

PLASMA GLUCOSE CONCENTRATION DURING THE
EARLY NEONATAL PERIOD

The levels of blood sugar in the newborn infants have been extensively documented. The earliest report as cited by Cornblath and Schwartz (1966) drags us to 1911 and yet there is a sort of disagreement as to the normal range of blood sugar levels in the newborn infants. Although, there is a generalised agreement that the range is spread widely. Smith (1959) commented the insignificancy of the normal figure of blood sugar in the view of the wide variations during the early period of life. However, Cornblath and Schwartz (1966) expounded the considerations of several factors, like duration and nature of labour, medications during labour period, age of the infants in hours (particularly within first 48 hours) etc., which could be correlated to the reported value, to give due significance.

In the present study plasma glucose is determined in 23 full-term normal infants during the first seven days of life. Table 1 represents the mean plasma glucose concentration of full-term normal infants during the early period of life, while Fig.1 illustrates the behaviour of the mean plasma glucose level during this neonatal period.

The mean plasma glucose concentration during the first hour of life is found to be 54.8 ± 5.03 (mean \pm S.E.) mg./100 ml. The level shows a considerable fall during the

next six hours, more particularly at three hours after birth. After 24 hours the level shows a continuous rising trend upto sixth day of life, when a maximum level of 67.0 ± 2.21 (mean \pm S.E.) mg./100 ml. is observed. However, the level on the seventh day is in good agreement with that on the sixth day.

Representative data from the literature on the blood sugar/glucose concentration of the full-term normal infants during the early neonatal period are summarised in Table 2.

A comparative evaluation of this data as regards to blood sugar/glucose concentration is difficult in view of the variability in the methods of blood sugar determinations. Most of the workers carried out sugar determinations by methods other than glucose oxidase, which invariably incorporates other reducing substances along with glucose. Moreover, the 'plasma' glucose determination in this study may also contribute minor variations.

Ketteringham and Austin (1938) reported a significant fall of blood sugar level during the early neonatal period of life which showed a tendency to rise by the third day. Miller and Ross (1940) found low blood sugar values during the first 48 hours of life. McKittrick (1940) studied serial determinations of blood sugar levels at hourly intervals for the first 12 hours of life and reported lower values of blood sugar in the male infants. Norval, Kennedy and Berkson (1949)

studied the 'true' capillary blood sugar during the first six days of life and reported low blood sugar levels during the early neonatal period. Gradual increase in blood sugar level is evident from their observations. Creery and Parkinson (1953) studied the blood sugar level during the first 12 hours of life and found a similar trend. Farquhar (1954) had made an extensive study of the problem and has reported low blood sugar levels during the early neonatal period, followed by a gradual increase upto ninth day. Cornblath, Ganzon, Nicolopoulos, Baens, Hollander, Gordon and Gordon (1961) while carrying out glucagon tolerance tests during early neonatal period, reported decrease in blood sugar levels upto two hours after birth, followed by an increase at four hours. Lower values are observed in their results. Mulligan and Schwartz (1962) also reported low blood sugar level during the first eight hours. Von Euler, Larsson and Persson (1964) studied blood sugar levels for eight days following birth and found low levels of blood sugar during first four days and a subsequent rising trend upto eighth day. Acharya (1962) studied blood sugar levels of the normal full-term infants during the first 48 hours of life and found low blood sugar levels during this period. Cornblath and Reisner (1965) studied blood glucose levels by glucose oxidase method extending over a period of 27 days after birth. Their results showed lower concentrations during first few days, which

gradually increased upto about six days. Appreciable increase is not noticed after six days as compared to the levels obtained during the later period of life. Anagnostakis and Lardinois (1971) carried out blood glucose estimation by glucose oxidase method for eight days of life. Their results also showed lower blood glucose levels during first few days, which followed by a gradual increase on the subsequent days. The results of the present series corresponds well with those of Cornblath and Reisner (1965) particularly during fifth and sixth days and those of Anagnostakis and Lardinois (1971) for first five days of life.

Large variations in the blood sugar levels are seen from the results of the majority of the authors who used nonspecific methods of blood sugar estimation. However, the variations are somewhat narrower in the results of those authors who used specific enzyme technique for blood glucose determinations.

Most of the authors agree that the blood sugar concentrations in full-term normal infants reach levels within the range of the normal adult (60 to 90 mg./100 ml.) by four to 10 days of age (Norval et al., 1949; Farquhar, 1954; Cornblath and Reisner, 1965; Gerda Wolfsohn-Zondek, 1968). The results of the present series are in agreement with the pattern observed by the above authors.

TABLE 1.

PLASMA GLUCOSE CONCENTRATION (mg./100 ml.) OF FULL-TERM NORMAL INFANTS DURING EARLY NEONATAL PERIOD. (PRESENT SERIES)

Age	Mean	Range	S.E. _±	No. of determinations
0-1 hour	54.8	20-117	5.03	20
3 hours	45.1	20-70	2.30	23
6 hours	44.2	26-60	2.01	23
12 hours	53.4	35-71	1.90	23
24 hours	53.0	42-65	1.40	23
3rd day	57.2	35-76	2.75	22
4th day	60.0	28-84	3.36	21
5th day	65.6	50-80	2.31	19
6th day	67.0	51-82	2.21	16
7th day	66.6	52-83	2.58	16

TABLE 2.

