Results

During the period from March 2008 to October 2008, this work was done on 70 children (38 males and 32 females aged from one year up to 15 years) admitted to the inpatients clinics of Benha University Hospital and from Benha Children Specialized Hospital, 18 contacts and hospital workers, in addition to 36 water samples.

Patients included in this study were selected from the following departments: Pediatrics, Cardiology, Orthopedic, Chest, Oncology, Urology, Hepatology and General surgery.

This study was carried out on two groups:

Group I: 70 patients of different ages who were subdivided into groups:
Immunocompetants group (Ia): includes 35 patients.
Immunocompromized group (Ib): includes 35 patients.

All subjects were examined and investigated at admission and choosen free from *G.lamblia* infection and reexamined again 15 days later to cover intermittent shedding of *Giardia* to determine nosocomial infection.

Group II: 18 contacts (six mothers, six foodhandlers and six medical stuff) examined for *G.lamblia* infection by taking three successive stool samples.

In the present study, the problem of nosocomial giardiasis was assessed and correlated to various host factors (age, immunological status, residence, food and water supply).

The present work aimed at assessment of the incidence rate of giardiasis as nosocomial infection and detection of possible sources of its infection.

The results obtained in the present study were presented in the following tables and figures.

Table (1): Shows results of direct smear of stool samples of immunocompetants (35) cases and immunocompromized (35) cases which were as follow: in immunocompetants (35) there was one +ve case (2.86%) while in immunocompromized (35) there were two +ve cases (5.71%). So, out of total (70) cases, there were three +ve cases detected by direct smear (4.29%).

Table (1): The results of examination of three successive stool samples after 15 days of admission by direct smear in relation to immune status.

Examined cases	No.	Direct smear		Z	P
		+ve	%		
Immunocompetants (Ia)	35	1	2.86%	0.58	>0.05
Immunocompromized (Ib)	35	2	5.71%		
Total number	70	3	4.29%		

Figure (7): The results of examination of three successive stool samples after 15 days of admission by direct smear in relation to immune status

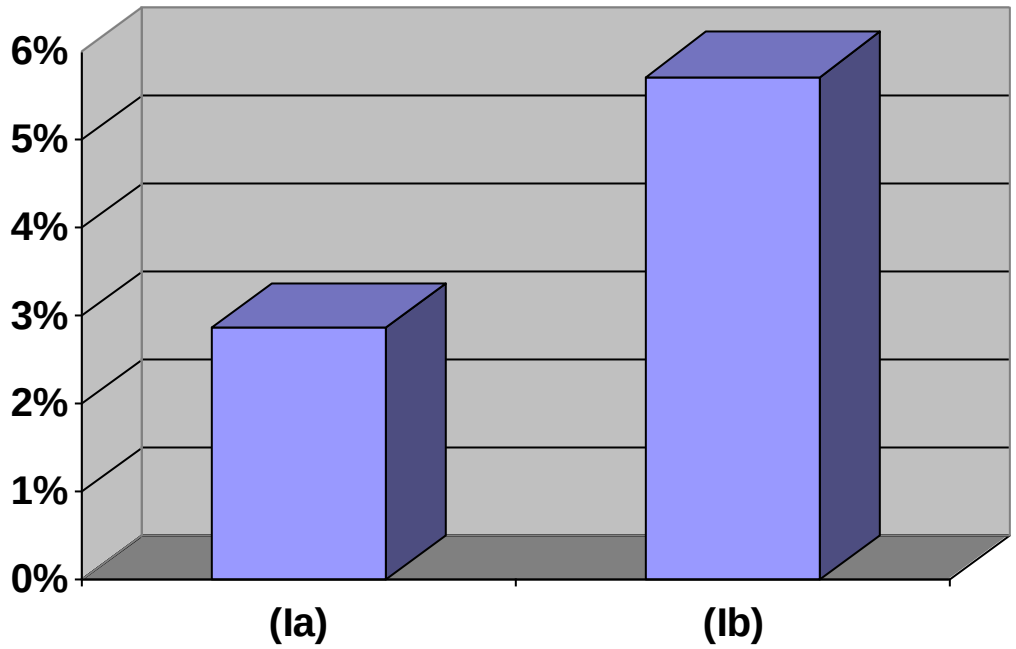

Table (2): Shows results of iodine stain of stool samples of immunocompetants (35) cases and immunocompromized (35) were as follow: in immunocompetants (35) there were three +ve cases (8.57%) (one +ve case was previously detected by direct smear plus two more cases detected only by iodine stain) while in immunocompromized (35) there were four +ve cases (11.43%) (two cases previously detected by direct smear plus two more cases were detected only by iodine stain). So, out of total (70) cases, there were seven +ve cases (10 %) detected by iodine stain (three cases were previously detected by direct smear plus more four cases detected only by iodine stain).

