Iranian J. Publ. Hlth,
Summer 1975, Vol. 4, No. 2

# DISTRIBUTION OF ENTEROPATHOGENS ASSOCIATED WITH DIARRHOEA AMONG INFANTS AND CHILDREN OF HIGH AND LOW SOCIO-ECONOMIC CLASSES IN TEHERAN*

K. Badalian**, F. Sheiban**, R. Nategh**
M. Asgari**, the late K. nafici** and S. Shahid

## ABSTRACT

Bacteriologic, parasitic, fungal and viral investigation of stools of 268 sick and 105 healthy infants and children during a two-year period from March 1970, through March 1972, revealed that: Shigella and Salmonellae are still the major causes of infantile endemic diarrhoea in Teheran. Enteropathogenic bacteria were isolated from 26.86% of sick vs 7.61% healthy children.

*Salmonella typhimurium* was found to be the most common enterobacterial pathogen in young sick children of the low social class, whereas in the sick children of high class, Shigella was the most prevalent organism and *Shigella sonnei* the predominant serotype. Cases of diarrhoea due to EPEC and Salmonella other than *Sal. typhimurium* occurred mainly in the high socio-economic class in this age group.

Protozoa and helminthic ova were detected in 17.91% of sick vs 30.47% of healthy and positive fungal cultures were obtained in 5.97% of sick vs 0.95% healthy, while enteroviruses were recovered from 38.43% of sick vs 32.38% healthy children. In 32.08% of diarrhoea cases, no pathogenic bacte-

*This study was supported in part by the funds of the School of Public Health and Isstitute of Public Health Research, University of Teheran, and partly by the Public Health Research Project of the Ministry of Health and Plan Organization.

Presented at the Nisth International Congress on Tropical Medicine and Malaria, Athens, 14-21 October, 1973.

**Department of Epidemiology and Pathobiology, School of Public Health and Institute of Public Health Research, University of Teheran, P.O. Box 1310, Teheranfi Iran.

*Bacterial Methods* :

Each fresh fecal sample was divided into three portions; one portion was cultured immediately for enteric bacterial and fungal organisms. The other two portions were sent for parasitic and viral investigation to the laboratories concerned.

for the detection of enteric pathogens, the method described by Edwards and Ewing(1) with modification by Mohadjer and Badalian(2) was used. Identification of Salmonella types and pathogenic *E. coli* was done by the techniques described by Le Minor.(3)

*Parasitological Methods*:

Protozoa and the ova of helminths were identified by the following methods :

1. Direct examination with Ringer Solution;
2. Direct examination by M.I.F. (Merthiolate and Lugol's Iodine For-Formaldehyde) Sapero, J.J. *et al.;*(4)
3. Flotation method of Willis;(5)
4. Trichrom staining method of Weatly (6)

*Fungi Isolation Methods* :

For the isolation of fungi from focal samples, the Vanbreuseghen method(7) was used. *Candidia albicans* and other candidia species were identified by the production of Calmidospores on PCB medium(8) and assimilation and fermentation of various sugars.(9)

*Isolation and Identification of Viruses:*

Stool specimens suspended in Hanks' solution, containing penicillin, streptomycin and amphotericin B, were centrifuged at 4000 rpm for 30 minutes and 0.2 ml of the supernatant fluid was innoculated into tissue culture tubes. Viruses were isolated and typed on monkey kidney cell culture and on a continuous cell line of Amnios (Am57).(10) for identification of enteroviruses (Polio, ECHO, Coxsackie B), the neutralisation test was carried out according to the methods described by Lennette.(11)

*RESULTS*

*Organisms Recovered* :

Organisms of possible significance recovered from the 268 sick and 105 healthy children are prsented in Table 3.

*Enteropathogenic Bacteria* (Salmonella, Shigella and path. *E. coli*)

were isolated from 7.6% of the 105 healthy and 26.8% of the 268 sick individuals, showing a significant difference.*

The infrequent recovery of Protei, Klebsiella, Arizona and Providencia in the present study show that these species are probably not important as causative agents in diarrhoeal diseases in this region and in this age group.

