

## GROWTH AND DEVELOPMENT STUDIES MEHARAN

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### Introduction:

Anthropometric data is one method of assessing the nutritional status of a community, but there is a paucity of physical growth data on infants and children in Bangladesh. Since over 80% of the people in Bangladesh are rural, we have commenced this study in a rural area where the date of birth of all children are known and the people are cooperative. In addition to collecting anthropometric measurements we intend to see if gastrointestinal or other illnesses during infancy have significant influence on the growth of children.

### Materials and Methods:

The study has been under taken in the village of Meharan, a low income area consisting primarily of fishermen, cultivators and small businessmen. This village is located on the bank of a canal far away from any urban area. This village has been under the surveillance of CRL since 1966. According to the census conducted by CRL in 1974, 1934 people reside in the village. Almost all newborns have been included in the study. In addition, we have added some other children whose dates of birth are known. There are over 300 children in our study now. A central clinic has been established in the village where the infants are brought for anthropometric measurements. A trained field worker and two locally trained dais reside in the village. Every expectant mother is followed-up and measurements of the newborns and estimation of the hemoglobin of both the mother and child are made within 1-5 days of birth. The socio-economic data for the family is available from the 1974 census. The history of illness, diet and dentition are recorded during regular clinic visits and also during unscheduled visits to the free clinic for medical care. During the first year measurements are made monthly and thereafter every 3-months. All measurements are made by the same set of instruments and by the same person. Medicines are supplied for minor illness. Children are referred to the CRL field hospital at Matlab for major diarrheal illness. Hemoglobin is estimated by using the Shallie Holden Hemoglobino-meter. The clinic is visited by a physician weekly for supervision and consultation and follow-up among the sick children.

### Results:

Table 1 shows 10, 50 and 90th percentile weight and height of boys and girls from birth through 1 year of age. The gain in weight at 50th

percentile level of boys for the 1st, 2nd, 3rd and 4th quarters are 84%, 22%, 9% and 7% respectively. The quarterly increase in height at 50th percentile level for boys are 21%, 10%, 5% and 5%. These increases for the girls are almost the same.

The continuation of Table 1 shows that the 50th percentile annual gain in weight of boys from 1st year to 5th year. These are 27%, 20%, 16% and 12% respectively. For girls the increase in weight are 19%, 22%, 16% and 14% respectively. The annual increase in heights of boys are 12%, 9%, 7% and 8% annually. The increase in heights of girls are 10%, 8%, 8% and 7% from the 1st year to the 5th year of age.

Table 2 shows the circumferences of head and chest. The 50 percentile quarterly increase in the circumference of head of children are 14%, 7%, 3% and 3%. The quarterly increase in the 50th percentile circumferences of chest of children are 22%, 5%, 3% and 3% respectively. The continuation of Table number 2 shows slow rate of growth from 1 year to 5 years of age.

Table 3 and its continuations show the mean weight, range, 10th, 50th and 90th percentile weight for height of Meharan children. It shows that the 90th percentile weight of Meharan children are approximately equal to the Harvard standard in the beginning though from the height of 65 c.m. the Harvard standard weight is higher than the Meharan 90th percentile weight.

Figure 1 shows that gain in weight of boys slows down after 6 months of age. The gain in Harvard children--continues and the gap with Meharan children widens up. Figure 2 shows similar trend in case of girls also.

Figure 3 shows the lagging of the increase in heights for boys from the age 6 months. But the difference in height with Harvard boys are less apparent than with that of weight. The Figure 4 shows the same trend in the height of girls. The difference between Meharan and Harvard girls is more apparent than that of boys.

The figure 5 shows the weight for age, sexes combined. The plateauing of growth curve and differences with Boston are quite remarkable. The next figure (6) shows the height for age of Meharan children, sexes combined. The flattening and widening up of the gap with Boston becomes apparent from the age of 12 months.

Figure 7 shows that the circumference of head of Meharan children increase almost parallel with Boston children. The circumferences of chest (shows by Figure 8) lags behind that of Boston from the 6th months of age.

Figure 9 shows the weight of children of lowest and comparatively better (social) groups of families. The upper two curves are the 90th percentile and lower two are 10th percentile weights. It is seen that after the age of 3 years the weights of better group are comparatively higher than the children of lowest income group. But these are not uniform and may not be significant. Figure 10 shows the same trends in heights.

Figure 11 gives the pattern of weight of children suffering from 0-1 and over 2 episodes of diarrhea quarterly. There is no clear association between the number of diarrheal episodes and the weights. Figure 12 also shows no relation between heights and episodes of diarrhea.

Figure 13 shows the monthly incidence of all illness and the gain in weight. Though the weight decreases in the group having higher number of illness monthly in the beginning it quickly regains the loss. No clear pattern can be seen in the figure. In the case of height (figure 14) also no characteristic can be seen.

#### Discussion:

This group is probably representative of the poorer class of rural Bengali children. However, the interest in the relationship between morbidity and growth in Bangladesh is focused largely in this socio-economic stratum and these data are intended to represent the outcome of the interrelationships between childhood illness and growth.

The growth patterns alone are interesting. The incremental growth of the median for both males and females are equal in the first year of life. Percentage weight gain by quarter are 84%, 22%, 9%, and 7% for both sexes. For height the percentage growth by quarter are 20%, 10%, 5% and 5% for both sexes. The quarterly weight and height gain for the 50th percentile of Boston children, are 68%, 33%, 20%, and 11% for weight and 20%, 10%, 7% and 6% for height. The difference is apparent on the widening gap between the Meharan and Boston growth curves. However, the percentage gain in weight and height is very similar among Meharan and Boston boys and girls from the second through the fifth years. Boston children weigh almost 1 kilogram more than Meharan children at birth. By the end of the 5th year they are about 6 kilograms heavier. Boston children are 4 centimeters longer at birth and are 14 centimeters taller by the fifth year.

These data have not been fully analyzed to determine the relationship between clinic visits, dietary history and diarrheal episodes and growth. An analysis of the data done earlier confirms what we expected to find -- that children receiving supplements are heavier -- but we could not detect weaning diarrhea or pin point a causal relationship between visits to the clinic for diarrhea or other illness and nutritional status a vice versa. We feel more objective clinical observations must be incorporated into the study to generate data which can answer these questions.

TABLE I

## GROWTH AND DEVELOPMENT STUDIES, MEHARAN

## MEASUREMENT OF BOYS FROM BIRTH TO 1 YEAR

	Percentile	Birth	3M	6M	9M	12M
Weight Kg.	10	2.20	3.85	4.60	5.15	5.52
	50	2.55	4.70	5.72	6.25	6.70
	90	2.90	5.50	6.82	7.50	8.20
Height Cm.	10	44.20	54.40	59.40	62.8	65.60
	50	47.30	57.40	63.30	66.2	69.50
	90	49.50	60.20	65.50	69.0	72.40

## MEASUREMENT OF GIRLS FROM BIRTH TO 1 YEAR

	Percentile	Birth	3M	6M	9M	12M
Weight Kg.	10	2.00	3.95	4.80	5.30	5.55
	50	2.42	4.47	5.57	6.05	6.50
	90	3.12	5.10	6.40	7.12	7.80
Height Cm.	10	44.40	54.00	58.10	62.30	63.50
	50	46.00	55.50	60.80	64.00	67.40
	90	49.10	58.60	64.10	67.70	71.40

TABLE I (Contd.)

