# Results

The results of this work are presented in the following tables and figures:

**Table (1): Frequency of the presenting symptoms in 50 children with typhoid fever.**

| Symptoms | No. | % |
|---|---|---|
| Fever | 50 | 100 |
| Headache | 45 | 90 |
| Abdominal pain | 41 | 82 |
| Dry cough | 33 | 66 |
| Constipation | 30 | 60 |
| Diarrhea | 19 | 38 |

Fig. - 1-2: Presenting symptoms in 50 selected patients with typhoid fever

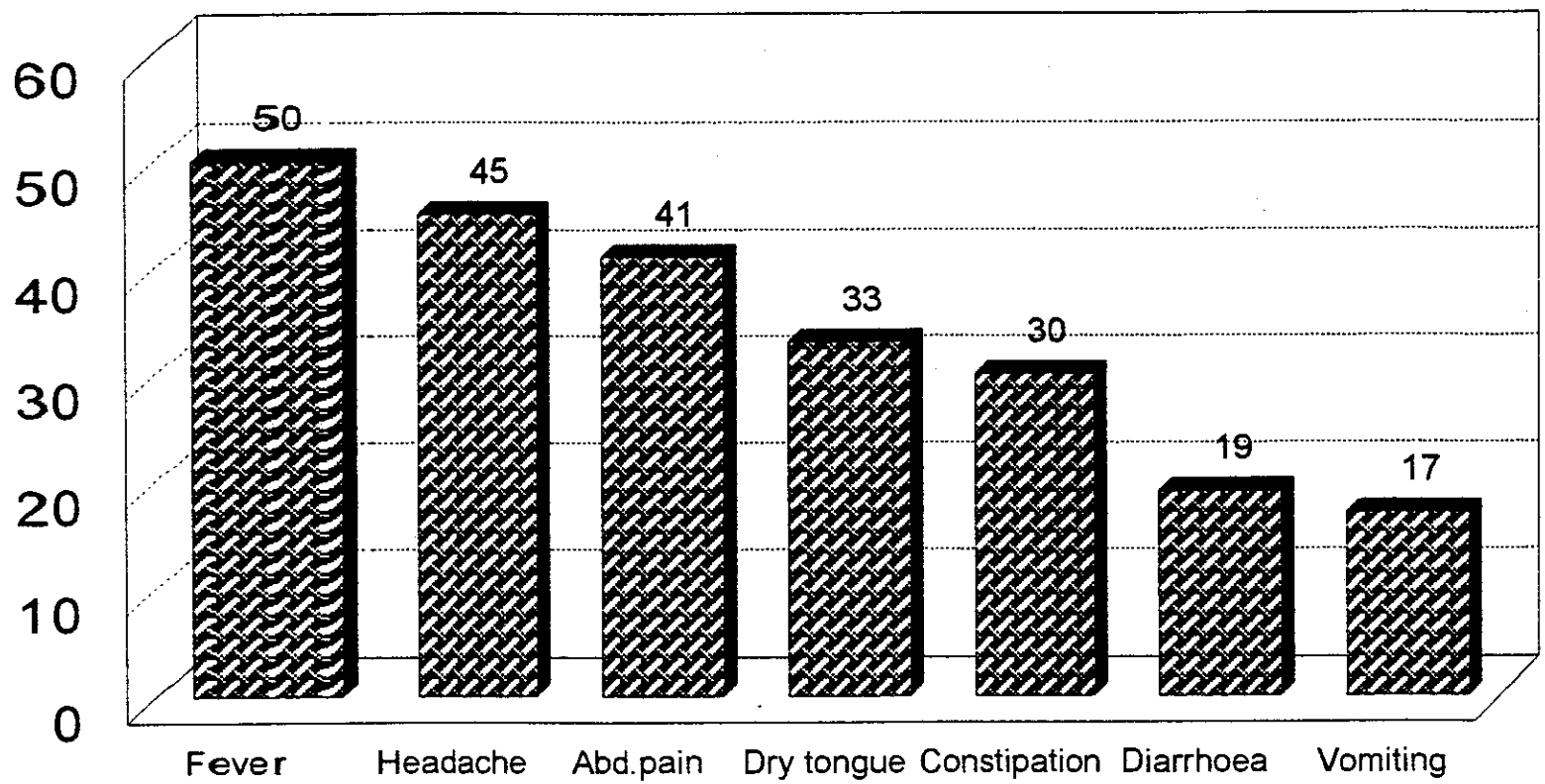


**Table (2): Frequency of the presenting signs in 50 children with typhoid fever.**

| Signs | No | % |
|---|---|---|
| Coated tongue | 45 | 90 |
| Tympanitic abdomen | 38 | 76 |
| Toxic facies | 35 | 70 |
| Sore throat | 33 | 66 |
| Splenomegaly | 20 | 40 |
| wheezy chest | 18 | 36 |
| Hepatomegly | 10 | 20 |
| Rose spots | 4 | 8 |

Fig. -2-: Presenting signs in 50 selected patients with typhoid fever

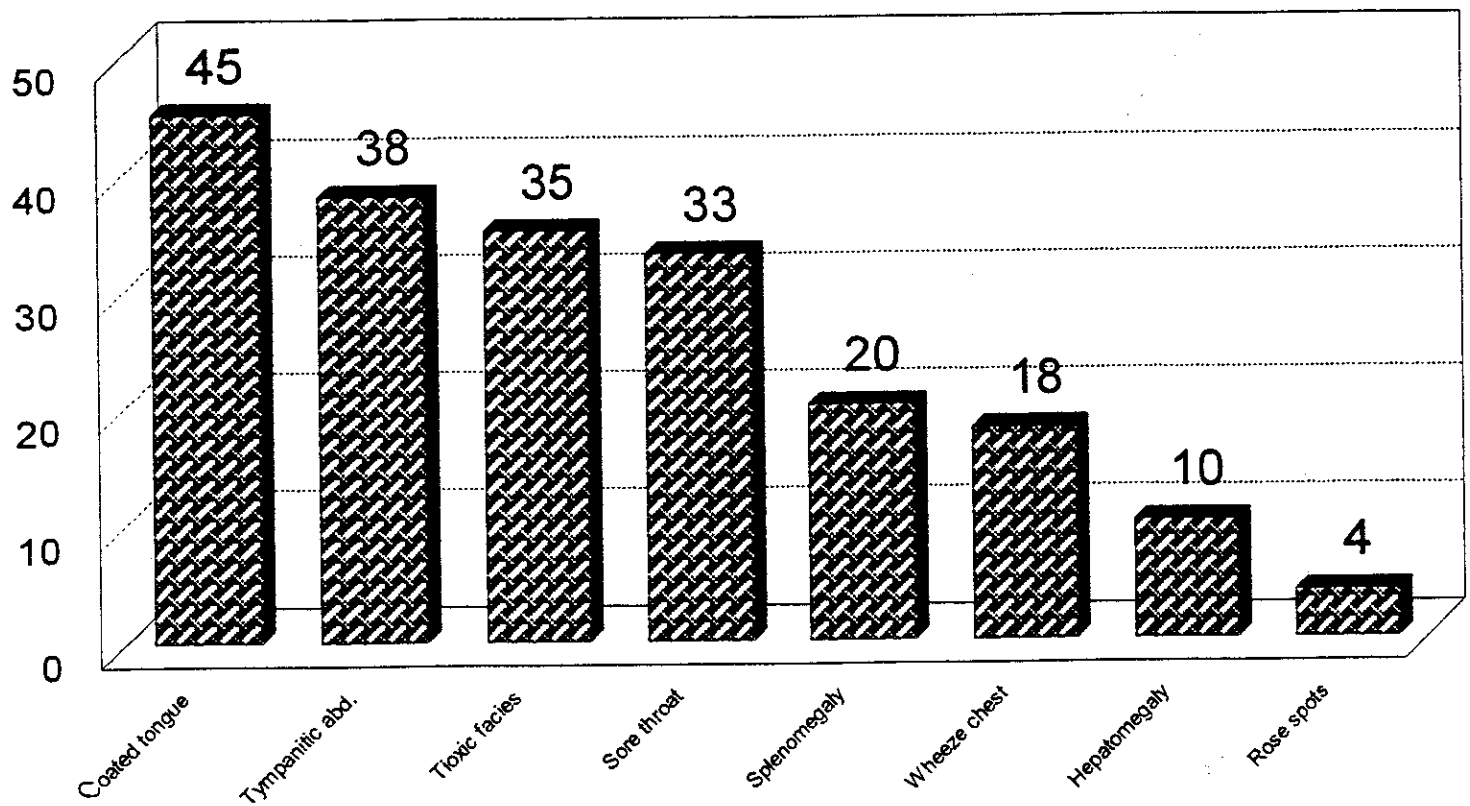


Fig. -3-: Number of studied cases with typhoid fever according to their leucocytic count

