TRACHOMA AND SOME OTHER EYE DISEASES IN A LIBYAN VILLAGE.

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by

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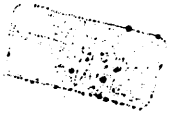
This thesis is dedicated

to

my wife Saddiga

and children

Anwar, Husam, Karim and Randa.



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SUMMARY

The population of a Libyan desert village (oasis) was examined for trachoma and other eye diseases in 1976 and in 1980 to assess the problem, study the pattern and assess the influence of socio - economic factors on the prevalence and intensity of the disease and its visually disabling lesions. Also to study the problem of blindness and its magnitude in such a community. A bacteriological study of the population was also undertaken for the first time in this country. Every member of this desert village (1000 people) was examined by the author and the visual acuity recorded. Each was assessed for trachoma and other eye conditions and a conjunctival smear from the upper palpebral conjunctiva was taken for Giemsa staining.

Every school child with active trachoma had a bacteriological swab taken from the conjunctivae to see if there is any association between trachoma and bacterial infections in this community. Those who did not have good vision were examined in detail to assess the cause of the poor vision. Ocular examination of the whole population was repeated in 1980 and compared with the findings of 1976 and the improved situation in 1980 were both noted.

It was found that Giemsa staining methods have possibly little value in areas of moderate to mild intensity of trachoma such as Marada. Newer methods will need to be assessed for field studies in such situations e.g. the "Rapid serological test". Socio-economics and environmental factors especially housing and water supply are important factors in trachoma control. Face washing is possibly the most important method of trachoma control and relies on health education for its success. It can also be applied to poor countries where

trachoma control is required. The incidence of blindness was totally different from census figures stressing the importance of either full surveys or randomised samples as the methods of choice for the recording of blindness. Cataracts and glaucoma are very important causes of blindness in trachoma endemic areas.

Some interesting points are raised and need to be looked at in detail in future studies in such areas:-

(a) Do some of the cicatrical scars disappear in time in areas where the disease is mild?

(b) What is the strong association between pterygium and trachoma?

(c) and most important what is the best method for the early detection of preventable blindness caused by chronic simple glaucoma in such a community.

INTRODUCTION

Trachoma and related infections of the eye continue to be the main cause of ocular disease in developing countries and, overall, these still constitute the largest single cause of blindness in the world (177). Trachoma has been endemic in many parts of the world especially in North Africa and the Middle East (52, 85). These diseases are estimated to affect 400 - 500 million people in the world, of whom approximately 2 million are blind. The elimination of this unnecessary blindness is justified not only on humanitarian grounds but also for its social and economic consequences.

B.R. Jones et al (1976) recommended that all countries that have or are suspected of having a blindness problem from communicable ophthalmia, need urgently to carry out a survey of suspected communities. It is essential that the full range of the population be surveyed by means of a valid random sample. Thus all ages must be surveyed for corneal blindness, potentially blinding trachoma deformities of the lids and for severe grades of intensity of upper tarsal conjunctival inflammation. He further added that these surveys are the key to effective action but it is necessary to clarify the inter-relations of trachoma; the classical chronic ophthalmia of chlamydia causation and mucopurulent conjunctivitis (MPC). He focussed attention on the urgent need for services in many countries to determine the presence and magnitude of blinding trachoma (83, 85).

The reporting of eye disorders should be based on the Ninth Revision of International Classification, which offers the advantage of uniform data recording that can be performed to the degree of specificity required while permitting the combination of specific categories

into a broader classification.

The need for laboratory work in field studies of hyperendemic trachoma and in the assessment of control measures arises from the fact that these tests can provide sensitive and objective measurements of the prevalence and nature of both active and past chlamydial infections and of the persistence, eradication or resurgence of the reservoir of infection (42, 80, 134).

PRESENT STUDY

The present study in Marada village in the south of Libya, therefore, was a step in this direction, as no survey had ever been done in the village. It was the first time that the total population of a desert rural area was studied in Libya. In Marada, local school records showed that intermittent blanket treatment of the school children was carried out during 1970 - 1974 under the National Trachoma Control Campaign (107). The present survey provided an opportunity to evaluate the effect of the Trachoma Control Campaign in reducing the risk of infection in the community. As the community was undergoing rapid improvements in socio-economic and environmental conditions, it was also possible to study the influence of these changes on trachoma endemicity. The initial survey in 1976 included a study of eye diseases with special reference to trachoma and its sequelae and laboratory investigations including bacteriological and Giemsa's staining for inclusion bodies. This was followed in 1980 by a survey to study the change, if any, in trachoma pattern during this period.

Basically the objectives of the study were the following:

1. To study the trachoma pattern and its visual disabling lesions in a rural desert endemic area.
2. To compare the problem of trachoma and its visual threatening sequelae in 1976 and 1980 i.e., the change in trachoma over 4 years and 8 months.
3. To study the influence of socio-economic development and environmental factors like housing, water supply, sanitation etc. on the prevalence and intensity of the disease in such a community.
4. To define the pattern of other ocular pathology and the relative position of trachoma in that pattern and to see if there were any changes in this pattern over the four year period.
5. To study the problem of blindness, its magnitude and conditions associated with blindness.
6. To study the bacteriological associations with trachoma cases.
7. To assess the usefulness of Giemsa's staining of conjunctival smears as a method of field diagnosis of the disease which has been applied in other areas of the world but never tested in Libya.

1.1 HISTORICAL REVIEW

Trachoma is one of the most ancient of all diseases. Our knowledge of trachoma extends back into the earliest medical writing five thousand years ago. It was clearly recognised and described in Egypt fifteen centuries before Christ (52, 64). Egyptians were already experienced in its treatment and developed a forcep for its management. Heliodorus of Alexandria worte a book on trachoma in the second century B.C. The well known and widely used classification of trachoma into four stages by MacCallan takes its origin from the descriptions of four stages by Aetius and Amida in A.D. 550 and is based on the naked eye description of conjunctival disease (175). In the 27th century B.C. trichiasis was treated in China. Medieval Greek and Arab surgeons wrote about the disease and its treatment, and it was considered in lectures ascribed to Mannan Ibn Ishaque who lived between 809 A.D. to 893 A.D. (69).

There is evidence that trachoma was transported from its natural home in the Middle East particularly Egypt, from time to time by travellers to be disseminated in other lands (52). The disease was not brought to the attention of European surgeons until practically the entire French Army of 32,000 and to a less extent the British, fell victims to it during the Napoleonic campaign in Egypt in 1798 - 1799 and a large number of soldiers were sent home blind. Its introduction to Europe dates from that time.

In the early part of the 19th century innumerable descriptions of the natural history of the disease existed. Various views were put forward by Vetch in 1807, Mackenzie in 1830 and Saemisch in

1876 to explain its pathology. Rachlmann in 1883, Mandelstamm in 1883, Rhein in 1885 and Elsching in 1925 maintained that follicles were pathognomic of trachoma, while Saemisch in 1879 and Sattler in 1881, Schmidt-Rimples in 1890 advocated a dualistic view of follicular conjunctivitis as a separate entity. Thereafter bacterial, rickettsial and viral causes received adherence by the findings of organisms by Hirchberg and Krause in 1881, Sattler in 1881, Koch in 1883 and others (52, 72).

The next major chapter in the development of our knowledge of trachoma concerns itself with the inclusions discovered by Halberstaedler and Prowazek in 1907, a chapter culminating in the successful growth of the causal "virus" by T'ang and his colleagues in 1957 in Peking and the subsequent verification of their conclusions in many countries of the world by various workers; Collier et al in 1958 - 1960, Furness et al in 1960, Gordon et al and Armstrong et al in 1963. The importance of trachoma as the world's foremost cause of blindness has been recognised repeatedly through modern history. The number of areas of the world in which trachoma is endemic has, however, diminished considerably since World War II and while the disease remains of enormous importance in the Middle East, North Africa and North India, its total world wide impact has been much reduced (64, 148).

DEVELOPMENTS IN LABORATORY DIAGNOSIS OF TRACHOMA

The Giemsa stain was first used to demonstrate the causative agent of trachoma by Halberstaedler and Von Prowazaki in 1907, who found inclusion bodies in conjunctival scrapings from an experimentally

infected orangutan. Iodine staining has been used by some investigators; Dawson and Schachter in 1967, Sowa Collier and Sowa in 1971. Fluorescent antibody (FA) staining methods have been shown to be very sensitive, but are essentially research tools requiring experienced investigators and do not allow detailed cytological analysis of slides (134, 137). Isolation methods to detect the trachoma agent by either egg isolation or tissue cultures are performed in some specialised laboratories (70, 80, 134, 135, 136).

Such developments in the laboratory diagnosis of trachoma made it possible to confirm the clinical diagnosis in a substantial number of cases and to demonstrate the presence of active disease. A wider application of these methods would introduce an objective and quantifiable element into diagnosis and epidemiological studies: in order to be able to compare results, however, a certain degree of uniformity of method was considered essential by the W.H.O. through expert committees, scientific groups, symposia and seminars.

The twenty second World Health Assembly in 1969 adopted a resolution (179) "requesting the Director General to undertake a study on the information which is at present available on the extent and all the causes of preventable and curable blindness".

Trachoma control activities assisted by W.H.O. and UNICEF have contributed significantly to the reduction of complications leading to loss of vision (4) but much remains to be done in many countries as was stressed in a number of resolutions, e.g. the twenty fifth World Health Assembly and the twenty eighth in 1975 (177).

"Encouraging countries to develop their own programmes for the prevention of blindness, especially blindness due to trachoma being the most readily preventable cause of blindness in the world" (42, 85, 86, 151, 155).

1.2 TRACHOMA WORLD SITUATION (excluding North Africa & Libya)

Trachoma has a worldwide distribution. At present trachoma is estimated to affect approximately 500 million people, most of them in the rural communities of the "developing world", especially of the tropical and sub-tropical zones. There are at least 2 million people blind from trachoma and a much larger number has suffered partial loss of vision (42).

A report from the 1962 WHO European Conference on Trachoma states "In countries where virtually whole populations are affected with trachoma and seasonal conjunctivitis, it is not uncommon to find more than 1% of adults are totally blind, and more than 4% are economically blind (i.e., unable to perform any useful work for which sight is essential), more than 10% have serious impairment of vision and a much higher percentage have serious visual defects. With each successive age group the incidence of visual loss increases" (180, 182).

In 1936 MacCallan divided the world into four groups according to trachoma prevalences: Universal, Very Common, Occasional with heavy local infections and Rare. He observed 'Trachoma is a rare disease in England, Scotland, Norway, Sweden, Denmark, Iceland, Switzerland and New Zealand whereas in countries like Egypt, Iraq and Palestine it is universally distributed' (101).

Trachoma infestation in some of the countries was as follows: 75% in India, 65% in Siam, 50% in China, 50% in Malaya and Poland, 45% in Hungary, 30% in Japan, Italy, Argentina, Brazil and Central America, 25% in Mexico and West Africa, 21% in Russia, 20% in Greece and 3% in the United States (90).

By the early sixties the disease was endemic in many parts of the world, particularly Eastern and Central Europe, the Middle East, Central and Eastern Asia (Persia, India, China and Japan), Indonesia and large areas of South America. In England it was a rare disease essentially confined to aliens. However, intensive trachoma campaigns, the efficacy of antibiotic treatment in controlling the active stages of the disease, improved hygienic and medical services in many countries and better living standards have outdated the earlier estimates and infection is progressively less serious in most countries (52, 64, 175).

According to Ida Mann in 1966 the world situation of trachoma was as follows (100):

Absent or old cases only:

Cocos Islands, Eskimos, Ireland, Norway, Sweden, Denmark, Holland, Venezuelan Indians, Amazon tribes and England.

Practically Absent or Rapidly Disappearing:

Marshall Bennet Islands, New Guinea, Hawaii, South Africa (white population), Borneo Aborigines, Sumatra, Thailand, Roumania, U.S.A., Mexico, Brazil, Argentina, Ireland, Ceylon, France, Germany, Iran and Maoris.

Especially Widespread:

Egypt and near-east, North Africa, India, Australian Aboriginals, Ports of New Guinea and South Pacific, Malta, North American Indians, South Italy, Aden (Arabia), Cambodia, Yugoslavia, parts of Japan, Taiwan, Jordan and Palestine.

Being Reintroduced by Migration:

Holland, England, France and White Australia.

In the late seventies trachoma was a major public health problem in various parts of a geographic area extending from North Africa and the Sub Saharan region, through the Middle East to the Indian sub-continent and South East Asia. Pockets also exist in Australia, Pacific Island and Latin America (42, 178).

There are marked variations in prevalance and the clinico-epidemiological picture of trachoma found in populations of different backgrounds living in different climatic and socio-economic conditions with differing personal hygienic and sanitary conditions. The variations in the figures are doubtlessly related to these factors. However, population based studies to determine the precise incidence in the community and factors involved in the transmission or exacerbation of the disease have helped in better understanding of the pattern of trachoma in many parts of the world. A brief account of these studies is given in the following pages.

Communicable eye diseases, notably trachoma and the acute ophthalmias are endemic in the Eastern Mediterranean Region, where these alone have been the major cause of total or partial loss of vision. Trachoma is known to be endemic in many countries in the Eastern Mediterranean Region and it has been estimated that 150 - 200 million inhabitants of the area are affected (103). A W.H.O. epidemiological survey in the Arabian Peninsula showed that the prevalence of trachoma in school

children in Kuwait in 1961 was 68%. In Yemen in 1972 trachoma in all stages was found in an average of 75% of school children in all areas while in the Democratic Yemen in 968, the prevalence rate of all stages ranged from 8% among primary school children in Aden to 86% among primary school children in rural areas. In Iraq a morbidity survey conducted in 1961 also showed a widespread prevalence of trachoma among school children - 54% in the urban and 65% in the rural areas (178).

Trachoma is endemic in Saudi Arabia. Nichols et al (1961) showed a prevalence rate in pre-school children in the Eastern province in excess of 90% in villages and 70% in towns (115). Bobb et al (1969) examined 436 school children in three villages. Trachoma was holoendemic in all three villages; 96% of the entire population and 93% of townside dwellers showed signs of disease (21). In 1980 Nichols et al reported that in Al Mallahan, an oasis village in Qatifi Eastern Province, 386 of 406 people had trachoma, a prevalence of 96% (118). Tabbara and Bobb (1980) found that 579 Saudi Arabian patients examined in the eye clinic of Dharan Health Centre, 77% showed clinical evidence of trachoma (147). Ihsan and Qureshi (1982) in a survey on 766 primary school boys in Al-Majmah in the winter of 1979 observed Trachoma I (94%), Trachoma II (77%), Trachoma III (16%) and Trachoma IV (3%). A survey of Al Asiah area of Qasim showed the prevalence of Trachoma I (89%), Trachoma II (73%), Trachoma III (45%) and Trachoma IV (44%) (75).

A study of 676 cases of blindness in Syria observed from 1886 to 1973 showed that glaucoma was the main cause of blindness in 48% of the cases

followed by external eye infections with a rate of 29%. Trachoma was responsible for 1% of the cases of blindness (77).

Trachoma is one of the most important communicable diseases in Turkey. In 1925 there existed about 3 million people affected with trachoma. Trachoma Control in Turkey started in 1925. Since then, Trachoma Control has become more and more extensive. Though trachoma is in the process of eradication, it remains an important problem in some areas of Turkey. Out of 1,508,578 people examined in 1972 there were 32,241 new cases of trachoma and 43,145 people with healed trachoma giving a prevalence rate of 2%. This rate came down to 1.50% in 1973 and in 1974 out of 1,921,415 people examined there were 31,249 new cases and 35,571 healed cases of trachoma giving a prevalence of 1.50% (138).

Trachoma is common in South Africa, particularly among the indigenous tribes of the Northern and North Western areas of Transversal, where it represents the largest single cause of preventable blindness (145, 146). In this area clinical manifestations are severe and include much scarring of the cornea, trichiasis and entropion. Trachoma moreover is the most frequent cause of blindness. Late sequelae are rarely seen in the urban population of Johannesburg and Durban, but recent studies have revealed that infection with chlamydia is not uncommon (56).

A five year study of 289 healthy school children was undertaken in South Africa in 1975. Follicles and papillae were found on the upper tarsal conjunctiva of 69% and TRIC agent was cultured in 50 (17%) boys. The TRIC agent was cultured from 9 cases with normal tarsal conjunctiva and this silent infection state was confirmed by

two independent laboratories. The prevalence of trachoma was studied in a representative sample of family units from a rural South African community. Evidence of current or previous infection was found in 82% of the total population and 25% of the population had intense upper tarsal disease. It was found that most children acquire the disease within the first 3 years of life. The prevalence of active disease and particularly blinding sequelae were higher in elderly females than in males of the same age (10). A recent survey in the Bungeni area of North Western Gazakulu in the Northern Transversal indicated that trachoma was holoendemic but that only 25% of the population could be considered as having intense upper tarsal disease.(45).

A trachoma prevalence survey was conducted in 1960 - 1961 by Assad et al in Taiwan. It was found that prior to the introduction of a large scale treatment campaign active and total trachoma prevalence were 21% and 49% respectively. The study indicated that the risk of infection is not related to household size, but to overall endemicity in the community. The higher the endemiicity the less is the chance of a household escaping infection. The study also demonstrates the interaction between socio-economic development of the household members and trachoma infection among its members (4, 5, 6, 7).

In a study published in 1978 by Tung Aung Kyan et al, conducted in a rural community in Burma, trachoma was identified as the single most important cause of blindness in Central Burma during the initial survey (1968 - 1972). Prevalence of active and healed trachoma observed was 45% and 43% respectively giving rise to a total trachoma

prevalence of 88%. In a follow up survey (1970 - 1974) active trachoma was reduced to 17% while healed trachoma increased to 73% resulting in an increase in total trachoma to 90%. These results were attributed to a trachoma control programme (164).

Ophthalmic surveys in the 14 areas of the Territory of Papua New Guinea showed wide variations in the incidence, clinical manifestations, severity of trachoma and other diseases. The incidence of trachoma varied from 9% to 86% (166). In Marshall Bennett Island the incidence was 9% in Balnan and in Pak Island it was 76% in Lorengau the incidence was 35%. In 1977 Scott et al did an ophthalmic survey in Peri, a New Guinean village with a population of about 375. They found a total incidence of trachoma 4%; 6% among females and 3% in males. No active trachoma was found among the adults. 37% of the older people in the village had senile cataracts, only 2 cases of myopia were found (71).

Examination of some 6,000 Navajo children in their schools in the Shirprook New Mexico area between 1975 - 1977 yielded an overall prevalence of trachoma of 2%. The prevalence was highest for high school pupils (4%) and lowest for pre-school children (2%) (97).

The Royal Australian College of Ophthalmologists (1980) has reported an enormous programme to determine the state of ocular health, especially with respect to trachoma in rural Australians and to provide an immediate treatment where necessary. A total of over 100,000 people were seen including 62,000 Aborigines. Nearly half the Aboriginal population screened had trachoma, a higher proportion than has been reported for many third world countries. In the Northern Territory and Western Australia in particular, the figure was 80%.

Up to 26% of Aborigines over 60 years in arid regions were blind, and the average blindness rate among those seen was 8 times higher in Aborigines that in Non-Aborigines. (130).

A study in Bendel State of Nigeria in 1978 based on 33,634 new ophthalmic patients seen at the eye clinic of the specialist hospital in Benin City revealed a trachoma incidence of 0.45 per 1000 of the population. The incidence of other eye conditions observed were: acute conjunctivitis 105.5, ophthalmia neonatorum 4.6, pterygium 19.86, chronic conjunctivitis 0.45, allergic conjunctivitis 4.94 and keratitis 10.04 (all per 1000 of the population) (8). In the Gambia, Sowa et al found trachoma in over 91% of children of 5 - 9 years old in their first survey (141).

A small survey was carried out in Ethiopia in 1974. Out of 835 new patients seen at clinics held in three remote areas in Wollo Province, 616 had trachoma. The prevalence and grades of trachoma increased with age (36).

Trachoma has been known in Bosnia in Yugoslavia since 1914. In addition to trachoma, various other forms of infectious conjunctivitis existed. In 1946 an organised campaign against trachoma in an endemic trachoma region with a prevalence of 5% resulted in a regression to 0.04%. The sudden fall in new cases reflects a change in the nature of the disease in this territory. However, the improvement in general socio-economic conditions is not sufficient to cause disappearance of trachoma. In P.R. area during the period 1966 - 1968 the number of stage I - III cases was between 0.46 and 0.67 to be progressively reduced and in 1976 - 1977 was only 0.007%. A programme of measures

has been conceived such as detection, treatment, epidemiological studies and health education which will be followed for a period of six years (19).

The epidemiology of trachoma eye infections is of two types. In endemic areas trachoma is common and it is transmitted eye to eye. In non-endemic areas trachoma occurs as a sporadic eye disease dependent on genital tract to eye transmission (64).

In the early 1960s Jones and co-workers in England reopened interest in the chlamydial infections of the genital tract now known in England and United States to be more common than gonococcal infections. Recent research has established its role in urethritis, epidedymitis, cervicitis, pneumonitis and endocarditis. Studies confirmed that neonates may be infected in multiple sites including the conjunctiva, middle ears, lungs, vagina and rectum. Prospective studies suggest that from 5% to 13% of pregnant women in an urban setting are infected with C. trachomatis; of infants born to infected women 40% to 50% will acquire a conjunctivitis. Thus 2% to 6% of all new borns may acquire this infection (78). The role of chlamydiae in neonatal disease of the eye and respiratory tract has been established by several authors (11, 137).

It is becoming increasingly well recognised that chlamydia trachomatis organisms are common causes of infections in the United States and other Western countries. These organisms are the major cause of non-gonococcal urethritis in men. Venereal infection in women is also common but the clinical syndromes are less well defined. Birth canal

infection of the new born have also been recognised. These infections may result in the well known syndromes, inclusion conjunctivitis of the new born or the recently described pneumonitis syndrome. Antibody studies in a general population group have also suggested that C. trachomatis infection is frequent (137). At the same time that the widespread nature of C. trachomatis infection is becoming clear, the eye disease trachoma, is receding worldwide. While trachoma remains an important and sometimes devastating disease in areas of North Africa and the Middle East it has virtually disappeared from many formerly endemic areas in association with improved socio-economic and hygienic conditions. Trachoma was diagnosed in 14 Danish patients with its onset in childhood. The source of the initial eye infection was thought to be the birth canal and the infectious reservoir is their mothers' genital tract (111). Malaty et al (1980) state that even in trachoma hyperendemic areas extra-ocular chlamydial infections occur and may be responsible for failures in trachoma therapy and also for diarrhoeas and other infections in children (105).

1.3 TRACHOMA IN NORTH AFRICA (excluding Libya)

In many North African countries more than nine tenths of the indigenous rural population become infected with trachoma in the first year of life (180). In North Africa the prevalence of trachoma is very high and the proportions of totally blind adults in desert communities is often as high as 1 to 2%, while as many as 4 to 8% might be 'economically blind'. Ida Mann (1966) classified trachoma as an especially widespread disease in North Africa (100). There are marked variations in the prevalence of trachoma in different populations as will be apparent from the following brief account of various studies carried out in this area.

In Morocco, as in other countries in North Africa and in the Middle East, trachoma has been endemic for many years. Sakon and Accort (1938) claimed an almost constant prevalence of trachoma of 100%, in 1938 in Tafilaet; (1949) reported a prevalence between 50% and 100%. Decour (1955) mentioned 3% trichiasis in the Pre-Sahara area. Survey of the blind carried out in 1953 by Jung (1960), with the aid of civil authorities, showed that 27,879 out of 7,442,110 estimated inhabitants of the country were blind; that is 3.75 persons per 1,000. Slightly higher rates were found in the South and the figures were thought to be an underestimate of the position. In 1952 practically all of the people were infected with trachoma in the first month of life and every year all were affected by bacterial conjunctivitis. A trachoma survey in 4 homogenous zones, each consisting of 100,000 inhabitants revealed

that trachoma was found to be almost universal in all 4 zones. Everywhere the disease was acquired very early in life and its prevalence increased very rapidly with age. Before they were 1 year old 50% were already infected and 95% were infected in the 1 - 4 year age groups. These proportions were reached somewhat sooner in females than in males (94).

A study by Dawson et al (1976) to quantify the prevalence of trachoma and its sight threatening sequelae was carried out in two villages in Tunisia, where trachoma was endemic. The pattern of active inflammatory trachoma and visual disability in these two Tunisian villages was probably typical of other underdeveloped areas where the disease is still endemic. In El Goloa village 75% of the children developed trachoma of severe or moderate intensity between birth and 9 years of age and of these two thirds developed potentially disabling lesions. 7% and 14% of adults respectively had visual acuity of 20/400 or less. Economic development in one village was associated with a decline in active infectious disease. In the second village whose traditional economy was unchanged, there was the same prevalence of active disease over a three year period (39, 40).

An epidemiological study of trachoma in Mauritania revealed an overall trachoma index of 36%. The disease was denign and the trichiasis rate was 7%. Study of the geographic distribution revealed the importance of climatic and socio-economic factors. The general trachoma index of coastal or river regions is only

20% whilst that of the desert area rises to more than 80% (139).

In Algeria a trachoma control campaign started in 1962. Trachoma prevalence in the region has regressed from 91% in 1962 to 30% in 1972 (103).