## GROWTH AND DEVELOPMENT STUDIES, MEHARAN

## MEASUREMENT OF BOYS FROM 1 YR. 3 MO. TO 5 YRS.

Measure- ment	Percen- tile	12M	1-3	1-6	1-9	2-0	2-3	2-6	2-9	3-0
Weight Kg.	10	5.5	6.1	6.6	6.8	7.1	7.5	8.0	8.1	8.6
	50	6.7	7.4	7.9	8.2	8.5	9.3	9.6	9.8	10.2
	90	8.2	8.7	9.1	9.4	10.1	10.5	11.0	11.5	11.7
Height Cm.	10	65.6	66.3	70.0	71.2	71.7	72.0	76.3	78.4	78.8
	50	69.5	70.8	72.6	75.4	77.7	79.5	82.0	83.2	85.0
	90	72.4	75.3	78.3	79.6	82.0	84.2	87.0	88.6	90.3

## MEASUREMENT OF GIRLS FROM 1 YR. 3 MO. TO 5 YRS.

Weight Kg.	10	5.5	5.8	5.8	6.4	6.3	6.7	7.1	7.5	7.8
	50	6.5	6.9	7.2	7.7	7.7	8.2	8.5	8.7	9.4
	90	7.8	7.9	8.4	9.2	9.1	9.8	9.9	10.4	10.6
Height Cm.	10	63.5	65.3	67.0	69.8	68.6	70.8	72.0	72.4	75.8
	50	67.4	69.4	70.7	72.8	74.2	75.2	77.2	78.7	80.4
	90	71.4	73.0	73.7	77.4	78.5	81.3	83.0	85.2	85.2

TABLE I (Contd.)

## GROWTH AND DEVELOPMENT STUDIES, MEHARAN

## MEASUREMENT OF BOYS FROM 3 YRS. TO 5 YEARS

Measure- ment	Percen- tile	3-0	3-3	3-6	3-9	4-0	4-3	4-6	4-9	5-0
Weight Kg.	10	8.6	8.4	8.8	8.9	9.9	10.2	10.1	10.8	10.9
	50	10.2	10.4	10.7	11.5	11.8	12.1	12.4	13.4	13.2
	90	11.7	12.0	12.7	12.8	13.5	14.0	14.7	15.5	15.6
Height Cm.	10	78.8	81.2	81.2	81.8	85.6	86.8	88.2	87.6	88.1
	50	85.0	86.2	88.2	89.2	90.8	91.6	95.1	96.5	98.4
	90	90.3	91.4	92.8	94.3	94.8	95.9	99.1	101.6	104.3

## MEASUREMENT OF GIRLS FROM 3 YRS. TO 5 YEARS

Weight Kg.	10	7.8	8.0	8.5	8.5	8.7	8.7	9.3	10.1	10.0
	50	9.4	9.5	9.7	10.0	10.9	11.1	11.3	11.7	12.4
	90	10.6	11.2	11.4	11.9	12.4	12.4	13.0	14.0	14.2
Height Cm.	10	75.8	76.4	77.3	78.6	81.0	81.1	82.2	82.5	87.5
	50	80.4	82.4	84.6	85.7	86.6	89.4	90.5	91.9	93.0
	90	85.2	87.4	89.3	90.6	92.1	94.3	96.1	97.6	100.2

TABLE II

GROWTH AND DEVELOPMENT STUDIES, MEHARAN  
MEASUREMENT OF HEAD AND CHEST, SEXES COMBINED

Measurement	Percentile	Birth	3M	6M	9M	12M
Head Cm.	10	31,5	36,4	39,0	40,3	41,2
	50	33,5	38,3	40,8	42,1	43,2
	90	35,0	40,4	42,7	44,0	45,2
Chest Cm.	10	27,8	33,4	35,5	37,2	38,5
	50	30,3	37,0	39,0	40,2	41,3
	90	32,3	39,2	42,2	42,8	44,3

TABLE II (Contd.)

GROWTH AND DEVELOPMENT STUDIES, MEHARAN  
MEASUREMENT OF HEAD AND CHEST, SEXES COMBINED

Measurement	Percentile	Age															
		1-3	1-6	1-9	2-0	2-3	2-6	2-9	3-0	3-3	3-6	3-9	4-0	4-3	4-6	4-9	5-0
Head Cm.	10	42.0	42.3	43.0	43.2	43.5	43.5	44.0	44.4	44.2	44.4	44.3	44.5	44.6	45.0	45.3	45.6
	50	44.0	44.7	45.0	45.2	45.6	45.7	46.0	46.2	46.5	46.5	46.3	46.5	47.0	47.2	47.5	47.5
	90	46.0	46.6	47.0	47.2	47.5	48.0	48.0	48.0	48.5	48.6	48.5	48.8	49.2	49.4	50.0	49.5
Chest Cm.	10	39.5	40.3	41.0	41.5	42.5	43.0	43.6	44.0	43.8	44.5	44.8	45.6	46.3	46.4	47.2	48.0
	50	42.3	43.2	44.0	44.5	45.5	45.3	46.2	46.5	46.4	47.5	48.1	48.9	49.4	49.5	50.0	50.9
	90	45.0	46.0	46.6	47.5	48.4	49.0	49.7	50.2	51.0	51.5	52.0	51.6	52.0	52.3	53.2	53.7



TABLE III

GROWTH AND DEVELOPMENT STUDY  
WEIGHT AS COMPARED TO HEIGHTS, SEXES COMBINED

Height Cm.	46	48	50	52	54	56	58	60	62	64	66	68	70	72
Mean Wt. Kg.	2.4	2.8	3.3	3.5	4.0	4.5	4.9	5.3	5.7	6.0	6.5	6.8	7.3	7.7
Range of Weight	2.0	2.0	2.5	2.4	3.1	3.5	3.7	4.2	3.4	3.4	5.5	5.6	6.2	6.1
No. of Observation	18	26	32	30	46	61	62	66	87	103	89	68	78	59
10 th Percentile	2.0	2.3	2.8	2.6	3.3	3.9	4.2	4.4	4.9	5.4	5.7	6.0	6.5	6.7
50 th Percentile	2.4	2.7	3.2	3.6	4.0	4.6	5.0	5.4	5.7	6.1	6.4	6.8	7.3	7.7
90 th Percentile	2.7	3.2	3.8	4.0	4.7	5.1	5.6	6.1	6.5	6.8	7.1	7.6	8.0	8.4
Harvard Standard	-	-	-	3.8	4.3	4.8	5.2	5.7	6.3	6.9	7.5	8.1	8.7	9.2

TABLE III (Contd.)

GROWTH AND DEVELOPMENT STUDY  
WEIGHT AS COMPARED TO HEIGHTS, SEXES COMBINED

Height Cm.	74	76	78	80	82	84	86	88	90	92	94	96	98	100
Mean Wt. Kg.	7.9	8.2	8.6	9.3	9.6	10.0	10.6	10.9	11.6	11.9	12.5	13.0	13.2	13.4
Range of Weight	6.8 9.1	6.8 9.7	7.4 9.9	8.2 11.1	8.1 12.2	8.1 11.9	8.7 13.0	8.8 12.6	9.3 13.1	10.2 13.5	10.9 14.8	10.6 14.9	12.1 15.4	12.4 15.5
No. of Observation	56	45	46	57	52	48	51	50	34	41	36	34	21	22
10 th Percentile	7.2	7.6	7.8	8.3	8.5	8.7	9.2	9.6	10.7	10.8	11.4	12.0	12.4	12.4
50 th Percentile	7.9	8.2	8.5	9.2	9.4	10.0	10.6	11.1	11.7	12.0	12.5	13.0	13.0	13.2
90 th Percentile	8.7	9.1	9.5	10.5	10.6	11.2	11.7	12.1	12.5	12.9	13.6	14.5	14.4	14.6
Harvard Standard	9.7	10.2	10.6	11.0	11.4	11.8	12.2	12.6	13.1	13.6	14.0	14.5	15.0	15.6

