CHAPTER III

THE PROBLEM AND PROCEDURE

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CHAPTER III

THE PROBLEM AND PROCEDURE

3.0 Introduction

The importance of the study of child development and the need of studying and establishing the norms and inter-relationships of the aspects of physical growth have already been discussed in the foregoing chapter. The relevant literature has also been reviewed in the proceeding chapter. However, the various aspects of study, the methodological issues and the procedural details about the study need to be described. This chapter deals with the details of the account of the study.

3.1 Statement of the Problem

The problem of the present study is:

A STUDY OF SOME ASPECTS OF PHYSICAL GROWTH
OF PUPILS OF THE AGE GROUP 10+ to 12+.

3.2 Scope of the Study

The area of physical growth is of course very wide and it's almost impossible to cover all the aspects of physical growth under the study. Hence, it was decided to restrict the study up to the physical measurements of some aspects only. It was decided not to include the biochemical
or radio-active influences on the physical growth of pupils, created by including radio-active rays. However, it was decided to study the physical growth in relation to the sex of the pupils and their socio-economic condition. The study is based upon the measurements of growth of about 18 parts of the body of the pupils of Kheda district only. Hence, the findings of the study would be applicable to the pupils of Kheda district only.

3.3 Delimitations of the Study

The study has been restricted to only the physical growth of the pupils of age group 10+ to 12+ only. Again it has been restricted to only 18 different measurements. The relationship of the difference were studied only in relation to three variables viz., Rural-urban Milieu, Socio-economic status and sex. The study is partly longitudinal and partly cross-sectional as is restricted to one year study of the growth only.

The data on the physical growth of pupils presented here, consists of 18 measurements and one is derived from them. The direct measurements are:

1. Weight
2. Height
3. Circumference of the head
4. Circumference of the neck
5. Circumference of the chest
6. Width between shoulders
7. Waist girth
8. Hip girth
9. Arm length
10. Length between shoulder and elbow
(11) Length between elbow and wrist (12) Upper arm girth
(13) Wrist girth (14) Leg-length (15) Thigh girth (16) Calf
girth (17) Foot length.

The derived measurement was the measurement of lower
limb length was obtained by substracting sitting height
from total (standing) height.

This study is further restricted to 1135 pupils from
25 schools of various villages and town places from Kheda
District.

3.4 Objectives of the Study

The present investigation has been taken up with the
following specific objectives.

1. To collect reliable data on the essential aspects of
physical growth, which would include in addition to
the usually studied aspects of height and weight, the
growth of head, neck, chest, waist, hip, arms, legs,
wrist, feet etc.

2. To establish reliable and acceptable norms of physical
growth at various age points of the pupils of age
group 10+ to 12+.
3. To investigate the influence of the urban and rural milieu as well as sex differences in the physical growth of 10+ to 12+ age group school pupils.

4. To study the relationship between the socio-economic status of the family and the physical growth of the 10+ to 12+ age group pupils.

3.5 Hypotheses

The district of Kheda is known for its achievements in various fields. In the past, it had provided the nation with the healthy and intelligent personalities like late Shri Sardar Vallabhbhai Patel, late Shri Vithalbhai Patel and late Shri Bhailalbhai Patel.

Healthy minds of the people are extremely necessary for the healthy growth of a nation. And it has been universally accepted that "healthy mind is in the healthy body".

S.K. Kochhar (1934) has rightly pointed out the fact as: "it is being realised by the modern educator that a sound mind can only function in a sound body; and that the results of true education is not shattered health and a louded brain on skeleton shoulders as is usually the case, but a wise and active brain on a chiselled physique."
The small town, as distinguished from rural units, may offer an excellent physical and psychological environment. Barker et al., (1951) in study of a small town, found it to be a good environment for children.

Socio-economic status determines to a longer degree the paucity or abundance of these conditions which are conducive to healthful living. Many studies in the past have pointed out to the fact that material well-being affects physical development. Karpinos (1958) found differences in height and weight between selective service registrants of differing socio-economic status. Children in a superior socio-economic environment generally are taller and heavier than children of comparable age who live in less favourable circumstances.

