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Bulletin No. 266 - Comparative Size of Rural and Urban Utah School Children as Determined by the Weight - Height - Age Relationship

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SUMMARY

The problem investigated was as to whether significant differences occur in size of rural and urban Utah school children. Through cooperation of school officials weight-height-age measurements were secured for the following groups of children from 6 to 15 years of age:

Boys		Girls	
Rural	7039	Rural	5874
Urban	6996	Urban	6875

The following significant differences were found:

(1) In mean standing heights of rural and urban boys for all age periods, except at 6 years.

(2) In mean standing heights of rural and urban girls for all age periods, except at 6 and 7 years.

(3) In mean weights of rural and urban boys at all age periods, except at 9 and 15 years.

(4) In mean weights of rural and urban girls at all age periods, except at age 6.

Differences in mean standing heights were greater and differences in mean weights were less for boys than for girls.

Mean weight-height indices were greater for urban boys at all ages, except at 6 and 10 years.

Mean weight-height indices were greater for urban girls at all ages studied, the greatest differences occurring at 11 and 12 years.

Percentage distributions according to heights and according to weights showed larger percentages of urban children in the taller ranges and in the intervals of greater weight.

Measures of variation showed, with few exceptions, greater variability in heights and in weights of urban children.

Comparison of mean heights and mean weights of groups studied with Baldwin-Wood standards showed the following:

1. Except at age 6, rural boys are below medium height.

2. Urban boys are medium tall, except at age 14, where they are 1 inch short.

3. Rural girls are medium tall at ages 6, 7, 12, 13, and 14 and shorter at other ages.

4. Urban girls are medium tall, except at ages 12 and 13, where they are one inch taller than medium.

5. In mean weight rural boys approach more nearly the Baldwin-Wood averages; rural girls are farthest away from these averages.

It is suggested that causes of smaller size in rural children are environmental rather than genetic (a) because differences are slight in earlier years, becoming greater with age; (b) the same racial stocks are represented in both rural and urban populations in Utah and in practically the same proportions.

Comparative Size of Rural and Urban Utah School Children as Determined by the Weight-Height-Age Relationship

Almeda P. Brown[2]

PLAN OF STUDY

This publication reports a comparison of size on the basis of weight and height for age of 12,913 rural and 13,871 urban children between the ages of 6 and 15 years. The term "rural," as used in this report, includes that part of the population residing outside of incorporated places having more than 2500 inhabitants. This strict interpretation of the term resulted in excluding from the study those boys and girls who are transported from their rural homes to consolidated schools in communities of more than 2500 population. The difficulty of separating, by methods of this study, the rural school children from those residing in these larger communities made such exclusion necessary. The result will be noted in the comparatively small numbers of rural boys and girls in the 14- and 15-year-old groups (Tables 1 and 2). Above age 15, the numbers of rural children in each age group were so small that it was not thought advisable to include them; since this study is comparative, this meant the exclusion also of urban children above 15 years of age.

The rural sample represents schools in 21 of the 29 counties of Utah; 56 schools in 11 different counties were not equipped with scales and hence could not furnish weight-height data.

It is presumed that the urban sample includes the total school population of Logan and of Provo within the age limits (6 to 15 years), since in one instance measurements were obtained through the superintendent's office and through the office of the school nurse in the other. Forty-nine per cent of the elementary and junior high schools of Salt Lake City are represented in the sample. No data were received from Ogden schools.

No attempt was made to obtain information concerning racial stock of children from whom measurements were secured, for the reason that it was feared such loading of the schedule might result in seriously limiting returns of weight-height data. Measurements from several small mining towns were excluded from the calculations because the mine workers were

Acknowledgment:—Appreciation is expressed to the following whose fine cooperation made possible the securing of necessary data: To the State Superintendent of Public Instruction, to superintendents of cities and of districts, to school principals and teachers, and to the two school nurses who assisted in making necessary tests; to John Vranes, Ludeen Jensen Vranes, and to Vera Greaves, for assistance in statistical treatment of data.

1Contribution from Department of Home Economics, Utah Agricultural Experiment Station.

2Associate in Home Economics Research.

Final Report on Purnell Project No. 145: Comparative Size of Rural and Urban School Children as Determined by the Weight-Height-Age Relationship.

Publication authorized January 9, 1936.

largely Italian. Mitchell[3] reports work done by the American Child Health Association which shows that children born in America of Italian parents are smaller than children born of American-born parents.

Weight and height measurements were made under the direction of teachers, and in order to secure comparable data cooperating teachers were requested to follow uniform procedure (Form 1, Appendix). It is quite possible that even with uniform technique slight differences in data might arise, due to the personal factor as well as to a probable lack of uniformity in scales, both as to style and adjustment. It is hoped that the size of sample will tend to overcome these unavoidable differences.

To eliminate possible effects of season on size of children only those measurements taken between December 1 and the middle of the following February were included in the calculations.

MEAN HEIGHTS AND WEIGHTS OF RURAL AND URBAN CHILDREN COMPARED

Up to and including the tenth year mean heights of rural and urban boys differ less than one inch; from eleven to fifteen years the differences are slightly above one inch. At six years mean weights differ not at all; from seven to ten years inclusive, the differences vary from 1.1 to 1.5 pounds; thereafter, the differences are 3 pounds or more. This information is summarized in Table 1. In Columns 2 and 3 (Table 1) is shown also the

Table 1—Comparison of mean standing heights and of mean weights of 7039 rural and 6996 urban boys, from 6 to 15 years of age1.

Age (yrs.)	No. Boys in Each Age Group		Mean Height (in.)		Excess in Mean Height Urban Over Rural	Mean Weight (lbs.)		Excess in Mean Weight Urban Over Rural
	Rural	Urban	Rural	Urban		Rural	Urban	
6	370	344	45.7	45.8	0.1	46.4	46.4	0.0
7	899	537	47.2	47.9	0.7	49.7	51.2	1.5
8	947	625	49.5	50.1	0.6	55.0	56.4	1.4
9	904	647	51.4	52.1	0.7	60.4	61.8	1.4
10	983	650	53.3	54.0	0.7	66.5	67.6	1.1
11	815	645	54.9	56.1	1.2	71.9	75.1	3.2
12	703	704	57.0	58.1	1.1	78.9	82.5	3.6
13	669	849	59.1	60.2	1.1	87.8	90.9	3.1
14	492	1100	61.4	62.5	1.1	98.3	101.6	3.3
15	257	895	63.7	64.8	1.1	110.5	113.6	3.1
All Ages	7039	6996						

1In all tables in this publication, ages are those at nearest birthday.

Table 2—Comparison of mean standing heights and of mean weights of 5874 rural and 6875 urban girls, from 6 to 15 years of age.