FIGURE 1

GROWTH AND DEVELOPMENT STUDY  
WEIGHT OF MEHARAN BOYS

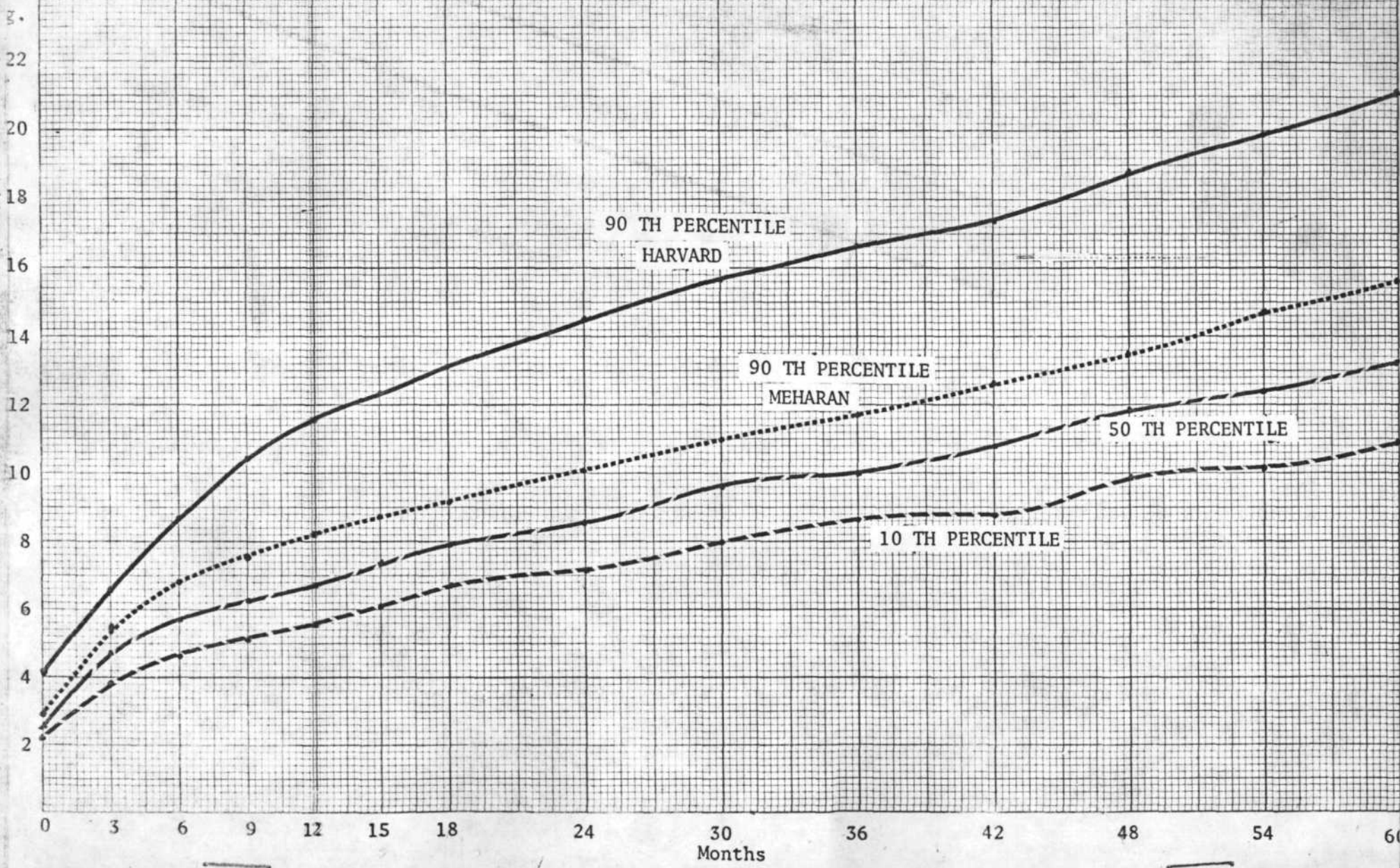


FIGURE 2

GROWTH AND DEVELOPMENT STUDY  
WEIGHT OF MEHARAN GIRLS

Kg.

