RESULTS AND STATISTICAL ANALYSIS

STATISTICAL ANALYSIS

1. Mean and Standard Deviation

- The mean value ($\bar{x}$) = the sum of all observations (Σx) divided by the number of observations (n)

$$\bar{x} = \frac{\Sigma x}{n}$$

- The Standard Deviation (S.D) = $\sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$

where, Σx^2 = sum of squares of each observation.

$(\Sigma x)^2$ = square of sum of all observations.

n = number of observations.

2. t-test:

Testing for significance of difference between the means ($\bar{x}$) of two samples was carried out by the t-test as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}}$$

where, $\bar{x}_1$ = the mean value in sample 1

$\bar{x}_2$ = the mean value in sample 2

S_p^2 = pooled variance of the two samples.

3. *P-value:*

It was used to compare two percentages.

$$P = \frac{p_1 - p_2}{\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}}$$

where, n_1 = the size of the first sample.

n_2 = the size of the second sample.

x_1 = the number of positive cases in the first sample.

x_2 = the number of positive cases in the second sample.

$$p_1 = \frac{x_1}{n_1} \qquad p_2 = \frac{x_1}{n_1}$$

P value $\leq$ 0.05 significant

RESULTS

Table (1) G6PD Level in babies with neonatal hyper-bilirubinaemia in both groups in our study

G6PD Level	Number & Percentage of cases	GROUPS		Row Total
		First Group	Second Group	
< 1200 U/L	No	16	92	108
	%	16.0%	24.5%	22.7%
1200-3000 U/L	No	84	284	368
	%	84.0%	75.5%	77.3%
Total	No	100	376	476
	%	21.0%	79.0%	100.0%

Chi-Square	Value	DF	Significance
Pearson	3.22919	1	0.07234 (insignificant)

Table (1) Shows that the number of G6PD deficient neonates with hyperbilirubinaemia in the first group in our study were 16 and in the second group were 92.

On the other hand the number of jaundiced neonates with normal enzyme level in the first group were 84 and in the second group were 284.
There is no statistical significance.

Figure (1)

Glucose 6 Phosphate dehydrogenase level in both Groups

Figure (1) shows the mean G6PD level in both groups in our study

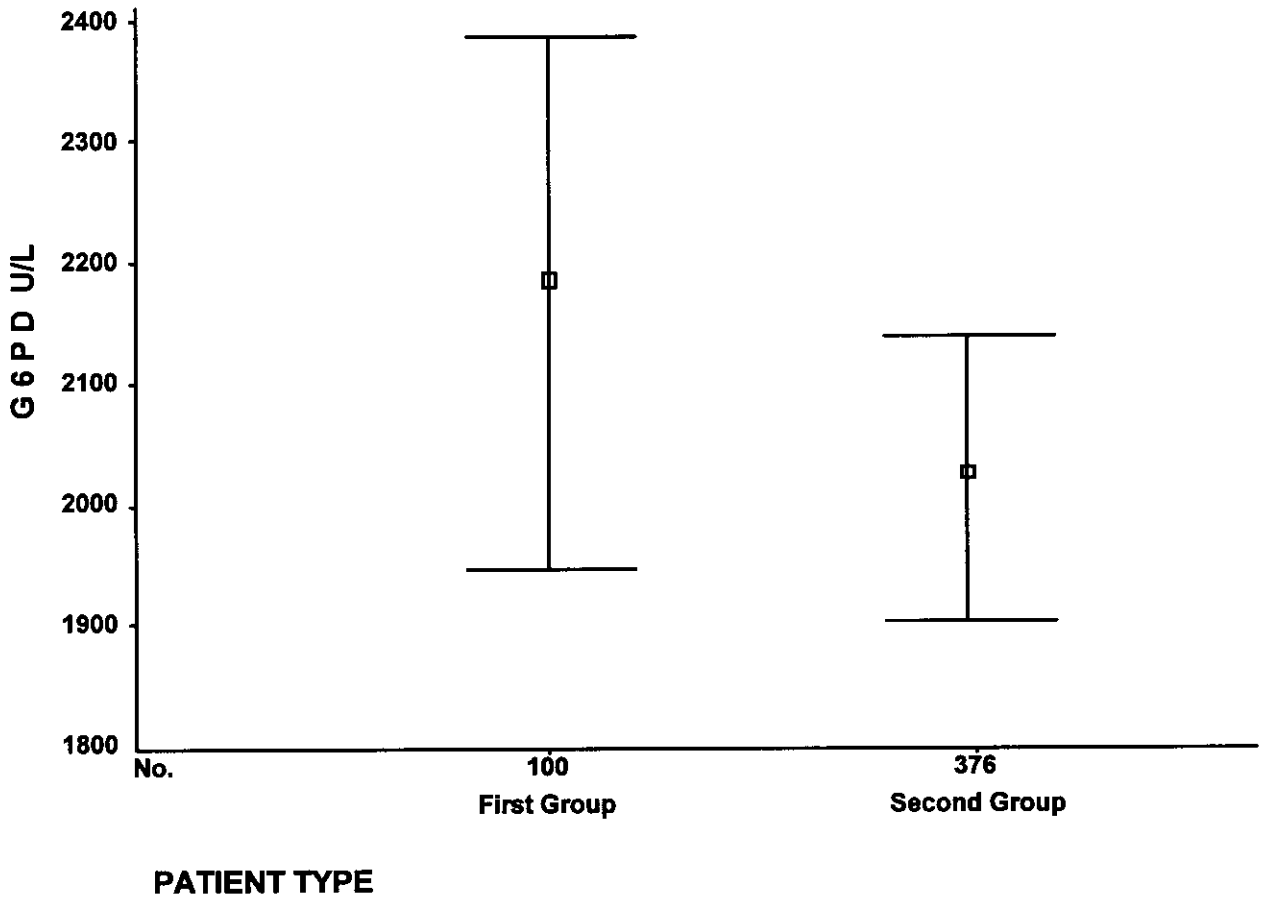

Figure (2)

Sex distribution among babies included in the study

Figure (2) shows that the percentage of male neonates in the first group were 54% and in the second group were 53%.
On the other hand the percentage of female neonates in the first group were 46% and in the second group were 47%.