As reported in our previous papers,(12, 13) again the enteric pathogens isolated showed a high degree of resistance to tetracycline, streptomycin, ampicillin, chloramphenicol and triple-sulfa, and *Sal. typhimurium* and path. *E. coli* (O111B4) were the most resistant strains.

*PARASITES*: The difference in the recovery rates of protozoa and helminthic ova (although high rate) was found to be not statistically significant.*

*Giardia lamblia* was the most common protozoan isolated in bothe classes. *Entamoeba hystolitica* was rarely encountered in this age group.

*Helminthic Ova*: The Ova of 4 species of helminths were found in the stools of 373 infants and children examined. *Hymenolepis nana* was the most predominant, *Ascaris lumbricoides* the second, followed by *Trichiuris trichiura* and *Enterobius vermicularis.*

*Fungi*: Sixteen patients with diarrhoea had high colonial counts of fungi (5.9% in the sick vs 0.9% in the healthy) in their stool cultures. Eight of these (50%) were *Candida albicans,* 6 were various candida species and 2 were yeasts.

Two of the *Candida albicans* were associated with Salmonella and one with virus. One of the yeasts was in association with Salmonella.

*Enteroviruses*: The isolation rate of enteroviruses was 38.4% in the sick and 32.4% in the healthy and did not show a statistically significant difference* between the controls and the sick cases. From the three types of Viruses isolated, ECHO had the highest frequency and Polio was the second by Coxsackie B, while 35 of the isolated enteroviruses were unclassified.

## *ANALYSIS BY SOCIAL CLASS*

*Bacteria*: From Table 4, it can be concluded that in the age group considered, bacterial infection (excluding *Sal. typhimurium*) is more prevalent in the sick of high class (28.2%) than in the sick of low class infants (13.7%).

*Salmonella typhimurium* was found to be the most prevalent bacterial pathogen in the sick of the lower class (10.8%) and shows a significant difference* compared with 3.8% in the sick of the higher class. In the case of *Shigella,* the situation is reversed and this organism was recovered from 13.9% of the sick of high class and 5.8% of the sick of the low class. The same applies to the prevalence of enteropathogenic E. Coli recovered from the sick of high class (7.7%), which is more than twice the rate in the sick of the low class

* Statistificaly significant difference proven by group a Chi square test at a 95% confidence level.

## *DISCUSSION*

In endemic diarrhoea among the pre-school population in two different socio-economic communities, as observed in the present study, a noteworthy percentage is associated with bacterial infection: 31% of high income sick and 23% of low incem sick vs 8.8% high income healthy and 5.4% low income healthy infants and children, which confirms the high icidence of bacterial pathogens in both communities as compared with other enteropathogens.

The 8 cases among healthy individuals may be attributed to asymptomatic infection, as it is rare to come across carriers in this age group. Our findings in this age group are very similar to the results obtained by others.(14, 15, 16, 17, 18)

*Salmonella typhimurium* is the prevailing bacterial pathogen in the low socio-economic community: 10.8% in low sick vs 3.8% in high sick. Similar results have been obtained from infants and children of low socio-economic class hospitalizsed in Teheran for diarrhoeal diseases. In 1969, of 88 enteropathogens, 17 (19.3%), (19) and in 1971 of 123, 17 (13.8%), were *Sal. typhimurium* (unpublished data).

However, salmonellae other than *Sal. typhimurium* are more prevalent in the sick of the high socio-economic group and the infection rates in high and low classes were 5.4% and 2.9%, respectiely. This phenomenon can be explained in the following way: one of the major causes of human Salmonellosis is the consumption of contaminated foods. These foods are available at an earlier age to infants and children of the higher social class, who usually start eating eggs, canned baby food, powdered milk, etc., after they are 3 months old. On the other hand, as reported by others,(20) Salmonellosis is more likely to be symptomatic when children are young. The results of this study show that the infection rate is higher in less than 2-year old children of the high social class. In the low social class most of the children are breast-fed until their second year, and the possibility of coming in contact with Salmonella (other than *Sal. typhimurium*) is very limited for them.

