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CHAPTER VI

SUMMARY AND SUGGESTIONS

The study of children and their development in various aspects, such as physical or biological growth, cognitive or intellectual processes, personality development and social behaviour, offers not only a huge mass of theoretical knowledge about children, but contributes enormously in a practical way to human betterment. A vast amount of research to understand basic growth processes as well as problems of physical and motor development, language development, problems of learning and thinking and of emotional and social development of children needs be carried out, confirmed and then applied to the practical problems in child education. The period from birth to age six is characterized by the rapid physical and psychological development of the child. The value of interdisciplinary studies of the many aspects of child development has been emphasized by UNESCO experts at a recent seminar on child education and child development. A study of basic physical growth processes needs special consideration in this respect. A number of studies of physical growth have provided sets of norms. The children involved in these studies have been mostly representative of European and North American populations, and such studies in

other parts of the world, especially in developing countries, are all the more necessary.

A very few studies of physical growth have been undertaken in India, and whatever is done pertains to studies of norms, mainly of height and weight, and hardly other measures of physical growth, and that too in only a few states. In view of the long-felt need of the problem, the present author has attempted in this investigation to study a number of different aspects (thirteen in all) of physical growth of children between ages two to six (the pre-school years), residing in the State of Gujarat, to set up norms for different measures at different periods of growth and to relate the growth of weight and height to a few other relevant variables, especially to study differences in growth due to sex as well as milieu or area of residence, viz. urban and rural, besides socio-economic level, birth order, mother's age and family size; growth in other measures were studied as related mainly to sex and milieu.

For the present study, samples of children of age levels from two to six were observed. The children of both sexes coming from families from urban and rural areas were mostly selected from nursery schools. The data on the physical development of infants presented here consisted of twelve direct measurements and an additional one derived from them. The

direct measurements with special measuring tools, under standard, uniform conditions as far as possible, included : (1) weight; (2) height; (3) head circumference; (4) chest circumference; (5) width between shoulders; (6) arm length; (7) sitting height; (8) upper arm circumference; (9) fore arm circumference; (10) thigh circumference; (11) calf circumference; and (12) foot length. The derived measurement was (13) the length of the lower limb, obtained by subtracting sitting height from total (standing) height. A very large number of children (more than 3500 in the initial stage) were observed. The above aspects of growth of children were measured at intervals of three months from two years to six years of age. In view of certain limitations of work, the investigator could not observe the same children continuously from two to six years of age. In view of this, the major portion of the study has been a cross-sectional study of children from two to six years, offering 17 age-points at intervals of three months. This study consisted of data available for analysis from a sample of 1858 children (990 boys and 868 girls, 991 from urban milieu and 867 from rural), providing in all 5699 observations for analysis at different 17 age points, (not necessarily of same children continuously at all age-points). However, by the way, a special longitudinal study was also carried out by separating out and analysing the data of some children of (nine) different age

ranges wherein the same children were observed continuously at least at five age points. The sample for this longitudinal study (better called mixed longitudinal) consisted of 600 children (316 boys and 284 girls) only from urban area. All these data were subjected to adequate statistical techniques, and such statistical analysis warranted the following inferences :

Most of the findings common to all measures revealed that each aspect increased with the increase in age, showing almost a significant linear trend of increase; that there were significant sex and area differences, boys being superior to girls and urban to rural in most aspects of growth.

Similarly, with respect to its relation with socio-economic level (classified in five categories from low to high), the results showed increase in growth with increase in socio-economic level, especially upto fourth level and sometimes a slight decrease at the highest S.E. level. The specific findings with respect to each measure are summarized below.

Cross-Sectional Study

1. Weight

- (a) Weight increased with increase in age, from a mean of 9.70 kg. at age of two years to 15.94 kg. at age of six years on the whole.

