The

PHYSIQUE OF BELFAST SCHOOLCHILDREN

A Report
to the Northern Ireland Hospitals Authority

by

E. A. Cheeseman and A. L. Walby
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and
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The heights, weights and intercristal diameters of a random sample of children attending the primary and intermediate schools of Belfast in 1951-52

by

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PREFACE

by

F. M. B. ALLEN

(Nuffield Department of Child Health, Queen's University of Belfast)

THE development of a child is of particular interest to its parents. Pædiatricians are in a better position than most to appreciate the anxiety of a mother as to whether or not her child is undernourished or underdeveloped. Unfortunately family doctors and pædiatricians have found that a modern standard of average height and weight of schoolchildren in this country is not available for the purpose of comparison with a particular child. With a view to meeting this need of doctors in Northern Ireland the authors of this paper undertook the laborious task of weighing and measuring more than twelve thousand children in Belfast.

The Department of Child Health was happy to be associated with the Department of Social and Preventive Medicine and the School Health Services of the Belfast Health Authority in the project. It should be acknowledged, however, that the formidable undertaking was only possible with the co-operation and financial assistance of the Medical Education and Research Committee of the Northern Ireland Hospitals Authority, to whom we are all duly grateful.

It would be of interest to compare the results of this survey with the findings in other industrial communities within the United Kingdom and possibly with one or more urban centres with less emphasis upon industrial activity. With a view to establishing a pattern which would apply widely this report is set out in considerable detail so that it may be easier to compare the development and nutrition of children in other centres with greater accuracy and ease.

1. INTRODUCTION.

1.1 Origin of the Survey.

In the spring of 1950 Professor F. M. B. Allen, of the Department of Child Health in the Queen's University of Belfast, discussed with us the scarcity of information about the physical measurements of Northern Ireland children. This led to the preparation of a memorandum on the action which might be taken to remedy this deficiency. The memorandum was considered at a meeting of interested parties convened by Professor Allen in May, 1950. Representatives attended from the Ministries of Health and Local Government and Education of Northern Ireland, the Northern Ireland Hospitals Authority, the Education and Health Committees of the Belfast Corporation and the Departments of Child Health and Social and Preventive Medicine of the University. Clinicians of the Royal Belfast Hospital for Sick Children and medical officers of the Belfast Corporation and local school-teachers also attended as individual members of the meeting.

As a result of the meeting it was decided that a survey should be undertaken to measure the heights, weights, and possibly other characteristics, of a representative group of children attending the schools administered by the Belfast Education Committee. To plan the survey a committee was formed whose members were as follows :—

PROFESSOR F. M. B. ALLEN (Professor of Child Health, The Queen's University of Belfast).

DR. E. A. CHEESEMAN (Reader in Medical Statistics, The Queen's University of Belfast).

MISS K. FLYNN (Principal, St. Comgall's Girls' Primary School).

DR. T. F. S. FULTON (Senior Schools' Medical Officer, Belfast County Borough).

MAJOR W. D. GEDDIS (Councillor, Belfast County Borough Council).

DR. J. S. HAWNT (Director of Education, Belfast County Borough).

MR. J. H. KEERS (Principal, Everton Primary School).

DR. A. L. WALBY (Assistant Medical Officer, Belfast County Borough).

1.2 Progress of the Survey.

The committee met twice, Councillor Geddis acting as chairman and one of us (A. L. W.) as secretary. At the first meeting it was agreed that a sample of about one in five of the children attending primary and intermediate schools should be measured; the characteristics chosen were height, weight, and intercristal diameter, which were to be measured at one centre by the minimum number of observers using the same equipment throughout. These measurements were to be related to age and sex, and the results of the survey were to be reported in a form suitable for clinical use. The authors agreed to draw up a plan for the investigation. This

plan was approved at the second meeting of the committee, at whose request they also agreed to undertake responsibility for the organisation, administration, and conduct of the survey and for reporting on the results.

The Northern Ireland Hospitals Authority gave financial support by paying for the cost of transporting children from their schools to the measurement centre and for the punch card analysis of the crude data. Preparation of the sampling plan, obtaining the necessary equipment, and preliminary organisation, occupied us until the summer of 1951, and measurements were made during the school year, 1951-52.

2. SAMPLING PROCEDURE.

2.1 The Population Surveyed.

The administrative difficulties in obtaining a sample representative of the complete child population of Belfast were too great to be overcome in the time available. Consequently it was necessary to limit the population surveyed to those children aged five to thirteen years inclusive who were attending primary or intermediate schools of the Belfast Education Committee during the school year, 1951-52.

At the Census of Population held in April, 1951, 68,927 children of the relevant ages were enumerated in Belfast, of whom 35,118 were boys and 33,809 were girls. (Registrar-General for Northern Ireland, 1952). From statistics compiled for the Belfast Education Committee it appears that at the end of December, 1951, there were 60,853 children on the rolls of primary and intermediate schools in the city. Of these children, 30,956 were boys and 29,897 were girls. (Hawnt, 1953; Patterson, 1953). Thus the population surveyed probably represents about 88.3 per cent. of the total resident child population at ages five to thirteen inclusive, and there is little difference between the sexes (88.1 per cent. for boys and 88.4 per cent. for girls).

It is likely, however, that this proportion would be somewhat lower in children over the age of eleven and higher before that age, because of the transfer of some children to secondary schools.

2.2 Size of Sample Used.

At the time when the survey was planned it was estimated that the population to be surveyed consisted of about 65,000 children aged five to thirteen years inclusive. It was hoped ultimately to present estimates of each measurement for each year of age for each sex. Thus for a single year of age and for one sex the estimates would represent the measurements of about 3,500 children. With the resources and time available it was expected that a random sample of about one in five children would give as much work as could be efficiently handled; thus at each year of age the proposed sample would consist of about 700 boys and 700 girls.

Work done elsewhere (Benjamin, 1943; Karn, 1936; and Fleming and Martin, 1933) suggested that for a group of 700 children the standard errors of mean height

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and weight estimates might be about 0.15 cm. and 0.04 kg. in the younger children and 0.25 cm. and 0.19 kg. in the older. No similar estimates for intercristal diameter could be traced. Such results (unless a one in twenty chance occurred in sampling) would imply a precision of plus or minus twice these standard errors for the total population means. No greater accuracy was needed for clinical use.

2.3 Method of Sampling.

No central list of pupils attending the primary and intermediate schools was available. However, each principal teacher maintained a roll of the children in his school, including the names, sexes, and dates of birth. After considering various methods of sampling from these rolls, it was agreed to include in the sample all schoolchildren born on any of the first seven days of any month. This gave slightly more than one in five of the population, but was thought unlikely to bias the sample from a random selection. Subsequently children aged less than five or more than thirteen were excluded from the results of the survey, although some of them were, in fact, measured. It was considered that these children, although representative of the pupils attending school at those ages, might be a somewhat biassed group compared with other ages in that they were not obliged to be at school, and the fact that they were attending could reasonably be related to their physique.

This method of sampling yielded 12,700 children aged five to thirteen years, of whom 6,429 were boys and 6,271 were girls. The sex ratio (50.62 boys per 100 boys and girls) compares reasonably well with that of the population from which they were drawn (50.87 boys per 100 boys and girls in the Education Committee's 1951 data) and with that of the Census of Population for children of this age group (50.95 boys per 100 boys and girls).

3. CONDUCT OF THE SURVEY.

3.1 Preliminary Arrangements.

If generalisations were to be made about the measurements of the total school population from the results obtained from the sample, then it was desirable that all sample members should be measured. Unfortunately this ideal was not attained, but the losses were relatively small, and are discussed later. In an attempt to attain the ideal, an approach was made to all individuals and authorities likely to be concerned with the children in the sample and their support obtained. The proposals of the committee were made known to the President of the Central Council of Parents' Associations in Northern Ireland, who also gave support and undertook to make members aware of the value of the survey and the need for full co-operation from parents. In this way, parents had some advance warning of the survey and its purpose before they were involved; this was thought to be advisable since the representatives of the Education Committee stipulated that parental consent was required.

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3.2 Procedure followed during Survey.

3.2.1 General Plan.

In an attempt to make all the measurements on different children comparable, the same team of workers, using the same equipment, carried out all measurements at one centre, the Royal Belfast Hospital for Sick Children. Throughout the school year, 1951-52, three measuring sessions were held at this centre each week, and on the average about one hundred children were present at each session. Schools were dealt with in batches, the sample members from one or more schools being brought to specified sessions.

The measurements were spread throughout a whole year to minimise the possible effect of seasonal variations in growth. For the same reason care was taken that schools of one type or from one district were not all sent for in the same season.

3.2.2 Preparation for a Measuring Session.

About five weeks before the sample members from a particular school were required to attend the measuring centre a letter was sent to the principal, explaining the purpose and conduct of the survey. Enclosed were sufficient copies of a letter to parents which the principal distributed to each child on the roll. The letter to parents explained the survey in simple terms and asked for co-operation, but gave each parent an opportunity of withholding his permission for the child to be measured. The principal noted the names of any children whose parent objected within the seven days allowed, and these are referred to as "refusals" in what follows.

A week later a second letter was sent to the principal, together with sufficient record cards for the sample likely to represent the school; one card was used for each child. Also enclosed with this letter were instructions for preparing the cards and a form (Form A) for entering the number of cards prepared. The card and Form A are reproduced in Appendix 1.

The instructions for completing the cards included the method of selecting the sample; and, having identified the sample members from the school roll, the principal entered the name, sex, date of birth, and registered number, of each sample member on a card of the appropriate colour—blue for a boy and pink for a girl. When one of the sample members was found to be a refusal, this was indicated by entering the child's address in the appropriate panel on the card. Having prepared the cards, the principal entered on Form A the number of boys and the number of girls in the sample for each year of birth—this in total corresponded to the number of cards prepared. Also on Form A, again by sex and year of birth, the number of refusals was entered—this in total corresponded to the number of cards on which children's addresses were entered. Form A was then sent to the secretary of the advisory committee.

About a week before the sample members of the school were required for measuring, a third letter was sent to the principal, giving the detailed arrangements for collection and return of the children by bus, or, if the school was near the hospital, the time at which the children were to attend. It was arranged that a

teacher accompanying the party should bring the record cards of all the sample members who were present on the measuring day and those of all refusals. Cards for those who were absent on the measuring day (henceforth termed "absentees") were kept at the school in the hope that these children would be measured later.

In the original design of the survey it was hoped that staff would be available to visit the parents of sample members who had not agreed to have their children measured and try to get their consent. In practice, however, neither staff nor time was available for such visits, and this feature of the survey was reluctantly abandoned. Similarly it was not possible to find time and sufficiently economic transport to collect the absentees. The possible effects of these omissions are discussed later.

3.2.3 Procedure at a Measuring Session.

Attendance was arranged so that the children arrived at the measuring centre at 2 p.m. On arrival in the hospital waiting-room each child was given his record card by the escorting teacher. The middle room of a suite of three, with communicating doors, was used for measuring, and the other two for boys' and girls' dressing-rooms. Undressing and dressing were assisted by nurses of the hospital and the school medical service. The children from one dressing-room then filed into the measuring-room, each with his card, where first height and then weight were recorded by one person, and lastly intercristal diameter was measured by another, who retained the card. The children then dressed and returned to the waiting-room, from whence they were taken back to school usually before 3.30 p.m.

A check was made by the nurse as each child entered the measuring room to see that he held his own card. It was found necessary to verify this by asking the child his name again at each stage, because cards were frequently exchanged in the queue through being dropped and picked up by the wrong child.

After the last measurement had been entered on a card it was scrutinised by a third observer for omissions or obvious errors so that they could be corrected before the child had left. It was sometimes necessary to recall from the dressing-room a child with one or other measurement unrecorded and to verify an unlikely measurement. These unlikely measurements were usually correct however, except that in recording height over 100 cm. errors sometimes arose owing to the calibration of the scale, which read: "98, 99, 100, 1, 2," etc. Badly written figures occasionally needed checking. The cards were again examined later, and some were still found to need verification. About 120 improbable measurements were compared with personal records of school medical examinations, and all, except six, were found to be consistent. Three children could not be traced; and three were remeasured, but revision of their cards was not necessary. All these cards were allowed to remain.

The sample included ten frankly abnormal children, but none of these was rejected, although their defects were noted on the cards. Thus are included an achondroplasiac, a one-legged and two one-armed children, three children wearing light plaster-of-paris splints for arm fractures, a child wearing a surgical corset

and collar for spinal paralysis, a child who could not be made to stand as detailed below owing to severe kyphoscoliosis, and one whose pelvis was deformed by an accident. No children were rejected because they were obese or spare or tall or short.

A minor administrative problem was presented by the not infrequent finding of illness, particularly infectious fevers, among children already undressed for measurement. Cases of whooping-cough, measles, German measles, scarlet fever, chickenpox, impetigo, and ringworm were encountered; minor injuries and cuts needed attention; a child who had fallen at school was found to have a fractured wrist.

3.3 Omissions from the Sample.

The validity of sample estimates as representing the population from which they are drawn is likely to be impaired if many of the sample members escape measurement. To avoid such losses the survey was originally planned so that refusals and absentees could be traced and if possible later included in the survey. This proved impracticable, and so the possibility that the omissions bias the sample estimates must be considered.

In the whole sample of 12,700 children, 11,425 (90 per cent.) were measured. The remaining 1,275 (10 per cent.) children consisted of 474 (4 per cent.) refusals, and 801 (6 per cent.) absentees. The age and sex distribution of the omissions is compared with that of the measured children in Table A.

The proportions of refusals at different ages are similar; the rate ranges between 2.8 and 4.6 per cent. for boys and 3.0 and 4.2 for girls. The proportions of refusals among boys and girls are also similar at 3.8 and 3.7 per cent. respectively for all ages combined; at no single year of age does the sex difference exceed 1.5 per cent. Slightly greater variation between the ages and between the sexes occurs in the absentee rates. Except at eleven, relatively more boys were absent than girls, but the difference in the absentee rates exceeds 1 per cent. only at ages six and eight with 2.6 and 1.3 per cent. respectively. In both sexes the proportion of absentees is high at the extreme ends of the age scale, the maximum difference between age groups being about 6 per cent. in each sex. This higher rate of absence in five- and thirteen-year-olds is the usual finding throughout the school year. It is thought to be accounted for by a high incidence of infections among five-year-olds on first going to school and the practice of keeping the older children at home to help in cases of illness or other domestic emergency.

To sum up, it seems unlikely that the refusals formed a select group in the matters of age and sex compared with the measured children, but it is possible that the absentees were somewhat different in their age constitution from the measured children. It is, of course, not possible to know whether the omitted children formed a group not representative of the whole in the matter of their physical measurements; it can be argued that the children of poorest physique are most likely to be absent, but the proportion of omissions is small and should have little effect unless such arguments can be strongly substantiated.

TABLE A.

Age and sex distribution of sample members measured compared with that of "absentees" and "refusals."