Anepidemiological study in Sudan (1975) revealed the highest morbidity rate of 83% in the Northern Province, followed by Khartoum province 67% and Blue Nile province 23%. The three Southern provinces, Upper Nile, Equatoria and Bahr El Gazal had the lowest incidence of 3.0, 0.94 and 0.23 per cent respectively. There was a marked difference between the prevalence of trachoma in towns and villages, 71% for age 1 - 4 years in villages and 52% for the same age group in the towns. This is probably due to better standards of living and hygiene in towns. The factors which they observed to be associated with a high prevalence in Northern Sudan' are (133):

(a) Mechanical trauma caused by frequent sand storms.
(b) Irritation of the eyes by dust particles.
(c) Poor personal hygiene and the habit of frequent hand shaking.
(d) Associated bacterial conjunctivitis and presence of eye seeking flies.

In Egypt out of 10,320 patients examined, as many as 99% showed signs of active trachoma or cured trachoma. The infective stage of Trachoma I and II was found in 42% of the school children. In a survey carried

out in 1950 - 1959 in Egypt prevalence of active trachoma and total trachoma was observed to be 65% - 81% and 97% respectively in the adult population and 97% in the child population (86). Hegazy found total trachoma in 48% of a group of primary school children in 1971 (112).

1.4 MICROBIOLOGY

Trachoma, inclusion conjunctivitis and lymphogranuloma venereum (LGV) have long been recognised as important human diseases. They are caused by an intracellular micro-organism that is inclusion-forming. These diseases plus urethritis, a syndrome of multiple aetiology with the closely related psittacosis and ornithosis that have been referred to by a variety of names in the past, are now called: Chlamydia. Two species are recognised (122). Chlamydia psittaci includes the agents of psittacosis and ornithosis and most of the animal pathogens; Chlamydia trachomatis includes the primary human pathogens, plus the agent of mouse pneumonitis.

The chlamydiae were formerly considered to be viruses, however it has been shown that they have a bacterial-like cell wall and that they multiply by binary fission. The organisms contain both DNA and RNA but are unable to sustain growth outside an animal cell. They are susceptible to many antibiotics. Therefore, they represent a unique intermediate group of micro-organisms whose obligate intracellular growth and sensitivity to physical inactivation are more like those of viruses, while in their chemistry and immunology they are more like bacteria (113, 124).

C. trachomatis is distinguished from C. psittaci in the formation by the former of compact, rigid wall inclusions that contain glycogen and are stained by iodine (57). C. psittaci inclusions are diffuse and are not stained by iodine. They would not compress the nucleus but grow around it. In addition, C. trachomatis is much more sensitive to sulfonamides than is C. psittaci.

Growth. Psittacosis and Lymphogranuloma Venereum (LGV) agents have been grown in the yolk sac of the embryonated chicken egg since the 1930s. Many efforts over the years to grow trachoma organisms failed. The trachoma agent was first cultivated successfully in Peking in 1957, when it was shown that streptomycin, but not penicillin could be used to control contamination (149). This finding opened the opportunity for laboratory investigations with these organisms. More recently, two technical developments have been instrumental in the rapid advancement of knowledge of trachoma and LGV: cell culture techniques for the isolation and growth of trachoma organisms (58) and a microimmunofluorescence technique for the demonstration of antigen and antibody with trachoma LGV organisms (167).

While the psittacosis and LGV agents grow readily in a variety of cell cultures, the trachoma agents do not. The late Francis Gordon was the first to isolate these organisms in cell culture by two special techniques. He irradiated McCoy cells and then centrifuged the inoculum on to the cell sheet (57, 58). Irradiated McCoy cells have been most widely used for isolation of trachoma organisms from the genital tract. Wentworth and Alexander have shown that 5-iodo-2-deoxyuridine can be used for treatment of McCoy cells in the place of X irradiation (172), thus simplifying the technique for general use.

IMMUNOLOGY

Group Antigen. All of the chlamydiae (C. trachomatis and C. psittaci, animal and human strains alike) have the same complement-fixing antigen.

The CF test measures antibodies to chlamydia group antigen, and it apparently makes little difference if the antigen is prepared from C. psittaci or trachomatis strains (14, 167). Thus, an elevated CF titre in a patient's serum indicates that he had infection with one of the Chlamydia group in the past, but does not distinguish which of the Chlamydia was responsible. As in virus diseases, an increase in serum CF titre in specimens taken the first week of an illness and one taken after the second or third week is strong presumptive evidence that the illness was due to one of the Chlamydiae. Since chlamydiae infections may have an insidious onset and are usually chronic, serum is usually obtained late in the course of the illness. Elevated CF tests occur in only 4% of the normal population, however, so a raised titre is suggestive of chlamydia infection. Depending on the laboratory, the minimum dilution considered to be "positive" is 1:8 or 1:16 (64). In adults with inclusion conjunctivitis positive serum CF titres range from 1:16 to 1:64, but in patients with LGV, CF titres are frequently more than 1:64 (64).

The CF test is also used to identify newly isolated strains as chlamydia. Antigen prepared from the unknown isolate is tested against standard serum (14). A positive test identifies the isolate as a member of the chlamydia group. The development of the MIF test has been a critical step in elucidating the immunology of the C. trachomatis infections (66, 92, 93, 163). The type-specific antigens of trachoma-LGV organisms are easily destroyed by purification efforts.

Delayed hypersensitivity

The presence of delayed hypersensitivity to chlamydial infections has

been demonstrated by the Frei skin test. Its sensitivity in patients with LGV has varied from 36% to 95% (1, 64). Satisfactory skin reactions in patients with ocular trachoma have not been demonstrated.

Vaccine

Various experimental efforts in the past to immunize against chlamydia infections, especially psittacosis, have been disappointing. While it has been possible to modify the course of experimental trachoma (60) and to prevent trachoma infection in the monkey model (61) and for one to two years in human field trials (62, 63, 64) the difficulty and expense of preparing high-titre purified antigen and the limited period of protection have suggested that current techniques of vaccins production will not provide a practical method for the control of trachoma (50, 65, 115).

Microimmunofluorescence test

The second major technical breakthrough referred to above was the development of a practical, sensitive and specific test for trachoma-LGV antigens and antibody (168, 169). Other workers had employed immunofluorescence with chlamydia (66) and McComb and Bell had succeeded in demonstrating some specificity (14). In the microimmunofluorescence test the antigens are egg yolk sac-grown organisms, which provides the highest concentration of elementary bodies. Using an old fashioned pen point, dots of as many as 15 different antigens can be placed in order close together, so that a single drop of serum can cover the antigens. By use of a template, a series of nine groups of antigens can be placed on a single microscope slide. After the antigen is fixed, drops of appropriate dilutions of human sera are added for study of antibody, or prototype mouse antisera are added for immunotyping of newly isolated strains. Fluorescein-conjugated antibody to human or mouse immunoglobulins and counterstain

drops are then overlaid and ultraviolet fluorescent microscopy is used for detection of antigen-antibody reaction. The specificity of the test is enhanced by its permitting observations, under the same serum drop, of the reaction of all the antigens to a given dilution.

Immunotypes

The microimmunofluorescence test quickly replaced the cumbersome mouse-toxicity prevention test for immunotyping trachoma strains and allowed immunotyping of LGV organisms for the first time (167). Using the test described, 15 separate immunotypes of trachoma-LGV organisms are described. They are lettered A to L with L1, L2 and L3 being the 3 LGV types. A complicated set of immunological interrelationships exists among these types (93).

In addition to the successful use of the microimmuno-fluorescence test for measurement of human serum antibodies (53, 125, 168, 67, 169, 170), the test has been highly effective in measurement of antibodies in eye secretions or tears (67, 106).

It has been recognised for some time that trachoma immunotypes A, B and C are the predominant types found in the eye in populations with endemic trachoma. Type A has been found almost exclusively in the Middle East and North Africa, whereas Types B and C have been found throughout the world. Ba strains have been the type most frequently isolated from cases of trachoma in American Indians, a population with endemic trachoma.

The genital strains have been isolated from both trachoma-endemic and non-endemic countries. In both areas, type E and type D have been

by far the most frequently found. The D and F types have been the next most frequent. These typed isolates represent only special segments of the total infections with trachoma organisms.

The ocular strains from non-endemic countries showed a distribution of immunotypes similar to that of the genital isolates. This was true if the eye disease involved was trachoma, inclusion conjunctivitis of the new born, or an intermediate syndrome (64).

While trachoma is always associated with chlamydia infection, the pathogenesis of the disease is still poorly understood. The chlamydial agent itself grows only in the epithelial cells (59). It has been proposed that the lymphoid response in the subconjunctival tissue and the scar formation are manifestations of disease produced by the host's immune response to chlamydial antigen that filters down from the epithelium. There is abundant evidence that antibody to the infecting chlamydia strain is present in the patient's serum and less frequently in tears (47, 48, 66, 163). Moreover, in humans and animals immunized with trachoma agent, there is also a cellular immune response. Another supportive piece of evidence that trachoma is an immune-mediated disease is the occurrence of "pseudo" trachoma with conjunctival follicles and scarring, and corneal vascularisation as a response to exogenously administered (and presumably antigenic) material; this occurs most frequently as a response to idoxuridine, atropine, eserine, other eye medications and molluscum contagiosum lesions of the lid that spill non-replicating viral protein into the conjunctiva (122). Jones has shown that the conjunctival follicles in such patients were probably producing antibody to the inciting

antigen (56, 83, 85). It has also been observed that the greater the degree of lymphoid follicle hyperplasia and inflammatory response in chronic trachoma, the greater the amount of trachoma agent in the conjunctiva (64, 172).

EPIDEMIOLOGY

The epidemiology of trachoma eye infections is of two types. In endemic areas trachoma is common, and it is transmitted eye to eye. In nonendemic areas trachoma occurs as a sporadic eye disease dependent on genital tract-to-eye transmission.

The name trachoma has been applied to chronic follicular conjunctivitis with pannus formation and typical conjunctival scarring. In countries where trachoma is endemic, follicular conjunctivitis without pannus, in which the follicles are of the trachomatous type (soft or necrotic), is usually diagnosed as trachoma. Although eye disease completely typical of trachoma may occur in non-endemic countries, unless the patient has come from a trachoma-endemic country, the diagnosis often is not made or even considered.

The types of eye diseases subsequent to transmission of trachoma organisms from the genital trace include conjunctivitis where the eye is infected in the birth canal; adult inclusion conjunctivitis with follicles and, sometimes, corneal opacities (78, 160) and the classical trachoma disease (79, 81, 82). Both neonatal and adult inclusion conjunctivitis are diagnosed muqh less frequently in trachoma-endemic countries than in non-endemic countries (64, 83, 111, 159).

Genital tract-to-genital tract transmission of trachoma organisms is worldwide. Our knowledge of the diseases caused by genital trace infections with these organisms is in an early stage of development, and it is not yet clear whether the epidemiologic pattern of genital trace disease is different in trachoma-endemic countries from that in non-endemic countries (161).

1.5 TREATMENT OF TRACHOMA

1.5.1 HISTORY OF TREATMENT

The history of trachoma therapy dates from 1500 B.C. when the use of copper salt was recorded on Ebers papyrus. A short review of what has been tried will illustrate the slow evolution of therapy in the past, and the progress accomplished since the introduction of sulfonamides and of antibiotics (154).

1.5.2 TREATMENTS USED IN THE PAST

Medical Treatment. The substance most commonly used for local treatment of trachoma, until the introduction of sulfonamides and antibiotics, was copper sulphate, already used by ancient Egyptians and Greeks and still occasionally used today, either as such, in sticks, or as 1 to 5% aqueous solution with or without glycerine or as an ointment. Other copper salts have also been utilised, such as acetate, citrate and albuminate. Silver nitrate and other silver salts were also used, with less satisfactory results, as 1 or 2% solutions. Also mercury sublimate and cyanide have been used, the first for local application as 1 : 5000 or 1 : 10,000 solution, the second in sub-conjunctival injections as a 1 : 5,000 solution.

Among other substances used were chalmoogra oil for local applications, phenol 0.5% by itself or associated with copper sulphate as eye drops or subconjunctival infections as such or with mercury, cyanide and several other substances such as salts of zinc, iron, iodine and arsenic.

1.5.3 SURGICAL OR MECHANICAL TREATMENT

Expression of follicles. This method was used in the most remote times and it is still sometimes applied. It used to be done without instruments simply by passing the finger-nail on the everted lid. Several instruments were subsequently designed for this purpose, such as the roller forceps of Knapps and the expression forceps of Kuhn.

Massage and Brossage. These methods were also used in the past, by rubbing the conjunctiva with cotton or other fibres impregnated with different substances supposed to have, by themselves, a therapeutic effect. The ancient Egyptians and Greeks used hanks of raw wool, the underside of fig leaves or the beards of corn ears, the skin of fish or of other animals.

Abadie and Darier reintroduced brossage at the end of the 19th century and developed various types of brushes, which were impregnated with different liquids or powders.

Curettage. Utilised for several centuries, it was done with a curette or metal spatula, expressing the follicles while massaging the conjunctiva. This procedure was repeated at various intervals, for a few months at least, and the medical treatment then in use was applied.

1.5.4 MEDICAMENTS USED AT PRESENT

Treatment of trachoma is essentially based today on the use of sulfonamides and of antibiotics. Both have an inhibitory effect

on the trachoma agent in the laboratory and a beneficial influence on the course of the disease.

The response of the disease to these substances, accompanied by specific changes in the appearance of the inclusion bodies, was already demonstrated before the trachoma agent could be cultivated and enabled, together with the morphology of the inclusions and the antigenic relationship shown by cross reactivity in complement fixation tests, the recognition of a close relationship between the agent of trachoma and the agent of lymphogranuloma venereum and of psittacosis and ornithosis.

The action of sulfonamides and of antibiotics on the disease has been attributed totally or in part to their effect on the associated bacterial flora. This cannot be excluded and it may play an important role in itself. From a practical point of view, this represents an additional indication for the use of these substances in the treatment of the disease, regardless of their mechanism of action. However, it should also be emphasised that a close correlation exists between susceptibility of the trachoma agent in the laboratory and the results obtained in the treatment of the naturally occurring disease. Furthermore, the mechanism of action of both sulfonamides and antibiotics and the structure and metabolism of the trachoma agent are today sufficiently known to admit that the effect of sulfonamides and antibiotics on the disease are in great part at least caused by their specific action on the agent.

Other forms of physical therapy e.g. cautery, diathermy, radiation and cryotherapy have been tried by different workers in the past and

so has protein therapy and steroid therapy.

From the point of view of their effect, antibiotics used in the treatment of trachoma can be considered as essentially bactericidal (Penicillins and aminoglycosides), bacteriostatic (tetracyclincs, macrolides, chloramphenicol and novobiocine), or both bactericidal and bacteriotatic (rifamycins and peoptides).

1.5.5 TREATMENT OF TRACHOMA IN INDIVIDUAL CASES

In the past forty years sulfonamides and antibiotics have been added to the great number of substances and methods which were previously used and which gave results only after prolonged and at time, painful treatment.

In the treatment of individual cases, the principles to be followed must be flexible enough to be adapted to differences in the clinical aspect, to the duration of the disease and to other conditions which may be present (42, 150).

Two main principles should be respected:-

(1) Improve the general condition of the patient and, if necessary, treat general or local affections which may be associated. From a general point of view, trachoma must be considered as any other morbid process and its evolution may have general repercussions. Regardless of the method of treatment, it is always useful, and at times it may be necessary, to correct deficiencies which may be present, to strengthen the general defenses of the host.

(2) Act on the trachomatous process itself so that cure may be

obtained as early as possible. Adequate consideration should be given to the frequently associated bacterial or viral conjunctivitis, or to allergic conditions. The source of the infection should also be located whenever possible so that reinfections may be avoided.

Sulfonamides and antibiotics are today the basis of the treatment of trachoma and at least one of them should be used, except under very special circumstances.

SULFONAMIDES

Shortly after they were introduced in therapy in 1937, sulfonamides started to be used for the treatment of trachoma, either locally as solutions or as ointments, or by systemic administration. Provided they are well tolerated, they give far better results than all previously used treatments. Local application is generally less satisfactory than systemic administration particularly by mouth.

Several cycles of treatment are usually indicated, with more or less prolonged intervals in between. The dose generally prescribed is of 40 - 50 mg per kilogramme of body weight, or approximately 2 - 2.5 g daily for an adult, for 10 - 15 days. In some cases, and under close supervision, the dosage may be increased to 3.5 g daily. The number of cycles of treatment may vary, but if more than two are given, the intervals between them should be increased to approximately three weeks. a few are in favour of even higher daily doses, over shorter periods, especially when relapses occur, or when there are associated infections. Adequate supervision of the cases receiving sulfonamides should always

be maintained, and special attention should be given to the blood picture and to renal function. Diuresis should be favoured.

Long acting sulfonamides are often preferred, as their protein binding properties and slow excretion allow for prolonged active concentrations to be maintained without frequent administration of the drug. Dosages may vary according to the prepartions used, but usually an initial dose of 1.5 to 2 g. is given in adults, followed by somewhat smaller doses every few days or once a week, by mouth.

Even if local application is less satisfactory, this route of administration should not be entirely excluded and a combination of general and local treatment may at times constitute the best treatment.

ANTIBIOTICS

The majority of antibiotics used in medical practice have been tried against trachoma, with more or less satisfactory results. Those found most effective are the so-called wide spectrum antibiotics such as the tetracyclines and erythromycins.

Only those which have been most widely used will be mentioned here.

Penicillin: It has been used against trachoma by local and systemic administration, with less conclusive result than some other antibiotics.

Tetracyclines: The antibiotics of this group, and more precisely

chlortetracycline, tetracycline hydrochloride and oxytetracycline are those which have been most extensively used and which have given the best results. They are given by local application, as solutions, suspensions or ointments at 1 - 3%, generally two or three times a day, over prolonged periods of several weeks at least. The choice among them may be influenced by factors related to their availability and cost, but it would seem that tetracycline and oxytetracyclines are more effective than chlortetracycline (43, 121, 150m 153).

Erythromycin: Although available data on its use is more limited, this antibiotic seems to give results at least as satisfactory as those which may be obtained with the tetracyclines. Erythromycin is also used locally, as solution or ointment at least 1 - 3% and, like the tetracyclines, should also be given over long periods (36, 37, 38, 39).

Rifamycin: The trials made so far indicate that some of the antibiotics of this relatively new group give promising result. Daragour, Jones and other (1980) found that the use of topical rifamycin 1% or erythromycin 1% twice per day for six weeks in South Iran was beneficial in reducing the intensity of trachomatous inflammation and suppressing its transmission (33).

COMBINATION OF ANTIBIOTICS AND SULFONAMIDES:

The efficacy of the treatment may be increased by a combination of two or more antibiotics, or of oral sulfonamides with local antibiotics.

Systemic administration of antibiotics may at times be considered. It

must be stressed that if there is practically no risk of toxic or allergic reactions when antibiotics are locally applied the need to continue treatment for several weeks increases this risk in the case of systemic treatment.

This system in therapy should therefore be recommended only in very special cases, and be carried out under close supervision. If this can be done, a combination of oral sulfonamides and oral antibiotics may be considered.

1.5.6 SURGICAL TREATMENT OF TRACHOMA

Possibly the most commonly used operations in the treatment of the complications of trachoma are the ones dealing with the lids, especially the upper lid e.g. tarsectomy, canthoplasty and various trichiasis corrections.

TARSECTOMY

This is a useful intervention in cases where the palpebral tarsus is thickened or deformed, a frequest cause of corneal ulcer even when there is no trichiasis.

Tarsectomy is generally indicated only for the upper lid.

CANTHOPLASTY

This procedure is especially indicated in cases of blepharophimosis with more or less pronounced local irritation. It consists essentially of a surgical prolongation of the outer angle of the lids, thus allowing for a widening of the palpebral fissure.

TRICHIASIS AND ENTROPION

Trichiasis, or rather trichiasis-entropion, is one of the most important complications of trachoma. Correction of this condition is a constant necessity in regions where trachoma is endemic. Many different procedures have been proposed, all of them with some advantages and disadvantages. For operations against entropion-trichiasis to be effective one must take into consideration the factors causing deviation of the lashes (150, 154).

1.5.7 MEDICAL TREATMENT IN ENDEMIC AREAS

The WHO expert committee on trachoma noted in 1961 that there was general agreement that most cases of trachoma could best be cured by sulfonamide given systematically or by one of several antibiotics given topically. It also noted that regional differences had been reported in rates of cure and that the elimination of trachoma agent from the conjunctiva and cornea requires a longer period of treatment than that necessary to clean bacterial infections. Time was required for the disappearance of trachomatous hyperplasia, even when elimination of agent had taken place. It therefore emphasised that a period of at least 3 months and preferably 6 months should elapse between the end of treatment and the assessment of result (180).

The expert committee recognised the tetracyclines and erythromycin as the most effective antibiotics. Oleandomycin, penicillin and chloramphenicol were considered to be less effective. It further recognised that "local application of effective drug twice daily for 3 - 6 consecutive days each month for 6 months has proved as satisfactory

as continuous local treatment and has economical and administrative advantages".

The committee indicated that treatment with sulfonamides by either local or systemic administration is more suitable for treatment of individual cases and that local administration of sulfonamide and systemic treatment with these drugs may entail a risk and require close supervision.

The recommended method for large scale medical treatment of trachoma continues to be the "intermittent" local application of antibiotic preparations either as ointments or as oily suspensions. In general the recommended schedule is treatment twice daily for 5 consecutive days each month for 6 months. The antibiotic recommended for large-scale treatment are the tetracyclines (127, 128, 177).

In a recent study in Southern Iran, Darougar, Jones, et al in 1980, found that under field conditions in hyper-endemic areas topical chemotherapy with rifampicin or oxytetracycline eye ointment twice daily for 6 weeks is beneficial in reducing the intensity of trachomatous inflammation and suppressing its transmission (33). Darougar, Jones, et al (1980) in another study found that intermittent therapy with a single dose of doxycycline orally (5 mgs. per kilogram body weight once a month) offered the advantage of being more practical and less expensive for mass control of trachoma as compared to tetracycline eye ointment although there was no difference between the efficacy of the two regimens for mass chemotherapy in endemic areas (32).

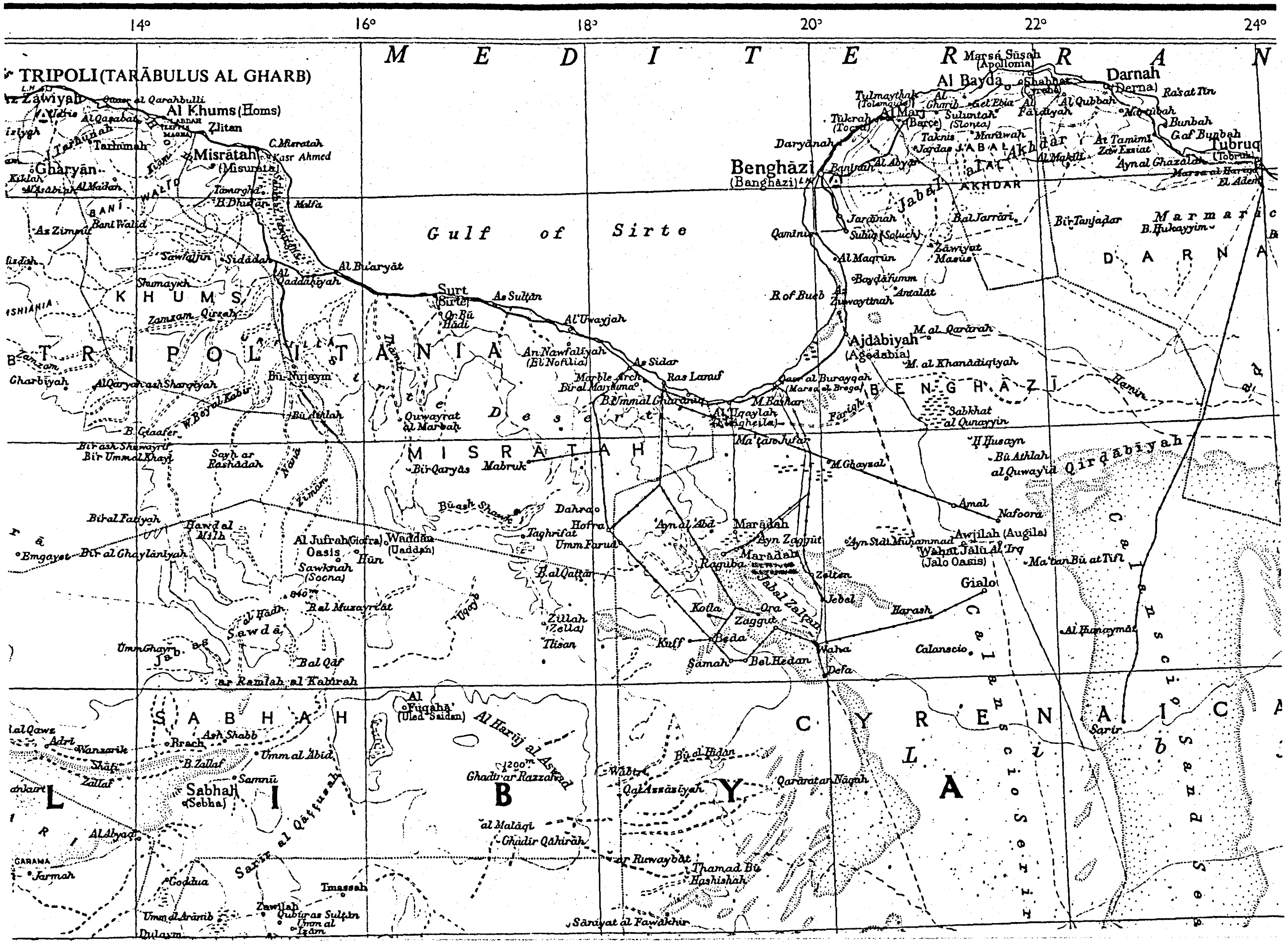


Fig.1. Geography and population of Libya.