It is also said that a child "grows" and "grows up". He "grows" in size; he "grows up" or matures in structure and function with the age.

There are definite differences between boys and girls. In the early school years they are equal in weight, but later between nine and fourteen years girls, because girls mature earlier than boys, pass through the puberal spurt of growth earlier than boys, are temporarily heavier than boys.
On the basis of all these observations and experiences the following hypotheses were laid down to study the physical growth of pupils.

Hypotheses

1. Mean score of weight increases with the increase in age of both boys and girls.

2. Mean score of weight of urban pupils is higher than that of rural pupils.

3. Mean score of weight of girls is higher than that of boys at all the age points.

4. Mean score of weight differs with different socio-economic status of the pupils.

5. Mean score of height increases with the increase in age of both boys and girls.

6. Mean score of height of urban pupils is higher than that of rural pupils.

7. Mean score of height of girls is higher than that of boys at the age points 11, 12 and 13 years.

8. Mean score of height differs with different socio-economic status of the pupils.

9. Mean score of the circumference of the head increases with the increase in age of both boys and girls.
10. Mean score of the circumference of the head of urban pupils is higher than that of rural pupils.

11. Mean score of the circumference of the head of boys is higher than that of girls.

12. Mean score of the circumference of head differs with different socio-economic status of the pupils.

13. Mean score of the circumference of the neck increases with the increase in age of both boys and girls.

14. Mean score of the circumference of the neck of urban pupils is higher than that of rural pupils.

15. Mean score of the circumference of the neck of boys is higher than that of girls.

16. Mean score of the circumference of neck differs with different socio-economic status of the pupils.

17. Mean score of circumference of the chest increases with the increase in age in both boys and girls.

18. Mean score of circumference of the chest of urban pupils is higher than that of rural pupils.

19. Mean score of circumference of the chest differs with different socio-economic status of the pupils.

20. Mean score of circumference of the chest of girls is higher than that of boys at age points 11, 12 and 13 years.
21. Mean score of width between shoulder increases with the increase in age in both boys and girls.

22. Mean score of width between shoulder of urban pupils is higher than that of rural pupils.

23. Mean score of width between shoulder of boys is higher than that of girls.

24. Mean score of width between shoulder differs with different socio-economic status of the pupils.

25. Mean score of waist girth increases with the increase in age in both boys and girls.

26. Mean score of waist girth of urban pupils is higher than that of rural pupils.

27. Mean score of waist girth of boys is higher than that of girls.

28. Mean score of waist girth differs with different socio-economic status of the pupils.

29. Mean score of hip girth increases with the increase in age in both boys and girls.

30. Mean score of hip girth of urban pupils is higher than that of rural pupils.

31. Mean score of hip girth of girls is higher than that of boys.
32. Mean score of hip girth differs with different socio-economic status of the pupils.

33. Mean score of arm length increases with the increase in age in both boys and girls.

34. Mean score of arm length of urban pupils is higher than that of rural pupils.

35. Mean score of arm length differs with different socio-economic status of the pupils.

36. Mean score of arm length of girls is higher than that of boys at the age 11, 12 and 13 years.

37. Mean score of length between shoulder and elbow increases with the increase in age in both boys and girls.

38. Mean score of length between shoulder and elbow of urban pupils is higher than that of rural pupils.

39. Mean score of length between shoulder and elbow of girls is higher than that of boys at the age 11, 12 and 13 years.

40. Mean score of length between shoulder and elbow differs with different socio-economic status of the pupils.
41. Mean score of length between elbow and wrist increases with the increase in age in both boys and girls.

42. Mean score of length between elbow and wrist of girls is higher than that of boys at 11, 12 and 13 years.

43. Mean score of length between elbow and wrist of urban pupils is higher than that of rural pupils.

44. Mean score of length between elbow and wrist is the highest in case of pupils belonging to the highest socio-economic status and the lowest in case of pupils belonging to the lowest socio-economic status.