Age Group in Years	Boys				Girls			
	Measured	Absentees	Refusals	Total	Measured	Absentees	Refusals	Total
5–	463 (86.9)	55 (10.3)	15 (2.8)	533 (100)	523 (86.4)	57 (9.4)	25 (4.1)	605 (100)
6–	700 (86.4)	76 (9.4)	34 (4.2)	810 (100)	645 (89.6)	49 (6.8)	26 (3.6)	720 (100)
7–	692 (89.6)	47 (6.1)	33 (4.3)	772 (100)	714 (90.5)	43 (5.4)	32 (4.1)	789 (100)
8–	752 (90.0)	51 (6.1)	33 (3.9)	836 (100)	798 (91.0)	42 (4.8)	37 (4.2)	877 (100)
9–	803 (90.8)	40 (4.5)	41 (4.6)	884 (100)	759 (93.1)	30 (3.7)	26 (3.2)	815 (100)
10–	707 (91.5)	34 (4.4)	32 (4.1)	773 (100)	689 (93.5)	26 (3.5)	22 (3.0)	737 (100)
11–	676 (92.2)	32 (4.4)	25 (3.4)	733 (100)	622 (91.2)	35 (5.1)	25 (3.7)	682 (100)
12–	523 (90.0)	45 (7.7)	13 (2.2)	581 (100)	486 (89.3)	38 (7.0)	20 (3.7)	544 (100)
13–	439 (86.6)	52 (10.3)	16 (3.2)	507 (100)	434 (86.5)	49 (9.8)	19 (3.8)	502 (100)
Total	5,755 (89.5)	432 (6.7)	242 (3.8)	6,429 (100)	5,670 (90.4)	369 (5.9)	232 (3.7)	6,271 (100)

Figures in brackets represent percentages of totals in each age and sex group.

4. TECHNICAL ASPECTS OF THE DATA.

4.1 Methods of Measurement.

4.1.1 Clothing.

It was originally intended to measure the boys in socks and underpants only, but it was soon found that many had no underwear, and so all were allowed to wear trousers. Girls were measured in socks and knickers only, with the exception of the older girls, who were allowed to wear vests if they wished. The apparatus showed no difference in height with or without socks.

4.1.2 Measurements.

All measurements were made by members of a team of five doctors, at least three of whom took part in each session. The same weighing machine, height scale, and pelvimeter, were used throughout the survey.

Height was measured with a sliding horizontal cursor on a centimetre scale attached to a wall. Children were made to stand as erect as possible, with feet together, with heels, back, and head, touching the wall, and looking forward at eye level. Height was recorded to the nearest 0.25 cm.

Weight was recorded to the nearest 0.1 kg. on a large platform balance with a 2 ft. diameter shadowless dial. With the machine used it was not necessary for children to stand exactly on the centre of the platform, and a low rail fitted to the platform prevented children steadying themselves by holding the fixed pedestal. Readings could be taken quickly and accurately, for the pointer soon came to rest. The accuracy of the machine was verified at the beginning, middle, and end, of the survey.

Intercristal diameter was measured with an obstetric pelvimeter calibrated in centimetres. Measurement was made without intervening clothing and was recorded to the nearest 0.5 cm.

4.2 Method of reporting Results.

The tables (I-XX) showing the results of the survey appear in Appendix 2 and the graphs (figures 1-10) based on the results appear in Appendix 3. The tables I-XVIII and the graphs should be considered in pairs; odd numbers refer to boys and even to girls. Tables I and II set out estimates in metric units of the three measurements for each single year of age. Tables III and IV repeat this information in Imperial units. Tables V and VI give estimates in metric units of weight and intercristal diameter of children in height groups of five cm. each over the height range 100-159 cm. In these two tables children whose height was outside this range have been omitted, as they were too few to give reliable results. Tables VII-XVIII set out the basic tabulations of the data to permit other calculations and for comparison with data produced elsewhere. Tables XIX and XX give a handy reference to the estimates according to age in metric and Imperial units respectively.

In the tables age is shown as, for example, "5–". This indicates that the age group includes all children who had attained their fifth birthday when they were measured, but who had not yet attained their sixth.

In tables showing groups of measurements the lower limit of a group is followed by a dash. This implies that the group includes all children of the recorded measurement shown and above, up to, but not including, the lower limit of the next measurement group.

In measurements distributed normally the range given by the mean plus or minus twice the standard deviation includes about 95 per cent. of all observations. In all measurements, however distributed, the range between the first and ninth deciles includes 80 per cent. of the observations. Thus, the tables give mean, standard deviation, standard error of mean, co-efficient of variation, median, and first and ninth deciles, since these will be of use to workers in this field. In the graphs only the median and the deciles are shown because not all the measurements are distributed normally.

Each graph is scaled in Imperial and metric units. Figures 1 and 2 show variations in height according to age; figures 3 and 4 show similar variations in weight, and figures 5 and 6 in intercristal diameter. Figures 7 and 8 show variations in weight according to height, and figures 9 and 10 show similar variations in intercristal diameter.

In all the figures the middle line of the graph shows the measurement above and below which half the observations lie for each group of the variable shown on the horizontal axis (age or height). This line joins the median values of successive age groups (figures 1-6) or height groups (figures 7-10). Ten per cent. of the children had measurements higher than the highest line and 10 per cent. had measurements lower than the lowest line for each group of the variable shown on the horizontal axis. The top line joins the ninth decile values and the bottom line the first decile values of successive age groups (figures 1-6) or height groups (figures 7-10).

5. RESULTS.

5.1 Height according to Age.

The median values of height and the mean heights are very similar for every age group examined (tables I and II); at no single year of age do they differ by more than 0.5 cm. in either sex. Up to age eleven, the boys' mean height exceeds the girls' by about one or two centimetres, but from age eleven onwards the girls become increasingly taller than the boys. At age five the boys' mean height exceeds the girls' by 1.4 cm., whereas at age thirteen the girls' mean exceeds the boys' by 1.5 cm. In both sexes height increases fairly uniformly with age, an average yearly increment of 4.8 cm. being observed for boys and 5.2 cm. for girls.

5.2 Weight according to Age.

The mean and the median weights of both sexes diverge as age advances; at the early ages the difference is about 0.2 kg., while at the later ages it is as high as

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The median values of height and the mean heights are very similar for every age group examined (tables I and II); at no single year of age do they differ by more than 0.5 cm. in either sex. Up to age eleven, the boys' mean height exceeds the girls' by about one or two centimetres, but from age eleven onwards the girls become increasingly taller than the boys. At age five the boys' mean height exceeds the girls' by 1.4 cm., whereas at age thirteen the girls' mean exceeds the boys' by 1.5 cm. In both sexes height increases fairly uniformly with age, an average yearly increment of 4.8 cm. being observed for boys and 5.2 cm. for girls.

5.2 Weight according to Age.

The mean and the median weights of both sexes diverge as age advances; at the early ages the difference is about 0.2 kg., while at the later ages it is as high as

1 kg. Associated with this tendency is the increasing variation of weight as age advances; the co-efficient of variation for boys increases from 11.42 per cent. at age five to 16.67 at age thirteen, while for girls the increase is from 12.24 per cent. to 19.62 at age twelve and 17.90 at age thirteen. As with height, the boys have a higher mean weight up to the age of eleven, but thereafter the girls are heavier; at age five the boys' mean weight exceeds the girls' by 1.1 kg., while at thirteen the girls' exceeds the boys' by 2.0 kg.

The average annual increments of weight are by no means as uniform as those of height; compare figures 1 and 2 with 3 and 4. Between ages five and six the increase in mean weight is only 1.6 kg. in each sex. The annual increment tends to increase somewhat inconsistently for girls, but fluctuates for boys up to the age of twelve. Between twelve and thirteen both sexes have an average increase much larger than between any other two successive years studied—4.2 kg. for boys and 5.3 kg. for girls.

5.3 Intercristal Diameter according to Age.

The mean and median intercristal diameters for each sex at each age are similar, no difference being greater than 0.1 cm. The co-efficients of variation in table I show very little difference in the relative scatter of boys' measurements, but in girls this scatter is greater in the oldest than in the youngest. Again the boys' mean measurements exceed the girls' up to age eleven, but from there onwards the girls' intercristal diameter is the greater.

The intercristal diameter of both sexes increases fairly uniformly from age five to age thirteen; for each year there is a mean increase of about 0.7 cm. in boys and 0.9 cm. in girls, though the girls' annual increment tends to be greater at the later ages.

5.4 Weight according to Height.

In this sub-section of the report and the next the comments are confined to children whose height fell between 100 cm. and 160 cm. The few children with heights outside this range do not give sufficient data for reliable estimates. Tables V and VI give estimates of weight for successive five cm. height groups; figures 7 and 8 show the relevant graphs.

In none of the height groups of either sex do the mean and median weights differ by more than one kilogram. The difference, however, becomes greater with increasing height, a feature in keeping with the greater variability found among weights as height increases; the co-efficients of variation in boys increase from about 7 per cent. to about 10 per cent. and in girls from about 8 per cent. to about 12 per cent., with some fluctuation in each sex.

Boys are slightly heavier than girls of the same height up to about 144 cms., after which the girls are heavier. In the shortest children the boys' mean weight exceeds the girls' by about 0.7 kg., while in the tallest the girls' mean exceeds the boys' by 1 to 2 kg.

Figures 7 and 8 show that, as height increases, weight increases more rapidly in tall children than in short. This is compatible with the larger annual weight increments found as age rises.

5.5 Intercristal Diameter according to Height.

This sub-section also is confined to children whose height fell between 100 cm. and 160 cm.

Tables V and VI show that the mean and median intercristal diameters never differ by more than 0.1 cm. at any height in either sex. The relative scatter of the observations is similar in each height group, the co-efficients of variation fluctuating from 4.22 to 5.09 per cent. for boys and from 4.10 to 5.06 per cent. for girls.

The boys' mean intercristal diameter is higher than the girls' from heights of 100 cm. to 134 cm., and the reverse is true for children taller than 135 cm. At heights where the boys' intercristal diameter exceeds the girls' the difference is never more than 0.2 cm. But for children taller than 135 cm. the difference between boys and girls becomes larger as height increases; a difference of 0.2 cm. appears in the height group 135-139 cm. and this increases to 0.8 cm. over 150 cm. height.

Figures 9 and 10 indicate the fairly linear progression of intercristal diameter with height in these children; each 5 cm. increase in height is associated on the average with an increase of 0.7 cm. in intercristal diameter in boys and 0.8 cm. in girls.

6. COMPARISON WITH OTHER DATA.

6.1 Scope of Comparison.

It is of interest to compare the results of this survey with estimates of height, weight, and intercristal diameter, obtained for children of similar age elsewhere. Unfortunately we have been unable to find any reference to measurements of intercristal diameter in children made during recent years, and consequently this measurement cannot be considered in this section. With heights and weights, however, we have been more successful, and from the literature available we have selected the two fairly recent analyses which are most comparable with the present data. These are discussed in sections 6.3 and 6.4, while in section 6.2 the results of the present survey are shown side by side with the results obtained at the routine medical inspections of Belfast schoolchildren carried out during 1951.

Comparisons using material of this nature cannot be too stringent, because, apart from the different times of measurement, considerable differences occur in sampling and measurement technique. For this reason formal tests of statistical significance are not used; instead similar and contrasting trends and features of the various pairs of series are noted.

6.2 Comparison with results of Routine Medical Inspections.

Fulton (1952), reporting on the work of the School Health Division in the annual report of the Medical Officer of Health for Belfast (Barron, 1952), tabulates the average heights and weights of boys and girls examined in various age groups who were present at school at the time of medical inspection. He points out that generally the absentee rate is of the order of 12-15 per cent., and draws attention

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TABLE B.

Mean of height and weight according to age and sex in survey compared with those of Belfast routine school medical inspections in 1951.

	Data*	Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
No. of boys examined	S	463	700	692	752	803	707	676	523	439
	RMI	1,842	1,132	165	2,688	518	27	1,712	558	10
Mean height of boys in cm.....	S	110.3	115.0	120.8	125.5	131.1	135.4	139.8	143.8	149.0
	RMI	110.0	113.5	119.3	126.8	129.8	135.7	141.0	143.4	148.6
Mean weight of boys in kg.....	S	19.6	21.2	23.4	25.4	28.1	30.5	33.3	35.8	40.0
	RMI	19.3	20.4	22.3	25.6	26.8	29.8	33.6	35.0	37.9
No. of girls examined	S	523	645	714	798	759	689	622	486	434
	RMI	1,633	1,097	171	2,703	457	24	1,737	608	15
Mean height of girls in cm.	S	108.9	113.6	119.6	124.5	129.0	134.2	139.9	144.7	150.5
	RMI	109.0	112.8	117.3	125.3	128.2	133.0	141.0	144.6	147.9
Mean weight of girls in kg.	S	18.5	20.1	22.2	24.3	26.5	29.7	33.3	36.7	42.0
	RMI	18.5	19.5	21.3	24.6	25.8	28.1	33.9	35.5	40.2

*S=Survey results. RMI=Results of routine school medical inspection.

to the fact that at some ages the numbers are too small for reasonable comparison with other age groups. The detailed procedure for measurement is not given, but it is understood that the children are measured wearing indoor clothing, but without shoes, and that portable spring balances are used.

Average measurements are given for three types of school: "public," "grammar," and "private grammar"; it is with the first group that comparison is now made, since it conforms most closely to the population from which the sample was drawn. Table B sets out the relevant statistics for this comparison, the medical inspection data which are reported in Imperial units having been converted to metric.

The mean heights of the two series show remarkable agreement, considering that the medical inspection data were collected by many observers using various appliances. In boys the difference never exceeds 1.5 cm. In girls the difference exceeds 1.5 cm. at ages seven and thirteen when it is 2.3 and 2.6 cm. respectively, but at these ages only 171 and 15 girls were measured at routine inspections. Moreover, there is no evidence from table B that one series gives a consistently higher mean than the other.

The mean weights of the two series are also similar. In boys the difference exceeds 1 kg. at ages seven, nine, and thirteen, when it is 1.1, 1.3, and 2.1 kg.; but only 165 boys aged seven and 10 aged thirteen were measured at routine inspections. In girls the difference between the means of the two series exceeds 1 kg. at ages ten, twelve, and thirteen, when it is 1.6, 1.2, and 1.8 kg.; but only 24 girls aged ten and 15 aged thirteen were measured at routine inspections. Apart from ages eight and eleven in both sexes and age five in girls, the survey means are the greater, and this result is surprising, since survey children wore less clothing than those measured at routine medical inspections.

Unfortunately no measure of the dispersion of the children according to height or weight is given in the report of the School Medical Officer, and this feature of the data cannot be compared. For the same reason, no comparison can be included of the distribution of weight according to height.

6.3 Comparison with results obtained from Routine School Medical Inspections in the County of London in 1949.

Daley (1950) reports an analysis of the heights and weights of a representative sample of school pupils in London during 1949. The sample consisted of 10,653 boys and 10,654 girls between the ages of five and fifteen years and his results, comparable to the scope of the present survey, are shown in tables C and D. The details of how the measurements were made are not given in this report, but an earlier publication (Menzies, 1940), with which Daley compares his results, indicates that the practice was to measure children in their indoor clothing without boots or shoes. Heights were recorded to the nearest cm. and weights to the nearest 0.1 kg.

In the London report, mean height and weight are tabulated according to "year of observation less year of birth", instead of according to age at last birthday, as in the present report. Consequently, in table C, the London means have been adjusted by simple linear interpolation so that they are directly comparable at each

TABLE C.

Mean of height and weight according to age and sex in survey compared with London routine school medical inspections in 1949

(London means adjusted to be comparable with survey means in respect of age).

	Data*	Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
Mean height of boys in cm.	S	110.3	115.0	120.8	125.5	131.1	135.4	139.8	143.8	149.0
	L.C.C.	110.5	116.2	122.0	127.5	132.9	137.9	142.0	146.5	152.2
Mean weight of boys in kg.....	S	19.6	21.2	23.4	25.4	28.1	30.5	33.3	35.8	40.0
	L.C.C.	19.6	21.7	24.0	26.7	29.5	32.3	35.0	38.3	42.8
Mean height of girls in cm.	S	108.9	113.6	119.6	124.5	129.0	134.2	139.9	144.7	150.5
	L.C.C.	109.8	115.5	121.2	126.7	132.0	137.7	143.2	148.8	153.7
Mean weight of girls in kg.	S	18.5	20.1	22.2	24.3	26.5	29.7	33.3	36.7	42.0
	L.C.C.	19.1	21.2	23.4	26.1	29.0	32.1	36.0	40.6	45.5

*S = Survey results. L.C.C. = Routine school medical inspections in London, 1949.