Age (yrs.)	No. Girls in Each Age Group		Mean Height (in.)		Excess in Mean Height Urban Over Rural	Mean Weight (lbs.)		Excess in Mean Weight Urban Over Rural
	Rural	Urban	Rural	Urban		Rural	Urban	
6	324	352	45.2	45.5	0.3	44.2	45.0	0.8
7	778	493	47.0	47.4	0.4	47.3	48.4	1.1
8	797	568	49.0	49.6	0.6	52.1	54.3	2.2
9	792	647	51.4	51.8	0.4	58.1	60.1	2.0
10	791	615	53.2	54.0	0.8	63.5	66.4	2.9
11	697	637	55.2	56.3	1.1	70.4	75.2	4.8
12	641	682	57.6	58.7	1.1	79.5	85.0	5.5
13	535	883	60.3	61.1	0.8	91.0	95.0	4.0
14	375	1118	61.7	62.5	0.8	100.5	104.1	3.6
15	144	880	62.3	63.3	1.0	105.3	110.1	4.8
All Ages	5874	6875						

3"A Study of Factors Associated with the Growth and Nutrition of Porto Rican Children." By H. H. Mitchell. In HUMAN BIOLOGY, 4: 469. 1932. Johns Hopkins Press. Baltimore, Maryland.

number of boys at each age from 6 to 15. Table 2 gives similar information for girls. It will be observed that mean heights of rural and urban girls approach each other more nearly than do heights of rural and urban boys, but at most ages the spread in mean weights is greater. That differences in heights and weights of rural and urban children are significant after the first year or two in school is shown by the values of the standard differences or critical ratios[4] (Table 3), which have been calculated in connection with the heights and weights of the groups at all ages from 6 to 15 years.

In Figure 1 mean heights and weights of both groups of children at each year of age are plotted on a semi-logarithmic scale in order to show the nature of the rate of increase in height and in weight, at various ages, and to compare the nature of these rates for rural and urban children grouped according to sex.

Fig. 1

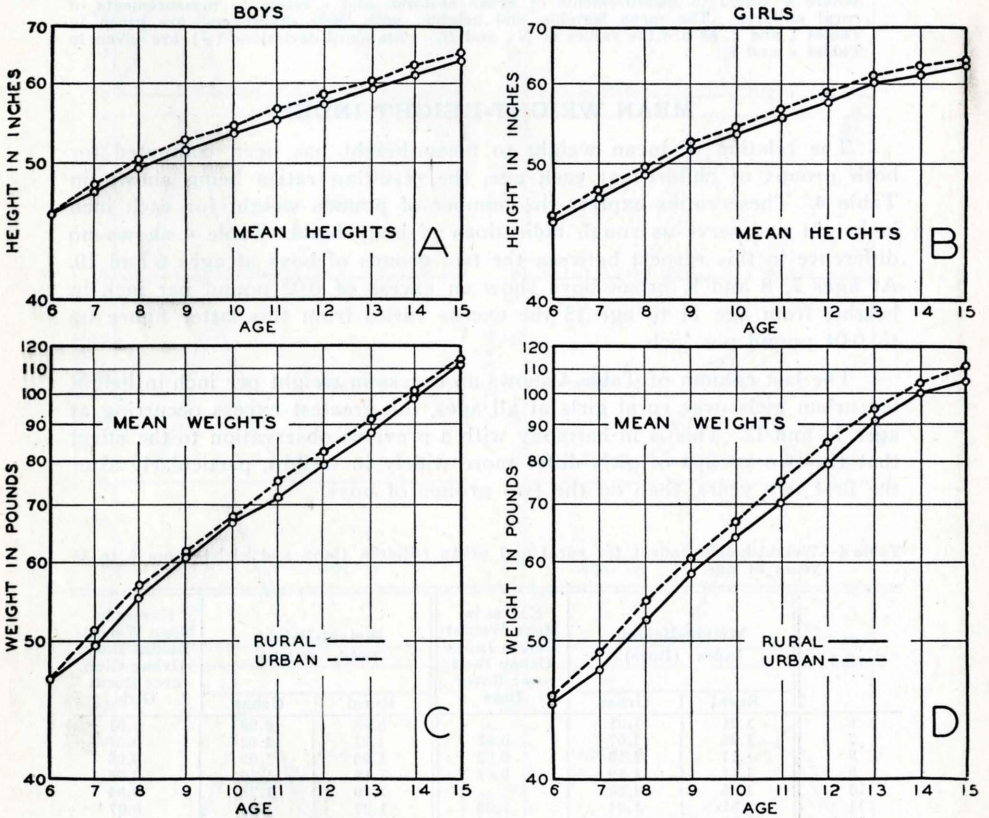

Fig. 1—Rate of increase in heights and weights of rural and urban children from 6 to 15 years of age.

[4]When this ratio is greater than 3, it may be assumed that for samples of children taken in the same manner as these the chances are negligible that the differences may have occurred by chance.

Table 3—Standard differences[1] of mean heights and of mean weights of rural and urban children (boys and girls) at each age, from 6 to 15 years of age.

Age Period	For Heights Standard Differences or Critical Ratios		For Weights Standard Differences or Critical Ratios	
	Boys	Girls	Boys	Girls
6	0.02	1.42	.....	1.90
7	5.64	2.79	4.22	3.11
8	5.04	4.38	3.88	5.67
9	4.77	3.43	4.23	4.49
10	4.70	5.13	2.47	5.36
11	4.67	6.81	5.90	6.75
12	7.31	6.22	5.63	6.85
13	6.33	4.58	4.04	4.30
14	5.35	4.25	3.38	3.73
15	4.70	4.42	2.35	3.51

[1]Formula: $$\frac{M_u - M_r}{\sqrt{\frac{\sigma_u^2}{N_u} + \frac{\sigma_r^2}{N_r}}}$$

Where u refers to measurements of urban children and r refers to measurements of rural children. The mean weights and heights, with their differences, are given in Tables 1 and 2, as are the values of N_u and N_r. Standard deviations (σ) are given in Tables 5 and 6.

MEAN WEIGHT-HEIGHT INDEX

The relation of mean weight to mean height has been computed for both groups of children at each age, the resulting ratios being shown in Table 4. These ratios express the number of pounds weight for each inch in height and serve as rough indications of body build. Table 4 shows no difference in this respect between the two groups of boys at ages 6 and 10. At ages 7, 8 and 9, urban boys show an excess of 0.02 pound per inch in height; from age 11 to age 15 the excess varies from this latter figure up to 0.04 pound per inch.

The last column of Table 4 shows an excess in weight per inch in height for urban girls over rural girls at all ages, the greatest excess occurring at ages 11 and 12. This is in harmony with a previous observation to the effect that the two groups of girls differ more widely in weight, particularly after the first two years, than do the two groups of boys.

Table 4—Weight-height index[1] for rural and urban children (boys and girls) from 6 to 15 years of age.