Shigella was recovered from only 5.8% of the low social class, but increased to 13.9% in the high social class. This difference in the rate of infection may be related to two factors:

1. Foods, mainly fruits and vegetables, are available to this age group in the higher class, but are not consumed by the lower class, which indicates the possibility of food-borne shigellosis.(21)
2. According to Kourany,(22) in pre-industrial countries shigellosis is rare in the first months of life, which means that breast-fed children have a special intestinal flora that protects them from this type of infection. Differences in the intestinal microflora of breast-fed and artificially-fed infants or other factors such as antibodies or anti-

bacterial substances in the mothers' milk, may be responsible for the varying behaviour of shigella infection.(23) (As we have already stated, children in our low class group are breast-fed until 2 years of age.)

Contr ary to Salmonella infections, which show a high incidence in summer, the shigella infections observed occurred mostly during spring, as has been reported by others as well,(24) although some authors have reported a higher icidence in seasons other than spring.

*Shigella sonnei* is the predominant shigella in both social classes. This prevailing infectious aganet is replacing *Sh. flexneri II*, which was the predominant bacterial pathogen in our previous study.(2)

Enteropathogenic *E. coli* was recovered from 5.6% of sick and 1.9% of healthy children; thus the rates of infection in our high and low social class groups were 7.7% and 3.6%, respectively. In this study, these sporadic cases of diarrhoea due to EPEC occurred mostly in the under 2 years age group and were recovered from 10.8% of the high and 2.3% of the low social class. This shows another bacterial pathogen with high incidence in industrialized countries.(25) The serotype most often isolated was O111B4, as reported by others as well.(17, 26)

Infection with bacteria alone or concurrently with other enteropathogens was invariably associated with diarrhoea (Table 10). The rate of bacterial isolation alone or in association with other enteropathogens was 28% and 42% for the diarrhoea and diarrhoea with fever groups. This shows a significant difference* in the rate of bacterial isolation by severity of disease. The association of beacteria with other organisms does not seem to affect the severity of the disease. In both groups of diarrhoea alone and diarrhoea with fever, 50% of the isolations were of single bacteria or bacteria in association with other enteropathogens, as has also been shown by others. (27).

*Protozoa* :

Giardia is well represented in both communities and appeared with approximately equal frequency in diarrhoea and control cases in the present investigation. Contrary to the bacterial findings, Giardia detection was higher in the less severe cases : 21.4% in the diarrhoea group and 11.6% in the diarrhoea with fever group, even though it has been reported that Giardia may cause acute attacks of gasteroenteritis.(28)

*Candida albicans* : *Candida albicans* can be considered the causative agent of a small fraction of diarrhoea cases in the study, due to the fact that the number of less than one-year old infants, the most vulnerable age group to this agent, was relatively low.(28, 29)

*Negative Cases* :

The results of the study agree with the conclusion drawn from the

studies of Pierce *et al.*, Joe *et al.* and Mata *et al.*(31, 32, 33) that only a part of the diarrhoeal disorders of children are caused by direct infectious agents, since 32.1% of our diarrhoeal cases were not associated with pathogenic bacteria, parasites, viruses or fungi. Other potential causes such as intolerance to some foods and drugs, milk allergy, metabolic diseases, feeding mismanagements, certain surgical conditions, malnutrition, etc., were not considered here.

No difference was observed in the two socio-economic groups in this respect; 32.3% of low sick and 34.8% of high sick of our diarrhoeal cases were not positive for any of the infectious agents.

*ACKNOWLEDGEMENT*

The authors are greatly indebted to Dr. M.A. Faghih, Dean of the School of Public Health and Director of the Institute of Public Health Research, Dr. H. Mohsenin, Chairman of the Department of Epidemiology and Pathobiology, and Dr. S. Mohadjer, Associate Professor of Bacteriology and Head of the Laboratory, for their encouragement and cooperation.

We also wish to thank Mr. H. Sabetzadeh, Mrs. Mehravash Javan, Mrs. Afsar Nakhjevan, Miss Mehvash Mohtadi and Mrs. Golan Asghari for their technical cooperation.

Our thanks are also due to Mrs. V. Rasti for her help in the preparation of the manuscript.