Table (2): The results of examination of three successive stool samples after 15 days of admission by iodine stain in relation to immune status.

Examined cases	No.	Iodine stain		Z	P
		+ve	%		
Immunocompetants (Ia)	35	3	8.57%	0.38	>0.05
Immunocompromized (Ib)	35	4	11.43%		
Total number	70	7	10%		

Figure (8): The results of examination of three successive stool samples after 15 days of admission by iodine stain in relation to immune status.

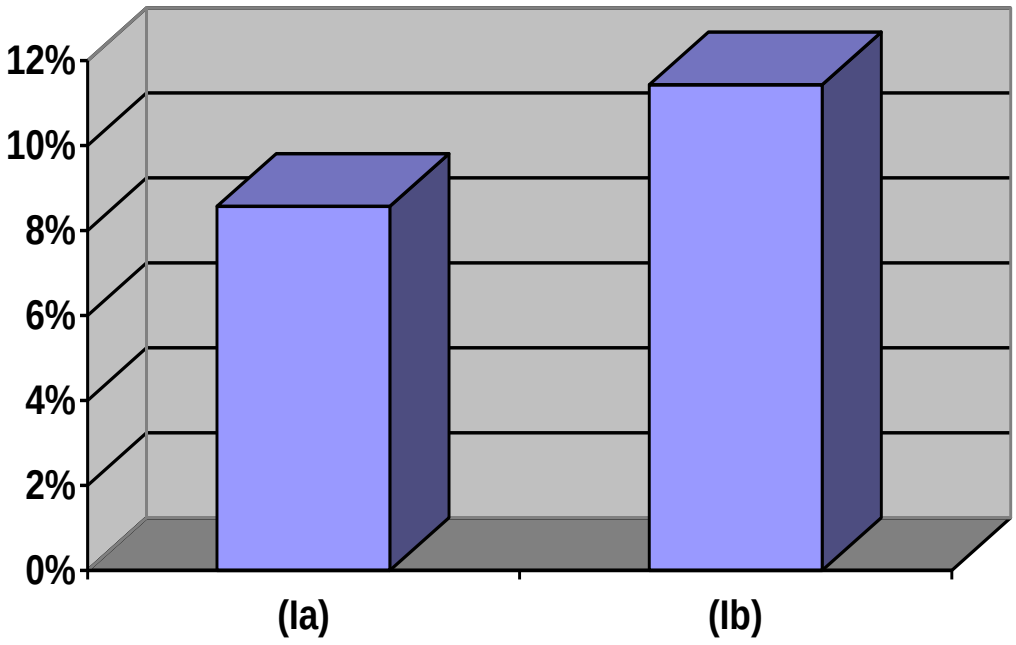

Table (3): Shows results of formol ether concentration technique of stool samples of immunocompetants (35) cases and immunocompromized (35) which were as follow: in immunocompetants (35) there were six +ve cases (17.14%) (three case were previously detected by direct smear and iodine stain plus three more cases detected only by formol ether concentration technique) while in immunocompromized (35) there were ten +ve cases(28.57%) (four cases were previously detected by direct smear and iodine stain plus six more cases were detected only by formol ether concentration technique). So, out of total (70) cases, there were 16 +ve cases (22.86%) were detected by formol ether concentration technique (seven cases were previously detected by direct smear and iodine stain plus nine more cases were detected only by formol ether concentration technique).

Table (3): The results of examination of three successive stool samples after 15 days of admission by formol ether concentration technique in relation to immune status.

Examined cases	No.	Formol ether concentration technique		Z	P
		+ve	%		
Immunocompetants (Ia)	35	6	17.14%	1.00	>0.05
Immunocompromized (Ib)	35	10	28.57%		
Total number	70	16	22.86%		

Figure (9): The results of examination of three successive stool samples after 15 days of admission by formol ether concentration technique in relation to immune status.

