# SHIGELLA DYSENTERIAE AND SH. FLEXNERI SEROTYPE PREVALENCE AND SEASONAL DISTRIBUTION IN ADDIS ABABA, ErnlOPIA (1978-85)

**Afeworki Gebre Yohannes, B.A., M.Sc.,* and B. S. Drasar, Ph.D.***

## ABSTRACT

*A total of 945 Shigella strains were isolated from stool specimens received at the National Research Institute of Health, between January 1978 and I£cember 1985. Seven hundred and ftfty-two strains, belonging to Shigella dysenteriae and Sh. flexneri, were further identified to serotype level, and the results analysed in respect to their annual fluctuation over an 8-year period. Their seasonal distributon was also noted.*

*Members of Sh. dysenteriae serotypes constituted 24.3% of total Shigella isolates. Within Sh. dysenteriae serotypes, type 1 followed by type 2 were dominant until 1984, when type 3 predominated. In 1985, types 1,2 and 3 were equally represented.*

*Members of Sh. flexneri comprised 56.3% of total Shigella isolates. Unti11981, type 1 was dominant, followed by types 2 and 4, in that order. Since then, however, type 1 gave way to type 2, as the dominant Shigella flexneri serotype in Addis Ababa area. The internationally rare serotype 5 was encountered only once ,on 1981.*

*Shigella infections were comparatively common during the months of April to June, and around the month of September. Its incidence was lowest at the height of the rainy season (July, August) and during the colder months of the year (December to january). The seasonal fluctuation of Shigella seemed to be influenced more by Sh. flexneri than by Sh. dysenteriae.*

## INTRODUCTION

In developing countries, diarrhoeal diseases are important causes of high morbidity and mortality, especially in pre-school age children (1). Together with plague, cholera and influenza, bacillary dysentery has been one of the great scourages of mankind. Considering the magnitude of the problem in Africa, availability of information on its incidence, prevalence and epidemiology is relatively scarce. This is because facilities for its study are not yet adequate. In Ethiopia, facilities for biochemical and serogroup determination have existed for a long time, though published reports appeared only recently (2-4). The possibility for complete serotype identification became available at the National Research Institute of Health in 1980 (5 ). The purpose of this communication is to study annual serotype fluctuation of Shigella dysenteriae and Sh.
flexneri, and to follow the seasonal isolation of Shigella species in Addis Ababa area.

*National Research htstitute of Health, P .0. Box 1242, Addis Ababa, Ethiopia.

## MATERIALS AND METHODS

### Collection of Shigella strains

Nine hundred and fourty-five shigella strains were isolated by cultural investi gation of stool specimens, received at the National Research Institute of Health, between January 1978 and December 1985. The isolates were biochemically identified following standard methods by Edwards and Ewing (6), and then serogrouped by slide agglutination using commerical antisera (DIFCO). Shigella strains collected in 1978-79, for a different study, were also included.

### Serotyping

The pattern of extended biochemical characterization of each Shigella isolate was used in selecting antisera for serotype indentification (6). Serotypes were identified again by slide agglutination, using DIFCO antisera, and counter checked by antisera from the Institute for Experimental Epidemiology , German Democmtic Republic. Agglutination reactions were observed with the naked eye over a source of fluorescent light. The specificity of each antisera was checked by control organisms from the National Collection of Type Cultures (England), and from the Center for Disease Control (U.S.A.).

### Comparative Study

Serotypes, thus identified, were analysed in respect to their annual distribution over an 8-year period. Analysis of Shigella species by month was carried out to map the seasonal distribution of Ishigellosis.