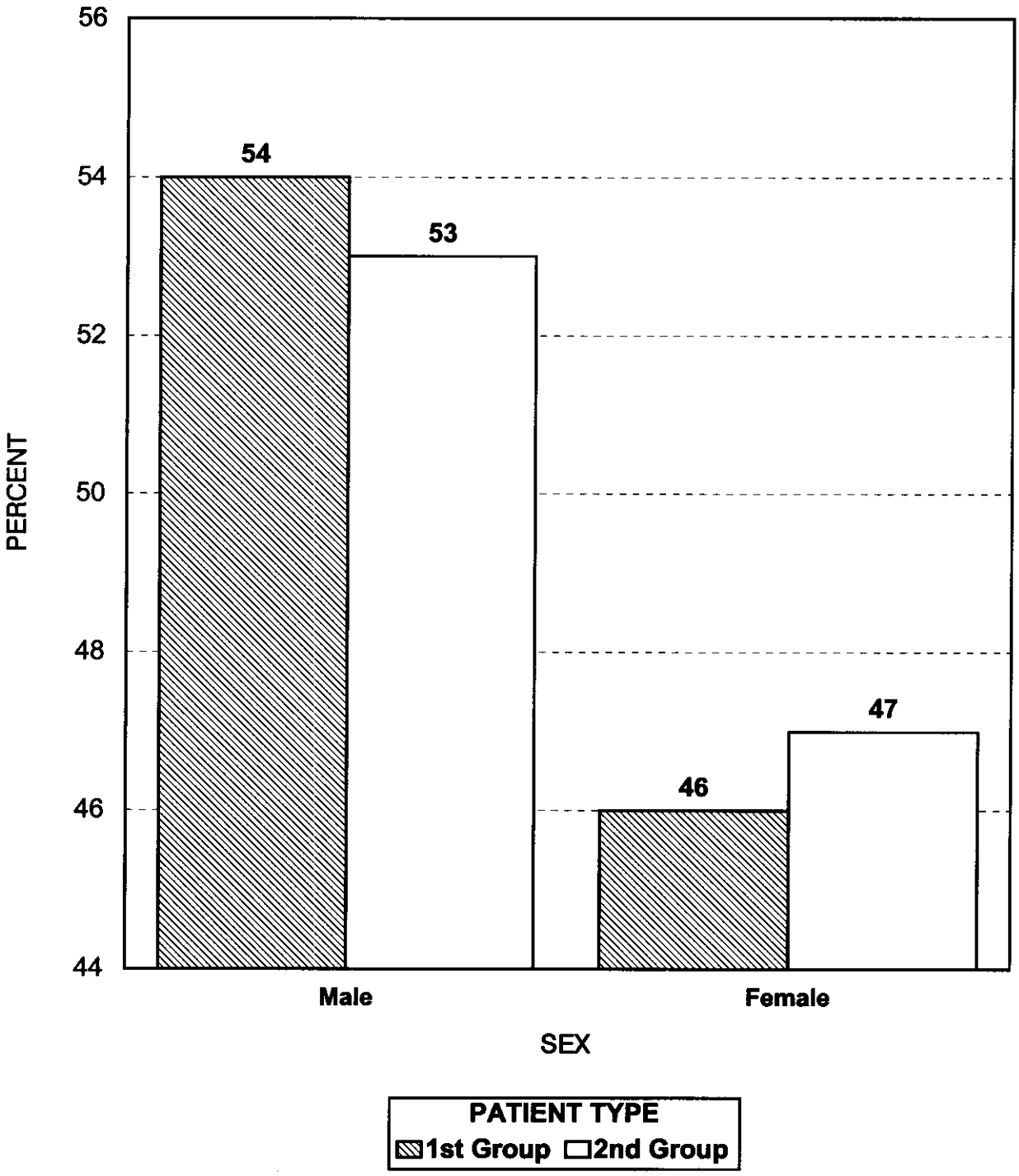

Figure (3)

Age of Presentation to the Hospital with Neonatal Jaundice in Both Groups

Figure (3) shows the mean age of jaundiced neonates at the time of Presentation to the hospital in both groups in our study

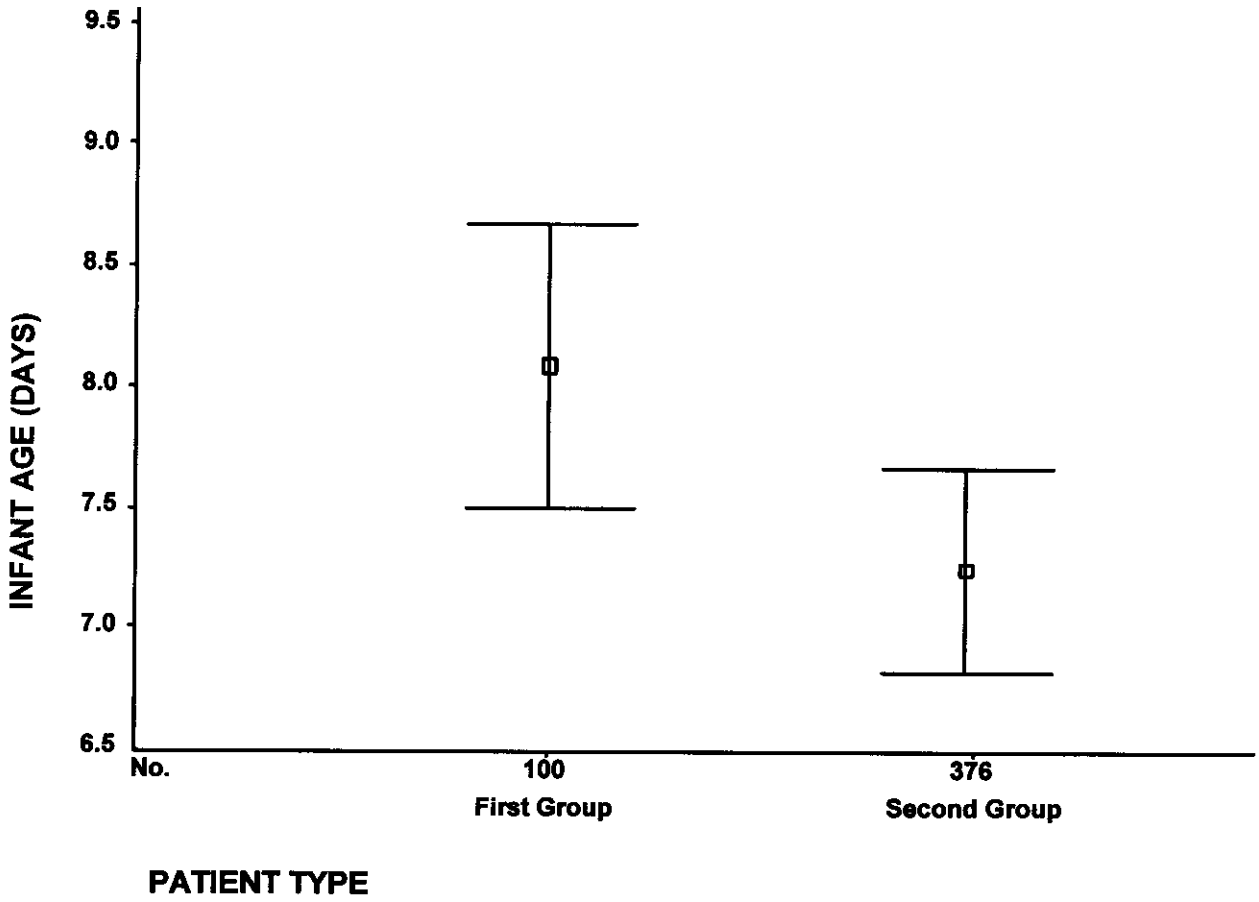

Figure (4)

Hospital admission, bilirubin level in both groups

Figure (4) shows the mean serum bilirubin level at the time of presentation to the hospital in both groups in our study