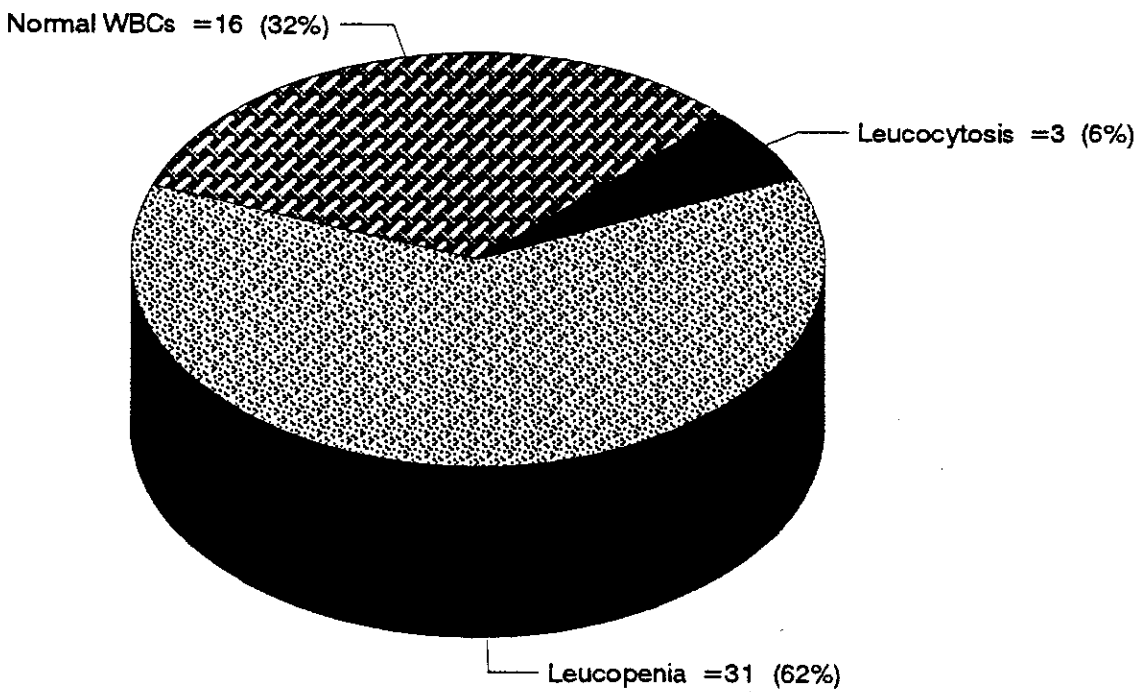


**Table (4) : Differential C.B.C in 50 children with typhoid fever .**

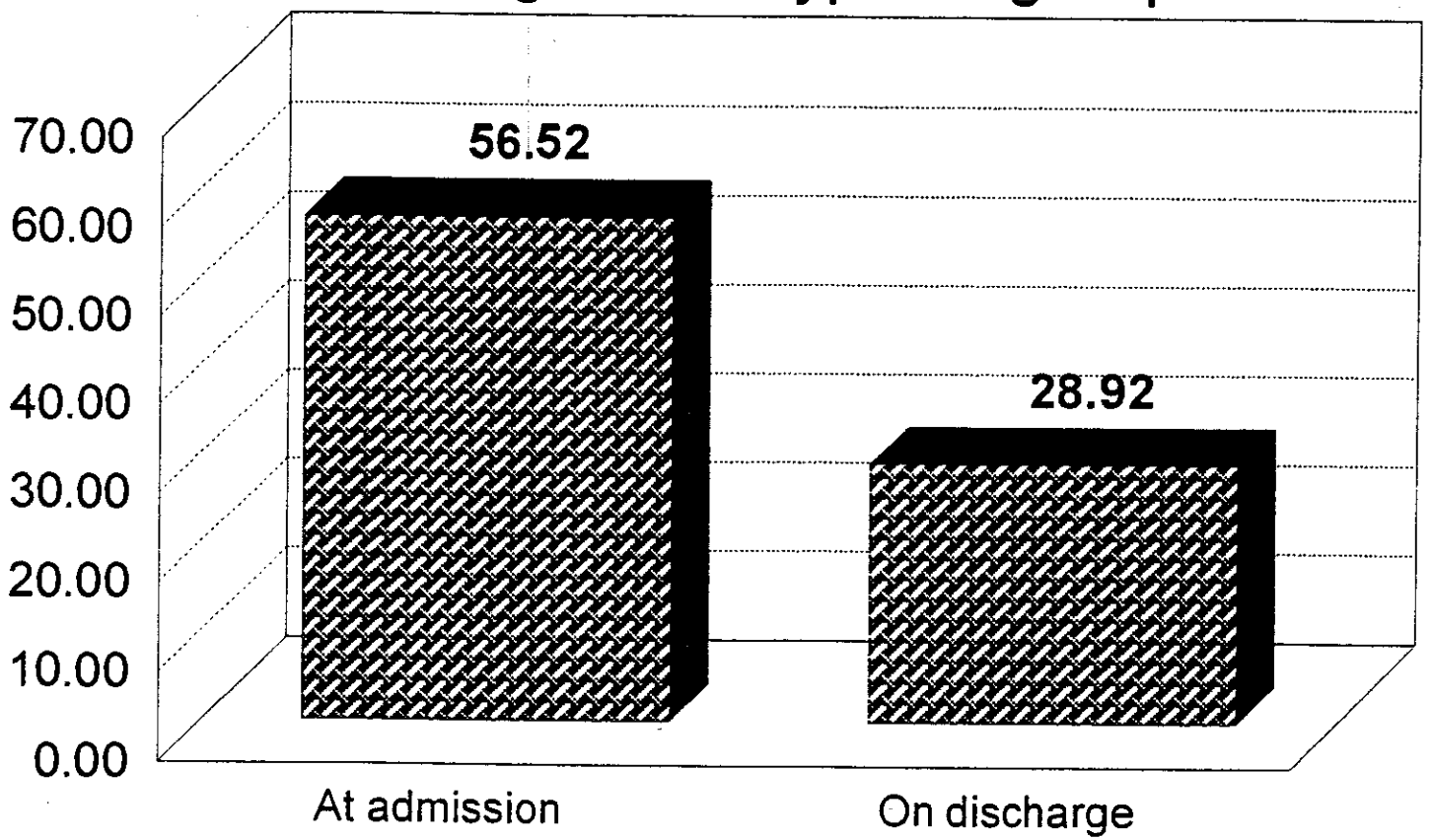
| Differential | NO. | Range | Mean ± S.D |
|---|---|---|---|
| Basophils % | 50 | 0-0 | 0.0 ± 0.0 |
| Eosinophiles % | 50 | 0-8 | 0.2 ± 0.0 |
| Monocytes % | 50 | 1-16 | 6.7 ±4.1 |
| Segminted and Staff cells % | 50 | 17-70 | 50.6 ± 16.0 |
| Lymphocytes % | 50 | 26-73 | 41.9 ± 13.9 |

**Table (5): Mean level of ADA (U/L) at admission and on discharge in typhoid cases regarding ADA level.**

| | At admission | On discharge |
|---|---|---|
| Mean | 56.52 | 28.92 |
| ±S.D | ±21.93 | ±12.27 |
| Range | 29-109 | 17-73 |
| T | 15 | |
| P | < 0.001 (H.S) | |

* P < 0.001 i.e highly significance .