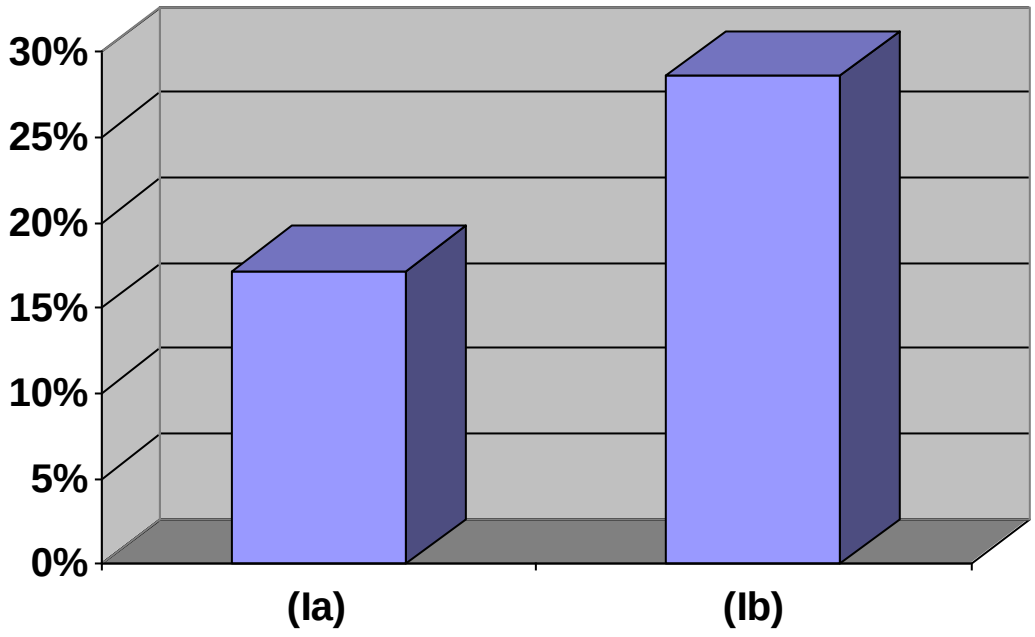

Table (4): Shows results of ELISA technique of stool samples of immunocompetants (35) cases and immunocompromized (35) which were as follow: in immunocompetants (35) there were nine +ve cases (25.72%) (six cases were previously detected by the previous three direct methods plus three more cases detected only by ELISA), in immunocompromized (35) there were 14 +ve cases(40 %) (ten cases were previously detected by the previous three direct methods plus four more cases detected only by ELISA). So, out of total (70) cases, there were 23 +ve cases (32.86 %) were detected by ELISA (seven cases were previously detected by direct smear and iodine stain plus nine cases were previously detected by formol ether concentration technique plus seven more cases detected only by ELISA).

Table (4): The results of examination of three successive stool samples after 15 days of admission by ELISA technique in relation to immune status.

Examined cases	No.	ELISA		Z	P
		+ve	%		
Immunocompetants (Ia)	35	9	25.72%	1.04	>0.05
Immunocompromized (Ib)	35	14	40%		
Total number	70	23	32.86%		

Figure (10): The results of examination of three successive stool samples after 15 days of admission by ELISA technique in relation to immune status.

