

British Army Recruits: 100 Years of Heights and Weights

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SUMMARY: The heights and weights of Army recruits have been placed on record since 1860 in Reports of the Army Medical Department with certain gaps, particularly during the two World Wars and the period between them, until their publication was discontinued in 1975. Mean values corrected where necessary for minimum standards of height and weight — in order that the results should represent the civilian population from which they were drawn — are presented, showing the trends over a century. The Quetelet index w/h^2 , an indicator of weight corrected for height, is recommended as a measure of obesity for the Army. The value to the Army Medical Services of a continuously published record of heights and weights is assessed, and the hope is expressed that publication of these data will be recommenced.

Introduction

A paper bearing the second half of the title above, published recently (1), constituted a review of height and weight data for Great Britain back to the 1880s and before. A principal feature for establishing trends, especially among young adult males, was the long series for Army recruits appearing in Army Medical Department (AMD) Reports, albeit with breaks as during the inter-war years. This series is reported here in greater detail — previously the data were in 5-year groups — and comments are offered on the use of such data to military medicine.

In 1883 the Anthropometric Committee of the British Association for the Advancement of Science produced the final report on the heights, weights and other physical characteristics of the inhabitants of the British Isles that it had been appointed in 1875 to collect. Although there were gaps in the coverage, especially in respect of women, height and weight data were fairly extensive, relying necessarily on institutions such as schools and the Army. The numbers were about 37,000 males and 4,600 females (over 12,000 were schoolchildren, 6,000 military and police, 6,400 Post Office messengers etc, 3,500 criminals, and some others such as employees of Whiteley's). It is clear that, though the Committee had obtained the co-operation of a "large number of independent observers living in different parts of the country", the results were not able, as they stood, to represent the general population — something not achieved, at any rate among adults, until a survey was carried out by the Office of Population Censuses and Surveys (OPCS) on behalf of the Department of Health and Social Security (DHSS) in 1980 (2). A bias existed towards measurements taken among the professional classes — the public schools for example were able to provide the data more readily — so a method was adop-

ted to compensate for this by averaging the means for the various classes. Unfortunately the method was inadequate in not allowing for the differing numbers in the classes and omitted altogether the lowest class comprising 11% of the population. The resulting upward bias meant that, for a long time afterwards, the authoritative report provided too high a criterion for judging the "degeneracy of the population", already a cause for concern at the time the report was written. It led, in 1917-18, to alarm being felt about an apparently stunted population, revealed by the National Service Medical Board's measurements of men of military age then being called up.

A more subtle cause of bias in the Anthropometric Committee's results was their dependence, to a large extent, on soldiers and recruits in their sample of adults. Recruits, at least, were drawn from the general population, but there were, in particular, height limits that ensured an upward bias on the average of any group that included them. For many years the minimum stood at 64in, and for some arms was occasionally raised to 66in and once even to 68in for a short while. A method exists for correcting this bias in so-called truncated data, though there are difficulties in its practical application as will be explained, and the resulting estimates can be somewhat variable.

The Anthropometric Committee's Report had an appendix showing the heights and weights of Army recruits as early as 1860-64, but made no direct use of the figures. Indeed, such data, at least as far as heights were concerned, were no longer published on a regular basis until they appeared in AMD Reports from 1879 — too late for the Committee to make use of them. By the outbreak of the first World War over 1½ million measurements had been reported, enabling a trend to be

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established which, if not a precise replica of the whole population, is probably parallel to it. In the present paper, every available year has been analysed and, as could be anticipated, the results do not plot as smoothly as the 5-year groups analysed previously. It is worth rehearsing some of the reasons, apart from the statistical fact that group means are less variable than individual years. In theory, for data which are normally distributed (in the technical statistical sense) as heights are, approximately, wherever the truncation takes place calculations on the remainder should yield the same estimate of the mean and standard deviation of the full distribution. To take an example, it should be possible from a sample of Guardsmen to estimate the average height of all young males. However the reliability of the estimate diminishes as the truncation point increases; in particular, where the truncation occurs at a point near the mean value the result can be quite wide of the mark, as in the 19th century when the average height at the age of 18 was only about 64in. A further technical difficulty attaches itself to the estimate of weights, which are far from being normally distributed; this is dealt with by a logarithmic transformation which compresses the upper tail of the distribution towards a symmetry with the lower. But more serious are the complications due to the elasticity of standards, as when a recruit hovered on the border of acceptability; and false declarations of age, due either to an eagerness to join or, as one comment put it, below 18 did not count for pension. The sources of data on recruits have varied over time, from primary inspections by civilian medical practitioners, as well as by Army medical officers at Regimental Depots and at HQs of Recruiting Districts, to final approval for service which became the customary source in the 1880s. Furthermore, there was a reorganisation of regiments following the Cardwell reforms of the 1870s, with one battalion at home and one abroad.

