HEALTHY PREMATURE INFANTS

GLUCAGON TOLERANCE TESTS

The blood glucose levels in the premature infants tend to be lower than those observed in the full-term normal infants for about two months after birth (Van Crevald, 1929; Norval, 1950; Ward, 1953; Baens, Lundeen and Cornblath, 1963). This level is dependent upon the content of liver glycogen stores and the integrity of the metabolic pathways involving liver glycogenolytic and gluconeogenetic processes. Change in the rate of glucose uptake (disappearance) may also play an important role in sustaining blood glucose level during the early neonatal period. With a view to evaluate the glycogen stores and hepatic output during the early neonatal period, glucagon tolerance tests were carried out on the first day (within two to three hours after birth) and on the eighth day of life in 15 healthy premature infants.

RESULTS:

The results of the mean concentrations of plasma glucose, inorganic phosphorus, potassium, urea and total amino acid nitrogen (TAN) before and after glucagon administration on the first and eighth days are presented in Table 11 and 12 respectively. The increases in plasma glucose concentrations after glucagon administration are given in Table 13. Fig. 4a shows the behaviour of the above mentioned parameters after glucagon administration. The net increases are presented in Fig. 5a.

First day:

The basal plasma glucose concentration in the premature infants is observed to be 43.9 ± 4.47 (mean ± S.E.) mg./100 ml. No appreciable difference is seen between this level and that obtained in the full-term normal infants.

After administration of glucagon, the maximum plasma glucose concentration of 97.6 ± 7.05 (mean ± S.E.) mg./100 ml. is attained at 90 minutes, with a net increase of 53.7 ± 5.83 (mean ± S.E.) mg./100 ml. This maximum increase although is higher, but not significantly more than that observed in the full-term normal infants.

Thereafter, the plasma glucose concentration is seen to decrease gradually and attains a level of 82.4 ± 10.36 (mean ± S.E.) mg./100 ml. at 150 minutes. A net increase of 38.5 ± 8.60 (mean ± S.E.) mg./100 ml. is observed over the basal level at the end of the glucagon tolerance test. This net increase though not significant, is higher than that observed in the full-term normal infants.

The basal plasma inorganic phosphorus concentration is found to be 5.42 ± 0.89 (mean ± S.D.) mg./100 ml. A significant fall of 0.84 mg./100 ml. is observed at 60 minutes after glucagon administration ($t = 2.55$; $.01 < P < .02$). A moderate rise is seen at 90 minutes, which is then followed by a little decrease upto 150 minutes. An early fall is evident in the premature infants at 60 minutes, while in the full-term normal infants it occurred at 150 minutes.

The basal plasma potassium level is found to be 5.50 ± 0.51 (mean ± S.D.) mEq/L. The maximum fall of 0.52 mEq/L. is seen at 90 minutes. The level then shows a gradual rising trend upto 150 minutes. Like plasma inorganic phosphorus, an early decrease is observed at 90 minutes in the premature infants, as compared to that in the full-term normal infants.

The basal plasma urea concentration is found to be 22.1 ± 6.07 (mean ± S.D.) mg./100 ml. The maximum level of 28.5 ± 8.12 (mean ± S.D.) mg./100 ml. is observed at 150 minutes, with a net significant difference of 6.40 mg./100 ml. ($t = 2.18$; $.02 < P < .05$).

The basal plasma TAN concentration of 6.04 ± 1.52 (mean ± S.D.) mg./100 ml. is observed. A significant fall of 1.95 mg./100 ml. is found at 60 minutes after glucagon administration ($t = 3.45$; $.001 < P < .01$). A slight increase is noticed at 90 minutes which is then followed by a negligible decrease during the rest of the tolerance period.

Eighth day:

The basal plasma glucose level of 52.3 ± 4.85 (mean ± S.E.) mg./100 ml. is seen on the eighth day of life. There is no significant difference between this basal level and that observed on the first day of life. However, this level is significantly lower than the basal level observed in the full-term normal infants on the eighth day of life ($t = 3.24$; $.001 < P < .01$).

Comparatively a rapid rise is observed in the plasma glucose concentration at 20 minutes after glucagon administration. A net rise of 22.7 ± 4.73 (mean ± S.E.) mg./100 ml. is observed, which is more than that seen on the first day of life (18.0 ± 3.39) mg./100 ml. These results indicate a quicker response to glucagon on the eighth day of life.

The maximum plasma glucose level of 84.3 ± 8.24 (mean ± S.E.) mg./100 ml. is seen at 40 minutes, with a net increase of 32.0 ± 7.70 (mean ± S.E.) mg./100 ml. The net increases are significantly lower at 60 minutes ($t = 2.30$; $.02 < P < .05$), at 90 minutes ($t = 3.20$ $.001 < P < .01$), at 120 minutes ($t = 3.78$; $.001 < P < .01$) and at 150 minutes ($t = 2.24$; $.02 < P < .05$) as compared to those observed on the first day of life in the healthy premature infants.