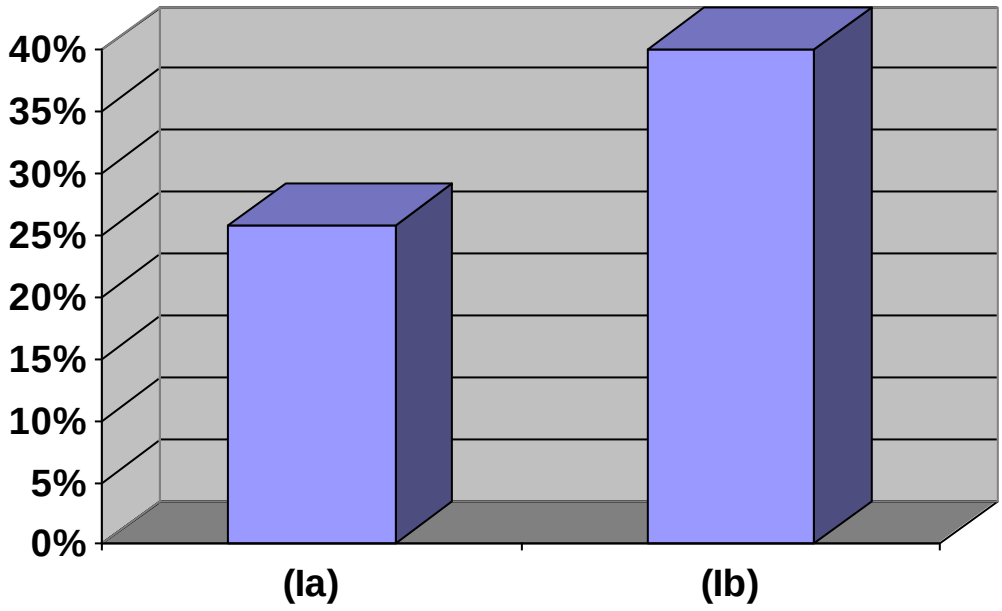

Table (5): Shows comparison between results of direct stool examination by three methods (direct smear, iodine stain and formol ether concentration technique) and indirect stool examination by ELISA) in immunocompetants (35) patients and immunocompromized (35) which were as follow: in immunocompetants (35) there was one +ve case (2.86%) detected by direct smear, there were three +ve cases (8.57%) detected by iodine stain (one +ve case was previously detected by direct smear plus two more cases were detected only by iodine stain), there were six +ve cases (17.14%) detected by formol ether concentration technique (three case were previously detected by direct smear and iodine stain plus three more cases were detected only by formol ether concentration technique), but by ELISA there were nine +ve cases (25.72%) (six cases were previously detected by the previous three direct methods plus three more cases detected only by ELISA). While in immunocompromized (35) there were two +ve cases (5.71%) detected by direct smear, there were four +ve cases (11.43%) detected by iodine stain (two cases were previously detected by direct smear plus two more cases were detected by only iodine stain), there were ten +ve cases (28.57%) detected by formol ether concentration technique (four cases were previously detected by direct smear and iodine stain plus six more cases detected only by formol ether concentration technique), but by ELISA, there were 14 +ve cases (40 %) (four cases were previously detected by direct smear and iodine stain plus six cases were previously detected by formol ether concentration technique plus four more cases detected only by ELISA).

So, out of total (70) cases, there were three +ve cases were detected by direct smear (4.29%) [one case related to immunocompetants group while two cases were related to immunocompromized group].There were seven +ve cases detected by iodine stain (10%) [three cases related to immunocompetants group while four cases related to immunocompromized group]. There were 16 +ve cases were detected by formol ether concentration technique (22.86%) [six cases related to immunocompetants group while ten cases related to immunocompromized group]. There were 23 cases detected by ELISA (32.86) [nine cases related to immunocompetants group, while 14 cases related to immunocompromized group].

Table (5): Comparison between results of examination of three successive stool samples after 15 days of admission by direct stool examination using three methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in relation to immune status.

Examined cases	No.	Direct smear		Iodine stain		Formol ether concentration technique		ELISA	
		+ve	%	+ve	%	+ve	%	+ve	%
Immunocompetants	35	1	2.86%	3	8.57%	6	17.14%	9	25.72%
Immunocompromized	35	2	5.71%	4	11.43%	10	28.57%	14	40%
Total number	70	3	4.29%	7	10%	16	22.86%	23	32.86%

Figure (11): Comparison between results of examination of three successive stool samples after 15 days of admission by direct stool examination using three methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in relation to immune status.