Age Period	Weight-Height Index (Boys)		Excess in Mean Weight-Height Index Urban Boys over Rural Boys	Weight-Height Index (Girls)		Excess in Mean Weight-Height Index Urban Girls over Rural Girls
	Rural	Urban		Rural	Urban	
6	1.01	1.01	.....	0.98	0.99	0.01
7	1.05	1.07	0.02	1.01	1.02	0.01
8	1.11	1.13	0.02	1.06	1.09	0.03
9	1.17	1.19	0.02	1.13	1.16	0.03
10	1.25	1.25	.....	1.19	1.23	0.04
11	1.31	1.34	0.03	1.27	1.34	0.07
12	1.38	1.42	0.04	1.38	1.45	0.07
13	1.48	1.51	0.03	1.51	1.55	0.04
14	1.60	1.63	0.03	1.63	1.67	0.04
15	1.73	1.75	0.02	1.69	1.74	0.05

[1] $\frac{\text{Mean weight in pounds}}{\text{Mean height in inches}}$ = Mean weight-height ratio, or weight-height index.

DIFFERENCES IN SIZE OF CHILDREN WITHIN THE SAME AGE GROUP

The mean heights and weights discussed so far give no information concerning the distribution of children on the bases of height and of weight within groups of like age and sex. For this reason, the percentages of boys and girls, both rural and urban, were computed for each inch in the range of heights and for each pound in the range of weights. This reduction of all heights and weights to a percentage basis makes possible a comparison of the relative tallness and heaviness of children within each sex and age group. Percentages for boys are plotted in Figures 2 and 3 and for girls in Figures 4 and 5.

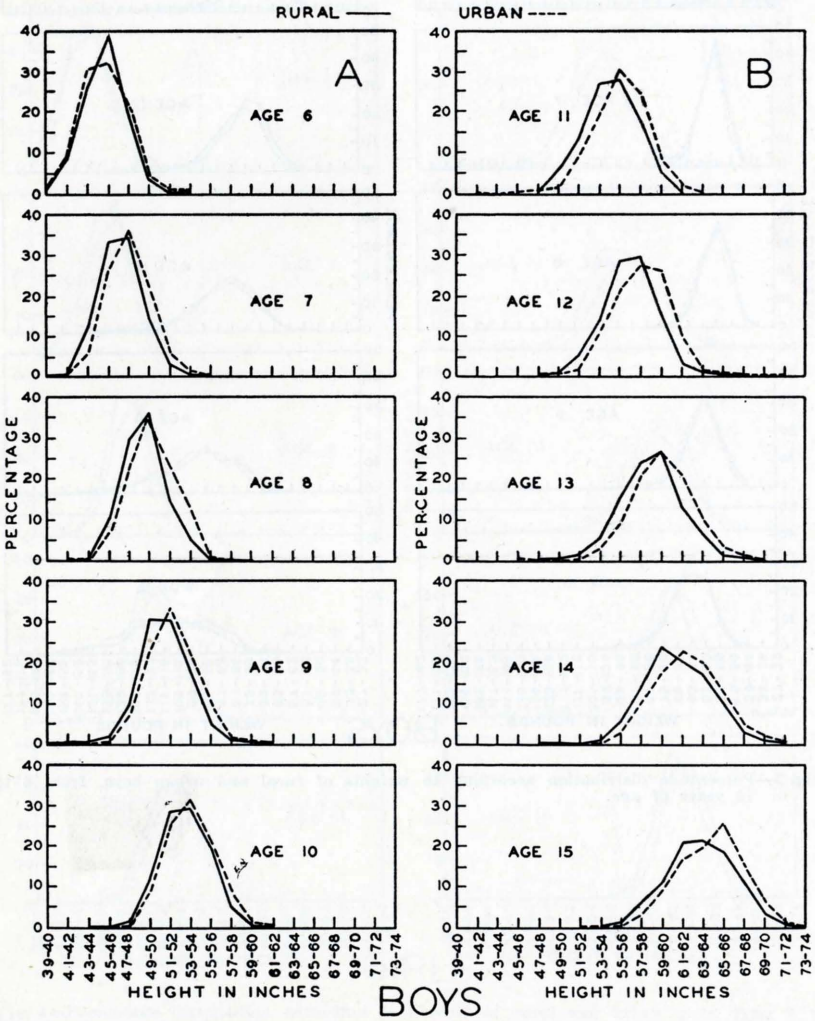

Fig. 2—Percentage distribution according to heights of rural and urban boys, from 6 to 15 years of age.

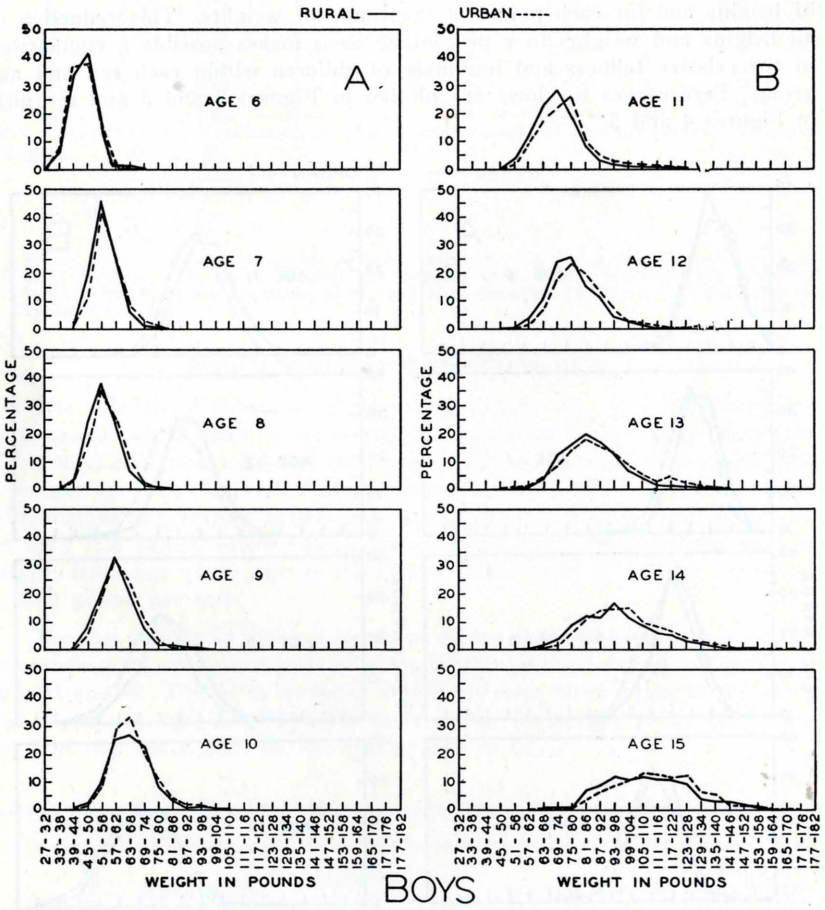

Fig. 3—Percentage distribution according to weights of rural and urban boys, from 6 to 15 years of age.