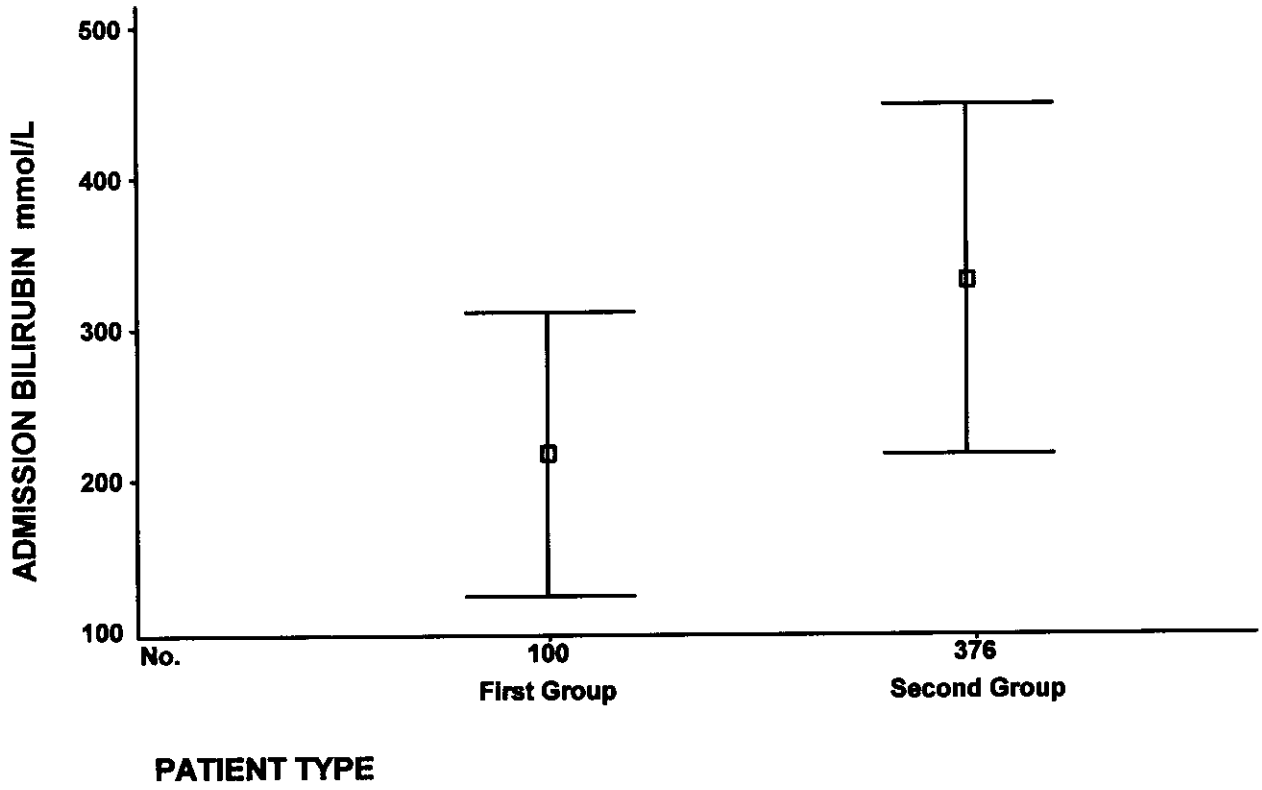

Figure (5)
Gestational Age in Relation to G6PD Level in Both Groups

Figure (5) shows that the percentage of full term jaundiced neonates in both groups with low G6PD level were 26% and with normal enzyme level were 74%.
On the other hand the percentage of preterm jaundiced neonates in both groups with low G6PD level were 9% and with normal enzyme level were 91%.

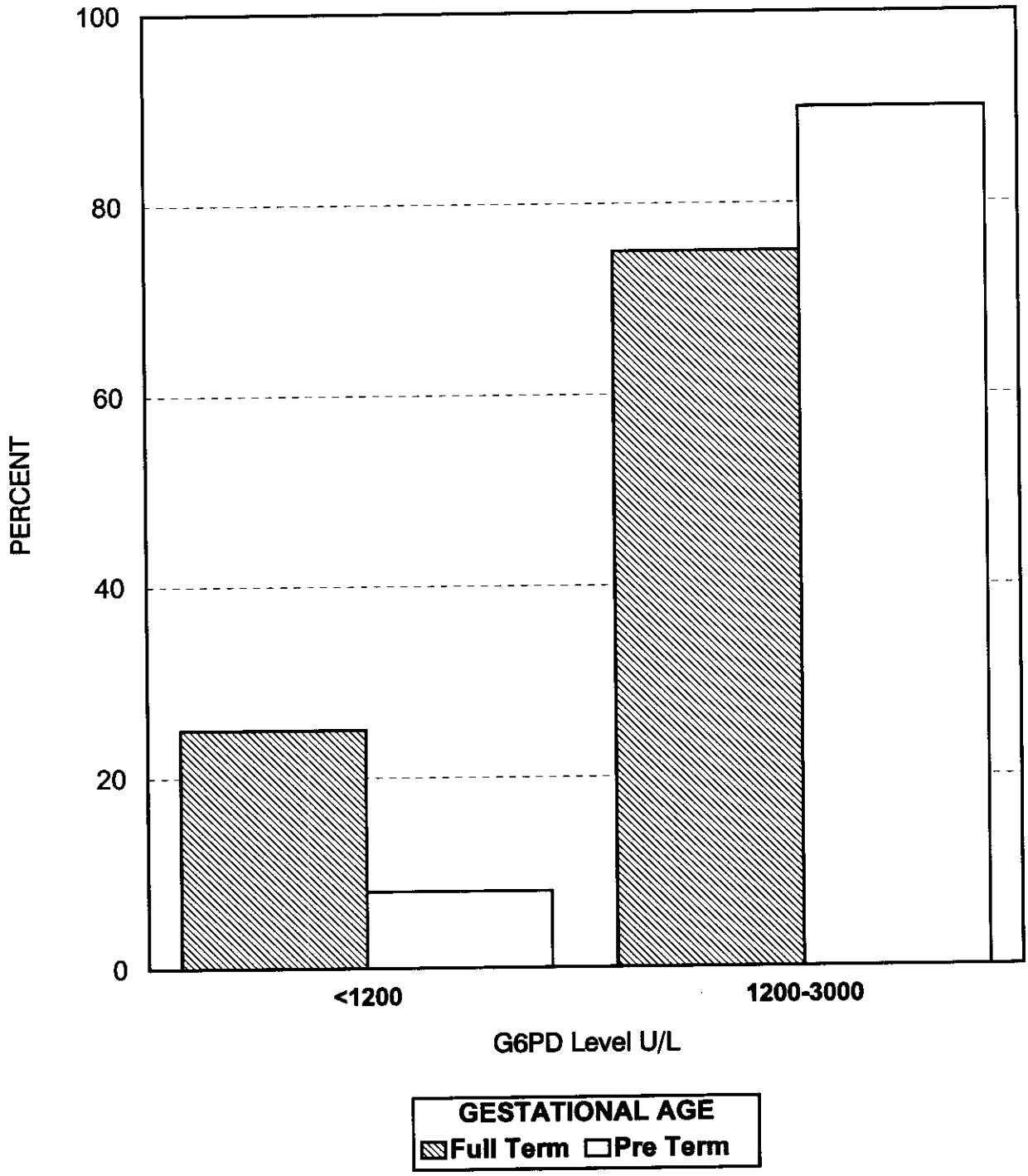

Figure (6)

Method of Delivery in Relation to G6PD Level in Both Groups

Figure (6) shows that the percentage of jaundiced neonates in both groups delivered by NSVD with low G6PD level were 28% and with normal enzyme level were 72%. On the other hand the percentage of jaundiced neonates in both groups delivered by CS with low G6PD level were 17.5% and with normal enzyme level were 82.5%.