## REFERENCES

1. Edwards, P.R. and Ewing, W.H. (1962). Identification of Enterobacteriaceae, 2nd Edition, Burgess Pub. Co., Minneapolis 15, Minnesota.
2. Mohadjer, S. and Badalian, K. (1969). Studies of diarrhoeal diseases in Iran — I. Occurremnce of bacterial infectionin pre-school children on the Central Plateau of Iran. J. Trop. Med. Hyg. 72 :265.
3. Le Minor, L. Le Diagnostic de Laboratoire des Enterobacteries, Editions de la Tourelle, 5 Rue Guynemer 594, St. Mande.
4. Sapero, J.J., Lawless, D.K. and Storme, C.P.A. (1951). An improved iodine-staining technique for routine laboratory diagnosis of intestinal protozoa. Science *114*:550.
5. Willis( 1961). Control of Ascariasis. R eport of WHO Expert Committee, Geneva, Switzerland, Ref. Series No. 379.
6. Weatley, W.B. (1951). A rapid staining procedure for intestinal amoebae and flagellates. Am. J. Clin. Path. *21*:990.
7. Vanbreuseghem, R. (1966). Guide Pratique de Mycologie Medicale et Veterinaire, Masson et Ciet Editeurs, 120 Boulevard St. Germain, Paris VI.
8. Pavlatou, M. and Marcelou, U. (1961). Rapid identification of *Candida albicans* with PCB Medium. J. Trop. Med. Hyg. *4*:268.
9. Marcelou-Kinti, U. and Vounous, M. (1961). Methode simple pour

l'etude du pouvoir fermentatif des Candida. Arch. Inst. Pasteur Hellen. *7* :163-166.

comparee des cultures primaires de rein de singe, des cellules diploides

10. Nategh, R., Gaudin, O.G., Jeddi, M. et Sohier, R. (1969). Sensibilite humaines (WI38) et d'une lignee continue d'amnios humain (AM-57) pour l'isolement des neterovirus non poliomyelitiques. Ann. de L'Inst. Pasteur *116* :121-129.
11. Lennette, H.E. and Schmidt, J.N. (1964). Diagnostic procedure for viral and rickettsial diseases. 3rd Edition, American Public Health Assoc. Inc., 1970 Broadway, New York, N.Y. 10019.
12. Badalian, K. and Mohadjer, S. (1972). Antibiotic sensitivity changes in enteric pathogens isolated in Central Plaeau of Iran. J. Trop. Med. Hyg. *75*:45.
13. Mohadjer, S., Badalian, K. and Mehrabian, S. (1973). The incidence of multiple drug resistance among enteric pathogens isolated in Iran. J. Trop. Med. Hyg. *76* :265-269.
14. Yow, D.M., Melnich, L.J., Blattner, J.R., Stephenson, B.W., Ribinson, M.N. and Burtchardt, A.M. (1970). The association of viruses and bacteria with infantile diarrhoea. Am. J. Epidem. *92*(1) :33-39.
15. Ingram, V.G., Rights, F.L., Ali Khan, H., Hashimi, K. and Ansari, K. (1966). Diarrhoea in children of Pakistan; occurrence of bacterial and parasitic agents. Am. J. Trop. Med. Hyg. *15* :743.
16. Kourany, M. and Vasquez, A.M. (1969). Enteropathogenic bacteria associated with diarrhoea among infants in Panama. Am. J. Trop. Med. Hyg. *18* :930.
17. Kuzemko, A.J. (1969). Gastro-enteritis in infancy postgad. Med. J. *45* :731.
18. Yow D.M., Melnick, L.Y., Phillips, A. Ch., South, A.M. and Blattner, J.R. (1966). An etiologic investigation of infantile diarrhoea in Huston during 1962 and 1963. Am. J. Epidem. *83* :255.
19. Gharagozloo, R.A., Naficy, K., Badalian, K., Najafian A., Salimpoor, R., Vosough. P. and Hedayati, B. Effects of a Trimethoprim/Sulphamethoxazole combination on the clinical course of eliminationa of fecal pathogens in bacterial enteritis. Proceedings of the VII Intenational Congress of Chemotherapy, Prague (in press).
20. Rosenstein, B.J. (1967). Salmonellosis in infants and children, epidemiologic and therapeutic consideration. J. Ped. *70*(1).
21. Donadid, J.A. and Gangarosa, E.J. (1969). Foodborne Shigellosis. J. Infect. Dis. *119* :666.
22. Kourany, M., Vasquez, M.A. and Mata, L.J. (1971). Prevalence of pathogenic enteric bacteria in children of 31 Panamanian communities. Am. J. Trop. Med. Hyg. *20* :608.
23. Mata, J.L., Urutia, J.J., Garcia, B., Fernandez, R. and Behar, M. (1969).