Though the mean height of 6-year-old urban boys is but 0.1 inch greater than the mean for rural boys of the same age, the percentage distribution of heights in the two groups is somewhat different, as shown by the curves for 6-year-old boys in Figure 2. The dotted curve, representing the percentage distribution of heights for urban boys, shows higher percentages for urban boys' heights at all intervals, except in the interval 45 to 46 inches. After age 6, as is clearly shown by succeeding curves, there is a larger percentage of urban boys in the tall ranges. This tendency is seen to increase as age increases.

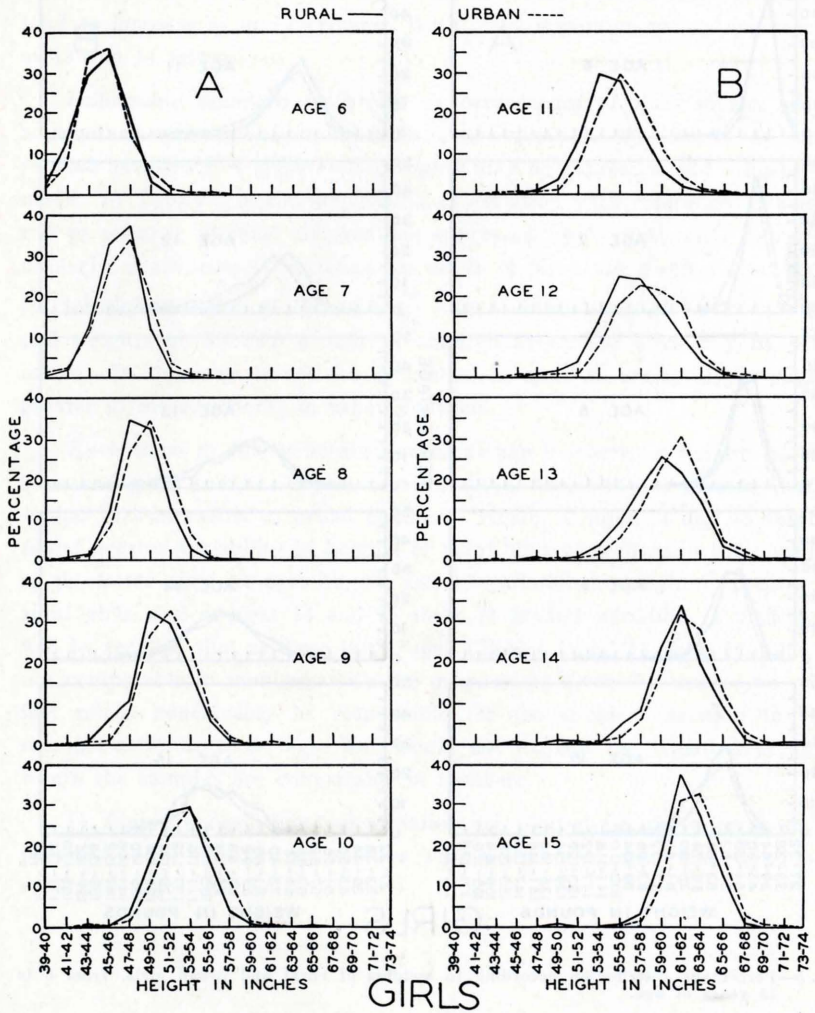

Fig. 4—Percentage distribution according to heights of rural and urban girls, from 6 to 15 years of age.

The curves in Figure 3, showing percentage distributions according to weights, illustrate the tendency for weights of urban boys to be distributed in the intervals of greater weight. This tendency also increases with age.

Percentage distributions of heights and weights of rural and urban girls bear close resemblance to those just discussed for boys, as may be seen from the curves in Figures 4 and 5.

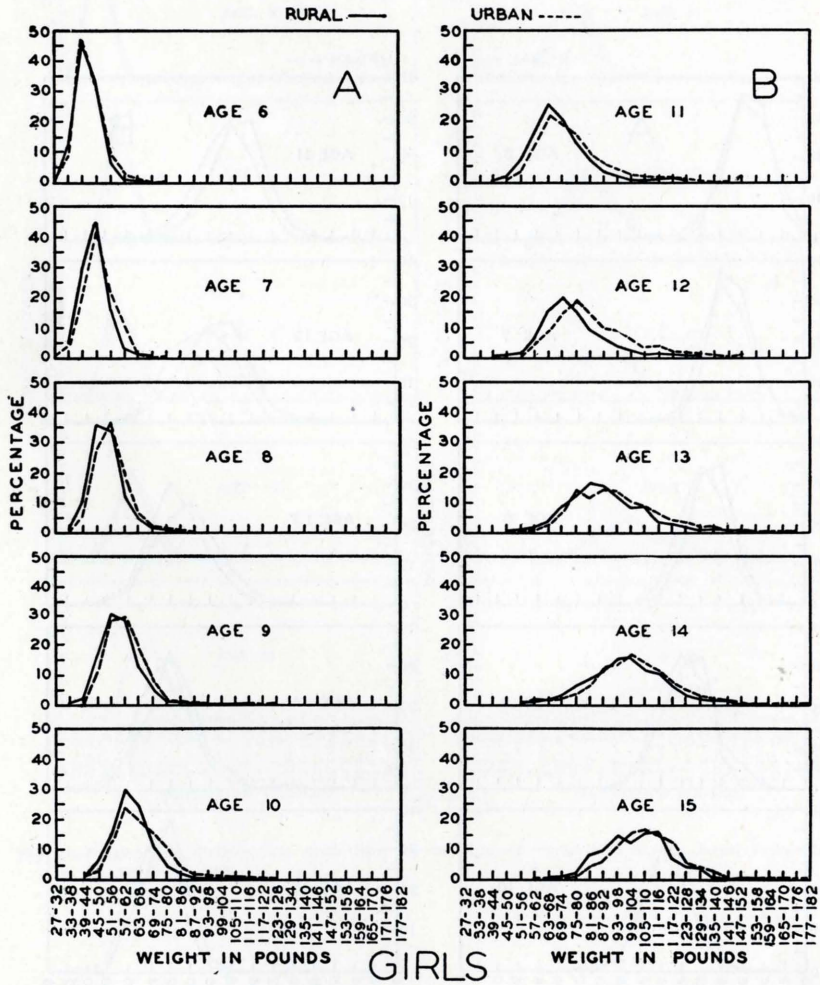

Fig. 5—Percentage distribution according to weights of rural and urban girls, from 6 to 15 years of age.