The First World War disrupted the production of AMD Reports, and we have only the National Service Medical Board's report, already referred to, which related to the Birmingham area. The inter-war years saw the resumption of AMD Reports which were much slimmer volumes than previously and carried no table of heights and weights at all, other than the year 1937 when a new system was being introduced which enabled Southern Command to report its figures. The Second World War put a stop to this and we are able only to quote Martin (3) on the militia called up in 1939, Clements and Pickett (4) on a sample called up in 1941, and a small sample for 1942-44, results for which are given in the Statistical Report on the Health of the Army for 1943-45. Thereafter figures were again published from 1951 and continued until 1974, bringing the total number of military measurements to about 3 million. This later period has not required any correction to take account of minimum standards because the population mean has risen so as to render the effect nugatory.

Table 1
Heights of recruits (inches) 1860-1974

	Age 18 20-24*		Age 18 20-24*		Age 18 20-24	
1860	63.3	65.7	1890	63.9	66.3	
1861	64.6	66.7	1891	64.2	66.0	1941
1862	66.6	67.5	1892	64.3	66.2	
1863	66.8	67.5	1893	64.0	66.2	1942-4
1864	66.0	66.9	1894	64.0	66.2	67.3
			1895	63.7	66.4	
			1896	63.6	66.4	
			1897	64.1	66.3	
			1898	64.6	66.4	
			1899	64.7	66.2	
			1900	64.5	65.9	
			1901	64.6	65.8	1951
			1902	64.3	65.9	1952
1873	65.9	66.7	1903	64.4	66.1	1953
			1904	64.7	66.4	1954
1874-7	65.7	66.5	1905	64.6	66.4	1955
			1906	64.6	66.5	1956
			1907	64.5	66.4	1957
			1908	64.8	66.4	1958
1879	66.4	67.1	1909	64.9	66.5	1959
1880	66.2	66.8	1910	65.0	66.5	1960
1881	65.5	65.3	1911	64.9	66.4	1961
1882	64.1	65.9	1912	64.9	66.1	1962
1883	63.7	65.3	1913	64.8	66.2	1963
1884	64.3	65.7			66.4	1964
1885	64.1	65.7			66.5	1965
1886	64.2	66.0			66.6	1966
1887	63.5	66.1	1917-8	64.9	66.1	1967
1888	63.4	66.2			66.2	1968
1889	63.9	66.3			66.3	1969
					66.4	1970
					66.5	1971
			1937	66.9	67.0	1972
					67.1	1973
					67.2	1974
					67.3	
					67.4	
					67.5	
					67.6	
					67.7	
					67.8	
					67.9	
					68.0	
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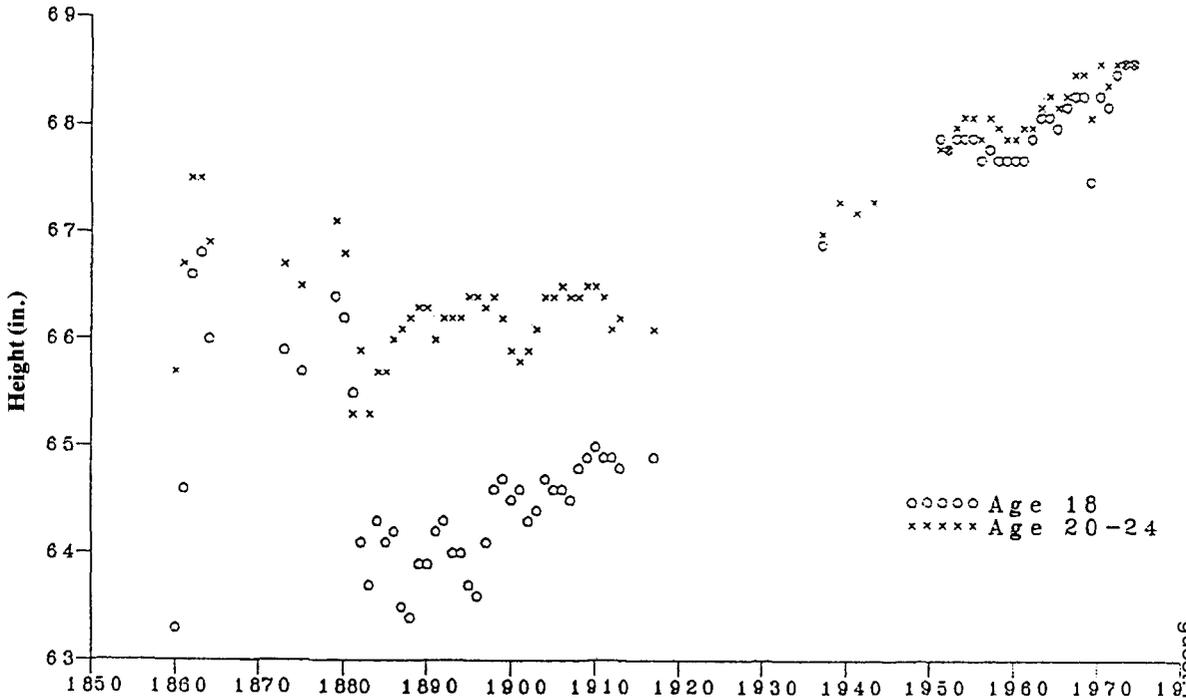