- (b) There were significant sex differences in weight; boys were heavier (13.94 kgs.) than girls (13.43 kgs.) on the whole.
- (c) Urban children on the whole were significantly heavier (13.79 kgs.) than rural (13.23 kgs.).
- (d) Weight increased with socio-economic level too, from 13.32 kgs. at SE_1 to 14.04 kgs. at SE_4 and then decreasing to 13.98 kgs. at SE_5 ; all pairs were significantly different, except SE_1-SE_2 , SE_2-SE_3 and SE_3-SE_4 .
- (e) Birth order as well as mother's age also showed a significant interaction in contributing to weight; more truly birth order showed significant differences in weight at two and three years of age of children, and not at others.
- (f) Family size (number of siblings) was not found to be a significant factor by itself, but had a significant interaction with mother's age.

2. Height

- (a) Height increased with increase in age, from a mean of 80.01 cms. at age of two years to 107.33 cms. at age of six years on the whole.

- (b) There were significant sex differences in height; boys were taller (98.88 cms.) than girls (97.31 cms.) on the whole.
- (c) Similarly, there were significant area differences; urban children on the whole were taller (98.44 cms.) than rural (96.60 cms.).
- (d) Height showed also significant differences according to socio-economic (SE) levels, increasing from 97.49 cms. at SE₁ level to 101.86 cms. at SE₅ level, the actual significantly different pairs being SE₁-SE₄, SE₁-SE₅, SE₂-SE₃, SE₂-SE₄ and SE₂-SE₅ only.
- (e) Again, birth order showed significant interaction with mother's age in contributing to height; only at the age level of three years, birth order was a significant factor.
- (f) Family size or mother's age was not a significant factor in height either by itself or in interaction with each other.

3. Head Circumference

- (a) Head circumference increased with increase in age on the whole, from 46.60 cms. at two years to 49.68 cms. at six years.
- (b) There were significant sex differences on the whole,

boys showing 49.003 cms. and girls showing 48.198 cms.

- (c) There were also significant area differences on the whole, urban children with 48.667 cms. and rural with 48.395 cms.
- (d) There is also a trend for head circumference to increase with socio-economic level on the whole.

4. Chest Circumference

- (a) Chest circumference increased with increase in age on the whole, from 46.54 cms. at two years to 52.24 cms. at six years.
- (b) There were significant sex differences on the whole, boys with 50.785 cms., and girls with 49.614 cms.
- (c) There were significant area differences on the whole, urban children with 50.311 cms. and rural with 49.826 cms.
- (d) Chest circumference tended also to increase with increase in SE level upto SE_4 , with a slight decrease at SE_5 .

5. Shoulder Width

- (a) Shoulder width increased with increase in age, on the whole, from 21.07 cms. at two years to 26.80 cms. at six years.

- (b) Sex played a significant role on the whole, boys with 25.038 cms. and girls with 24.921 cms.
- (c) Area of residence too played a significant role on the whole, urban children with 24.798 cms. and rural with 24.762 cms.
- (d) Shoulder width showed also a trend to increase with increase in SE level, upto SE_4 .

6. Arm Length

- (a) Arm length increased with increase in age on the whole, from 34.99 cms. at two years to 47.71 cms. at six years.
- (b) There were significant sex differences on the whole, boys with 43.639 cms. and girls with 42.806 cms.
- (c) There were significant area differences on the whole, urban children having 43.296 cms. and rural 43.001 cms.
- (d) Arm length increased also with increase in SE level at each age.

7. Sitting Height

- (a) Sitting height increased on the whole with age, from 46.51 cms. at two years to 58.73 cms. at six years.
- (b) There were significant sex differences on the whole,

boys with 54.531 cms. and girls with 53.593 cms.

- (c) There were also significant area differences, urban children with 53.994 cms. and rural with 54.564 cms.
- (d) Mostly sitting height increased with increase in SE level at each age.

8. Upper Arm Circumference

- (a) Upper arm circumference increased on the whole with increase in age, from 13.77 cms. at two years to 15.07 cms. at six years.
- (b) Sex was not a significant factor in upper arm circumference, however, girls tended to be superior (14.730 cms.) to boys (14.712 cms.).
- (c) Only area was a significant factor, urban with 14.784 cms. and rural with 14.394 cms.
- (d) Upper arm circumference increased with increase in SE level.