2.1 GEOGRAPHY AND POPULATION OF LIBYA

The country, covering some 685,000 square miles, extends from the central Mediterranean coasts of North Africa, across the Sahara to the highlands of northcentral Africa. Within this vast territory as large as France, Spain, Italy and West Germany combined are three traditional regions - Tripolitania (Western region), Cyrenaica (Eastern region) and Fezzan (Southern region) - each of which had a distinct historical development before Libya emerged as an independent state in 1951.

The Mediterranean and the Sahara Desert are the two geographical features that have most affected Libyan development. The Mediterranean influence predominates only along two narrow coastal enclaves, whereas the Sahara holds over the rest of the country, giving rise to the related problems of aridity, a meagre supply of ground water, torrid temperatures and frequent droughts. Only about 1% of the country's area is regarded as suitable for permanent cultivation.

The agriculturally productive Mediterranean enclaves are separated by the Gulf of Sidra, which cleaves the coastline to meet the predesert of the Sirtica - a fact of considerable geopolitical importance. Each enclave has undergone separate historical development as the core area of a distinct region: the coastal oasis and the Jefara Plain of the west became the heart of Tripolitania, and the Al Marj Plain and its adjoining highland in the east formed the economic centre of Cyrenaica. Each geographical area remained comparatively isolated from the other, and this isolation was

reinforced by different patterns of foreign domination. In both regions, moreover, the forbidding Sahara discouraged contact with the interior. Geography thus had a strong influence on regionalism (20, 126).

2.2 BOUNDARIES

Facing the Mediterranean on the north, the country is bounded on the east by Egypt and the Sudan, on the south by Chad and Niger, and on the west by Algeria, except where Tunisia touches Libya's north western frontier. Most of the country's boundaries were established before its attainment of independence in 1951 through a series of agreements with the former colonial powers of northern and central Africa - the Ottoman Empire, France, Great Britain and Italy. With rare exceptions, the borders with the six neighbouring countries are long, almost straight lines through desert regions that have widely scattered minor oases inhabited by small sedentary communities. The 285 mile long north western border with Tunisia runs southward from the Mediterranean coast to Ghadamis, an important oasis town and meeting place of main desert routes. The border with Niger is about 250 miles long; the border with Sudan, some 300 miles; and the border with Egypt about 700 miles; the border with Algeria 700 miles long and the border with Chad is also 700 miles long.

2.3 TOPOGRAPHY

The Mediterranean and the Sahara Desert are the country's most prominent geographical features. There are several highlands, but true mountain ranges are rare. There are no perennially running rivers, only

intermittent streams called wadis that are dry during most of the year but quickly overflow after rainfall. Only the relatively narrow coastal strip is directly under Mediterranean influence; the rest is dominated by the Sahara, itself an extension of the North African plateau that begins at the Atlantic and stretches across the continent to the Red Sea (89).

2.4 CLIMATE

The country has five climatic zones. The first is under the predominant influence of the Mediterranean and encompasses the coastal strips between Zuwarah and Misratah in Tripolitania and between Benghazi and Derna in Cyrenaica. Summers are hot and humid in this zone; temperatures are in the high eighties, and humidity stays close to 90%. Rainfall is relatively plentiful, averaging about 16 inches a year in the Mediterranean oasis near Tripoli and rarely less than eight inches elsewhere along the coast. In the winter it rains only for a short period of time, and droughts frequently occur.

In the Mediterranean climatic zone winds blow mainly from the north and east between May and October and from the west and north between November and April. The ghibli is a scorching air current that originates in the southern desert and may cause temperatures to rise by as much as 40°F within a few hours. The soil is dried, vegetation is parched and fruit trees and grain crops are often destroyed as clouds of the searing red dust swirl northward from the desert. The ghibli is more frequent in the spring and autumn, but it may develop at any

time of the year. It lasts one to three days and may blow from the south, the southeast or the southwest; the gadamsi, a south-westerly wind blowing from the direction of the town of Ghadamis, is the strongest and hottest of these winds.

The second climatic zone extends over both the maritime and the continental steppe. In Tripolitania it covers the western portion of the Jefara Plain, the area immediately surrounding Al Khums and Misratah, and a small band of territory along the Gulf of Sidra. In Cyrenaica it comprises the area near Benghazi between the Jabal al Akhdar and the sea. The climatic influence of the Mediterranean in this zone yields to that of the southerly winds; there is less humidity, and the diurnal range of temperature is higher than on the coast. The annual average rainfall on the eastern Jafara Plain is about 14 inches; and in the Cyrenaican sector of this zone, about twelve inches.

The third zone is the plateau climate, which includes the northern highlands. At this higher elevation the mean temperatures are generally lower than those along the coast. Summer temperatures are rarely as high as those in the preceding steppe zone (notably in Cyrenaica); in the winter, temperatures drop to zero, and snow may sometimes be seen on the mountain crests. Because of the more favourable effect of the northern and northwestern winds at these higher altitudes, humidity is higher, cloudiness is more frequent, and rainfall is more plentiful than in the steppe zone. On some parts of the Jabal al Akhdar rainfall averages as much as twenty-four inches annually, but the grazing belt of the south receives an

average of only about two to four inches a year.

The predesert and the desert constitute the last two climatic zones. Temperatures in the interior desert range between 90°F and 95°F in the summer, and midday temperatures range between 60°F and 70°F but drop to around 40°F at night. Habitation is possible only where ground-water resources support modest vegetation and limited cultivation in these zones. The infrequent and irregular rainfall has no effect on the pervasive aridity. Marada oasis is in the desert climatic zone.

2.5 WATER SUPPLY

There are no perennially flowing rivers - only water - courses called wadis that are dry most of the year but swifty rise to overflowing when rain falls.

In the early 60's huge water reservoirs were discovered in Sareer and Kufra areas (108). The possibility of taking the water to the coast by pipes is being studied at present (108, 109).

2.6 OIL

The country's endowment of known and exploitable natural resources is largely limited to petroleum. In 1972 the proved reserves were estimated at around 35 billion barrels thus ranking fourth or fifth in the world. The development beginning in 1968 of a large underground lake of water in the area of the Al Kufrah oasis in Southeastern Cyrenaica improved the country's prospects for expanding the cultivable land area. The oil industry is complemented by productive irrigated agriculture. In the five year plan of 1976 - 1980, 1.8 billion Dinars were allotted for agriculture which represents 12% of the total expenditure.

2.7 POPULATION

In mid-1972 the total population was esimated to be 2,096000 - the smallest among all the countries of North Africa although the country is the fourth largest on the African continent. The people were concentrated primarily in the two agricultural regions of the narrow coastal plain, on the better watered highland farther inland, and around a few scattered oases deep in the interior. Libyan Muslims accounted for the vast majority of the population, although there was a resident alien community of about 200,000 consisting of Egyptians, Europeans and Tunisians. Egyptians, numbering over 100,000 have replaced Italians as the largest and most prominent alien group. In 1973 by census the total population of the country was 2.25 millions which is estimated to be 3 million for 1980. Demographic characteristics of Libyan population according to geographic distribution are shown in Table 1. Marada oasis is part of Al Khalij area and is the least populated area in the country.

Since the discovery of oil during the mid 1950s the population has become increasingly urbanised as rural people moved to the cities in growing numbers, hoping for better employment and benefiting from housing and other public programmes financed by oil revenues. Tripoli and Benghazi have been the recipients of the mainstream of this rural - urban move, their populations growing at annual rates of 6.5% and 7% respectively during the late 1960s.

In the early 1970s the population was growing at a rate of from 3.4% to 3.7% annually and was expected to double by about 1985. Most

experts agreed that the high growth rates were related to improved health conditions, reflected in an increase of live births and declining mortality rates, and to immigration (89, 68).

DEMOGRAPHIC CHARACTERISTICS OF THE LIBYAN POPULATION

1. Geographic Distribution

Area, Total Population and Population Density in Libya

By Region 1973

Table no. 1

	Population Density per 100 Sq. Km.	Thousands of Persons	Population % of all Libyans	Area Thousands of Sq Kms.	Area % of all Libya
DERNA	119	123	4	103	6
GEBAL AKHDAR	776	132	16	17	1
BENGHAZI	1,953	332	15	17	1
EL-KHALIJ	15	105	4	720	41
MISRATA	120	178	6	148	9
HOMS	644	161	5	25	1
TRIPOLI	23,567	707	29	3	1
ZAWIA	3,486	244	10	7	1
GHARIAN	103	154	6	150	9
SEBHA	20	111	5	559	32
TOTAL	-	2,247	100	1,749	100

2.8 TRACHOMA IN LIBYA

The earliest recorded paper on trachoma in Libya was by Professor E. Bartolotta in 1920 who worked in Tripoli's Central Hospital during the Italian rule of Libya (1911 - 1942) (12, 13). Writing in the "ARCHIVO ITALIANO DI SCIENZE MEDICHE COLONIALI" (Colonial Medical and Scientific Archives) he stated that active trachoma was very common and placed it with other infectious diseases as one of the three main causes of blindness in the area, the other two being local treatment (quack treatment i.e., tattooing, scarification and application of local medicine to the eye) and smallpox. Also R Onorato (1931) working in the same place observed that trachoma was prevalent in 50% of the general population and 50% of the school children (120). Thereafter various studies by different workers based on outpatient records, school and general population examinations showed that both active and total trachoma were high in all parts of Libya, especially the southern part which is more than 620 miles from the coastal cities (Table no. 2).

In 1970 - 1971, a survey which included 1.5% of the total elementary school children (4,217 children, 2,915 males and 1,302 females) was carried out in 111 primary schools from all parts of the country. This work was carried out in collaboration with W.H.O. This was the first time that a statistically controlled survey was ever conducted regarding trachoma in school children in Libya (107). Active trachoma was found in 1,206 school boys (41%) and in 559 school girls (43%). The over all active trachoma prevalence rate was 42%. The over all total trachoma prevalence rate was found to be 49%.

Dr Wasi Haider and others (51, 107) carried out other surveys in various areas: Sallok, which is 30 miles west of Benghazi; Jalo (186 miles south west of Benghazi and 93 miles north east of Marada), and Kufra 620 miles south of Benghazi.

They found that out of 763 people examined in SALLOK active trachoma was found in 38%. Total trachoma (Trachoma I, II, II, IV) was found in 57% of the population.

Out of 606 people examined in JALO, active trachoma was found in 67%. Total trachoma was found in 95%.

Out of 511 people examined in KUFRA, active trachoma was found in 62%. Total trachoma was found in 89%.

These studies established trachoma as a major public health problem in the country, which led the Government to organise a Communicable Eye Diseases Control Project, with the assistance of W.H.O. They carried out regular surveys with the aim of ascertaining prevalence

rates, disabling and potential disabling lesions of trachoma and to evaluate the effect of treatment. From 1970 onwards blanket treatment consisting of the application of chlortetracycline hydrochloride 1% eye ointment for 10 days a month for 6 months was given to school children. This programme had varying degrees of success and depended largely on the cooperation of school health authorities including school teachers who gave the treatment in most areas (107).

In 1973 a follow-up examination of elementary school children in Sebha in the south showed that after blanket treatment, active trachoma was reduced from 36% to 30%. In 1974 the prevalence of active trachoma in elementary school children (in the south) decreased from 64% to 12% (51, 103). From 1975 onwards the Ministry of Health figures for trachoma control have become promising and indicated an over all reduction in the prevalence throughout the country especially in coastal cities where over 90% of the population lives (107, 108). In Benghazi active trachoma was 1%, Derna 1% and in the south 5% - 10% (107).

By 1976 the prevalence rates of active trachoma appeared to have been reduced to around 1% in the coastal cities and to 5% in some areas of the south (107). These figures relate to the active disease or new cases but the problem of healed trachoma and its sequelae remain.

Benghazi Central Eye Clinic figures indicate that problems resulting mainly from complications of trachoma are still very important, and

constitute an important cause of visual handicap especially in the 40 years and above age group. During 1977, out of 54,264 patients who attended the clinic, 13% had trachoma complications (entropion, trichiasis, xerosis, corneal opacities). Similarly for the years 1978, 1978, 1980, 1981 and 1982 figures were 14%, 16%, 12%, 15% and 10% respectively.

The Results of Various Workers

Table No. 2

No.	NAME OF WORKER	YEAR	AREA	TYPE OF POPULATION	SIZE OF POPULATION	ACTIVE TRACHOMA	TOTAL TRACHOMA	REMARKS
1	E Bartolotta	1920	Tripoli Area	General	Not Stated	Very Common	-	Main cause o blindne
2	R Onorato	1931	Tripoli Area	General School Children		50% 46%		
3	Caseti	1938	Feizzan	General	8,917	50%		
4	Delon	1954	Benghazi & East	Schools		80%		53% afte treatmen
5	Rostosky	1956	Benghazi & East	Schools	4,851	60.5%	?	-
6	Tihet	1957	West	Schools	5,049	67%	?	23% afte treatmen
7	Livadioti	1957	East West	Schools Schools	- 5,494	30% 70%	- -	- -
8	Rostosky	1957	West	Schools	4,249	55%	-	-
9	P. Zavagoza	1967-68	Tripoli	Students	12,391	11%	78%	-
10	Chao-Raniel	1966-67	Sebah(South)	General	4,908	41%	-	-
11	Preobragreski	1968	Tripoli	School	12,884	10%	85%	-
12	Doci et al	1970	Ferran	General	2,000	35.7%	95.2%	Pre-treatmen
13	Wasi I	1970	Salok	General	743	38%	57%	-
	Wasi II	1970	Jabro(East)	General	606	67%	95%	-
	Wasi III	1970	Kufra		511	62%	89%	-
14	Kadiki Doci et al	1972	All Areas	Schools	4,217	41.9%	48.5%	After Treatmer
15	Doci et al	1973	Ferran	Schools	?	30.2%	93.8%	After Treatmer
16	Majcuk	1974	Fezzan	Schools	-	17.9%	-	After Treatmer
17	Wasi et al	1976	Benghazi	Schools	17,489	0.6%	-	

WEST - Tripoli and surrounding area

East - Benghazi and surrounding area

South - Fezzan and surrounding area

3.0 POPULATION AND METHODS

During the first two weeks of March 1976, the eyes of the entire population of Marada village were examined to determine the state of ocular health, the prevalence of trachoma and its clinical features. Conjunctival scrapings were obtained from all the inhabitants and stained with Giemsa stain looking for trachoma inclusion bodies. No inclusion body studies in Libya have been reported in the literaturs. Random samples of active trachoma cases and population controls were studied bacteriologically for their relationship with trachoma. Between 3rd and 12th November 1980, the eyes of the entire population of the village were re-examined especially with respect to trachoma to study the change in trachoma prevalence, its sequelae and possible factors associated with this change.

3.1 SURVEY AREA

Marada village was selected for the study for the following reasons:-

1. It is a representative desert area of a Libyan rural community with a small static population (about 1,000 people) accessible by road. It is 286 miles south west of Benghazi and 118 miles south of the Mediterranean coast.

2. It is a known trachoma endemic area, which received intermittent blanket treatment during 1970 - 1974. No treatment was carried out for one and a half years prior to the initial survey and no treatment for 4 years and 8 months during the 1976 - 1980 period.

3. It underwent a rapid development (socio-economic and housing) during 1976 - 1980 with a huge agricultural project costing 16 million Dinars.

3.2 GEOGRAPHIC DESCRIPTION

Marada village is situated 286 miles south west of Benghazi and 155 miles from Agedabia, Capital of Khalige province (Fig. 1). It lies in the centre of an area of 740 square miles which is completely surrounded by desert with about 7,000 palm trees in a neglected state. In the north it is surrounded by marshes covering an area of 310 sq. miles. Rainfall is scarce in the area. The main sources of water are springs and artesian wells. Salinity in the water is as high as 3,000-7,000 p.p.m. Summers are hot and dry and quite often sand storms (Gibli) may occur for a few days at a time. Climatic conditions are summarised in Table no. 3.

Climatic Conditions of Marada

Table no. 3

Temperature	**Range**
January	18°C - 30°C
July	19°C - 37°C
Humidity	
January	23% - 87%
July	18% - 93%
Rainfall	Annual average of 16 m.m.
Wind Velocity	3 - 7 miles per hour. Sand storms may reach up to 20 miles per hour

3.3 POPULATION

A census was made of the entire village population. Every family was interviewed, the age, sex and relationship of each individual were established and recorded. Age and sex composition of the population examined is given in Table no. 4. Age structure of the village population was similar to the over all populations of the country. Mainly it was a young population (1973 census) with about 50% below the age group of 15 years.

TABLE NO. 4

Age and Sex Distribution of Marada Village Population (1976) examined

Age in Years	Male	Female	Total
0 - 1	21	17	38
2 - 5	71	88	159
6 - 14	221	169	390
15 - 24	76	44	120
25 - 44	52	65	117
45 - 64	34	39	73
65 +	27	17	44
TOTAL	502	439	941

3.4 SOCIO-ECONOMIC CONDITIONS

The village economy was mainly based on traditional agriculture and sheep rearing. About 15 varieties of dates are produced in the area. Palm trees are constant and conspicuous feature of the village as a palm tree has a life span of about 100 years and it bears fruits in about 4 years. The pace of economic development had been accelerated for the last 10 years. There were multiple developmental projects under way in the area. Two important projects viz. a new water works and sewage works were under construction in 1976 and were completed in 1980. A new secondary school, 50 new houses, market place, new abbatoir, a Health Centre were all under construction and nearing completion in 1980. The main agricultural project of budget 16 million Libyan Dinars (48 million U.S. Dollars) was started in 1975 and is still in progress promising good results. The project aims at the reclamation of land and the setting up of 50 farms for the local inhabitants and is expected to be finished in 1983.

3.5 OCCUPATION

The working population of the village is made up of

1. Persons (201 males and 20 females) who are giving a public service and drawing a salary from the local authorities (e.g. Health, Education, Municipality etc.).

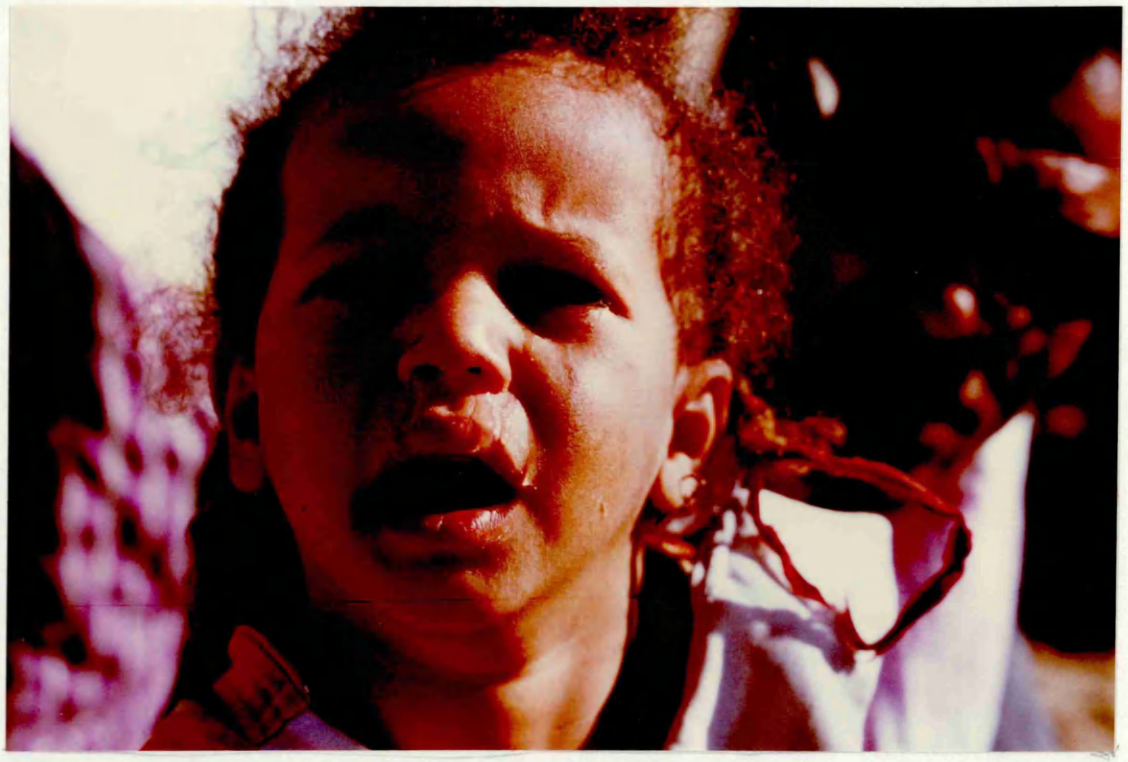
2. Persons - all males (88 males) who stated when questioned that they were self employed, usually in farms and sheep rearing. Females help their husbands and family in looking

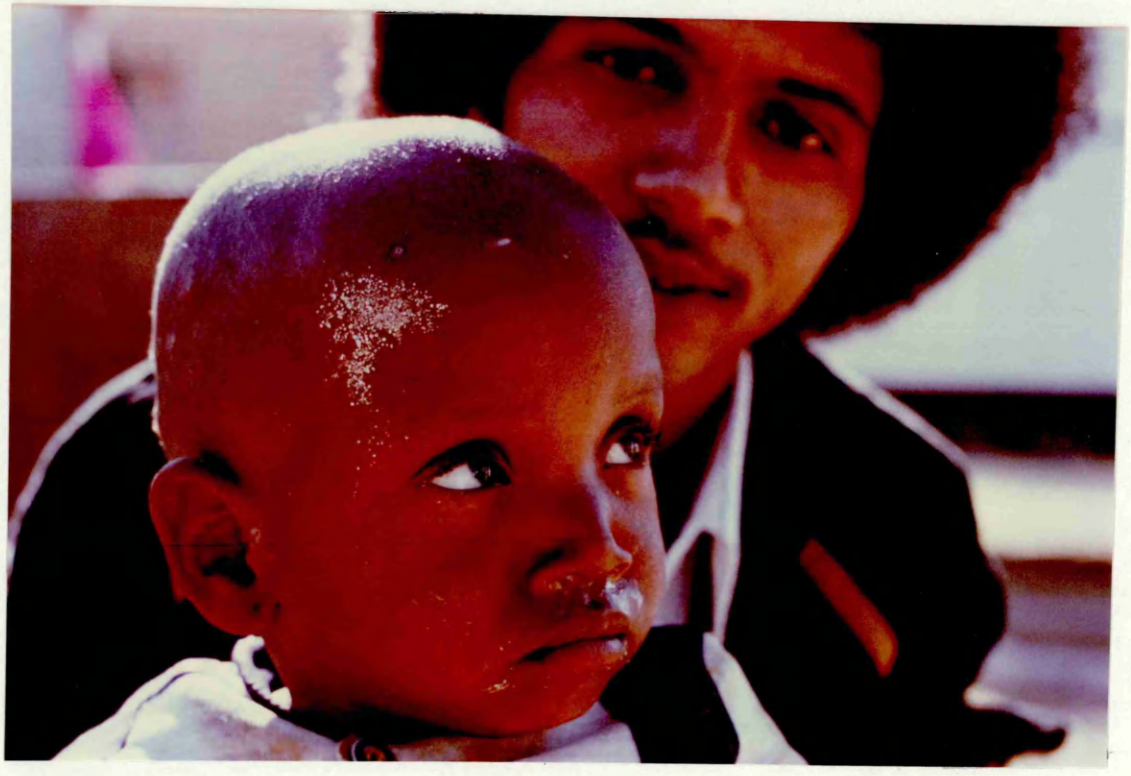
Fig. 2 (upper) Marada: a general view of the oasis

Fig. 3 (lower) Marada Village: a water point with buckets and container for water carrying.

Fig.4 (upper) Marada Village: a mudstone house

Fig.5 (lower) Marada Village: old houses (mainly tin huts) and animal shades.





Figs. 6 and 7. Children of Marada Village (1976)

Fig. 8 (upper) Marada Village: old houses (brown)
new houses (white)

Fig.9 (lower) Adjacent new houses in more detail.

Fig. 10 (upper) Marada Village: a new house

Fig.10a (lower) Marada Village: another new house with street lighting.