22

20

18

16

14

12

10

8

6

4

2

0

3

6

9

12

15

18

24

30

36

42

48

54

60

Months

90 TH PERCENTILE HARVARD

90 TH PERCENTILE MEHARAN

50 TH PERCENTILE

10 TH PERCENTILE

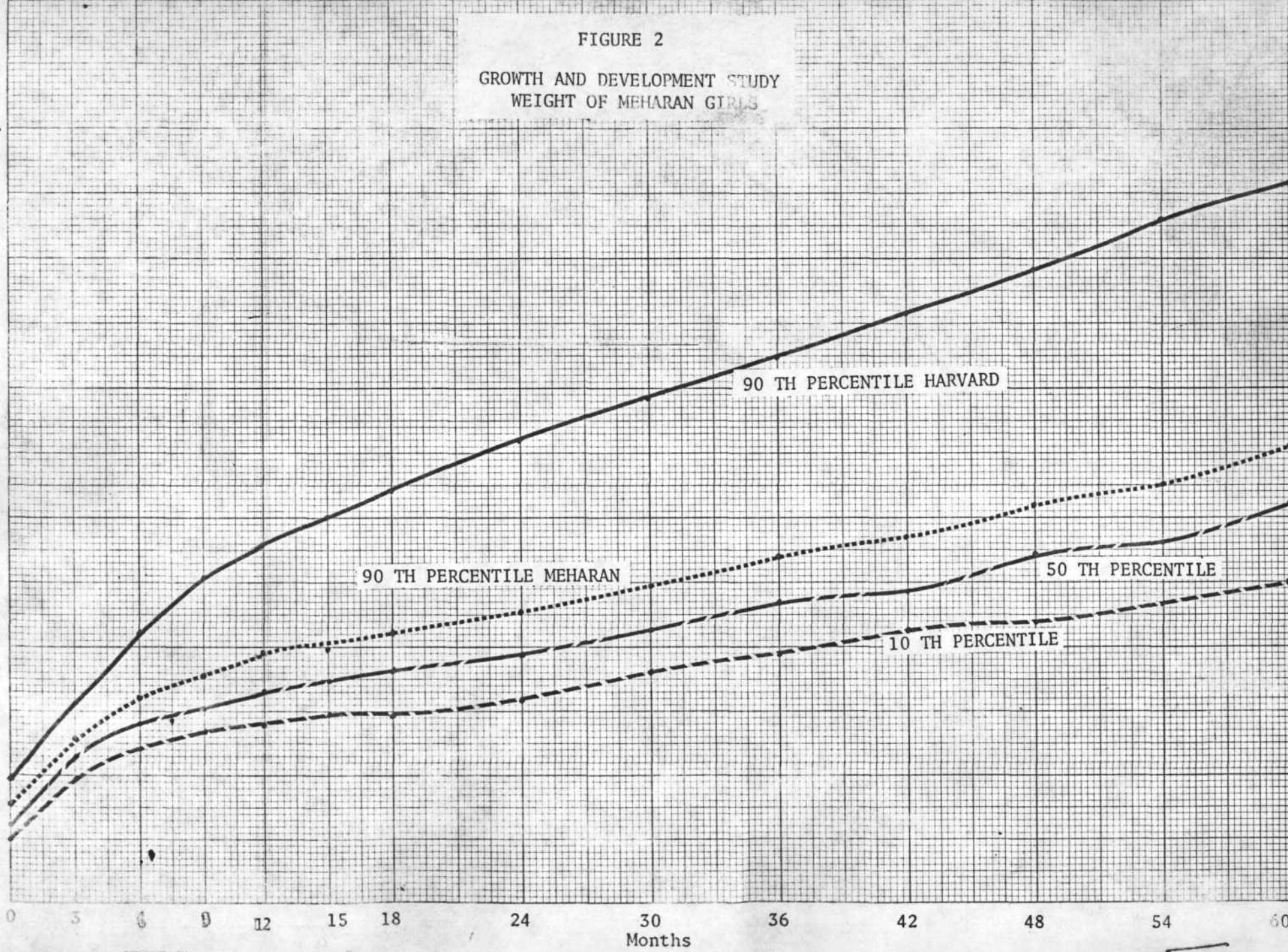


FIGURE 3  
GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF MEHARAN BOYS

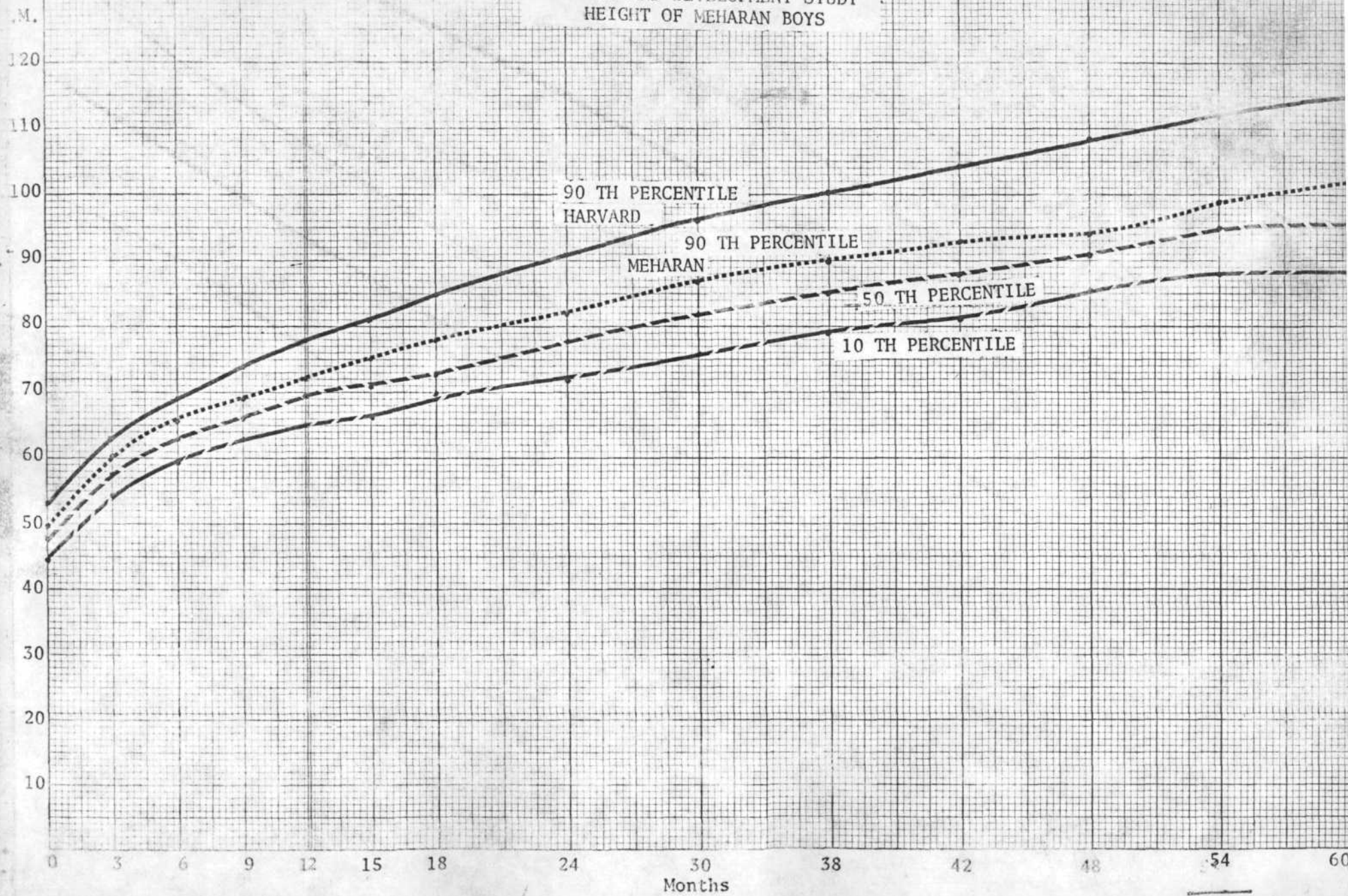