Fig. -4- Mean level of ADA at admission and on discharge in the typhoid group



# Fig. -5-
# Number and percent of complicated and uncomplicated typhoid cases

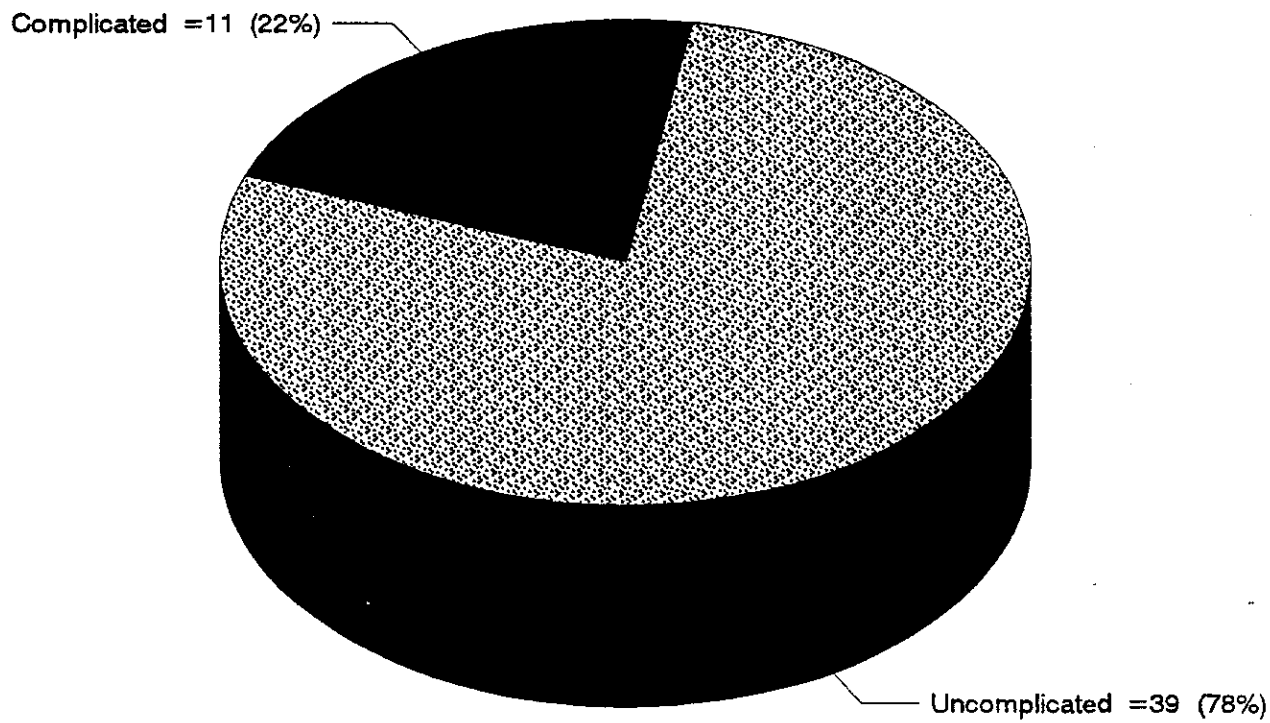


**Table (6): Mean level of ADA (U/L) in uncomplicated typhoid cases at admission and on discharge.**

| | At admission | On discharge |
|---|---|---|
| No | 39 | 39 |
| Mean | 77.60 | 37.30 |
| ± SD | ±12.5 | ±13.1 |
| t | 17.3 | |
| P | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

Fig. -6-

Mean level of ADA in (U/L) at admission and on discharge in uncomplicated typhoid cases

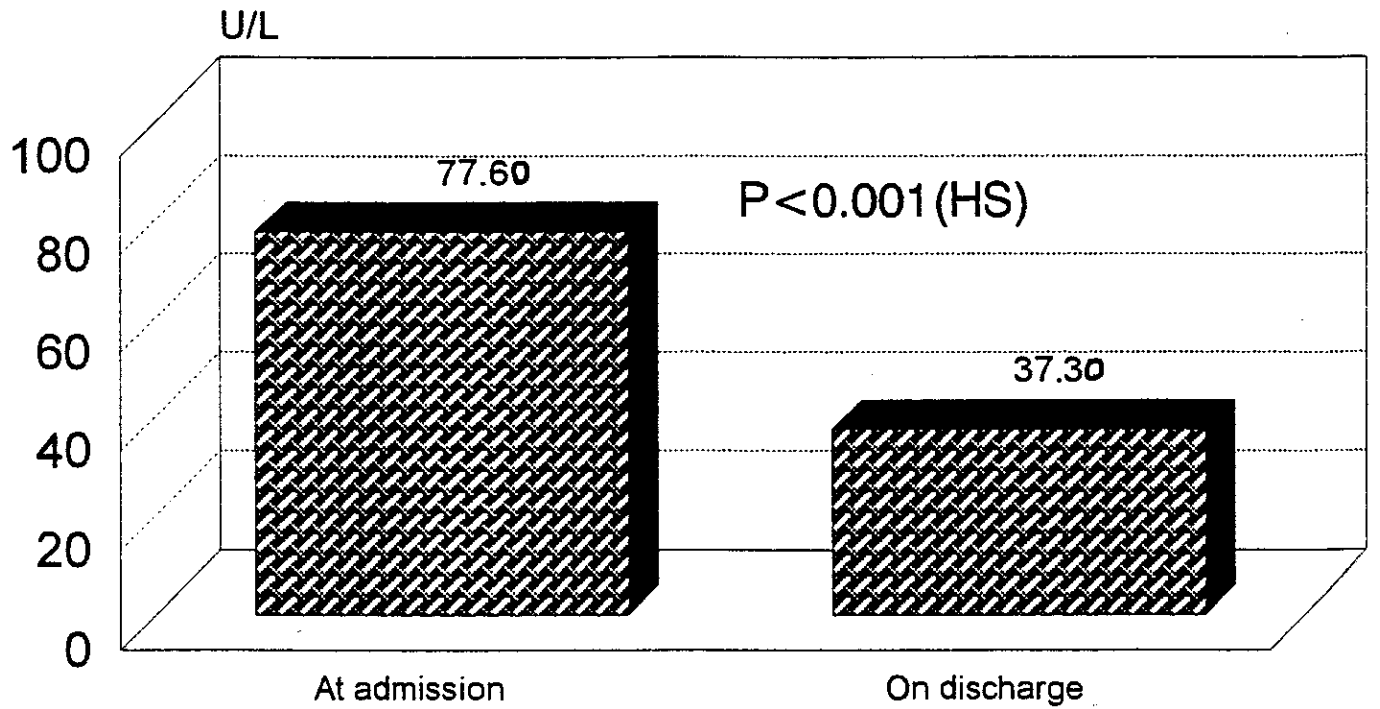


**Table (7): Mean level of ADA (U/L) in complicated typhoid cases at admission and on discharge.**

| | At admission | On discharge |
|---|---|---|
| No | 11 | 11 |
| Mean | 40.50 | 22.02 |
| ± SD | ±8.5 | ± 3.9 |
| t | 12.6 | |
| P | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

Fig. -7-

Mean level of ADA in (U/L) at admission and on discharge in complicated typhoid cases

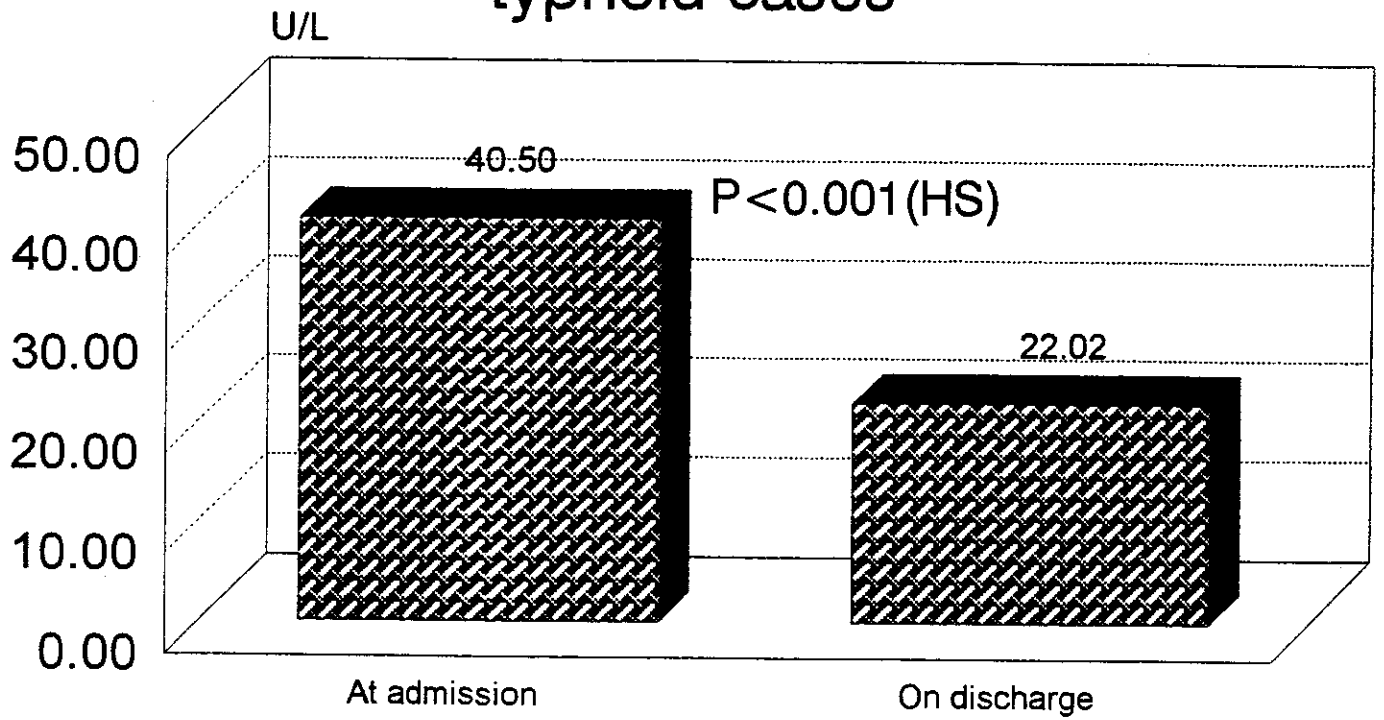


**Table (8): Comparison between the mean level of ADA (U/L) in complicated and uncomplicated typhoid cases at admission.**

| | At admission | |
|---|---|---|
| | Complicated | Uncomplicated |
| No. | 11 | 39 |
| Mean | 40.50 | 77.60 |
| ± SD | ± 8.5 | ± 12.5 |
| t | 11.4 | |
| P | <0.001(H.S) | |

* P < 0.001 i.e highly significance .