VARIABILITY IN HEIGHTS AND WEIGHTS

Observance of height and weight curves in Figures 2 to 5 shows a marked degree of dispersion about the means, particularly noticeable in the older age groups.

Numerical measures of such dispersion are expressed by the standard deviations, computed for each group of children at various ages, and shown in Tables 5 and 6, along with the standard errors. Values of these measures show no great differences in dispersion about mean heights and weights of rural and urban children of the same age, but values of the standard deviation tend to increase as age increases. With girls, maximum values are reached at 13 and 14 years.

Expressing standard deviations as percentages of their means affords abstract measures, termed coefficients of variation, by means of which relative variability in heights and weights may be expressed and comparisons made. In Tables 5 and 6 coefficients of variation with reference to heights and to weights of rural children are expressed by V, with an r subscript; similarly, coefficients of variation for urban children are given a u subscript. By calculating values of the ratio $\frac{V_r}{V_u}$, the comparative variability in heights and weights of the two groups of children at various ages may be determined. In this way it will be seen that, in general, variability is slightly greater in measurements of urban children.

Exceptions to this generality occur at age 9 where, in heights of rural boys and girls and in weights of rural boys, variability is greater than in similar measurements of urban children. Again, at ages 14 and 15 there is found greater variability in heights of rural boys as well as in their weights at the latter age. At ages 13, 14, and 15 variation in height is greater for rural girls, and at ages 14 and 15 there is greater variation in weight. It will be recalled that at these latter ages (Tables 1 and 2) rural samples are not comparable in numbers with the urban samples at the same ages. This fact might conceivably be responsible for the greater variation in rural measurements at those ages but would not explain the situation at age 9 where the samples are comparable in numbers.

In Figure 6 coefficients of variation are plotted for the purpose of expressing more clearly the relative variability in heights and weights of rural and urban children.

Table 5—Variability in heights and weights of rural and urban boys, from 6 to 15 years of age.

Age (yrs.)	Heights							Weights						
	Standard[1] Deviation		Standard[2] Error		Coefficient of 3 Variation (V)		$\frac{V_r}{V_u}$	Standard Deviation		Standard Error		Coefficient of Variation (V)		$\frac{V_r}{V_u}$
	Rural	Urban	Rural	Urban	Rural (V_r)	Urban (V_u)		Rural	Urban	Rural	Urban	Rural (V_r)	Urban (V_u)	
6	2.22	2.35	0.115	0.127	4.83	5.11	94.5	5.31	5.40	0.276	0.291	11.54	11.73	98.4
7	2.31	2.53	0.077	0.109	4.91	5.27	94.3	5.63	7.01	0.188	0.302	11.26	13.74	95.9
8	2.41	2.47	0.078	0.099	4.93	4.95	99.6	6.30	7.06	0.205	0.282	11.45	12.61	93.8
9	2.60	2.58	0.086	0.101	5.10	4.95	103.0	7.87	7.56	0.262	0.297	13.12	12.20	107.5
10	2.59	2.79	0.083	0.109	4.88	5.16	94.6	8.54	8.83	0.272	0.346	12.75	12.99	98.1
11	2.77	2.98	0.097	0.117	5.04	5.32	94.7	9.51	10.90	0.333	0.429	13.21	14.54	90.8
12	2.83	3.05	0.107	0.115	4.96	5.25	94.5	11.06	12.71	0.417	0.479	14.00	15.50	90.3
13	3.24	3.34	0.125	0.115	5.49	5.57	98.6	13.71	15.88	0.530	0.545	15.58	17.45	89.3
14	3.52	3.54	0.159	0.107	5.78	5.70	103.1	17.56	18.47	0.792	0.557	17.92	18.11	98.8
15	3.34	3.31	0.208	0.111	5.22	5.10	102.3	19.36	18.04	1.208	0.603	17.60	15.82	111.2

Table 6—Variability in heights and weights of rural and urban girls, from 6 to 15 years of age.

Age (yrs.)	Heights							Weights						
	Standard Deviation		Standard Error		Coefficient of[3] Variation (V)		$\frac{V_r}{V_u}$	Standard Deviation		Standard Error		Coefficient of Variation (V)		$\frac{V_r}{V_u}$
	Rural	Urban	Rural	Urban	Rural (V_r)	Urban (V_u)		Rural	Urban	Rural	Urban	Rural (V_r)	Urban (V_u)	
6	2.35	2.42	0.130	0.129	5.23	5.37	97.4	5.43	5.98	0.302	0.319	12.34	13.29	92.8
7	2.21	2.48	0.079	0.112	4.71	5.56	84.7	5.62	6.22	0.201	0.280	11.95	12.95	92.3
8	2.41	2.56	0.085	0.107	4.91	5.11	96.1	6.68	7.35	0.237	0.308	12.84	13.60	94.4
9	2.52	2.54	0.089	0.099	4.93	4.87	101.2	8.23	9.10	0.292	0.358	14.19	15.16	93.6
10	2.65	2.84	0.094	0.144	5.00	5.27	94.9	9.54	10.48	0.339	0.423	15.15	15.88	95.4
11	2.80	3.04	0.106	0.120	5.08	5.43	93.5	11.44	14.16	0.443	0.561	16.35	18.88	86.6
12	3.19	3.38	0.126	0.130	5.49	5.73	95.8	13.35	16.08	0.527	0.616	16.90	18.92	89.3
13	3.34	3.09	0.144	0.104	5.57	4.89	113.9	16.44	17.61	0.711	0.593	18.06	18.54	97.4
14	2.99	2.75	0.154	0.082	4.83	4.44	108.8	16.58	16.58	0.856	0.496	16.58	15.94	104.0
15	2.39	2.42	0.199	0.082	3.86	3.84	100.5	15.05	15.71	1.254	0.530	14.33	14.28	100.3