The plasma glucose level of 60.4 ± 4.06 (mean ± S.E.) mg./100 ml. is found at 150 minutes, with a net increase of 8.1 ± 5.27 (mean ± S.E.) mg./100 ml. over the initial basal level. Unlike the full-term normal infants, the level less than the basal is not observed in the premature infants.

The basal plasma inorganic phosphorus of 4.62 ± 0.68 (mean ± S.D.) mg./100 ml. is found on the eighth day of life. The level gradually decreases upto 60 minutes, which is then followed by a slight increase at 90 minutes. Maximum fall of 0.69 mg./100 ml. is seen at 120 minutes. A slight increase

is observed at 150 minutes.

The basal plasma potassium concentration of 4.15 ± 0.42 (mean ± S.D.) mEq/L. is found on the eighth day of life in the healthy premature infants. A significant fall of 0.55 mEq/L. is observed at 90 minutes ($t = 2.29$; $.02 < P < .05$). The level then shows a gradual upward trend during the rest of the tolerance period.

The basal plasma urea concentration of 20.8 ± 6.30 (mean ± S.D.) mg./100 ml. is observed on the eighth day of life. This level gradually increases during the entire period of glucagon tolerance test. A maximum increase of 5.50 mg./100 ml. is found at 150 minutes. This is more than that observed in the full-term normal infants.

The basal concentration of plasma TAN is found to be 4.97 ± 1.63 (mean ± S.D.) mg./100 ml. A maximum fall of 1.55 mg./100 ml. is observed at 60 minutes, which is similar to that observed on the first day of life. The level then shows an upward trend during the rest of the tolerance period.

Representative data from the literature as regards the changes in blood sugar concentrations after intravenous glucagon administration in the premature infants during the early neonatal period are summarised in Table 14.

Cornblath et al. (1958) studied the behaviour of blood sugar changes in the premature infants after glucagon (50 µg./kg., i.v.) administration during 1/3 to 30 hours after birth. They observed a maximum rise of 36 mg./100 ml. in the

blood sugar level at 45 minutes after glucagon administration. Slow rate of glucose disappearance is evident from their results. The net increase on the first day in the present series is comparatively more than that observed by the above authors. The maximum increase of 35 mg./100 ml. in the blood sugar concentration was observed by these authors at 30 minutes after glucagon administration to similar infants varying in age from five to 22 days. An improved rate of glucose disappearance at the later age period can be evaluated from the results of the above authors. The maximum net increase on the eighth day in the present series seems to be in agreement with that observed by Cornblath et al. (1958) during the later age period.

DISCUSSION:

The responses of the glucagon tolerance tests on the first day of life in the premature infants are similar to those of the full-term normal infants in respect to the basal level, the period of occurrence of maximum increase and the magnitude of the increase in plasma glucose concentration. It would be seen from these observations that the healthy premature infants possess sufficient carbohydrate reserves, which could be compared to those of the full-term normal infants on the first day of life.

On the eighth day basal plasma glucose concentration is significantly lower than that of the full-term normal group. Glucagon administration results in quicker but lower hyperglycaemic response which is indicative of poor glycogen stores.

Cornblath et al. (1963) in their study on carbohydrate metabolism in the premature infants showed an increased glucose output after glucagon administration during the later age period of eight to 27 days than that during the early age period between three to seven days, whereas, the results of the present series indicate a poor hyperglycaemic response on the eighth day as compared to that on the first day. It is probable that glycogen stores in the premature infants at birth may be adequate for a satisfactory hyperglycaemic response to glucagon on the first day of life. Subsequently, the infant has to depend on food and calorie intake for building up the glycogen stores in the body. It is likely that in the

premature infants calorie intake may be low in comparison to that of the full-term normal infants. The poor hyperglycaemic response to glucagon seen on the eighth day could be on account of a deficient replacement of the glycogen stores due to low calorie intake. Furthermore, adequate secretion of insulin is essential for a satisfactory glycogenesis to occur. An inadequacy of insulin secretion in the premature infants could also contribute towards the deficient glycogenesis which accounts for the poor replenishment of the glycogen stores.

