WEIGHT, HEIGHT AND SKINFOLD THICKNESS OF ZULU ADULTS IN DURBAN

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Despite the value of weight and height norms in the assessment of the clinical state of individuals and groups, there is a paucity of such norms for African groups.

This report deals with observations of the weight, height, and skinfold thickness measurements, of Zulu adults (aged 20 years or more) residing in a housing scheme for Africans in Durban. These observations were made in the course of a broader nutrition-hypertension study project carried out in October-December 1958.

METHODS AND SUBJECTS

The subjects were weighed unclothed, by means of an Avery personal scale. Height was measured standing erect, with the line of sight horizontal.

The relative weight of each subject was assessed by expressing the actual weight as a percentage of the mean weight of a US adult of the corresponding sex, age, and height. A relative weight of 125% indicated that the person was 25% over-weight relative to this standard. The US standards used were derived from the US Medico-actuarial Mortality Investigation.[1] As our subjects were measured without clothes, the findings were first adjusted by adding 1 inch and 10 lb. for men, or 1½ inches and 6 lb. for women. Subjects aged over 55 years were compared with the standard provided for persons of 55.

Skinfold thickness measurements were made with the Harpenden skinfold caliper,[2-3] which exerts a constant pressure of 10 g. per sq. mm. of contact surface. Measurements were made halfway down the back of the right arm, over the triceps. The site was marked, a fold of skin and subcutaneous tissue lifted, and the caliper applied. Three measurements were made at each site by each of two clinicians, and further readings were taken if the values were not close. A mean was calculated on the basis of 3 consecutive close values recorded by each clinician. If there was much difference between observers, further observations were made.

The sample comprised the adult Zulu residents of a randomly selected 1-in-7 sample of the homes in the housing scheme. The population of this housing scheme is predominantly Zulu (72·5%). The men are mainly employed in unskilled, predominantly manual, occupations.[4] Approximately a fifth of the women are gainfully employed away from home, mainly in domestic service. The median income per caput is £2 6s. 0d. per month, and the median food expenditure per caput £1 5s. 0d. per month. The main cereal eaten is refined maize, which contributes slightly over 50% of the average caloric intake. The usual diet includes relatively small quantities of fruit, green or yellow vegetables, milk, meat and fish.[5] There is a high prevalence of malnutrition in the community, manifested in a variety of skin and mucosal lesions.[6]

Of the persons in the sample, 63·7% were examined, comprising 76·6% of the women and 45·2% of the men. In view of the high failure rate among the men, it was not

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certain that the male sample, in particular, was a representative one. Accordingly, information was obtained about the marital state, income, food expenditure, social class, rurality and education of the non-examined persons of the sample, for comparison with the corresponding characteristics of the persons who had been examined. This comparison indicated significant differences only in respect of social class and education. Among the men examined, persons in the lowest social class (V) and persons with 4 or more years of schooling were significantly under-represented, while among the women examined, those in the upper social classes (I, II and III) were significantly under-represented. Examination of the weight, height and skinfold data in relation to social class and education indicated, however, that these selective factors did not affect the findings. Among the women examined, for example, there were no significant differences between the measurements of those in social classes I, II and III, and those in social classes IV and V. It seems reasonable to conclude, therefore, that the data which follow are applicable to the Zulu population of this housing scheme as a whole.

FINDINGS

Weight and Height

The data are summarized in Tables I, II and III.

TABLE I. WEIGHT AND HEIGHT. MEAN VALUES AND QUARTILE DISTRIBUTION

	Men	*Women*
No. in group	106	219
Height (inches)		
Mean	65·4	61·4
S.D.	2·4	2·3
25th percentile	64·1	60·1
50th percentile (median) ..	65·4	61·4
75th percentile	67·1	62·8
Weight (lb.)		
Mean	147·2	155·7
S.D.	27·9	33·7
25th percentile	124·5	131·0
50th percentile (median) ..	137·3	152·1
75th percentile	154·4	176·8

TABLE II. WEIGHT AND HEIGHT, BY AGE AND SEX

Age (*yrs.*)	*No. in group*	*Weight* (*lb.*)			*Height* (*ins.*)		
		Mean	*S.D.*	*Median*	*Mean*	*S.D.*	*Median*
Men							
20 - 29	33	135·1	12·0	136·7	65·3	1·9	65·7
30 - 39	32	144·5	20·9	145·8	65·8	2·1	65·5
40 - 49	20	142·5	28·7	136·9	64·9	3·5	64·8
50+	21	153·4	40·9	134·9	65·8	1·9	65·5
Women							
20 - 29	69	145·1	27·4	138·0	61·6	2·2	61·0
30 - 39	67	151·0	29·4	146·2	62·3	2·0	62·1
40 - 49	44	174·5	36·6	166·2	61·3	2·4	61·3
50+	39	161·2	37·1	159·9	61·1	2·4	61·0

TABLE III. WEIGHT/HEIGHT RELATIONSHIP

Height (*ins.*)	*No. in Group*	*Mean Weight* (*lb.*)	*S.D.*
Men			
62 - 63·9	15	136·5	—
64 - 65·9	41	140·7	16·5
66 - 67·9	29	146·0	29·6
Women			
58 - 59·9	30	150·5	35·1
60 - 61·9	81	154·2	29·3
62 - 63·9	58	160·1	34·7
64 - 65·9	22	170·2	27·5

The findings relate to 106 men aged 20 - 81 years, not suffering from major illnesses (tuberculosis, congestive cardiac failure, diabetes and hemiplegia), and 219 women aged 20 - 86 years, not pregnant or suffering from major diseases.