[1]Formula: $\sigma = \sqrt{\frac{\Sigma fd^2}{N} - c^2} \times I$

[2]Formula: $\sigma_m = \frac{\sigma}{\sqrt{N}}$

[3]Formula: $V = \frac{\sigma}{M} \times 100$

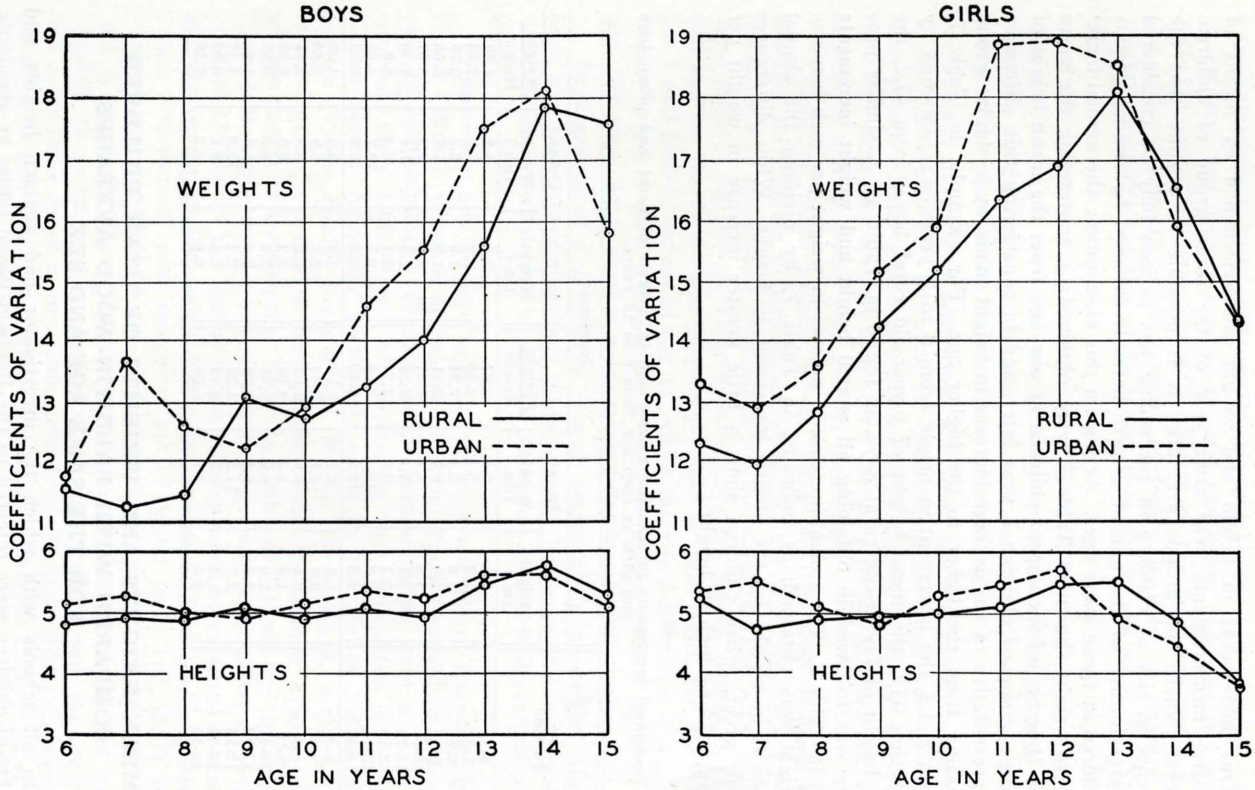

Fig. 6—Relative variability in heights and weights of rural and urban boys and girls from 6 to 15 years of age. (Expressed by coefficients of variation.)

ANNUAL INCREMENTS IN STANDING HEIGHT AND IN WEIGHT

True increments in height and weight are determined by means of successive measurements year after year of the same group of children. However, where the groups are large it is possible to assume that the difference in size of children in succeeding age periods may be considered as representative of the annual growth actually attained by similar groups of children at those same ages. Acting on this assumption, the annual increments in height shown in Table 7 were obtained by subtracting the mean height (number of inches) of children at one age from the mean height of the same group of children a year later, and in considering this difference as representative of the average increase in height made by a similar group in passing from the lower to the higher age. For example, in Table 7, Column 2, 1.5, the increment in height from 6 to 7 years, was obtained by subtracting 45.7, the mean height of 6-year-old rural boys, from 47.2, the mean height of 7-year-old rural boys, as found in Table 1. A similar procedure was followed in obtaining all annual height and weight increments found in Table 7. The annual increase in pounds in weight per inch increase in height was obtained, as indicated in Table 7, by dividing the annual increment in weight by the annual increment in height. While differences are not great, urban children show a little greater increase in weight per increase of one inch in height.

Table 7—Annual increments in standing heights and in weights of rural and urban boys and girls at each age from 6 to 15 years.

	Age Period	Increment					
		Rural			Urban		
		Height (in.)	Weight (lbs.)	Weight / Height	Height (in.)	Weight (lbs.)	Weight / Height
Boys	6-7	1.5	3.3	2.21	2.1	4.8	2.29
	7-8	2.3	5.3	2.30	2.2	5.2	2.36
	8-9	1.9	5.4	2.84	2.0	5.4	2.70
	9-10	1.9	6.1	3.21	1.9	5.8	3.05
	10-11	1.6	5.4	3.37	2.1	7.5	3.57
	11-12	2.1	7.0	3.33	2.0	7.4	3.70
	12-13	2.1	8.9	4.24	2.1	8.4	4.0
	13-14	2.3	10.5	4.56	2.3	10.7	4.65
	14-15	2.3	12.2	5.30	2.3	12.0	5.22
Girls	6-7	1.8	3.1	1.72	1.9	3.4	1.79
	7-8	2.0	4.8	2.40	2.2	5.9	2.68
	8-9	2.4	6.0	2.50	2.2	5.8	2.64
	9-10	1.8	5.4	3.00	2.2	6.3	2.86
	10-11	2.0	6.9	3.45	2.3	8.8	3.83
	11-12	2.4	9.1	3.79	2.4	9.8	4.08
	12-13	2.7	11.5	4.26	2.4	10.0	4.17
	13-14	1.4	9.5	6.79	1.4	9.1	6.50
	14-15	0.6	4.8	8.00	0.8	6.0	7.50

MEAN HEIGHTS AND WEIGHTS OF UTAH CHILDREN COMPARED WITH BALDWIN-WOOD AVERAGES FOR THE SAME AGE AND SEX

In all schools with which the investigator had contact, heights and weights of children were referred to the Baldwin-Wood tables as standards. This is presumably the practice throughout the state. For this reason mean heights and weights of children in this study were compared with Baldwin-Wood averages for children of the same age and sex.

It was readily seen that measurements for neither urban nor rural groups compared with Baldwin-Wood averages for tall children; hence, in Tables 8 and 9 mean heights of rural and urban children are compared with the averages for medium-tall children of the same age and sex. For this purpose nearest whole number of inches is used to express mean heights of children in this study rather than the means given in Tables 1 and 2.

Table 8 shows that rural boys may be called medium-tall at 6 years of age; at other ages they are one inch shorter than medium, except at age 14 where the deficiency is 2 inches. Urban boys are medium-tall at all ages, except at 14 years where they are one inch shorter.

Table 9 shows that both rural and urban girls approach more nearly to the Baldwin-Wood averages for medium height than do the boys in their groups. Rural girls are medium-tall at ages 6, 7, 12, 13, and 14. At the other ages they are one inch short. Urban girls are medium-tall, except at ages 12 and 13, where they are one inch taller.