TABLE D.

Mean and standard deviation of weight according to height and sex in survey compared with those of London routine school medical inspection in 1949.

		Data*	Height Group in cm.											
			100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–
No. of boys examined		S	75	278	470	641	702	758	767	734	571	416	180	106
		L.C.C.	100	310	534	712	814	971	1,189	1,364	1,232	1,180	828	538
Weight of boys in kg.	Mean	S	17.0	18.6	20.2	22.0	24.0	26.2	28.7	31.4	34.6	37.3	41.3	45.4
		L.C.C.	?	18.8	20.3	21.9	24.0	26.4	29.1	31.8	35.0	38.0	41.9	45.9
	Standard deviation	S	1.18	1.42	1.48	1.58	1.72	2.18	2.28	2.88	3.20	3.48	4.13	4.52
		L.C.C.	?	1.50	1.55	1.81	2.01	2.30	2.66	2.94	3.64	4.02	4.72	5.31
No. of girls examined		S	143	342	527	655	758	739	671	600	436	364	251	114
		L.C.C.	119	308	550	733	791	989	1,071	1,060	1,001	945	1,052	1,055
Weight of girls in kg.	Mean	S	16.3	18.0	19.5	21.3	23.3	25.8	28.2	31.4	34.2	38.3	42.7	47.4
		L.C.C.	16.6	18.3	19.7	21.7	23.7	26.3	28.7	31.6	35.1	39.2	43.9	48.7
	Standard deviation	S	1.36	1.63	1.55	1.75	1.84	2.52	2.85	3.87	3.94	4.57	5.31	5.73
		L.C.C.	1.46	1.72	1.77	1.98	2.27	2.56	3.11	3.52	4.53	5.26	5.67	6.73

*S = Survey results. L.C.C. = Routine school medical inspection in London, 1949. ? = not calculated.

age with the Belfast means. The London data are more numerous than those of Belfast.

The mean heights recorded in the present survey are slightly less than the corresponding means of the London series. The difference between the two series tends to become greater as age advances; thus at age five the difference is less than 1 cm., but at age thirteen it is more than 3 cm.

The mean weights of the Belfast children are also less than the corresponding means of the London children. Again the difference increases with increasing age from less than 1 kg. at age five to about 3 kg. at age thirteen.

In table D estimates of weight are shown for the two series according to the height of the children measured. For like height groups the boys never differ in their mean weights by more than 0.7 kg., and, except at heights between 115-124 cm., the London means are always the greater. In girls of comparable height the London means are consistently greater, the differences being small and varying between 0.2 and 0.5 kg. up to height 139 cm., and between 0.9 and 1.3 kg. thereafter. The dispersion of the observations in each height group is very similar in the two series, although London data tend to have slightly larger standard deviations.

It appears from the comparisons shown in these two tables that the London estimates of 1949 are slightly greater than those of the Belfast survey. Appropriate allowances for differences in clothing, if they could be made, might account for some of the difference in weight.

6.4 Comparison with results obtained from an English Sample in 1948.

Sutcliffe and Canham (1950) report the results of a survey based on measurements of about 17,000 English schoolchildren during the spring of 1948. The children were selected "so that they would be a fair sample of the whole child population of the country". Up to age eleven the measurements are confined to children attending primary schools and later ages are composed of secondary or grammar school pupils. They do not state how many children were measured at each age, but the 17,000 covered the school ages up to seventeen. All those taking measurements were asked to observe certain rules of procedure, of which the following are important in the ensuing comparison. The children were measured for height without footwear, with heels together touching the base of the upright; the back was flattened against the upright until the back of the head was touching it; the children were encouraged to stretch upwards, keeping the feet flat and looking forward at eye level, and the horizontal arm of the measuring stand was brought down to touch the highest point of the head. Heights were measured to the nearest quarter-inch. For weight, balances were calibrated, and where spring type were used the pointers were brought back to zero before use; the children stood motionless on the scale platform without shoes, and a deduction was made from the weight recorded to compensate for clothing worn.

In table E the survey data are shown against those of Sutcliffe and Canham, with their estimates converted to metric units. They tabulate median measurements,

TABLE E.

Median and standard deviations of height and weight according to age and sex in survey compared with sample of English schools, 1948.

		Data*	Age Group in Years								
			5–	6–	7–	8–	9–	10–	11–	12–	13–
No. of boys examined		S	463	700	692	752	803	707	676	523	439
		E	?	?	?	?	?	?	?	?	?
Height of boys in cm.	Median	S	110.2	115.1	120.7	125.5	131.1	135.3	139.7	143.8	148.5
		E	107.9	113.7	119.4	125.1	130.8	135.3	139.7	145.4	151.1
	Standard deviation	S	5.41	5.64	5.56	6.11	6.15	6.52	6.56	7.44	8.26
		E	4.06	4.32	4.57	4.83	5.33	5.84	6.35	6.86	8.13
Weight of boys in kg.	Median	S	19.4	21.0	23.2	25.0	27.8	30.1	32.7	35.3	39.0
		E	18.1	20.4	22.7	25.4	27.7	30.4	32.7	35.8	39.9
	Standard deviation	S	2.23	2.56	2.83	3.40	3.54	4.41	4.67	5.64	6.66
		E	1.95	2.13	2.63	2.99	3.36	3.58	3.67	5.31	6.35
No. of girls examined		S	523	645	714	798	759	689	622	486	434
		E	?	?	?	?	?	?	?	?	?
Height of girls in cm.	Median	S	108.5	113.4	119.3	124.6	128.8	134.0	139.6	144.9	150.8
		E	107.3	112.4	118.1	123.8	129.5	134.6	139.1	144.8	151.1
	Standard deviation	S	5.43	5.59	5.62	5.89	6.39	6.99	6.96	7.66	7.39
		E	4.57	4.83	5.08	5.33	5.84	6.35	7.11	7.37	7.37
Weight of girls in kg.	Median	S	18.4	19.9	22.0	24.1	26.1	28.8	32.6	35.7	41.5
		E	18.1	20.0	21.8	23.6	25.9	28.6	32.2	36.3	40.8
	Standard deviation	S	2.26	2.69	3.07	3.42	4.13	5.05	5.79	7.20	7.51
		E	1.77	2.13	2.47	2.83	3.54	3.83	4.94	6.03	6.85

*S=Survey results. E=Sample of English schools, 1948. ?=not stated.

certain percentiles, and standard deviations, for single years of age. Table E is limited to comparison of medians and standard deviations.

In boys the median heights of the two series differ by more than 2 cm. at the extreme ages of five and thirteen. From ages five to nine the survey medians are greater, the difference becoming consistently smaller; at ages ten and eleven the medians are identical, but at ages twelve and thirteen survey medians are smaller by 1.6 and 2.6 cm. Thus for boys there is a consistently steeper increase of height with age in the English than in the Belfast data. The inclusion of secondary schoolboys at the later ages in the English series cannot completely explain this; for the trend is apparent from the lowest age onward. The difference in rate of increase in the girls' height is nothing like so marked; from ages five to thirteen the differences between the medians are (survey median – English median): 1.2, 1.0, 1.2, 0.8, –0.7, –0.6, 0.5, 0.1, and – 0.3. The dispersion of the survey height data is generally greater than that of the English, as measured by the standard deviations. At all ages in boys and at all, except eleven, in girls the survey standard deviation is the greater.

There is no great difference between the median weights of the two series. In boys aged five, six, seven, and nine, the survey median is greater than the English; the greatest difference is 1.3 kg. at age five. At age eleven the medians are the same, and at the remaining four ages the English median is the greater. In girls the greatest difference is 0.7 kg. at age thirteen and, except at ages six and twelve, the survey median is the greater. Again the standard deviations of weight in the English series are consistently less than in the survey, suggesting less dispersion of the individual weights of English than of Belfast children in each age group.

6.5 Summary of Comparisons.

In the foregoing comparisons attention is drawn to similarities and differences between the results of the Belfast survey and other estimates, but different sampling and measurement techniques and times of measurement prevent strict comparisons. Within these limits the estimates for Belfast children agree quite closely with those from the routine medical inspections in Belfast schools, similar inspections in London, and the sample from English schools. The following points of difference are noted :—

1. In general, the survey mean weights are slightly greater than those obtained at routine school medical inspections in Belfast.
2. The mean heights and weights of children in the survey tend to be lower than those obtained for London schoolchildren of comparable age in 1949. In comparing children of like height almost invariably the mean weight of the London children is greater.
3. The mean height of the survey children tends to increase with age less steeply than does that of the English sample, especially in boys. The dispersion of both heights and weights for like age and sex is greater among the survey children than among the English.

7. RECOMMENDATIONS AND SUMMARY.

7.1 Recommendations for the use of the Survey Results.

The data reported upon here form the most up-to-date and reliable series of heights, weights, and intercristal diameters, of children aged five to thirteen available for Belfast. The similarity of the results with height and weight estimates from other sources suggests that they might safely have wider application outside Belfast.

For clinical use those who prefer to work with graphs should refer to figures 1 to 10. A child's measurement can be plotted against age on the appropriate graph (i.e., one of the figures 1-6). If the plot falls within the top and bottom lines then the child's measurement will be within a range which includes 80 per cent. of children of the same age and sex. If the plot falls above the top line the child is among the 10 per cent. of children whose measurements are very high; if it falls below the bottom line he is among the 10 per cent. whose measurements are very low. The nearer the plot is to the middle line the closer does the child's measurement approach the average.

Similarly, if a child's measurements at various ages are known, a series of plots can be made, and the slope of the line joining them can be compared with that of the middle line to show how the child's rate of growth compares with the average.

Similar use can be made of the remaining figures 7 to 10, in which weight or intercristal diameter can be plotted against height.

It is assumed here that the average does not change with the passage of time. In fact the average probably is undergoing a continuous change under the influence of social and other factors, and is liable to sudden fluctuation in war time. These changes must be small, however, and the so-called longitudinal survey is needed to demonstrate them.

Where children are being measured periodically the incorporation of such graphs in their medical records might conveniently be introduced, and the measurements could then be plotted direct on to the child's personal diagram.

For ease of use of the figures, it is suggested that the appropriate guide lines should be drawn according to the wishes of the person using the figures. For example, with figures 1-6 those who use Imperial units will draw horizontal guide lines from the scale on the right-hand axis of the figures, while those who prefer to work in metric units will draw their lines from the scale on the left. Most people will find it helpful to draw vertical lines separating the age groups scaled on the horizontal axis of these figures. Similarly, figures 7-10 can be adapted for use by drawing appropriate guide lines from the right hand and top axes for Imperial units and from the left hand and bottom axes for metric units.

For those who prefer their data in tabular form, the results of the survey are summarised in tables XIX (metric units) and XX (Imperial units). These tables show, for height, weight, and intercristal diameter, of each age and sex the median measurement and the limits within which 80 per cent. of the children lie—these limits are the first and ninth deciles. For example, in boys aged five the median

height is 110.0 cm. or 43½ inches, and 80 per cent. of five-year-old boys are expected to be between 103.0 and 117.5 cm., or 40½ and 46¼ inches tall.

It will be noted that in these tables the estimates have been approximated to conform with a degree of accuracy of measurement not likely to be exceeded in general clinical use.

7.2 Summary.

1. Measurements of height, weight, and intercristal diameter, of a representative sample of children attending primary and intermediate schools in Belfast are presented in tabular and graphic form.
2. The organisation and administration of the survey are described.
3. The results are presented to show in metric and Imperial units the mean, median, first and ninth deciles, and standard deviation, of each measurement for each single year of age for boys and girls separately.
4. Similar statistics are given of weight and intercristal diameter for children of each sex grouped according to 5 cm. height intervals.
5. The results are discussed and compared with other work.
6. Recommendations are made for the use of the data accumulated in the survey.

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Those involved in carrying out this survey were too numerous to mention by name. Over 150 principals and over 300 other teachers carried out their part, and without their help and that of the nurses the survey could not have been made.

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APPENDIX 1.

ADMINISTRATIVE DOCUMENTS USED IN THE SURVEY.

1. Record card.
2. Form A.

1. Record Card.

THE ROYAL BELFAST HOSPITAL FOR SICK CHILDREN

SURVEY OF PHYSICAL MEASUREMENTS

Surname		Registered No. A /	B /
First Names		Sex	Age Group
Sex Boy Girl	Date of Birth / /	Age in years	
If parent objects to child being measured enter child's home address.		Weight in Kgms.	
		Height in Cms.	
X			
Date of examination		Intercristal Diam. in Cms.	

2. FORM A.

ROYAL BELFAST HOSPITAL FOR SICK CHILDREN—SURVEY OF PHYSICAL MEASUREMENTS. FORM A.

School..... *School Roll No.*.....

STATEMENT OF CARDS PREPARED

YEAR OF BIRTH.	BOYS (Blue Cards).			GIRLS (Pink Cards).		
	No. in Sample (i.e., No. of Cards prepared)	No. of Refusals received from Parents of Children in the Sample.	LEAVE BLANK.	No. in Sample (i.e., No. of Cards prepared)	No. of Refusals received from Parents of Children in the Sample.	LEAVE BLANK.
1936						
1937						
1938						
1939						
1940						
1941						
1942						
1943						
1944						
1945						
1946						

Signature of responsible Teacher..... *Date*.....

APPENDIX 2.

Tables of Results.

TABLE I.

Estimates of height, weight and intercristal diameter of Boys according to age—estimates in metric units.

Estimates etc.		Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
Number of boys measured	....	463	700	692	752	803	707	676	523	439
		Height								
Mean	cm.	110.3	115.0	120.8	125.5	131.1	135.4	139.8	143.8	149.0
Standard error of mean	cm.	0.25	0.21	0.21	0.22	0.22	0.25	0.25	0.33	0.39
Standard deviation	cm.	5.41	5.64	5.56	6.11	6.15	6.52	6.56	7.44	8.26
First decile	cm.	103.1	107.3	113.5	117.5	123.0	126.7	131.3	135.0	138.9
Median	cm.	110.2	115.1	120.7	125.5	131.1	135.3	139.7	143.8	148.5
Ninth decile	cm.	117.7	122.6	128.4	133.6	139.0	144.1	148.6	153.3	159.4
Co-efficient of variation	%	4.90	4.91	4.60	4.87	4.69	4.82	4.69	5.18	5.54
		Weight								
Mean	kg.	19.6	21.2	23.4	25.4	28.1	30.5	33.3	35.8	40.0
Standard error of mean	kg.	0.10	0.10	0.11	0.12	0.12	0.17	0.18	0.25	0.32
Standard deviation	kg.	2.23	2.56	2.83	3.40	3.54	4.41	4.67	5.64	6.66
First decile	kg.	16.6	18.1	20.1	21.4	24.0	25.6	28.1	29.4	32.2
Median	kg.	19.4	21.0	23.2	25.0	27.8	30.1	32.7	35.3	39.0
Ninth decile	kg.	22.6	24.6	27.0	29.7	32.5	35.7	39.0	42.4	49.3
Co-efficient of variation	%	11.42	12.08	12.13	13.41	12.60	14.44	14.06	15.75	16.67
		Intercristal diameter								
Mean	cm.	17.9	18.6	19.4	20.0	20.9	21.5	22.2	22.8	23.8
Standard error of mean	cm.	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.06	0.08
Standard deviation	cm.	1.14	1.15	1.19	1.23	1.24	1.27	1.34	1.37	1.61
First decile	cm.	16.4	17.1	17.9	18.3	19.3	19.9	20.5	21.0	21.8
Median	cm.	18.0	18.6	19.4	20.0	20.9	21.5	22.2	22.8	23.7
Ninth decile	cm.	19.5	20.1	20.8	21.6	22.6	23.3	24.0	24.6	25.7
Co-efficient of variation	%	6.34	6.19	6.15	6.16	5.92	5.89	6.03	6.02	6.78

TABLE II.