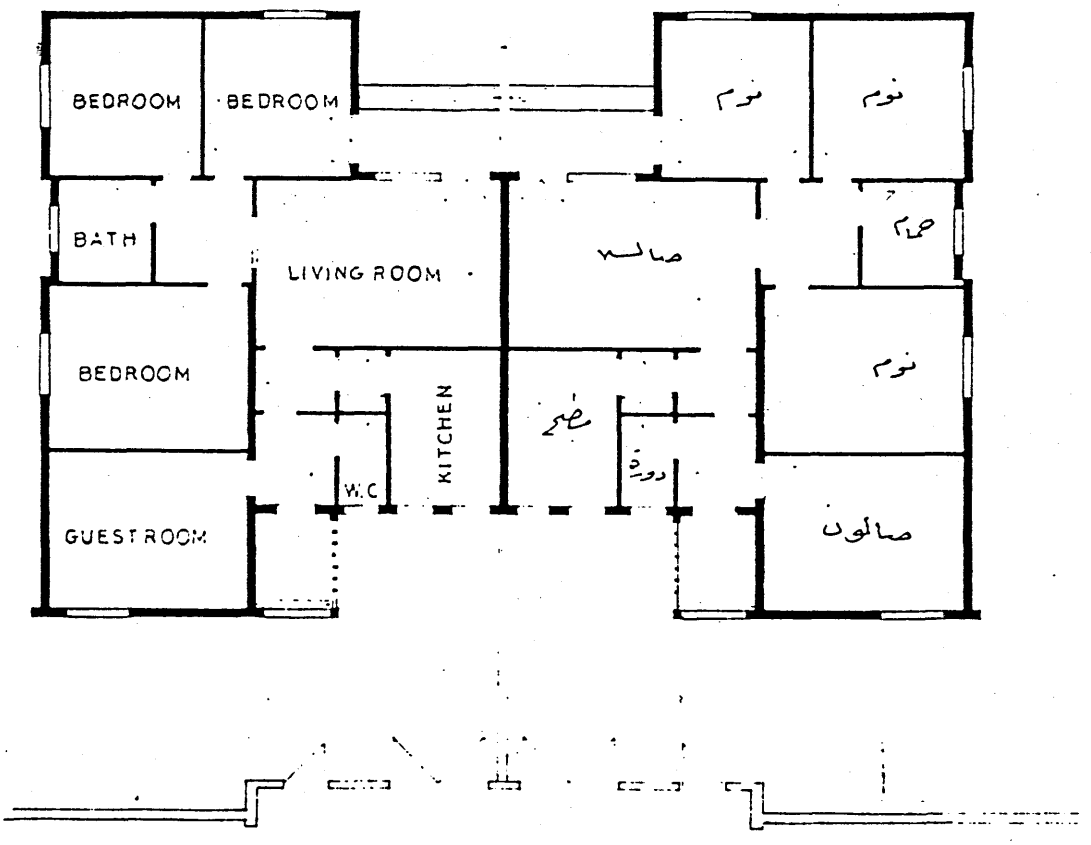


Fig.11. NEW HOUSES

General plan of 2 adjacent new houses.

after the sheep and in bringing water into the home from the public water taps and of course in cooking and looking after children (compressed liquid gas is used for cooking in all the homes).

Small farming and sheep rearing represented the number one occupation in this village. It was found to be practiced by 88 persons representing 40% of the working population. Civil or public service comes second with 63 people engaged in it representing 28% of the working population; 25 (11%) persons were working in Raguba oil field 20 km away; 13 persons worked with the police department representing 6%. Another 13 worked as store keepers; 19 persons worked as school teachers - all were foreigners.

3.6 HOUSING AND WATER SUPPLY

In 1976, most of the population lived in 150 old mudstone houses with primitive sanitary facilities and without a separate water supply in these houses. There were only 50 new houses of which 13 were occupied by the foreign teachers. There were common public water taps and people carried water from these taps to their houses in buckets for their daily use. The distance of the water taps to any house was from 100 - 500 metres. Poor personal hygiene and a high fly density were common features of the area (Figures 2 - 7). At the time of the re-survey in 1980 the housing situation was markedly changed. Most of the population (831) lived in the 150 newly finished new houses with adequate space, sanitation and a separate water supply. The old habit

of sleeping all the children on mats on the floor and in one room is however practised still. The grandparents had their own house, usually next door. Fifty families or 375 persons were still living in the old mud-stone houses awaiting the completion of the last 50 new houses. Flies were just as plentiful because of the close proximity of the shades used for sheep rearing. The sewage scheme was completed and the new homes were connected to it. The new chlorinated water works was completed and working (Fig. 8, 9, 10 and 10a).

3.7 SURVEY

A team consisting of an ophthalmologist (the author), a technician, a clerk and 2 local health visitors (nurses) conducted the survey. The team made house to house visits during their 14 days stay in the village. Prior information of the visit was given, so that all members of the family could be present in the house. During the visit the local health visitors interviewed the family and the clerk recorded the number of family members with their age, sex and main occupation. Information regarding housing conditions was also obtained and recorded. The local health visitors knew the inhabitants very well and could tell if any members of their household were missing. The eyes of each person were examined by the ophthalmologist. Those family members who were not present at the time of the visit were recorded and were asked to attend the local clinic to complete the examination of everyone in the family. All families were co-operative, rather, were eager to be examined by the ophthalmologist. The school children were examined at their

school. 25 persons who were working in Ragoba Oil Field, which is 13 miles south east of the village were visited by the team for their eye examinations. Every effort was made to cover the entire village population and in fact we successfully completed the examination of 941 (99%) persons. However, 12 (1%) persons could not be included in the study because they were away from the village during the survey period.

3.8 OPHTHALMOLOGICAL EXAMINATIONS

(i) Clinical Examination of the Eyes.

All members of the family were examined by the same ophthalmologist. The examination was made by means of a simple binocular loupe in natural daylight. Field conditions did not permit the use of a slit lamp, however, where doubt existed a second examination was made at the village clinic. Clinical signs and MaCallan stages were recorded according to the system suggested by the W.H.O. Fourth Scientific group of trachoma (181). The results of examination were classified according to the third report of W.H.O. expert committee on trachoma (180), and recorded. Other external eye conditions were also recorded.

(ii) Visual Acuity & Visual Disability

At each clinical examination the visual acuity was ascertained by using a modified Snellen's test chart for illiterates (E test) in natural light. Those eyes which had vision 6/24 or less were subjected to further examination in the clinic including tonometer and ophthalmoscopy to assess the reason for visual loss.

Blindness was defined according to the recommendations of W.H.O. study group on the prevention of blindness (177). An eye was considered as blind when the maximal visual acuity with the best possible correction was 3/60 or less. A person was labelled blind if his/her maximum visual acuity with both eyes using the best possible correction was 3/60 or less. 3/60 was taken to be the ability to see the top letter of the illiterate E test at 3 metres.

(iii) Tonometry

Schiotz tonometer with 0.4% Novesine drops was used for tonometry in those eyes which were suspected of being glaucomatous on clinical examination. The cut off point used was 20 m.m. Hg.

(iv) Cataract

Cataract was defined as the absence of the red reflex on direct ophthalmoscopy.

3.9 BACTERIOLOGICAL INVESTIGATIONS

Bacteriological investigations were done during the course of the initial survey in 1976. All the 15 school children with trachoma stage II were selected. An equal number from trachoma stage IV and trachoma dubious were randomly selected. Out of these, 13 school children with trachoma stage II, 12 school children with trachoma stage IV and 11 school children with trachoma dubious could be studied. 39 (controls) school children matched for age and sex

were randomly selected from those without trachoma. In all 75 school children were bacteriologically investigated. Material from the lower fornix conjunctiva was collected with a sterile cotton tipped applicator, moistened with sterile water, when needed and inoculated on to chocolate agar plates. Inoculated plates which were collected in the morning were rapidly transported by car to Benghazi in the afternoon and all plates were incubated aerobically at 37°C for 48 hours. Organisms grown were then identified by their morphology, cultural and biochemical properties according to Lowen and Steel (1965) (96). Anaerobic cultures were not carried out since anaerobes are rarely isolated from the eye (96).

3.10 GIEMSA STAINING

Conjunctival scrapings were taken from the upper tarsal conjunctiva using firm even strokes across the tarsal surface. Standard silver spatulae were sterilised by flaming and wiping with 70% ethanol and dried before each scraping; they were always clean, coll and dry when used. The material was spread evenly on a clean glass slide and attempts made to prepare smears not more than one cell thick. The smears were air dried and promptly fixed after collection by dipping in fresh absolute methanol for at least 5 minutes. The slides were packed in boxes and transported to Benghazi for processing. The smear was covered for 1 hour with diluted Giemsa stain, freshly prepared each day. The slide was next rinsed rapidly in 95% ethanol to remove excess dye, dried and examined for the presence of typical basophilic intracytoplasmic inclusion bodies (117, 136). Approximately 134 slides representing different stages of trachoma were decolourised

with 70% alcohol and restained by the iodine stain using Ingots iodine (Difco Laboratory Survey) for $1\frac{1}{2}$ to 2 hours.

STATISTICAL ANALYSIS

The present study was basically a descriptive study of trachoma in a defined geographic area. The hypothesis generated from descriptive data was tested by chi square (χ^2) test as a measure to show whether observed differences were, in fact, likely or unlikely to be the result of chance. The procedure has been adopted from A.B. Hill (1961). Principals of Medical Statistics, The Lancet Limited, 7th Ed. London.

Table No. 5

GENERAL POPULATION - TOTAL - INCLUDING SCHOOL CHILDREN

MARADA - MARCH, 1976

Age in Years			0 - 1			2 - 5			6 -14			15 - 24			25 - 44			45 - 64			65 +			TOTA		
Diagnosis		Sex	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
TR-0	No.		18	14	32	49	55	104	116	96	212	22	18	40	21	14	35	4	6	10	6	2	8	236	205	44
	%		85.7	82.3	84.2	69.0	62.5	65.4	52.4	56.8	54.3	28.9	40.9	33.3	40.3	21.5	29.9	11.7	15.3	13.6	22.2	11.7	18.1	47.0	46.6	46
TR-D	No.		3	3	6	12	22	34	11	9	20	4	5	9										30	39	69
	%		14.2	17.6	15.7	16.9	25.0	21.3	4.9	5.3	5.1	5.2	11.3	7.5										5.9	8.8	7.3
TR-I	No.																									
	%																									
TR-II	No.					10	10	20	11	5	16	2	0	2										23	15	38
	%					14.0	11.3	12.5	4.9	2.9	4.1	2.6	0	1.6										4.5	3.4	4.0
TR-III	No.					0	1	1	51	39	90	29	9	38	10	11	21	3	6	9				93	66	159
	%					0	1.1	0.6	23.0	23.0	23.0	38.1	20.4	31.6	19.2	16.9	17.9	8.8	15.3	12.3				18.5	15.0	16.
TR-I-III (Active)	No.					10	11	21	62	44	106	31	9	40	10	11	21	3	6	9				116	81	197
	%					14.0	12.5	13.2	28.0	26.0	27.1	40.7	20.4	33.3	19.2	16.9	17.9	8.8	15.3	12.3				23.1	18.4	20.
TR-IV	No.					0	0	0	32	20	52	19	12	31	21	40	61	27	27	54	21	15	36	120	114	234
	%					0	0	0	14.4	11.8	13.3	25.0	27.2	25.3	40.3	61.5	52.1	79.4	69.2	73.9	77.7	88.2	81.8	23.9	25.9	24.
TR-I-IV Total	No.					10	11	21	94	64	158	50	21	71	31	51	82	30	33	63	21	15	36	236	195	431
	%					14.0	12.5	13.2	42.5	37.8	40.5	65.7	47.7	59.1	59.6	78.4	70.0	88.2	84.6	86.3	77.7	88.2	81.8	47.0	44.4	45.
TR-ND	No.																									
	%																									
Total Examined	No.		21	17	38	71	88	159	221	169	390	76	44	120	52	65	117	34	39	73	27	17	44	502	439	941
	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

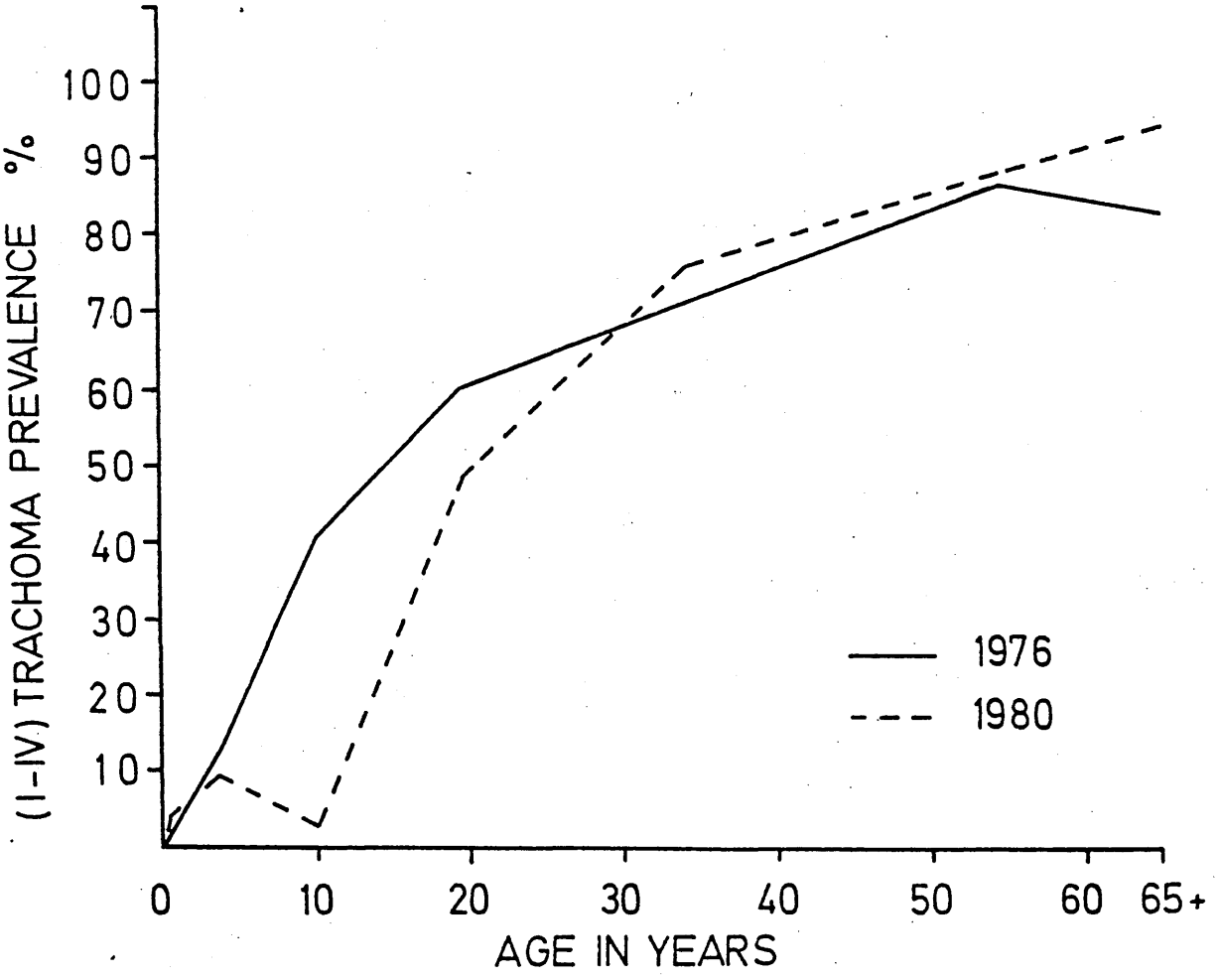


Fig. 12 showing age distribution of Total Trachoma (I-IV)

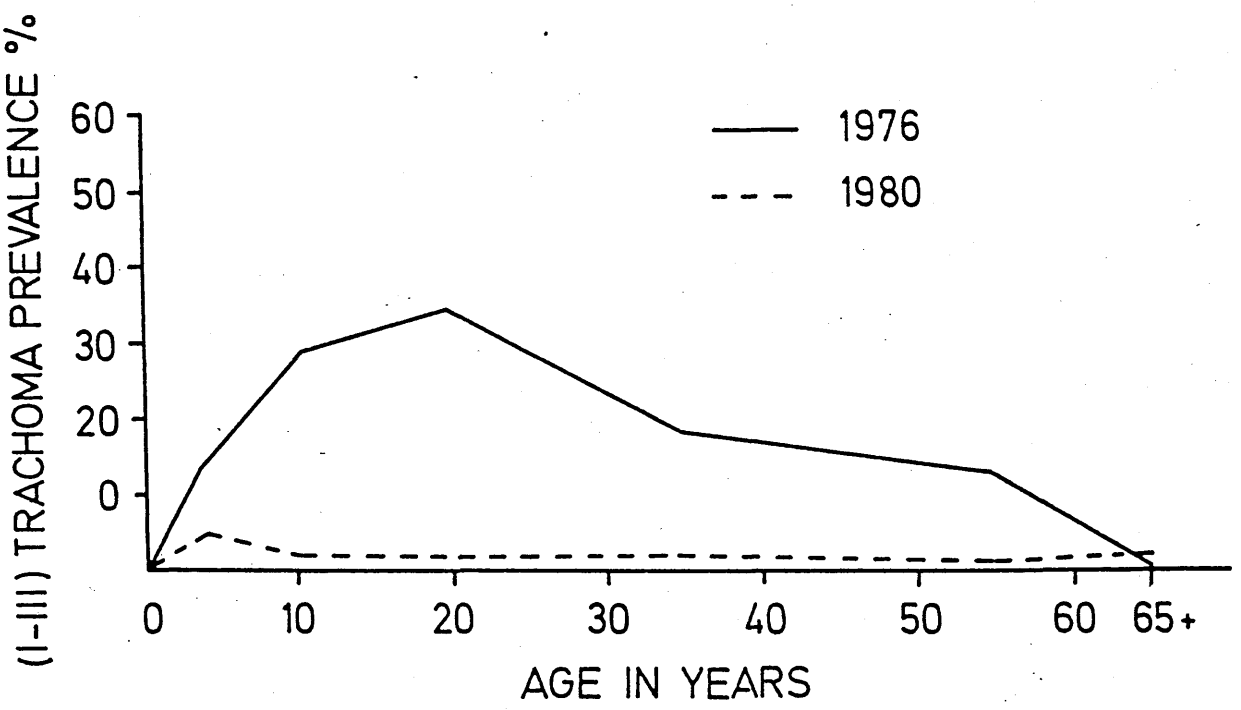


Fig. 13. showing age distribution of Active Trachoma (I-III)

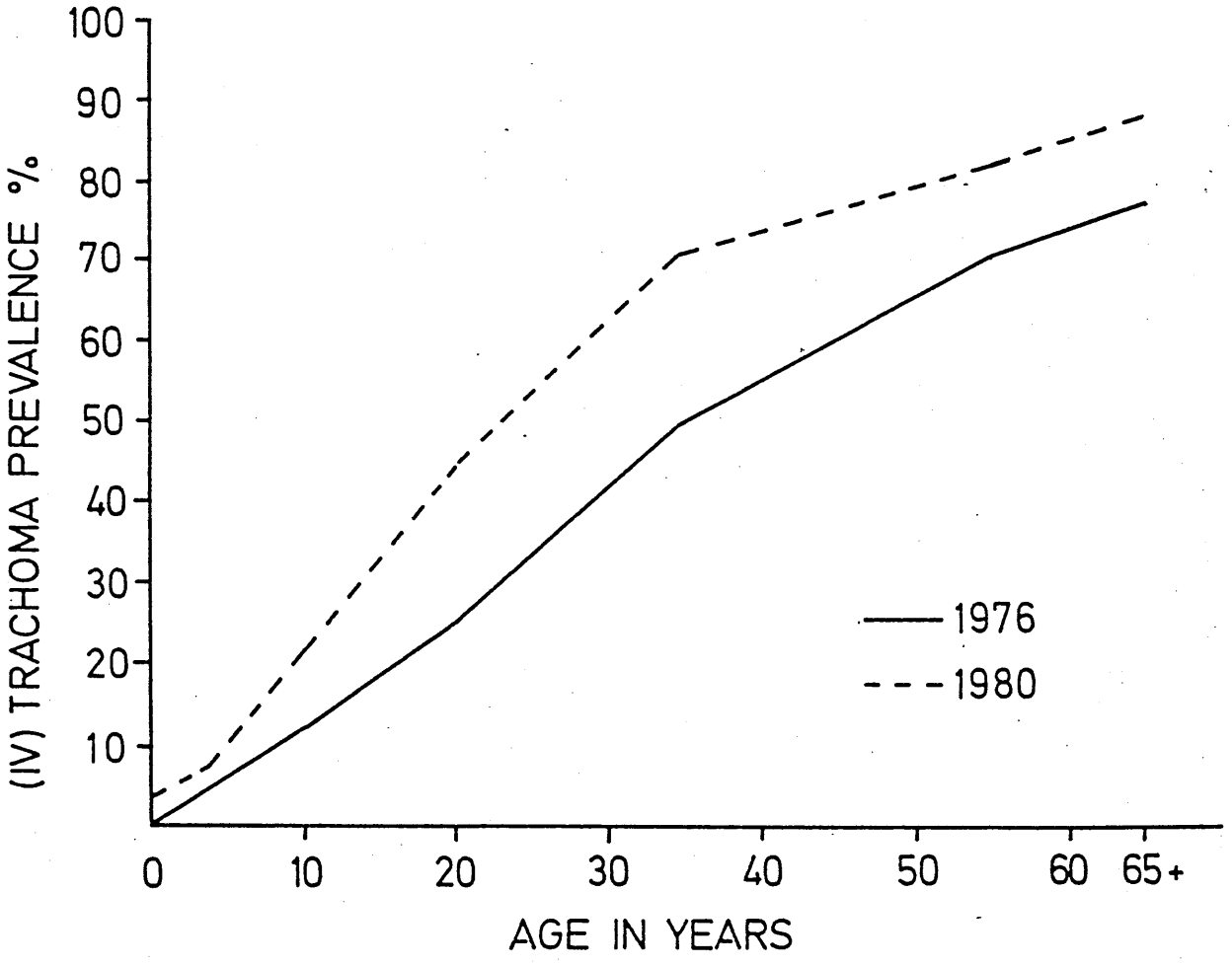


Fig. 14. showing age distribution of Healed Trachoma(IV)

OBSERVATIONS

4.0 FINDINGS OR RESULTS OF INITIAL SURVEY (1976)

4.1 TRACHOMA PREVALENCE (in over all population)

Out of a total 941 persons examined, 431 persons had trachoma (I - IV) giving rise to an over all prevalence rate of 46%. Age specific trachoma prevalence rates indicate a positive association with age. Trachoma prevalence increased with age reaching as high as 86% in the age group of 45 - 64 years, however, it was 82% in the age group of 65 years and above. A similar trend with age in relation to both sexes was observed (Table 5 & Fig. 12).

Males (47%) in general had a higher prevalence than females (44%) in all age groups excepting in the age groups of 25 - 44 years and 65 years and above. This difference between the two sexes was found to be statistically not significant ($P < 0.5$).

Table 5 and Fig. 13 and 14 show the prevalence of active trachoma (I - III) and healed trachoma (IV) by age. Active trachoma prevalence observed was 21%. The highest age specific prevalence of trachoma was in the age group 15 - 24 followed by 6 - 14 years age group, however, the bulk of active cases 106 (52% of the total) were in the 6 - 14 years group. Infants (0 - 1 years) had no active trachoma and the healed trachoma prevalence was 25%. The frequency of healed trachoma increased with age reaching the level of 74% and 82% in the age group 45 - 64 years and 65 years and over respectively. 69 (7%) persons had doubtful trachoma (TD) and none could be put in grade I trachoma. 40 (58%) cases with trachoma dubium were below 54 years of age.

4.2 TRACHOMA PREVALENCE IN SCHOOL CHILDREN

Table No. 6

Age		Sex	Active Trachoma Number	Active Trachoma %	Healed Trachoma Number	Healed Trachoma %	Total Trachoma Number	Total Trachoma %
Examined								
6 - 14	204	M	59	28.92	32	15.68	91	44.60
	144	F	40	27.77	18	12.50	58	40.27
TOTAL	348							
15 - 24	64	M	22	34.37	14	21.87	36	56.25
	9	F	1	11.11	2	22.22	3	33.33
TOTAL	73							
Total	268	M	81	30.22	46	17.16	127	47.38
	153	F	41	26.79	20	13.07	61	39.86
TOTAL	421		122	28.97	66	15.67	188	44.65

Trachoma Prevalence in School Children by Age & Sex

Out of 421 school children examined, 188 children had trachoma (I - IV) giving rise to a prevalence rate of 45% among school children, which was similar to the over all trachoma prevalence rate. Table No. 6 shows age and sex distribution of active, healed and total trachoma among school children. 122 (29%) children had active trachoma which was slightly higher than observed in the general population. 99 (71%) cases of active trachoma were concentrated in the younger age group of 6 - 14 years. Healed trachoma prevalence rate was 15.6% among school children, a lower rate than in the over all population.