9. Fore arm Circumference

- (a) Fore arm circumference increased with increase in age on the whole, with 13.79 cms. at two years to 15.48 cms. at six years.
- (b) There were significant sex differences on the whole,

boys with 15.091 cms. and girls with 14.901 cms.

- (c) There were significant area differences on the whole, urban children with 15.045 cms. and rural with 14.772 cms.
- (d) It increased also with increase in SE level, especially at 4 and 5 years.

10. Thigh Circumference

- (a) Thigh circumference increased with the increase in age on the whole, with 25.35 cms. at two years to 30.25 cms. at six years.
- (b) There were significant sex differences on the whole; however, girls were superior (29.029 cms.) to boys (28.354 cms.), as in case of upper arm circumference.
- (c) There were significant area differences on the whole, urban with 28.790 cms. and rural with 28.072 cms.
- (d) There was a trend for thigh circumference to increase with increase in SE level upto SE_4 , with a slight decrease at SE_5 in case of children of two and six years.

11. Calf Circumference

- (a) Calf circumference increased with increase in age on the whole, from 17.32 cms. at two years to

20.38 cms. at six years.

- (b) There were significant sex differences on the whole, boys with 19.502 cms. and girls with 19.372 cms.
- (c) There were significant area differences on the whole, urban with 19.564 cms. and rural with 18.803 cms.
- (d) It increased with increase in SE level with slight decrease at SE_5 in case of children of 2, 3 and 6 years.

12. Foot Length

- (a) Foot length increased with increase in age on the whole, from 13.24 cms. at two years to 17.71 cms. at six years.
- (b) There were significant sex differences on the whole, boys with 16.333 cms. and girls with 15.987 cms.
- (c) There were significant area differences on the whole, urban with 16.241 cms. and rural 15.794 cms.
- (d) Foot length mostly increased with increase in SE level.

13. Lower Limb (Leg Length)

- (a) Leg length increased with increase in age on the whole, from 33.49 cms. at two years to 48.60 cms. at six years.

- (b) Sex did not play a significant role in leg length on the whole, (as in case of upper arm circumference), both being almost equal (boys - 44.343 cms. and girls - 43.709 cms.).
- (c) Only area played a significant role on the whole, urban with 44.435 cms. and rural with 42.035 cms.
- (d) Leg length generally tended to increase with increase in SE level, particularly at 4, 5 and 6 years of age.

Norms for each measure at each age point are presented in respective tables in the body of the thesis.

Longitudinal Study (mixed)

The mixed longitudinal approach to the sample of 600 children providing 3000 observations in case of each of nine age-ranges, continuously for five age-points showed almost the same trend of growth as the cross-sectional study in case of each of the 13 measures, as discussed above. In case of this longitudinal study, a special statistical technique of trend analysis was applied to the data to study the significance of trend of growth, and it was statistically found that only the linear component of trend was significant; all other components viz. quadratic, cubic and quartic, were found insignificant.