45. Mean score of upper arm girth increases with the increase in age in both boys and girls.

46. Mean score of upper arm girth of boys is higher than that of girls at all ages.

47. Mean score of upper arm girth of urban pupils is higher than that of rural pupils.

48. Mean score of upper arm girth is the highest in case of pupils belonging to the highest socio-economic status and the lowest in case of pupils belonging to the lowest socio-economic status.

49. Mean score of wrist girth increases with the increase in age in both boys and girls.
50. Mean score of wrist girth of rural pupils is higher than that of urban pupils.

51. Mean score of wrist girth of girls is higher than that of boys.

52. Mean score of wrist girth differs with different socio-economic status of the pupils.

53. Mean score of leg length increases with the increase in age in both boys and girls.

54. Mean score of leg length of urban pupils is higher than that of rural pupils at all ages.

55. Mean score of leg length of girls is higher than that of boys at 11, 12 and 13 years.

56. Mean score of leg length differs with different socio-economic status of the pupils.

57. Mean score of lower limb length increases with the increase in age in both boys and girls.

58. Mean score of lower limb length of urban pupils is higher than that of rural pupils at all ages.

59. Mean score of lower limb length of girls is higher than that of boys at 11, 12 and 13 years.
60. Mean score of lower limb differs with different socio-economic status of the pupils.

61. Mean score of thigh girth increases with the increase in age in both boys and girls.

62. Mean score of thigh girth of girls is higher than that of boys at all ages.

63. Mean score of thigh girth of urban pupils is higher than that of rural pupils.

64. Mean score of thigh girth differs with different socio-economic status of the pupils.

65. Mean score of calf girth increases with the increase in age in both boys and girls.

66. Mean score of calf girth of urban pupils is higher than that of rural pupils.

67. Mean score of calf girth of girls is higher than that of boys at all ages.

68. Mean score of calf girth differs with different socio-economic status of the pupils.

69. Mean score of foot length increases with the increase in age in both boys and girls.

70. Mean score of foot length of boys is higher than that of girls at all ages.
71. Mean score of foot length of urban pupils is higher than that of rural pupils.

72. Mean score of foot length differs with different socio-economic status of the pupils.

3.6 Procedure

The investigator had to make certain decisions regarding the (1) methods of study, (2) the sample to be selected for the study, and (3) the tools and techniques to be selected for study. These procedural points are discussed here in details.

In any science, several different methods of study sometimes must be applied to a problem before all the pieces fit together properly. Each method contributes in its own way to the final solution. In planning a study, the scientist attempts to select the method or methods most appropriate to the particular problem under consideration.

3.6.1 Methods of Study

Generally the following methods are used for the study of physical growth:

1. Diary method
2. Time sampling
3. Field study method
4. Life history method
5. Survey method
6. Experimental method
7. Interview method
8. Questionnaire method

1. **Diary Method**

This is the oldest method of studying child development (Wright, 1960). It deserves re-examination and practical attention by students of child development whose households include young children. It is a recording technique to maintain a sequential account of growth changes and behavioural episodes from the life history of the child. The notings are selective in the face of innumerable events that pass in an endless procession. The entry record in sequence need behavioural events in the behavioural continual of one subject. A special feature of the method has always been close and essentially continuous contact between the subject and the observer. Diary records may include reports of casual interviews and of improvised psychological tests. Diary records may be defective in being biased in selecting procedure, but as a basic method it has unique advantages. It gives a multimentional picture of simultaneous and successive factors in behaviour and circumstances of an individual child. It saves for later study at any time and for any purpose comparatively intact.
specimens of behaviour with its context. Diary description takes into account the continuity of behaviour. It records the actual unrolling of one stage after another and the steps by which the changes come about. The longitudinal principle in this method is better implemented than in any other method. Trained students of child behaviour could keep diary records without bias and error. So much of the work of psychologists on growth problems has been piece work in the absence of the best assembly line—the growth stages of a single child.