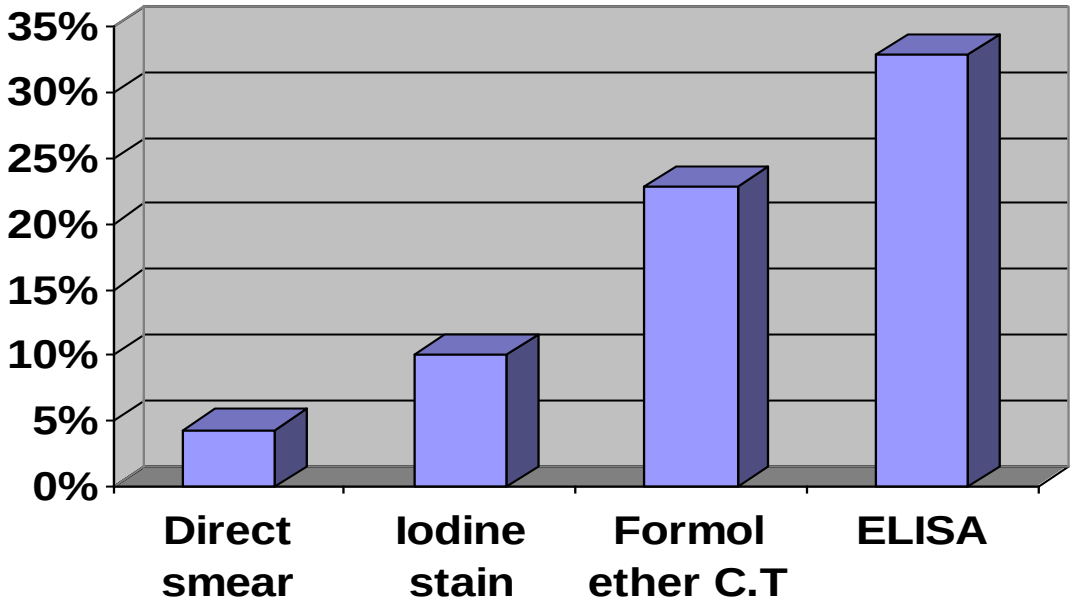

Table (6): Shows sensitivity and specificity of direct smear , iodine stain and ELISA according to formol ether concentration technique. It is found that sensitivity of direct smear, iodine staine and ELISA are (18.75%), (43.8%) and (100.0%) respectively. On the other hand, specificity of direct smear, iodine staine and ELISA are (100.0%), (100.0%) and (87.1%) respectively. +ve predictive values (PPV) of direct smear, iodine staine and ELISA are (100.0%), (100.0%) and (69.6%) respectively. While -ve predictive values (NPV) of direct smear, iodine staine and ELISA are (80.6%), (85.7%) and (100.0%) respectively.

Table (6): Sensitivity and Specificity of direct smear , iodine stain and ELISA according to formol ether concentration technique.

Screening test / Results	Direct smear	Iodine stain	ELISA
Sensitivity	18.75%	43.8%	100.0%
Specificity	100.0%	100.0%	87.1%
PPV	100.0%	100.0%	69.6%
NPV	80.6%	85.7%	100.0%

PPV= +ve predictive values.

NPV= -ve predictive values.

Figure (12): Sensitivity and Specificity of direct smear , iodine stain and ELISA according to formol ether concentration technique.

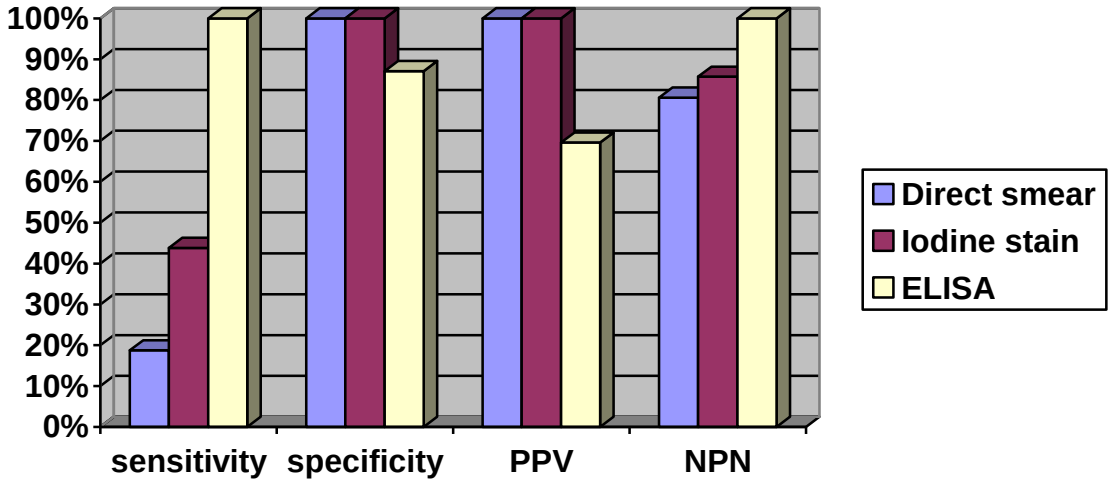

Table (7): Shows comparison between results of direct stool examination by three methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in contacts (six mothers, six food handlers and six medical stuff) which were as follow: by direct smear there was one +ve case detected (5.56%). But by iodine stain there were two +ve cases detected (11.1%) (one case previously detected by direct smear plus one more case detected only by iodine stain). While by formol ether concentration technique three +ve cases were detected (16.67%) (two cases were previously detected by direct smear and iodine stain plus one more case detected by formol ether concentration technique). But by ELISA four +ve cases were detected (22.22%) (two cases were previously detected by direct smear and iodine stain plus one case was previously detected by formol ether concentration technique plus one more case was detected by ELISA). The overall relations were statistically insignificant (p value > 0.05).

Table (7):The results of examination of three successive stool samples by direct stool examination using three methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in contacts.

Examined cases	No.	Direct smear		Iodine stain		Formol ether concentration technique		ELISA	
		+ve	%	+ve	%	+ve	%	+ve	%
Contacts	**18**	**1**	**5.56%**	**2**	**11.1%**	**3**	**16.67%**	**4**	**22.22%**

Z1=0.58 P>0.05 Z1= Direct smear versus iodine stain.
Z2=1 P>0.05 Z2= Direct smear versus formol ether.
Z3=1.34 P>0.05 Z3= Direct smear versus ELISA.