TABLE 11.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS, POTASSIUM, UREA AND TOTAL AMINO ACID NITROGEN CONCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE FIRST DAY (within 2 to 3 hours) OF LIFE AFTER GLUCAGON (30 µg./kg., i.m.) ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucagon administration					
		20	40	60	90	120	150
Glucose (mg./100 ml.)							
Mean	43.9	61.9	80.3	92.9	97.6	93.3	82.4
S.E.±	4.47	5.45	6.51	7.13	7.05	10.05	10.36
Range	22-74	31-98	37-112	39-126	40-138	38-170	32-167
No.	15	15	15	15	15	15	14
Inorganic phosphorus (mg./100 ml.)							
Mean	5.42	5.12	4.72	4.58	4.82	4.72	4.65
S.D.±	0.89	0.97	0.88	0.73	0.80	0.77	1.04
Range	3.6-6.7	3.3-6.6	2.9-5.8	3.3-6.0	3.5-6.2	3.5-6.5	2.5-6.5
No.	12	12	12	12	12	12	12
Potassium (mEq/L.)							
Mean	5.50	5.23	5.02	4.99	4.98	5.00	5.19
S.D.±	0.51	0.66	0.74	0.74	0.74	0.66	0.79
Range	4.8-6.8	4.6-6.7	3.9-6.7	3.9-6.6	3.7-6.1	3.7-6.1	3.7-6.6
No.	12	12	12	12	12	12	12
Urea (mg./100 ml.)							
Mean	22.1	24.0	25.8	26.9	27.2	28.3	28.5
S.D.±	6.07	5.94	6.89	6.77	7.76	8.36	8.12
Range	14-36	15-37	16-42	16-42	16-43	15-45	16-45
No.	12	12	12	12	12	12	12
Total amino acid nitrogen (mg./100 ml.)							
Mean	6.04	4.92	4.28	4.09	4.67	4.62	4.56
S.D.±	1.52	1.19	1.22	1.22	1.88	1.53	1.09
Range	2.8-8.3	2.2-7.1	2.3-6.0	2.5-6.0	2.0-8.0	2.3-7.9	2.3-6.7
No.	12	12	12	12	12	12	12

TABLE 12.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS, POTASSIUM, UREA AND TOTAL AMINO ACID NITROGEN CONCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE EIGHTH DAY OF LIFE AFTER GLUCAGON (30 µg./kg., i.m.) ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucagon administration					
		20	40	60	90	120	150
Glucose (mg./100 ml.)							
Mean	52.3	75.0	84.3	81.6	73.7	64.6	60.4
S.E.±	4.85	6.02	8.24	7.25	7.44	5.81	4.06
Range	36-71	56-108	59-124	59-112	37-92	35-79	43-77
No.	7	7	7	7	7	7	7
Inorganic phosphorus (mg./100 ml.)							
Mean	4.62	4.23	4.05	3.99	4.08	3.93	4.08
S.D.±	0.68	0.69	0.62	0.79	0.72	0.75	0.56
Range	3.8-5.3	3.4-5.2	3.3-5.1	2.9-5.1	3.2-4.9	3.1-4.7	3.4-4.9
No.	6	6	6	6	6	6	6
Potassium (mEq/L.)							
Mean	4.15	3.92	3.82	3.90	3.60	3.65	3.99
S.D.±	0.42	0.45	0.35	0.68	0.40	0.49	0.28
Range	3.8-4.8	3.7-4.5	3.4-4.3	3.4-5.2	3.1-4.1	2.8-4.3	3.5-4.3
No.	6	6	6	6	6	6	6
Urea (mg./100 ml.)							
Mean	20.8	24.5	25.0	25.0	25.5	26.0	26.5
S.D.±	6.30	5.36	3.85	5.01	3.69	4.00	6.46
Range	12-29	19-33	19-31	18-30	21-30	21-31	16-33
No.	6	6	6	6	6	6	6
Total amino acid nitrogen (mg./100 ml.)							
Mean	4.97	3.50	3.50	3.42	3.70	3.47	3.70
S.D.±	1.63	1.83	1.38	1.76	1.61	1.22	1.73
Range	2.9-7.5	1.5-6.0	2.0-5.7	1.4-6.5	1.9-6.0	2.3-5.1	1.9-6.2
No.	6	6	6	6	6	6	6

TABLE 13.

INCREASE IN THE PLASMA GLUCOSE CONCENTRATIONS (mg./100 ml.) OF THE HEALTHY PREMATURE INFANTS ON THE FIRST (within 2 to 3 hours) AND EIGHTH DAY OF LIFE AFTER GLUCAGON (30 µg./kg., i.m.)ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucagon administration					
		20	40	60	90	120	150
First day (within 2 to 3 hours)							
Mean	43.9	18.0	36.4	49.0	53.7	49.4	38.5
S.E.±	4.47	3.39	4.76	4.90	5.83	6.27	8.60
Range	22-74	4-32	7-60	11-84	16-93	11-101	-5 to 99
No.	15	15	15	15	15	15	14
Eighth day							
Mean	52.3	22.7	32.0	29.3	21.4	12.3	8.1
S.E.±	4.85	4.73	7.70	7.01	7.78	5.72	5.27
Range	36-71	10-37	0-53	0-50	-7 to 47	-9 to 32	-5 to 32
No.	7	7	7	7	7	7	7

TABLE 14.