2. **Time Sampling**

This closed procedure fixes attention of observer and analyst upon selected aspects of the behaviour stream as they occur within uniform and short time intervals (Wright, 1960). This method is defined primarily by its temporarily uniform observation intervals. Time sampling has served attraction which include systematic controlled selection of phenomena to be observed, representativeness and reliability, economy of time and effort. Its coding schemes minimize equivocal judgments and it achieves standardization of observer and analyst. However, on the other side, it is limited to problems of incidence. It has been concluded that if the behaviour to be observed occurs less than once in fifteen minutes on the average some other method is indicated. It does not often link behaviour with co-existing situation. The evident aim of the method
in its more typical applications is normative. Time sampling may be at its best in proving an efficient way of testing hypothesis about how often children behave in given ways in life settings under specified conditions.

3. Field study Method

The field study method is the oldest research technique used in any science. It is not a substitute for the experimental method, but is often applicable where experimentation is impossible. The field study method might be described as making direct observations of nature. The investigator simply goes into the field with a definite question (or set of questions) and makes observations, without trying to hold constant or even to know all the conditions under which his subjects are operating. Often the observer does not even need the direct co-operation of his subjects in fact, some field studies are most successful when the subjects are not aware of being observed. In other instance the investigator finds it helpful to join in the day to day at his subjects for a time in order to gain a clearer understanding of their ways of living. Variation of this field study, is the method of direct measurement. In this method the investigator simply goes into the field and gets actual objective measurements of the various body parts. These measurements are obtained with the help of objective tools by applying certain
techniques to measure the different dimensions of the body parts. The method of direct measurement has become more popular in the recent years for anthropological studies.

4. Life History Method

Life history methods of psychological research involve making intensive studies of individuals over a considerable period of time, usually in the attempt to trace the development of a particular form of behaviour being investigated. In other words the psychologist studies the conditions in people's lives which have led to their becoming whatever they are, be they criminals, physicians, spinsters or political agitators. By studying the antecedents of a specific form of behaviour, he hopes to find its causes. The three basic life history methods are the day book method, the clinical method and the biographical method.

The day book method is most often used in child study. The child's development is carefully observed and recorded day by day. A day book record might contain descriptions of when a baby first sits, stands, walks and begins to talk. Accumulated records of this kind give standards by which one can judge the normality of the development of individual children.
The clinical method represents an elaboration and extension of the day book method. Here the past life history and present life situation of a person are explored on the basis of any information available, usually in an effort to discover the cause of and solution to some emotional or social adjustment problem. The most effective clinical study usually requires at least three professional functions. A physician examines the individual for signs of physical illness, a social worker examines the home conditions which surround and have surrounded the patient, and a psychiatrist administers and scores various tests of aptitude and personality. When a full record has been obtained of the important past and present influences in the patient's life, this information is put together and discussed at a staff meeting and recommendations are made. In some cases extensive therapy is undertaken; in others special training of some kind or a change in the home situation may be called for. A good psychological clinic provides for a follow up to see whether its recommendations have been carried out and whether progress has been made.

The clinical method has two important functions. First, it compiles information concerning the emotional and personality adjustments of human beings and it becomes thus an additional means of observing and interpreting facts. Second, this method involves attempts to modify
behaviour in the interests of greater personal and social welfare.

The biographical method is simply an attempt to obtain psychological understanding from an analysis of the records of men's lives as set down by themselves or others.

An example of the use of the literary biography for psychological research is found in a study by the famous psychologist and educator Edward L. Thorndike, who made personality analyses of ninety-one famous men on the basis of information contained in their biographies (Thorndike, 1950). Using evidence drawn from the writings, speeches, and actions of these men, Thorndike undertook to rate each man in terms of forty-eight different personal characteristics such as intelligence, sensitiveness, sociability, agreeable, liking for beauty, liking for exercise and so on.

The results of such biographical studies can be useful in giving insight into the characteristics which underlie the achievement of greatness in various professional fields. There are certain limitations, however, to the scientific value of this method. In the first place, the biographer's motivation is always a matter of question. The writer may strive for a true record, but if his interest is great enough to motivate him to write, he is likely to be biased
either for or against his subject. In the second place, biographical accounts are not always sufficiently complete or accurate, for most biographers are not psychologists and may overlook seemingly insignificant incidents which actually were important in determining the course of the person's actions and achievements. Lewis M. Terman, a psychologist who devoted much of his life to a study of mental development, complained of the "utter inability of a majority of otherwise competent biographical writers to appraise and interpret the facts which they themselves have recorded with reference to the early mental development of their subjects."