Fig. 1 Heights of recruits 1860-1974

ness of the socks, or possibly the way they affected the stance. No attempt has been made in this paper to correct for such a factor since it is impossible to guess how the regulations were interpreted at any one period.

A striking feature of Fig 1 is the increase in heights over the last fifty years. Although it cannot be claimed that they exactly represent the general population, it seems reasonable to assume that the trend is a parallel one. A further feature is the closeness of the results at ages 18 and above compared with the earlier wide separation. The two end-points mentioned in the general population were the Anthropometric Committee's values for around 1875, corrected for the biases previously discussed, and the OPCS survey of 1980:

(a) 1875 age 18 65.7in (b) 1980 age 18 68.8in
 21-24 66.7in 20-24 69.3in

The trend moreover, is reinforced by similar plots at age 15 and age 11 (without the benefit of military data of course) which are given in the first reference (1). Unfortunately, the data for females are much sparser but, such as they are, they confirm the trend. The children's measurements indicate that heights were increasing steadily during the period where there is a gap in the Army figures, rather than jumping suddenly to the new level. Again, at the two end-points the heights of boys were:

(a) 1875 age 11 51.7in (b) 1980 age 11 56.2in
 15 59.9in 15 65.7in

The height of children has generally been considered

an indicator of nutritional level in the population (6) its increase over a century is consistent with the view that nutrition has improved continuously. Children have not simply become bigger but have matured earlier. It was previously thought that maximum height, achieved by about age 27 in 1870, and about age 19 in the late 1940s, had remained unchanged at 67.5in (7). This may have seemed a fair inference in 1948 when the observation was made, especially if the Anthropometric Committee's figures are taken at face value. Floud and his colleagues in a book on heights in the United Kingdom (8), have obtained estimates back to the mid-18th century from Army and Royal Marine records held at the Public Record Office in the form of Description Books which they have sampled. They take average height to be an indicator of nutritional status in the context of a wide historical study of economic and human welfare. Nowadays all the historical heights have been exceeded at 69in. Looking ahead, can an end to this process of increasing heights be foreseen? One mechanism is by further reduction of social class differentials which appear to have narrowed over the past century; officers were found, in a 1962 survey, to be on average 1.8in taller than other soldiers, a difference which might in part be attributed to social class. There is some evidence that increases in recruits' heights may come to a halt in the next few years: the continuing study by Chinn and others (9) has shown that the trend towards increased heights in 5 to 11 year old children had ceased or been

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considerably reduced in the period from 1879 to 1886. This would imply a cessation of increases among recruits sometime in the present decade.

Mean heights have so far dominated the discussion, but variation about the mean must also be borne in mind and is reported in full in the first paper (1). The main result is simply stated: the standard deviation has remained at about 2.5 to 2.6in for recruits at a given age. However the 1980 survey of the general population produced a standard deviation of 2.9in at age 20-24 (10), implying that only 2 or 3 in every 1,000 adult males lie outside the limits of 5ft to 6ft6in.

