THE GROWTH AND NUTRITION OF THE SLUM CHILD IN RELATION TO HOUSING—THE ONE AND TWO-ROOMED HOUSE.

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A report of the Medical Research Council (1926) was published last year on the results of extensive investigations, carried out under the auspices of the Scottish Child Life Committee of the Medical Research Council, on the environmental and parental conditions affecting the growth and nutrition of the slum child. This showed that while there were great differences in the growth and nutrition of these children as indicated by weight and height, these differences could not be correlated with such environmental factors as income and air space (degree of crowding), nor with the parental factor maternal health, while the evidence adduced did not indicate that diet was a determining factor. In fact the only significant correlation discovered was with the efficiency of the mother.

A possible factor not investigated in the original work was suggested by Dr A. K. Chalmers, namely, the prejudicial effect of the one-roomed house so common in slum areas. The influence of this factor upon the physique of children has been studied by several workers, but the bulk of the work has been done on children of school age.

Leslie Mackenzie in 1903, in a report on the physical examination of 600 Edinburgh school children, grouped the children into those living in one, two, three, four, five or more rooms, but did not relate the weight and height of the children to the number of rooms. Hay in the same report compared the weight and height of Aberdeen school children in one and two rooms with those in three and in four or more rooms. He found that the children in one and two rooms were on the average lighter and shorter than those in three and in four rooms. The number of children examined, however, was too small to form any definite conclusions.

Kay, in 1904, compared the average weight and height of Glasgow school children living in one, two, three, four and five rooms. He found that the children in one-apartment houses were lighter and shorter than those in two, three, four and five apartments, but the number of children examined in one-apartment houses (15 boys and 18 girls) was too small to render any conclusions justifiable.

In the Report of the Education Committee of the London County Council for 1905 figures are given showing the average divergence of children living in one, two, three and four rooms from the mean age physique of the school. A marked divergence (− 1·3 kilo and − 2·6 cm.) from the average was found

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in the weight and height of the children in one-roomed houses. No conclusions, however, are possible, as in the one-roomed houses only 15 cases were included.

Leslie Mackenzie and Foster (1907), in a Report on the Physical Condition of Children attending the Public Schools on the School Board for Glasgow, analysed the average weight and height of a large number of children in one, two, three and four rooms in four social grades of schools. They found that the one-room child was on the average distinctly smaller and lighter than the two-room child; and the two-room than the three-room; and the three-room than the four-room. In the case of the children in one and two rooms their figures showed that the boys in one-roomed houses were on the average 3·5 lb. lighter and 1·5 in. shorter than those in two-roomed houses; while the girls in one-roomed houses were on the average 3·3 lb. lighter and 1·5 in. shorter than those in two-roomed houses.

Macgregor (1908–9) published results showing the average height of Glasgow children, ages 2 to 7 years, living in one, two and three rooms. In the case of the children in one and two rooms, he found that the boys in one-roomed houses were slightly smaller (difference of less than 0·5 in.) than those in two-roomed houses. The girls in one-roomed houses were distinctly smaller than those in two-roomed houses (difference between 1 and 2 in.).

None of these previous investigations have been checked by statistical methods.

A considerable amount of work has also been done on the influence of this factor on infant mortality.

In Dundee, Carnelley, Haldane and Anderson (1887) analysed the death rate in that town by grouping the cases as whether they lived in one, two, three or four-roomed houses. They state, that, comparing the houses of four rooms and upwards with those of three, two, and one rooms, there was an increase in the death rate together with a lowering of the mean age at death; and that the increase in the death rate was most marked in children under 5. They found actually that the death rate among these young children in one-roomed houses was nearly four times as great as in four-roomed houses, whereas the general death rate was not quite twice as great.