TABLE 1
STRIBUTION OF INFANTS AND CHILDREN BY CLASS

| HEALTH / CLASS | SICK | HEALTHY | TOTAL |
|---|---|---|---|
| LOW | 139 | 37 | 176 |
| HIGH | 129 | 68 | 197 |
| TOTAL | 268 | 105 | 373 |

TABLE 2
AGE DISTRIBUTION OF SICK AND HEALTHY INFANTS AND CHILDREN BY CLASS

| HEALTH / AGE | LOW CLASS | | HIGH CLASS | |
|---|---|---|---|---|
| | SICK | HEALTHY | SICK | HEALTHY |
| 0-<2 YEARS | 85 | 13 | 74 | 21 |
| 2-<4 YEARS | 26 | 6 | 28 | 18 |
| 4-7 YEARS | 28 | 18 | 25 | 29 |
| UNKNOWN | - | - | 2 | - |
| TOTAL | 139 | 37 | 129 | 68 |

TABLE No. 3

ORGANISMS RECOVERED IN HEALTHY AND SICK INFANTS AND CHILDREN

| ORGANISMS RECOVERED / HEALTH | NO. TESTED | SALMONELLA TYPHIMURIUM | SALMONELLAE | SHIGELLA | PATH. E. COLI | PROTOZOA | HELMINTHS' OVA | FUNGI | ENTERO VIRUSES | MIXED INFECTIONS | NONE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HEALTHY | 105 | 1 (0.9) | 3 (2.8) | 2 (1.9) | 2 (1.9) | 20 (19) | 12 (11.4) | 1 (0.9) | 34 (32.4) | 8 (7.6) | 46 (43.8 |
| SICK | 268 | 20 (7.4) | 11 (4.1) | 26 (9.7) | 15 (5.6) | 37 (13.8) | 11 (4.10) | 16 (5.9) | 103 (38.4) | 46 (17.1) | 86 (32) |

TABLE No. 4

ORGANISMS RECOVERED IN HEALTHY AND SICK INFANTS AND CHILDREN BY CLASS

| ORGANISMS RECOVERED / HEALTH & CLASS | NO. TESTED | SALMONELLA TYPHIMURIUM | SALMONELLAE | SHIGELLA | PATH. E. COLI | PROTOZOA | HELMINTHS' OVA | FUNGI | ENTERO VIRUSES | MIXED INFECTIONS | NONE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HEALTHY (LOW) | 37 | – | 1 (2.70) | 1 (2.70) | – | 12 (32.4) | 7 (18.9) | 1 (2.70) | 12 (32.4) | 7 (18.9) | 15 (40.5 |
| SICK (LOW) | 139 | 15 (10.8) | 4 (2.9) | 8 (5.8) | 5 (3.6) | 21 (15.1) | 7 (5) | 11 (7.9) | 53 (38) | 25 (17.9) | 45 (32.4 |
| HEALTHY (HIGH) | 68 | 1 (1.5) | 2 (2.9) | 1 (1.5) | 2 (2.9) | 8 (11.7) | 5 (7.3) | 0 – | 22 (32.3) | 1 (1.5) | 31 (45.5 |
| SICK (HIGH) | 129 | 5 (3.8) | 7 (5.4) | 18 (13.9) | 10 (7.7) | 16 (12.4) | 4 (3.1) | 5 (3.8) | 50 (38.7) | 21 (16.7) | 41 (34.8 |