Weights

Rather less attention in the literature has been paid to weights, and they are of course more volatile and more dependent on dietary changes. The AMD Report for 1926 recorded that the average recruit gained 7lb in his first six months as the result, no doubt, of Army food and rigorous training. All the problems associated with height measurement have their counterpart in weight measurement with the added difficulties of weighing machine calibration and clothing. As regards the latter, although the data on recruits from 1860 onwards were stated to have been taken nude, the Anthropometric Committee's Report was not explicit on the subject of clothing, and recourse has had to be made to other publications by Roberts, the chief author, who spoke of "the whole of the indoor dress with the shoes" being included

and their weight ideally recorded separately (11). He estimated that 9 or 10lb should be allowed for the clothing of the time. Army recruits in more recent times have been weighed with the "minimum of clothing"; in particular, boots and shoes and outer garments should have been removed and only underwear retained; consequently 1kg has been deducted for the sake of comparisons. The 1980 OPCS Survey achieved an equivalent unclothed status by having each item of clothing noted on a check-list, then allowed for later. The important thing for subsequent users of the data is that there should be a statement in any publication about what clothing, if any, is included in the results. (If it has not already been made clear, all weights in this paper are unclothed).

Table 2 and Fig 2 give the average weights of recruits at age 18 last birthday and 20-24, corresponding to the heights of Table 1 and Fig 1. Comparing Fig 1 with Fig 2 over the later period, there is a greater separation between the weights of the two age-groups, because weights continue to increase when heights have ceased to do so. A pronounced dip at the time of the Boer War, both in heights and weights, is evidence of a change in the source of recruits: there were re-enlistments and embodied militia, together with fresh volunteers, but a reduced height standard, *per se*, should not have affected the truncation procedure. There was indeed a weight minimum of 115lb, and in the weight equivalent of the method used for heights the point of truncation was taken to be 110lb. By 1904 recruits were back to pre-