Fig. -8-

Comparison between complicated and uncomplicated typhoid cases regarding ADA level at admission

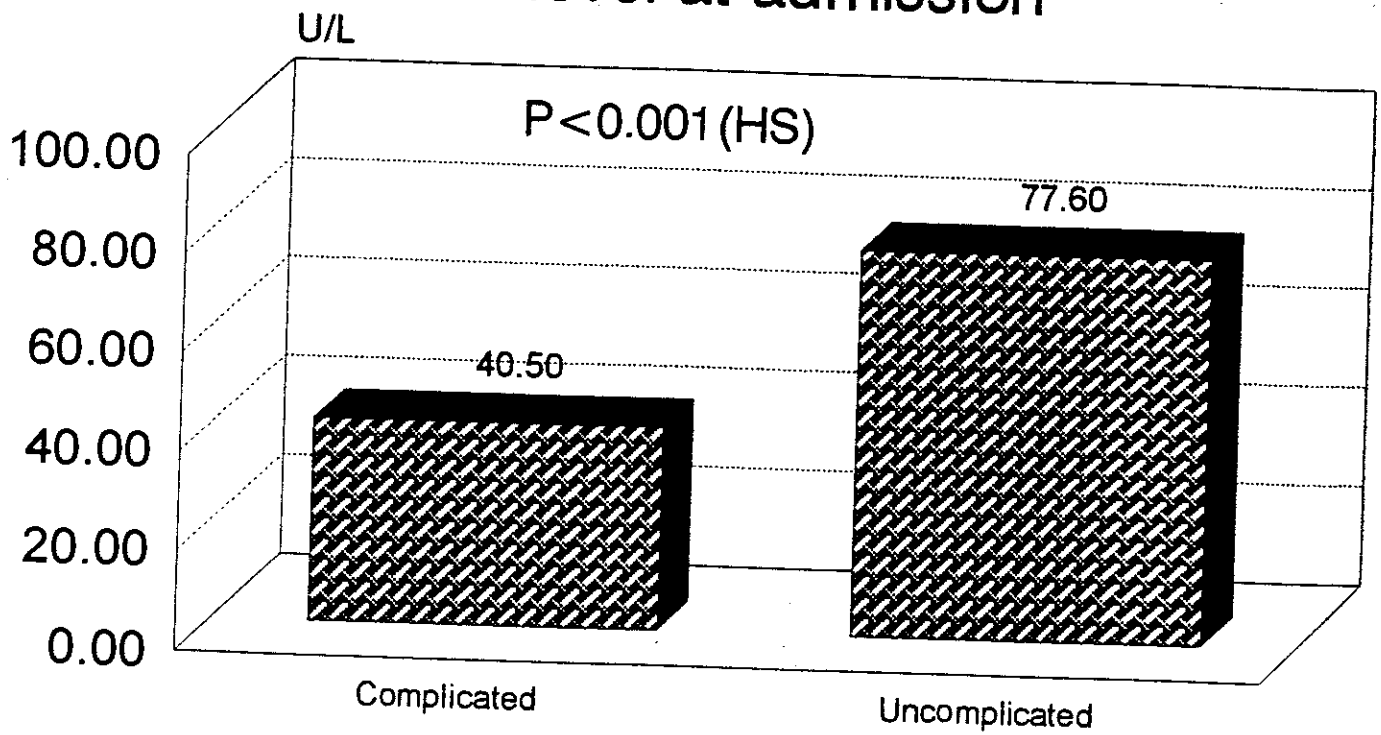


**Table (9): Comparison between the mean level of ADA (U/L) in complicated and uncomplicated typhoid cases on discharge .**

| | On discharge | |
|---|---|---|
| | Complicated | Uncomplicated |
| No. | 11 | 39 |
| Mean | 22.02 | 37.30 |
| ± SD | ± 3.9 | ± 13.1 |
| t | 6.9 | |
| P | <0.001 (.S) | |

P < 0.001 i. e. highly significance.

Fig. -9-

Comparison between complicated and uncomplicated typhoid cases regarding ADA level on discharge

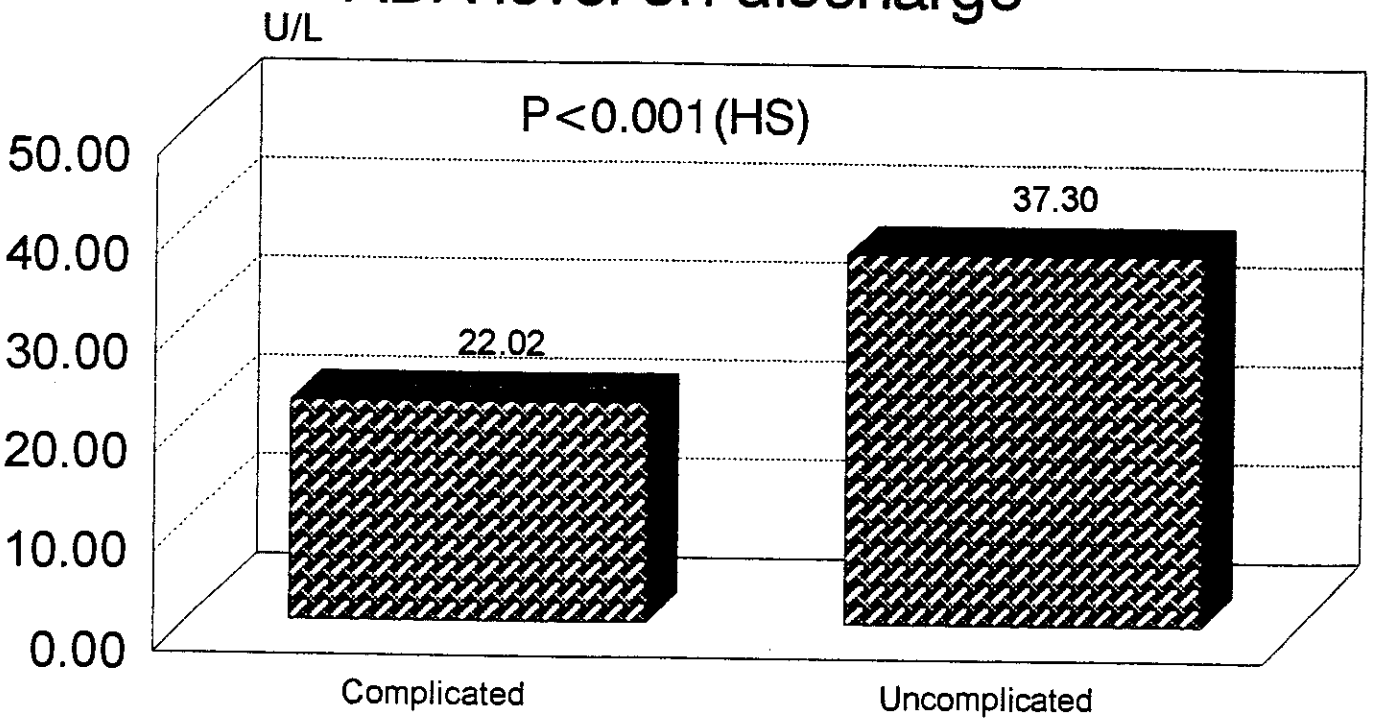


**Table (10): Mean level of ADA (U/L) in other groups (II-III) rather than typhoid group.**

| | Viral hepatitis A (24 cases) | T.B (12 cases ) | Meningitis (16 cases) | Measles (22 cases) | Control group (50 cases) |
|---|---|---|---|---|---|
| Mean | 21.25 | 20.25 | 19.68 | 19.81 | 12.32 |
| ± S.D | + 3.59 | 4.95 | 4.85 | 4.51 | 2.60 |
| Range | 16-29 | 15-32 | 14-29 | 13-34 | 8-20 |

**Table (11): Difference between typhoid cases at admission and viral hepatitis A cases regarding ADA level (U/L).**

| | Typhoid at admission | Viral hepatitis A |
|---|---|---|
| No. | 50 | 24 |
| Mean | 56.52 | 21.25 |
| ±S.D | ±21.93 | 3.59 |
| Range | 29-109 | 16-29 |
| t. | 7.8 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance .

**Table (12): Difference between typhoid cases on discharge and viral hepatitis A cases regarding ADA level (U/L).**

| | Typhoid on discharge | Viral hepatitis A |
|---|---|---|
| No. | 50 | 24 |
| Mean | 28.92 | 12.25 |
| ±S.D | ±12.27 | ±3.59 |
| Range | 17-73 | 16-29 |
| t. | 2.99 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

**Table (13): Difference between typhoid cases at admission and T.B. cases regarding ADA level (U/L).**

| | Typhoid at admission | T.B |
|---|---|---|
| No | 50 | 12 |
| Mean | 56.52 | 20.25 |
| ±S.D | ±21.93 | ±4.95 |
| Range | 29-109 | 15-32 |
| t. | 5.65 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

**Table (14): Difference between typhoid cases on discharge and T.B. regarding ADA level (U/L).**

| | Typhoid on discharge | T.B |
|---|---|---|
| No | 50 | 12 |
| Mean | 28.92 | 20.25 |
| ±S.D | ±12.27 | ±4.95 |
| Range | 17-73 | 14-32 |
| t. | 3.38 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

**Table (15): Difference between typhoid cases at admission and meningitis cases regarding ADA level(U/L).**

| | Typhoid at admission | Meningitis |
|---|---|---|
| No | 50 | 16 |
| Mean | 56.52 | 19.68 |
| ±S.D | ±21.93 | ±5.85 |
| Range | 29-109 | 14-29 |
| t. | 3.63 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance.

**Table (16): Difference between typhoid cases on discharge and meningitis cases regarding ADA level (U/L).**

| | Typhoid on discharge | Meningitis |
|---|---|---|
| No | 50 | 16 |
| Mean | 28.92 | 19.68 |
| ±S.D | ±12.27 | ±5.85 |
| Range | 17-73 | 14-29 |
| t. | 2.92 | |
| P. | <0.001 (H.S) | |

* P < 0.001 i.e highly significance .

**Table (17): Difference between typhoid cases at admission and measles cases regarding ADA level (U/L).**

| | Typhoid at admission | Measles |
|---|---|---|
| No | 50 | 22 |
| Mean | 56.52 | 19.80 |
| ±S.D | ±21.93 | ±4.51 |
| Range | 29-109 | 13-34 |
| t. | 7.74 | |
| P. | < 0.001(H.S) | |

* P < 0.001 i.e high significance.

**Table (18): Difference between typhoid cases on discharge and measles cases and regarding ADA level (U/L).**

| | Typhoid on discharge | Measles |
|---|---|---|
| No | 50 | 22 |
| Mean | 28.92 | 19.81 |
| ±S.D | 12.27 | 4.51 |
| Range | 17-73 | 13-34 |
| t. | 3.36 | |
| P. | < 0.001 (H.S) | |

* P < 0.001 i.e high significance .

**Table (19): Difference between typhoid cases at admission and control group regarding ADA level (U/L).**

| | Typhoid at admission | Control |
|---|---|---|
| No. | 50 | 50 |
| Mean | 56.52 | 12.32 |
| ± S.D | ± 21.93 | ± 2.60 |
| Range | 29-109 | 8-20 |
| t. | 14.4 | |
| p. | <0.001(H.S) | |

* P<0.001 i.e highly significance

**Table (20) : Difference between typhoid cases on discharge and control group regarding ADA level (U/L).**

| | Typhoid on discharge | Control |
|---|---|---|
| No. | 50 | 50 |
| Mean | 28.92 | 21.32 |
| + S.D | + 12.27 | + 2.60 |
| Range | 17-73 | 8-20 |
| t. | 9.35 | |
| p. | <0.001 (H.S) | |

* P<0.001 i.e highly significance

**Table ( 21) : Difference between viral hepatitis A cases and T.B cases regarding ADA level (U/L).**

| | Viral hepatitis A | T.B |
|---|---|---|
| No | 24 | 12 |
| Mean | 21.25 | 20.25 |
| ±S.D | ± 3.59 | ± 4.95 |
| Range | 16-29 | 15-32 |
| t. | 0.69 | |
| P. | > 0.05 (N.S) | |

*P > 0.05 i.e non significance .

**Table (22): Difference between viral hepatitis A cases and meningitis cases regarding ADA level (U/L).**

| | Viral hepatitis A | Meningitis |
|---|---|---|
| No | 24 | 16 |
| Mean | 21.25 | 19.68 |
| ±S.D | 3.59 | 4.85 |
| Range | 16-29 | 14-29 |
| t. | 1.17 | |
| P. | > 0.05 (N.S) | |

*P > 0.05 i.e non significance .

**Table (23): Difference between viral hepatitis A cases and measles cases regarding ADA level (U/L).**

| | Viral hepatitis A | Measles |
|---|---|---|
| No | 24 | 22 |
| Mean | 21.25 | 19.81 |
| ±S.D | 3.59 | 4.51 |
| Range | 16-29 | 13.34 |
| t. | 1.20 | |
| P. | > 0.05 (N.S) | |

*P > 0.05 i.e non significance .

**Table (24): Difference between viral hepatitis A cases and control group regarding ADA level (U/L) .**

| | Viral hepatitis | Control |
|---|---|---|
| No | 24 | 50 |
| Mean | 21.25 | 12.32 |
| ±S.D | 3.59 | 2.60 |
| Range | 16-29 | 8-20 |
| t. | 12.22 | |
| P. | < 0.001 (H.S) | |

*P < 0.001 i.e highly significance .

**Table (25): Difference between T.B cases and meningitis cases regarding ADA level (U/L).**

| | T.B | Meningitis |
|---|---|---|
| No | 12 | 16 |
| Mean | 20.25 | 19.68 |
| ±S.D | 4.95 | 4.85 |
| Range | 15-32 | 14-29 |
| t. | 0.30 | |
| P. | > 0.05 (N.S) | |

* P > 0.05 i.e non significance .

**Table (26): Difference between T.B. cases and measles regarding ADA level (U/L).**

| | T.B | Measles |
|---|---|---|
| No | 12 | 22 |
| Mean | 20.25 | 19.81 |
| ±S.D | 4.95 | 4.51 |
| Range | 15-32 | 13-34 |
| t. | 0.25 | |
| P. | > 0.05 (N.S) | |

* P > 0.05 i.e non significance .

**Table (27): Difference between T.B cases and control group regarding ADA level (U/L).**

| | T.B | Control |
|---|---|---|
| No | 12 | 50 |
| Mean | 20.25 | 12.32 |
| ±S.D | 4.95 | 2.60 |
| Range | 15-32 | 8-20 |
| t. | 7.78 | |
| P. | < 0.001 (H.S) | |

* P < 0.001 i.e highly significance .

**Table (28): Difference between meningitis cases and measles cases regarding ADA level. (U/L).**

| | Meningitis | Measles |
|---|---|---|
| No | 16 | 22 |
| Mean | 19.68 | 19.81 |
| ±S.D | 4.85 | 4.51 |
| Range | 14-29 | 13-34 |
| t. | 0.08 | |
| P. | > 0.05 (N.S) | |

* P > 0.05 i.e non significance.

**Table (29): Difference between meningitis group and control group regarding ADA level (U/L).**

| | Meningitis | Control |
|---|---|---|
| No | 16 | 50 |
| Mean | 19.68 | 12.32 |
| ±S.D | 4.85 | 2.60 |
| Range | 14-29 | 8-20 |
| t. | 7.83 | |
| P. | < 0.001 (H.S) | |

*P < 0.001 i.e highly significance .

**Table (30): Difference between measles group and control group regarding ADA level (U/L).**

| | Measles | Control |
|---|---|---|
| No | 22 | 50 |
| Mean | 19.81 | 12.32 |
| ±S.D | 4.51 | 2.60 |
| Range | 13-34 | 8.20 |
| t. | 8.89 | |
| P. | < 0.001 (H.S) | |

* P < 0.001 i.e highly significance .

Fig. -10-: Mean level of ADA in different groups versus the control group (U/L).