Figure (13):The results of examination of three successive stool samples by direct stool examination using three methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in contacts.

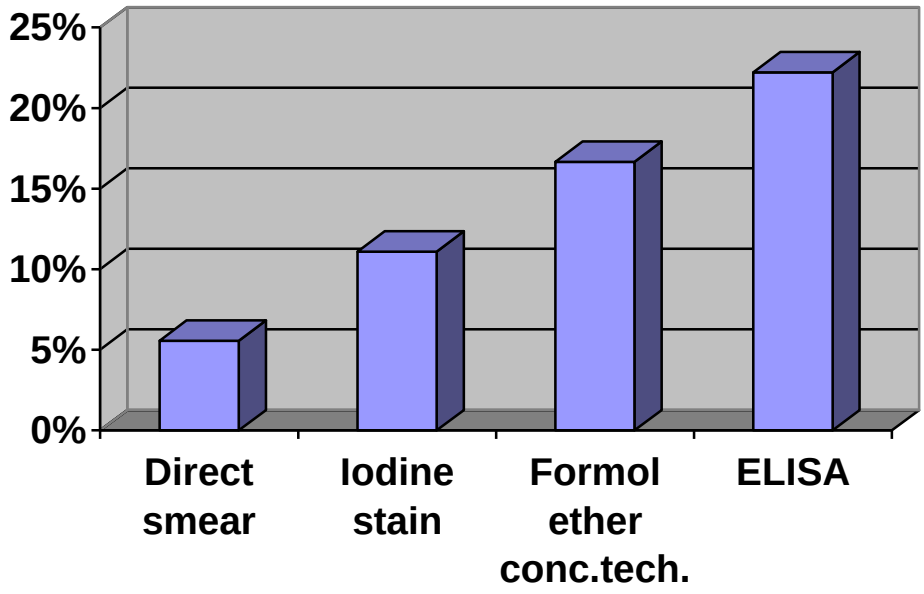

Table (8): Shows the incidence of nosocomial giardiasis detected by three direct methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in correlation to age groups and it is as follows: in age group (1-5 years), 15 cases (37.5%) out of 40 examined cases were positive by ELISA while only 10 cases (25%) were positive by direct methodes. In children (6-10 years), five cases (29.41%) out of 17 examined cases were positive by ELISA, while four cases (23.52%) are positive by three direct methodes. In age group (11-15 years), three cases (23.1%) out of 13 examined cases were positive by ELISA, while two cases (15.38%) are positive by direct methods. The overall relations were statistically insignificant (p value > 0.05).

Table (8): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to age.

Methods of diagnosis / Age group (in years)	direct methods				ELISA				Z	P
	+ ve		- ve		+ ve		- ve			
	No	%	No	%	No	%	No	%		
1—5 (N=40)	10	25	30	75	15	37.5	25	62.5	Z1=1 Z2=0.67	>0.05 >0.05
6 —10 (N=17)	4	23.52	13	76.47	5	29.41	12	70.58	Z1=0.33 Z2= 0.2	>0.05 >0.05
11—15 (N=13)	2	15.38	11	84.61	3	23.1	10	76.92	Z1=0.45 Z2=0.22	>0.05 >0.05

Z1= between percentage of positive (+ve) cases.

Z2= between percentage of negative (-ve) cases.

Chisqare test ($\mathbf{X^2}$): of three direct methods= 0.52, of ELISA= 1.05

Probabelitiy (**P**): of three direct methods = 0.05, of ELISA= 0.05

Figure (14): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to age.