INCREASE IN THE BLOOD SUGAR CONCENTRATION (mg./100 ml.) AFTER GLUCAGON ADMINISTRATION IN THE PREMATURE INFANTS. (REPRESENTATIVE DATA FROM LITERATURE)

Author & (Year)	Infants	Age	Glucagon dose		Fasting level	Minutes after glucagon administration 30	45	60	90	120
Cornblath et al. (1958)	Premature	1/3-30 hours	50 µg./kg. i.v.	Mean	41	30	36	31	23	17
				S.E.±		3.4	3.7	2.7	3.1	2.3
				Range	23-66					
Method: Nelson-Somogyi.				No.						
	Premature	5-22 days	50 µg./kg. i.v.	Mean	55	35	30	23	7	-1
				S.E.±		2.8	4.7	3.2	1.8	1.7
				Range	48-64					
				No.						
Cornblath et al. (1961)	Premature, vaginal delivery. Labour-Yes, fluid to mother-glucose.	0-3 hours	300 µg./kg. i.v.	Mean	49	18	-	40	42	47
				S.E.±	4.7	2.2		3.4	12.5	7.7
				Range	27-73	10-31		20-53	27-92	14-89
Method: Nelson Somogyi.				No.				10		

FIGURE 4a.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS, POTASSIUM, UREA AND TOTAL AMINO ACID NITROGEN COCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE FIRST (▲----▲) AND EIGHTH (Δ----Δ) DAY OF LIFE AFTER GLUCAGON (30 µg./kg., i.m.) ADMINISTRATION.

FIGURE 4b.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS AND POTASSIUM CONCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE SECOND (▲----▲) AND EIGHTH (Δ----Δ) DAY OF LIFE AFTER GLUCOSE (2.5 G/kg., oral) ADMINISTRATION.

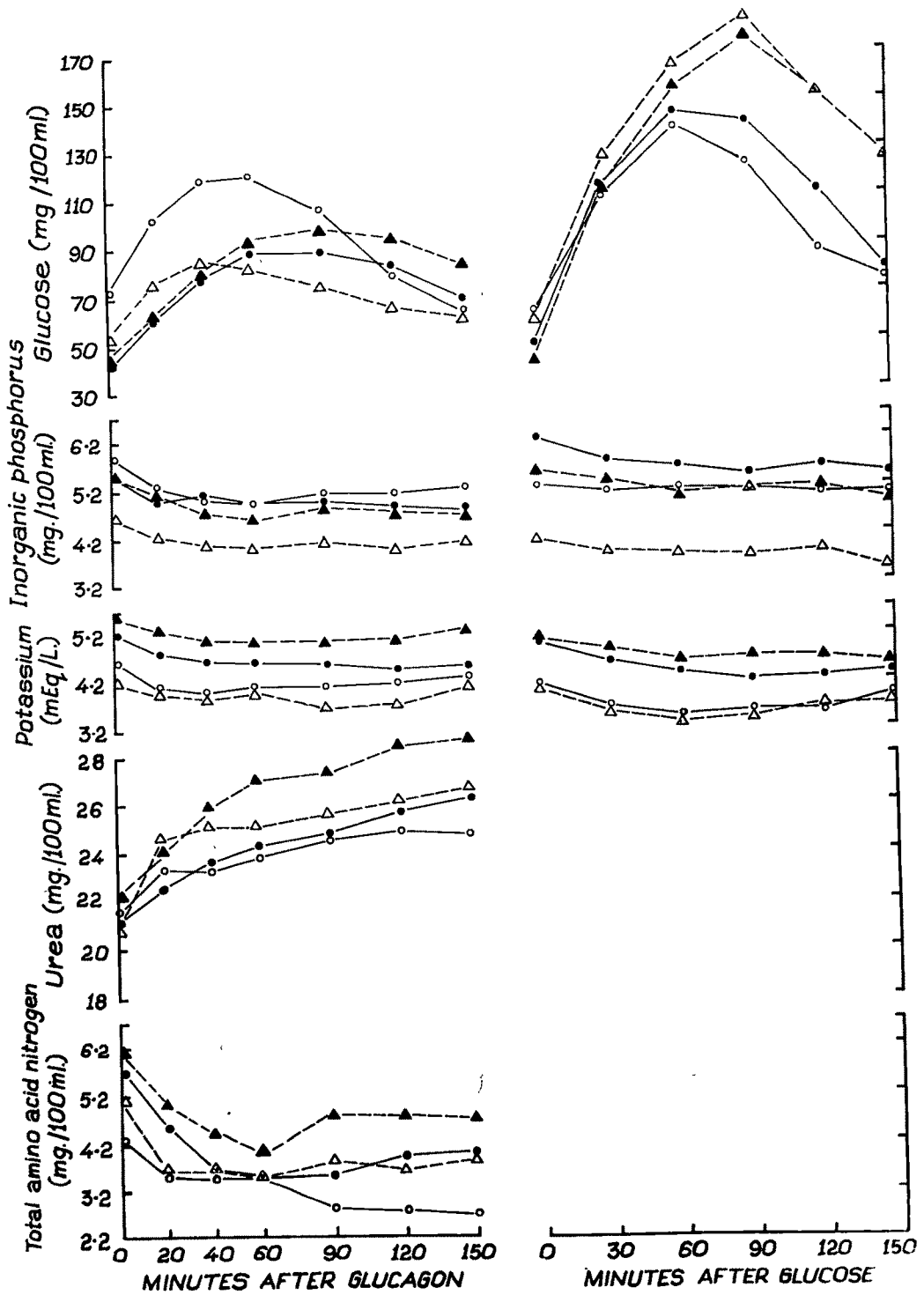
Glucose (mg /100ml)
170
150
130
110
90
70
50
30
Inorganic phosphorus (mg./100ml)
6·2
5·2
4·2
3·2
Potassium (mEq./L.)
5·2
4·2
3·2
Urea (mg./100ml)
28
26
24
22
20
18
Total amino acid nitrogen (mg./100ml)
6·2
5·2
4·2
3·2
2·2
0 20 40 60 90 120 150
MINUTES AFTER GLUCAGON
0 30 60 90 120 150
MINUTES AFTER GLUCOSE