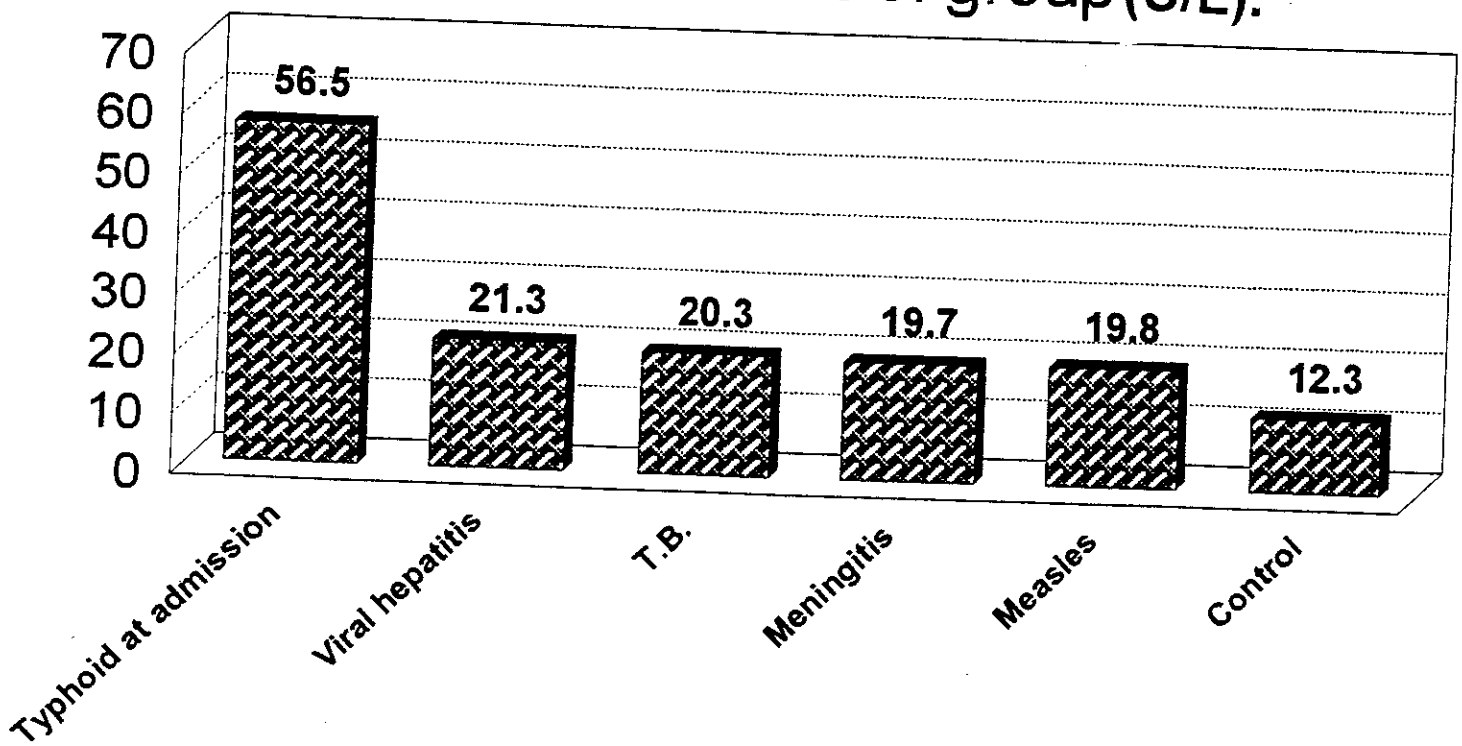


**Table (31) : Sensitivity and specificity of ADA activity in typhoid fever cases (Cut – off 80 U/L) .**

| ADA level | ADA > 80 U / L | ADA < 80 U/L . |
|---|---|---|
| * results | + ve results | -ve results |
| Typhoid Patients (50 cases) | 46 True +ve | 4 false-ve |
| Control. (50 children) | 0 False + ve | 50 True-ve |

| | |
|---|---|
| Sensitivity of a test | 92 % |
| Specificity of a test | 100 % |
| Positive predictive value | 100 % . |
| Negative predictive value | 92,5 |
| Accuracy | 96 % . |

# Analysis of the results

## The results of this study are presented in the following tables:

1- **Table (1) and Figure (1) Show**: frequency of the presenting symptoms in 50 children with typhoid fever . Regarding the commonest symptoms, there are fever in 100% of children , headache in 90% , abdominal pain in 82% , dry cough in 66% , constipation in 60% , on the contrast diarrhea only present in 38% , and vomiting in 34% .

2- **Table (2) and figure (2) Show:** frequency of the presenting signs in 50 children with typhoid fever. Regarding , the most frequent presenting sign is coated tongue being present in 90% of cases followed by tympanitic abdomen in 76% , toxic facies in 70% ,sore throat in 66% , splenomegaly in 40% , wheezy chest in 36% , hepatomegaly in 20%, lastly rose spots in 8% of cases .

3- **Table (3) and figure (3) show:** results of total leucocytic count in 50 children with typhoid fever . This table shows leucopenia in 62% of our cases , normal total leucocytic count in 32% of our cases and leucocytosis in 6% of our cases .

4- **Table (4) shows :** differential C.B.C in 50 children with typhoid fever . As regard, this table shows that the range of basophilic percentage is 0% - 0% with the mean value of 0.0 ± 0.0 % , the range of eosinophilic percentage is 0% - 8% with mean value of 0.2 ± 0.0 , the range of monocytes percentage is 1% with mean value of 6.7 ± 4.1 % , the range of segmented and staff cells are 17% -70% with mean value of 50.6 ± 16.0% and the range of lymphocytic percentage is 26 % - 73 % with mean value of 41.9 ± 13.9 % .

5- **Table (5) and figure (5) show:** mean level of ADA at admission and on discharge in typhoid cases .The mean level of ADA in typhoid cases at admission is (56.52 ± 21.93 U/L) and on discharge is (28.92 ± 12.27 U/L) .There is H.S difference between both groups (P< 0.001) .

6- **Table ( 6 )and figure (6) show:** The mean level of ADA in un-complicated typhoid cases at admission is (77.60 ± 18.5 U/L) and on discharge is (37.30 ± 13.1 U/L) with highly significant difference (P < 0.001) .

7- **Table (7) and figure (7) show :** The mean level of ADA in complicated typhoid cases at admission is ( 40.50 ± 8.5 U/L) and on discharge is (22.02 ± 3.9 U/L) with highly significant difference (P < 0.001).

8- **Table (8) and figure (8) show:** Comparison between the mean level of ADA in complicated typhoid cases and un -complicated typhoid cases at admission where the mean level of ADA is (40.50 ± 8.5 U/L) and (77.6 ± 12.9 U/L) respectively , with highly significant difference (P < 0.001).

9- **Table (9) and figure (9) show :** Comparison between the mean level of ADA in complicated typhoid cases and un-complicated typhoid cases on discharge where the mean level of ADA is (22.02 ± 3.9 U/L) and (37.30 ± 13.1 U/L) respectively , with highly significant difference (P < 0.001)

10- **Table (10) shows:** The mean level of ADA in other groups (II – III) rather than typhoid group.

11- **Table (11) shows:** Difference between typhoid cases at admission and viral hepatitis A regarding , the level of ADA, where the mean level in typhoid cases at admission is (56.52 ± 21.93 U/L) while its level in

viral hepatitis A cases is (21.25 ± 3.55 U/L) with highly significant difference between both groups .(P< 0.001)

12- **Table(12) shows:** Difference between typhoid cases on discharge and viral hepatitis A cases regarding, the level of ADA ,where the mean level of ADA in typhoid cases on discharge is (28.92 ± 12.27 U/L) while its level in viral hepatitis A cases is (21.25 ± 3.55 U/L) with highly significant difference between both groups.(P<0.001)

13- **Table (13) shows:** Difference between typhoid cases at admission and T. B. cases regarding, the level of ADA, where the mean level of ADA in typhoid cases at admission is (56.52 ± 12.93 U/L) while its level in T. B. cases is (20.25 ± 4.95 U/L) with highly significant difference between both of them .(p < 0.001)

14- **Table (14) shows:** Difference between typhoid cases on discharge and T. B. cases regarding, the level of ADA , where the mean level of ADA in typhoid cases on discharge is (28.92 ± 12.27 U/L) while its level in T. B. cases is (20.25 ± 4.95 U/L ) with highly significant difference between both of them .(p < 0.001)

15- **Table (15) shows:** Difference between typhoid cases at admission and meningitis cases regarding, the level of ADA, where the mean level of ADA in typhoid cases at admission is (56.52 ± 21.93 U/L) while its level in meningitis cases is (19.68 ± 5.85 U/L) with highly significant difference between both of them .(P< 0.001)

16- **Table (16) shows:** Difference between typhoid cases on discharge and meningitis cases regarding, the level of ADA, where the mean level of ADA in typhoid cases on discharge is (28.92 ± 12.27 U/L) while its level in meningitis cases is (19.68 ± 5.85 U/L) with highly significant difference between both of them .(P< 0.001)

**Table (17) shows:** Difference between typhoid cases at admission and measles cases regarding , where the mean level of ADA , the level of ADA in typhoid cases at admission is (56.52 ± 12.93 U/L) while its level in measles cases is (19.81 ± 4.51 U/L) with highly insignificant difference between both of them . ($P > 0.001$) .