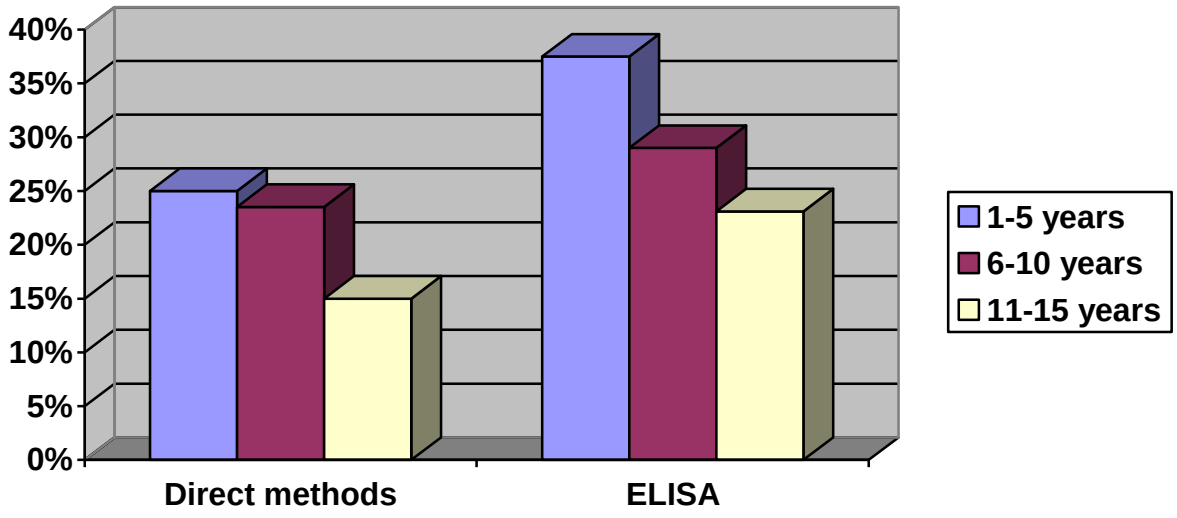

Table (9): Shows the incidence of nosocomial giardiasis detected by three direct methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in correlation to food supply and it is as follows: ten cases (25%) out of 40 were detected by direct methods ate from hospital food, while 16 cases (40%) out of 40 were detected by ELISA ate from hospital food. On the other hand six cases (20%) out of 30 were detected by direct methods ate from house food, while seven cases (23.33%) out of 30 were detected by ELISA ate from house food. The overall relations were statistically insignificant (p value > 0.05).

Table (9): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to food supply.

Methods of diagnosis / Food Suply	direct methods				ELISA				Z	P
	+ ve		- ve		+ ve		- ve			
	No	%	No	%	No	%	No	%		
Hospital Food (N=40)	10	25	30	75	16	40	24	60	Z1=1.18 Z2=0.82	>0.05 >0.05
House Food (N=30)	6	20	24	80	7	23.33	23	76.66	Z1=0.28 Z2=0.15	>0.05 >0.05

Z1= between percentage of positive (+ve) cases.

Z2= between percentage of negative (-ve) cases.

($\mathbf{X^2}$) of three direct methods= 0.24, of ELISA= 2.16

(**P**) of three direct methods = 0.05, of ELISA= 0.05

Figure (15): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to food supply.

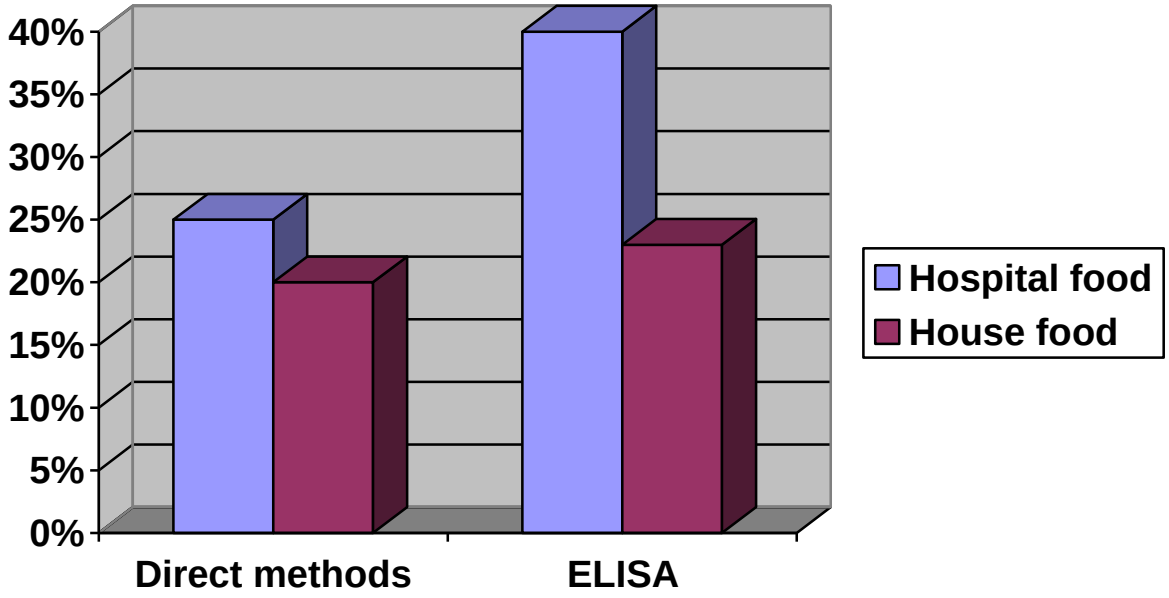

Table (10): shows the incidence of nosocomial giardiasis detected by three direct methods (direct smear, iodine stain and formol ether concentration technique) and ELISA in correlation to residence and it is as follows: 11 cases (27.5%) out of 40 were detected by direct methods from rural areas, while 15 cases (37.5%) out of 40 were detected by ELISA from urban areas. On the other hand five cases (16.66%) out of 30 were detected by direct methods from rural areas, while eight cases (26.66%) out of 30 were detected by ELISA from urban areas. The overall relations were statistically insignificant (p value > 0.05).