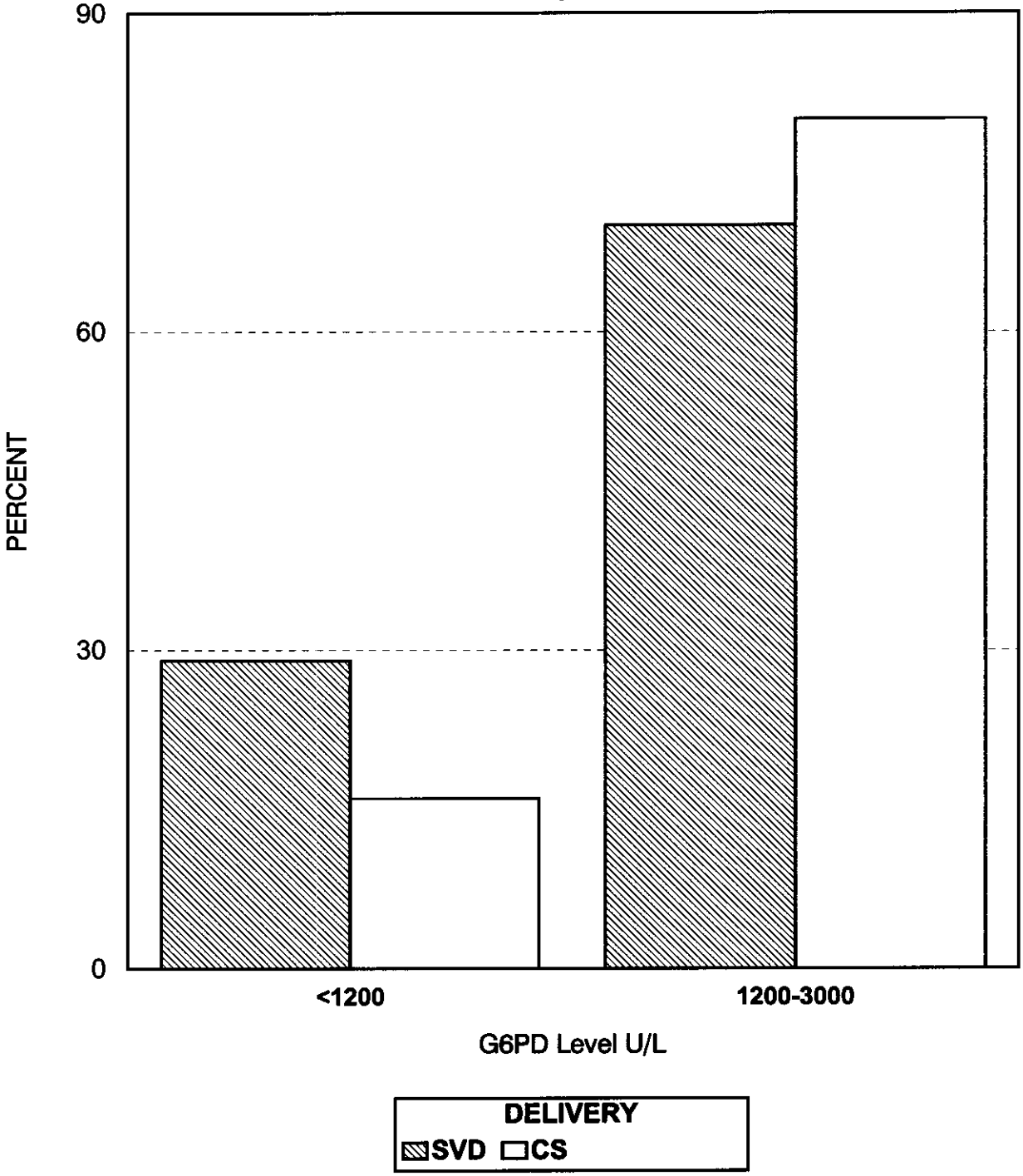

Figure (7)
Patients' Sex in Relation to G6PD Level in Both Groups

Figure (7) shows that the percentage of male neonates in both groups with low G6PD level were 32% and with normal enzyme level were 68%. On the other hand the percentage of female neonates in both groups with low G6PD level were 15% and with normal enzyme level were 85%.

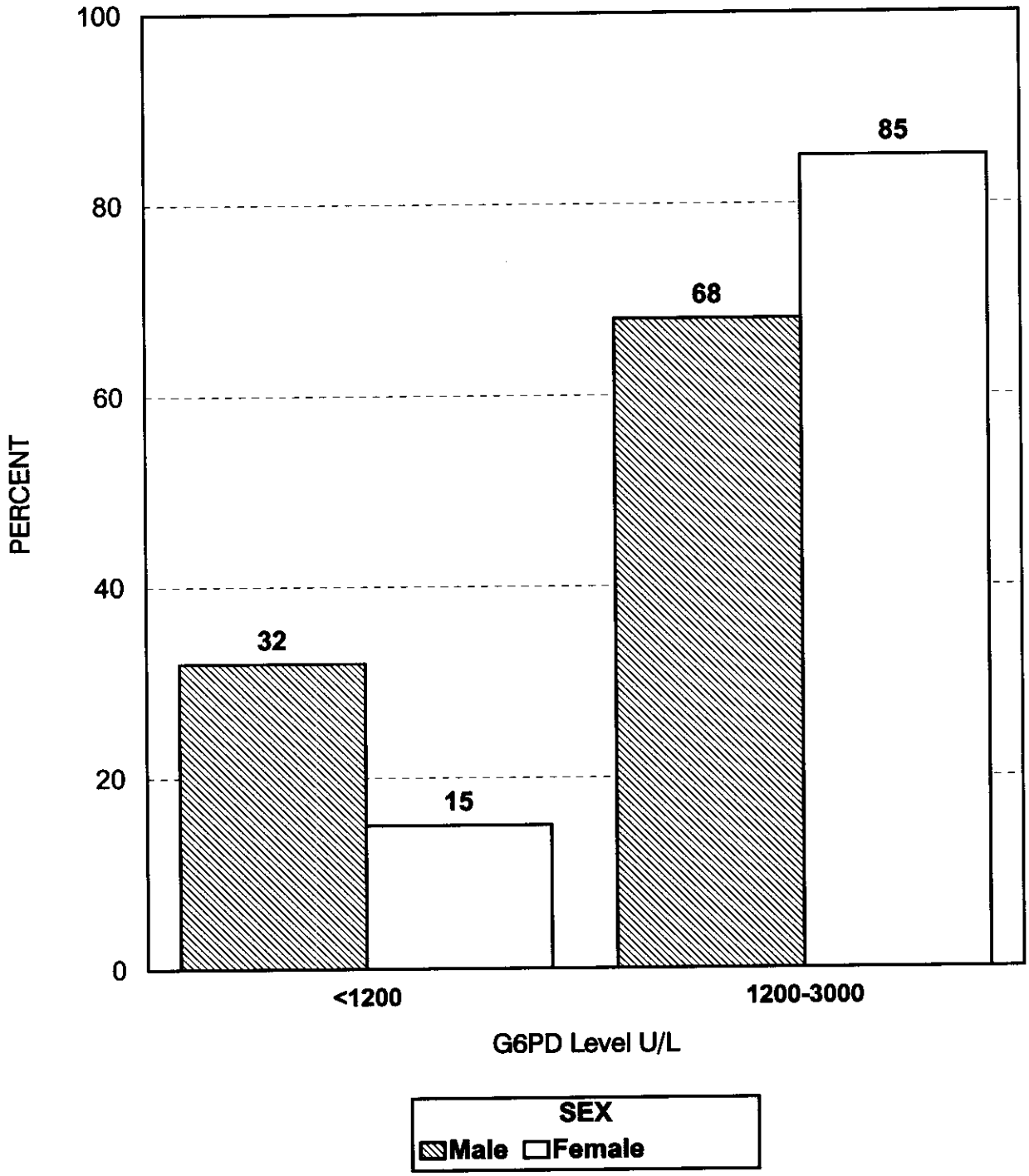

Table (3) Relation between G6PD level and some other clinical data in the second group of our study