BLOOD SUGAR CONCENTRATION (mg./100 ml.) OF FULL-TERM NORMAL INFANTS.
(REPRESENTATIVE DATA FROM LITERATURE)

Author & (Year)	Cord	DURING THE FIRST 24 HOURS AFTER BIRTH															
		Hours after birth															
		1	2	3	4	5	6	7	8	9	10	11	12	18	24		
Ketteringham and Austin (1938). Method: Folin-Malmors	Mean	103.6	-	-	-	-	66.8-	-	-	-	-	-	-	-	-	-	-
	S.D. _±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Range	-	-	-	-	59.9 - 79.1	-	-	-	-	-	-	-	-	-	-	-
	No.	47	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-
3 to 6 hours																	
McKittrick (1940). Method: Folin	<u>Male infants</u>																
	Mean	72	76	72	67	74	77	81	83	83	87	87	85	86	-	-	-
	S.D. _±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Range	-	45- 113	45- 102	45- 93	43- 109	53- 109	56- 111	54- 110	55- 109	66- 113	67- 109	59- 105	69- 109	-	-	-
	<u>Female infants</u>																
	No.	-	71	55	54	57	76	92	104	66	68	54	50	43	-	-	-
	Mean	92	82	77	73	78	79	79	81	85	86	85	85	89	-	-	-
	S.D. _±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Range	-	55- 160	59- 109	54- 99	52- 99	54- 111	43- 120	54- 105	67- 114	62- 110	65- 100	58- 118	63- 105	-	-	-
	No.	-	16	16	16	18	23	29	33	22	26	17	21	13	-	-	-

TABLE 2. (CONTINUED)

Author & (Year)	Cord	Hours after birth											
		1	2	3	4	5	6	7	8	9	10	11	12 18 2
Mulligan and Schwartz (1962). Method:Nelson Somogyi	Mean S.D. \pm Range No.	- - - -	- - - 2 to 4 hours	45.3 14.0 12.4 - 63.5 16	- - - 4 to 6 hours	43.3 13.0 11.6 - 69.0 32	45.4 10.1 25.1 - 61.6 10	- - - 6 to 8 hours	- - - -	- - - -	- - - -	- - - -	- - - -
Acharya(1962). Method:Natelson (modified Nelson-Somogyi)	Mean S.D. \pm Range No.	73.0 16.9 45- 96	62.64 20.1 31- 108	58.92 19.0 31- 93	63.78 10.1 39- 112	63.0 22.0 40- 97	- - - 14	59.57 22.0 35- 88	- - - 14	59.0 14.0 33- 88	- - - 14	65.14 26.6 42- 144	- 63.0 57.4 - 19.6 13. - 42- 29- 104 78
von Euler, Larsson and Persson (1964). Method:Hultman	Mean S.D. \pm Range No.	- - - -	58.6 - 41-92 11	- - - 1 to 4 hours	- - - -	- - - -	- - - -	74.1 - 46-115 20	- - - 6 to 24 hours	- - - -	- - - -	- - - -	- - - -
Keele, Kay, Brown and Nordquist (1966). Method:Somogyi Nelson	Mean S.D. \pm Range No.	76 16 - 20	57 13 - -	- - - -	65 - - -	- - - -	- - - -	55 15 - -	- - - -	- - - -	- - - -	- - - -	60 60 5 13 12 1

TABLE 2. (CONTINUED)

Author & (Year)	DURING THE EARLY DAYS AFTER BIRTH									
	Days of life									
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
Ketteringham et al. (1938). Method: Folin- Malmors	Mean	68.3	70.3	76.1	-	-	-	-	-	-
	S.D. \pm	-	-	-	-	-	-	-	-	-
	Range	46.6- 102.2	52.4- 102.9	57.1- 110.3	-	-	-	-	-	-
No.	45	41	42							
Miller & Ross (1940). Method: Folin- Malmors	Mean	49.9	-	-	-	-	-	-	-	-
	S.D. \pm	12.5	-	-	-	-	-	-	-	-
	Range	-	-	-	-	-	-	-	-	-
No.	17									
During first 48 hours.										
Norval et al. (1949). Method: Modified Somogyi	Mean	54.8	57.5	62	68	67	-	-	-	-
	S.D. \pm	14.4	12.0	-	-	-	-	-	-	-
	Range	-	-	-	-	-	-	-	-	-
No.	102	102	102	-	-	-	-	-	-	-
Farguhar (1954). Method: Ramsay	Mean	65.6	64.8	69.1	73.3	74.3	77.5	78.7	82.7	81.3
	S.D. \pm	12.0	11.02	10.86	11.49	10.20	10.04	13.34	12.26	9.37
	Range	42.75- 102	45.5- 90.75	42.0- 89.75	49.25- 95.5	51.25- 94.25	55.0- 104.75	59- 114.25	60.75- 111.0	60.75- 98.0
No.	-	32	32	32	32	32	31	31	30	28