Table (10): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to residence.

Methods of diagnosis / residence	direct methods				ELISA				Z	P
	+ ve		- ve		+ ve		- ve			
	No	%	No	%	No	%	No	%		
Rural areas (N=40)	11	27.5	29	72.5	15	37.5	25	62.5	Z1=0.78 Z2=0.54	>0.05 >0.05
Urban areas (N=30)	5	16.66	25	83.33	8	26.66	22	73.33	Z1=0.83 Z2=0.44	>0.05 >0.05

Z_1= between percentage of positive (+ve) cases.

Z_2= between percentage of negative (-ve) cases.

($\mathbf{X^2}$) of three direct methods= 1.14, of ELISA= 0.91

(**P**) of three direct methods = 0.05, of ELISA= 0.05

Figure (16): The incidence of nosocomial giardiasis detected by direct methods and ELISA in relation to residence.

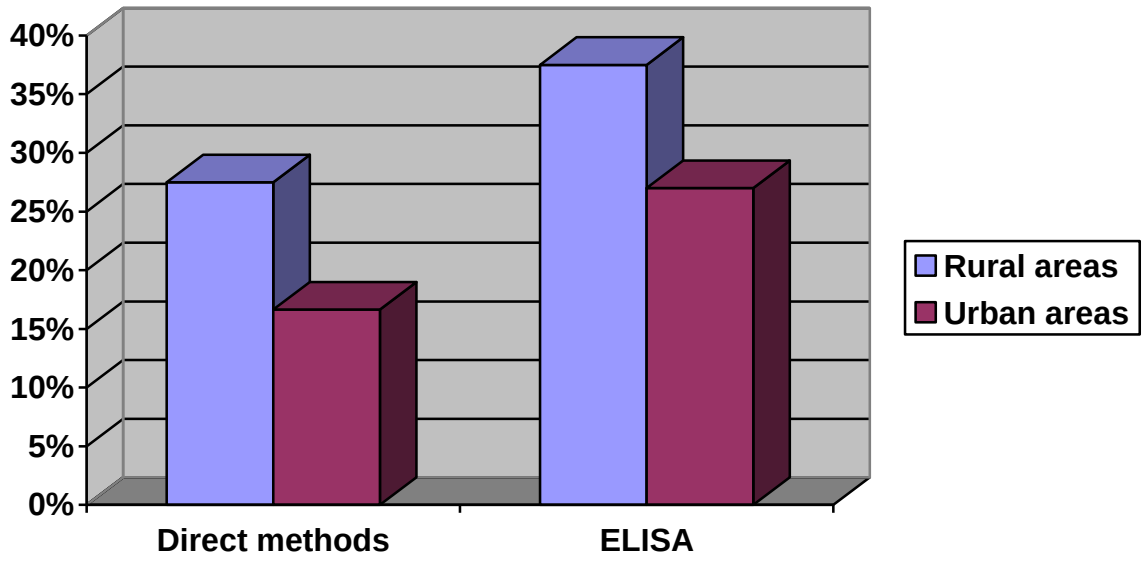

Table (11): Shows results of water examination by direct examination, filtration and ELISA. That were found to have no +ve results for the presence of *G.lamblia*.

Table (11): Distribution and result of water samples.

This table shows that water samples from both hospitals were free.

Figure (17): Results of ELISA.

Collection site	Direct examination	Filtration techniques	ELISA
Tank 1	- Ve	- Ve	- Ve
Tank 2	- Ve	- Ve	- Ve
4th floor of both hospitals **Source a** **Source b**	 -Ve -Ve	 - Ve - Ve	 -Ve -Ve
3rd floor of both hospitals **Source a** **Source b**	 -Ve -Ve	 - Ve - Ve	 -Ve -Ve
2nd floor of both hospitals **Source a** **Source b**	 -Ve -Ve	 - Ve - Ve	 -Ve -Ve
1st floor of both hospitals **Source a** **Source b**	 -Ve -Ve	 - Ve - Ve	 -Ve -Ve