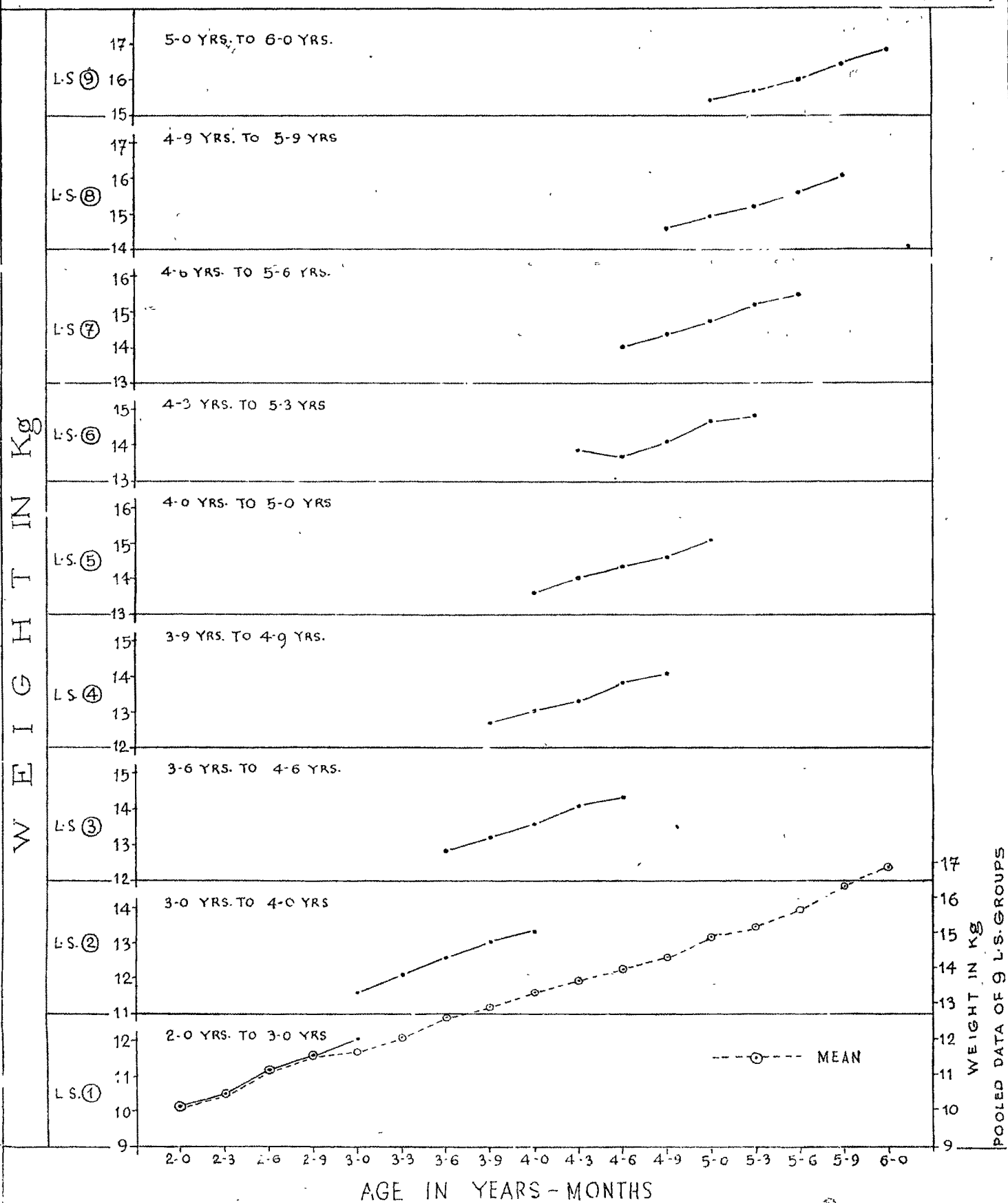
This confirmed the findings that all aspects of growth studied showed a linear trend in increase.