Estimates of height, weight and intercristal diameter of Girls according to age—estimates in metric units.

Estimates etc.		Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
Number of girls measured	....	523	645	714	798	759	689	622	486	434
		Height								
Mean	cm.	108.9	113.6	119.6	124.5	129.0	134.2	139.9	144.7	150.5
Standard error of mean	cm.	0.24	0.22	0.21	0.21	0.23	0.27	0.28	0.35	0.35
Standard deviation	cm.	5.43	5.59	5.62	5.89	6.39	6.99	6.96	7.66	7.39
First decile	cm.	101.7	106.1	112.0	116.3	120.8	125.5	132.0	135.1	140.4
Median	cm.	108.5	113.4	119.3	124.6	128.8	134.0	139.6	144.9	150.8
Ninth decile	cm.	116.6	121.1	127.2	132.3	137.8	143.4	149.2	154.6	160.1
Co-efficient of variation	%	4.99	4.93	4.70	4.73	4.96	5.21	4.97	5.29	4.91
		Weight								
Mean	kg.	18.5	20.1	22.2	24.3	26.5	29.7	33.3	36.7	42.0
Standard error of mean	kg.	0.10	0.11	0.11	0.12	0.15	0.19	0.23	0.33	0.36
Standard deviation	kg.	2.26	2.69	3.07	3.42	4.13	5.05	5.79	7.20	7.51
First decile	kg.	15.5	16.7	18.6	20.3	22.1	24.3	27.0	28.2	32.7
Median	kg.	18.4	19.9	22.0	24.1	26.1	28.8	32.6	35.7	41.5
Ninth decile	kg.	21.5	23.5	25.9	28.3	31.6	36.3	40.5	46.1	51.5
Co-efficient of variation	%	12.24	13.39	13.82	14.04	15.56	17.04	17.37	19.62	17.90
		Intercristal diameter								
Mean	cm.	17.5	18.2	19.0	19.7	20.5	21.4	22.4	23.2	24.5
Standard error of mean	cm.	0.05	0.04	0.04	0.04	0.05	0.06	0.06	0.08	0.08
Standard deviation	cm.	1.09	1.10	1.17	1.23	1.27	1.49	1.50	1.72	1.73
First decile	cm.	16.0	16.8	17.7	18.1	18.9	19.7	20.4	21.0	22.2
Median	cm.	17.4	18.2	19.0	19.7	20.4	21.3	22.4	23.3	24.6
Ninth decile	cm.	18.8	19.7	20.5	21.4	22.3	23.4	24.4	25.5	26.7
Co-efficient of variation	%	6.26	6.01	6.14	6.25	6.21	6.96	6.69	7.38	7.04

TABLE III.

Estimates of height, weight and intercristal diameter of Boys according to age—estimates in Imperial units.

Estimates etc.		Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
Number of boys measured		463	700	692	752	803	707	676	523	439
		Height								
Mean	in.	43.4	45.3	47.6	49.4	51.6	53.3	55.1	56.6	58.7
Standard error of mean	in.	0.10	0.08	0.08	0.09	0.09	0.10	0.10	0.13	0.16
Standard deviation	in.	2.13	2.22	2.19	2.41	2.42	2.57	2.58	2.93	3.25
First decile	in.	40.6	42.3	44.7	46.3	48.4	49.9	51.7	53.1	54.7
Median	in.	43.4	45.3	47.5	49.4	51.6	53.3	55.0	56.6	58.5
Ninth decile	in.	46.3	48.3	50.6	52.6	54.7	56.7	58.5	60.4	62.8
Co-efficient of variation	%	4.90	4.91	4.60	4.87	4.69	4.82	4.69	5.18	5.54
		Weight								
Mean	lb.	43.1	46.7	51.5	56.0	61.9	67.3	73.3	79.0	88.1
Standard error of mean	lb.	0.23	0.21	0.24	0.27	0.28	0.37	0.40	0.54	0.70
Standard deviation	lb.	4.92	5.64	6.25	7.51	7.80	9.72	10.30	12.43	14.68
First decile	lb.	36.6	39.8	44.3	47.2	52.9	56.3	61.8	64.7	70.9
Median	lb.	42.9	46.3	51.1	55.2	61.3	66.3	72.2	77.8	86.1
Ninth decile	lb.	49.9	54.2	59.6	65.5	71.7	78.8	86.0	93.5	108.7
Co-efficient of variation	%	11.42	12.08	12.13	13.41	12.60	14.44	14.06	15.75	16.67
		Intercristal diameter								
Mean	in.	7.1	7.3	7.6	7.9	8.2	8.5	8.8	9.0	9.4
Standard error of mean	in.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Standard deviation	in.	0.45	0.45	0.47	0.48	0.49	0.50	0.53	0.54	0.63
First decile	in.	6.4	6.7	7.0	7.2	7.6	7.8	8.1	8.3	8.6
Median	in.	7.1	7.3	7.6	7.9	8.2	8.5	8.7	9.0	9.3
Ninth decile	in.	7.7	7.9	8.2	8.5	8.9	9.2	9.4	9.7	10.1
Co-efficient of variation	%	6.34	6.19	6.15	6.16	5.92	5.89	6.03	6.02	6.78

TABLE IV.

Estimates of height, weight and intercristal diameter of Girls according to age—estimates in Imperial units.

Estimates etc.		Age Group in Years								
		5–	6–	7–	8–	9–	10–	11–	12–	13–
Number of girls measured		523	645	714	798	759	689	622	486	434
		Height								
Mean	in.	42.9	44.7	47.1	49.0	50.8	52.8	55.1	57.0	59.3
Standard error of mean	in.	0.09	0.09	0.08	0.08	0.09	0.10	0.11	0.14	0.14
Standard deviation	in.	2.14	2.20	2.21	2.32	2.52	2.75	2.74	3.01	2.91
First decile	in.	40.0	41.8	44.1	45.8	47.5	49.4	52.0	53.2	55.3
Median	in.	42.7	44.7	47.0	49.0	50.7	52.7	55.0	57.1	59.4
Ninth decile	in.	45.9	47.7	50.1	52.1	54.3	56.5	58.7	60.9	63.0
Co-efficient of variation	%	4.99	4.93	4.70	4.73	4.96	5.21	4.97	5.29	4.91
		Weight								
Mean	lb.	40.7	44.3	49.0	53.7	58.5	65.4	73.5	81.0	92.5
Standard error of mean	lb.	0.22	0.23	0.25	0.27	0.33	0.42	0.51	0.72	0.79
Standard deviation	lb.	4.99	5.92	6.77	7.53	9.11	11.14	12.77	15.88	16.55
First decile	lb.	34.1	36.8	40.9	44.8	48.6	53.6	59.4	62.3	72.0
Median	lb.	40.7	43.8	48.4	53.2	57.6	63.5	71.8	78.6	91.4
Ninth decile	lb.	47.3	51.8	57.2	62.3	69.6	80.1	89.2	101.7	113.5
Co-efficient of variation	%	12.24	13.39	13.82	14.04	15.56	17.04	17.37	19.62	17.90
		Intercristal diameter								
Mean	in.	6.9	7.2	7.5	7.8	8.1	8.4	8.8	9.2	9.7
Standard error of mean	in.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Standard deviation	in.	0.43	0.43	0.46	0.49	0.50	0.59	0.59	0.68	0.68
First decile	in.	6.3	6.6	7.0	7.1	7.4	7.8	8.0	8.3	8.8
Median	in.	6.9	7.2	7.5	7.8	8.0	8.4	8.8	9.2	9.7
Ninth decile	in.	7.4	7.7	8.1	8.4	8.8	9.2	9.6	10.0	10.5
Co-efficient of variation	%	6.26	6.01	6.14	6.25	6.21	6.96	6.69	7.38	7.04

TABLE V.

Estimates of weight and intercristal diameter of Boys according to height—estimates in metric units.

Estimates etc.	Height Group in cm.											
	100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–
Number of boys observed	75	278	470	641	702	758	767	734	571	416	180	106
	Weight											
Mean .... kg.	17.0	18.6	20.2	22.0	24.0	26.2	28.7	31.4	34.6	37.3	41.3	45.4
Standard error of mean .... kg.	0.14	0.08	0.07	0.06	0.06	0.08	0.08	0.11	0.13	0.17	0.31	0.44
Standard deviation .... kg.	1.18	1.42	1.48	1.58	1.72	2.18	2.28	2.88	3.20	3.48	4.13	4.52
First decile .... kg.	15.2	16.5	18.2	20.1	22.0	23.7	26.1	28.2	30.8	33.5	36.6	40.3
Median .... kg.	17.0	18.6	20.2	21.9	24.0	26.0	28.7	31.1	34.3	36.9	40.8	45.1
Ninth decile .... kg.	18.9	20.6	21.9	23.9	26.2	29.1	31.6	35.1	38.9	41.6	46.5	51.1
Co-efficient of variation .... %	6.97	7.63	7.34	7.17	7.16	8.30	7.93	9.16	9.24	9.33	10.02	9.96
	Intercristal diameter											
Mean .... cm.	16.8	17.6	18.2	19.0	19.6	20.4	21.1	21.8	22.6	23.3	24.0	24.7
Standard error of mean .... cm.	0.10	0.05	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.05	0.08	0.10
Standard deviation .... cm.	0.84	0.89	0.82	0.90	0.93	0.93	0.94	1.04	1.05	1.04	1.03	1.04
First decile .... cm.	15.8	16.3	17.1	17.9	18.3	19.1	19.9	20.4	21.1	21.9	22.8	23.3
Median .... cm.	16.9	17.6	18.2	19.0	19.6	20.3	21.1	21.8	22.6	23.3	24.0	24.8
Ninth decile .... cm.	18.0	18.7	19.4	20.2	20.7	21.6	22.4	23.3	23.9	24.7	25.4	26.0
Co-efficient of variation .... %	4.99	5.09	4.52	4.73	4.76	4.54	4.44	4.75	4.64	4.45	4.31	4.22

TABLE VI.

Estimates of weight and intercristal diameter of Girls according to height—estimates in metric units.

Estimates etc.		Height Group in cm.											
		100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–
Number of girls observed		143	342	527	655	758	739	671	600	436	364	251	114
		Weight											
Mean	kg.	16.3	18.0	19.5	21.3	23.3	25.8	28.2	31.4	34.2	38. 3	42.7	47.4
Standard error of mean	kg.	0.11	0.09	0.07	0.07	0.07	0.09	0.11	0.16	0.19	0.24	0.34	0.54
Standard deviation	kg.	1.36	1.63	1.55	1.75	1.84	2.52	2.85	3.87	3.94	4.57	5.31	5.73
First decile	kg.	14.4	16.1	17.4	18.8	20.8	22.8	24.9	27.4	29.5	32.6	36.8	40.4
Median	kg.	16.3	17.9	19.4	21.2	23.2	25.5	27.9	30.6	33.8	38.0	41.9	46.8
Ninth decile	kg.	17.9	19.9	21.6	23.7	25.8	28.8	31.7	36.0	39.3	44.4	49.1	54.4
Co-efficient of variation	%	8.34	9.03	7.93	8.22	7.90	9.76	10.11	12.35	11.53	11.92	12.44	12.11
		Intercristal diameter											
Mean	cm.	16.6	17.4	18.0	18.8	19.4	20.3	21.0	22.0	22.7	23.8	24.8	25.5
Standard error of mean	cm.	0.07	0.05	0.04	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.08	0.10
Standard deviation	cm.	0.78	0.83	0.90	0.88	0.87	0.95	1.06	1.08	1.13	1.15	1.21	1.04
First decile	cm.	15.8	16.2	16.9	17.8	18.2	19.0	19.8	20.6	21.2	22.2	23.2	24.0
Median	cm.	16.6	17.4	18.1	18.8	19.4	20.2	21.0	22.0	22.8	23.8	24.7	25.5
Ninth decile	cm.	17.7	18.5	19.2	19.8	20.6	21.5	22.4	23.4	24.2	25.2	26.5	26.7
Co-efficient of variation	%	4.68	4.79	4.97	4.70	4.46	4.70	5.06	4.89	5.00	4.86	4.90	4.10

TABLE VII.

Distribution of Boys according to age and height.

Height Group in cm.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
90–	–	–	–	–	–	–	–	–	–	–
95–	9	1	–	1	–	–	–	–	–	11
100–	58	17	–	–	–	–	–	–	–	75
105–	154	106	14	3	1	–	–	–	–	278
110–	153	216	76	21	2	–	–	1	1	470
115–	75	236	218	94	11	3	3	1	–	641
120–	10	99	232	231	106	21	2	1	–	702
125–	4	18	117	229	224	128	29	8	1	758
130–	–	7	31	130	243	187	117	39	13	767
135–	–	–	4	36	163	189	195	111	36	734
140–	–	–	–	6	38	129	182	129	87	571
145–	–	–	–	1	14	42	109	138	112	416
150–	–	–	–	–	1	7	31	62	79	180
155–	–	–	–	–	–	1	8	24	73	106
160–	–	–	–	–	–	–	–	5	23	28
165–	–	–	–	–	–	–	–	4	11	15
170–	–	–	–	–	–	–	–	–	3	3
Total	463	700	692	752	803	707	676	523	439	5755

TABLE VIII.

Distribution of Girls according to age and height.

Height Group in cm.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
90–	1	–	–	–	–	–	–	–	–	1
95–	11	2	–	–	–	–	–	–	–	13
100–	109	34	–	–	–	–	–	–	–	143
105–	192	120	27	2	–	1	–	–	–	342
110–	136	234	104	45	8	–	–	–	–	527
115–	64	174	254	112	40	9	1	1	–	655
120–	8	68	219	257	155	43	6	2	–	758
125–	1	12	84	250	224	131	31	5	1	739
130–	1	1	21	109	192	197	108	36	6	671
135–	–	–	5	18	108	172	174	92	31	600
140–	–	–	–	4	29	94	153	106	50	436
145–	–	–	–	1	3	30	100	124	106	364
150–	–	–	–	–	–	10	39	75	127	251
155–	–	–	–	–	–	2	10	34	68	114
160–	–	–	–	–	–	–	–	11	36	47
165–	–	–	–	–	–	–	–	–	8	8
170–	–	–	–	–	–	–	–	–	1	1
Total	523	645	714	798	759	689	622	486	434	5670

TABLE IX.

Distribution of Boys according to age and weight.