In Glasgow, Russell (1888–9) found that the mortality rate of persons living in one and two-roomed houses was nearly three times as great as that of persons living in houses of five rooms and over. Dr A. K. Chalmers has made a special study of the death rate in Glasgow in relation to the size of house. In 1903, in a study of the death rate in one-apartment houses based on the census returns of 1901, he found that little short of 30 per cent. of the total infantile deaths in that city occur among the 14 per cent. of the population who inhabited one-apartment houses, and that 31 per cent. of the total deaths under 5 years of age occur there. In 1913, in a paper on "The House as a Contributory Factor in the Death Rate," he confirmed these results, relating them more especially to the age of the inhabitants.

Jones in 1925, in a report published under the auspices of the Glasgow

Public Health Department, stated that the expected years of life of one-apartment males at age 10 was exceeded by 2·6, 5·56 and 6·13 years respectively in the two, three and four-apartment groups. Among females at the same age the differences were 3·05 and 7·86 years for the two and three apartments, while the difference compared with four apartments was as much as 11·95 years. These figures are based on tables given by Chalmers (1913).

Since the material collected in the course of the investigation on Poverty, Nutrition and Growth gave particulars of children of *pre-school age when home environment is preponderant*, at the request of Dr Chalmers a statistical investigation was undertaken to determine how far any correlation can be established between the growth and nutrition of the children used in the previous investigation and the size of the house—one and two rooms. The slum children of Glasgow, ages 1 to 5 years, were selected for the study because, as pointed out in the original report, 43·7 per cent. of the families studied in that town lived in one-apartment houses, 53·7 per cent. in two apartments and only 2·54 per cent. in three or more apartments. The children were accordingly grouped into those of one and two-apartment houses. In all 1203 children were included.

Two methods may be employed: (1) the method employed by previous investigators, *i.e.* the difference between the average weight and height of the children living in one and two-roomed houses checked, as these previous investigations were not checked, by the determination of the standard deviation and probable error; (2) the correlation of the weight and height of the children with the number of rooms. The latter is the method generally accepted by statisticians in the investigation of the relationship of two or more variables.

The results of this study are given in the following tables:

I. *Average weight and height of children in one and two rooms.*

The average weight and height, standard deviations, and the differences in the average weight and average height of children living in one and two rooms are shown in Tables I, II, III, IV.

The first glance at these tables seems to indicate that in this series the children living in one-roomed houses are on the whole lighter and shorter than those living in two-roomed houses. But in order to test whether these apparent differences are significant their probable error was calculated. If the difference obtained is at least three times the probable error of the difference,

Table I. *Average weight (lb.)—Boys in one and two rooms.*

	Two rooms			One room			Two rooms and one room	
Age	Average weight and P.E.	Stand. dev.	No.	Average weight and P.E.	Stand. dev.	No.	Difference and P.E.	Diff. / P.E.
1	21·6695 ±0·3087	3·5158	59	20·8977 ±0·3829	3·7654	44	0·7718 ±0·4918	1·569
2	25·9000 ±0·2620	3·3645	75	26·0342 ±0·2732	3·4608	73	−0·1342 ±0·3784	0·355
3	30·4194 ±0·3419	3·9908	62	29·1064 ±0·3724	3·7852	47	1·3130 ±0·5056	2·597
4	32·6641 ±0·3969	4·7077	64	32·8667 ±0·5282	5·2527	45	−0·2026 ±0·6607	0·307
5	37·9048 ±0·4572	5·3804	63	35·6795 ±0·4649	4·3048	39	2·2253 ±0·6520	3·413

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Table II. *Average weight (lb.)—Girls in one and two rooms.*