Item	G6PD Level in U/L	
	<1200	1200 - 3000
Number of jaundiced neonates	92	284
Sex Distribution	Male 62 67.4%	Male 138 48.6%
	Female 30 32.6%	Female 146 51.4%
Mean ± ***SD*** age in days at the time of presentation to the hospital with hyperbilirubinaemia	7.326 ± 3.067	7.253 ± 4.062
Gestational age	No. %	No. %
Full term babies	90 97.8%	262 92.2%
Preterm babies	2 2.2%	22 7.8%
Method of Delivery	No. %	No. %
SVD	72 78.3%	182 65%
CS	20 21.7%	102 35%
Birth Weight	No. %	No. %
Normal	90 97.8%	260 91.5%
Low	2 2.2%	24 8.5%
Mean ± ***SD*** G6PD Level in u/L	467.6935 ± 407.667	2502.0183 ± 727.574
Mean ± ***SD*** Serum bilirubin level in mmol/L	344.5217 ± 55.341	318.0282 ± 56.641
Mean ± ***SD*** Haemoglobin level in g/dL	15.19333 ± 2.8797	16.66049 ± 2.1378

Significant points of Table (3):

1. There is statistical significant increase in the number of males with G6PD deficiency than females. P value = 0.00169
2. There is significant correlation in the number of neonates delivered by NSVD and associated with G6PD deficiency in comparison to those delivered by CS. P value = 0.01773
3. There is statistical significant increase in the number of neonates with normal birth weight and low G6PD level more than those with low birth weight and low G6PD level P value = 0.03917
4. There is statistical significant increase in the serum bilirubin level at the time of admission to the hospital in neonates with low G6PD level in the second group more than those with normal enzyme level. P value = 0.000
5. There is statistical significant decrease in the ***mean*** ± ***SD*** Hb in g/dL in the neonates with low enzyme level (15.165 ± 2.87) than the ***mean*** ± ***SD*** Hb in g/dL in the neonates with normal enzyme level (16.66 ± 2.13).
6. There is considerable percentage of neonates suffering from neonatal hyper-bilirubinaemia with G6PD deficiency. (Statistical significant ratio) P value = 0.000

Figure (8)

Comparison between the age of admission to the hospital with neonatal jaundiced and G6PD level in the second group

Figure (8) shows the mean age of jaundiced neonates at the time of admission to the hospital in the second group in our study

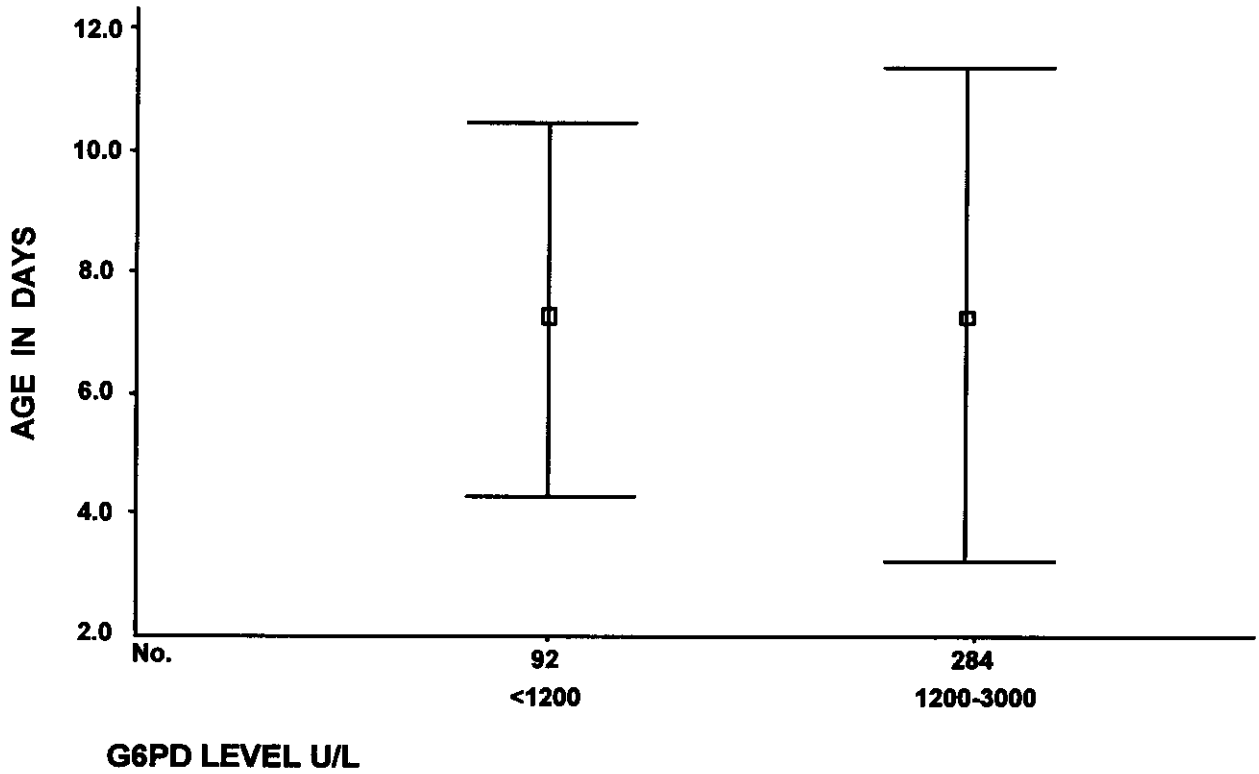

Table (4) Mothers' blood group phenotypes and its relation to the clinical condition of babies with neonatal hyperbilirubinaemia

Mother's Blood Group	Number & Percentage of cases	GROUPS		Row Total
		First Group	Second Group	
Missing	No	100	14	114
	%	100%	3.7%	23.9%
A-		-	18	18
			4.8%	3.8%
A+		-	134	134
			35.6%	28.2%
B+		-	30	30
			8.0%	6.3%
O-		-	4	4
			1.1%	0.8%
O+		-	176	176
			46.8%	37.0%
Total	No	100	376	476
	%	21.0%	79.0%	100.00%

Chi-Square	Value	DF	Significance
Pearson	402.08870	6	0.00000
			(Significant)

Table (4) Shows significant increase in the number of Mothers with blood group O+.

Table (5) Type of Mothers' Blood Group in Relation to G6PD Level in the Second Group.

Mother's Blood Group	Number & Percentage of cases	GROUPS		Row Total
		First Group	Second Group	
Missing	No	8	6	14
	%	8.7%	2.1%	3.7%
A-		-	18	18
			6.3%	4.8%
A+		20	114	134
		21.7%	40.1%	35.6%
B+		10	20	30
		10.9%	7.0%	8.0%
O-		-	4	4
			1.4%	1.1%
O+		54	122	176
		58.7%	43.0%	46.8%
Total	No	92	284	376
	%	24.5%	75.5%	100.0%

Chi-Square	Value	DF	Significance
Pearson	26.76978	5	0.00006
Likelihood Ratio	31.15481	5	0.00001

Minimum Expected Frequency : 0.979
Cells with Expected Frequency : < 5 - 4 OF 12 (33.3%)
Number of missing observations: 14

Table (5) shows that there is positive significant correlation between Mothers with blood group O+ and G6PD deficiency.