Weight Group in kg.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
12–	1	–	–	–	–	–	–	–	–	1
14–	13	5	–	1	–	–	–	–	–	19
16–	99	56	8	2	–	–	–	–	–	165
18–	160	167	49	17	–	–	–	1	–	394
20–	127	229	169	76	11	1	1	–	–	614
22–	50	151	197	174	65	16	–	1	–	654
24–	11	70	168	197	153	67	11	9	–	686
26–	2	14	58	135	188	123	50	11	4	585
28–	–	6	26	85	189	140	108	43	6	603
30–	–	1	11	38	102	139	121	57	30	499
32–	–	1	4	11	50	91	121	76	34	388
34–	–	–	2	9	25	66	107	95	54	358
36–	–	–	–	4	10	33	70	80	59	256
38–	–	–	–	2	3	9	37	51	61	163
40–	–	–	–	1	4	9	19	42	49	124
42–	–	–	–	–	2	4	14	21	37	78
44–	–	–	–	–	–	3	3	12	31	49
46–	–	–	–	–	–	–	5	10	22	37
48–	–	–	–	–	1	3	3	2	12	21
50–	–	–	–	–	–	1	4	3	18	26
52–	–	–	–	–	–	1	1	4	9	15
54–	–	–	–	–	–	–	–	1	2	3
56–	–	–	–	–	–	1	1	1	7	10
58–	–	–	–	–	–	–	–	–	1	1
60–	–	–	–	–	–	–	–	2	2	4
62–	–	–	–	–	–	–	–	–	–	–
64–	–	–	–	–	–	–	–	1	–	1
66–	–	–	–	–	–	–	–	–	–	–
68–	–	–	–	–	–	–	–	–	–	–
70–	–	–	–	–	–	–	–	–	–	–
72–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	1	1
Total	463	700	692	752	803	707	676	523	439	5755

TABLE X.

Distribution of Girls according to age and weight.

Weight Group in kg.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
12–	3	1	–	–	–	–	–	–	–	4
14–	65	25	1	–	–	–	–	–	–	91
16–	152	102	32	13	1	–	–	–	–	300
18–	170	205	126	45	9	2	–	–	–	557
20–	107	175	196	123	58	8	3	1	–	671
22–	18	93	193	202	150	43	8	2	–	709
24–	7	29	95	194	148	90	28	5	3	599
26–	1	12	46	133	162	138	46	35	3	576
28–	–	1	14	50	110	154	99	38	8	474
30–	–	–	6	20	55	93	98	57	20	349
32–	–	1	2	9	28	52	98	54	26	270
34–	–	–	1	3	18	35	79	60	31	227
36–	–	1	–	2	5	27	49	49	40	173
38–	–	–	1	–	5	16	46	40	52	160
40–	–	–	–	2	4	9	22	42	46	125
42–	–	–	–	2	3	7	14	28	48	102
44–	–	–	1	–	2	7	13	25	42	90
46–	–	–	–	–	1	3	7	15	32	58
48–	–	–	–	–	–	1	4	14	28	47
50–	–	–	–	–	–	3	3	6	15	27
52–	–	–	–	–	–	1	2	5	14	22
54–	–	–	–	–	–	–	–	4	7	11
56–	–	–	–	–	–	–	1	1	5	7
58–	–	–	–	–	–	–	–	–	5	5
60–	–	–	–	–	–	–	1	2	3	6
62–	–	–	–	–	–	–	–	1	2	3
64–	–	–	–	–	–	–	–	1	1	2
66–	–	–	–	–	–	–	–	–	1	1
68–	–	–	–	–	–	–	1	1	1	3
70–	–	–	–	–	–	–	–	–	1	1
72–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	–	–
Total	523	645	714	798	759	689	622	486	434	5670

TABLE XI.

Distribution of Boys according to age and intercristal diameter (I.D.).

I.D. Group in cm.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
14–	1	–	–	–	–	–	–	–	–	1
15–	8	6	1	–	–	–	–	–	–	15
16–	62	25	10	2	–	–	–	–	–	99
17–	124	113	39	18	1	–	–	1	–	296
18–	164	255	146	99	24	3	1	1	1	694
19–	79	201	246	196	107	41	17	7	–	894
20–	24	78	177	231	237	159	69	22	8	1005
21–	1	18	53	156	248	205	163	78	33	955
22–	–	3	18	41	125	173	194	137	64	755
23–	–	1	2	9	50	100	149	161	118	590
24–	–	–	–	–	11	20	61	79	100	271
25–	–	–	–	–	–	6	20	30	79	135
26–	–	–	–	–	–	–	2	6	18	26
27–	–	–	–	–	–	–	–	1	10	11
28–	–	–	–	–	–	–	–	–	6	6
29–	–	–	–	–	–	–	–	–	1	1
30–	–	–	–	–	–	–	–	–	1	1
Total	463	700	692	752	803	707	676	523	439	5755

TABLE XII.

Distribution of Girls according to age and intercristal diameter (I.D.).

I.D. Group in cm.	Age Group in Years									
	5–	6–	7–	8–	9–	10–	11–	12–	13–	Total
14–	–	–	–	–	–	–	–	–	–	–
15–	24	5	4	2	–	–	–	–	–	35
16–	106	50	15	2	–	1	–	–	–	174
17–	189	160	57	27	4	3	1	1	–	442
18–	147	231	225	130	49	11	1	1	–	795
19–	48	146	240	249	163	57	15	5	2	925
20–	6	51	132	237	243	171	66	29	3	938
21–	2	2	31	109	169	180	114	60	21	688
22–	1	–	9	35	94	148	166	87	35	575
23–	–	–	–	5	36	78	146	112	76	453
24–	–	–	1	2	1	27	79	101	99	310
25–	–	–	–	–	–	6	22	59	97	184
26–	–	–	–	–	–	7	10	22	58	97
27–	–	–	–	–	–	–	2	8	30	40
28–	–	–	–	–	–	–	–	–	11	11
29–	–	–	–	–	–	–	–	1	2	3
30–	–	–	–	–	–	–	–	–	–	–
Total	523	645	714	798	759	689	622	486	434	5670

TABLE XIII.

Distribution of Boys according to height and weight.

Weight Group in kg.	Height Group in cm.																	
	90–	95–	100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–	160–	165–	170–	Total
12–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
14–	–	5	12	2	–	–	–	–	–	–	–	–	–	–	–	–	–	19
16–	–	5	49	92	19	–	–	–	–	–	–	–	–	–	–	–	–	165
18–	–	–	14	144	188	46	2	–	–	–	–	–	–	–	–	–	–	394
20–	–	–	–	37	222	282	68	3	2	–	–	–	–	–	–	–	–	614
22–	–	–	–	3	38	249	270	84	9	1	–	–	–	–	–	–	–	654
24–	–	–	–	–	2	61	282	282	54	5	–	–	–	–	–	–	–	686
26–	–	–	–	–	–	2	71	255	215	41	1	–	–	–	–	–	–	585
28–	–	–	–	–	1	1	9	102	282	186	21	1	–	–	–	–	–	603
30–	–	–	–	–	–	–	–	20	155	226	84	13	1	–	–	–	–	499
32–	–	–	–	–	–	–	–	6	36	152	158	35	1	–	–	–	–	388
34–	–	–	–	–	–	–	–	4	12	88	139	108	7	–	–	–	–	358
36–	–	–	–	–	–	–	–	2	1	23	92	107	30	1	–	–	–	256
38–	–	–	–	–	–	–	–	–	–	5	42	77	32	7	–	–	–	163
40–	–	–	–	–	–	–	–	–	1	3	18	41	44	15	2	–	–	124
42–	–	–	–	–	–	–	–	–	–	1	12	17	28	19	1	–	–	78
44–	–	–	–	–	–	–	–	–	–	1	1	8	17	20	2	–	–	49
46–	–	–	–	–	–	–	–	–	–	–	2	2	7	24	2	–	–	37
48–	–	–	–	–	–	–	–	–	–	1	–	4	5	6	4	1	–	21
50–	–	–	–	–	–	–	–	–	–	–	1	1	5	6	10	3	–	26
52–	–	–	–	–	–	–	–	–	–	1	–	2	1	3	4	3	1	15
54–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	2	–	3
56–	–	–	–	–	–	–	–	–	–	–	–	–	1	3	2	3	1	10
58–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
60–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	1	4
62–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
64–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
66–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
68–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
70–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
72–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Total	–	11	75	278	470	641	702	758	767	734	571	416	180	106	28	15	3	5755

TABLE XIV.

Distribution of Girls according to height and weight.

Weight Group in kg.	Height Group in cm.																	
	90–	95–	100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–	160–	165–	170–	Total
12–	–	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
14–	1	11	55	19	4	1	–	–	–	–	–	–	–	–	–	–	–	91
16–	–	1	71	156	65	7	–	–	–	–	–	–	–	–	–	–	–	300
18–	–	–	14	133	268	128	12	–	2	–	–	–	–	–	–	–	–	557
20–	–	–	–	31	164	303	156	15	1	1	–	–	–	–	–	–	–	671
22–	–	–	–	2	25	176	346	146	14	–	–	–	–	–	–	–	–	709
24–	–	–	–	–	1	36	180	266	104	12	–	–	–	–	–	–	–	599
26–	–	–	–	–	–	4	59	213	224	64	12	–	–	–	–	–	–	576
28–	–	–	–	1	–	–	5	60	195	169	41	3	–	–	–	–	–	474
30–	–	–	–	–	–	–	–	22	75	158	71	23	–	–	–	–	–	349
32–	–	–	–	–	–	–	–	10	32	87	103	34	4	–	–	–	–	270
34–	–	–	–	–	–	–	–	3	13	49	100	53	9	–	–	–	–	227
36–	–	–	–	–	–	–	–	2	6	23	42	69	28	3	–	–	–	173
38–	–	–	–	–	–	–	–	1	1	13	34	65	40	6	–	–	–	160
40–	–	–	–	–	–	–	–	–	2	7	13	46	47	10	–	–	–	125
42–	–	–	–	–	–	–	–	1	1	7	10	30	39	12	2	–	–	102
44–	–	–	–	–	–	–	–	–	1	6	7	22	24	21	9	–	–	90
46–	–	–	–	–	–	–	–	–	–	3	–	9	27	13	6	–	–	58
48–	–	–	–	–	–	–	–	–	–	–	1	7	14	18	5	2	–	47
50–	–	–	–	–	–	–	–	–	–	1	2	2	5	10	6	1	–	27
52–	–	–	–	–	–	–	–	–	–	–	–	–	6	9	4	3	–	22
54–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	3	1	1	11
56–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	1	1	–	7
58–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	5
60–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	1	–	–	6
62–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	–	–	3
64–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	2
66–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
68–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	–	3
70–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
72–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	1	13	143	342	527	655	758	739	671	600	436	364	251	114	47	8	1	5670

TABLE XV.

Distribution of Boys according to height and intercristal diameter (I.D.).

I.D. Group in cm.	Height Group in cm.																	
	90–	95–	100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–	160–	165–	170–	Total
14–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
15–	–	2	4	5	1	2	1	–	–	–	–	–	–	–	–	–	–	15
16–	–	5	30	44	13	4	3	–	–	–	–	–	–	–	–	–	–	99
17–	–	4	30	110	110	31	10	1	–	–	–	–	–	–	–	–	–	296
18–	–	–	10	101	228	229	102	19	4	1	–	–	–	–	–	–	–	694
19–	–	–	–	16	110	263	286	163	42	13	1	–	–	–	–	–	–	894
20–	–	–	–	2	7	105	239	334	206	92	19	1	–	–	–	–	–	1005
21–	–	–	–	–	1	5	58	195	331	244	94	23	4	–	–	–	–	955
22–	–	–	–	–	–	1	3	41	155	244	197	98	14	2	–	–	–	755
23–	–	–	–	–	–	1	–	4	28	132	193	158	58	16	–	–	–	590
24–	–	–	–	–	–	–	–	1	1	6	55	104	63	33	7	1	–	271
25–	–	–	–	–	–	–	–	–	–	1	12	30	37	42	8	5	–	135
26–	–	–	–	–	–	–	–	–	–	1	–	1	3	10	8	3	–	26
27–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	4	3	–	11
28–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	2	6
29–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
30–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Total	–	11	75	278	470	641	702	758	767	734	571	416	180	106	28	15	3	5755

TABLE XVI.

Distribution of Girls according to height and intercristal diameter (I.D.).

I.D. Group in cm.	Height Group in cm.																	
	90–	95–	100–	105–	110–	115–	120–	125–	130–	135–	140–	145–	150–	155–	160–	165–	170–	Total
14–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15–	–	5	14	7	7	2	–	–	–	–	–	–	–	–	–	–	–	35
16–	1	7	70	60	29	5	–	–	2	–	–	–	–	–	–	–	–	174
17–	–	1	49	162	153	55	15	3	3	1	–	–	–	–	–	–	–	442
18–	–	–	9	100	243	264	141	33	5	–	–	–	–	–	–	–	–	795
19–	–	–	1	12	90	263	332	163	54	7	3	–	–	–	–	–	–	925
20–	–	–	–	1	4	59	232	348	215	65	13	1	–	–	–	–	–	938
21–	–	–	–	–	–	5	36	151	247	165	68	16	–	–	–	–	–	688
22–	–	–	–	–	1	1	2	36	119	231	132	44	9	–	–	–	–	575
23–	–	–	–	–	–	1	–	4	24	109	151	118	39	7	–	–	–	453
24–	–	–	–	–	–	–	–	1	2	18	61	126	82	18	1	1	–	310
25–	–	–	–	–	–	–	–	–	–	3	4	46	72	45	14	–	–	184
26–	–	–	–	–	–	–	–	–	–	1	3	10	33	33	13	3	1	97
27–	–	–	–	–	–	–	–	–	–	–	1	2	14	10	11	2	–	40
28–	–	–	–	–	–	–	–	–	–	–	–	1	2	1	6	1	–	11
29–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	3
30–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	1	13	143	342	527	655	758	739	671	600	436	364	251	114	47	8	1	5670

TABLE XVII.

Distribution of Boys according to intercristal diameter and weight.

Weight Group in kg.	Intercristal diameter Group in cm.																	
	14–	15–	16–	17–	18–	19–	20–	21–	22–	23–	24–	25–	26–	27–	28–	29–	30–	Total
12–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
14–	1	1	11	4	2	–	–	–	–	–	–	–	–	–	–	–	–	19
16–	–	5	47	80	32	–	–	–	1	–	–	–	–	–	–	–	–	165
18–	–	6	30	135	183	38	–	1	1	–	–	–	–	–	–	–	–	394
20–	–	1	9	64	278	218	39	3	1	1	–	–	–	–	–	–	–	614
22–	–	–	2	10	138	316	164	22	2	–	–	–	–	–	–	–	–	654
24–	–	1	–	2	53	202	307	105	12	4	–	–	–	–	–	–	–	686
26–	–	–	–	1	6	72	240	194	63	9	–	–	–	–	–	–	–	585
28–	–	–	–	–	2	36	153	257	128	27	–	–	–	–	–	–	–	603
30–	–	–	–	–	–	9	67	192	158	64	8	1	–	–	–	–	–	499
32–	–	–	–	–	–	1	22	101	161	83	18	2	–	–	–	–	–	388
34–	–	–	–	–	–	2	7	58	110	138	38	5	–	–	–	–	–	358
36–	–	–	–	–	–	–	2	12	58	123	50	10	1	–	–	–	–	256
38–	–	–	–	–	–	–	2	6	27	59	52	13	3	1	–	–	–	163
40–	–	–	–	–	–	–	2	2	15	43	36	24	1	1	–	–	–	124
42–	–	–	–	–	–	–	–	2	15	17	22	18	3	1	–	–	–	78
44–	–	–	–	–	–	–	–	–	2	13	16	18	–	–	–	–	–	49
46–	–	–	–	–	–	–	–	–	1	6	11	10	7	1	1	–	–	37
48–	–	–	–	–	–	–	–	–	–	1	5	12	1	1	1	–	–	21
50–	–	–	–	–	–	–	–	–	–	–	7	14	3	2	–	–	–	26
52–	–	–	–	–	–	–	–	–	–	2	5	3	3	1	–	1	–	15
54–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	–	–	3
56–	–	–	–	–	–	–	–	–	–	–	2	3	2	1	2	–	–	10
58–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
60–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	1	–	–	4
62–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
64–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
66–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
68–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
70–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
72–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Total	1	15	99	296	694	894	1005	955	755	590	271	135	26	11	6	1	1	5755

TABLE XVIII.