4.3 DISABLING OR POTENTIALLY DISABLING LESIONS (1976) .

Table 7

Age in Years	C3 (conjunctival scars)		Corneal Scarring		C4 + Trichiasis/ Entropion	
	No.	%	No.	%	No.	%
0 - 1	-	-	-	-	-	-
2 - 5	-	-	-	-	-	-
6 - 14	5	1.28	-	-	3	0.76
15 - 24	3	2.50	3	2.50	2	1.66
25 - 44	5	4.27	10	8.54	16	13.67
45 - 64	14	19.17	14	19.17	17	23.28
65 +	5	11.36	20	45.45	24	54.54
TOTAL	32	3.40%	47	4.99%	62	6.58%

Disabling or Potentially disabling lesions by age

Table no. 7 and Fig. 15 show the disabling lesions by age. Severity of the lesions (conjunctival scarring, corneal scarring, trichiasis/entropion) generally increased with age. The majority of these lesions 94 (67%) were in the age group of 45 years and above. However, conjunctival scarring was highest in the age group of 45 - 64 years. No disabling or potentially disabling lesions were seen in 0 - 1 and 2 - 5 years age group.

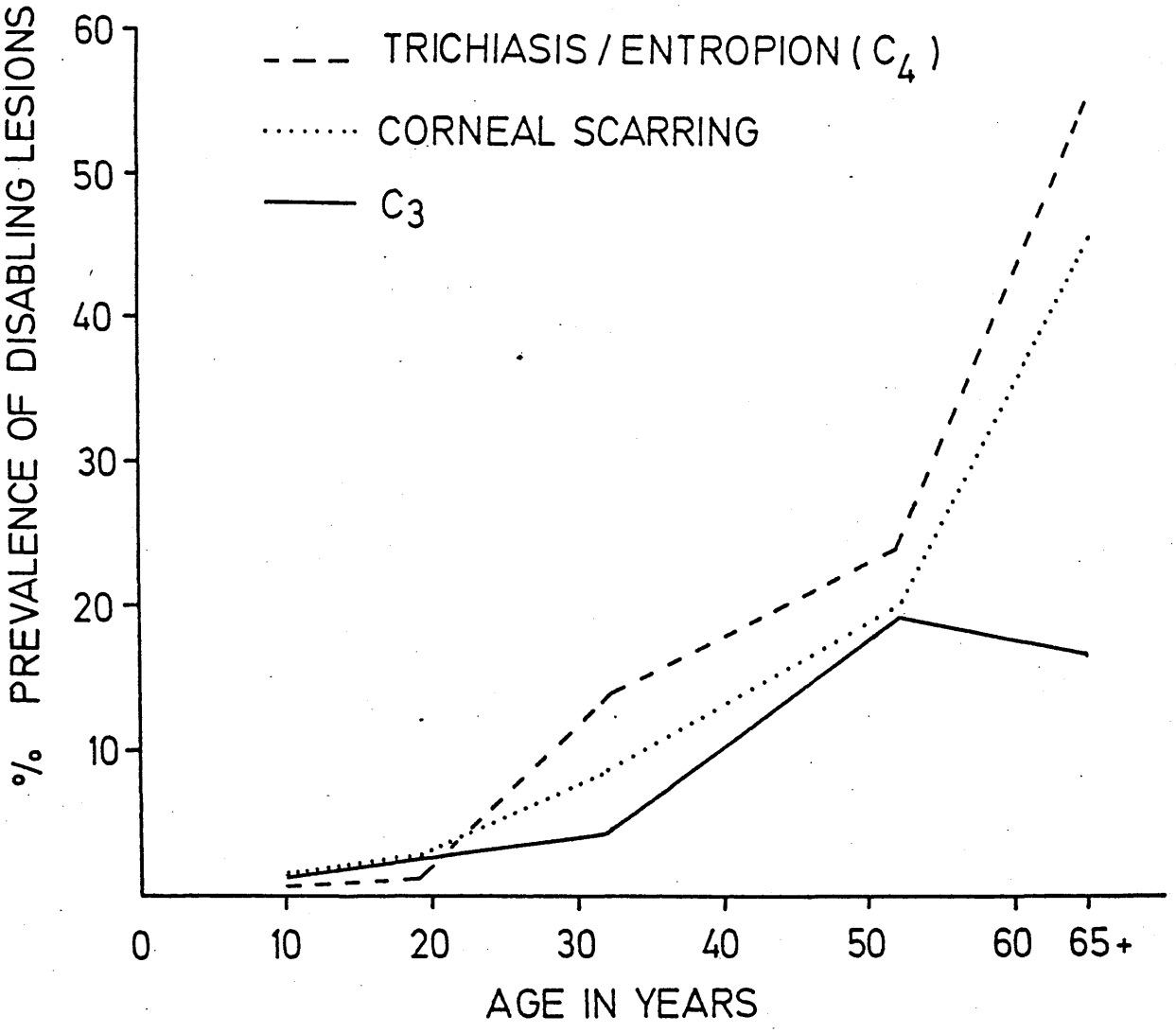


Fig. 15. Age distribution of disabling lesions - 1976.

4.4 TRACHOMA PREVALENCE AND HOUSING CONDITIONS

Table no. 8

TYPE OF HOUSING	NO EXAMINED	NO OF CASES	PERCENTAGE
NEW HOUSES	70	35	50
OLD HOUSES	450	208	45.22
TOTAL	520	243	47.73

Trachoma Prevalence According to the Housing Conditions (76).

(χ^2 = 0.3472 df 1, P < 0.5).

The population of the area (excluding school children) studied according to housing conditions in 1976 and the prevalence of trachoma among them is shown in Table No. 8. Most of the population 450 (87%) persons still lived in old houses with poor living conditions and only 70 (13%) persons lived in new houses for the last 6 months. Statistical analysis revealed no significant difference between the trachoma prevalence among residents of new and old houses (P < 0.5).

4.5 OCULAR PATHOLOGY

Table No. 9 shows the prevalence of other ocular pathology by age and sex. The prevalence of cataract was 5% followed by squint (3%) glaucoma (2%) and mucopurulent conjunctivitis (1%).

Age	Sex	M.P. Conjunctiva No. %	Allergic conj. No. %	Pinguecula No. %	Trichis/ Entrop. No. %	Corneal Scar. No. %	Cataract No. %	Glaucoma No. %	Squint No. %	OTHERS
0- 1	M	— —	— —	— —	— —	— —	— —	— —	— —	—
	F	— —	— —	— —	— —	— —	— —	— —	— —	—
0- 5	M	5 7.04	— —	2 2.8	— —	— —	— —	— —	1 1.40	—
	F	1 1.13	— —	— —	— —	— —	— —	— —	1 1.13	
6-14	M	2 0.90	6 2.71	2 0.90	2 0.90	— —	— —	— —	9 4.07	2 (Nevus Iris) 1 (cong ptosis).
	F	2 1.18	3 1.77	— —	— —	1 0.59 (injury)	— —	— —	6 3.55	1 (Nevus Iris) 1 (cala-zion)
15-24	M	— —	— —	1 1.31	— —	3 3.94	1 1.31 (injury)	— —	2 2.63	1 (pthisis bulbi) 1 injury)
	F	— —	— —	— —	1 2.27	— —	— —	— —	— —	1 (high myopia)
25-44	M	— —	1 1.92	2 1.92	2 3.84	4 7.69	2 3.84	— —	2 3.84	1 (Nevus Iris)
	F	— —	— —	— —	5 7.69	6 9.23	4 6.15 (1 injury)	2 3.07	3 4.61	1 (Band degeneration 1 (pthisis bulbi)
45-64	M	— —	— —	1 2.94	3 8.84	4 11.76	6 17.64	3 8.82	1 2.94	1 (pthisis bulbi)
	F	— —	— —	3 7.69	4 10.25	10 25.64	9 23.07	3 7.69	1 2.56	2 (ant. staphyloma).
65+	M	— —	— —	3 11.11	5 18.51	12 44.4	21 77.77	5 18.51	2 7.40	
	F	— —	— —	— —	8 47.05	8 47.05	14 51.85	2 11.76	— —	
Total	M	7 1.39	7 1.39	11 2.19	12 2.39	23 4.58	30 5.97	8 1.59	17 3.38	
	F	3 0.68	3 0.68	3 0.68	18 4.10	25 5.69	27 6.15	7 1.59	11 2.50	
G. Total:		10 1.06	10 1.06	14 1.48	30 3.18	48 3.18	57 4.88	15 1.59	28 2.97	

4.6 VISUAL ACUITY AND DISABILITY

Out of 941 persons examined in Marada village in 1976, 38 were children in the age group of 0 - 1 year and 159 were children in the age group 2 - 5 years. These children totalling 197 were not tested for visual acuity, although they were all given a full eye examination and had conjunctival smears taken from their conjunctivas like everybody in the village. Five categories of visual acuity were considered. (Table 10 and Fig. 16).

Table No 10

Vision		Adults. M	Adults. F	Schoolchildren 6-14 yrs M	Schoolchildren 6-14 yrs F	Total M	Total F	Total Eyes
3/60 of less (Blind)	No.	39	41	2	1	41	42	83
	%	12.26	14.28	0.28	0.32	6.16	7.09	6.60
6/60-3/60 Partially Blind	No.	31	33	1	4	32	37	69
	%	9.74	11.49	0.28	1.31	4.81	6.25	5.48
6/30-6/24 Poor Vision	No.	45	50	6	5	51	55	106
	%	14.15	17.42	1.72	1.63	7.66	9.29	8.43
6/18-6/12 Satisfactory	No.	102	117	48	24	150	141	291
	%	32.07	40.76	13.83	7.86	22.55	23.81	24.14
6/9-6/6 Good	No.	101	46	290	271	391	317	708
	%	31.76	16.02	83.57	88.85	58.79	53.54	56.32
TOTAL	No.	318	287	347	305	665	592	1257

Showing age and sex distribution of visual acuity

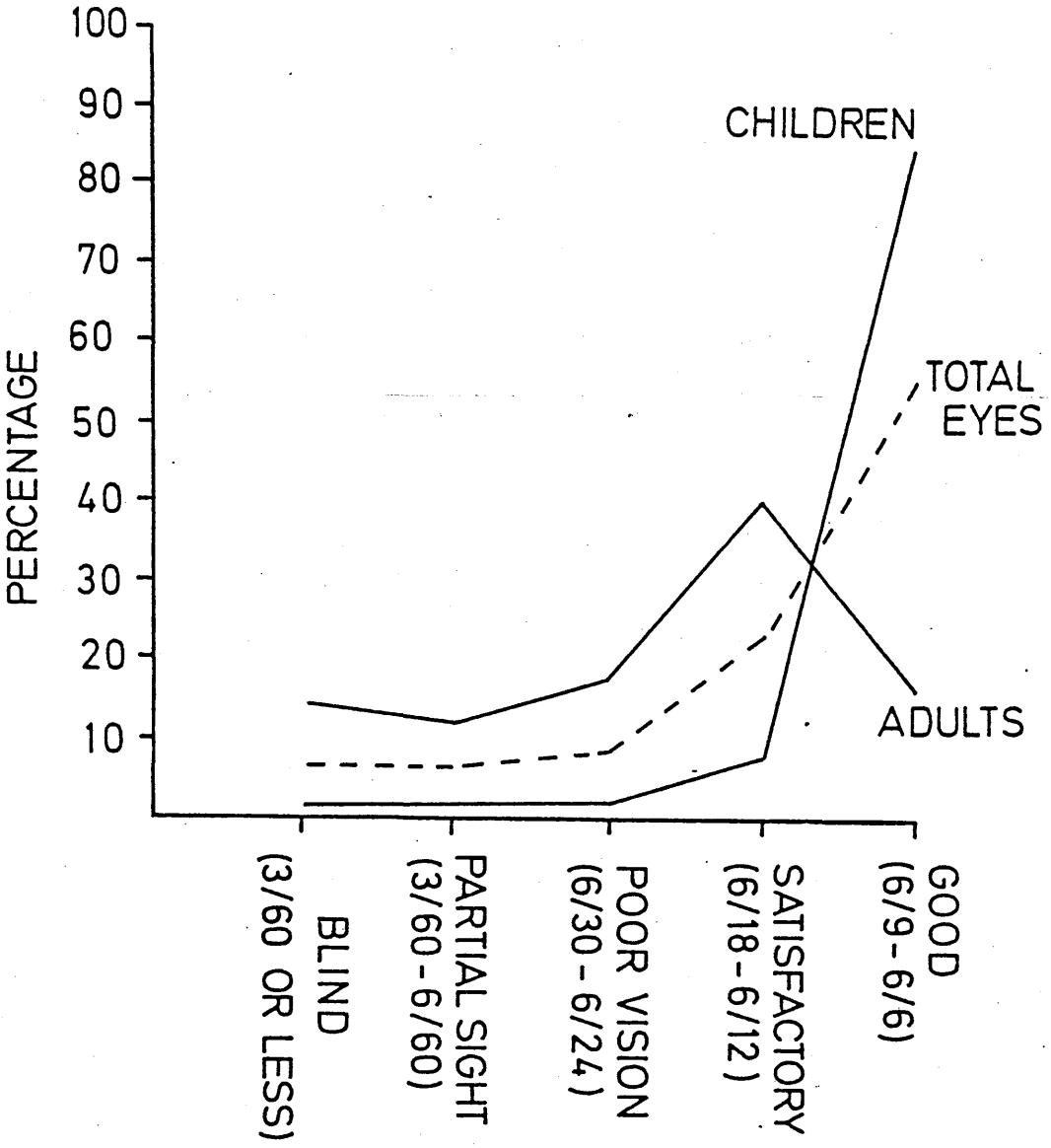


Fig. 16. Proportion of grades of vision among children, adults & total eyes examined

1. Persons with visual acuity 3/60 or less were considered to be blind.

2. Persons with visual acuity 6/60 are considered to be partially sighted.

3. Persons with visual acuity of 6/24 or 6/36 were considered to have poor vision.

4. Persons with visual acuity of 6/12 or 6/18 were considered to have satisfactory vision.

5. Persons with visual acuity of 6/6 or 6/9 were considered to have good vision.

Persons whose vision even after correction with lenses is no better than 3/60 i.e. can read the top letter on the modified Snellens E chart at 3 metres were labelled blind and the eye was labelled a blind eye. 83 eyes were found to be blind in Marada village. This represents 7% of all eyes tested. 36 persons were blind in both eyes, giving a blindness prevalence rate of 4% of the population. 11 (2%) persons had one eye blindness or monocular blindness. Monocular blindness was defined as having one eye which was blind (3/60 or worse) with the other eye having poor vision (6/24 or less).

Table no. 11

Age in Years	Both eyes Blind				Monocular Blindness				Total number of Blind Eyes			
	M	F	T	%	M	F	T	%	M	F	T	%
6 - 14	1	-	1	0.25	-	1	1	0.25	2	1	3	0.75
15 - 24	-	1	1	0.83	-	-	-	-	-	2	2	0.83
25 - 44	1	1	2	1.70	-	1	1	0.85	2	3	5	2.13
45 - 64	3	6	9	12.33	2	1	3	4.10	8	13	21	14.36
65	13	10	23	52.82	3	3	6	13.63	29	23	52	59.09
TOTAL	18	18	36	3.82	5	6	11	1.16	41	42	83	6.60
%	3.58	4.10			0.99	1.36			6.16	7.09		

Showing age and sex distribution of blindness (1976).

Table no. 11 and Fig. 17 show age and sex distribution of persons with both eyes blind, monocular blindness and total blind eyes. Sex specific blindness rates were relatively higher for females than for males. In females both eye blindness rate, monocular blindness rate and total blind eyes rates were 4%, 1% and 7% respectively whereas these rates in males were 4%, 1% and 6% respectively. These differences between the two sexes were more pronounced in the age group of 45 - 64 years as the female : male blindness ratio was about 2 : 1.

Blindness rates increased with age dramatically after the age of 45 years. 25% of the blind are in the age group of 45 - 64 years and 64% in 65 years and above. Similarly the proportion for monocular blindness in the age group of 45 - 64 years and 65 years and above were 27% and

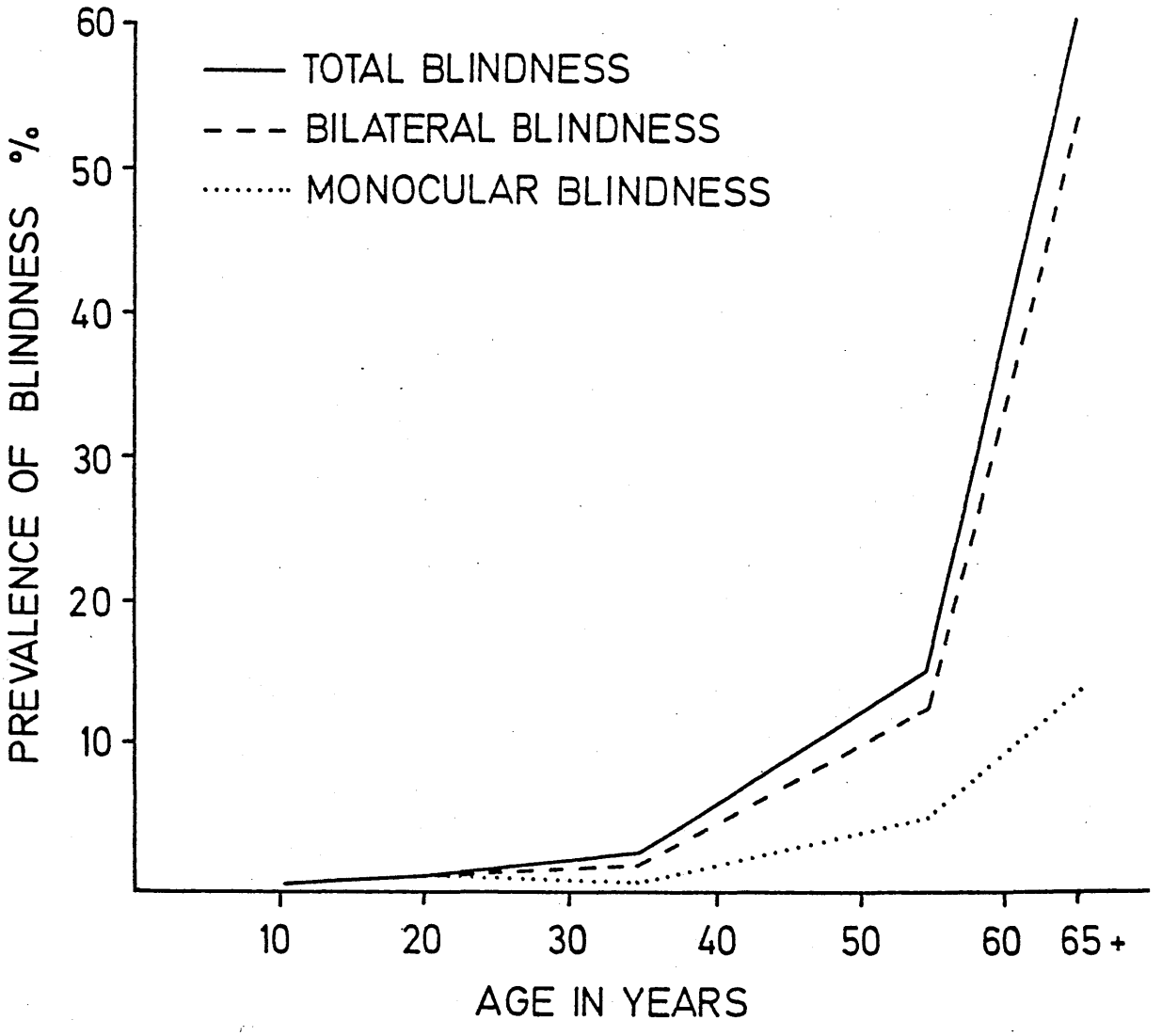


Fig.17. showing age distribution of both eyes blindness, monocular blindness and total blindness

and 56% respectively. Only 3 eyes were blind in children below 14 years of age. Two of them were due to retinal degeneration (myopic) and one due to injury.

5% of eyes tested had vision no better than 6/60. This includes 5 (1%) children below 14 years of age. All these five children had amblyopia due to squint. If both groups (blind group + partially sighted) were added together then 12% of all the eyes tested had vision of 6/60 or less with no significant difference between the sexes. If blindness is taken to mean vision 6/60 or less then 9 more persons all above 20 years of age are to be added to the blind people giving a blindness prevalence in this case of 4%.

8% of all the eyes tested had poor vision between 6/24 and 6/36. Only 11 (2%) children below 14 years were in this group, again all with amblyopia due to squint. 95 adults eyes (16%) had poor vision. No significant differences between the sexes were found.

24% of all the eyes tested had vision of 6/18 or 6/12 or satisfactory vision. 72 (11%) eyes in children and 219 (36%) eyes in adults had satisfactory vision.

56% of all the eyes tested had vision 6/9 or 6/6 or good vision. 561 (86%) eyes of children below 14 years of age had good vision, whereas among the adult population only 147 (24%) eyes had good vision. Overall satisfactory to good vision was observed among 633 (97%) school children and 219 (60%) adult eyes.

Table no. 12 shows age and sex distribution of blind eyes according

TABLE NO 12

Age	Sex	Primary Cause: Myopia No.	Myopia %	Cataract No.	Cataract %	Trachoma No.	Trachoma %	Glaucoma No.	Glaucoma %	Phthisis No.	Phthisis %	Associated Cause: Cataract No.	Cataract %	Trachoma No.	Trachoma %
6 - 14	(2) M	2	100.00	-	-	-	-	-	-	-	-	-	-	-	-
	(1) F	-	-	-	-	-	-	-	-	1	100.00	-	-	-	-
15 - 24	(0) M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(2) F	2	100.00	-	-	-	-	-	-	-	-	-	-	-	-
25 - 44	(2) M	-	-	-	-	2	100	-	-	1	50.00	2	100.00	-	-
	(3) F	-	-	1	33.3	-	-	2	66.6	-	-	2	66.6	-	-
45 - 64	(8) M	-	-	4	50.00	2	25.00	4	50.00	-	-	-	-	4	50.00
	(13) F	-	-	5	38.46	7	53.84	3	23.07	-	-	2	15.38	-	-
65 +	(29) M	-	-	15	51.72	13	44.82	7	24.13	-	-	8	27.58	-	-
	(23) F	-	-	14	60.86	5	21.73	2	8.69	1	-	2	8.69	6	26.08
Total	(41) M	2	4.87	19	46.34	17	41.46	11	26.82	1	2.43	10	24.39	4	9.75
	(42) F	2	4.76	20	47.61	12	28.57	7	16.66	2	4.76	6	14.28	6	14.28
G.TOTAL (83)		4	4.81	39	46.9	29	34.93	18	21.68	3	3.61	16	19.27	10	12.04

Showing Causes of Blindness according to Age and Sex.

to cause. Multiple ocular pathologies were observed in blind eyes but for ascertaining the cause of blindness the main condition which was considered to have directly led to blindness was taken as the primary cause of blindness and the other condition or conditions though present but not causing direct blindness were considered as associated causes.

Out of a total of 83 blind eyes observed, cataract was the major cause of blindness in the area and it was considered as the primary cause of blindness in 39 (47%) of blind eyes in the village. Cataract was found to be an associated cause of blindness in 16 (19%) of the blind eyes. The second most common cause of blindness observed was trachoma and its sequelae. Corneal opacities typical of trachoma are central and associated with trichiasis and entropion with typical lid scarring varying from criss-cross scars to complete or nearly complete scarring of the conjunctiva of the upper lid. Also there may be xerosis of the eye and Herbert's pits around the limbus. Trachoma was considered in 29 (35%) eyes as the primary cause of blindness and in 10 (12%) of blind eyes trachoma sequelae were seen. Other important causes of blindness observed in the village were glaucoma (22%), myopia 4 (5%) and injury 3 (4%). A blind eye had more than one pathological condition as the cause of blindness usually. One hundred and nineteen pathological conditions, as primary or associated causes were observed in 83 blind eyes giving an average 1.4 conditions per blind eye.

4.7 BACTERIOLOGICAL INVESTIGATIONS

Table No. 13

Micro-organisms	Trachoma doubtful No. examined 11		Trachoma No. examined 25		Non Trachomatous No. examined 39	
	No.	%	No.	%	No.	%
Staphylococcus	7	63.63	15	60.00	18	46.15
Diphtheroids	6	54.54	4	16.00	9	23.07
Lactobacilli	1	9.09	9	36.00	4	10.25
Streptococcus haemolyticus	4	36.36	5	20.00	6	15.38
Streptococcus haemolyticus	-	-	1	4.00	2	5.12
Haemophilus	3	27.27	3	12.00	6	15.12
Proteins	1	9.09	-	-	3	7.69
Klebsiella	1	9.09	-	-	2	5.12
Moraxella	1	9.09	-	-	3	7.69
TOTAL	24	-	37	-	53	-
A/V isolates per specimen	2.18	-	1.5	-	1.35	-

Distribution of bacterial isolates from conjunctival swabs taken from school children (March 1976).

The different bacterial genera, isolated from trachoma dubious, trachomatous and non trachomatous (controls) school children are summarised in Table 13. The most commonly isolated organism from all groups of school children was staphylococcus epidermidis (Coagulase negative). However, the bacterial isolation rate was higher among trachoma dubious (64%) and trachomatous school children (60%) than from controls (46%). Diphtheroids were the second commonest organisms isolated, accounting for 55%, 16% and 23% in trachoma dubious, trachomatous and control school children respectively. A higher frequency of diphtheroid organism was especially evident in this study in trachoma dubious group of school children. Lactobacilli isolation rates were relatively higher in trachomatous group (35%) than in controls (10%).