Fig. 4a. 4b.

FIGURE 5a.

INCREASE IN PLASMA GLUCOSE CONCENTRATIONS (Δ mg./100 ml.) OF THE HEALTHY PREMATURE INFANTS ON THE FIRST (▲- - - -▲) AND EIGHTH (Δ- - - -Δ) DAY OF LIFE AFTER GLUCAGON (30 µg./kg., i.m.) ADMINISTRATION.

FIGURE 5b.

INCREASE IN PLASMA GLUCOSE CONCENTRATIONS (Δ mg./100 ml.) OF THE HEALTHY PREMATURE INFANTS ON THE SECOND (▲- - - -▲) AND EIGHTH (Δ- - - -Δ) DAY OF LIFE AFTER GLUCOSE (2.5 G/kg., oral) ADMINISTRATION.

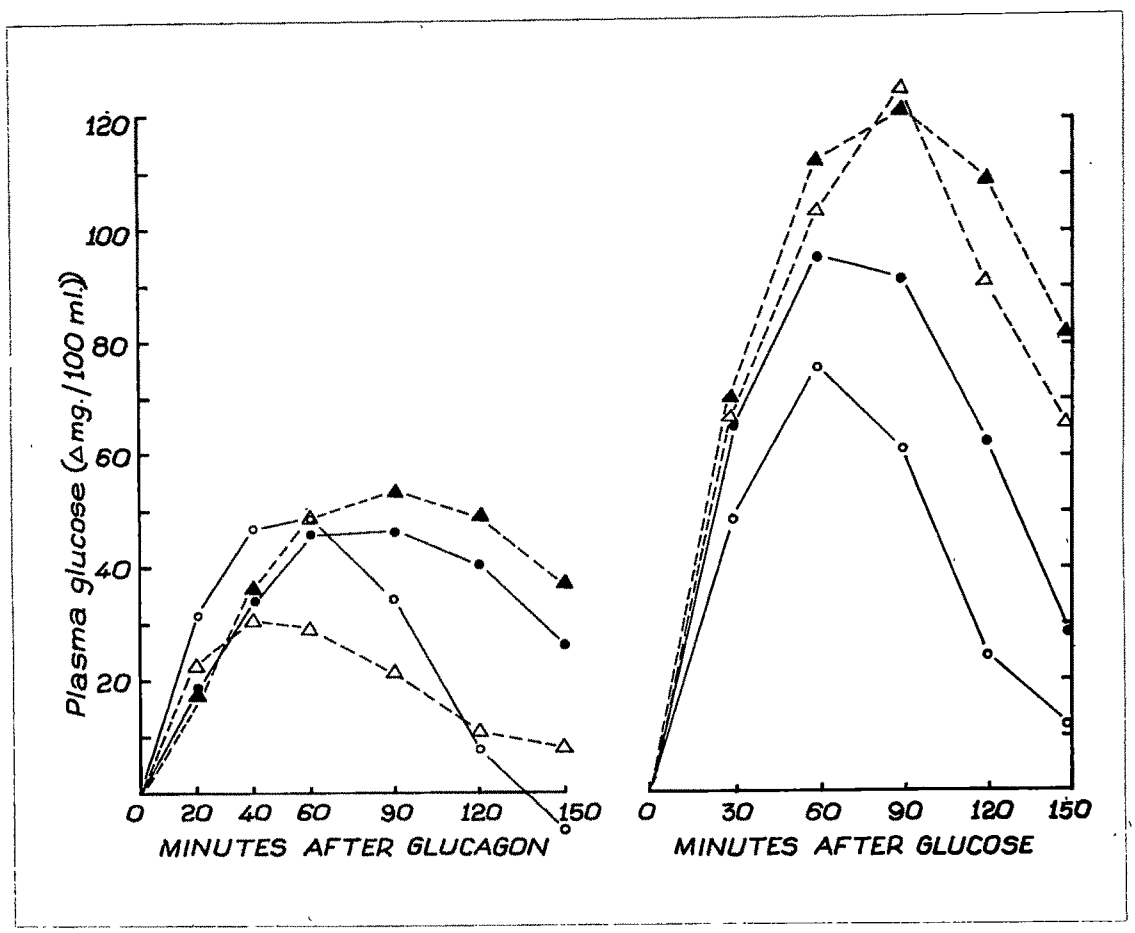
120
100
80
60
40
20
Plasma glucose (Δmg./100 ml.)
0 20 40 60 90 120 150
MINUTES AFTER GLUCAGON
0 30 60 90 120 150
MINUTES AFTER GLUCOSE