5. Survey Method

When it is not feasible or desirable to spend a long period of time in the field or to obtain data about all the individuals in a group, much valuable information may be obtained by conducting a survey. In this method the investigator, by using written questionnaires or oral interviews obtains data from a selected group. It is important that he chooses his group carefully so that it will constitute a representative sample of the larger group, or universe, in which he is interested. A representative sample is one drawn in such a way that every person in the universe from which it is drawn has an equal chance being
selected. If the sample is not representative, the data collected will be of little value.

6. Experimental Method

The most highly developed, formalized and accurate of all scientific methods is the experimental method. This method provides a procedure for testing the validity of tentative hypothesis and predictions that have been formulated on the basis of previously observed facts. It is the one preferred by most psychologists, and the one that has given us most of our basic facts.

Before making any actual observations, the experimenter carefully defines and analysis the problem under consideration to ensure the greatest possible accuracy and clarity of results. A formal statement called the experimental design defines the experimental problem, states the conditions under which the observations are to be made and described the instruments and apparatus to be used in making accurate observations, and outlines the procedures to be followed in interpreting the results. The preparation of an experimental design has an advantage over less formal methods in which it allows the same experimenter, or other experimenters to repeat the investigation under the same conditions in order to see if the same results are obtained. Such replication is essential, for only as early observations
are confirmed in later studies can they be then finally accepted with confidence. Indeed, replicability is the mark that distinguishes sound work in any science.

7. Interview Method

The interview is a technique to uncover subjective definitions of experiences. It may be the principal technique in studies on concept development. It may also be used in pilot studies for developing hypothesis to be tested subsequently with other techniques. Interview as a technique depends on an inter-personal relationship; hence, it may be more suitable for certain types of problems than others.

A major problem in interviewing children is their limitations in language. It can not be used as a preverbal stage of development or with children having auditory or language handicaps. Special care must be exercised by the interviewer to avoid influencing the child to give the response he thinks will win adult approval. The interviewer must convey to the child his genuine interest in him and in his feelings and ideas.

In the standardized interview the questions are completely formulated prior to the interview session and are presented the structure may consist merely of an outline of suggested topics to be introduced at any point it seems meaningful to do. In the directive approach the interviewer may maintain complete control of the contents of the inter-
view whereby in the non-directive approach the interviewer may simply open up an area of discussion and follows the leads of the child.

The form in which the data are collected and recorded will determine the kinds of analysis that will be possible.

Compared with the written questionnaire the interview has a number of advantages. The interviewer is in a position to clarify the questions.

6. Questionnaire Method

The written questionnaire in contrast to the interview with its personal relationship, creates very different subjective setting for the child as it involves a minimal personal relationship between subject and investigator. Whenever possible, the attitude questionnaire should be tested as an interview to establish a feel for children's reaction to it, before applying it in the field. The technique of asking questions requires a combination of various kinds of knowledge and skill if it is to be used fruitfully with children.

A questionnaire is relatively free from the biasing influence from the race, sex, attitudes, age and such other characteristics of the interviewer. On the other hand better of question is possible in the interview than in the questionnaire.
From the alone discussion it can be seen that no single method is competent enough for studying the growth of an individual. The nature of the present study demands physical measurements of various body parts in order to find out the pattern of growth if there is any, as such it was decided to make use of more than one method of studying the growth. Hence, it was further decided to make use of the combination of time-sampling method, the field study method—especially the method of direct measurements, the survey method and the interview method.

3.6.2 The Sample to be selected for the Study

The other crucial problem was about deciding the area, size of the sample and the methods of selecting the sample.

1. Problems of selecting the Urban and Rural Areas

As the investigator is residing in Anand and is enrolled as a Ph.D. student in the M.B. Patel College of Education, Sardar Patel University, Vallabh Vidyanagar. It was decided to have two district areas i.e. urban and rural but the problem was to consider the urban area as there is no big city in the district, so it was decided to select taluka places towns as urban milieu and villages as rural milieu from Kheda district.
Further for the partly longitudinal study, pupils were to be measured every four months which implied that the areas to be included in the study had to be accessible by road and rail throughout the year.