FIGURE 4  
GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF MEHARAN GIRLS

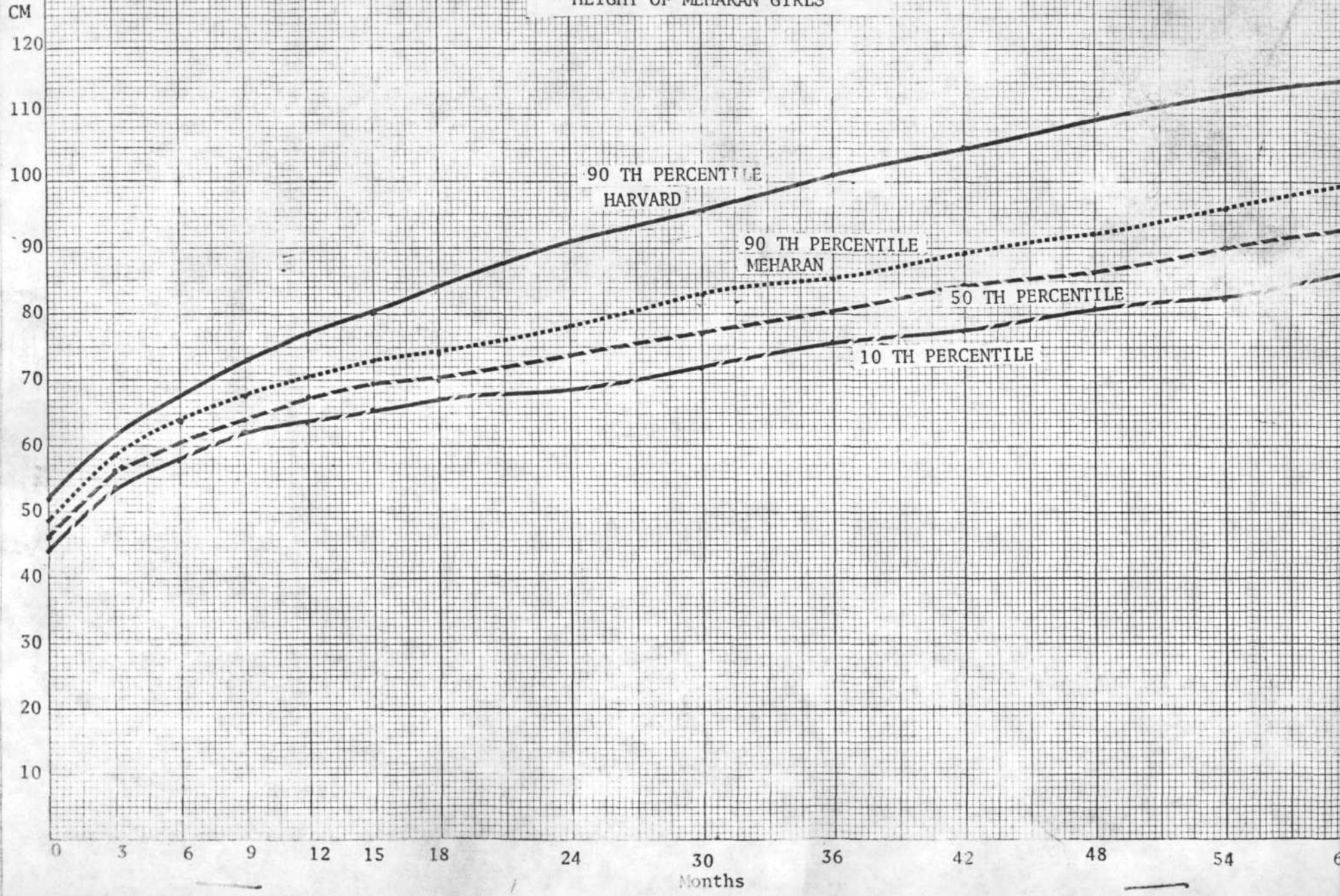


FIGURE 5

GROWTH AND DEVELOPMENT STUDY  
WEIGHT FOR AGE, SEXES COMBINED

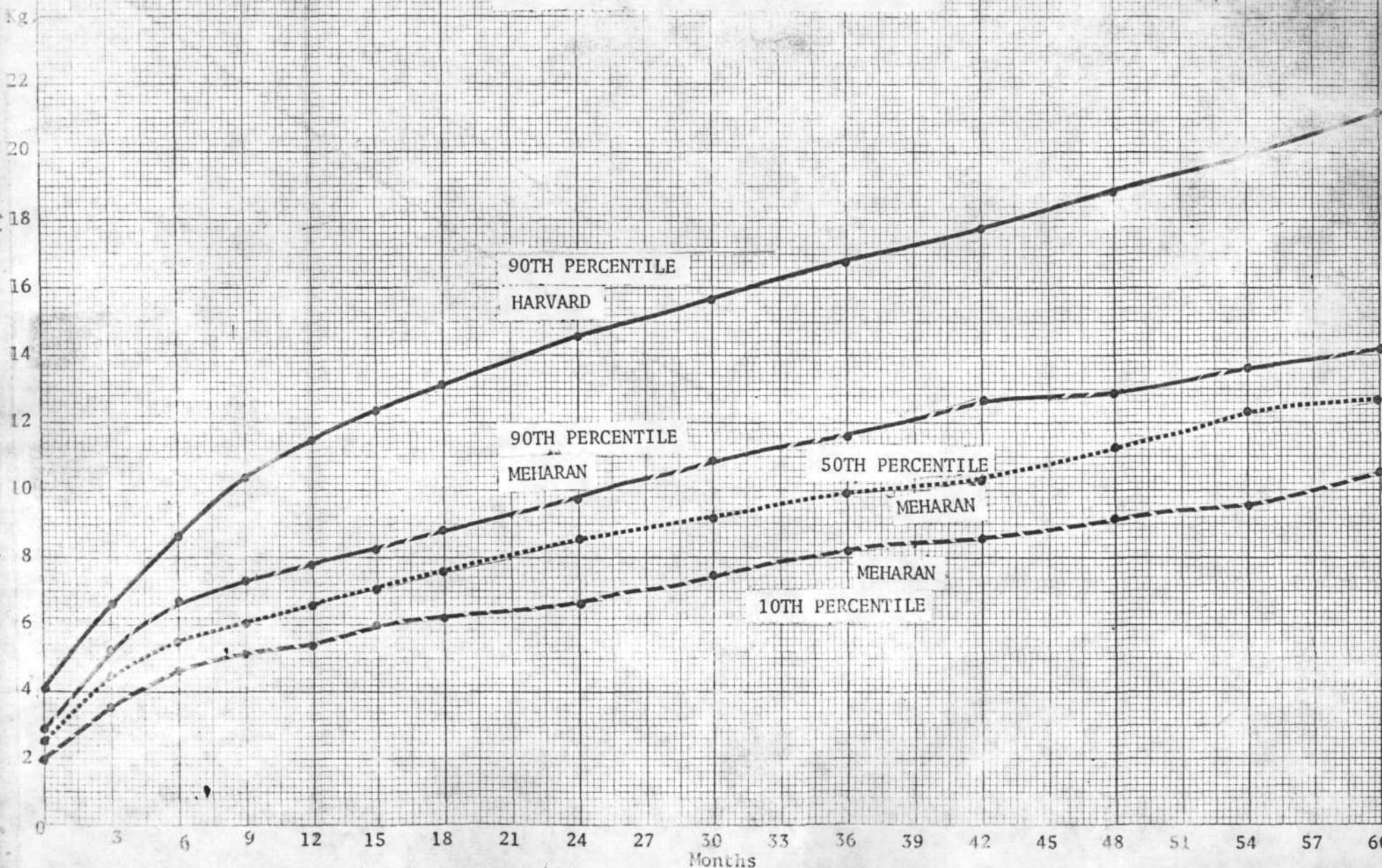


FIGURE 6

GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF MEHARAN CHILDREN: SEXES COMBINED