## RESULTS

During the study period (1978-85), a total of 945 Shigella strains were collected. Sh. dysenteriae and Sh. flexneri comprise 23.3% and 56.3%, respectively. Annual serotype fluctuation of Sh. dysenteriae is shown in Figs. 1 and 2. Sh. dysenteriae serotype 1 followed by type 2 were dominant until 1984, when type 3 predominated. In 1985, the isolation rate of types 1, 2 and 3 were comparable. Serotypes, 4, 6 and 7 were not commonly encountered. Serotype fluctuation of Sh. flexneri is shown in Figs. 3 and 4. Until 1981, type 1 was dominant followed by types

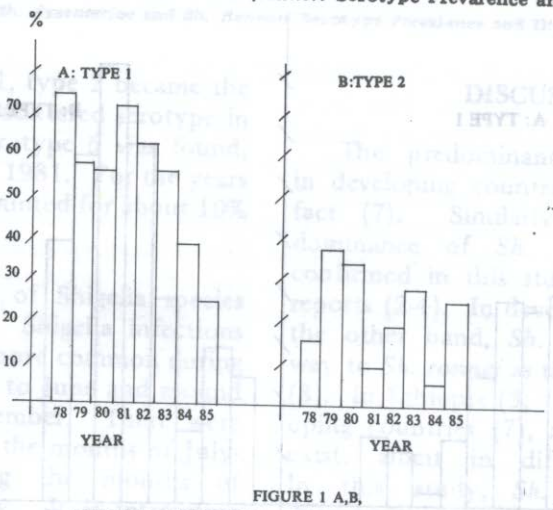



FIGURE 1 A,B,
SHIGELLA DYSENTERIAE, YEARLY SEROTYPE FLUCTUATIONS
(1978-85)

Fig. 1A,B. *Shigella dysenteriae:* yearly serotype fluctuations (1978-85)

FIGURE 2 A,B,C,D
SHIGELLA FLEXNERI: YEARLY SEROTYPE FLUCTUATIONS
(1978-85)

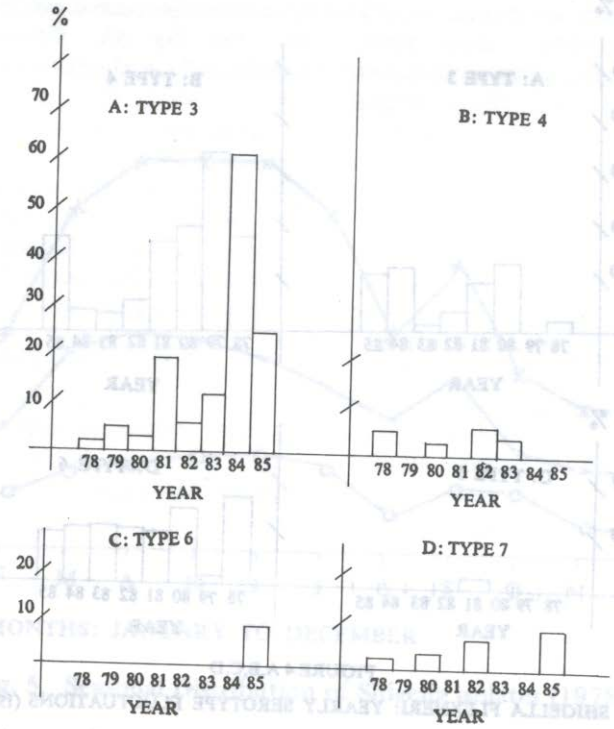



Fig. 2 A,B,C,D. *Shigella dysenteriae:* yearly serotype fluctuations (1978-85)