Distribution of Girls according to intercristal diameter and weight.

Weight Group in kg.	Intercristal diameter Group in cm.																
	14–	15–	16–	17–	18–	19–	20–	21–	22–	23–	24–	25–	26–	27–	28–	29–	30–	Total
12–	–	–	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–	4
14–	–	15	45	27	3	1	–	–	–	–	–	–	–	–	–	–	–	91
16–	–	11	77	134	74	4	–	–	–	–	–	–	–	–	–	–	–	300
18–	–	6	42	186	237	77	7	–	2	–	–	–	–	–	–	–	–	557
20–	–	3	6	75	281	245	57	3	1	–	–	–	–	–	–	–	–	671
22–	–	–	–	14	147	321	196	29	2	–	–	–	–	–	–	–	–	709
24–	–	–	1	2	41	171	259	106	17	2	–	–	–	–	–	–	–	599
26–	–	–	–	1	12	77	234	175	65	12	–	–	–	–	–	–	–	576
28–	–	–	–	–	–	23	124	161	124	41	1	–	–	–	–	–	–	474
30–	–	–	–	1	–	4	36	112	127	62	6	1	–	–	–	–	–	349
32–	–	–	–	1	–	2	19	53	90	78	23	3	1	–	–	–	–	270
34–	–	–	–	–	–	–	4	24	86	67	43	2	1	–	–	–	–	227
36–	–	–	–	–	–	–	1	15	29	70	44	12	2	–	–	–	–	173
38–	–	–	–	–	–	–	–	5	15	54	58	25	1	2	–	–	–	160
40–	–	–	–	–	–	–	1	2	7	38	40	27	9	–	1	–	–	125
42–	–	–	–	–	–	–	–	2	4	12	40	26	11	5	2	–	–	102
44–	–	–	–	–	–	–	–	1	3	12	27	26	16	5	–	–	–	90
46–	–	–	–	–	–	–	–	–	1	4	9	24	12	4	4	–	–	58
48–	–	–	–	–	–	–	–	–	1	1	7	23	11	3	–	1	–	47
50–	–	–	–	–	–	–	–	–	1	–	7	5	13	–	1	–	–	27
52–	–	–	–	–	–	–	–	–	–	–	2	3	9	7	1	–	–	22
54–	–	–	–	–	–	–	–	–	–	–	1	2	5	3	–	–	–	11
56–	–	–	–	–	–	–	–	–	–	–	2	–	2	2	–	1	–	7
58–	–	–	–	–	–	–	–	–	–	–	–	2	–	2	1	–	–	5
60–	–	–	–	–	–	–	–	–	–	–	–	1	2	3	–	–	–	6
62–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	–	–	–	3
64–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	2
66–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
68–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	–	3
70–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
72–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
74–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	35	174	442	795	925	938	688	575	453	310	184	97	40	11	3	–	5670

TABLE XIX.

Median, first and ninth deciles (approximated) of height, weight, and intercristal diameter, in Metric units of Boys and Girls according to age.

Age Group in Years	Height (To nearest 0.5 cm.)			Weight (To nearest 0.1 kg.)			Intercristal Diameter (To nearest 0.5 cm.)		
	First decile	Median	Ninth decile	First decile	Median	Ninth decile	First decile	Median	Ninth decile
	Boys								
5–	103.0	110.0	117.5	16.6	19.4	22.6	16.5	18.0	19.5
6–	107.5	115.0	122.5	18.1	21.0	24.6	17.0	18.5	20.0
7–	113.5	120.5	128.5	20.1	23.2	27.0	18.0	19.5	21.0
8–	117.5	125.5	133.5	21.4	25.0	29.7	18.5	20.0	21.5
9–	123.0	131.0	139.0	24.0	27.8	32.5	19.5	21.0	22.5
10–	126.5	135.5	144.0	25.6	30.1	35.7	20.0	21.5	23.5
11–	131.5	139.5	148.5	28.1	32.7	39.0	20.5	22.0	24.0
12–	135.0	144.0	153.5	29.4	35.3	42.4	21.0	23.0	24.5
13–	139.0	148.5	159.5	32.2	39.0	49.3	22.0	23.5	25.5
	Girls								
5–	101.5	108.5	116.5	15.5	18.4	21.5	16.0	17.5	19.0
6–	106.0	113.5	121.0	16.7	19.9	23.5	17.0	18.0	19.5
7–	112.0	119.5	127.0	18.6	22.0	25.9	17.5	19.0	20.5
8–	116.5	124.5	132.5	20.3	24.1	28.3	18.0	19.5	21.5
9–	121.0	129.0	138.0	22.1	26.1	31.6	19.0	20.5	22.5
10–	125.5	134.0	143.5	24.3	28.8	36.3	19.5	21.5	23.5
11–	132.0	139.5	149.0	27.0	32.6	40.5	20.5	22.5	24.5
12–	135.0	145.0	154.5	28.2	35.7	46.1	21.0	23.5	25.5
13–	140.5	151.0	160.0	32.7	41.5	51.5	22.0	24.5	26.5

TABLE XX.

Median, first and ninth deciles (approximated) of height, weight, and intercristal diameter, in Imperial units of Boys and Girls according to age.

Age Group in Years	Height (To nearest ¼ inch)			Weight (To nearest ¼ lb.)			Intercristal Diameter (To nearest ¼ inch)		
	First decile	Median	Ninth decile	First decile	Median	Ninth decile	First decile	Median	Ninth decile
	Boys								
5–	40½	43½	46¼	36½	42¾	49¾	6½	7	7¾
6–	42¼	45¼	48¼	39¾	46¼	54¼	6¾	7¼	8
7–	44¾	47½	50½	44¼	51	59½	7	7½	8¼
8–	46¼	49½	52½	47¼	55¼	65½	7¼	8	8½
9–	48½	51½	54¾	53	61¼	71¾	7½	8¼	9
10–	50	53¼	56¾	56¼	66¼	78¾	7¾	8½	9¼
11–	51¾	55	58½	61¾	72¼	86	8	8¾	9½
12–	53¼	56½	60¼	64¾	77¾	93½	8¼	9	9¾
13–	54¾	58½	62¾	71	86	108¾	8½	9¼	10
	Girls								
5–	40	42¾	46	34	40¾	47¼	6¼	7	7½
6–	41¾	44¾	47¾	36¾	43¾	51¾	6½	7¼	7¾
7–	44	47	50	41	48½	57¼	7	7½	8
8–	45¾	49	52	44¾	53¼	62¼	7¼	7¾	8½
9–	47½	50¾	54¼	48½	57½	69¾	7½	8	8¾
10–	49½	52¾	56½	53½	63½	80	7¾	8½	9¼
11–	52	55	58¾	59½	71¾	89¼	8	8¾	9½
12–	53¼	57	61	62¼	78½	101¾	8½	9¼	10
13–	55¼	59¼	63	72	91½	113½	8¾	9¾	10½

APPENDIX 3.

Diagrams of Results.

Figure 1. Dispersion of height according to age—boys.

Figure 2. Dispersion of height according to age—girls.

Figure 3. Dispersion of weight according to age—boys.

Figure 4. Dispersion of weight according to age—girls.

Figure 5. Dispersion of intercristal diameter according to age—boys.

Figure 6. Dispersion of intercristal diameter according to age—girls.

Figure 7. Dispersion of weight according to height—boys.

Figure 8. Dispersion of weight according to height—girls.

Figure 9. Dispersion of intercristal diameter according to height—boys.

Figure 10. Dispersion of intercristal diameter according to height—girls.

Key to Figures.

1. The middle line joins the median measurements of successive age groups (figures 1-6) or successive height groups (figures 7-10).

2. The bottom line joins the first decile measurements of successive age groups (figures 1-6) or successive height groups (figures 7-10). Of all children measured in each age group (figures 1-6) or each height group (figures 7-10), 10 per cent. had smaller measurements than those indicated by the position of this line.

3. The top line joins the ninth decile measurements of successive age groups (figures 1-6) or successive height groups (figures 7-10). Of all children measured in each age group (figures 1-6) or each height group (figures 7-10), 10 per cent. had greater measurements than those indicated by the position of this line.

4. In each age group (figures 1-6) or height group (figures 7-10) 80 per cent. of the children had measurements within the range of the top and bottom lines.

5. In each age group (figures 1-6) or height group (figures 7-10) 40 per cent. of the children had measurements within the range of the top and middle lines and 40 per cent. had measurements within the range of the middle and bottom lines.