In trachoma dubious group there was a higher average number of organisms isolated from each ocular specimen examined. More than 2 organisms per specimen were isolated as compared with an average of less than 2 organisms per specimen in the trachomatous and control groups. There was also a higher bacterial isolation rate in trachoma dubious cases of the alpha haemolytic streptococcus and haemaphilus species as compared with that obtained from the trachomatous and control groups. These two findings may well be involved in causing papillary hypertrophy and producing the clinical picture of doubtful trachoma.

4.8 MICROSCOPIC EXAMINATION OF STAINED SMEARS

A majority of Giemsa-stained smears depicted an average of 400 - 500 epithelial cells, while about 19% contained approximately 80 - 100 cells. Occasional slides showed in addition to polymorphonuclear

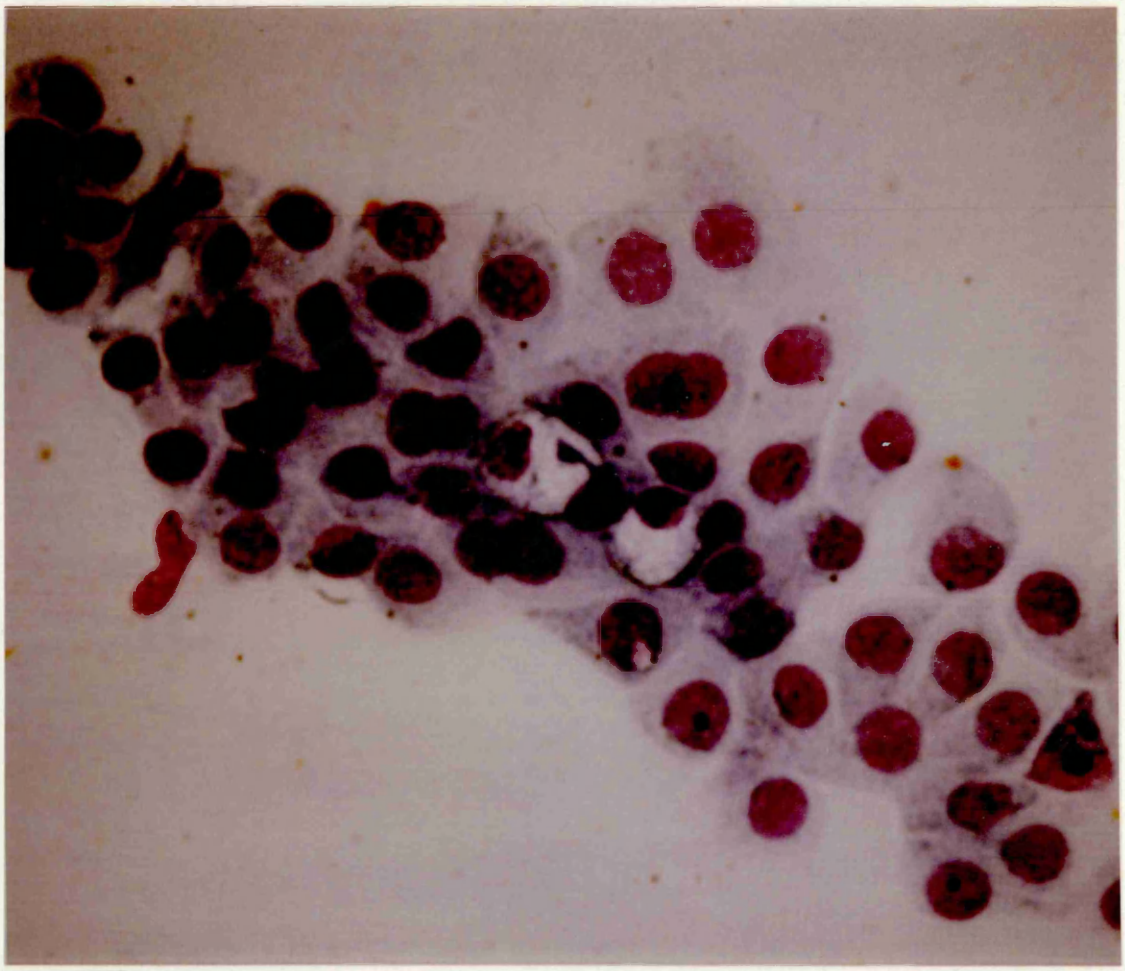


Fig. 18 Microscopic examination of a stained smear.

cells or lymphocytes, eosinophilic granules, bacterial and irregular sized clumps of black-green pigment (melanin) granules; the latter formed a close packed "cap" over the epithelial-cell nucleus. Nuclear extrusions and Goblet cells were not observed.

No elementary bodies or inclusion bodies were detected in all the slides stained with Giemsa, nor in the decolourised slides restained with iodine. This was also verified by J Sowa who was visiting Benghazi at the time (143).

5. FOLLOW UP SURVEY (1980) FINDINGS AND COMPARISON WITH 1976 FINDINGS

Table no. 14

	Initial Examination	Follow-up Examination
1. Date	March 1976	November 1980
2. Population Examined	941	1206
3. Trachoma Prevalence:		
3.1 Total Trachoma Prevalence (I - IV)	431 (45.8%)	390 (32.33%)
3.2 Active Trachoma (I - III)	197 (20.9%)	20 (1.65%)
3.3 Healed Trachoma (I - IV)	234 (24.8%)	370 (30.68%)
3.4 Trachoma Dubium (TD)	69 (7.3%)	8 (0.66%)
4. Proportion of total trachoma (Percentage of total trachoma cases)		
4.1 Active Trachoma	197 (45.70%)	20 (5.12%)
4.2 Healed Trachoma	234 (54.29%)	370 (94.87%)
	1976	1980
5. Disabling and potentially disabling lesions		
5.1 C_3 lesions (percentage of total trachoma)	32 (7.42%)	26 (6.66%)
5.2 Trichiasis/Entropion + C_4	62 (14.32%)	71 (18.20%)
5.3 Corneal Scarring	47 (10.9%)	29 (7.43%)
5.4 V_3 or more lesions	88 (20.41%)	6 (1.53%)
Total: Lesions	229 (53.13%)	132 (33.84%)

Table no. 15

Trachoma Stages	Trachoma Prevalence % 1976	1980	% Change
Active Trachoma	20.9	1.65	- 92.10
	P < 0.00001		
Healed Trachoma	24.8	30.68	+ 23.70
	P < .02		
Total Trachoma	45.8	32.33	- 29.41
	P < .001		
Disabling and potentially disabling lesions C_3 lesions	3.40	2.15	- 36.76
Corneal Scarring	4.99	2.40	- 51.90
Trichiasis/Entropion	6.58	5.88	- 10.63

Comparison of trachoma prevalence during initial and follow-up survey

5.1 The follow up survey findings and comparison with initial survey findings with respect to trachoma and its sequelae have been summarised in Tables 14 and 15 and Fig. 19. Only 20 persons (1.65) had signs of active trachoma in 1980 as against 197 (20.90%) persons with active trachoma in 1976. The rate of healed trachoma had increased from 25% to 31% during the four years and 8 months period. The total trachoma prevalence declined from 46% to 32%. These changes were found to be statistically significant.

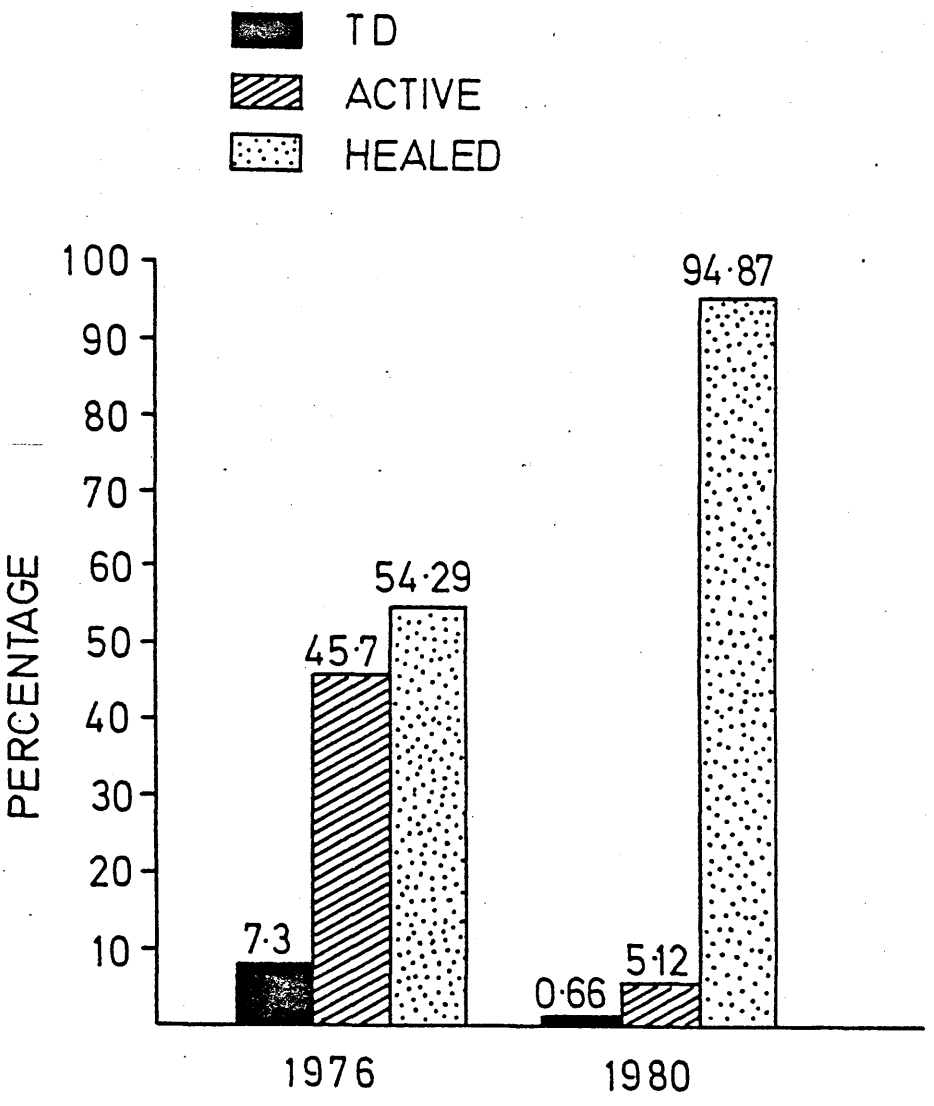


Fig.19. showing relative position of various trachoma stages

Table No. 16

Trachoma Stage	1976 No.	1976 Prevalence	1980 No.	1980 Prevalence
Active Trachoma I - III	122	28.97	5	1.22
Healed Trachoma V	66	15.67	14	3.43
Total Trachoma	188	44.65	19	4.65
Trachoma Dubium TD	29	6.8	8	1.96

Comparison of trachoma pattern amongst school children in 1976 and 1980

Among school children, healed, active and total trachoma showed a declining trend (Table 16). However, the decline was more pronounced in active trachoma which went down from 29% to 1%.

Table No. 17

Age in Years	1976 No. Examined	1976 No. of Cases.	1976 %	1980 No. Examined	1980 No. of Cases.	1980 %
0 - 1	38	-	-	85	-	-
2 - 5	159	21	13.20	203	10	4.92
6 - 14	390	106	27.17	408	5	1.22
15 - 24	120	40	33.33	163	2	1.22
25 - 44	117	21	17.94	156	2	1.28
45 - 64	73	9	12.32	126	-	-
65+	44	-	-	65	1	1.53
TOTAL	941	197	20.93	1206	20	1.65

Comparison of active trachoma by age in 1976 and 1980

During 1976 - 1980 there was a marked reduction in the age specific prevalence rates of active trachoma in all age groups excepting the age group of 65 years and above (Table No. 17). 127 (63%) active trachoma cases were in the age group of 0 - 14 years in 1976, whereas 15 (75%) active trachoma cases observed in 1980 were under 14 years of age. In 1976 the peak of active trachoma (33%) prevalence was in the age group 15 - 24 years, whereas in 1980 the age specific prevalence rate of active trachoma was highest (5%) in the age group of 2 - 5 years, suggesting a shift in the load of infection from a higher to a lower age during this period.

Table No. 18

Age in Years	1976 No. Examined	1976 No. of Cases.	1976 %	1980 No. Examined	1980 No. of Cases.	1980 %
0 - 1	38	-	-	85	2	2.35
2 - 5	159	21	13.20	203	17	8.31
6 - 14	390	158	40.51	408	7	1.71
15 - 24	120	71	59.16	163	77	47.23
25 - 44	117	82	70.08	156	117	75.00
45 - 64	73	63	86.30	126	109	86.50
65 +	44	36	81.81	65	61	93.84
TOTAL	941	431	45.80	1206	390	32.33

Comparison of total trachoma prevalence (I - IV) by age 1976 - 1980.

The prevalence of total trachoma (I - IV) was reduced in all age groups under 24 years excepting in 0 - 1 year which had 2 (2%) cases of trachoma. The reduction in total trachoma prevalence was maximum in the age group of 6 - 14 years. It fell from 41% to 2%. In the higher age groups of 25 years to 65 years and above there was an increase in the trachoma prevalence during this period (Table 18 and Fig. 12).

Table No. 19

Age in Years	1976 No. Examined	No. of Cases.	%	No. Examined	No. of Cases.	%
0 - 1	38	-	-	85	2	2.3
2 - 5	159	-	-	203	7	3.95
6 - 14	390	52	13.33	408	2	0.50
15 - 24	120	31	25.83	163	75	45.95
25 - 44	117	61	51.13	156	115	73.80
45 - 64	73	54	73.97	129	109	86.5
65 +	44	36	81.81	65	60	93.81
TOTAL	941	234	24.86	1206	370	30.68

Comparison of healed trachoma (IV) by age in 1976 - 1980

Comparison of healed trachoma (IV) by age in 1976 and 1980 is shown in Table No. 19 and Fig. 14. There was an increase in healed trachoma in all age groups excepting in the age group of 6 - 14 years where it was reduced from 13.33% to 0.5% only.

Trachoma prevalence rates were relatively higher for males than for females in 1976, but in 1980 these rates were higher for females than for males. Statistical analysis revealed no significant difference between the two sexes in 1976 as well as in 1980.

5.2 DISABLING AND POTENTIALLY DISABLING LESIONS

Table No. 20

Age Group	1976 %			1980 %		
	C3 Conjunctival Scar	Trichiasis Entropion	Corneal Scarring	C3	Trichiasis Entropion	Corneal Scarring
0 - 1	-	-	-	-	-	-
2 - 5	-	-	-	-	-	-
6 - 14	1.28	0.76	-	-	-	-
15 - 24	2.50	1.66	2.50	-	-	-
25 - 44	4.27	13.67	8.54	2.04	15.46	1.36
45 - 64	19.17	23.28	19.17	10.23	19.68	11.02
65 +	11.36	54.54	45.42	16.66	38.33	21.66
TOTAL	3.40	6.58	4.99	2.15	5.88	2.40

Comparison of prevalence of disabling lesions in 1976 and 1980 by age

During 1976 - 1980 changes that occurred in these parameters were quite pronounced (Table 20, Fig. 20 and Fig. 21). Prevalence of conjunctival scarring (C_3 was reduced from 3% to 2%, corneal scarring from 5% to 2% and trichiasis/entropion from 6% to 5%. Reduction in these lesions was maximum for corneal scarring (- 52%) following by conjunctival scarring (- 37%). Age wise comparison revealed that in 1980 these disabling lesions were observed only in the higher age groups of 25 years and above, however, in 1976 these lesions could be seen in the younger age groups of 6 - 14 years and 15 - 24 years, although low in frequency.

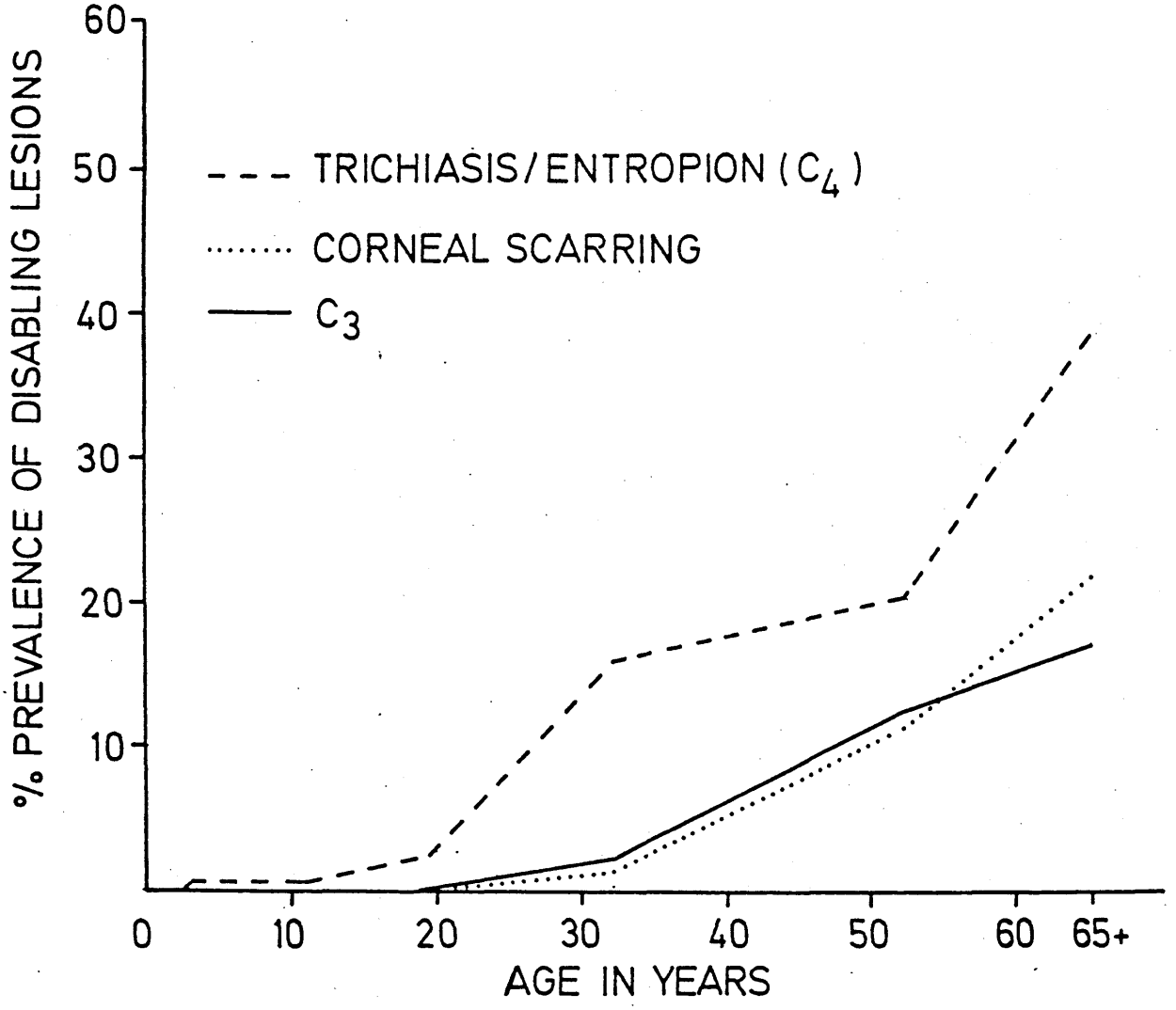


Fig. 20. Age distribution of disabling lesions-1980.

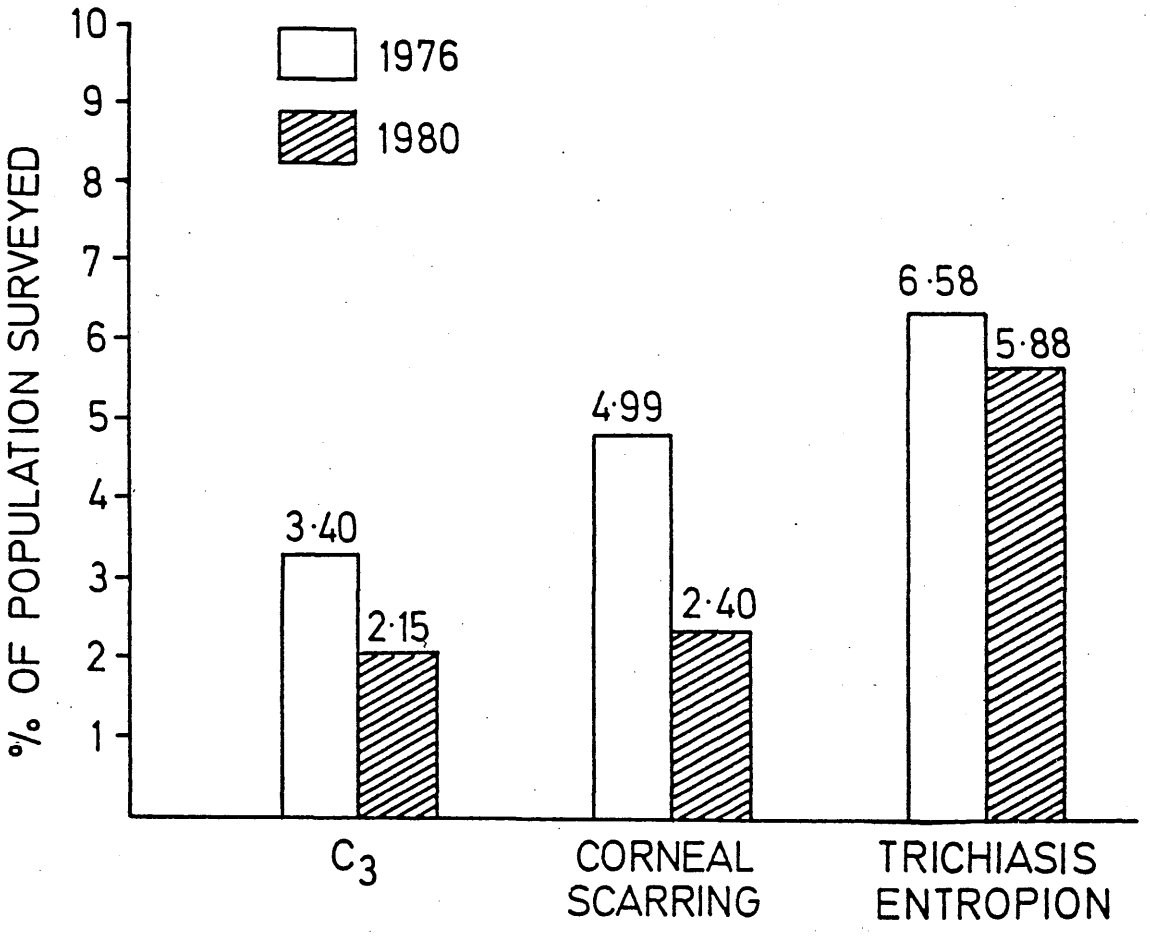


Fig.21. Disabling lesions - 1976 & 1980

5.3 CHANGES IN HOUSING CONDITIONS AND TRACHOMA PREVALENCE

Table No. 21

Housing Type	No. Examined	No. of positive Cases	Percentage
New	831	242	29.21
Old	375	148	38.46
TOTAL	1206	390	32.33

Prevalence of trachoma according to housing 1980

(χ^2 = 12.6385 df 1 P < 0.001)

In 1980, 831 (69%) persons were living in the 150 new houses with separate chlorinated water supply connected to the newly completed sewage plant, as against 80 (13%) persons in new houses in 1976. Housing and living conditions improved dramatically in the area during this period of 4 years and 8 months. Comparison of trachoma prevalence in persons living in new houses and those living in old houses revealed a significantly higher prevalence of trachoma in those living in old houses (Table 21). The last family to move into a new house did so one year prior to the second survey.

5.4 INTENSITY OF INFLAMMATORY DISEASE

In both surveys 1976 and 1980, the intensity of the inflammation was found to be mild in all trachoma cases. The disease was considered

mild because the papillae were tiny and never exceeded P2. The follicles were either immature or small, never exceeding 1 - 1.5 m.m. (F2) in diameter. If one applies the intensity scale as put forward by Dawson et al (45), then the intensity can be said to have come down from moderate to mild over the 4 years and 8 months period, separating the two surveys. This becomes more apparent if one applies the modified Dawson scale suggested by Dawson, Jones and Tarizzo in 1981 (42) as no follicles were seen in either surveys in zone one by using an ordinary loop and no P_3 at all were seen in the conjunctivae.

5.5 PTERYGIUM

Pterygium was observed only in the age group of 25 years and above. Out of 347 persons in Marada who were 25 years or age or older, examined in both the old and new houses, 24 persons (14 males and 10 females) had unilateral pterygium or bilateral pterygia giving rise to a prevalence rate of 2% for the whole village and 7% as an average for all persons of 25 years of age and above. 1% of the total population had unilateral pterygium.

Table no. 22

Age Group	Bilateral pterygia Persons		Unilateral pterygium Persons		Number of Eyes	
	No.	%	No.	%	No.	%
25 - 44 (156)	2	1.28	5	3.20	9	2.88
45 - 64 (126)	5	3.96	4	3.17	14	5.55
65 + (65)	4	6.15	4	6.15	12	9.23
TOTAL for village (1206)	11	0.9	13	1.07	35	1.45

Pterygium prevalence and distribution according to age.