Keeping this in mind the schools were selected:

2. Schools to be covered in the Study

In Kheda district schools of primary and secondary levels were selected from different localities so as to cover the different socio-economic groups. The schools were selected for studying the physical growth of pupils, because in the schools, measurements of many pupils can be taken up at a time in the required age group, coming from varied socio-economic groups. One may also expect co-operation from headmasters and teachers, who appreciate the importance of the study. At a time one may measure a large number of children with relatively less consumption of time at low expenditure, in comparison to take measurements at homes scattered over a large area. The schools are better places than homes for such studies. In the former, one may expect to get the same child for observations at least for a year and the children enrolled in schools are usually available throughout the school days.

With the above consideration in mind only school going pupils were included in the present study. The details about the schools selected is given in Appendix-A.
3. **Sample of the present study**

Considering the requirements demanded by the statistician, one has to take into account the possibility of losing many of the pupils half way during the period of study. This risk of losing the pupils for study is there, in case of the age group 10 to 12 years. This may not present a very serious problem in a cross-sectional study, but the inadequacy of the children in a longitudinal study is obvious. Such consideration make it imperative that larger number of pupils are included at each age level than the minimum numbers desired on statistical groups. For the longitudinal study the minimum number of pupils fixed at 40 on the whole at each of the 12 age points distributed on intervals of four months between 10 to 12 years of age under study. Efforts were made to insure that at least at this lower limit of numbers of pupils, boys and girls were sufficiently represented for statistical reasons. Thus out of a fairly large number of pupils (more than 1600) contacted in the beginning, the number of pupils actually available for the statistical analysis of the data at the end of study included 773 boys and 362 girls making a total of 1135 pupils of whom 556 came from the urban milieu and the rest i.e. 579 from the rural milieu. The observations made on these 1135 subjects at different short intervals amounted to 3405 in all.
3.6.3 Tools and Techniques
(for figures see Appendix-B)

Another important issue of the study was about deciding the tools for measurement and the techniques to be adopted for measurement. Tools of many kinds and varieties are available, research pertaining to the selection of instruments has been reported by Whilacre (1934) and Gray (1935). The work by Robinson (1963) on defining anthropometric measurements and fixing the bodily landmarks was found useful. The tools and the techniques, adopted for the study for the measurements of different parts are discussed in the pages to follow:

1. **Weighing Balance**

The weight of all pupils, were taken with the help of spring balances in kilograms. First of all each pupil, one by one, made to stand barefooted on the platform of the balance and the weight was taken. The weight was taken with school dress on. Every time a pupil was to be weighed and the pointer on the balance scale was adjusted to zero. The units of measurements of weight were in kilograms.

2. **Measurement of Height (standing height) and the sitting height**

All the measurements other than weight were taken in centimetres and from the left side of the pupil.
A platform-cum-measuring rod was used for the height measurement. The pupil was made to stand barefooted on the platform in such a way that the heels touched the flanks. The head is positioned so that the lowest point on the boarder of the bone socket of the left eye and the highest point on the anterior margin of the tragus of each ear lie in a plane at right angles to the long axis of the trunk. In this position the standing height was measured as the projected distance from the top of the head to the planter surface of the feet. The right angle was suitably moved in the grave so that its projected arm rested upon the top of the pupil's head. The reading on the scale corresponding to the lower surface of the projected arm of the right angle gave the standing height in centimetre.

Sitting Height

The measuring device was placed on a table at such a height that the feet of a pupil sitting on the top with the legs, hanging freely from the knee joint, would not touch the floor on which the table rests. The pupil was made to sit on the platform in an upright position with his flanks touching the platform and the lower half of the lower limbs (legs) hanging freely from the knee joint. The dorsal surface of the buttocks would press against the flanks on the lower end of the rod. The reading on the scale corresponding to the top of the head in this position would give the sitting height.
The length of the lower limbs was derived from the difference between the standing height and the sitting height of the pupil. The difference between the two measurements was considered as length of the lower limbs.