Age	Two rooms: Average weight and P.E.	Two rooms: Stand. dev.	Two rooms: No.	One room: Average weight and P.E.	One room: Stand. dev.	One room: No.	Two rooms and one room: Difference and P.E.	Two rooms and one room: Diff. / P.E.
1	20·3188 ±0·2663	3·2795	69	20·1667 ±0·2553	3·0750	66	0·1521 ±0·3689	0·412
2	25·7531 ±0·2514	3·3546	81	24·3561 ±0·3025	3·6437	66	1·3970 ±0·3933	3·552
3	28·1341 ±0·3004	4·0330	82	27·7105 ±0·2920	3·2688	57	0·4236 ±0·4189	1·011
4	31·8431 ±0·3544	3·7518	51	31·9388 ±0·3350	3·4766	49	−0·0957 ±0·4876	0·196
5	36·0000 ±0·3287	4·4138	82	33·9655 ±0·7686	6·1364	29	2·0345 ±0·8359	2·434

Table III. *Average height (in.)—Boys in one and two rooms.*

Age	Two rooms: Average height and P.E.	Two rooms: Stand. dev.	Two rooms: No.	One room: Average height and P.E.	One room: Stand. dev.	One room: No.	Two rooms and one room: Difference and P.E.	Two rooms and one room: Diff. / P.E.
1	29·3136 ±0·2330	2·6535	59	29·3352 ±0·2566	2·5235	44	−0·0216 ±0·3466	0·062
2	33·1000 ±0·2061	2·6464	75	32·2226 ±0·2515	3·1856	73	0·8774 ±0·3253	2·697
3	35·6331 ±0·2505	2·9246	62	35·6011 ±0·2733	2·7785	47	0·0320 ±0·3708	0·086
4	38·1289 ±0·3133	3·7163	64	37·7889 ±0·3858	3·8365	45	0·3400 ±0·4970	0·684
5	40·1468 ±0·2008	2·3628	63	39·5064 ±0·2552	2·3634	39	0·6404 ±0·3247	1·972

Table IV. *Average height (in.)—Girls in one and two rooms.*

Age	Two rooms: Average height and P.E.	Two rooms: Stand. dev.	Two rooms: No.	One room: Average height and P.E.	One room: Stand. dev.	One room: No.	Two rooms and one room: Difference and P.E.	Two rooms and one room: Diff. / P.E.
1	29·2391 ±0·1851	2·2800	69	29·4356 ±0·2010	2·4209	66	−0·1965 ±0·2733	0·719
2	33·0494 ±0·2190	2·9223	81	32·5947 ±0·2382	2·8695	66	0·4547 ±0·3236	1·405
3	35·3262 ±0·2167	2·9096	82	34·9605 ±0·2430	2·7204	57	0·3657 ±0·3256	1·123
4	38·1618 ±0·2198	2·3272	51	37·5765 ±0·3109	3·2266	49	0·5853 ±0·3808	1·537
5	39·5579 ±0·2298	3·0858	82	38·9052 ±0·4441	3·5458	29	0·6527 ±0·5000	1·305

it may be regarded as significant. An examination of these tables indicates that in weight, boys at age 5 and girls at age 2 in two-roomed houses, alone, are significantly heavier than those in one-roomed houses. The differences at the other ages are insignificant.

II. *Correlations. Weight and height and number of rooms.*

The correlations of number of rooms and the weight and height of the children are shown in Tables V and VI, with the probable error.

Table V. *Weight and number of rooms.*

Age	Boys: Correlation: Weight and number of rooms	Boys: Number of boys	Girls: Correlation: Weight and number of rooms	Girls: Number of girls
1	0·1078 ±0·066	103	0·0246 ±0·058	135
2	−0·0402 ±0·055	148	0·2095 ±0·053	147
3	0·1918 ±0·062	109	0·0910 ±0·057	139
4	−0·0280 ±0·065	109	−0·0293 ±0·067	100
5	0·2861 ±0·061	102	0·2291 ±0·061	111

Table VI. *Height and number of rooms.*

Age	Boys: Correlation: Height and number of rooms	Boys: Number of boys	Girls: Correlation: Height and number of rooms	Girls: Number of girls
1	0·0141 ±0·066	103	−0·0416 ±0·058	135
2	0·1929 ±0·053	148	0·1073 ±0·055	147
3	0·0163 ±0·065	109	0·0815 ±0·057	139
4	0·0592 ±0·064	109	0·1263 ±0·066	100
5	0·1448 ±0·065	102	0·1223 ±0·063	111

From the above tables (V and VI) it will be seen that the correlations of both weight and height to the number of rooms are of a very low order and are on the whole insignificant. There is no apparent difference in the sexes and no real change with age, although the correlation coefficients at age 5 are in all cases higher than at age 1.