Fig. 5a. 5b.

GLUCOSE TOLERANCE TESTS

The rate of glucose disappearance particularly in the premature infants has been investigated by Cornblath et al. (1963) and by Gentz, Warrner, Persson and Cornblath (1969) after intravenous glucose load. However, the disappearance rate after a potent stimulus of an oral glucose load would be a better guide line in the assessment of the glucose uptake. This was investigated after oral glucose load in the premature infants on the second and eighth day of life in the present series.

RESULTS:

Results of the mean concentrations of plasma glucose, inorganic phosphorus and potassium before and after oral glucose administration on the second day and that on the eighth day after birth are shown in Table 15 and 16 respectively. The net increases in the plasma glucose concentrations after glucose administration are summarised in Table 17. Fig. 4b shows the behaviour of the above mentioned parameters after an oral glucose load in the premature infants. The net increases are represented in Fig. 5b.

Second day:

The basal plasma glucose concentration of 42.5 ± 2.50 (means ± S.E.) mg./100 ml. is observed on the second day of life. This level is less than that observed in the full-term normal infants at similar age period.

After glucose administration the maximum level of plasma glucose observed at 90 minutes is 164.1 ± 12.90 (mean ± S.E.) mg./100 ml. with a net rise of 121.6 ± 10.87 (mean ± S.E.) mg./100 ml. Net increases in the plasma glucose levels are significantly higher at 90 minutes ($t = 2.33$; $.02 < P < .05$), at 120 minutes ($t = 3.48$; $.001 < P < .01$) and at 150 minutes ($t = 3.62$; $.001 < P < .01$) than those observed in the full-term normal infants after oral glucose load at similar time intervals.

At 150 minutes a level of 124.5 ± 15.34 (mean ± S.E.) mg./100 ml. plasma glucose is seen with a net rise of 82.0 ± 13.39 (mean ± S.E.) mg./100 ml.

The plasma inorganic phosphorus concentration is found to be 5.52 ± 0.86 (mean ± S.D.) mg./100 ml. on the second day of life. The level gradually decreases upto 90 minutes. At 120 minutes slight increase is seen. However, the minimum level of 4.85 ± 0.95 (mean ± S.D.) mg./100 ml. is seen at 150 minutes after an oral glucose load, with a maximum fall of 0.67 mg./100 ml. This maximum fall is less than that observed in the full-term normal infants.

The plasma potassium level of 5.02 ± 1.26 (mean ± S.D.) mEq/L. is observed initially. The level then gradually decreases upto first 60 minutes. A slight rising trend is noted which is followed by a gradual fall. The maximum fall of 0.55 mEq/L. is observed at 150 minutes. Like serum inorganic phosphorus, the net decrease in plasma potassium

is less than that observed in the full-term normal infants.