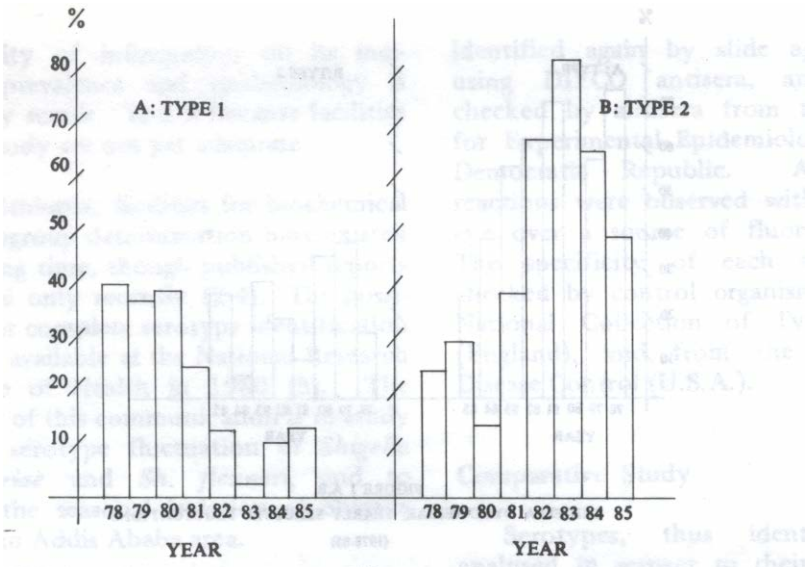



**FIGURE 3 A,B**

**SHIGELLA FLEXNERI: YEARLY SEROTYPE FLUCTUATIONS (1978-85)**

Fig. 3A,B. *Shigella flexneri:* yearly serotype fluctuations (1978-85)

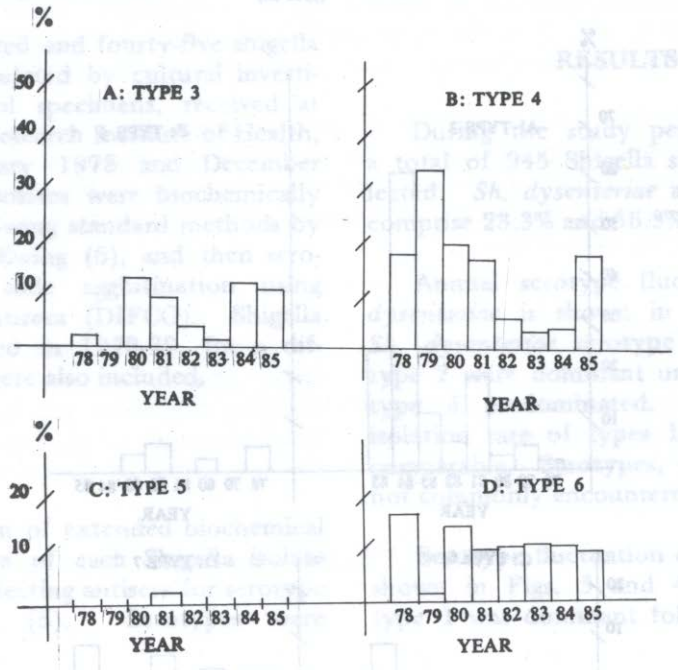



FIGURE 4 A,B,C,D
SHIGELLA FLEXNERI: YEARLY SEROTYPE FLUCTUATIONS (1978-85)

Fig. 4 A,B,C,D. *Shigella flexneri:* yearly serotype fluctuations (1978-85)

2 and 4. Since 1981, type 2 became the most commonly encountered serotype in the study area. Serotype 5 was found, for the first time, in 1981. For the years t981-85, type 6 accounted for about 10% of yearly isolation. Monday isolation of Shigella species is shown in Fig. 5. Shigella infections were comaratively more common puring the months of April to June and around the month of September. There were less isolations during the months of July- August, and during the months of November to January. It is interesting to observe" that these changes were influenced more by Sh. flexnei than by Sh. dysenteriae.

