers in such areas as infant nutrition, preparation of milk powder, as well as the use of other food stuffs supplied from Europe.

Schools were erected and instruction in handicrafts was given; the faculties of versatility and adaptability of the field team were put to extreme tests.

The field work was later conducted in cooperation with the German Red Cross organization and two other charitable organizations as well as the Technical Development Service of the Federal Republic of Germany.

After an inital smooth operation of this field assignment difficulties did arise in the very moment that several organizations appeared on the scene without coordination. These problems could at last be solved when the physicians of the various organizations elected Dr Merkle of the Hamburg Tropical Institute as their spokesman and coordinator. Unfortunately, however, some of the organizations unfamiliar with conditions in tropical countries had sent unsuitable personnel, without any preparation, partly even without prior vaccination. Better consultation and coordination between the head offices in Germany, other international groups and the teams employed in the field would often have been highly desirable.

Aid services deployed in the field at times of catastrophes should be placed on an international basis, with precise agreement relating to the services of the various groups and teams, whilst the services of staff thoroughly familiar with the country concerned are also vital. The personnel sent out into the field should be thoroughly instructed and sufficiently protected by vaccinations and inoculations. Only in such manner can emergency and aid services of this type be efficient in times and areas of catastrophes.

F. Merkle : May I take the opportunity to give some short comments concerning the epidemiology of famine in Ethiopia. The main aim of our relief work was to go to the people with help and not to wait for the arrival of migrated people in the shelters along the road, where the slum situation created more problems than the famine itself. Free grain and milk distribution has, according to our opinion, been the main reason for the explosion

of migration rate. The German Relief Group started the work in November 1973 in the area of Affars or Adals a Nomadic tribe in the eastern lowlands of Wollo province. The Nomades had ruled few decades ago in vast areas of eastern and northern Africa. To-day they lead a precarious existence pushed away to the poorest regions. Only the number, not the quality of the cattle assign their reputation and their richness, a real danger for the scanty vegetation. To pay their breadstuffs they can only offer animal products and firewood. Milk and meat are the main contents of their poor alimentation. Very little is known about the prevalence of epidemic diseases. Regular treatment and epidemic surveillance are not any more existing than any form of education. The trial to force this proud people into settlements was a failure. So far as developing projects like irrigation and farming in the fruitful ancestral regions of the nomades had just started, they have created mostly dislodgment or upsetting instead of acclimatisation. Plantations along the Awash river have shown that the Afar people were pushed off from their safe pastures and ended up as seasonal workers in the slums at the gates of the big farms. With this picture in mind we can understand that these groups react sceptically when confronted with foreign influence. In the living space of Eastern Wollo the Ethiopian nomades can normally hope for an annual rainfall of 100 to 400 ml. Only the available water supply limits the quantity of herds and the number of persons. Epidemics like cholera therefore create in these groups more frequent and more lasting disasters than in the settled farmers of the highlands. In Wollo province invading Somalia-Nomades who practised on the weakness due to the famine of kindred neighbours has decimated once more the livestock. Concluding, the analysis of the disaster in this part of Ethiopia shows the following elements :

1. The man-made catastrophe is due to overgrasing, to goats and the abuse of firewood and also certain so-called developing projects.

2. The real natural disaster is caused by the draught and by epidemics like cholera, cattle plague and camel diseases.

3. Tribal hostilities and tribal induced disregard in relief measures.

Causes and consequences have been essentially different from this in the agriculture area. The far-reaching destruction of vegetation and epidemics has caused the death of nearly all cattle : 58 per cent of the Nomade people around our camp Chiffra died between 1971 to 1973. In this number are included the victims of a cholera-like epidemic which couldn't anamnestically be separated. The comparable numbers were for all the relief camps in the drought-afflicted farming area 33 per cent and in the highland 18 per cent. There was an extremely high mortality of the under-five group and of the over-sixty group in the lowlands. We found a lot of malnourished and marasmic children but protein deficiency oedema quite seldom, as opposed to the camps in the uplands, certainly interacted by the higher content of animal protein in the children's food.

Additional epidemiological findings have been the rareness or absolute absence of diseases caused by filaria, schistosoma, hookworms, strongy-

loides, amoeba and of yaws, leprosy, scabies and venereal diseases. The extremely high spleen index of surviving Affar people of 60 to 80 per cent according the system of Hackett cannot be satisfactorily explained by malaria. Leishmaniasis and brucellosis can be suspected as additional causes. Famine was only one sign of the total breakdown of the traditional way of life in the Ethiopian lowlands. It calls for special funds for rehabilitation for these people, if not they will be eradicated within a few years. In our relief camp we started to frame a medical and economic network of rehabilitation. The main aim was prevention by educating people to self-responsibility. One step was a food-for-work programm including health-station, school, kitchen and road construction. The next one was involvement in small farm irrigation projects always discussed beforehand with the responsible village elders. Besides the step by step settlement of the Nomades with self-responsible small agriculture programms.

In the medical field the following aims are pursued :

1. Epidemiological exploration.

2. Prevention of the settlement related diseases.

3. Last but not least instruction of young Afar people as front line health workers with their own tribesmen.