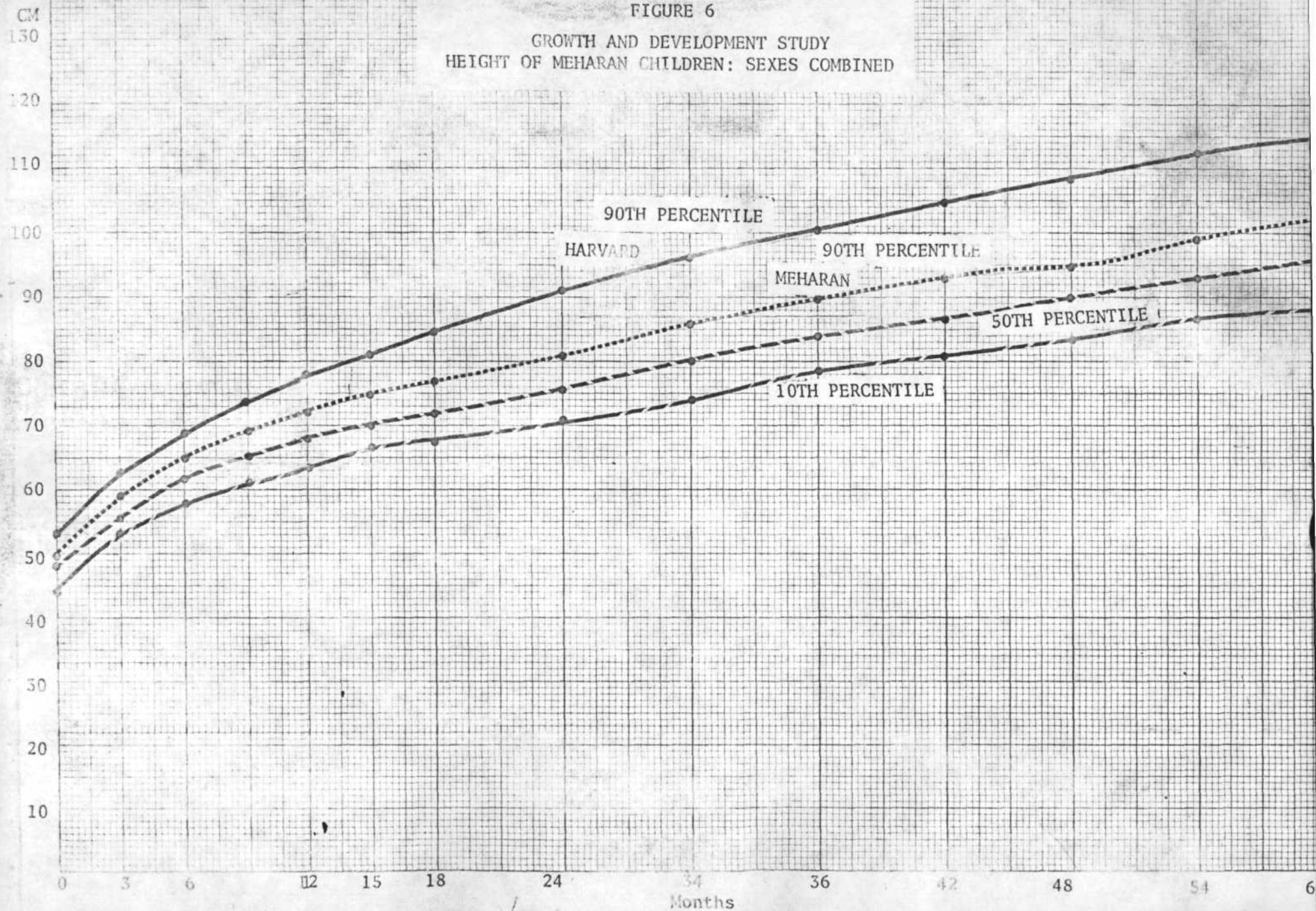




FIGURE 7

GROWTH AND DEVELOPMENT STUDY  
HEAD CIRCUMFERENCE OF MEHARAN CHILDREN: SEXES COMBINED

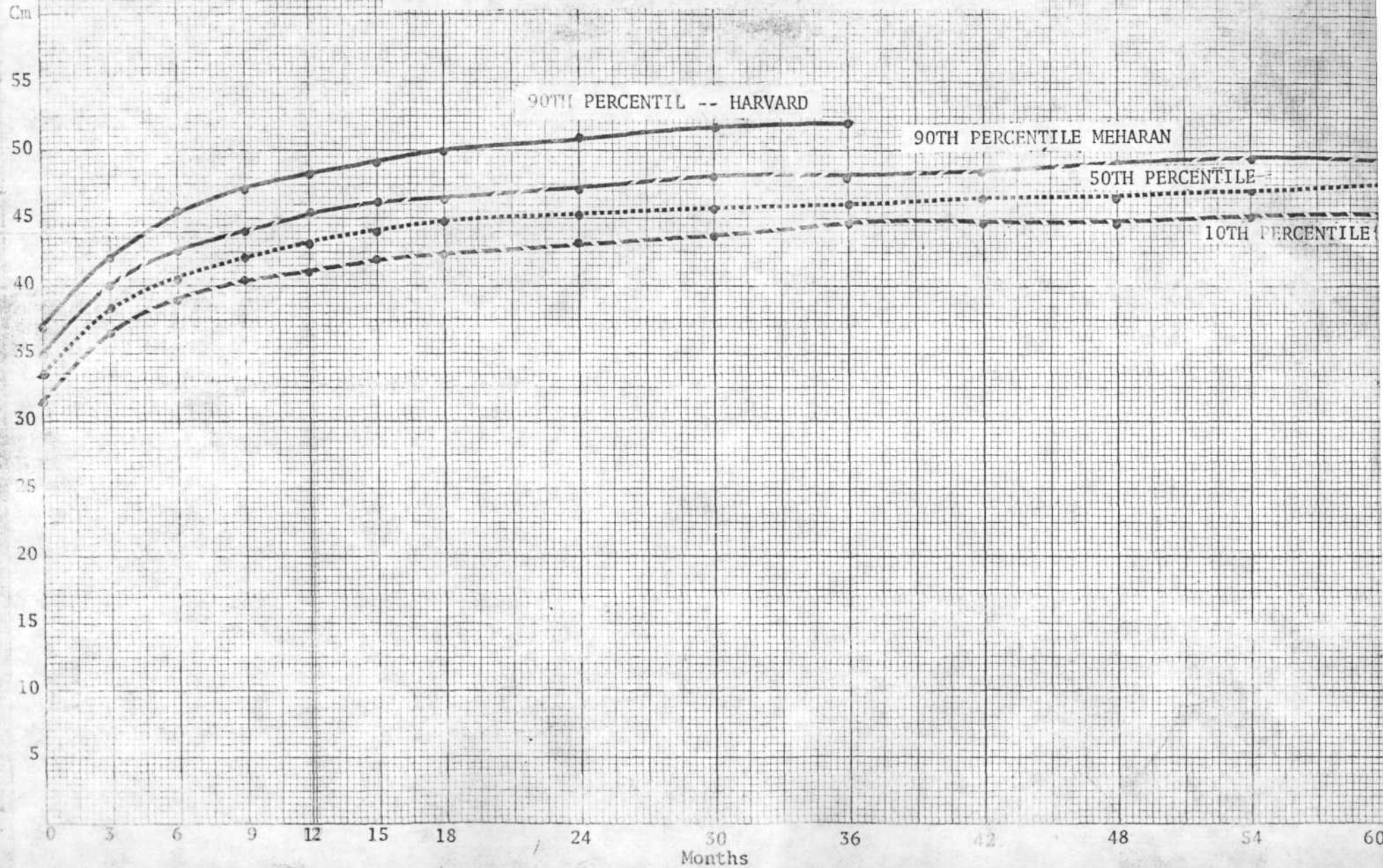


FIGURE 8  
 GROWTH AND DEVELOPMENT STUDY  
 CHEST CIRCUMFERENCE OF MEHARAN CHILDREN: SEXES COMBINED