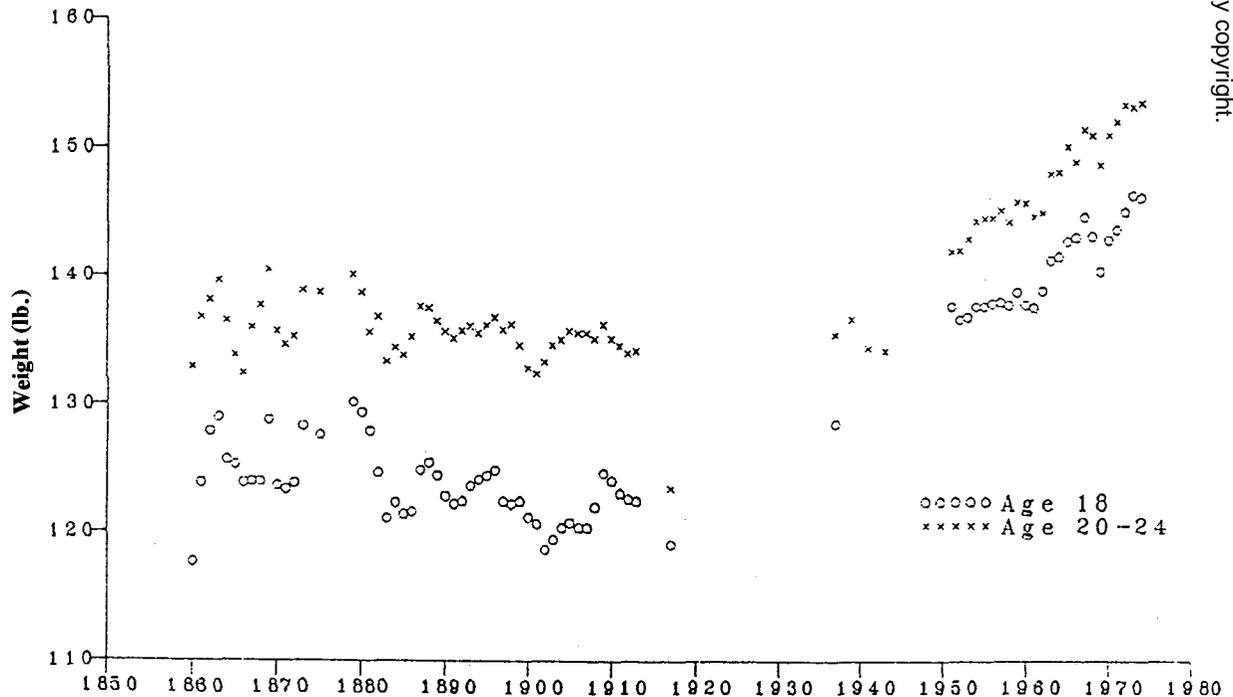


Fig. 2 Weights of recruits 1860-1974

Table 3

Army Recruits; Quetelet Index 1860 and 1974

Age (years)	18	20-24
1860	20.7	21.7
1974	21.9	23.0

and unfit. Historically, Table 3 shows the average change that has occurred during the 120 years of data collection, implying greater numbers above the limit. These data, along with the information from studies on serving soldiers, point to the problem — for the nation as well as for the Army — of obesity as an increasingly serious public health malady. It is not the purpose of this paper to discuss the ill effects of obesity; the association with an increased morbidity and mortality is well documented. For the Services, who have a requirement for a very high standard of physical fitness, obesity is even more undesirable.

The physical state of Army recruits necessarily reflects the condition of the population from which they are drawn and it is salutary to ponder the changes in status that have occurred since 1860, taking note of the reported trends in body weight and height (see Figs 1 and 2) which act as a key to the social and medical well being of young adults. For the Army, incipient obesity has been the spur to an enhanced awareness of the need to examine the effects of recruits' physical training and also to monitor the record of trained soldiers' weight changes throughout their service. Finally, useful as is the Quetelet index for both groups and individuals it remains a relatively coarse investigative tool and cannot discern the body component changes which may stem from an intensive Army regime of physical development. A study of 254 recruits, average age 19½, at the Army's centralized Recruit Selection Centre in 1972 (16) demonstrated, over a twelve-week training period, an increase in mean body weight of 0.3kg and a rise in the mean level of Q from 22.2 to 22.5; this small increase was accompanied by a significant decrease in body fat — measured from skinfold thickness — of 8.6%, indicating a gain of muscle at the expense of fat. Nonetheless, heights and weights, along with Q as the derived index, remain the best method yet of maintaining a true record of physical stature. The reader's notice is drawn again to the sad fact that the publication of recruit height and

weight data ceased in 1975. A plea is made for publication to be restarted as a matter of both Army and national interest.

REFERENCES

- ROSENBAUM S. 100 years of heights and weights. *J R Statist Soc A* 1988; **151**: 276-309.
- KNIGHT I. The heights and weights of adults in Great Britain. Office of Population Censuses and Surveys. London: HMSO, 1984.
- MARTIN W J. The physique of young adult males. Medical Research Council Memorandum No 20. London: HMSO, 1949.
- CLEMENTS E M B, PICKETT K G. Stature and weight of men from England and Wales in 1941. *Br J Prev Soc Med* 1957; **11**: 51-60.
- MORANT G M. Heights and weights of German civilians in 1946-7 and R.A.F. and other British series. *Biometrika* 1948; **35**: 368-396.
- ACHESON D. Nutritional monitoring of the health of the nation. *J R Soc Hlth* 1987; **6**: 209-214.
- MORANT G M. Changes in the size of British people in the past hundred years. In Homenaje a Don Luis De Hoyos Sainz 1949; **1**: 235-241, Madrid.
- FLOUD R C, WACHTER K W, GREGORY A. Height, Health and History. Cambridge: Cambridge University Press, 1990.
- CHINN S, RONA R J, PRICE C E. The secular trend in height of primary school children in England and Scotland. *Ann Hum Biol* 1989; **16**: 387-395.
- ROSENBAUM S, SKINNER R K, KNIGHT I B, GARROW S. A survey of heights and weights of adults in Great Britain, 1980. *Ann Hum Biol* 1985; **12**: 115-127.
- ROBERTS C. A manual of anthropometry. London: Churchill, 1878.
- CRAWFORD J A. The work at the Recruits' Physical Development Depot, Canterbury. *J R Army Med Corps* 1939; **73**: 1-39.
- KEMSLEY, W F F. Letter to the Editors. *J R Statist Soc A* 1989; **152**: 249-250.
- HARRIES J M, HOLLINGSWORTH D F. Food supply, body weight, and activity in Great Britain, 1943-9. *Br Med J* 1953; **i**: 75-78.
- CROWDY J P. Obesity and the Soldier. Army Medical Directorate Bulletin (Third Series). London: Ministry of Defence, 1978.
- VOGEL J A, CROWDY J P, AMOR A F, WORSLEY D E. Changes in Aerobic Fitness and Body Fat during Army Recruit Training. *Eur J Appl Physiol* 1978; **40**: 37-43.