3. Measurement of length and Circumferences

The device used for the measurements of length of the arm, leg, and foot and the circumference of various parts of the body was a measure tape, known as a singer measure tape. The techniques adopted are as follows:

a. Circumference of the head

The circumference of the head was measured along with the hair. The investigator stood before the pupil and the tape was held on the forehead with the left hand and then taken around the head horizontally over the left side to the galebella. The tape was allowed to overlap the zero and beyond the 10th centimetre mark and the marking on the scale of the overlapping portion of the tape corresponding to the 10th mark was read. This reading minus ten gave the head circumference in centimetre.

b. Width between Shoulders

The pupil stood on the floor, and the investigator stood behind the pupil, with the left hand, the investigator placed the zero end of the tape on the left acromion of
the pupil and with the right hand the tape was stretched up to the right acromion of the subject. The distance was taken as the biacromial width.

c. Circumference of the Neck

The pupil stood in front of the investigator. The investigator with his left hand placed the 10th mark of the tape on the front side of the neck of the pupil and with the right hand the tape was placed around the neck horizontally. The reading on the tape overlapping this point which corresponded with the 10th centimetre was read. The reading minus ten centimetre gave the circumference of the neck in centimetre.

d. Circumference of the Chest

Chest circumference was measured with the pupil breathing normally. The investigator stood in front of the pupil. The tape was placed around the chest horizontally at the level of the nipples passing over the lower scapular angle in such a way that the mark of 10th centimetre on the tape was placed on the right nipple of the subject and the reading on the tape overlapping this point which corresponded with the 10th centimetre was read. The reading minus ten centimetre gave the circumference of the chest in centimetre.
e. Waist Girth

To take the waist girth, the investigator stood in front of the pupil. The tape was placed around the waist horizontally at the level of the navel, the mark of the 10th centimetre of the tape was placed on the navel of the pupil and the reading on the tape overlapping this point which corresponded with the 10th centimetre was read. The reading minus ten centimetre gave the girth of the waist in centimetre.

f. Hip Girth

This was measured as the maximum circumference between the loin and the upper part at the thigh. The investigator held the tape at the 10th mark on the scale and placed it around the loin from the left side of the pupil. The mark on the scale on the overlapping tape corresponding to the tenth mark was read. This reading minus ten gave the girth of the hip.

g. Arm-Length

The pupil stood erect in front of the investigator, with the arms fully stretched and hanging freely. The investigator measured the distance between the acromion and the tip of the middle finger of the left hand of the pupil with the measuring tape. This gave the length of the full arm.
h. Length between Shoulder and Elbow

The procedure adopted was similar to that described for arm length. The distance between the acromion and the bone of the elbow, was taken as the length between shoulder and elbow.

i. Length between Elbow and Wrist

The procedure for measuring the length was similar to that of described for arm length. The distance between the elbow and wrist was taken as the length between elbow and wrist.

j. Upper Arm Girth

This was taken as the maximum circumference of the left upper arm where the bicept muscles are most developed.

k. Wrist Girth

The girth of the wrist was taken at the point where the lower end of the hand and upper part of the palm joined together with the help of the measuring tape. The procedure of measuring the girth was similar to that of described for neck circumference.

l. Leg Length

The length of the leg was derived from the difference between the standing height and the sitting height of the subject.
m. **Lower Limb Length**

The pupil stood straight before the investigator. The investigator held the zero end of the tape on the ground touching the lower part of instep of the left leg and the other side of the tape towards upper part of the leg. The distance between the lower part of the instep and the lower part of the knee was taken as the length between the knee and the sole of the foot.

n. **Thigh Girth**

The girth of the thigh was measured at the maximum circumference of the upper leg between the knee joint and gluteal furrow. The investigator held the tape at the 10th mark on the scale and placed at round the left thigh from the left side of the subject. The mark on the scale on the overlapping tape corresponding to the tenth mark was read. This reading minus ten gave the girth of the thigh.

o. **Calf Girth**

The girth of the calf was measured at the maximum circumference where calf muscles are most developed. The procedure adopted was similar to that described for thigh girth.
p. **Foot Length**

The pupil stood at the corner of the classroom in such a way that his heel of the left foot touched the corner of classroom and toe towards the wall. The investigator had well in advance marked the measurements with the measure tape from the corner of the classroom on one of the walls. This marking was just one inch above the bottom. The investigator read the markings at the toe-point. This gave the length of the foot.