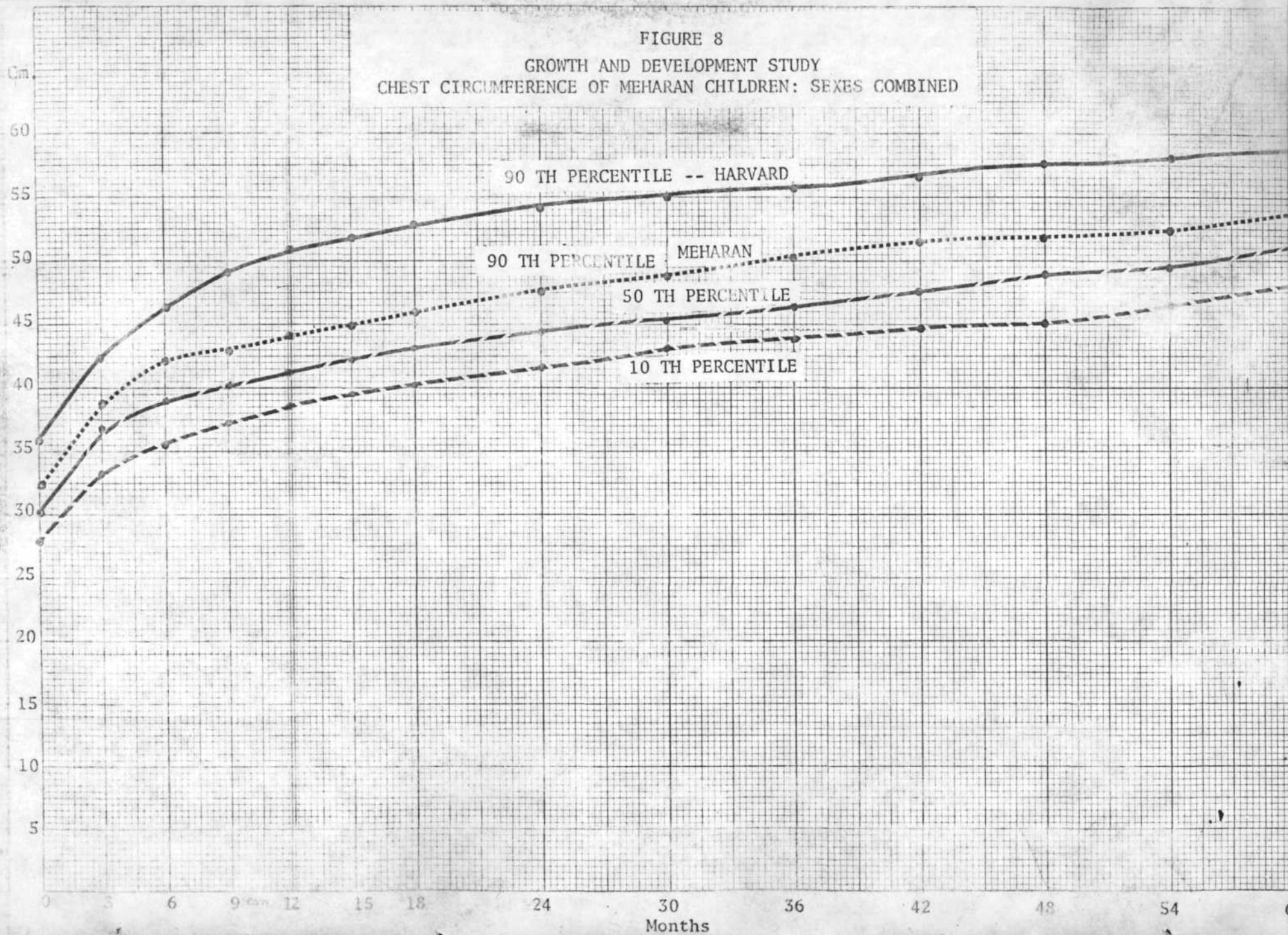


FIGURE 9

GROWTH AND DEVELOPMENT STUDY  
WEIGHT OF CHILDREN OF LOWEST AND BETTER GROUP

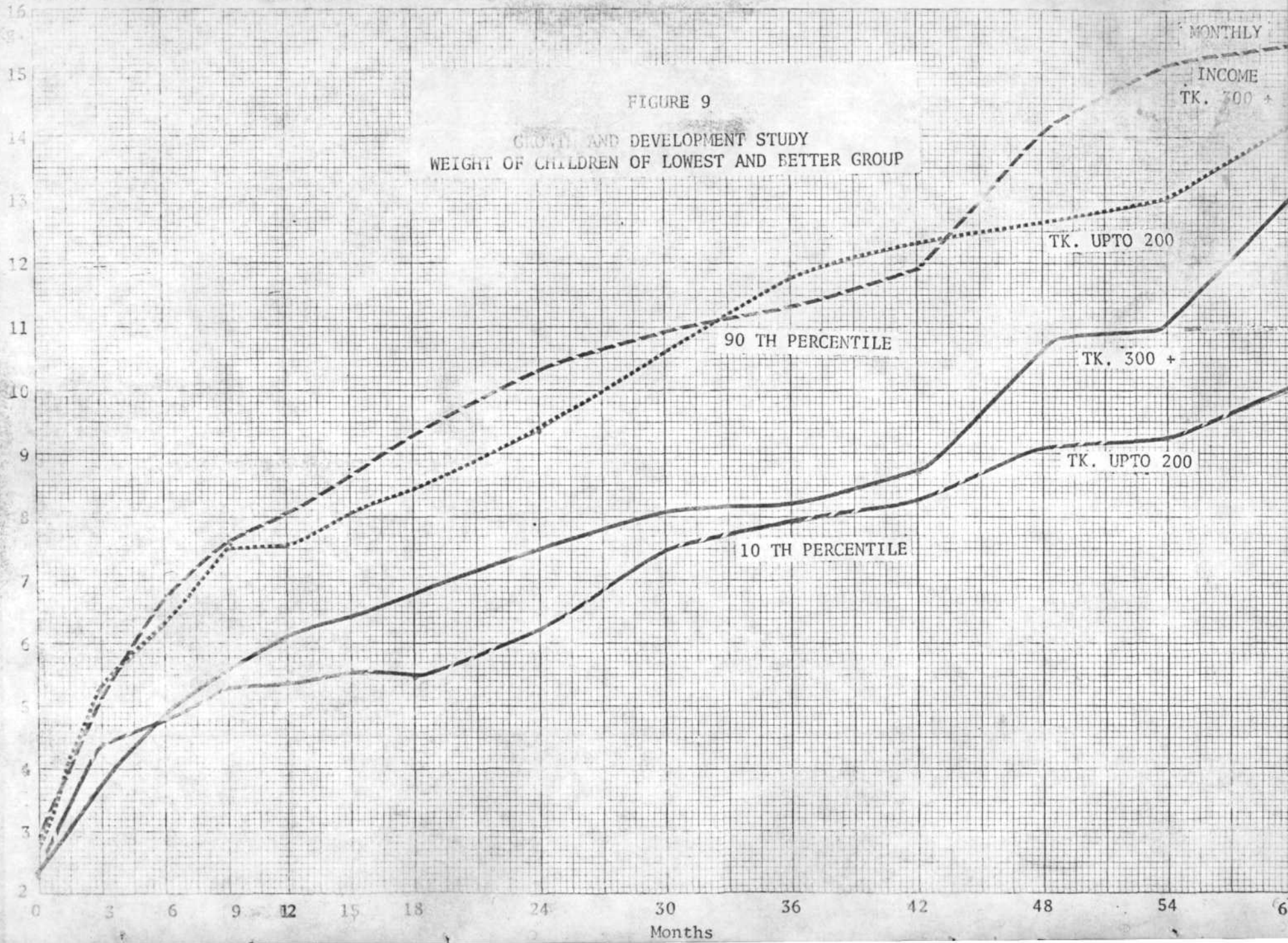


FIGURE 10

GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF CHILDREN OF LOWEST AND BETTER GROUP