Comparing mean weights of the Utah children with Baldwin-Wood averages for children of corresponding height, age, and sex, rural boys are found to bear the closest relationship to the standards and rural girls the most remote. As seen in Table 8, rural boys are "up to weight for height and age" at the 7-, 8-, and 10-year periods; at other ages, the variation is but 1 or 2 pounds, except at age 15, where there is a difference of 5 pounds. Urban boys are quite consistently 2 pounds "below weight" at most ages and, like rural boys, show a more marked "underweight" at age 15.

Both groups of girls show a greater degree of "underweight" than do boys, and the number of pounds below average increases with age, reaching a maximum for rural girls at age 14; for urban girls this is reached a year later.

Apparently, any attempt to make the rank and file of Utah elementary school children measure up to the Baldwin-Wood standards could result only in disappointment. Children whose measurements were used in constructing these tables[5] were all resident in the northeastern part of the United States. According to a study made by the United States Health Service (Public Health Reports Vol. 50, No. 10, March 8, 1935), children of this section, comprising New England and the Middle Atlantic states, are the largest in the country. Those of Utah and Nevada are the smallest. These facts suggest the desirability of having constructed tables of averages to which children of this section of the country could be expected to measure up. The accompanying weight-height-age tables (Tables 10-13, inclusive), though constructed from measurements of 12,913 rural and 13,871 urban children, and smoothed by the method of least squares, are not offered as such a standard. These children constitute an entirely unselected group, including the subnormal in physical development, along with the others, as well as all races found in the public schools of the state. However, as stated elsewhere in this report, an attempt was made to exclude children of Italian-born parents by eliminating those few mining communities in which Italians

5Reference is made to explanations accompanying the tables as published by the American Child Health Association in a supplement to the July 1923 issue of MOTHER AND CHILD.

Table 8—Mean heights and weights of rural and urban school boys, compared with Baldwin-Wood averages for the same age.

Age (yrs.)	Mean Height (Boys)		Baldwin-Wood Avg. for Medium Tall Boys	Differences (Boys)		Mean Weights (Boys)		Baldwin-Wood Avg. Weight for Boys of Same Height and Age		Differences (Boys)	
	Of Rural	Of Urban		For Rural	For Urban	Of Rural	Of Urban	For Rural	For Urban	For Rural	For Urban
6	46	46	46	0	0	46	46	48	48	-2	-2
7	47	48	48	-1	0	50	51	50	53	0	-2
8	49	50	50	-1	0	55	56	55	58	0	-2
9	51	52	52	-1	0	60	62	61	64	-1	-2
10	53	54	54	-1	0	67	68	67	70	0	-2
11	55	56	56	-1	0	72	75	73	77	-1	-2
12	57	58	58	-1	0	79	82	81	85	-2	-3
13	59	60	60	-1	0	88	91	89	93	-1	-2
14	61	62	63	-2	-1	98	102	99	103	-1	-1
15	64	65	65	-1	0	110	114	115	120	-5	-6

Table 9—Mean heights and weights of rural and urban school girls, compared with Baldwin-Wood averages for the same age.

Age (yrs.)	Mean Height (Girls)		Baldwin-Wood Avg. for Medium Tall Girls	Differences (Girls)		Mean Weights (Girls)		Baldwin-Wood Avg. Weight for Girls of Same Height and Age		Differences (Girls)	
	Of Rural	Of Urban		For Rural	For Urban	Of Rural	Of Urban	For Rural	For Urban	For Rural	For Urban
6	45	45	45	0	0	44	45	45	45	-1	0
7	47	47	47	0	0	47	48	50	50	-3	-2
8	49	50	50	-1	0	52	54	55	57	-3	-3
9	51	52	52	-1	0	58	60	61	64	-3	-4
10	53	54	54	-1	0	63	66	68	70	-5	-4
11	55	56	56	-1	0	70	75	74	78	-4	-3
12	58	59	58	0	+1	79	85	86	90	-7	-5
13	60	61	60	0	+1	91	95	97	101	-6	-6
14	62	62	62	0	0	100	104	109	109	-9	-5
15	62	63	63	-1	0	105	110	113	116	-8	-6

Table 10—Smoothed weight-height-age table for rural Utah school boys[1].

Height (In.)	Average weight in pounds at each age from 6 to 15 years									
	6	7	8	9	10	11	12	13	14	15
41	37									
42	40	41								
43	42	42								
44	44	44								
45	45	45	47							
46	47	47	48	50						
47	49	50	50	51						
48	50	52	52	52	54					
49		54	54	54	56	58				
50		56	57	57	58	59				
51		58	59	60	61	61	63			
52			61	62	63	64	66			
53			63	65	66	67	68			
54			64	68	69	70	71	73		
55				70	72	73	74	74		
56				72	74	76	77	77	77	
57					77	78	79	80	81	
58					79	81	83	84	84	88
59						82	86	88	89	91
60						83	90	93	93	95
61							94	96	98	99
62							98	100	102	103
63								102	107	108
64								103	112	113
65									116	119
66									120	124
67									124	129
68										135
69										140

Table 11—Smoothed weight-height-age table for urban Utah school boys[1].

Height (In.)	Average weight in pounds at each age from 6 to 15 years									
	6	7	8	9	10	11	12	13	14	15
42	40									
43	41									
44	43	44								
45	45	45	46							
46	47	47	48							
47	49	49	49	49						
48	51	51	52	52						
49	53	54	54	55	55					
50		56	56	57	57	58				
51		58	59	59	60	61				
52		60	62	62	63	64				
53			64	64	65	67				
54				67	68	69	69	72		
55				71	72	72	73	73	77	
56				75	75	75	76	76	79	
57					78	78	79	79	81	
58					82	82	82	82	84	86
59						86	86	86	87	90
60						90	90	91	91	93
61							94	95	95	98
62							100	100	100	102
63								104	104	107
64								109	109	112
65								112	114	117
66								115	119	122
67								117	123	126
68									128	130
69									132	133
70										135

1General equation: $Y = a + bx + cx^2 + dx^3$

Table 12—Smoothed weight-height-age tables for rural Utah school girls[1].

Height (In.)	Average weight in pounds at each age from 6 to 15 years									
	6	7	8	9	10	11	12	13	14	15
41	38									
42	39	39								
43	40	41								
44	42	42	43							
45	44	44	44							
46	46	46	46	46						
47	47	47	48	48						
48	48	49	50	50	52					
49	49	52	53	53	54					
50		54	55	55	56	56				
51		58	58	58	58	58	59			
52			60	61	61	61	62			
53			61	63	63	64	65			
54				65	66	67	68	69		
55				67	70	71	71	72		
56				68	74	74	75	75		
57					78	78	78	79		
58						81	82	82	84	
59						84	85	86	89	
60						87	89	91	94	96
61							92	95	100	102
62							95	99	105	107
63							98	104	109	110
64								108	112	113
65								113	113	114

Table 13—Smoothed weight-height-age tables for urban Utah school girls[1].