*METHOD OF STUDY*

Eight villages were randomly selected from the entire province. In each village, all men and women aged 40-60 who were present in the village were studied. Each person was first interviewed, and a questionnaire on socio-economic status, occupation, education, number of children, cigraette smoking, etc., was filled out; then height, weight and blood pressure were measured. Afterward, a 12 lead ECG was taken using a Cardiopan apparatus with a speed of 25 mm per second. ECG tracings were coded according to the modified Minnesota code described by Rose and Blackburn in 1968(10) Because of difficulties in obtaining the correct ages of the subjects, we could not limit ourselves to 40-59 years.(1)

*RESULTS*

Out of a population of 3451 in the villages studied, 599 persons were listed as eligible for study (men and women aged 40-60), including 276 women and 324 men. We examined 198 women (71.7%) and 178 men (54.6%) who were present in the villages at the time of the study. The rest were absent, most of them on trips to urban areas. There were only a few who refused and did not want to cooperate.

Table I shows the percentage of various types of ECG abnormalities. It is seen that only 45% of the tracings are completely normal. Important ECG abnormalities are shown in Table II. We may discuss them as follows :

*Q/QS items* (1 :-2-3) : These abnormalities were seen in 7 men (3.9%) and 11 yomen (5.5%). Out of these 18 persons, 5 of them showed these abnormalities only in V1 - V3 leads and 4 others only in V1 - V2 leads.

*Lefat axis deviation* (2:1): This was recorded in 6 men (3.3%) and 9 women (4.5%).

*Increased R amplitude* (3ı - 3): This was seen in 10 men (5.6% and 4 women (2%).

*St Segment depression* 4ı - 3) : This was seen in 7 men (3.9%) and 23 women (14.1%). T wave inversion (5ı - 2) was recorded in 4 men (2.2%) and 23 women (11.6%). Flat T wave ($5_3$) was seen in 5 men (2.8%) and 19 women (9.65%).

Table III and Figure 1 show ECG abnormalities by blood pressure categories. For a definition of these, we have used the valuees and cutpoints recommeded by the Expert Committee of the World Health Organization in 1959 (13) to differentiate three blood pressure groups. It can be seen that 93.7% of normotensive men and 74.4% of normotensive women have completely normal ECG tracings while about 40% of hypertensive individuaals (men and women) have at least one important abnormality in their ECG.

Shigella infection in breast-fed Guatemalan Indian neonates. Am. J. Dis-Child *117* :142-146.

24. Gordon, J.E., Ascoli, W., Pierce, V., Guzman, M.A. and Mata, L.J. (1965). Studies of diarrhoeal disease in Central America — VI. An epidemic of diarrhoea in a Guatemalan Highland village, with a component due to *Shigella dysenteriae* Type I. Am. J. Trop Med. *14* :404.
25. South, M.A. (1971). Enteropathogenic *Escherichia coli* disease — new developments and perspectives. J. Ped. *79* :1.
26. Young, V.M., Lindberg, B.R., Ortiza Jahiel, D., Sochard, R.M. and Hemphill, J.J. (1962). Studies of infectious agents in infant diarrhoea — III. Bacterial, viral and parasitic agents in feces of Puerto Rican childern. Am. J. Trop. Med. Hyg. *11* :380.
27. Ramos-Alvarez, M. and Olarte, J. (1964). Diarrhoeal diseases of children, the occurrence of enteropathogenic viruses andbacteria. Am. J. Dis. Child. *107* :218.
28. Ramsay, A.M. (1968). Acute infective diarrhoea. Brit. Med. J. *2* :347.
29. Kozinn, J. and Taschdian, L.C. (1962). Enteric candidates. Pediatrics *30* :71.
30. Moffet, L.H., Shulenberger, K.H.B.S. and Burkholder, R.E.B.S. (1968). Epidemiology and etiology of severe infantile diarrhoea. J. Ped. *72*(1).
31. Pierce, V., Ascoli, W., De Leon, R. and Gordon, J.E. (1962). Studies of diarrhoeal disease in Central America — III. Specific etiology of endemic diarrhoea and dysentery in Guatemalan children. Am. J. Trop. Med. Hyg. *11* :395.
32. Joe, L.K., Rukmono, B., Oemijapis, S.K., Newell, K.W. Hway, S.T. and Talogo, W. (1966). Diarrhoea among infants in a crowded area of Djalcarta, Indonesiafl. Bull. Wld Hlth Org. *34197* :210.
33. Mata, J.L., Urrutia, J.J. and Gordon, J.E. (1967). Diarrhoeal disease in a cohort of Guatemalan village, children observed from birth to age two years. Trop. Geog. Med. *19* :247.

ria, virus, parasite or fungi were found in the stool specimens. The rate of mixed infections was considerably greater in diarrhoeal cases than in the control group, 17.1% vs 7.6%.