4. **The tool to measure socio-economic levels of the pupils**

To decide the socio-economic levels of the pupils a separate tool was prepared (vide Appendix C) wherein there are six different parts, under each parts (except the 6th one) there are five different categories. Each category denotes a separate level of socio-economic status. These categories are in hierarchic order and each having a score of one point. That means in each part the maximum possible score is **five** and the minimum possible score is one. In the sixth part there are ten items arranged in a hierarchic order and each having a $+\frac{1}{2}$ score the preceding one. The maximum possible score for this section would be $5$ and the minimum possible score would be zero.
Dividing the total by the number of items, the score for SES was obtained. For convenience such scores were converted into the whole numbers.

The tool to measure socio-economic levels of the pupils

1. Education of the father classified as:
   i. Illiterate
   ii. Primary Education
   iii. Secondary Education
   iv. College Education (U.G.)
   v. Post-graduate Education

2. Family income level per month classified into five categories:
   i. Rs. 150 to 300
   ii. Rs. 301 to 450
   iii. Rs. 451 to 800
   iv. Rs. 801 to 1600
   v. Rs. 1601 and above

3. Physical facilities/vehicle
   i. Cart or Cycle
   ii. Car or Scooter
   iii. Scooter or Motorcycle
   iv. Car or Tractor
   v. More than one car or equipments with tractor or truck etc.
4. **Occupation levels of the father classified as:**
   
i. Manual labour, Peasants, Service of Class IV.
   
ii. Teacher, Clerk, Owner of a small shop, Service of Class III.
   
iii. Farming medium range business, Lecturer in College Service of Class II.
   
iv. Doctor, Lawyer, Contractor, Engineer, Service of Class I.
   
v. Industrialist, Director of Commerce, Senior Administrative Officer

5. **House Classified as:**
   
i. Hut, Mud-hut or rent upto Rs. 50/-.
   
ii. Small mansard structure or rent Rs. 51/- to 100/-.
   
iii. Medium size pacca bulding or rent Rs. 101/- to Rs. 250/-
   
iv. Owned bunglow or rent Rs. 201/- to 450/-
   
v. Independently owned bunglow or rent Rs. 451/- and more

6. **Other facilities classified as:**
   
i. Table, Chair
   
ii. Pressure Cooker
   
iii. Heart of gas or electric cooking range
   
iv. Radio or tape recorder
3.7 Training to Assistants

It was rather impossible to cover up the entire sample for three consecutive measurements individually. Hence, it was decided to train the assistants for data collection by way of taking various measurements at regular time intervals. As the same sample of pupils was to be measured thrice, it was decided to have the first measurement set by the researcher himself and the other two sets with the help of assistants. Keeping this in mind the first set of measurements was taken by the researcher himself in presence of the assistants to be trained for the purpose. Different techniques of taking measurements were demonstrated before them. After evaluating their performance they were asked to take measurements independently. This way the other sets of measurements were to be obtained with the help of trained assistants.
3.6 The System of Analysis of the Data

As soon as the collection of data was over, a detailed "Master Chart", showing numerical scores for all the variables under study was prepared.

On the basis of the said Master Chart, the score cards were then got punched at the Computer Centre, Sardar Patel University, Vallabh Vidyanagar, for further statistical calculations. After verifying the cards, the computer machine was fed with the cards to calculate the required statistics.

The main purpose of the study is to investigate the influence of the urban and rural milieu, the socio-economic status as well as sex differences in the physical growth of 10 to 12 age group pupils, and hence, the M'S and SD'S of all the variable were obtained, and 't' value for the difference between mean scores were obtained to test the significance of the differences between mean scores of different groups. The data of 446 pupils were classified according to four (SE₂, SE₃, SE₄, SE₅) socio-economic levels, irrespective of area and sex, and they were subjected to statistical technique of analysis of variance.