Age specific pterygium prevalence rates are shown in Table No. 22. The prevalence rates for unilateral, bilateral and total eyes with pterygia increased with age - a positive association with age. There seems to be an association between pterygium prevalence and housing conditions. Out of 375 persons living in the old houses 10 had pterygia, giving a prevalence rate of 3% whereas out of 831 persons living in new houses only 14 persons had pterygia giving a prevalence rate of 2%. 14 out of 559 males in the village had pterygia, a prevalence rate of 3% and 10 out of 647 females had pterygia, a prevalence rate of 2% giving a strong association between pterygium prevalence and sex.

All cases of pterygia had trachoma stage IV except one female of 44 years who had trachoma stage III, giving a definite association between pterygia and trachomatous scarring. Similarly there was a strong association with Herbert's Pits; for 23 out of 24 cases of pterygia (96%) had Herbert's Pits.

6.0 DISCUSSION

In Marada village during the period 1970 - 1974 as part of the national Trachoma Programme, intermittent treatment was applied to the eyes of school children consisting of the application of chlortetracycline eye ointment 1% once daily for 10 days of each month for 6 months. The treatment was carried out by the school teachers under the direction and guidance of health visitors from the health dispensary.

In the absence of proper records, but after questioning the school teachers, it is doubtful if the children had received the complete treatment of 60 applications a year as recommended by W.H.O. (180). No treatment had been given in the school a year and a half prior to the 1976 survey. The state of trachoma in the village prior to 1976 is not known for certain as no surveys had even been made in that village (107). The national trachoma prevalence rate was said to be 42% for active trachoma in 1970. The active trachoma prevalence rate in Jaloo village, which is 150 km north east of Marada, in 1970 was 67% (107). The national survey of school children undertaken in 1974 was the first proper randomised sample of all Libyan school children. The active trachoma prevalence rate for the country as a whole was 18% (107).

When the present survey was undertaken in March 1976 it revealed an active trachoma prevalence of 21% in the general population of the village and 29% in school children. This is similar to other studies where trachoma prevalence was found to be higher in school children

than other sections of the community (4). It is evident, therefore, that there was a reduction in active trachoma in the overall population, but there was no appreciable change in active trachoma prevalence among school children. In both situations the risk of trachoma remained high suggesting that intermittent therapy carried out during 1970 - 1974, appeared to be ineffective in producing a significant reduction in the risk of trachoma in this rural community. However, the possibility that an influx of new residents which included young adults, with their parents, together with young children aged 0 - 5 years, could have changed the risk profile of the population for trachoma cannot be ruled out. Similarly other workers observed varying degrees of success of trachoma eradication campaigns in controlling the infection (2, 32, 41, 51, 76, 110, 121, 128).

There is evidence that in a number of endemic areas trachoma is changing over the years from a grave to a milder disease. This has occurred in areas where large scale treatment operations are in progress; it is also taking place in some areas where systemic treatment has not been applied and here the change has been attributed to improvements in standard of living and hygiene (46, 49, 95, 97, 98, 123).

In a study in Burma, evaluation of control measures under the National Trachoma Control Project was done. According to recent simplified criteria of evaluation the prevalence of active trachoma has been reduced by more than 60% and the rate of active inflammatory disease of moderate and severe intensity reduced from 7% to 2%.. A reduction in the risk of becoming infected was evident from changes that had occurred among younger age groups. The authors concluded that control measures started in 1964 considerably reduced the degree

of endemicity and severity of the disease in the areas treated (164).

Another study in Burma included a total of 4682 children in eight different villages. These children were given mass treatment using local sulphacetamide. The prevalence of trachoma among these children was 74% before treatment and it came down to 40% and 46% at the second (after 6 months) and third (after nine months) check ups. Therefore according to these authors in a developing country mass treatment by topical application of antibiotic or sulphas, seems advisable (173).

In Morocco a large trial conducted under the aegis of W.H.O. gave a cure rate of 80% for the topical application of 1% chlortetracycline ointment two to three times daily for 60 days (94, 127, 128). It Ethiopia Bietti et al (15) obtained a similar rate of cure with oral long acting sulphonamide given intermittently for 3 months. Shukla et al (133) reviewed earlier trials of sulphonamide in India and reported 75% cures in Northern India with the simultaneous use of systemic long acting sulphonamide and topical sulphafurazole.

On the other hand, a controlled double blind trial in a group of American Indian children with chronic trachoma demonstrated that in both groups of children who received treatment (topical application of tetracycline and sulphoxazole) and those who received placebos, the incidence of activity did not vary during the 7 months of observation. During this period the children lived in boarding school under good hygienic conditions, and the disease activity was judged by the number of positive findings of immunofluorescence of conjunctival smears. The persistence

of the aetiological agent remained unchanged. Eye drops of 1% tetracycline hydrochloride in oil three times daily for 6 weeks or a suspension of sulphafunazole 4 gm daily for 3 weeks by mouth was not remarkably superior to the administration of placebo. The good environment seemed to be the most important factor in the control of chronic, mild trachoma, uncomplicated by bacterial conjunctivitis. (41).

Foster et al in 1963 studied 2,674 Indian boarding school children up to 20 years. They were screened for trachoma activity and 457 or 17% had active disease. The active cases were divided at random into three treatment groups: one group received topical tetracycline and one was left untreated as control. When re-examined after 12 months by double blind technique the cure rate in the untreated control group was as high as in the treated groups. It seems that the milder the disease the more difficult is the proof that chemotherapy contributes to clinical improvement (55).

The time interval between the initial and follow up examination of this study was 4 years and 8 months (March 1976 - November 1980). During this period there were no treatment activities carried out in the village but there was a marked improvement in the socio-economic and living conditions of Marada residents. At the end of 1980, 831 (69%) persons were living in new houses with an independent water supply, connected to the new sewerage disposal plant as against only 70 (7%) persons, living in new houses in 1976. The average Libyan per capita income improved dramatically from 1798 U.S. dollars in 1970 and 5671

U.S. dollars in 1976 to 6452 U.S. dollars in 1980 (109).

137,700 houses were built in the period 1969 - 1979 in Libya 200 of which were allocated to Marada village (109). The health statistics were also very impressive; from 3.5 beds per 1,000 population in 1970 to 4.5 beds per 1,000 population in 1978 (107) and from 0.4 doctors for each 1,000 persons to 1.2 doctors in 1980 (107, 109). In Marada there was one doctor in general practice in 1976 and 2 doctors plus a laboratory technician in 1980. A new dispensary was under construction with 5 beds in 1980 and 48 million U.S. dollars were spent on the agricultural project in Marada by that time (109).

Trachoma figures for 1980 revealed an improvement in the prevalence rates of active disease and total trachoma as compared to 1976. Analysis of trachoma prevalence according to housing and living conditions revealed significantly lower trachoma prevalence among persons living in the new houses (Table No. 21).

A number of studies in different parts of the world have provided similar evidence of a close link between trachoma endemicity and environmental factors; socio-economic developments and improvements in environmental conditions play a major role in the reduction of trachoma morbidity in a community (46, 49, 95, 97, 98, 100, 123).

Detels and associates in their study of Indians living in Canada and those remaining in the Punjab believe that improvement in environmental conditions of subjects of 20 years of age or more, effected substantially

the sequelae of trachoma. The Canadian environment exerted a favourable effect on severe scarring; in contrast, continued residence in India led to trachoma of increased gravity (46).

Bob & Nicols (21), writing on trachoma in the Eastern province of Saudi Arabia found statistically significant differences between townsite and oasis children and that the intensity and gravity of trachoma in the oasis subjects exceeded the severity of the disease found in townsite children. They further state that their study equated the epidemiologic variables alleged to be important by many workers (100) e.g. race, climate, cultural pattern, geography, nutrition and extrinsic contacts, between the oasis and townsite dwellers, emphasising the potential of crowding and poor personal hygiene in producing an environment in which trachoma may progress to the point of impairment of vision. Crowding, an important epidemiological variable may be considered in the Marada study for although the same family moved into the new bigger home they carried with them the same habits e.g. sleeping on mats, children sleeping in the same room with the grandmother and parents sleeping in their own room. There remains one very important factor i.e. personal hygiene especially the presence or absence of tap water and its availability inside the new houses and its absence from inside the old ones. (Fig. 3 and 10a).

Comparing the results of 1976; the numbers of active trachoma in school children (intermittent treatment) and adults (no treatment), the intermittent treatment of school children in this area of the country with mild trachoma has failed to produce greater clinical

improvement than in the no treatment population. Nevertheless one cannot rule out the possibility that this intermittent treatment and the common use of local antibiotics by the general population (107) exerted a beneficial influence on the clinical activity of trachoma and possibly conjunctivitis, and possibly also had an effect on extraocular chlamydial infections which are supposed to be widespread even in hyperendemic areas according to Malaty et al (1981) and are responsible for diarrhoeas, pneumonias in children and failures of therapy in Third World countries (105).

Judging by the fact that "Microbiological cures" of acute infections often require repeated courses of drug treatment (37) (38) (150) Jawetz et al (76) have shown that even paratrachoma (Tric infections) cannot be regularly and rapidly eradicated by topical tetracyclines or a single 3 weeks course of oral sulphafurazole. Presumably the same will hold for cases of active disease in an endemic area such as Marada village and the intermittent treatment that school children received in 1970 - 1974 was not perhaps the main reason for the falling prevalence rates but that the improvements in the socio-economics and housing with its chlorinated water supply are perhaps the main cause of the great improvement seen over the four years' period.

Tedesco (1980) states, after his study of trachoma in Northern Australia, that improvements in environmental conditions may be far more important for the control of chronic mild or severe trachoma uncomplicated by bacterial conjunctivitis than chemotherapy. Environmental indices of living conditions, housing, diet and sanitation set against the climatic realities of the Australian rural area within the Northern

Territory, clearly influence the incidence of active trachoma in these communities (150).

Similarly, a recent Australian study (1980) (130) shows that cicatrical trachoma prevalence rates for all ages fell from 67% to 10% as housing conditions improved. Follicular trachoma also fell from 45% to 4% as housing improved. They also found that the best improvements were the result of housing, sewerage systems then water access. This is similar to our findings in Marada village.

Active trachoma indicates the risk of infections and repeated reinfections. These cases constitute the source of infection. The higher the prevalence in the community the greater the risk of infection to the non trachomatous members and of reinfection to those already infected (4). The prevalence of active trachoma was initially (1976) 21% in the overall population and 29% in school children. In 1980, 4 years and 8 months later it was 2% and 2% respectively in the population as a whole and school children corresponding to a reduction of the risk of trachoma infection of 91% in the community.

Another interesting change observed was the shift in peak prevalence towards a lower age during this period (Fig. No. 13). In 1980, 75% of active trachoma cases were in children below 14 years of age, and 50% of active cases were in pre-school children of the 2 - 5 age group. While in 1976 the highest prevalence rates were in the 6 - 14 and 15 - 24 age groups which constituted 74% of active cases.

27% of all the 6 - 14 age group (school children) had active trachoma in 1976. This figure dropped to 1% in 1980.

Although the 2 - 5 age group in 1980 had the highest prevalence rates of activity it still represented an improvement on the 1976 situation because, whereas 13% of the children in the age group 2 - 5 had active trachoma in 1976 only 5% of the same age group had active trachoma in 1980. A number of workers have found a similar situation (10, 164) and some have called this a shift in prevalence. Table 17 indicates that there is an improvement in nearly all the age groups rather than a shift in prevalence from one age group to another.

In the new improved situation of 1980, the 2 - 5 age group has more activity than the other age groups. It was noticeable that children of 2 - 5 age group were running around with faces unwashed (Fig. 6 and 7) even in the new housing areas whereas school children learned how to wash their faces before going to school. One assumes that with health eduction for mothers and instructions to wash their children's faces the situation could improve dramatically amongst this 2 - 5 age group.

Total and Healed Trachoma

Total and healed trachoma prevalence rates indicate the load of trachoma infection sustained by the community (6). The results of the initial and the follow up examinations show that the rate of total trachoma decreased from 45.8% to 32% in the general population and from 19% to 2% in children below 14 years. Taking the prevalence of total trachoma as the end product of change, this was reduced over 4 years

8 months by 14%. However, this change was more pronounced in children below 14 where it was 17% suggesting a shift of load of the disease to the older age groups (Fig. 12) This is similar to the findings of other workers (3).

Intensity of Inflammatory Disease

There was an overall decrease in the degree of intensity in all the age groups. In all cases only tiny papillae and immature follicles were found reinforced by the laboratory finding of no inclusion bodies in any; the disease was thus mild in nature. Presumably the explanation given by Assad et al (6) is also true in this situation. A reduction in the risk of infection over a period of years following socio-economic and environmental improvements, may first be reflected in a lowering of the intensity of clinical signs and an increase in the cure rate, followed by a reduction in incidence and hence in the long run in the prevalence of the disease. Similarly Ihsan et al (75) noticed a change in the severity of the disease in Saudi school children, which was attributable to improvements in living conditions, water supply and garbage disposal.

Disabling Lesions

In this study, trichiasis and entropion or both; the severest grade of conjunctival scarring (C_3) and corneal scarring were considered to be the disabling lesions (42). Corneal scarring rarely occurred in the absence of trichiasis, entropion and severe conjunctival scarring. The change that occurred in these parameters was quite pronounced except in trichiasis and entropion 7% to 7%). Corneal scarring decreased by

50% (5% to 3%), although it is an irreversible condition, presumably because no new cases were added due to the decrease in the intensity of the disease.

Yoneda et al observe that the examination of Giemsa-stained smears of chlamydial inclusions is a useful technique for the diagnosis of trachoma by laboratories that do not have the specialised facilities for the identification of these chlamydial infections by the technically more complex procedures of immunofluorescent staining, serology, isolation in eggs or tissue cultures (183) as is the case in our laboratories.

The great advantage of Giemsa staining is that the original stained smear can be stored indefinitely and examined repeatedly without damage to the specimen. These smears can also be sent to specialised laboratories for confirmation of suspected inclusions. In our case an experienced worker in this field (J Sowa) was visiting the area and kindly examined a good cross section of the smears and confirmed the absence of inclusion bodies in any (143) presumably because of the low intensity of the disease in this part of the world and in contrast to findings in neighbouring countries, Tunisia to the west (36, 39, 40) and Egypt to the east which are still considered as hyperendemic areas of trachoma (82, 112, 131, 182).

In the Royal Australian College of Ophthalmologists study also, no chlamydial trachomatis inclusions were detected in epithelial cells in conjunctival scrapings taken on to microscope slides, suggesting that

the load of infectious organisms in clinical trachoma is less than in some other areas of endemic trachoma (130).

There is a great need, in countries with deficient laboratory services, for a simply laboratory test for the detection of chlamydia. Daraugar and Associates in advocating the use of the "rapid serological test" in hyperendemic areas state that the high sensitivity and specificity of this rapid and simple test coupled with the practical method of collection and transport of blood and tears (using cellulose sponges) offer advantages over the cultural tests for routine diagnosis of ocular chlamydial infections (35).

BACTERIOLOGY

The most commonly isolated organisms for all groups of school children were staphylococcus epidermidis. Diphtheroids were the second commonest organisms isolated. The number of school children examined for bacteria is too small for these findings to be statistically significant but then are similar to those found by Mena et al in India (114) and unlike the findings of Dawson et al who found haemophilus to be the commonest organisms in epidemic conjunctivitis in Tunis (39, 40).

A most interesting finding is that there was a higher average number of organisms isolated from trachoma dubium than from the other stages of trachoma or from the controls and also higher isolation rates in trachoma dubium of pathogenic haemophilus and α-haemolytic strep than the other groups. Both facts possibly cause confusion in the clinical diagnosis of papillary hypertrophy in field studies.

PTERYGIUM

In Marada a pterygium prevalence rate of 2% for the whole village was found. Only people of 25 years and above had pterygia giving a 7% prevalence rate for adults of 25 years of age and above.

There was a strong association between pterygium and sex for it was found to be commoner in males (3%) than females (2%) which is to be expected when women are more likely to be confined to houses and are less likely to be exposed to the climatic factors said to be responsible for pterygium (49, 100, 130). There was also a strong association with housing conditions with a prevalence of 3% for people living in old houses and 2% for people living in new houses.

In 1953 Ida Mann found pterygium in 4% of 2,860 persons examined of whom 59% were aborigines (100). Recently pterygium was found to affect 12% of aborigines over 40 years and to have a strong association with ultra-violet light, hygienic variables and cicatricial trachoma. It was found to have only a poor association with latitude rainfall, humidity and evaporation rates.

It was interesting to find a strong assocation in Marada village between pterygium and cicatrical trachoma and pterygium and Herbert's pits as was found in the Australian study (130).

7. CONCLUSIONS AND RECOMMENDATIONS

1. Giemsa method may detect only the most heavily infected individuals and in areas such as Marada where the intensity of the disease is mild to moderate its value is suspect.

2. Socio-economic improvements may be difficult or impossible to achieve in some parts of the world and blanket treatment can be expensive, difficult to apply and may be ineffective in dealing with trachoma. This study indicates that improvements in housing conditions and personal hygiene are probably very important in trachoma control and that the presence of running water in new houses is possibly the most important factor. There is a need to improve the water supply to new or old houses before people can be expected to wash their faces properly and regularly. Face washing is possibly the most inexpensive method of trachoma control but requires health education to emphasise its importance in controlling communicable eye diseases in a community.

3. The blindness rate for this desert community is nearly 10 times the National Census' figures stressing the fact that the only method of recording the incidence of blindness should be by full national, randomised surveys and not through attendance figures of out-patient clinis, small area surveys or national assistance statistics.

4. It will be interesting to repeat this study in the near future using the rapid serological test in a community where cicatrical trachoma is still a major problem whereas active trachoma is not.

Repeating this study will also show if the improvements seen over the 4 years and 8 months period are sustained and consolidated. There is also a great need to resurvey this and other similar areas for the other disease that is fast becoming even in developing countries one of the main causes of blindness, namely chronic simple glaucoma.

5. Another interesting point that requires further study is what happens to areas of cicatrisation. Some scars disappear in time it seems and some do not.

6. There is a need to repeat this study in other parts of Libya regarding the prevalence of pterygium especially in one of the coastal towns to compare the prevalence there with that in the desert and to see if geographical factors have an influence on the condition or if degenerative conjunctival conditions and ultraviolet light are the only or the most important factors involved in the aetiology.

REFERENCES:

1. Abrams, A.J. (1968). Lymphogranuloma venereum. Journal of American Medical Association, 205, 199-202.

2. Ahmed Abdel Aty and Hamed El. Defrawi (1969). Evaluation of five years mass campaign against communicable eye diseases in kindergartens and primary schools of Kuwait. Bulletin of Ophthalmic Society of Egypt, 62, 11 - 20.

3. Aoki, K. (1971). Trachoma Studies in Eritrea. Comparison of Laboratory results and clinical diagnosis. Review International du Trachoma. 48, 70 - 75.

4. Assaad F.A., Sundaresan T.K., Yang C.Y., et al. (1971). Clinical evaluation of the Taiwan Trachoma Control Programme. Bulletin World Health Organisation, 45, 491 - 509.

5. Assaad F.A., Maxwell-Lyons F. (1967). Application of clinical scoring system to trachoma research. American Journal of Ophthalmology 63 (suppl), 1327 - 1356.

6. Assaad F.A., Sundaresan T., & Maxwell-Lyons F. (1971). The household pattern of trachoma in Taiwan. Bulletin of World Health Organisation. 44, 605 - 615.

7. Assaad F.A., Maxwell-Lyons F., Sundaresan T. (1968). Use of local variations in trachoma endemicity in Taiwan to elucidate some of the clinical and epidemiological aspects of the disease. Bulletin of World Health Organisation. 39, 567 - 586.

8. Ayanru, J.O. (1978). Affections of conjunctiva and cornea in Bendel State of Nigeria. Tropical and Geographical Medicine. 30, 69 - 74.

9. Bai, K.I., Malika R. (1975). Incidence of trachoma in primary school children of Tirupati. Indian Paediatrics. 12, 7, 583 - 585.

10. Ballard, R.C., Sutter, E.E., and Fotheringham, P. (1978). Trachoma in a rural South African Community. American Journal of Tropical Medicine and Hygiene. 27, 1, 113 - 120.

11. Barenfanger, J. (1975). Studies on the role of the family unit in the transmission of trachoma. American Journal of Tropical Medicine and Hygiene. 24, 3, 509-515.

12. Bartolotta, E. (1920). Causes of Blindness in Libya. Archivio Italiano Di Scienze Mediche Coloniali, 1, 6, 165 - 267.

13. Bartolotta, E. (1920). Deformita Trachomatose in Libya L'entropion. Archivio Italiano De Scienze Mediche Coloniali. 1, 7, 322 - 325.

14. Bell, S.D. Jr., and Nichols, R.L. (1969). Differentiation of trachoma bedsoniae in vitro. Proceedings Society Experimental Biological Medicine, 124, 34 - 39.

15. Bietti, G.B., Pannarale, C., Minalo, C. (1967). Further contributions to the intermittent therapy of trachoma with new long acting sulfonamides. American Journal of Ophthalmology, 63, 2, 1569 - 1586.

16. Bietti, G.B., Freyche, M.J. and Vozza, R. (1962). The present distribution of trachoma in the world. Acta vol. 2, XIX Concillium Ophthalmologicu, New Delhi, 1071 - 1076.

17. Bietti, G. and Werner, G.H. (1967). Trachoma - Prevention and Treatment. Charles C. Thomas, Illinois, U.S.A. Edn.

18. Bland, R.H. et al. (1967). Planning of Health Services, Kingdom of Libya. · Survey & Recommendations, Alexandria, Egypt. World Health Organisation Regional Office for the East Mediterranean.

19. Blagojevic, M., Andjelkovic, M., Vasovic, N., Debeljkovic, O. Dedic. (1979). Problems in the Campaign against trachoma in areas with low prevalence and incidence of trachoma. Review International du Trachome, Vol. 56, 1, 23 - 31

20. Blunsum, Terrence (1968). Libya: The Country and its People. Queen Anne Press, London.

21. Bobb, A.A., Jr., and Nichols, R.L. (1969). Influence of Environment on Clinical Trachoma in Saudi Arabia. American Journal of Ophthalmology. 67, 2, 235 - 243.

22. Brett, Michael (1972). "The U.N. and Libya". Journal of African History, London, 13, 1, 168 - 170.

23. Briones, O.C., Hanna, L., Jewetz, E., et al. (1974). Type specific antibodies in human Chlamydial trachomatis infections of the eye. Journal of Immunology, 113, 1262 - 1270.

24. Chang-Yui Sun (1958) Trachoma control in Taiwan. Chronicle World Health Organisation, 12, 373 - 376.

25. Chaterjee, A. et al. (1968). Vision survey in Mimalagan area. American Journal of Ophthalmology, 66, 113 - 116.

26. Chovet, M., Negrel, A.D. Ducam, M. et Panouse De A. (1979). Realite Du Trachoma Au Sahel. A propos D'une enquete dans La region du gourma, Medicine Tropicale, 39, 1, 97 - 101.

27. Collier, L.H. (1973). Life at the border: a review of the work of the MRC trachoma unit. Annual Report of the Lister Institute of Preventative Medicine, 1 - 26.

28. Collier, L.H., Sowa, J., and Sowa, S. (1972). The serum and conjunctival antibody response to trachoma in Gambian children. Journal of Hygiene, 70, 727 - 740.

29. Cooper, S.N. (1966). Epidemiology of Trachoma. Oriental Archives of Ophthalmology, 6, 1, 1 - 4

30. Cornand, G. (1979). Trachoma and armies. Review International du Trachoma, 56, 3 - 4, 99 - 110.

31. Cowan, S.T., Steel, K.J. (1965). Manual for the identifications of medical bacteria. Cambridge University Press.

32. Darougar, S., Jones, B.R. et al. (1980). Family based suppressive intermittent therapy of hyper-endemic trachoma with topical oxytetracycline or oral doxycycline. British Journal of Ophthalmology 64, 4, 291 - 295.

33. Darougar, S., Jones, B.R. et al. (1980). Topical therapy of hyper-endemic trachoma with Rifampicin Oxytetracycline or Spiramycin eye ointments. British Journal of Ophthalmology, 64, 1, 37 - 42.

34. Darougar, S., Dwyer, R.S., Treharne, J.D., et al. (1971). A comparison of laboratory methods of diagnosis or chlamydial infection; in Nichols RL (ed); Trachoma and Related Disorders Caused by Chlamydial Agents. Exerpta Medica International Congress series, 223, 445 - 460.

35. Darougar, S., Treharne, J.D., Minassian, D., El-Sheikh, H., Dines, R.J. and Jones, B.R. (1978). Rapid serological test for diagnosis of chlamydial ocular infection. British Journal of Ophthalmology, 62, 503 - 508

36. Davey, M.G. (1975) Letter: Ethiopia. The Medical Journal of Australia, 2, 4, 153.

37. Dawson, C.R. (1973). Therapy of diseases caused by Chlamydia organisms in External Ocular Diseases: Diagnosis and Current Therapy. International Ophthalmology Clinics, 13, 4, 93 - 101.

38. Dawson, C.R., Ostler, H.B., Hanna, L et al. (1971). Tetracyclines in the treatment of chronic trachoma in American Indians. Journal of Infectious Diseases, 124, 255 - 263.