Table (6) Babies' blood group phenotypes and its relation to the clinical condition of babies with neonatal hyperbilirubinaemia

Baby's Blood Group	Number & Percentage of cases	GROUPS		Row Total
		First Group	Second Group	
Missing	No	66	10	76
	%	66.0%	2.7%	16.0%
A-		-	16	16
			4.3%	3.4%
A+		10	130	140
		10.0%	34.6%	29.4%
B+		8	32	40
		8.0%	8.5%	8.4%
AB+		4	4	8
		4.0%	1.1%	1.7%
O-		-	6	6
			1.6%	1.3%
O+		12	178	190
		12.0%	47.3%	39.9%
Total	No	100	376	476
	%	21.0%	79.0%	100.0%

Chi-Square	Value	DF	Significance
Pearson	249.35151	6	0.00000 (Significant)

Table (6) Shows significant increase in the number of Babies with blood group O+.

Table (7) Type of Babies' Blood Group in Relation to G6PD Level in the Second Group.

Baby's Blood Group	Number & Percentage of cases	GROUPS		Row Total
		First Group	Second Group	
Missing	No	8	2	10
	%	8.7%	0.7%	2.7%
A-		-	16	16
			5.6%	4.3%
A+		24	106	130
		26.1%	37.3%	34.6%
B+		10	22	32
		10.9%	7.7%	8.5%
AB+		-	4	4
			1.4%	1.1%
O-		-	6	6
			2.1%	1.6%
O+		50	128	178
		54.3%	45.1%	47.3%
Total	No	92	284	376
	%	24.5%	75.5%	100.0%

Chi-Square	Value	DF	Significance
Pearson	29.70625	6	0.00004
Likelihood Ratio	32.91081	6	0.00001

Minimum Expected Frequency : - 0.979
Cells with Expected Frequency : < 5 - 6 OF 14(42.9%)
Number of missing observations: 8

Table (7) shows that there is positive significant correlation between Babies with blood group O+ and G6PD deficiency.

Family history of acute hemolytic episodes among G6PD deficient jaundiced babies:

The parents of G6PD deficient jaundiced babies of both group I and II were inquired about the presence of acute hemolytic episodes among other members of the family (First and second degree consanguinity).

The results show that a positive history of acute hemolytic episodes among family members of G6PD deficient jaundiced babies was present in 2 cases in the first group and 3 cases in the second group.

Statistical analysis shows no significant difference between +ve family history and -ve family history of acute hemolytic episodes.

The effect of possible stressing factors in G6PD deficient jaundiced neonates:

Individual newborn infants of group I and group II were surveyed for possible exposure to the following presumably stressing factors:

1. Maternal intake of hemolytic drug, local use of any agent capable of causing oxidative hemolysis or ingestion of fava beans late in pregnancy or during labour.
2. Presence of maternal infection by the time of delivery.
3. Evidence of fetal and/or early neonatal distress.

The surveillance for the first two factors (maternal factors) proved that none of the enzyme deficient jaundiced infants investigated was subjected to such a stressing effect.

Fetal and/or early neonatal distress were presumed present if one or more of the following conditions was present:

a) Prolonged labour.
b) Passage of meconium before or during labour.
c) Low 1 and 5 minutes Apgar score.
d) Need for resuscitation.
e) Signs of early neonatal distress e.g. cardio-pulmonary distress, acidosis, infection... etc.

Results shows that 25% of G6PD deficient jaundiced infants with neonatal distress (signs of neonatal sepsis or infection) developed marked hyperbilirubinemia, whereas, only 30.4% of enzyme deficient jaundiced infants without distress developed such a degree of hyperbilirubinemia. The difference between the two percentages was not sadistically significant. ($P = 0.974$).

Table (8) Correlation between serum bilirubin level and G6PD level in the second group at the time of admission to the hospital

Variable	G6PD Level	Number of Cases	Mean bilirubin m mol /L	SD	SE of Mean
BILIRUBIN at time of Admission in mmol/L	<1200 U/L	92	344.5217	55.341	5.770
	1200-3000 U/L	284	318.0282	56.641	3.361

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	3.92	374	0.000	6.757	(13.204, 39.783)
Unequal	3.97	157.41	0.000	6.677	(13.302, 39.685)

Mean Difference = 26.4936

Levene's Test for Equality of Variances: F = 0.026 P = 0.000

Table (8) shows that there is statistical significant increase in the serum bilirubin level at the time of admission to the hospital in neonates with low G6PD level in the second group more than those with normal enzyme level.

NB: the number of jaundiced neonates with low G6PD level were 92 and the number of jaundiced neonates with normal enzyme level were 284

Figure (9)

Correlation between serum bilirubin level and G6PD level in the second group at the time of admission to the hospital

Figure (9) shows the mean serum bilirubin level in mmol/L and its relation to G6PD level in U/L at the time of admission to the hospital in the second group of our study

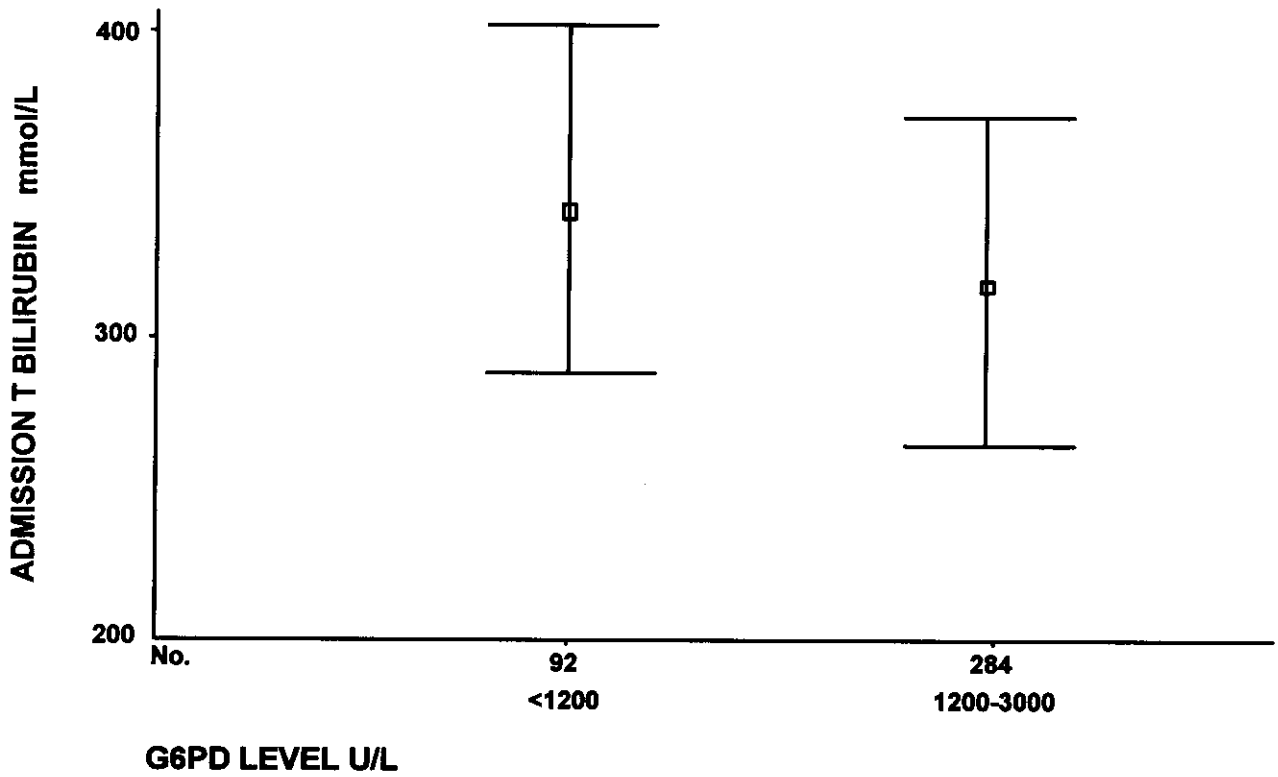

Table (9) Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 6 hours from the time of admission to the hospital

Variable	G6PD Level	Number of Cases	Mean bilirubin m mol /L	SD	SE of Mean
BILIRUBIN after 6 hours from time of Admission in mmol/L	<1200 U/L 1200-3000 U/L	92 284	305.0217 290.6620	68.872 56.231	7.180 3.337

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	2.01	374	0.045	7.144	(0.309, 28.411)
Unequal	1.81	132.56	0.072	7.918	(-1.305, 30.024)

Mean Difference = 14.3598

Levene's Test for Equality of Variances: F = 1.818 P = 0.178

Table (9) shows the process of gradual improvement of serum bilirubin level in Jaundiced neonates after recieving treatment.