These results do not bring out any significant difference between the one and two-room children.

It was thought that it might be of interest to compare the above correlation results with those already obtained for two other factors, viz. air space per person and maternal efficiency (Tables VII and VIII). The former was selected as being another gauge of the size of the house in relation to that of the family and the latter for the reason that it had shown the most significant correlation with the physique of the children.

III. *Number of rooms, air space, and maternal efficiency.*

Table VII. *Weight and number of rooms, air space per person and maternal efficiency.*

Age	Number of rooms	Air space per person	Maternal efficiency
		Boys	
1	0·1078 ±0·066	0·2720 ±0·060	0·2996 ±0·059
2	−0·0402 ±0·055	0·2346 ±0·051	0·2080 ±0·052
3	0·1918 ±0·062	0·1798 ±0·062	0·4935 ±0·048
4	−0·0280 ±0·065	0·2518 ±0·060	0·1769 ±0·062
5	0·2861 ±0·061	0·2973 ±0·059	0·2932 ±0·059
		Girls	
1	0·0246 ±0·058	0·0966 ±0·057	0·0469 ±0·058
2	0·2095 ±0·053	0·2363 ±0·052	0·4191 ±0·046
3	0·0910 ±0·057	0·1771 ±0·054	0·3340 ±0·049
4	−0·0293 ±0·067	0·0031 ±0·066	0·0861 ±0·066
5	0·2291 ±0·061	0·2583 ±0·058	0·1875 ±0·060

Table VIII. *Height and number of rooms, air space per person and maternal efficiency.*

Age	Number of rooms	Air space per person	Maternal efficiency
		Boys	
1	0·0141 ±0·066	0·0129 ±0·065	0·3512 ±0·057
2	0·1929 ±0·053	0·1907 ±0·052	0·3252 ±0·049
3	0·0163 ±0·065	0·1487 ±0·062	0·4581 ±0·050
4	0·0592 ±0·064	0·2173 ±0·061	0·2835 ±0·059
5	0·1448 ±0·065	0·1971 ±0·062	0·4173 ±0·053
		Girls	
1	−0·0416 ±0·058	−0·1169 ±0·057	0·0808 ±0·057
2	0·1073 ±0·055	0·1705 ±0·054	0·4692 ±0·043
3	0·0815 ±0·057	0·1090 ±0·055	0·2746 ±0·051
4	0·1263 ±0·066	0·0900 ±0·055	0·3867 ±0·057
5	0·1223 ±0·063	0·1564 ±0·061	0·3320 ±0·056

An examination of Table VII shows that the correlation coefficients of weight and number of rooms are lower than those of weight and air space in both sexes and at all ages except at age 3 in boys. The correlations of weight and maternal efficiency are on the whole much higher than those of weight and number of rooms except in the case of girls at age 5.

The correlation coefficients of height and number of rooms (Table VIII) are lower than those of height and air space per person at all ages except at ages 1 and 2 in boys and age 4 in girls. The correlations of height and maternal efficiency are higher at all ages in both boys and girls.

These correlation results show that while the size of the correlations obtaining for weight and height with air space per person may not justify the suggestion that in these homes overcrowding is closely related to the growth and nutrition of the child, yet statistically this factor is found to be of more significance than the mere number of rooms in the home; while the size of the correlations for weight and height with maternal efficiency shows a closer relationship.

CONCLUSION.

No consistent evidence is afforded by the present investigation that the weight and height of the children observed under 5 years are related to their inhabiting one or two-roomed houses.

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