39. Dawson, C.R., Daghfous, T., Messadi, M. et al. (1976). Severe endemic trachoma in Tunisia. British Journal of Ophthalmology, 60, 245 - 252..

40. Dawson, C.R., Daghfous, T., Messadi M., Hoshiwara, I., and Schachter, J. (1976). Severe endemic trachoma in Tunisia. British Journal of Ophthalmology, 92, 198 - 203.

41. Dawson, C.R. (1967). Controlled Treatment Trials of Trachoma in American Indian Children. The Lancet, 961 - 964.

42. Dawson, C.R., Jones, B.R., Tarizzo, M.L. (1981). Guide to Trachoma Control. World Health Organisation.

43. Dawson, C.R., Daghfous, T., Whitcher, J., et al. (1981). Intermittent trachoma chemotherapy. A controlled trial of topical tetracycline or erythomycin. Bulletin World Health Organisation, 59, 1, 91 - 97.

44. Dawson, C.R., Schwab, I.R. (1981). Epidemiology of cataract - a major cause of preventable blindness. Bulletin World Health Organisation, 59, 4, 493 - 501.

45. Dawson, C.R., Jones, B.R., Darougar, S. (1975). Blinding and non-blinding trachoma: assessment of intensity of upper tarsal inflammatory disease and disabling lesions. Bulletin World Health Organisation, 52, 279 - 282.

46. Detels, R., Alexander, E.R., Dhir, S.P. (1966). Trachoma in Punjabi Indians in British Columbia: A prevalence study with comparison to India. American Journal of Epidemiology 84, 81 - 91.

47. Dhir, S.P., Hakomori, S., Kenny, G.E., Grayston, J.T. (1972). Immunochemical studies on chlamydial group antigen (presence of 2-keto-3-deoxycarbohydrate as immunodominant group). Journal of Immunology, 109, 116 - 122.

48. Dhir, S.P., Wang, S.P., Grayston, J.T. (1971). Type-specific antigens of trachoma organisms. In R.L. Nichols (ed.). trachoma and related disorders caused by chlamydial agents. Exerpta Medica, Amsterdam, 133 - 141.

49. Dhir, S.P., Detels, R. and Alexander, E.R. (1967). The role of environmental factors in cataract, pterygium and trachoma. American Journal of Ophthalmology, 3, 64, 128 - 135.

50. Dhir, S.P., Agarwal, L.P., Detels, R. et al. (1967). Field trial of two bivalent trachoma vaccines in children of Punjab Indian villages. American Journal of Ophthalmology, 63, 1639 - 1653.

51. Doci, J., & Masalati, M. (1974). Prevalence and treatment of Trachoma in L.A.R. Review International du Trachome, 3, 85 - 97

52. Duke Elder (1965). System of Ophthalmology. 8, 1. Henry Kimpton, London.

53. Dwyer, R. St. C., Treharne, J.D., Jones, B.R., Herring, J. (1972). Chlamydia infection: Results of micro-immunofluorescence tests for the detection of type-specific antibody in certain chlamydial infections. British Journal of Venereal Diseases, 48, 252 - 459.

54. Foster, S.O., Powers, D.K., Thygeson, P. (1966). Trachoma therapy: A controlled study. American Journal of Ophthalmology, 61, 451 - 455.

55. Foster, S.O. (1965). Trachoma in an American Indian Village. Public Health Report, 80, 829 - 832.

56. Gear, J.H.S., Gordon, F.B., Jones, B.R., Bell, S.D. Jr. (1963). Nomenclature of isolates of virus from trachoma and inclusion blennorrhea. Nature, London, 197, 26.

57. Gordon, F.B., Quan, A.L. (1965). Occurrence of Glycogen in inclusions of psittacosis-lymphogranuloma venereum-trachoma agents. Journal of Infectious Diseases, 115, 186 - 196.

58. Gordon, F.B., Quan, A.L. (1965). Isolation of the trachoma agent in cell culture. Proceedings Society of Experimental Biological Medicine, 118, 354 - 359.

59. Grayston, J.T. (1963). Symposium on trachoma: Biology of the virus. Journal of Investigation Ophthalmology, 2, 460 - 470.

60. Grayston, J.T., Wang, S.P., Yang, Y.F., Woolridge, R.L. (1962). The effects of trachoma vaccine on the course of experimental trachoma infection in blind volunteers. Journal of Experimental Medicine, 115, 1009 - 1022.

61. Grayston, J.T., Kim, K.S.W., Alexander, E.R., Wang, S.P. (1971). Protective studies in monkeys with trivalent and monovalent vaccines. In R.L. Nichols (ed.). Trachoma and related disorders caused by chlamydial agents. Excerpta Medica, Amsterdam, 377 - 385.

62. Grayston, J.T., Gale, J.L., Yeh, L.J., Yang, C.Y. (1972). Pathogenesis and immunology of trachoma. Transaction of Association of American Physicians, 85, 203 - 211.

63. Grayston, J.T., Wang, S.P., Woodridge, R.L. et al (1964). Prevention of trachoma with vaccine. Archives of Environmental Health, 8, 518 - 526.

64. Grayston, J.T., Wang, S.P., (1975). New knowledge of Chlamydiae and the diseases they cause. The Journal of Infectious Diseases, 132, 1, 87 - 105.

65. Guerra, et al. (1967). Analysis of Clinical and Laboratory data of an experiment with Tr. Vaccine in Ethiopia. American Journal of Ophthalmology, 63, 605 - 612.

66. Hanna, L., Bernkopf, H. (1964). Trachoma viruses isolated in the United States. VIII. Separation of TRIC viruses from related agents by immunofluorescence. Proceedings Society Experimental Biological Medicine 116, 827 - 831.

67. Hanna, L., Jawaetz, E., Briones, O., Ostler, H.B., Keshishyan, H, Dawson, C.R., (1973). Antibodies to TRIC agents in matched human tears and sera. Journal of Immunology, 110. 1464 - 1469.

68. Habib, Henri, (1981). Libya Past and Present, Aedam Publishing Home Ltd., Malta 3rd Edition.

69. Haddad, N.A. (1965). Trachoma in Lebanon. American Journal of Tropical Medicine and Hygiene, 4, 652 - 655.

70. Halberstaedter L., Von Prowazk S. (1907). Zur Aetiologie das Trachome. Dutch Medicine Wochenschr, 33, 1285 - 1287.

71. Heath, S.A., and Heath, B.H. (1973). Trachoma and other eye diseases in a New Guinea village. American Journal of Ophthalmology 75, 121 - 129.

72. Hobson, W. (1963). World Health and History. John Wright & Sons Ltd., Bristol.

73. Hoshiwara, I. (1971). Ophthalmological care for American Indians. Archives of Ophthalmology, 86, 368

74. Hosni, F.A. (1980). The Corneal and Trachoma in Developing Countries. Review International du Trachome, 57, 107 - 114.

75. Ihsan, A.B., Qureshi, I.H. (1982). Trachoma in Saudi Arabia. Saudi Medical Journal, 3, 1, 53 - 56.

76. Jawetz, E. (1969). Chemotherapy of chlamydial infections. Advances Pharmacological Chemotherapy, 253 - 282.

77. Jebejian, A., Kechichian, A. (1975). La cecite en Syrie et L'evolution de ses causes depuis 1950. Review International du Trachome, 52, 91 - 103.

78. Jones, B.R., (1964). Ocular syndromes of TRIC virus infection and their possible genital significance. British Journal of Venereal Diseases, 40, 3 - 15.

79. Jones, B.R. (1964). Genital trachoma, Review International du Trachome, 41, 425 - 438.

80. Jones, B.R. (1974). The laboratory tests for chlamydial infections: Their role in epidemiological studies of trachoma and its course. British Journal of Ophthalmology, 58, 438 - 454.

81. Jones, B., Al-Hussani, K., Dunlop, E. (1965). Infection of the eye and genital tract by TRIC agent: III Ocular symdromes associated with infection of the genital tract by TRIC agent. Review International du Trachome, 42, 27 - 43.

82. Jones, B.R. (1964) Ocular syndrome of TRIC virus infection and their possible genital significance. British Journal of Venereal Diseases, 40, 3 - 18.

83. Jones, B.R., Darougar, S. (1976). Communicable Ophthalmia. The blinding scourge of the Middle East. British Journal of Ophthalmology, 60, 492 - 498.

84. Jones, B.R. (1974). Laboratory tests for chlamydial infection. Their role in epidemiological studies of trachoma and its control. British Journal of Ophthalmology, 58, 438 - 454

85. Jones, B.R. (1975). The prevention of blindness from trachoma (The Bowman lecture). Transaction of the Ophthalmic Society of the United Kingdom. 95, 16 - 33.

86. Kamel, S. (1973). The acute ophthalmias: The main cause of blindness in the Middle East. Review International du Trachome, 4, 39 - 42.

87. Kadiki, O., Khan, A. (1972). Trachoma in L.A.R. Ministry of Health, Tripoli. Endemic Diseases Department's publication, 6, 1 - 34.

88. Keshishyan, H., Hanna, L., Jewetz, E. (1973). Emergence of rifampicin resistance in Chlamydia trachomatis. Nature, 244, 173 - 174.

89. Khadduri, Majid (1963). Modern Libya. Baltimore, John Hopkins Press.

90. Knapp, A.A. (1951). Blinding diseases of the world. Indian Journal of Ophthalmology, 12, 1 - 15.

91. Kuo, C.C., Wang, S.P., Grayston, J.T. (1972). Differentiation of TRIC and LGV organisms based on enhancement of infectivity by DEAE-dextran in cell culture. Journal of Infectious Diseases 125, 313 - 317.

92. Kuo, C.C., Wang, S.P., Grayston, J.T. (1971). Studies on delayed hypersensitivity with trachoma organisms. In R.L. Nichols (ed.) Trachoma and related disorders caused by chlamydial agents. Excerpta Medica, 158 - 176.

93. Kuo, C.C., Wang, S.P., Grayston, J.T. Alexander, E.R. (1974). TRIC type K, a new mimmunologic type of chlaymdia trachomatis. Journal of Immunology, 113, 591 - 596.

94. Kupka, K., Nizetic, B., Reinhards, J. (1968). Sampling studies on the epidemiology and control of trachoma in southern Morocco. Bulletin of World Health Organisation, 39, 547 - 566.

95. Lawrence R. Tedesco (1980). Trachoma and Environment in the Northern Territory of Austrlia. Society of Science and Medicine, 14D, 111 - 117.

96. Locatcher Khorazo, D., Seegal, B.C. (1972). Microbiology of the eye. Mosby Co., Saint Louis.

97. Ludlam, J.A. (1978). Prevalence of Trachoma among Navajo Indian Children. American Journal of Optometry & Physiological Optics, 55, 2. 116 - 118.

98. Marshall, C.L. (1968). The relationship between trachoma and piped water in developing area. Archives Environmental Health, 17, 215 - 220.

99. Maxwell-Lyons, F. (1953). The two fold problem of acute conjunctivitis and trachoma in Egypt. A survey of their epidemiology and of recent experiments on their prophylaxis. Review International du Trachome, 30, 341 - 351.

100. Mann, Ida. (1966). Culture, Race, Climate and Eye Diseases. C.C. Thomas, Illinois.

101. MacCallan (1936). Trachoma, Butterworth and Co., London.

102. Majcuk, F. Jr. (1966). A study of trachoma and associated infections in Sudan. Bulletin of World Health Organisation, 35, 262 - 272.

103. Majcuk, Y.F. (1976). WHO/EMRO. Miscellaneous blindness in the Middle East. Bulletin of the Ophthalmic Society of Egypt, 69, 629 - 633.

104. Mani, C. (1958). Trachoma major single cause of blindness in India. Journal of Indian Medical Association, 30, 31.

105. Malaty, R., Zaki, S., Said, M.E. et al. (1981). Extra-ocular infections in children in areas with endemic trachoma. Egypt Journal of Infectious Diseases, 143, 6, 853.

106. McComb, D.E., Nichols, R.L. (1970). Antibody type specificity to trachoma in eye secretions of Saudi Arab children. Infectious Immunology, 2, 65 - 68.

107. Ministry of Health Reports: (1969 - 1982). Arabic Endemic Diseases Department, Tripoli, Libya.

108. Ministry of Agriculture. Sareer and Kufra Executive Committee Report: 1975 (Arabic). Benghazi, Libya.

109. Ministry of Planning - Tripoli: 5 years plan (1975 - 1980) 1983 Report in Arabic. Tripoli, Libya.

110. Mitsui, Y. et al. (1964). Trachoma, its treatment with long-acting sulfonamide administered orally. American Journal of Tropical Medicine, 13, 488 - 491.

111. Mordhorst, C.H., Wang, San-Pin, Grayston, J.T. (1978). Childhood trachoma in a non-endemic area. Danish trachoma patients and their close contacts, 1963 to 1973. Journal of American Medical Association, 239, 1765 - 1771.

112. Mordhurst, C.H., Hegazy, N. (1974). Laboratory study of trachoma in Egyptian rural school children. Cytological and serological investigation on infection by Chlamydia trachomatis. Bulletin of World Health Organisation, 51, 167 - 171.

113. Moulder, J.W. (1966). The relation of the psittacosis group (chlamydiae) to bacteria and ciruses. Annual Review of Microbiology, 20, 107 - 130.

114. Nema, N.V., Bal, A., Nath, K. and Shukla, B.R. (1964). Bacterial flora of the trachomatous conjunctiva. British Journal of Ophthalmology, 48, 690 - 691.

115. Nichols, R.L., Bell, S.D., Jr., Haddad, N.A., Bobb, A.A. (1969). Studies on trachoma, IV. Microbiological observations in a field trial in Saudi Arabia of vivalent trachoma vaccine at three dosage levels. American Journal of Tropical Medicine and Hygiene, 18, 723 - 730.

116. Nichols, R.L., Moshe Lahav, and Albert D.M. et al. (1976). Trachoma in a rural Haitian Community. American Journal of Ophthalmology, 81, 76 - 81.

117. Nichols, R.L. et al. (1963). "Studies on trachoma. 2. Comparison of fluorescent antibody, Giemsa and egg isolation method for detection of trachoma virus in human conjunctival scrapings". American Journal of Tropical Medicine and Hygiene, 12, 223 - 229.

118. Nichols, R.L., McComb, D.E. and Synder, J.C. (1980). Proceedings of the fourth Saudi Medical Conference, King Faisal University, Dammam, 91.

119. Nyrop, R. et al. (1973). Area Handbook for Libya. U.S. Government Printing Office, Washington D.C. 20402.

120. Onorato, R. (1931). Lo Stato Attuale Delle Nostre Conoscenze Sulla Nosografia Tripolotania. Archivio Italiano di Scienze Mediche Coloniali, 12, 139 - 186.

121. Ostler, H.B., Hanna, L. Hoshiwara, I., et al. (1971). A Comparison of tetracycline and doxycycline in chronic trachoma of American Indians, in Nichols R.L. (ed): Trachoma and related disorders caused by chlamydial agents. Excerpta Medica International Series, 223, 540 - 544.

122. Page, L.A. (1968). Proposal for the recognition of two species in the genus Chlamydia. International Journal of Systemic Bacteriology, 18, 51 - 66.

123. Parthasarthy, N.R., and Gupta, C.K. (1962). Influence of some of the socio-economic factors on the prevalence of trachoma. Indian Journal of Social Work, 29, 127 - 130.

124. Perkins, H.R., Allison, A.C. (1963). Cell-wall constituents or rickettsiae and psittacosis-lymphogranuloma organisms. Journal of General Microbiology, 30, 469

125. Philip, R.N., Casper, E.A., Gordon, F.B., Quan, A.L. (1974). Fluorescent antibody responses to chlamydial infection in patients with lymphogranuloma venereum and urethritis. Journal of Immunology, 112, 2126 - 2134.

126. Prothero, M.R. (ed) (1969). A geography of Africa. New York, Praeger.

127. Reinhards, J., Weber, A., Maxwell-Lyons, F. (1959). Collective antibiotic treatment of trachoma. Report on comparative trials leading to more economic methods of treatment. Bulletin of World Health Organisation, 21, 665 - 702.

128. Reinhards, J. (1966). The possibilities and limitations of mass treatment in the control of trachoma. World Health Organisation EUR/RC 16 - 4.

129. Rosic, A. (1979). How can the organised struggle conduce to the disappearing of trachoma in Bosnia - Herzogowina's Republic? Review International du Trachome, 56, 7 - 11.

130. Royal Australian College of Ophthalmologists' (1980) Report: The National Trachoma and Eye Health Programme.

131. Said, M.E. et al. (1970). Prevalence and causes of blindness in urban and rural areas of Egypt. Public Health Reports, 85 587 - 599.

132. Salim, A.R., Sheikh, H.A. (1975). Trachoma in the Sudan. An epidemiological study. British Journal of Ophthalmology, 59, 600 - 604.

133. Shukla, S.P. (1966). Epidemiological survey of incidence of trachoma in the district of Nagpur. Journal of All India Ophthalmological Society, 14, 147 - 164.

134. Schacter, J., Mordhurst, C.H., Moore, B.W. et al. (1973). Laboratory diagnosis of trachoma: A collaborative study. Bulletin of World Health Organisation, 48, 509 - 575.

135. Schacter, J., Rose, L., Dawson, C.R. et al. (1967). Comparison of procedures for the laboratory diagnosis of oculogenital infections with inclusion conjunctivitis agents. American Journal of Epidemiology, 85, 453 - 458.

136. Schacter, J. (1970). Recommended criteria for the identification of trachoma and inclusion conjunctivitis agents. Journal of Infectious Diseases, 122, 105 - 107.

137. Schacter, J. (1978). Chlamydial infections: The New England Journal of Medicine, 298, 540 - 549.

138. Sendilek, I. (1975). Trachoma control in Turkey and results. Review International du Trachome, 52, 1-2, 48-54.

139. Segalen, D. Pr. G. Cornand et al., Charpin M. (1977). Le Trachome en Mauritanie. Aspects sociaux et Geographiques. Review International du Trachome, 63 - 68.

140. Simon, J. (1980). Middle East Health: World Health Organisation for Eastern Mediterranean Publication, Alexandria.

141. Sowa, S., Sowa, J. Collier, L.H., and Blyth, W. (1965). Trachoma and allied infections in a Gambian village. Medical Research Council Report, 308

142. Sowa, J., Collier, L.H., Sowa, S. (1971). A comparison of the iodine and fluorescent antibody methods for staining trachoma inclusions in the conjunctiva. Journal of Hygiene, 69, 693 - 708.

143. Sowa, J: Personal communication.

144. Sundaresan, T.K., Assad, F.A. (1973). The use of simple epidemiological models in the evaluation of disease control programmes: a case study of trachoma. Bulletin of the World Health Organisation, 48, 709 - 714.

145. Sutter, E.E., Ballard, R.C. (1978). A community approach to trachoma control in the Northern Transvaal. South African Medical Journal, 622 - 625.

146. Sutter, E.E. (1973). Blidnness among South African Negroes in the far Northern Transvaal. South African Medical Journal, 27, 593 - 597.

147. Tabbara, K.F., and Bobb, A. (1980). Ophthalmology, Rochester USA 87, 298 - 301.

148. Taborisky, J. (1952). Historic and Ethnologic Factors in the Distribution of Trachoma. American Journal of Ophthalmology, 35, 1305 - 11.

149. T'ang, F., Chang, H., Huang, Y., Wang, K. (1975). Studies on the aetiology of trachoma with special reference to isolation of the virus in chick embryo. Chinese Medical Journal, 75, 429 - 447.

150. Tarizzo, M.L. (1972). Chemotherapy of trachoma. World Health Organisation Chronicle, 26, 99 - 101.

151. Tarizzo, M.L. (ed): 1973. Field Methods for the control of trachoma. Geneva, World Health Organisation.

152. Tarizzo, M.L. (1975). The World Health Organisation and the Prevention of Blindness. Symposium: International Problems of Blindness. Transaction Academy of Ophthalmology and Otolaryngology. 453 - 456.

153. Tarizzo, M.L., Nabli, B. (1967). The effect of antibiotics on the growth of TRIC agents in embryonated eggs. American Journal of Ophthalmology, 63, 1550 - 1557.

154. Tarizzo, M.L., Nataf, R. (1970). Le traitment du trachoma. Review International du Trachome, 1, 9 - 87.

155. Tarizzo, M.L. (1972). Trachoma, in Hoeorich PD (ed): Infectious Diseases: A guide to the understanding and management of infectious processes. Hagerstown, Md. Harper & Row Publishers, Inc., 1249 - 1252.

156. Tarizzo, M.L., Nabli, B., Labonne, J. (1968). Studies on trachoma: II. Evaluation of Laboratory diagnostic methods under field conditions. Bulletin of World Health Organisation, 38, 897 - 905.

157. Taylor, et al. (1958). Eye infections in a Punjab village. American Journal of Tropical Medicine and Hygiene, 7, 42 - 50.

158. Tedesco, L.R. (1980). Trachoma and environment in the Northern Territory of Australia. Social Science and Medicine, 14. 111 - 117

159. Thygeson, P., Dawson, C.R. (1966). Trachoma and Follicular conjunctivitis in children. Archives of Ophthalmology, 75, 3 - 12.

160. Thygeson, P., Stone, W. (1942). Epidemiology of inclusion conjunctivitis. Archives of Ophthalmology, 27, 91 - 122.

161. Thygeson, P. (1971). Historical review of oculogenital disease. American Journal of Ophthalmology, 71, 975 - 985.

162. Thygeson, P. (1960). Trachoma manual and atlas. U.S. Department of Health Education and Welfare.

163. Treharne, J.D., Devey, S.J., Gray S.J., Jones, B.R. (1972). Immunological classification of TRIC agents and some recently isolated LGV agents by the microimmunofluorescence test. British Journal of Venereal Diseases, 48, 18 - 25.

164. Tun Aung Kyaw, Thein Nyunt, T.K., Sundaresan & M.L. Tarizzo (1978). Control of trachoma and prevention of blindness in rural communities in Burma. Bulletin of World Health Organisation, 56, 945 - 955.

165. Wang, S.P. (1973). Incidence du Trachoma en Thailande. Review International du Trachome, 50, 9 - 10

166. Wang, S.P., Grayston, J.T. (1967). Pannus with experimental trachoma and inclusion conjunctivitis agent infection of Taiwan monkeys. American Journal of Ophthalmology, 63, 1133 - 1145.

167. Wang, S.P., Grayston, J.T. (1970). Immunologic relationship between genital TRIC, lymphogranuloma venereum and related organisms in a new microtitre indirect immunofluorescence test. American Journal of Ophthalmology, 70, 367 - 374.

168. Wang, S.P., Grayston, J.T. (1974). Human Serology in Chlamydia trachomatis infection with micro-immunofluorescence. Journal of Infectious Diseases, 130, 388 - 397.

169. Wang, S.P., Kuo, C.C., Grayston, J.T. (1973). A simplified method for immunological typing of trachoma-inclusion conjunctivitis-lymphogranuloma venereum organisms. Infectious Immunology, 7, 356 - 360.

170. Wang, S.P., Grayston, J.T., Alexander, E.R., Holmes, K.K. (1975). A simplified microimmunofluorescence test with trachoma-lymphogranuloma venereum (Chlamydia trachomatis) antigens for use as a screening test for antibody. Journal of Clinical Microbiology, 1, 25 - 255.

171. Warner, H.J. (1929). Trachoma work of U.S. Indian service in the South-west. Public Health Report 44, 2913 - 2920.

172. Wentworth, B.B., Alexander, E.R. (1974). Isolation of Chlamydia trachomatis by use of 5-iodi-2-dexyuridine treated cells. Applied Microbiology 27, 912 - 916.

173. Werner, G.T. and Sareen, D.K., (1977). Trachoma in Punjab. A study of the prevalence and of mass treatment. Tropical & Geographical Medicine, 29, 135 - 140

174. Winkler, P.G. (1963). A morbidity survey on trachoma and other communicable eye diseases in the district of Hebron, Jordan. Bulletin of World Health Organisation, 28, 417 - 436.

175. Woodhouse, D.H. (1975). Tropical Eye Diseases in Britain. The Practitioner, 214, 646 - 653.

176. Wood, Roman, T., Chandler, R. Dawson, (1967). Bacteriological studies of a trachomatous population. American Journal of Ophthalmology, 63, 1299 - 1301.

177. W.H.O. Study Group: (1973). The prevention of blindness. World Health Organisation Technical Report Series. 518

178. WHO monthly statistical bulletin from March 1972 to November 1980. World Health Organisation, Geneva.

179. World Health Organisation (1971). Trachoma Statistics Report. 1955 - 1969, 24, 275 - 329.

180. WHO Expert Committee on Trachoma (1962). Report 3. World Health Organisation Technical Report Series, 234.

181. WHO Fourth Scientific Group on Trachoma Research Report (1966). Technical Report Series 330

182. WHO Study Group (1979). Data on blindness throughout the world. Chronicle World Health Organisation, 33, 275 - 283.

183. Yoneda, G., C.R. Dawson, T. Daghfous, I. Hoshiwara, P. Jones, M. Messadi and J. Schacter (1975). Cytology as a guide to the presence of chlamydial inclusions in Giemsa-stained conjunctival smears in severe endemic trachoma. British Journal of Ophthalmology, 59, 116 - 124.