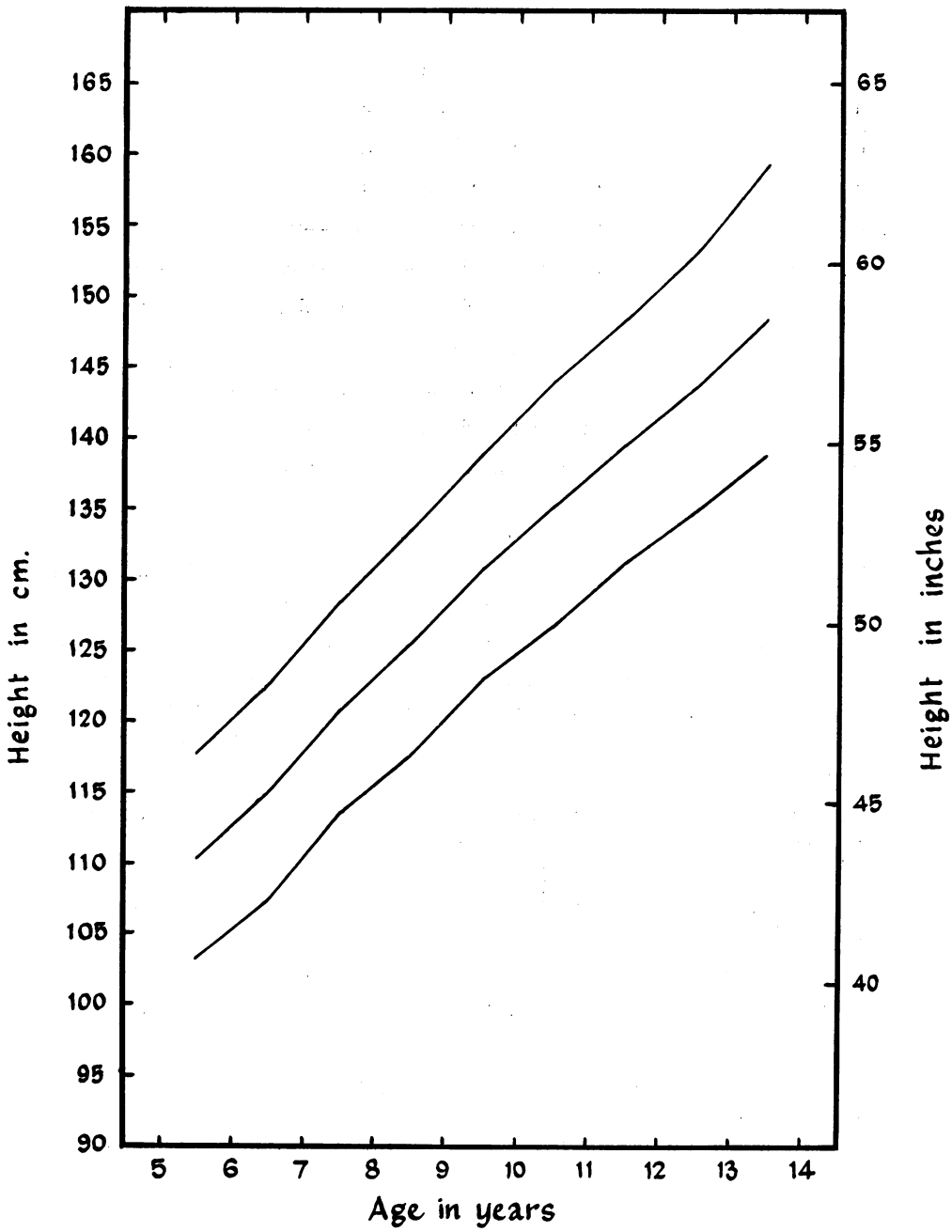

Figure 1. Dispersion of height according to age
BOYS

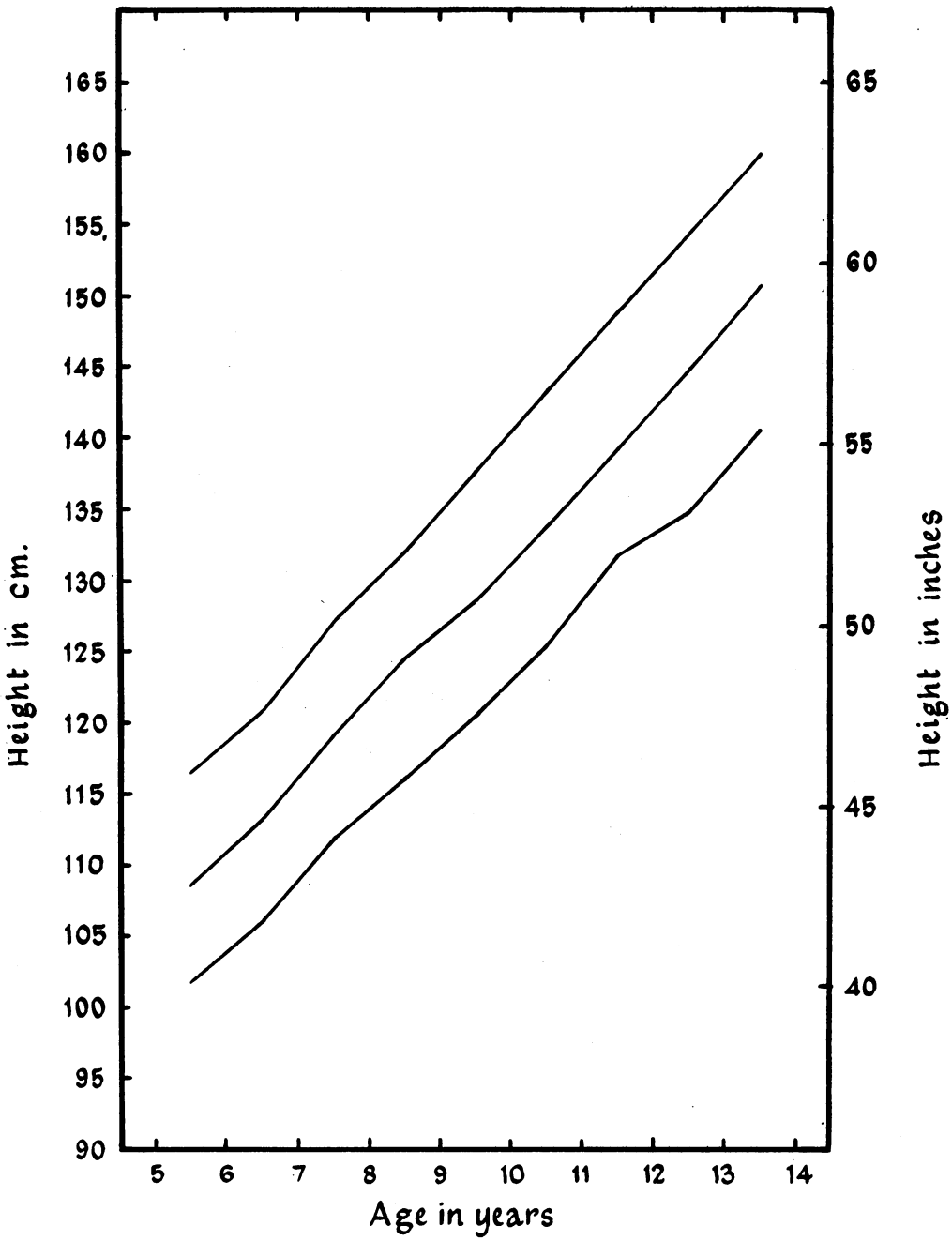

Figure 2. Dispersion of height according to age
GIRLS

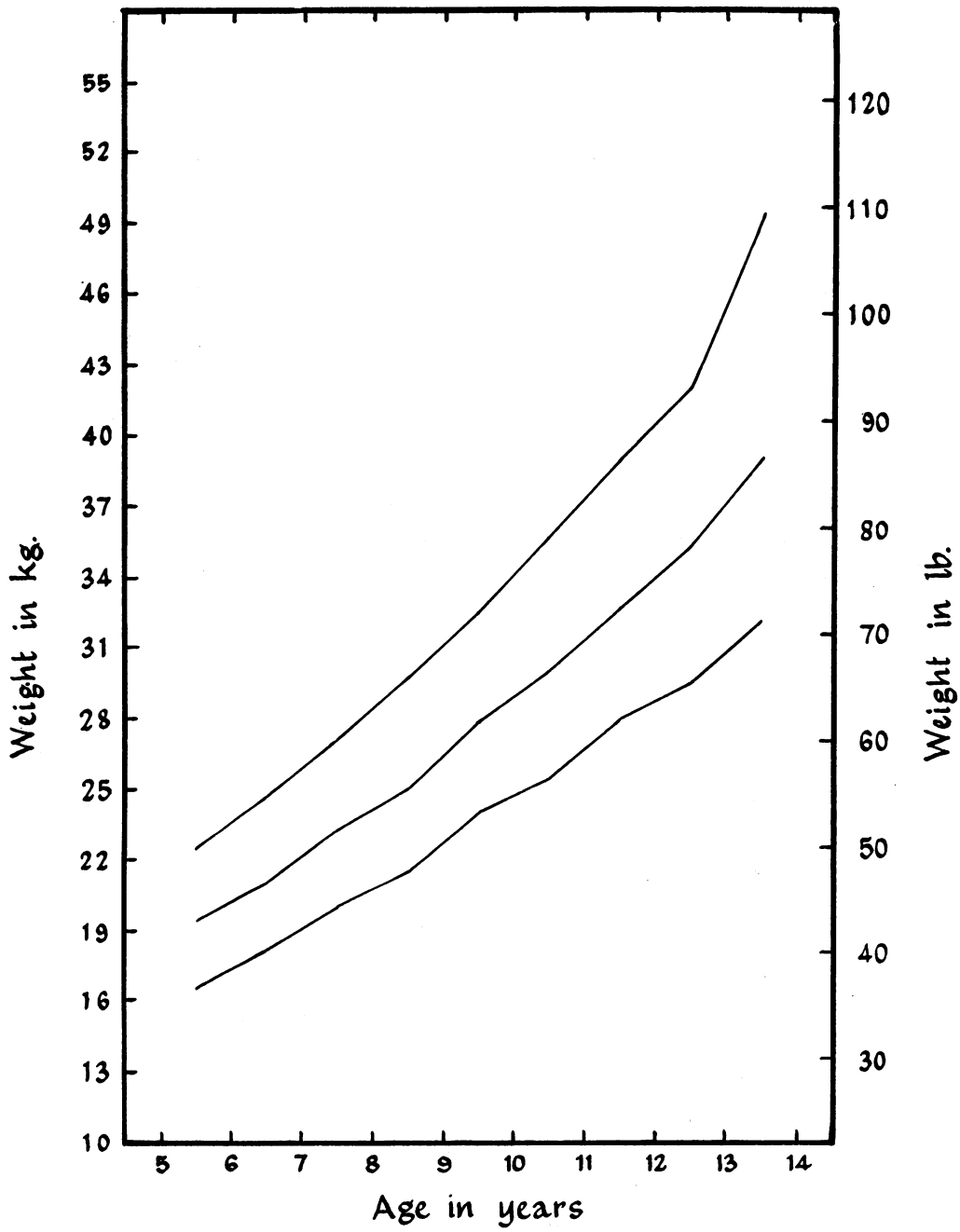

Figure 3. Dispersion of weight according to age
BOYS

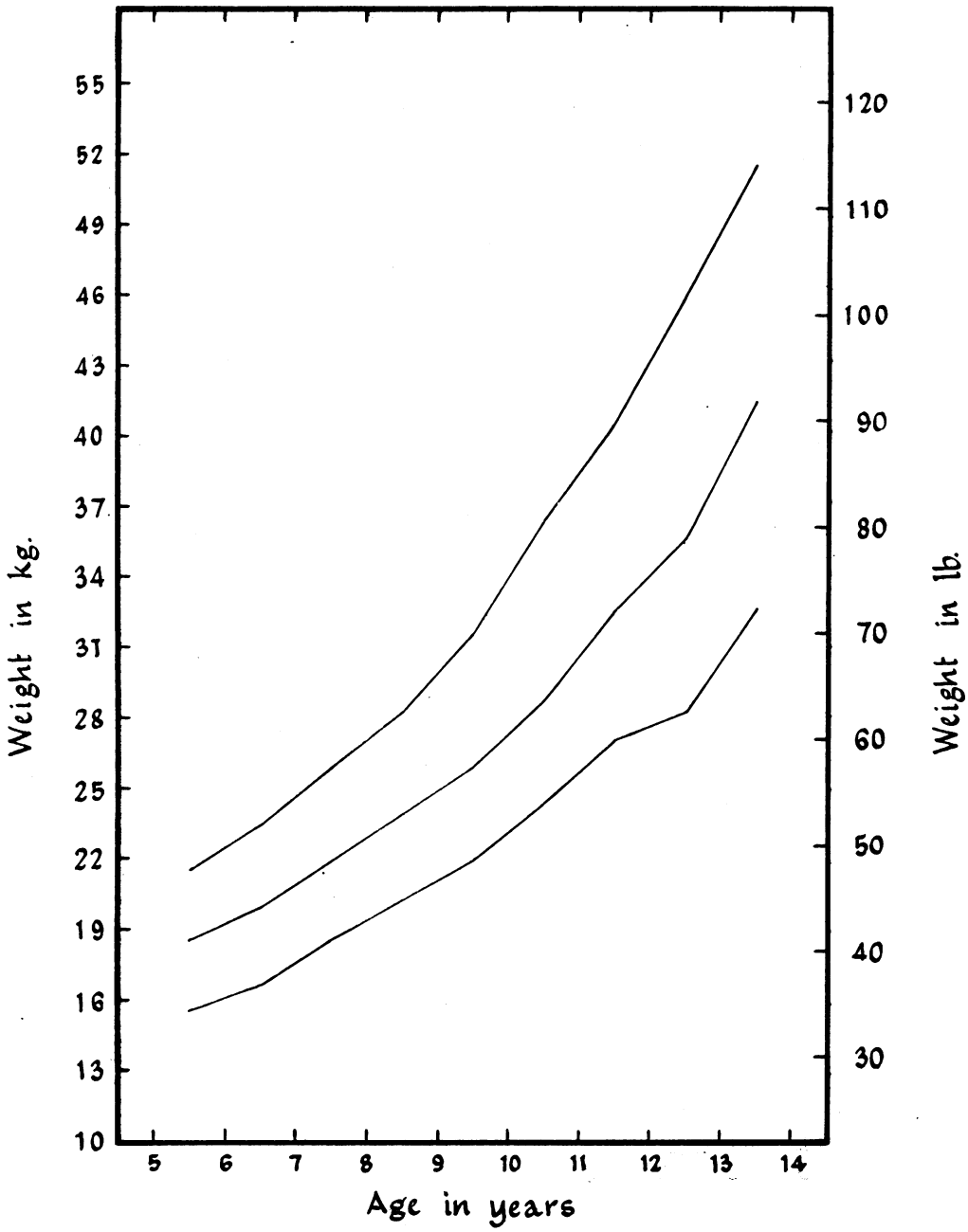

Figure 4. Dispersion of weight according to age
GIRLS

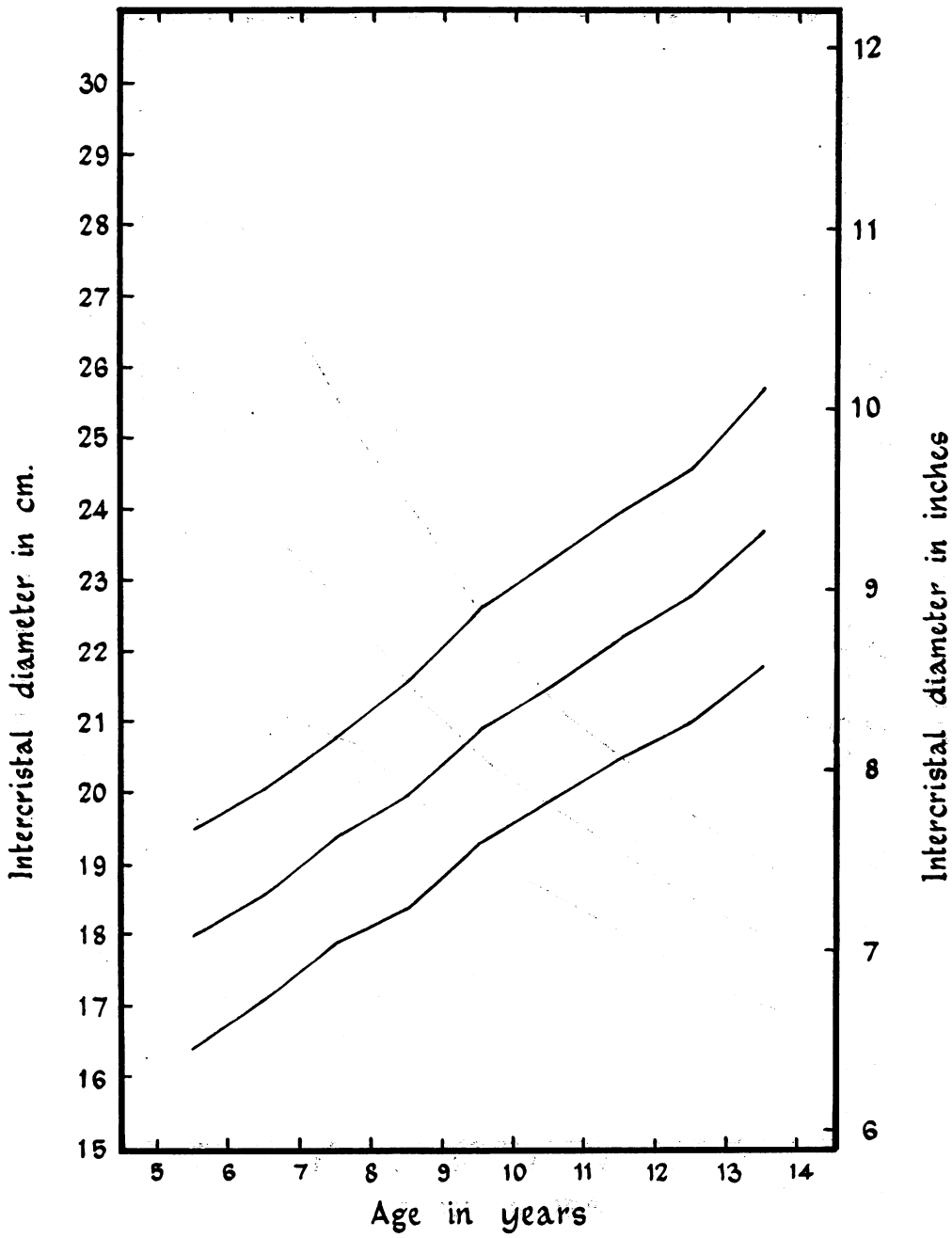

Figure 5. Dispersion of intercristal diameter according to age
BOYS