NB: the number of jaundiced neonates with low G6PD level were 92 and the number of jaundiced neonates with normal enzyme level were 284 after recieving 6 hours treatment. (No difference in the rate of improvement between G6PD deficient neonates and neonates with normal enzyme level within this period of treatment).

Figure (10)

Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 6 hours from the time of admission to the hospital

Figure (10) shows the mean serum bilirubin level in mmol/L and its relation to G6PD level in U/L after 6 hours from the time of admission to the hospital in the second group of our study

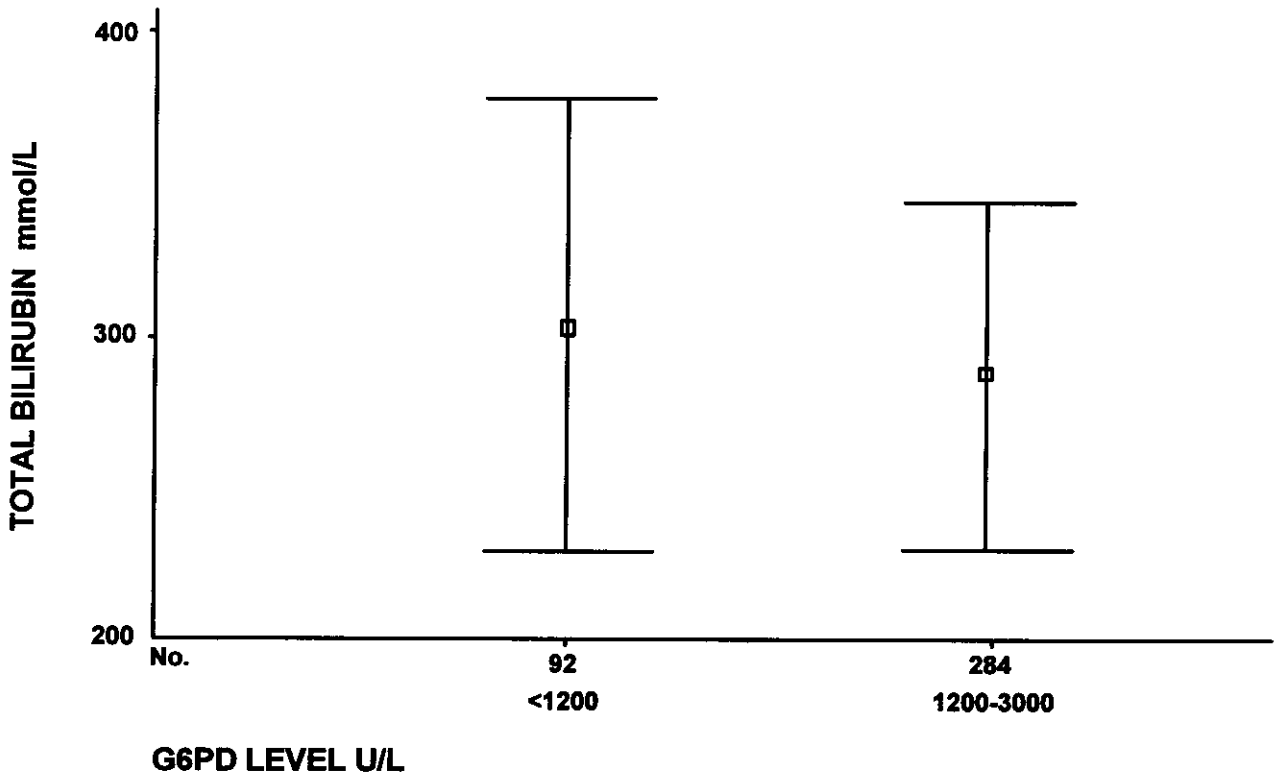

Table (10) Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 24 hours from the time of admission to the hospital

Variable	G6PD Level	Number of Cases	Mean bilirubin m mol /L	SD	SE of Mean
BILIRUBIN after 24 hours from time of Admission in mmol/L	<1200 U/L 1200-3000 U/L	92 264	256.3913 252.2879	54.398 43.271	5.671 2.663

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	0.73	354	0.465	5.616	(-6.944, 15.151)
Unequal	0.65	133.31	0.514	6.266	(-8.292, 16.499)

Mean Difference = 4.1034

Levene's Test for Equality of Variances: F = 14.810 P = 0.000

Table (10) Shows the process of improvement of serum bilirubin level in jaundiced neonates after recieving treatment.

NB : the number of jaundiced neonates with low G6PD level remain 92 and the number of jaundiced neonates with normal enzyme level reduced to 264 after recieving 24 hours treatment.(There is observed difference in the rate of improvement)

Figure (11)

Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 24 hours from the time of admission to the hospital

Figure (11) shows the mean serum bilirubin level in mmol/L and its relation to G6PD level in U/L after 24 hours from the time of admission to the hospital in the second group of our study