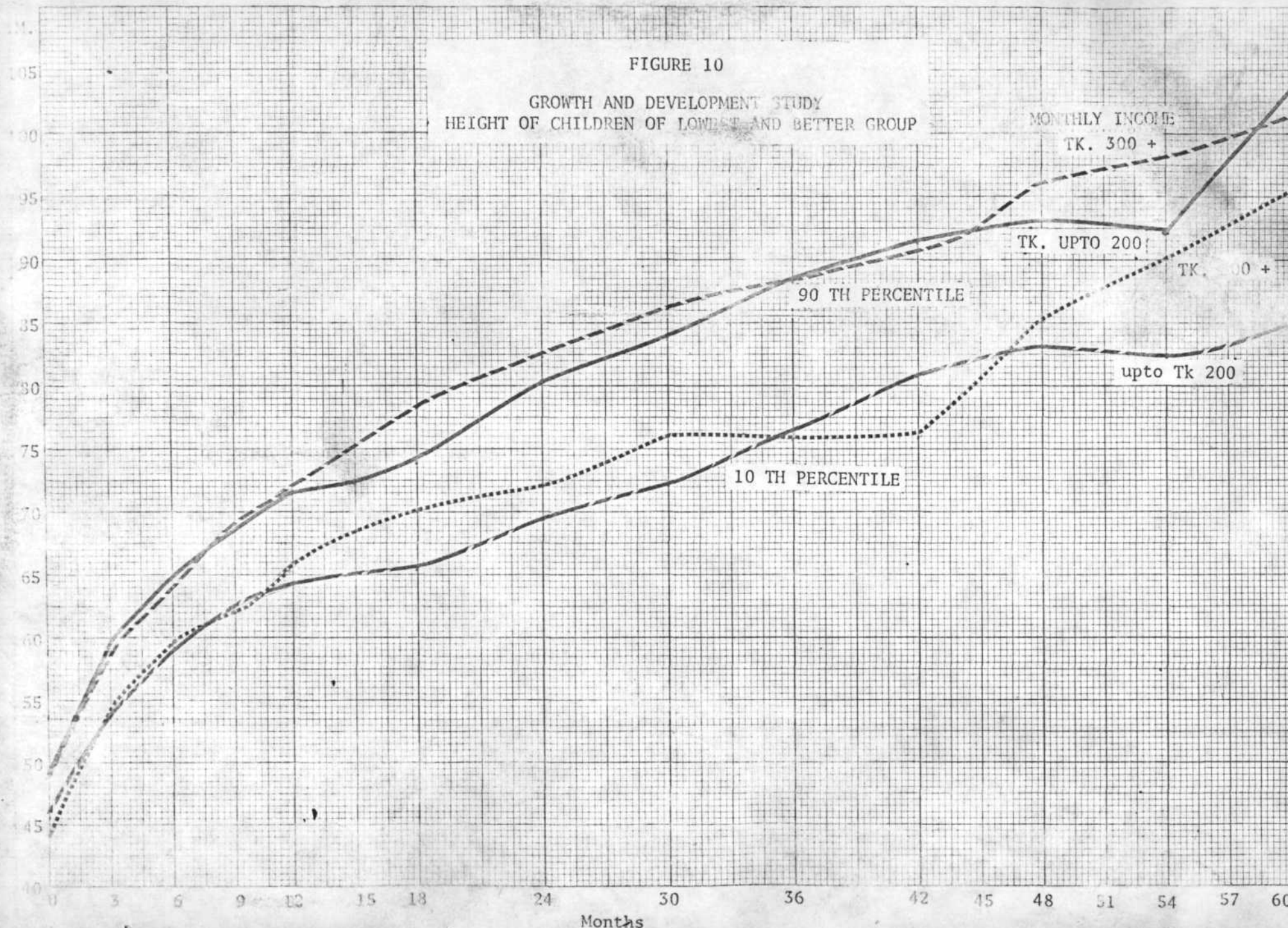


FIGURE 11

GROWTH AND DEVELOPMENT STUDY  
WEIGHT AND DIARRHEAL ILLNESS

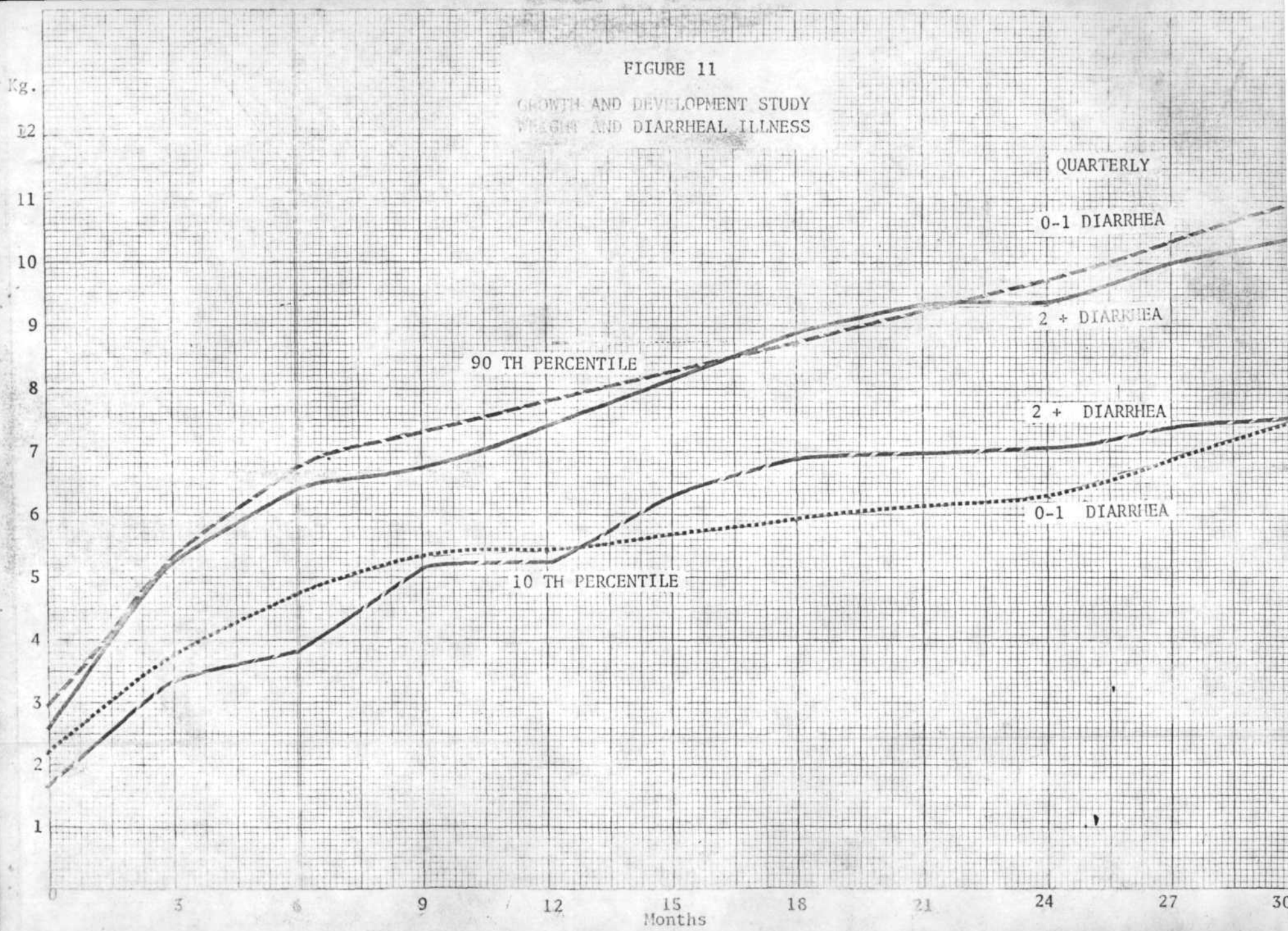


FIGURE 12

GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF CHILDREN ATTENDING CLINIC FOR DIARRHEA ILLNESS

C.M.

100

90

80

70

60

50

40

30

20

10

0

3

6

9

12

15

18

21

24

27

30

Months

QUARTERLY

2 + ILLNESS

0-1 ILLNESS

90 TH PERCENTILE

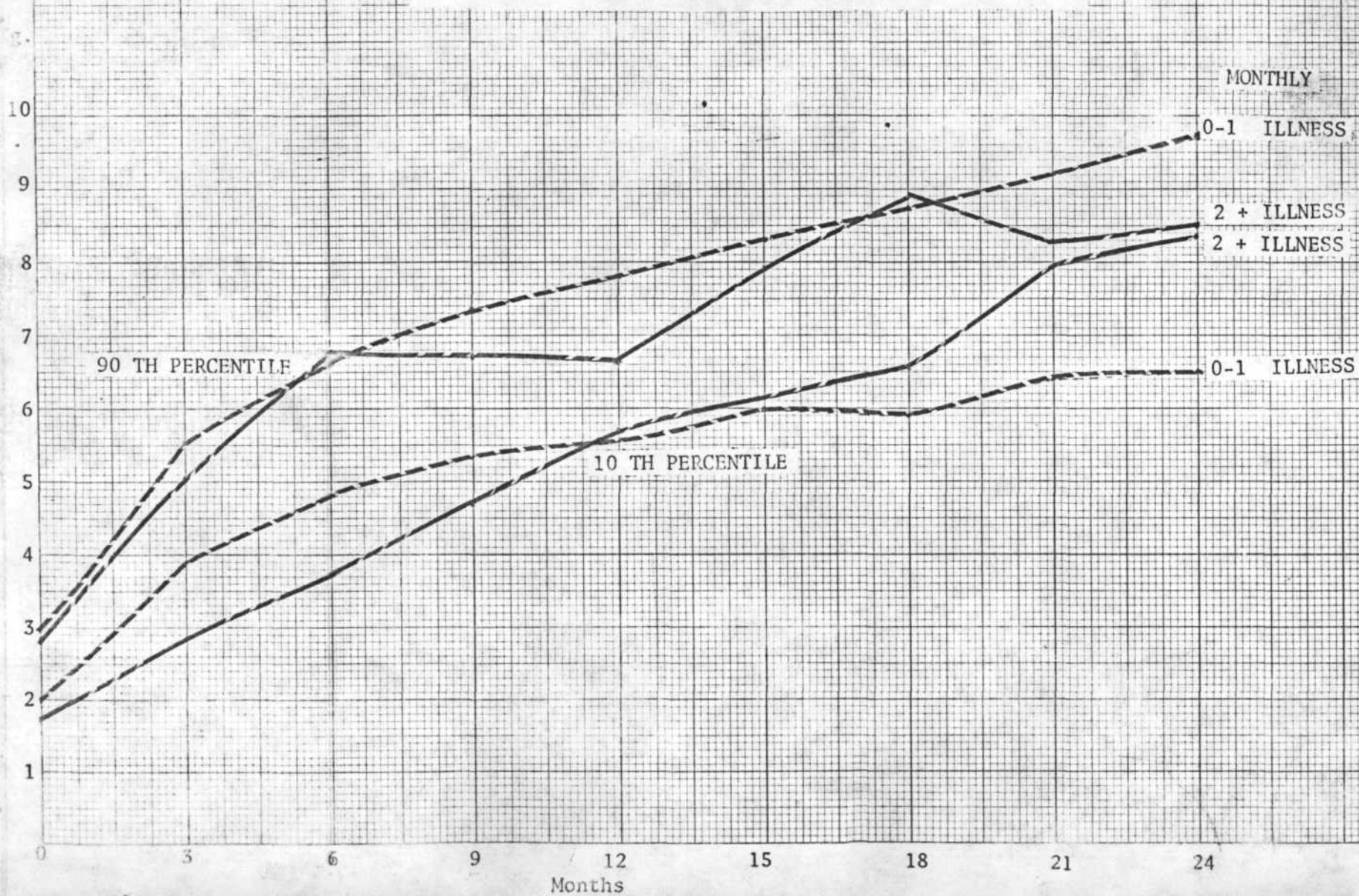
2 + ILLNESS

0-1 ILLNESS

10 TH PERCENTILE

FIGURE 13

GROWTH AND DEVELOPMENT STUDY  
WEIGHT OF CHILDREN ATTENDING CLINIC FOR ANY ILLNESS



C.M.

110

105

100

95

90

85

80

75

70

65

60

55

50

45

40

35

30

FIGURE 14

GROWTH AND DEVELOPMENT STUDY  
HEIGHT OF CHILDREN ATTENDING CLINIC FOR ANY ILLNESS

MONTHLY

0-1 ILLNESS

2 + ILLNESS

2 + ILLNESS

0-1 ILLNESS

90 TH PERCENTILE

10 TH PERCENTILE

0

3

6

9

12

15

18

24