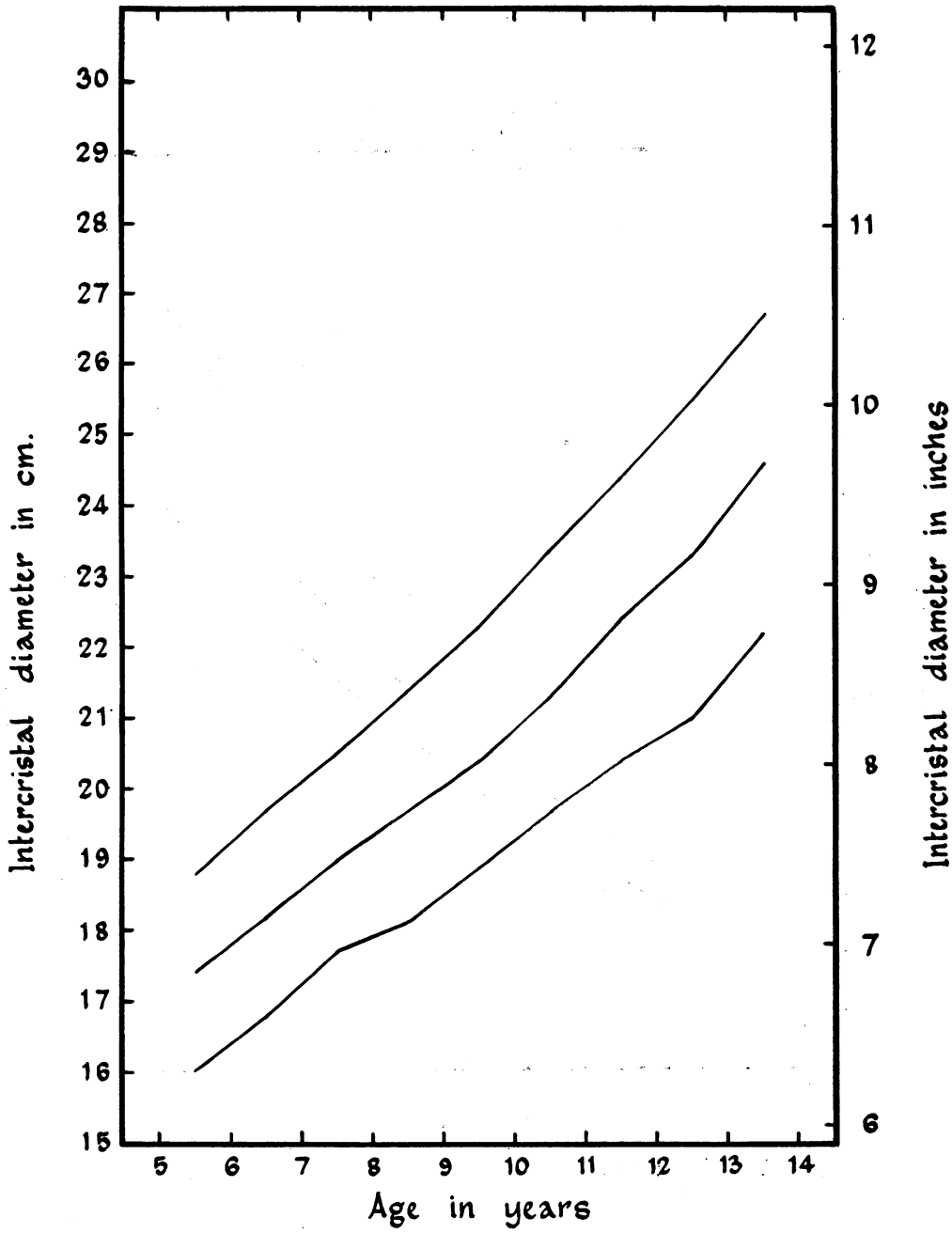

Figure 6. Dispersion of intercristal diameter according to age
GIRLS

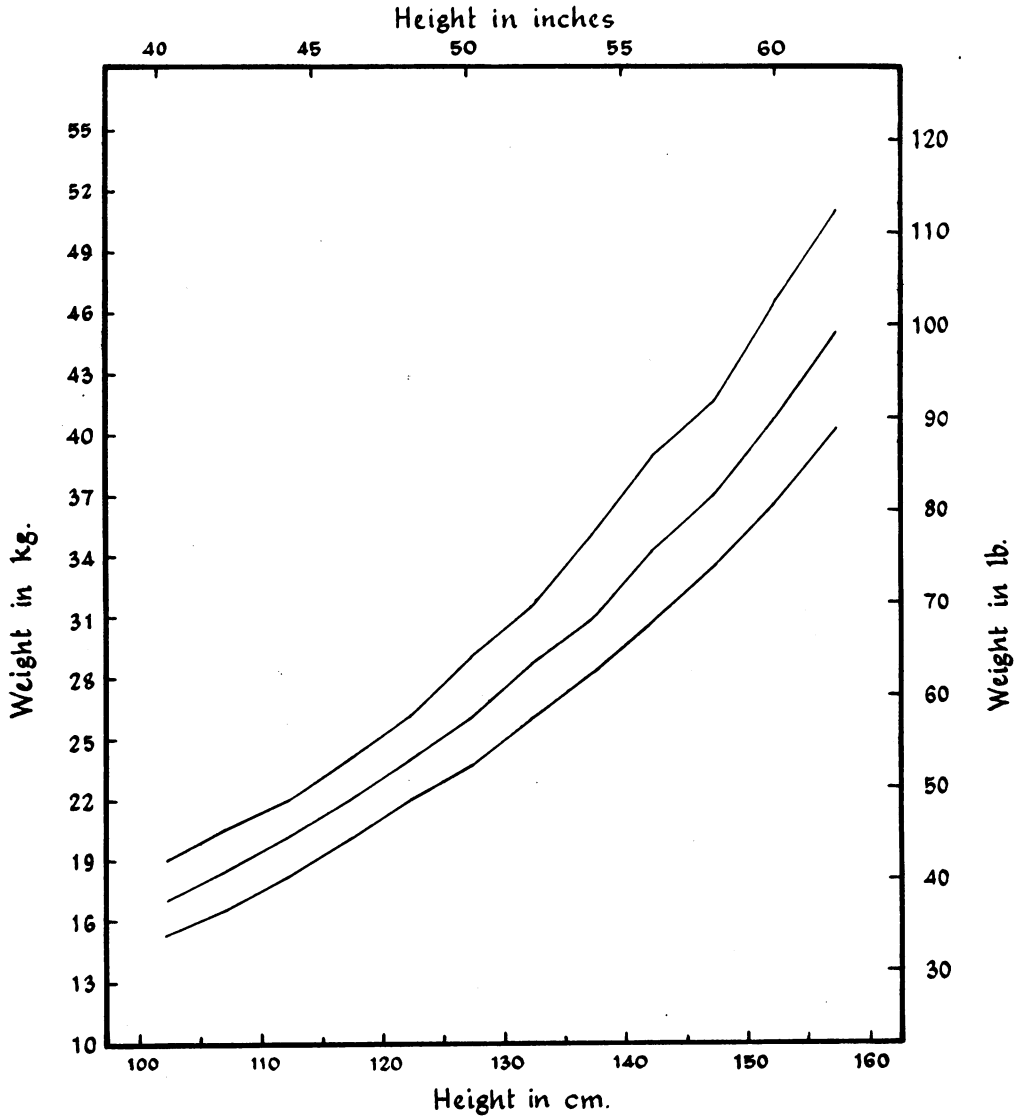

Figure 7. Dispersion of weight according to height
BOYS

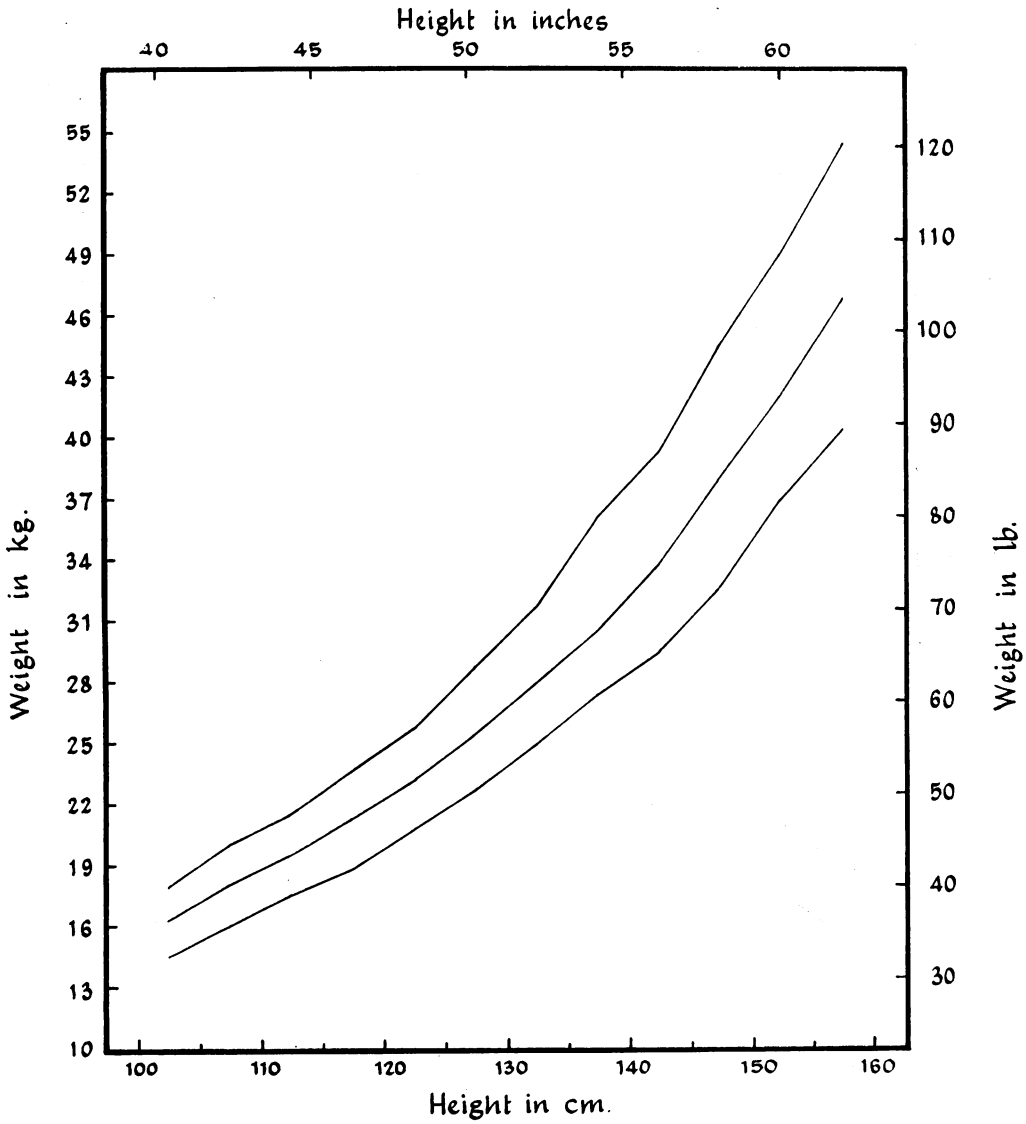

Figure 8. Dispersion of weight according to height
GIRLS

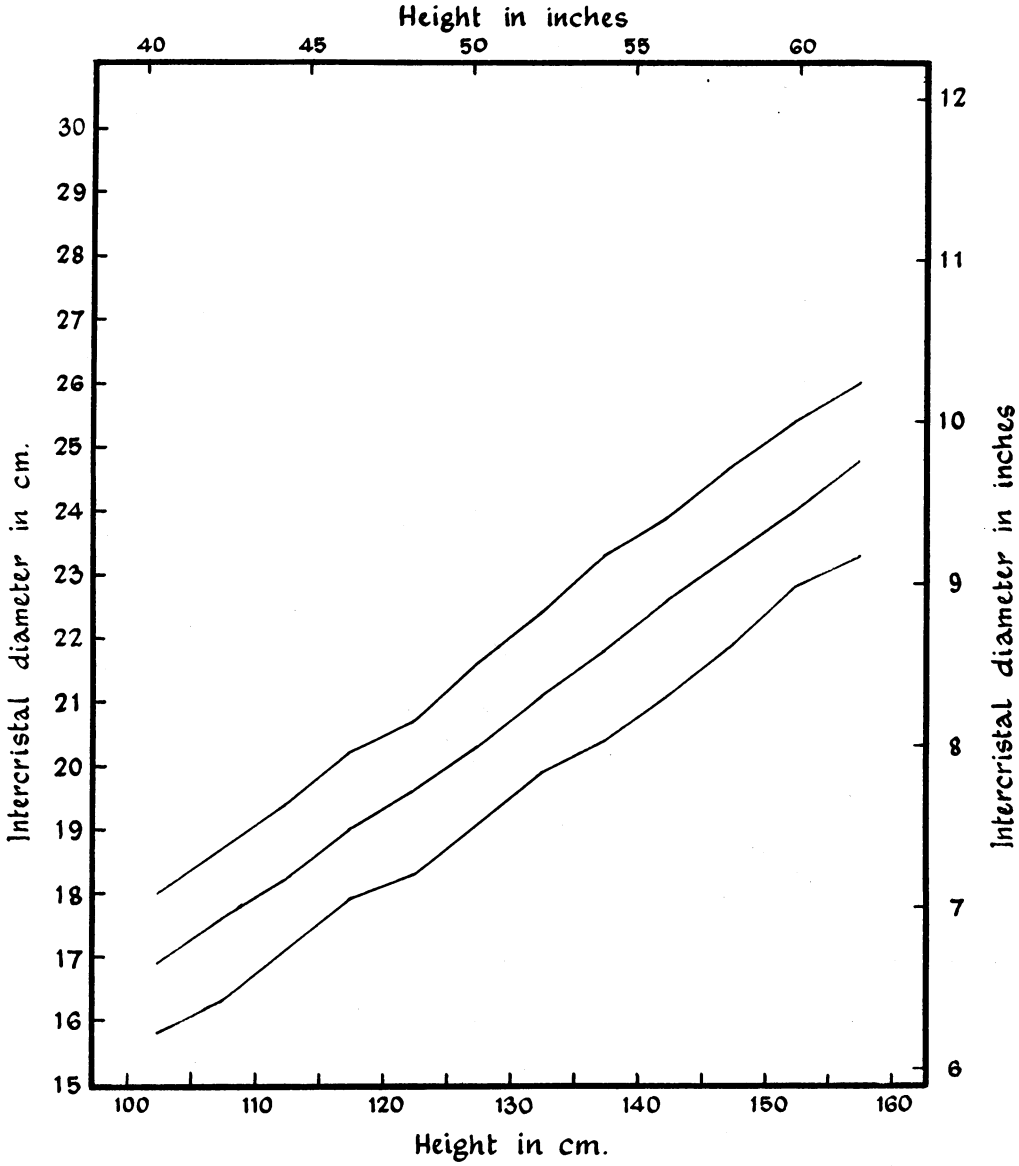

Figure 9. Dispersion of intercristal diameter according to height
BOYS

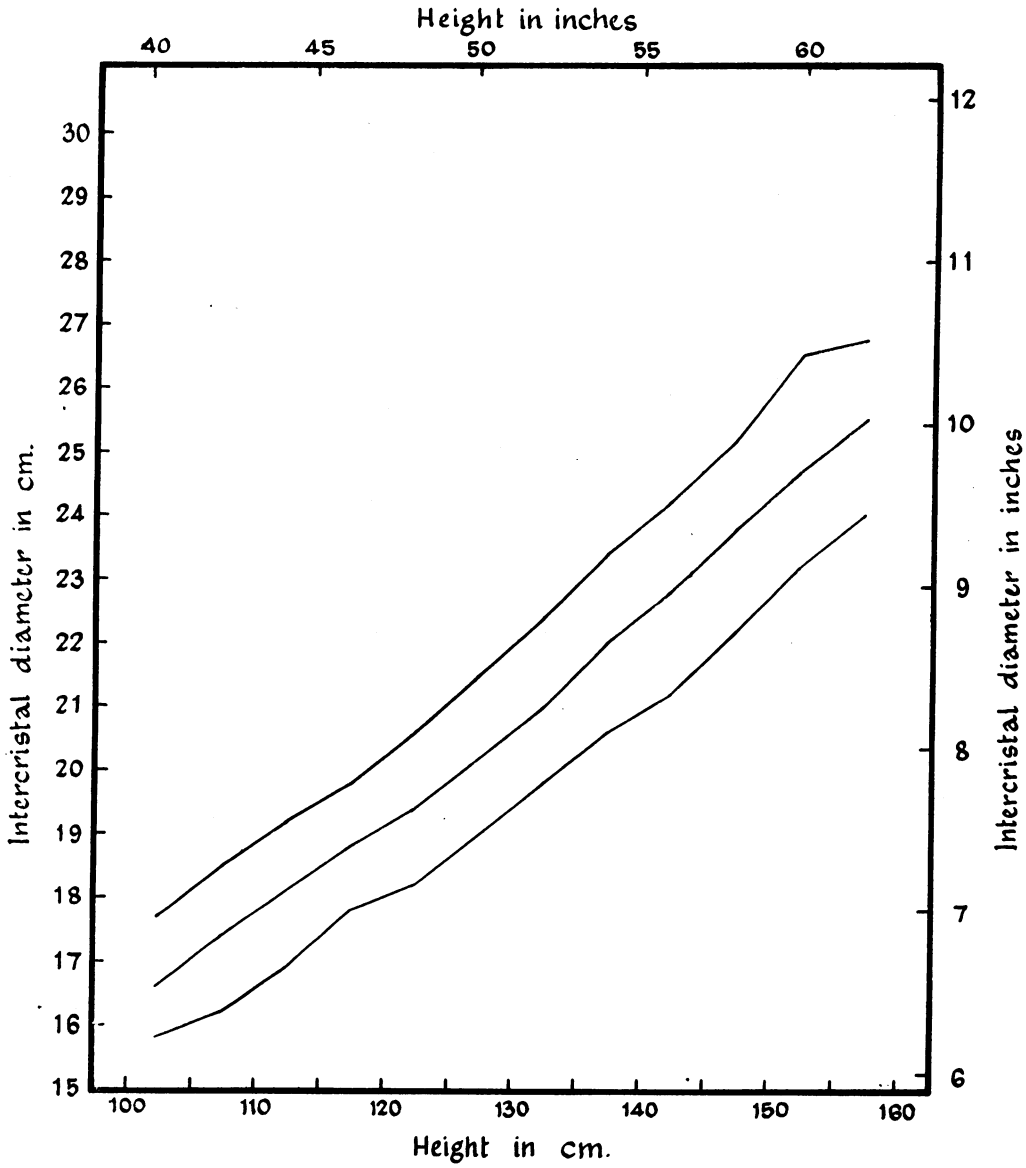

Figure 10. Dispersion of intercristal diameter according to height
GIRLS