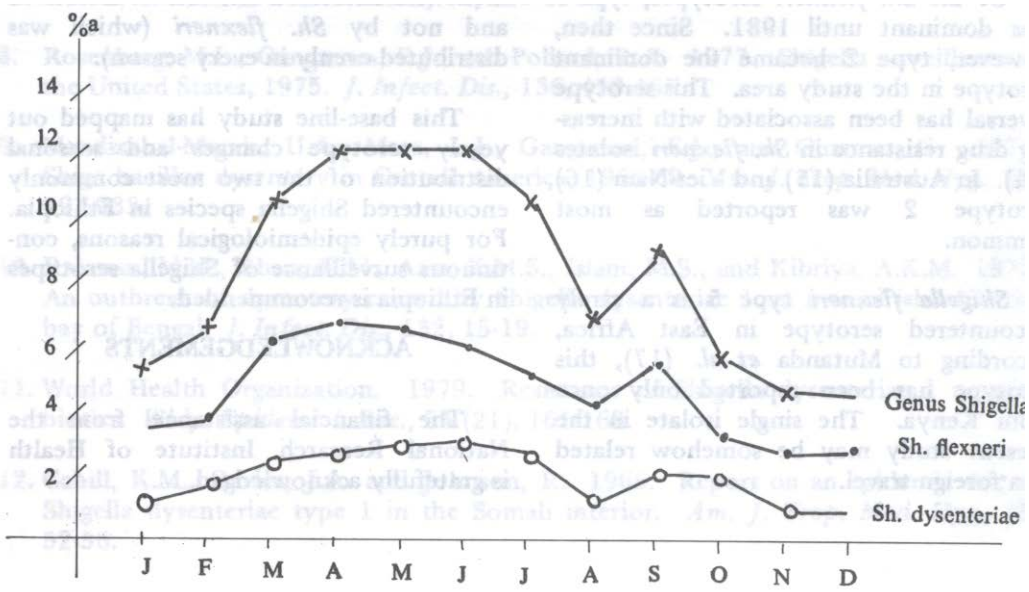
## DISCUSSION

The predominance of Sh. flexneri in developing countries is an established fact (7). Similarly in Ethiopia, the

dominance of Sh. flexneri has been confirmed in this study and in previous reports (2-4). In developed countries, on the other hand, Sh. flexneri has given way to Sh. sonnei as the dominant species (8). In Ethiopia (3, 4), as in other developing countries (7), all four species coexist, albeit

in different proportion. In this study, Sh. flexneri and Sh. dysenteriae accounted for about 80% of total isolates. It is clear, therefore, that the epidemiology of shigellosis in Ethiopia is mainly determined by these two species.

FIGURE 5
SEASONAL DISTRIBUTION OF SHIGELLA ISOLATES (1978-85)




MONTHS: JANUARY TO DECEMBER

FIG 5. Seasonal Distribution of Shigella isolates (1978-85)

The high endemicity of Sh. dysenteriae serotype 1 (Shiga's bacillus) has been clearly demonstrated in this study. It has, however, shown a relati\l:e decrease since 1981, and may well be replaced by type 3 in the near future. Shiga's bacillus, it is to be recalled, has caused wide-spread epidemics in Central America during the year1969-72 (9). In recent years, this serotype has caused severe outbreaks in Bangladesh (10), Srilanka (11), Somalia (12), and very recendy in Central Africa (13). Endemic outbreaks of Shiga's bacillus diarrhoea occur practically every year in rural Ethiopia. Laboratory investigation of these outbreaks has been, to our knowledge, limited to hastely organized field trips in unusually serious outbreaks. Systematic and sustained study of shigellosis in rural Ethiopia remains to be carried out.

Of the Sh. flexne. serotypes, type I was dominant until 1981. Since then, however, type 2 became the dominant serotype in the study area. This serotype reversal has been associated with increasing drug resistance in Sh. flexneri isolates (14). In Australia (15) and Viet-Nam (16), serotype 2 was reported as most common.

Shigella flexneri type 5 is a rarely encountered serotype in East Africa, according to Mutanda et al (17), this serotype has been reported only once from Kenya. The single isolate in the present study may be somehow related to a foreign travel.

In a recent thesis report, the seasonal distribution of 360 Shigella isolates showed two peaks; one in June and another in September (5). fu this study, which included 945 Shigella isolates, a similar pattern was observed. These two peaks overlapped with the beginning and end of the heavy rains in Ethiopia. This phenomenon may be related to an in- creased load of infectious material associated with temporary environmental modification. For conclusive evidence, however, a controlled microbiological study of the environment may be required.

Another significant observation is the fact that the seasonal fluctuation is dictated more by Sh. flexneri than by Sh. dysenteriae. fu Hungary (18), where Sh. sonnei is the dominant serogroup, the yearly July-September peak was associated with increased Sh. sonnei isolations and not by Sh. flexneri (which was distributed evenly in every season).