SUGGESTIONS

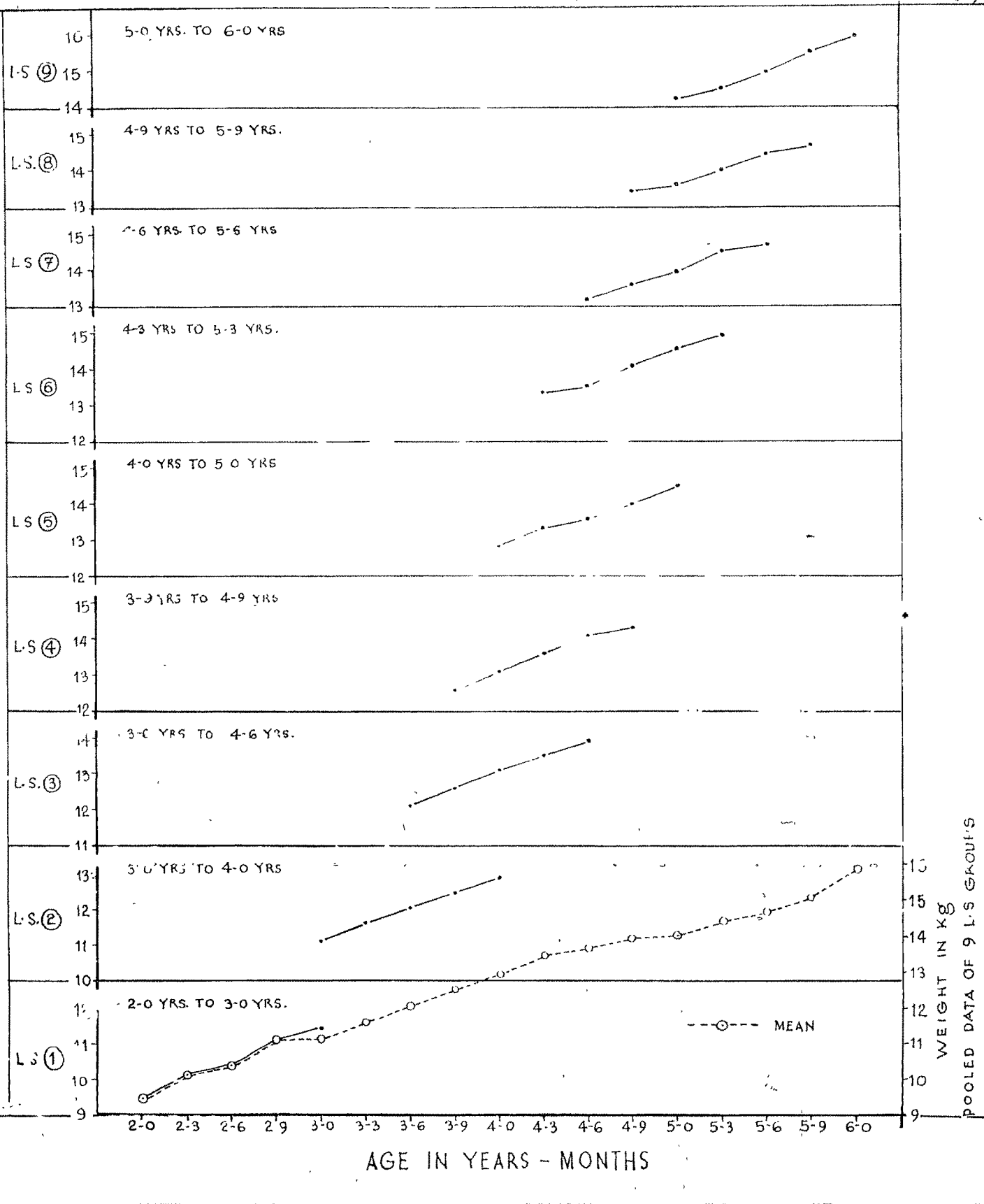
The present investigation is the most extensive study undertaken in Gujarat as it includes more parameters of growth than any investigation reported so far. Its findings may be utilized for fixing the regional norms for Gujarat for the pre-school-age children (two years to six years). It is suggested that the parameters of growth found for the SE₄ children be accepted as norms for pre-school children of Gujarat. These norms can be revised later in light of more extensive investigations.

It should be noted however, that in view of the specific limitations of time and space in case of a doctoral work, the investigator deplores for not studying statistically the contribution of all other relevant variables to each of the 13 measures, and also for not applying varied other statistical techniques in all cases, especially in the longitudinal study. The investigator hopes that these may be taken up as a follow-up work for further research. A longitudinal study of also rural children needs be undertaken. However, whatever has been done in the present case is done systematically and usefully, it is hoped. These studies need be followed up by similar studies in other areas.