Eighth day:

The basal plasma glucose concentration is found to be 60.4 ± 3.10 (mean ± S.E.) mg./100 ml. This level then increases upto 90 minutes and attains the maximum level of 182.7 ± 20.44 (mean ± S.E.) mg./100 ml. with a net increase of 121.6 ± 10.87 (mean ± S.E.) mg./100 ml. over the basal level. The net increases in plasma glucose concentrations are significantly higher at 90 minutes ($t = 3.86$; $.001 < P < .01$), at 120 minutes ($t = 3.45$; $.001 < P < .01$) and at 150 minutes ($t = 2.84$; $.01 < P < .02$) than those observed in the full-term normal infants on the eighth day of life. However, no significant differences are seen between the results of the net increases observed on the second day and the eighth day of life in this group.

At 150 minutes, the plasma glucose concentration is found to be 124.9 ± 24.37 (mean ± S.E.) mg./100 ml. with a net increase of 64.5 ± 23.50 (mean ± S.E.) mg./100 ml.

The basal plasma inorganic phosphorus level on the eighth day is found to be 4.08 ± 0.56 (mean ± S.D.) mg./100 ml. The level gradually decreases till 90 minutes. Intermitant increase is seen at 120 minutes, which is followed by a fall. The maximum decrease of 0.88 mg./100 ml. is observed at 150 minutes. This decrease is more than that observed in the full-term normal infants.

The basal plasma potassium level of 3.99 ± 0.28 (mean ± S.D.) mEq/L. is seen initially. Significant fall of 0.69 mEq/L. is observed at 60 minutes ($t = 4.93$; $P < .001$). The level then shows a gradual rise upto 150 minutes. The decrease is comparable to that seen in the full-term normal infants at similar age intervals.

Representative data as regards the changes in the blood sugar concentrations after oral glucose administration in the premature infants during the early neonatal period are not available in the literature. The same is also true for the behaviour of plasma inorganic phosphorus and potassium concentrations after an oral glucose load.

DISCUSSION:

The net increases in plasma glucose on the second and the eighth day at 30 minutes after glucose administration seen in the premature infants of the present series indicate the efficacy of the glucose absorption.

The maximum net increase is about 286 per cent of the initial level on the second day while it is about 202 per cent of the basal level on the eighth day. Thus the premature infants actually reflect the diabetic pattern of glucose tolerance on both second and eighth days of life.

The results of the present series indicate that the rate of glucose disappearance on the second day is much slower than that seen in the full-term normal infants at a similar age period.

The rate of glucose disappearance as seen from its behaviour in Fig. 5b on the eighth day seems to be slightly improved as compared to that on the second day in the premature infants. However, it is much slower than the rate of disappearance observed in the full-term normal infants on the eighth day. Similar findings were reported by Cornblath et.al. (1963) after intravenous glucose administration. These authors reported that the glucose disappearance rate is slower during the first three days as compared to that observed between three to seven days and more. They also observed the slower disappearance rate of glucose (net increase Ki) during three and seven days than that observed during the later age period

(more than seven days). Gentz et al. (1969) found lower rate of glucose disappearance (Kt) after i.v. glucose load in 'appropriate for gestational age infants' (AGA) for the first 24 hours and found no significant improvement during the subsequent three days of life. Thus it appears that the premature infant takes longer time for improvement in the rate of glucose disappearance than the normal infant during the neonatal period.

Grasso, Messina, Saporito and Reitano (1968) studied the response of insulin secretion to glucose and amino acid infusions in the premature infants. The authors have shown that there is no appreciable rise in the plasma insulin concentration after glucose infusion. However, the same infants showed a marked increase in plasma insulin after i.v. amino acid infusion. The blood glucose concentrations remained unchanged or progressively increased. They explained these changes on the basis that hyperglycaemia is not an adequate stimulus to pancreas for the release of insulin and that a higher blood glucose concentration is relatively insensitive to insulin secretion during the early neonatal period. In their opinion, insulin primarily acts as a growth hormone promoting the protein synthesis at this age. However, Cornblath et al. (1963) demonstrated that simultaneous intravenous administration of glucose (1 G/kg.) and insulin (0.25 U/kg.) resulted in an increased rate of glucose disappearance, suggesting that insulin is capable of regulating the blood

glucose concentration during the early neonatal period of life. Furthermore, these authors reported only slight hypoglycaemic trend after tolbutamide administration in the premature infants during the first three days of life, however, a fair hypoglycaemic response was observed in the older premature infants. Gentz et al. (1969) studied plasma insulin levels after i.v. glucose administration in the 'AGA' infants and found three different types of insulin responses in the peripheral plasma. These authors explained this variability of responses to insulin on the basis that, the insulin level in the peripheral plasma is not a true reflection of the pancreatic insulin secretion, but is a balance between its secretion and its alternations by some factors like liver degradation, blood flow, local inactivation etc.