18- **Table (18) shows:** Difference between typhoid cases on discharge and measles cases regarding, the level of ADA, where the mean level of ADA in typhoid cases on discharge ( 28.92 ± 12.27 U/L) while its level in measles cases is (19.81 ± 4.51 U/L) with highly insignificant difference between both of them . ($P > 0.001$).

19- **Table (19) shows:** Difference between typhoid cases at admission and control group regarding, the level of ADA, where the mean level of ADA in typhoid cases at admission is ( 56.52 ± 21.93 U/L) and its level in control group is ( 12.32 ± 2.60 U/L) with highly significant difference between both of them . ($P > 0.001$)

20- **Table (20)shows:** Difference between typhoid cases on discharge and control group regarding, the level of ADA, where the mean level of ADA in typhoid cases on discharge is (28.92 ± 12.27 U/L) while its level in control group is (12.32 ± 2.60 U/L) with highly significant difference between both of them . ($P< 0.001$)

21- **Table (21) shows:** Difference between viral hepatitis A cases and T. B. cases regarding, the level of ADA, where the mean level of ADA in viral hepatitis A cases is (21.25 ± 3.59 U/L) while its level in T. B. cases is ( 20.25 ± 4.95 U/L) with insignificant difference between both of them . ($P > 0.05$)

22- **Table (22) shows:** Difference between viral hepatitis A cases and meningitis cases regarding, the level of ADA , where the mean level of

ADA in viral hepatitis A cases is (21.25 ± 3.59 U/L) while its level in meningitis cases is (19.68 ± 4.85 U/L) with insignificant difference between both of them . ($P > 0.05$)

23- **Table (23) shows:** Difference between viral hepatitis A cases and measles cases regarding ADA, where the mean of level ADA in viral hepatitis A cases is (21.25 ± 3.59 U/L) while in measles cases was (19.81 ± 4.51 U/L) with an insignificant difference between both of them . ($P < 0.05$)

24- **Table (24) shows:** Difference between viral hepatitis A cases and control group as regarding, the level of ADA ,where the mean level of ADA in viral hepatitis A cases is (21.25 ± 3.59 U/L) while its level in control group is (12.32 ± 2.60 U/L) with highly insignificant difference between both of them .($P > 0.001$)

25- **Table (25) shows:** Difference between T. B. cases and meningitis cases regarding, the level of ADA, where the mean level of ADA in T. B. cases is (20.25 ± 4.95 U/L) while its level in meningitis cases is (19.68 ± 4.85 U/L) with insignificant difference between both of them .($P < 0.05$)

26- **Table (26) shows:** Difference between T. B. cases and measles cases regarding, the level of ADA, where the mean level of ADA in T. B. cases is (20.25 ± 4.95 U/L) while its level in measles cases is (19.81 ± 4.51 U/L) with insignificant difference between both of them .($P < 0.05$).

27- **Table (27) shows:** Difference between T. B. cases and control group regarding, the level of ADA, where the mean level of ADA in T. B. cases is ( 20.25 ± 4.95 U / L ) and its level in control group is ( 12.32

± 2.60 U/L) with insignificant difference between both of them. (P> 0.05).

28- **Table (28) shows:** Difference between meningitis cases and measles cases regarding, the level of ADA, where the mean level of ADA in meningitis cases is ( 19.68 ± 4.85 U / L ) and its level in measles cases ( 19.81 ± 4.51 U/L) with insignificant difference between both of them. (P> 0.05)

29- **Table (29) shows :** Difference between meningitis cases and control group regarding, the level of ADA, where the mean level of ADA in meningitis cases is (19.86 ± 4.85 U /L ) while its level in control group is (12.32 ± 2.60 U /L ) with highly significant difference between both of them .(P< 0.001)

30- **Table (30) shows**: Difference between measles cases and control group regarding, the level of ADA, where the mean level of ADA in measles cases is (19.81 ± 4.51 U / L) while its level in control group is 12.32 ± 2.60 U /L) with highly significant difference between both of them. (P < 0.001).

31- **Table (31) shows:** That sensitivity of ADA activity in typhoid fever cases is 92%, specificity of ADA is 100%, predictive positive value is 100%, predictive negative value is 92.5% and accuracy is 96% (Cut-off 80 U / L) .

So in this work, the estimation of serum adenosine deaminase level "ADA" is done to study its importance in early diagnosis of typhoid fever. The cases are grouped into 3 groups: ***Group (I):*** consisted of 50 children diagnosed as typhoid fever by Widal test, CBC and blood culture. ***Group (II):*** as other group of fevers such as hepatitis A virus 24 cases, meningitis 16 cases, measles 22 cases and T.B.12 cases. ***Group (III):*** Control group consisted of 50 healthy children.

In this study, all patients of typhoid, were complaine of fever, as shown in ***( table 1, and figure 1 )*** . Our results are in agreement with **(Edelman and Levine, 1986, Christie 1987 and Feigin, 1992).** They reported that the fever was the most common symptom being present in 100% of cases. Next to fever, other symptoms are namely headache 90%, abdominal pain 82%, dry cough 66%, constipation 60%, diarrhea 38% and vomiting 34% as shown in ***( table 1 and figure 1 ).*** Results reported by **(Huckstep, 1962,Abdel Wahab et al.,1977 and Hoffman,1991)** were similar to our findings .

The major signs found in typhoid cases, are coated tongue 90%, tympanitic abdomen 76%, toxic facies 70%, sore throat 66%, splenomegaly 40% wheezy chest 36%, hepatomegaly 20% and rose spots 8% as shown in ***(table 2 and figure 2 ).*** Similar results were reported by **( Adel Wahab et al.,1977,Hornick 1989 and Hoffman ,1991).**

In this study, the typhoid cases show that hemoglobin " Hb " ranged between 8.1-13.5 gm /dl, with mean value of 10.9 ±1.5 gm/dl, anemia "Hb" <11 gm / dl is found in 34.8 % of typhoid patients. This is in agreement with **(Hoffman, 1991),** who reported that moderate anemia is present in typhoid patients

In our study of typhoid cases: " T.L.C " total leucocytic count showed leucopenia in 62 % of cases . This finding is in agreement with **Hoffman 1991, but Abdel- wahab et. al, 1977** reported that only 18 % of the cases of typhoid fever shows leucopenia. This study also shows that there is leucocytosis in only 6 % of cases as shown in ***( table 3 and figure3).***

In this study the level of serum adenosine deaminase "ADA" is studied in different groups of fever and control group in comparison with typhoid fever.

In comparison of ADA level in typhoid group (group I), and control group (group III), it is high in typhoid group than its level in control group, the difference is highly significant where the mean level of ADA in typhoid cases at admission is (56.52 $\pm$ 21.93 U / L ) and on discharge is (28,93 $\pm$ 12.27 U / L ) while its level in control group is (12.32 $\pm$ 2.60 U / L ) as shown in ***( table 19,20 ).*** Our results are in agreement with **( Casanueva et al.,1992,Mishra et al.,1994 and Zaki, 1996).**

In typhoid cases (group I), there is estimation of ADA : at admission of patient to hospital and on discharge. (i.e. after 10-14 days of treatment). The results show that at admission, serum ADA ranged between 29-109 U / L with mean value of (56.52 $\pm$21.93 U / L). On discharge: serum ADA ranged between (17 U / L -73 U / L ) with mean of (28.92 $\pm$ 12.27 U /L) it is significantly high at admission with ($P< 0.001$) as shown in ***(table 5 and figure 4).*** This is in agreement with **(Casanueva et al., 1992, Mishra et al., 1994 and Zaki, 1996)** who reported that an increase in serum ADA activity was already present at admission i.e. start of illness reaching the highest values by 2 weeks. Then there was a progressive fall in serum ADA

illness. This may be due to the fact that there is a correlation between ADA activity and percentage of T- lymphocyte, where ADA is an enzyme active in the catabolism of purenes and essential for T-lymphocyte proliferation and maturation. The percentage of T-lymphocyte is increased when the lymphocyte immune respone is developed after the first week of illness and gradually increased during the following days **(Casanueva et al.,1992).**

In this study, we found that ADA activity is influenced by the treatment where the level is high at admission then after 10-14 days of treatment, the level decreased but it is still high in comparison with control group as shown in ***(table 5,18,19).*** This means that the treatment has an effect on the enzyme activity, so the enzyme levels decrease with treatment. In contrary to our results; **(Casanueva et al., 1992)** found that serum ADA activity not influenced by the treatment.