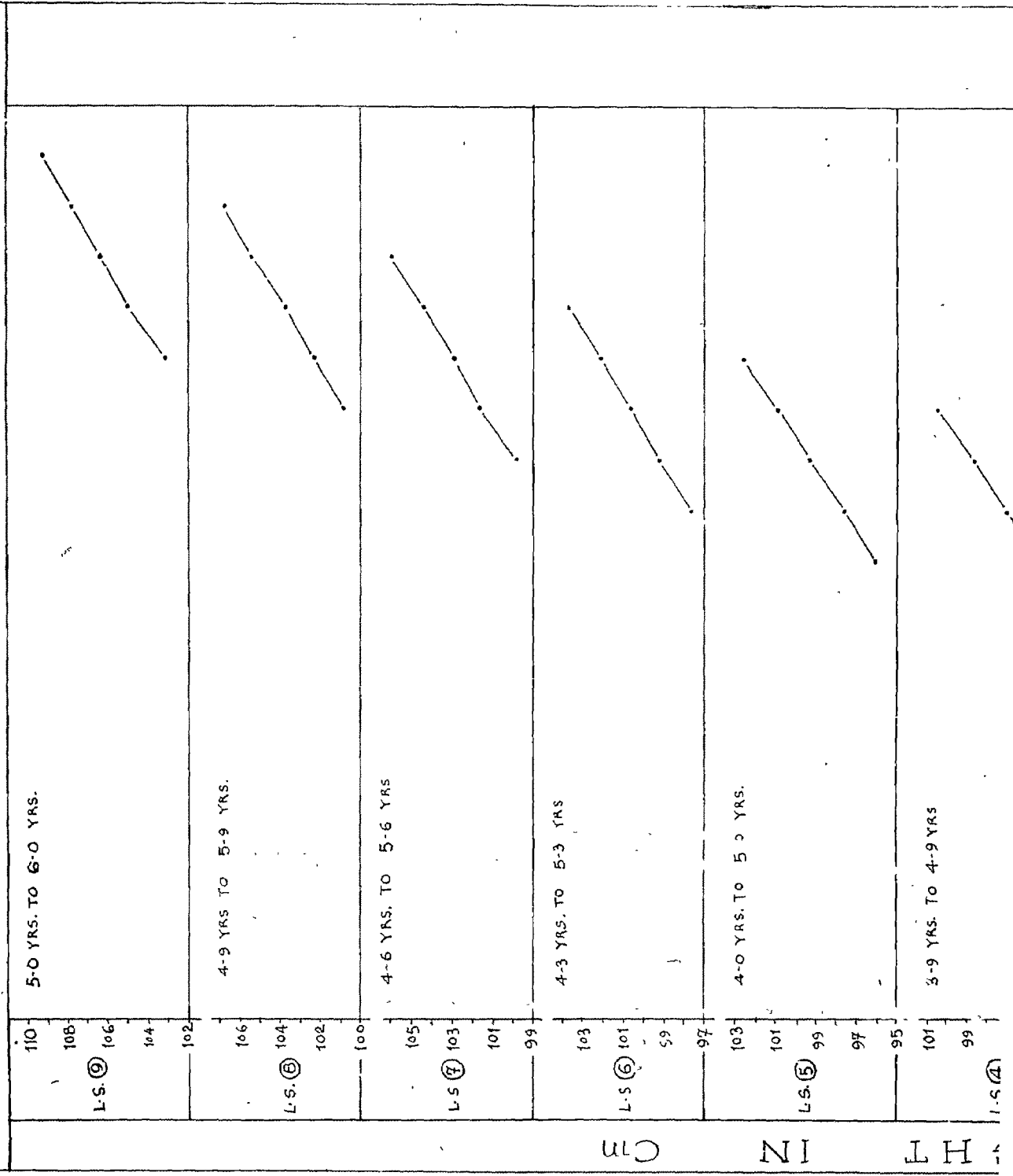
DISTANCE CURVES OF INCREASE IN WEIGHT (IN KG) OF BOYS IN THE 9 LONGITUDINAL STUDY (L.S.) GROUPS OF VARYING AGE RANGES (OF ONE YEAR EACH) FIG. 5.15 (1)