High FFA levels have been reported in the AGA infants during the 24 to 48 hour age period. After an exogenous load of glucose the FFA and beta-hydroxybutyrate concentrations show a much smaller fall in the 'AGA' infants as compared to the moderate drop seen in the full-term normal infants (Gentz et al., 1969). The extent and duration of the decrease im the glucose tolerance are comparatively higher in the premature infants than in the normal full-term infants.

Im the light of the above discussion, it would be seen that insulin secretion per se is efficient in controlling the blood glucose concentration. Moreover, hyperglycaemia is not insensitive to insulin action during the early neonatal period.

Rather, it is possible that there is a deficient insulin release mechanism present during the early postnatal days, which is responsible for the significant higher net increases and poor glucose disappearance rates seen in the premature infants. Deficient insulin release mechanism is also supported by the behaviour of FFA and beta-hydroxybutyrate concentrations after intravenously administered glucose load as reported by Gentz et al. (1969).

In view of the variability in the peripheral plasma insulin levels and nonavailability of the pancreatic vein plasma insulin concentrations, the rate of glucose disappearance may be a better index of insulinogenic activity of the pancreas during the early postnatal days.

TABLE 15.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS AND POTASSIUM CONCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE SECOND DAY OF LIFE AFTER GLUCOSE (2.5 G/kg., oral) ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucose administration				
		30	60	90	120	150
Glucose (mg./100 ml.)						
Mean	42.5	112.7	155.0	164.1	152.4	124.5
S.E.±	2.50	8.30	11.47	12.90	10.96	15.34
Range	22-73	70-212	103-280	112-300	95-292	61-254
No.	15	15	15	14	14	14
Inorganic phosphorus (mg./100 ml.)						
Mean	5.52	5.31	5.08	5.01	5.12	4.85
S.D.±	0.86	0.93	0.91	0.83	0.85	0.95
Range	4.2-6.8	3.5-6.7	3.1-6.5	3.5-6.4	3.8-6.2	3.4-6.2
No.	12	12	12	11	11	11
Potassium (mEq/L.)						
Mean	5.02	4.82	4.58	4.64	4.62	4.47
S.D.±	1.26	0.74	0.67	0.70	0.65	0.62
Range	4.3-6.4	3.7-5.8	3.6-5.8	3.9-5.8	3.6-5.8	3.6-5.2
No.	12	12	12	11	11	11

TABLE 16.

PLASMA GLUCOSE, INORGANIC PHOSPHORUS AND POTASSIUM CONCENTRATIONS (MEAN) OF THE HEALTHY PREMATURE INFANTS ON THE EIGHTH DAY OF LIFE AFTER GLUCOSE (2.5 G/kg., oral) ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucose administration				
		30	60	90	120	150
Glucose (mg./100 ml.)						
Mean	60.4	127.3	164.0	182.7	151.1	124.9
S.E.±	3.10	3.14	17.61	20.44	24.52	24.37
Range	43-77	67-198	96-230	100-243	77-232	57-207
No.	7	7	7	7	7	7
Inorganic phosphorus (mg./100 ml.)						
Mean	4.08	3.85	3.79	3.72	3.82	3.20
S.D.±	0.56	0.66	0.50	0.63	0.55	0.85
Range	3.4-4.9	3.2-4.8	3.1-4.6	3.0-4.7	2.7-4.8	2.1-4.1
No.	6	6	6	6	6	6
Potassium (mEq/L.)						
Mean	3.99	3.53	3.30	3.37	3.57	3.67
S.D.±	0.28	0.22	0.17	0.26	0.26	0.40
Range	3.5-4.3	3.2-3.7	3.0-3.5	3.0-3.7	3.2-3.9	3.1-4.3
No.	6	6	6	6	6	6

TABLE 17.

INCREASE IN THE PLASMA GLUCOSE CONCENTRATIONS (mg./100 ml.) OF THE HEALTHY PREMATURE INFANTS ON THE SECOND AND EIGHTH DAY OF LIFE AFTER GLUCOSE (2.5 G/kg., oral) ADMINISTRATION. (PRESENT SERIES)

	Basal level	Minutes after glucose administration				
		30	60	90	120	150
Second day						
Mean	42.5	70.2	112.5	121.6	109.9	82.0
S.E.±	2.5	8.1	9.88	10.87	11.05	13.39
Range	22-73	7-139	40-207	56-227	62-219	23-181
No.	15	15	15	14	14	14
Eighth day						
Mean	60.4	66.9	103.6	122.3	90.7	64.5
S.E.±	3.10	14.4	16.18	18.28	22.67	23.50
Range	43-77	24-139	53-171	57-184	22-173	-3 to 148
No.	7	7	7	7	7	7