The enteric pathogens isolated in this study showed a high degree of resistance to tetracycline, chloramphenicol, streptomycin, ampicillin and triple-sulfa.

## *INTRODUCTION*

Diarrhoea is a clinical syndrome induced by various organisms as well as non-infectious factors. In this study, data is presented concerning the bacterial, protozoal, helminthic, fungal and viral findings and their association with diarrhoea in children of low and high socio-economic classes in Teheran.

The study was conducted on 268 infants and children sick with diarrhoea (more than 4 bowel movements per day with and without fever, vomiting, loose stools with and without mucus and blood) and 105 healthy individuals who were brought to pediatric clinics for treatment, check-up and vaccination during a period of two years (1970-1972).

## *MATERIALS AND METHODS*

### *Patients*:

Fresh fecal specimens were obtained from both healthy and sick (accute or chronic diarrhoea)infants and children. The condition of the disease was diagnosed by one of two pediatricians, who referred the cases to the laboratory.

In the study, the healthy and sick children were classified according to age and socio-economic group by the income of the family : 10,000 rials (about $135) or less per month was classified as "low" and more than 10,000 rials as "high" socio-economic groups. The occupational status of the family head was also taken into consideration and the low social class consisted mainly of the children of non-commissioned officers of the army and laborers.

The distribution of cases according to social class is shown in Table 1.

The age of infants and children ranged from 15 days to 7 years, with the distribution shown in Table 2.

A stool specimen was considered positive when any of the organisms was found on appropriate single examination. In cases where a first specimen was found to be negative for any of the organisms, a second and third specimen were obtained and the case was labled negative after three consecutive examinations only. Two different enteric pathogens from the same patient within a one-month interval were considered as two positive cases.

(3.6%). Table 5 shows bacterial findings in sick and healthy children by social class.

*Parasites*: No significant difference* could be observed between the two classes regarding protozoal and helminthic infestation. Table 6 shows the prevalence of protozoa and helminthic ova in the fecal material of these two groups.

*Giardia lamblia* was the most common parasite found alone or in combination with other enteropathogenic agents: 13.6% in the low income sick, 29.7% in low healthy, 11.6% in high sick and 10.2% in high healthy, no significant difference* being detected between the high and low classes in this respect.

*Fungi*: It appears that the recovery of fungi in sick children is more frequent in the low (7.9%) than in the high class( 3.8%). None of our control group had *Candida albicans.*

*Viruses*: No difference was observed in the isolation rates of enteric viruses in the high and low classes.

*Seasonal Distribution*

Table 7 shows the seasonal distribution of the enteropathogens. Salm onella show a higher prevalence in summer; Shigella increase considerably in the spring and decline in autumn. From 17 EPEC, 8 were isolated in summer. No difference of any significance was observed in protozoal and helminthic infestation by season of the year, and the number of yeast-like organisms isolated was too small to allow any comparisons in this respect.

*Age*:

From Table 8, it is evident that in the less than 2 age group of both social clases, *Salmonellae* and path. *E. cloi* are the most prevealene organisms, while in the over two years age group the predominant bacterial pathogens are the Shigellae.

The incidence of protozoal infestation increases with age in both social classes. As expected, helminthic infestation in this age group was very low; no infestation in the less than 2 age group was encountered but there was a considerable increase in childcen older than 4 years in the low social class, from 7.7%to 17.8%.

The fungi were mainly limited to the less than 2 age group, 12 out of 16 (75%) of the positive cases being in this age group.

*Mixed Infections*:

In children with diarrhoea, there was a high incidence of association of pathogenic bacteria with viruses: 19/268 (7.08%) in sick vs 1/105 (0.95%) in healthy (Table9).