In our study, there is a high ADA level in un-complicated and complicated typhoid cases either at admission or on discharge. Mean level of ADA in un-complicated typhoid cases at admission is (77.60± 12.52 U / L) and on discharge is (37.30 ± 13.10 U / L). as shown in ***(table 6 and figure 6).*** While mean level of ADA in complicated typhoid cases at admission is (40.50 ± 8.54 U / L), on discharge is (22,02 ± 3.93 U / L) as shown in ***(table 7 and figure 7).*** In comparison between the complicated and un-complicated typhoid cases regards ADA level at admission, the level of ADA is higher in un-complicated typhoid cases and the difference is highly significant where the mean level of ADA in complicated typhoid cases is (40.50 ± 8.54 U /L) while the mean level of ADA in un-complicated typhoid cases is (77,60 ± 12.52 U / L) respectively ($P < 0.001$) as shown in ***(table 8 and figure 8).*** Also in comparison between the complicated and un-complicated typhoid cases as regards ADA level on

discharge, the level of ADA is higher in un-complicated typhoid cases and the difference is highly significant where the mean level of ADA in complicated typhoid cases is (22.02 $\pm$ 3.39 U / L) while the mean level of ADA, in un-complicated typhoid cases is (37.30 $\pm$ 13.10 U / L) ($P < 0.001$) as shown in ***(tables 9 and figure 9).***

Our results are in agreement with **(Giblett et al.,1972 ,Sarma et al., 1977 ,Nyerges et al., 1979, Rajagoplan et al., 1981 and Mishra et al., 1994)** where they reported that complicated patients had lower mean ADA activity at diagnosis as compared to un-complicated group, and they showed a rise in enzyme level during defervescence. These results can be explained according to cell-mediated immune response (CMI) which appeared after the first week of illness, as it remained negative in patients who had complicated. On further follow-up of complicated cases, the clinical recovery coincides with the development of CMI response. CMI response is more important than antibodies for recovery in typhoid fever **(Sarma et al., 1977):** and accordingly, the ADA values are increased. So the mean level of ADA is high in un-complicated cases.

In comparison of ADA level in typhoid group (group I) and other group of other fevers " group II " we found that the level of ADA is higher in typhoid cases either at admission or on discharge than any other studied fever and the difference is highly significant ( $P < 0.001$).

There is higher level of ADA in typhoid cases than its level in viral hepatitis A cases where the mean level of ADA in typhoid cases at admission is (56.52 $\pm$ 21.93 U / L) and on discharge is (28.92 $\pm$ 12.27 U / L) while its level in viral hepatitis A cases is (21.25 $\pm$ 3.55 U / L) as shown in ***(table 11,12)*** our results are in agreement with **(Casanueva et al., 1992)**

where they performed their research on children with acute hepatitis A virus which showed negative cultures for S. typhoid and they found that there was high level of ADA in typhoid cases more than its level in viral hepatitis A cases and the difference was highly significant. Also **(Casanueva et al., 1992)** stated that the differentiation between typhoid fever and hepatitis A can be made by clinical picture and specific diagnostic test for each of them. Patients with hepatitis A have abnormal liver function tests together with positive hepatitis immunological test.

Also, there is higher level of ADA in typhoid cases than its level in T.B cases where the mean level of ADA in typhoid cases at admission is (56.52 $\pm$ 21.93 U / L) and on discharge is (56.52 $\pm$ 21.93 U / L ) while the mean level of ADA in T.B is (20.25 $\pm$ 4.95 U / L). and the difference is highly significant ($P < 0.001$) as shown in ***(table 13,14)***. Our results are in agreement with **(Casanueva et al., 1992)** where they found high level of ADA in typhoid cases more than its level in pulmonary T.B cases and added that the differentiation between typhoid cases and T.B cases can be made by clinical picture, tuberculin test, X-ray chest, and sputum culture.

There is higher level of ADA in typhoid cases than its level in meningitis cases where the mean level of ADA in typhoid cases at admission is (56 $\pm$ 52$\pm$ 21.93 U /L) and on discharge is (28.82 $\pm$ 12.27 U / L). While the mean level of ADA in meningitis cases is (19.68 $\pm$ 4.85 U / L) the difference is highly significant ($P < 0.001$) as shown in ***(tables 15,16)*** our results are in agreement with **(Casanueva et al., 1992)** where they found that cases with viral encephalitis, there was high level of ADA but its level was more higher in typhoid cases than its level in viral encephalitis and the difference is highly significant. Also **(Casanueva et**

al., 1992) stated the differentiation between encephalitis cases and typhoid cases can be made by clinical picture, C.S.F. culture and C.B.C.

There is higher level of ADA between typhoid cases measles cases, its level is higher in typhoid cases than its level in measles cases where the mean level of ADA in typhoid cases at admission is (56.52 ± 21.93 U / L) and on discharge is (28.92 ± 12.27 U / L), while the mean level of ADA in measles cases is (19.81 ± 4.51 U / L) difference is highly significant ($P < 0.001$) as shown in ***(table 17,18).*** Our – results are in agreement with ***(Casanueva et al., 1992)*** where they found that in measles cases there was high level of ADA, but there is highly significant difference between these cases and typhoid cases where its level in typhoid is more higher than its level in measles cases. Patients with measles can be differentiated from typhoid fever by clinical picture nainly ***(Casanueva et al., 1992).***

On the other hand, comparison between the other cases of fevers (group II) and control group (group III), the level of ADA is more higher in each studied fever than its level in control group and the difference is highly significant ($P < 0.001$). Where the mean level of ADA in viral hepatitis A cases is (21.25 ± 3.59 U / L) and level in control group is (12.32± 2.60 U / L) there is highly significant difference ($P < 0.001$) as shown in ***(table 24).*** Our –results are in agreement with ***(Casanueva et al.,1992)*** where they found that there was high level of ADA in viral hepatitis A cases more than control group.

The mean level of ADA in T.B cases is (20.25 ± 4.95 U / L) and in control group is (12.32 ± 2.60 U / L) there is highly significant difference " $P < 0.001$) as shown in ***(table 27).*** Our –results are in agreement with ***(Shimokata et al., 1991 casanueva et al., 1992, Daoud, 1993 and ZAKI,***

*1996)* where they found that there was high level of ADA in Pulmonary T.B more than control "highly significant difference " $P < 0.001$).

The mean level of ADA in meningitis cases is (19.68 $\pm$ 4.85 U /L) and in control group is (12.32$\pm$ 2.60 U / L) " there is highly significant difference " ( $P < 0001$).as shown in ***( table 29).*** Our –results are in agreement with **(Casanueva et al., 1992)** where they found that there was high level of ADA in viral encephalitis more than the controls.

The mean level of ADA in measles cases is (19,812 $\pm$ 4.51 U / L) and in control group is (12.32 $\pm$ 4.85 U / L) there is highly significant difference " ( $P < 0001$). As shown in ***( table 30).*** Our results are in agreement with **(Casanueva et al., 1992)** where they found that there was high level of ADA in measles cases more than controls.

Our –results are in agreement with **( Casanueva et al., 1992)** when study sensitivity and specificity of ADA activity in typhoid cases, where our study revealed that sensitivity of ADA is 92% and, specificity is 100%, positive predictive value is: 100%, negative predictive value is 92.5% and the accuracy is 96% when we used the level of ADA at 80 U / L. as cut-off, as shown in ***(table 31)*** while they found that the sensitivity was 91.8% specificity was 92.5% in identifying the patient with typhoid fever when using 80 units / liter as cut off values, the positive predictive value of the test was; 83.8% and negative predictive value was 96%.

From this study it was found that serum ADA activity is increased in typhoid cases with level significantly higher than control group and other fevers group such as viral hepatitis A, meningitis, measles and T.B, and inspite of its high level in the other fevers than the control group it is still significantly higher in typhoid cases, while there is no significant

difference regarding its level in comparison between each type of fever and the other (group II).

So the estimation of ADA activity is useful in early diagnosis of typhoid fever and it is a good negative screening test for diagnosis of typhoid fever typhoid and has a prognostic value for typhoid Cases.