TABLE 2. (CONTINUED)

Author & (Year)	Days of life										
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	
Acharya (1962). Method: Natelson	Mean S.D. \pm Range No.	56.5 16.9 30-91 14	59.13 13.5 40-90 14	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	
		At 36 hour At 48 hour									
von Euler et al. (1964). Method: Hulthman	Mean S.D. \pm Range No.	60.8 - 49-95 10	57.6 - 37-75 11	66.4 - 46-82 15	81.3 - 59-97 12	81.0 - 59-101 10	82.8 - 60-103 9	- - - -	- - - -	- - - -	
		1-2 day 2-3 day 3-4 day 4-5 day 5-6 day 6-8 day									
Cornblath & Reisner (1965). Method: Glucose oxidase	Mean S.E. \pm Range No.	57 1.8 21-85	57 2.9 46-77	70 3.4 49-88	69 2.3 58-81	68 4.7 36-90	70 2.9 55-82	- - -	71.0 3.3 58-88	69 4.5 46-104	72 2.2 62-82
	 10 to 35									
		7-13 days 14-20 days 21-27 days									
Anagnostakis & Iardinois (1971). Method: Glucose oxidase	Mean S.D. \pm Range No.	49.2 8.1 -	54.4 8.8 -	56.1 9.6 -	60.0 10.8 -	63.4 11.8 -	62.2 10.7 -	70.0 13.0 -	73.2 8.5 -	- - -	- - -
	 5									

FIGURE 1

PLASMA GLUCOSE CONCENTRATION (mg./100 ml.) OF
FULL-TERM NORMAL INFANTS DURING THE EARLY NEONATAL PERIOD.

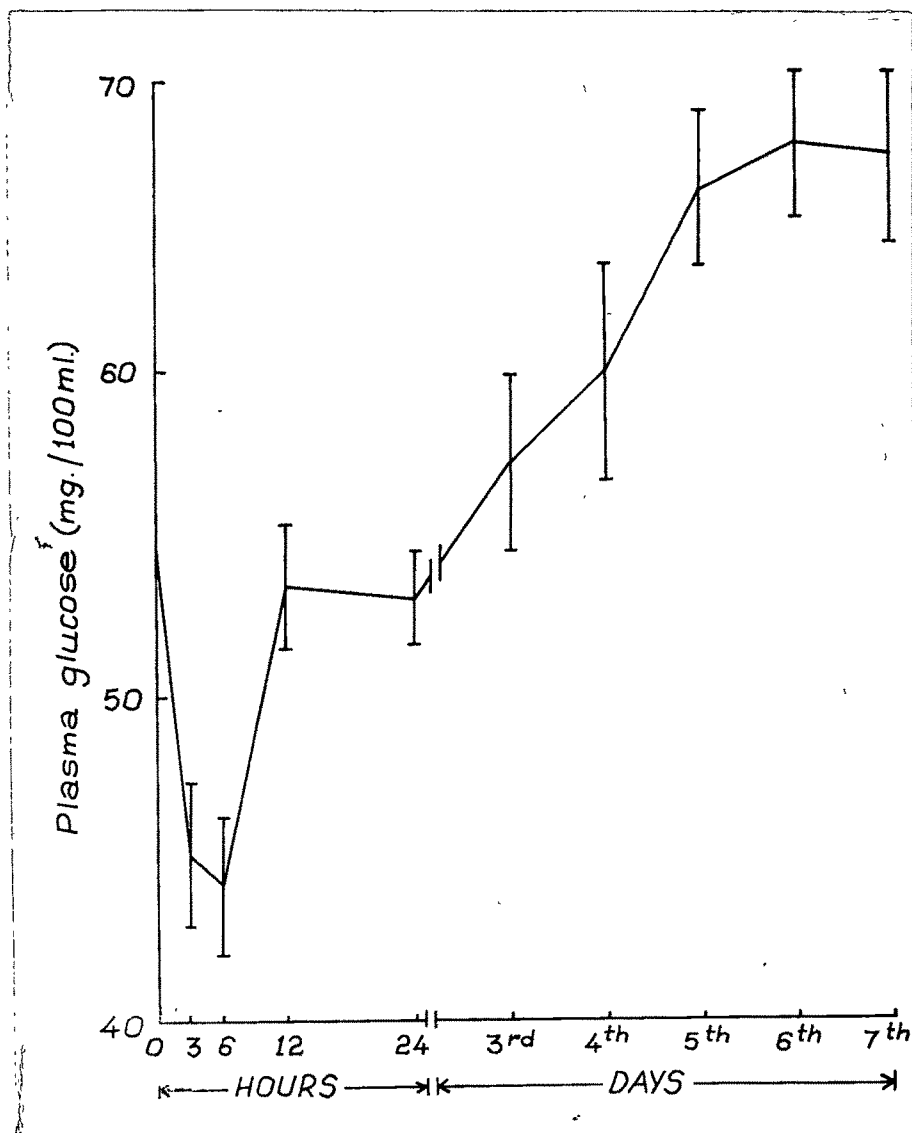


Fig. 1