Height (In.)	Average weight in pounds at each age from 6 to 15 years									
	6	7	8	9	10	11	12	13	14	15
42	38									
43	40	40								
44	42	42								
45	44	44	46							
46	46	46	47							
47	47	48	49	50						
48	50	50	51	51						
49	51	51	53	53	54					
50		52	55	56	57					
51		55	58	58	59					
52			60	60	61	63				
53			63	63	64	65	65			
54			66	66	67	68	68			
55				67	70	70	71	72	73	
56				71	73	74	76	76	77	
57					77	77	79	79	81	
58					79	81	82	83	85	
59					83	85	86	87	89	92
60						90	90	92	92	99
61						94	94	97	97	103
62							99	101	101	107
63							103	105	105	110
64							108	109	109	112
65								111	113	117
66								113	117	120
67									121	125
68										132

[1]General equation: $Y = a + bx + cx^2 + dx^3$

are found. Tables 10 to 13, inclusive, are presented, therefore, rather as an indication of what may be expected as averages in size for the general run of children in Utah communities, and not as standards.

COMMENT

The data here presented show no significant differences occurring in relative size of rural and urban children in the early years of school experience. However, as age increases significant differences do occur, which tend to increase with age.

These facts suggest the existence in rural living of a factor, or group of factors, inimical to the best growth of children. That these factors are environmental rather than genetic is suggested by the fact that they appear comparatively inoperative in early childhood but have a cumulative effect later. Further, as shown by population figures in the 15th United States Census (1930)[6] the same racial stocks are represented in both rural and urban populations of Utah, and in practically the same proportions.

Studies are needed to determine what these environmental factors are, how early in the life of the individual they become operative, and whether their influence continues to affect growth beyond the 15th year, which is the upper age limit of children included in this study.

Mitchell[7] found in his study of white Porto Rican children that the rural group had lower indices of nutrition than did urban children of the same age and bony dimensions. He was unable, however, to correlate the poorer growth of rural children with socio-economic factors investigated. There are not available for large numbers of Utah children the biometric measurements[8] used by Mitchell in determining indices of nutrition for the children of his study. Neither is there available information concerning dietary practices of children in the Utah cities from which data for this study were obtained. There is available, however, information[9] on dietary habits of nearly 1000 rural children, which show for the average child of the group nutritional deficiencies now believed to affect growth of children. These data were obtained in the early years of the depression (1929-31) and may, therefore, be not entirely representative of present dietary practices. For this reason, it is suggested that the desirable procedure in determining whether the factor of nutrition enters into differences in size of rural and urban Utah children would be to determine indices of nutrition for large numbers of both groups. By this means, comparison of nutritional status of rural and urban children at a given time could be accomplished.

6Percentages were determined for children in rural and urban Utah whose parents were born in various foreign countries from Table 19 in the following reference: Fifteenth Report of the Bureau of Census (1930): Population, Vol. III, Pt. 2: 1105. 1931. These percentages are shown in Appendix Table 1.

7See Footnote 3.

8Development of these indices is described in School Health Research Monograph No. II, American Child Health Association, New York City: "Physical Measures of Growth and Nutrition" 1929.

9"Food Habits of Rural School Children in Relation to Their Physical Well-being." By Almeda Perry Brown. Utah Agricultural Experiment Station Bulletin 246. 1934.

APPENDIX

Table 1—Percentages of native-born Utah children of foreign-born parents, rural and urban, with birthplace of parents.

Community	England	Scotland	Wales	Ireland	Norway	Sweden	Denmark	Netherlands	Switzerland	France	Germany	Austria	Yugoslavia	Russia	Finland	Greece	Italy	Spain	Canada	Mexico	Australia	All Other	Total
Ogden, Provo, and Salt Lake City	36.3	7.0	3.5	4.0	4.0	8.4	10.4	3.7	2.4	0.9	8.8	0.5	0.2	0.7	0.2	1.0	2.1	0.1	3.3	0.2	0.4	1.9	100.0
Provo and Salt Lake City[1]	36.0	7.0	3.5	4.0	4.1	8.9	10.7	2.4	2.6	0.8	9.4	0.4	0.2	0.8	0.2	1.1	1.9	0.1	3.3	0.2	0.4	2.0	100.0
All Counties	36.0	6.2	3.6	2.9	3.4	8.6	15.0	2.1	2.8	0.7	6.2	0.6	1.1	0.4	0.5	1.3	3.1	0.2	2.7	0.4	0.3	1.9	100.0

[1]The original table from which these percentages were compiled gives this type of information for counties and for cities of 10,000 population or more. The population of Logan "precinct" is given as 10,061 (Table 21, page 26); the city itself, therefore, probably contains slightly less than 10,000 population, which explains its not being included in Bureau of Census Table 19. Without doubt, its inclusion would change these percentages little, if at all. (Fifteenth Report of the Bureau of Census: Population, Vol. III, Pt. 2: 1105 (Table 19). 1931.

Form 1

Utah Agricultural Experiment Station
Logan, Utah

Research Project No. 145

HOW TO MEASURE AND WEIGH CHILDREN

Two responsible persons should work together in taking heights and weights, in order to check against each other; a third person should do the recording. All heights and weights should be taken without shoes and with all outdoor clothing removed.

1. Taking Heights:

The child stands on scales with back toward rod, feet together, and heels at edge of platform. Do not let the child lean against the vertical rod. The arms are pendant, the palms turned inward. Have child stand straight with chin level. Do not allow him to stretch up to be taller.

Lower and raise head bar three times before reading height. Record to nearest quarter inch.

In case no scale with measuring rod is available, make a measure by marking a scale on a plane, perpendicular surface, such as the casing in an open doorway, or a timber strip placed perpendicularly against a wall. With the aid of a good yardstick, mark inches, half, and quarter inches, beginning not more than 30 inches from the floor and continuing up to 72 inches. Many cheap yardsticks are inaccurate; hence, only approved hardwood yardsticks, such as may be purchased from school supply companies, should be used.

2. Taking Weights:

The best time to take a child's weight is the last period before noon, when the stomach is empty. Each child should be requested to empty the bladder before getting on the scales, as this sometimes makes a difference of 0.5 pound or more in the weight.

Have the child, without shoes and outdoor clothing, stand quietly in the middle of the scale platform until the weight is recorded and checked.

Note: Unless the precautions here outlined for taking heights and weights are carefully followed the value of the data is greatly diminished.

Form 2

Utah Agricultural Experiment Station
Logan, Utah

Research Project 145

City..... School.....

Date on which measurements are taken.....

Boys						Girls					
No.	Hgt.	Wgt.	Date of Birth			No.	Hgt.	Wgt.	Date of Birth		
			Month	Day	Year				Month	Day	Year

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