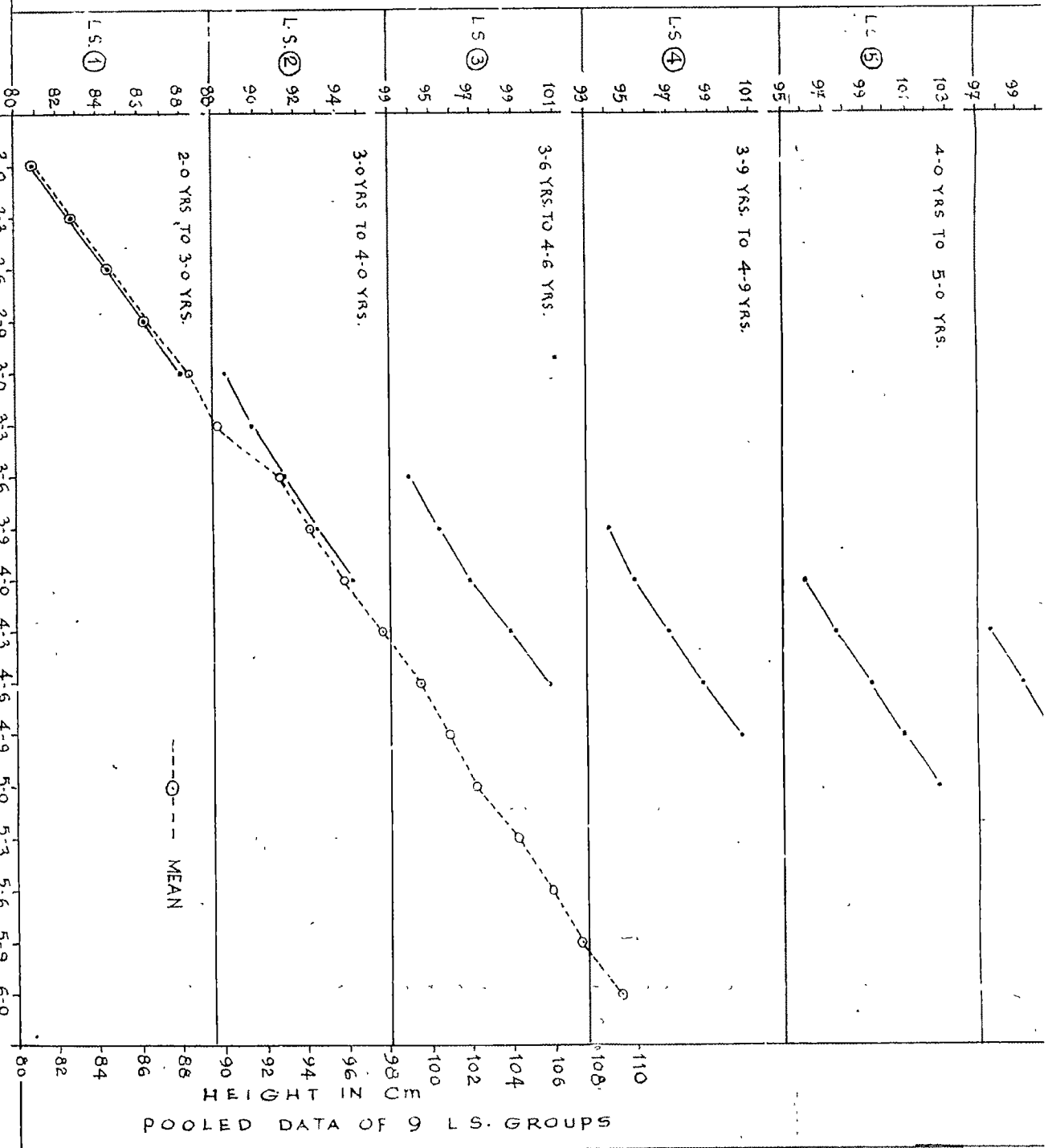
DISTANCE CURVES OF INCREASE IN WEIGHT (IN Kg) OF GIRLS IN THE 9 LONGITUDINAL STUDY (L.S.) GROUPS OF VARYING AGE RANGES, (OF ONE YEAR EACH). FIG. 5.15(ii)



DISTANCE CURVES OF INCREASE IN HEIGHT (IN CM) OF BOYS IN THE 9 LONGITUDINAL STUDY (L.S.) GROUPS OF VARYING AGE RANGES, (OF ONE YEAR EACH). FIG. 5.1.5(i)



HEIGHT IN C



AGE IN YEARS - MONTHS

DISTANCE CURVES OF INCREASE IN HEIGHT (IN CM) OF GIRLS IN THE 9 LONGITUDINAL STUDY (L.S.) GROUPS OF VARYING AGE RANGES (OF ONE YEAR EACH) FIG. 5.15 (11)