This base-line study has mapped out yearly serotype changes and seasonal distribution of the two most commonly encountered Shigella species in Ethiopia. For purely epidemiological reasons, continuous suIVeillance of Shigella serotypes in Ethiopia is recommended.

**ACKNOWLEDGEMENTS**
The financial assistance from the National Research fustitute of Health is gratefully acknowledged.

**REFERENCES**
1. Walsh, J.A., and Warren, K.S. 1979. Selective primary health care an inetrim strategy for disease control in developing countries. N. Eng. I. Med., 301,967-974.
2. Gedebou, M., and Tassew, A. 1979. Abstract: Antibiotic susceptibility patterns and R-factors among Salmonella and Shigella isolates. Ethiop. Med. I., 17,99.,100.
3. Gebre- Y ohannes, A., and Limenih, Y. 1980. Multiple drug resistance within Shigella serogroups. Ethiop. Med,I., 18,7-14.
4. Gedebou, M., and Tassew, A. 1982. Shigella species from Addis Ababa: frequency of isolation and in-vitro drug sensitivity. I. Hyg. Camb., 88,47-55.
5. Gebre-Yohannes, A. 1980. Thesis: Identification of s~rotypes and assessment of multiple drug resistance in 360 Shigella isolates. Addis Ababa University, Graduate School Programme, Addis Ababa.
6. Edwards, P.R, and Ewing, H.E. 1972. The genus Shigella, in: Identification of Enterobacteriaceae, 3rd. ed., p. 108-139, Burgess, Minneapolis.
7. Mailloux, M. 1971. Les Shigella dans la region de Tanger., Frequence et serotypes recontres. Bull. Soc. Path. Exot., 64, 389-407.
8. Rosenberg, M.L., Gangarosa, E.J., and Pollard, R.A. 1977. Shigella surveillance in the United States, 1975. I. Infect. Vis., 136,458-461.
9. Mendizabal-Morris, U.A., Mata, L.J., Gangarosa, E.J., and Guzman, G. 1971. Shiga bacillus dysentery in Central America, 1968-69. Am. I. Trop. Med. Hyg., 20, 927 -933.
10. Rahman, M.M., Khan, M.M., Aziz, K.M.S., Islam, M.S., and Kibriya, A.K.M. 1975. : An outbreak of dysentery caused by Shigella dysenteriae Ion a coral island in the Ibay of Bengal. I. Infect. Vis., 132, 15-19.
11. World Health Organization. 1979. Resistance of Shigella dysenteriae 1 to antibiotics. Wkly. Epidemiol. Rec., 54 (21),161-168.
~12. C~ill, K.M., Da,:ies, J.A. ~d Johnson, ~.. 19.?6. Report on an epidemic due to

Shigella dysentenae type 1 m the Somali mtenor. Am. I. Trop. Med. Hyg., 15, 52-56.
13. Frost, J.A., Rowe, B., Vandepitte, J., and Threlfall, E.J. 1981. Plasmic characterization in the investigation of an epidemic caused by multiply resistant Shigella dysenteriae type I in Central Africa. The Lancet, 2, 1074-1076.
14. Gebre- Y ohannes, A. 1984. Changing patterns of drug resistance in Shigella flexneri serotypes (1978-82). EastAfr. Med. I., 6, 600-604.
15. Morahan, R.J., and Hawksworth, D.N. 1970. Antibiotic and sulphadiazine in some New Guinea Salmonella and Shigella. Med. I. Aust., 2, 222-224.
16. Rosse, H.J. 1968. Contribution a l'etude des shigellosis and Sud-Vietnam. Bull. Soc. Path. Exot., 61, 699-721.
17. Mutanda, L.N., Kaviti, J.N., and Wombola, L.A. 1979. Patterns of Shigella species and serotypes in East Africa. EastAfr. Med.I., 56, 381-387.
18. Rundai, 0., Straub, I., Laszlo, V.C., Hajnal, A., and Lanyi, B. 1981. Salmonella and Shigella surveillance in Hungary, 1972-76. n. Shigella surveillance. Acta Microbiol. Acad. Sci. Hung., 28, 53-65.