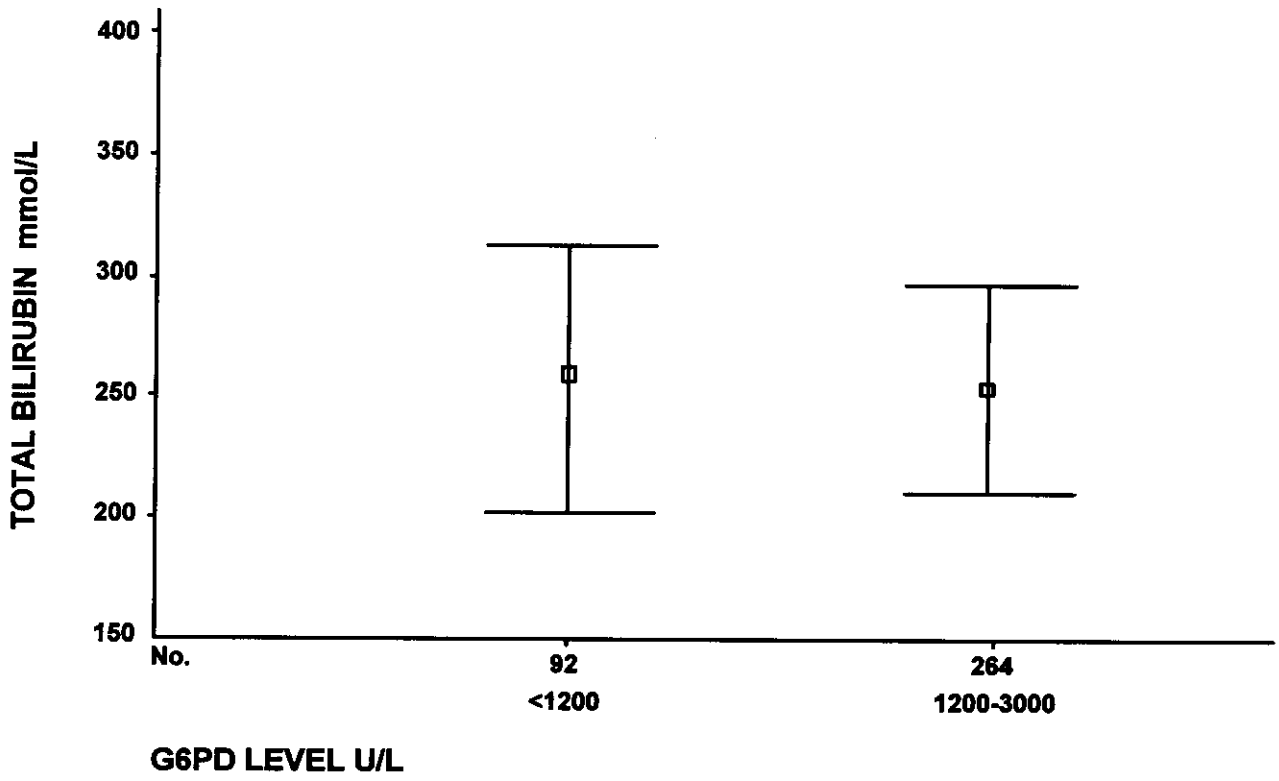

Table (11) Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 48 hours from the time of admission to the hospital

Variable	G6PD Level	Number of Cases	Mean bilirubin m mol /L	SD	SE of Mean
BILIRUBIN after 48 hours from time of Admission in mmol/L	<1200 U/L 1200-3000 U/L	76 218	226.5789 219.5229	46.824 33.447	5.371 2.265

Mean Difference = 7.0560

Levene's Test for Equality of Variances: F = 1.496 P = 0.222

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	1.42	292	0.157	4.974	(-2.737, 16.849)
Unequal	1.21	102.93	0.229 insignificant	5.829	(-4.508, 18.620)

Table (11) Shows the process of improvement of serum bilirubin level in jaundiced neonates after recieving treatment.

NB : the number of jaundiced neonates with low G6PD level were 76 and the number of jaundiced neonates with normal enzyme level were 218 after recieving 48 hours treatment. (There is observed difference in the rate of improvement).

Figure (12)

Prognosis of neonatal hyperbilirubinaemia in neonates with G6PD deficiency and those with normal enzyme level after 48 hours from the time of admission to the hospital

Figure (12) shows the mean serum bilirubin level in mmol/L and its relation to G6PD level in U/L after 48 hours from the time of admission to the hospital in the second group of our study

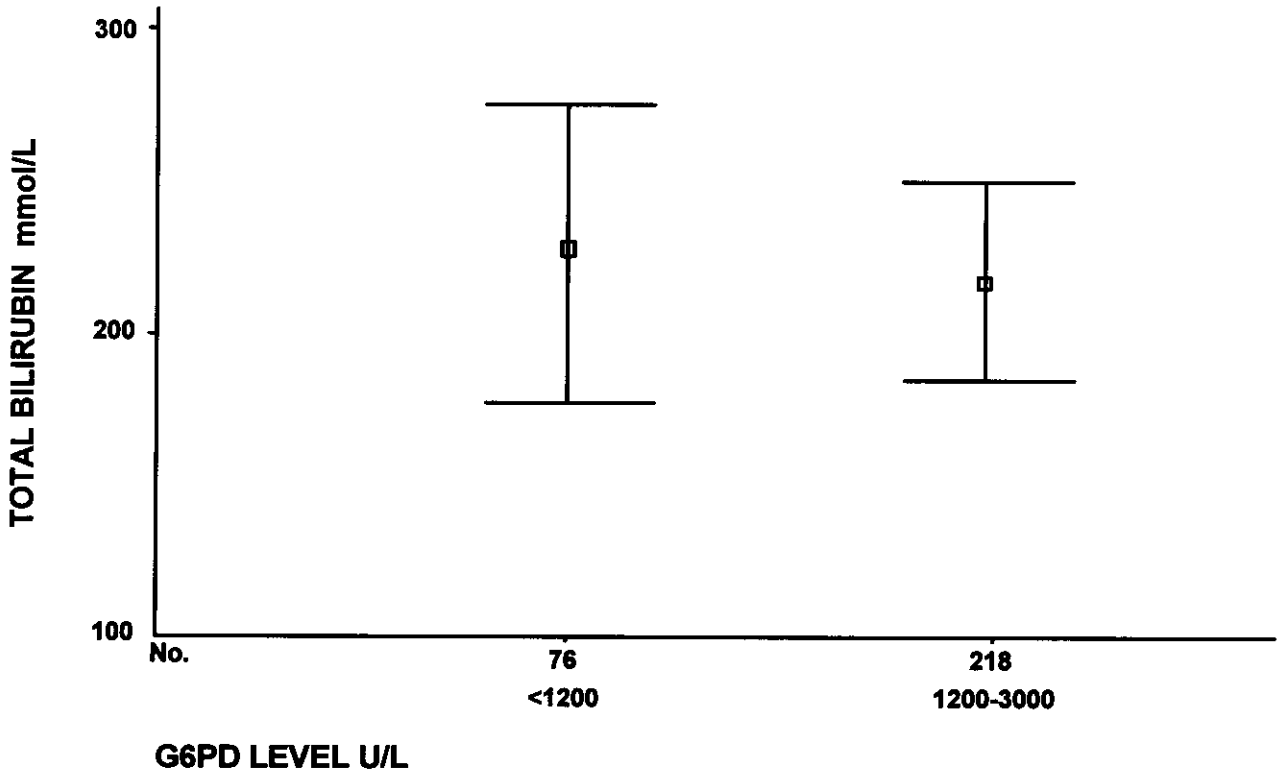

Table (12) Frequency of exchange transfusion among babies with neonatal hyperbilirubinaemia in the second group of our study

Transfusion	Number & Percentage of Cases	GROUP Second Group	Row Total
No Exchange	No	368	368
	%	97.9%	97.9%
Exchange Transfusion was done	No	8	8
	%	2.1%	2.1%
Total	No	376	376
	%	100.0%	100.0%

NB: Exchange Transfusion was indicated in 8 cases in the second group of our study because of severe hyperbilirubinaemia.
Those cases were fallen in the Red Zone (zone of obligatory exchange) in the infant jaundice Graph (see before).

Table (13) Exchange Transfusion in Relation to G6PD Level in the Second Group

Transfusion	Number & Percentage of Cases	G6PD Level <1200 u/L	G6PD Level 1200-3000 u/L	Row Total
No Exchange Transfusion	No	90	278	368
	%	97.8%	97.9%	97.9%
Exchange Transfusion was done	No	2	6	8
	%	2.2%	2.1%	2.1%
Total	No	92	284	376
	%	24.5%	75.5%	100.0%

Chi-Square	Value	DF	P Value
Pearson	6.21080	2	0.05481
Likelihood Ratio	5.66823	2	0.05877
Mantel-Haenszel test for linear association	5.44912	1	0.01958

Minimum Expected Frequency : 0.489
Cells with Expected Frequency : < 5 - 3 OF 6 (50.0%)
Number of missing observations: 0

Table (13) shows that the number of of Jaundiced neonates in the second group of our study with low G6PD level and they had recieved transfusion were 2. on the other hand the number of jaundiced neonates in the second group with normal enzyme level and they had recieved transfusion were 6.

NB: Those neonates were fallen in the red zone (Zone Of Obligatory Exchange) of the infant jaundice Graph .