It is apparent from Table I that the women are decidedly heavier, though shorter, than the men. As Table II indicates, this tendency for the women to be relatively heavy is found at all ages, but particularly after the age of 40 years. The weight preponderance of the women is apparent when persons of the same height are compared (Table III).

As in other communities, there is a tendency, more clearly shown in the women, toward relative lightness among persons aged 50 and over (Table II). There is no evidence of a change in height with advancing years.

As expected, the mean weight rises with height in both sexes (Table III).

The relative weights of the persons studied, in comparison with a US standard, are presented in Table IV. It is apparent

TABLE IV. RELATIVE WEIGHT (IN RELATION TO US STANDARD)

Weight, expressed as percentage of US standard weight	*Men* (*No: 106*)		*Women* (*No: 219*)	
	No.	*%*	*No.*	*%*
Under 90%	23	21·7	13	5·9
90 - 109%	57	53·8	55	25·1
110 - 124%	20	18·9	68	31·0
125% or more	6	5·7	83	37·9

that a high proportion of the women are over-weight, 68·9% having weights which exceed the standard by 10% or more. The corresponding figure found in a US study[7] was 30·3% (based on 10,000 unselected life-insurance examinees, standardized for age and sex according to the population of the US). Over a third of the Zulu women are over-weight by 25% or more. Only 5·9% of the Zulu women are under-weight by 10% or more, compared with the US figure of 15·3%. The Zulu men, on the other hand, have a similar prevalence of over-weight to US men (24·6% and 25·7% respectively), but a higher prevalence of under-weight (21·7% and 10·2%).

As these differences may be partly due to ethnic factors, a comparison was made with figures available for other African groups (Table V). This indicated that the men studied

TABLE V. MEAN WEIGHT FOR HEIGHT, COMPARED WITH AVAILABLE AFRICAN STANDARDS (PERSONS AGED 20 YEARS OR OVER)

Height (*ins.*)	*Mean weight* (*lb.*)		
	Durban Zulu	*Rural Zulu*[8] *	*Uganda*[9] †
Men			
62 - 63·9	136·5	122·5	113·3
64 - 65·9	140·7	131·1	121·8
66 - 67·9	146·0	138·3	130·5
Women			
58 - 59·9	150·5	114·0	—
60 - 61·9	154·2	121·1	—
62 - 63·9	160·1	128·9	—
64 - 65·9	170·2	137·0	—

* The mean weights given are those of men whose height is 63 ins., 65 ins., and 67 ins. respectively, and women whose height is 59 ins., 61 ins., 63 ins., and 65 ins. respectively.

† The mean weights given are those of men whose height is 63 ins., 65 ins., and 67 ins. respectively.

are somewhat heavier, at all heights, than rural Zulu men[8] and Uganda men of varied ethnic origins.[9] The Durban Zulu women are considerably heavier, by over 30 lb., than rural Zulu women of the same height.[8]

Weight-age curves of the Durban adults studied, and of rural Zulu and Canadian adults[10] are shown in Fig. 1. In

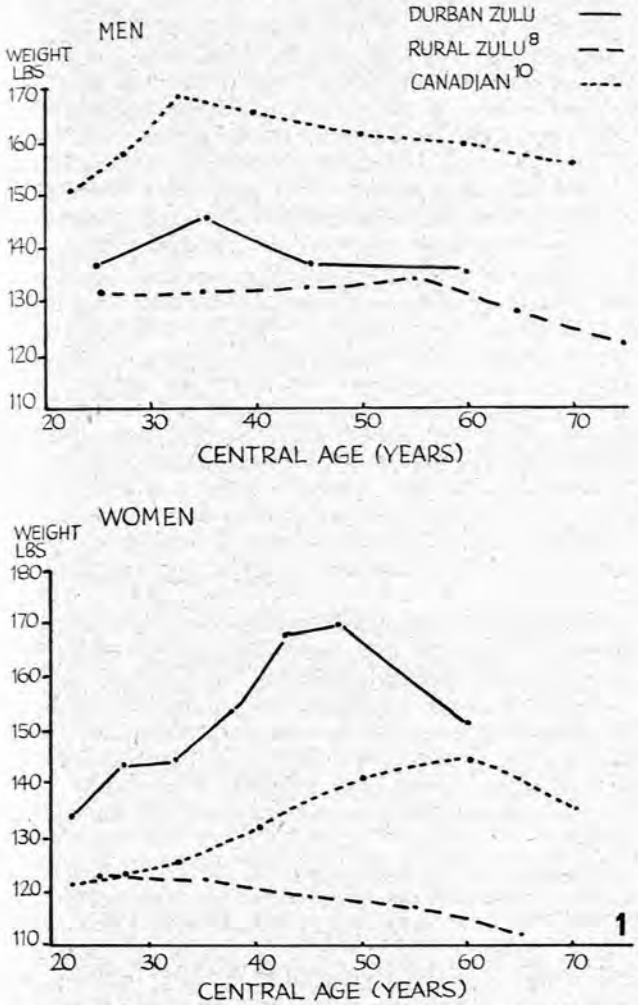

Fig. 1. Weight-age curves. The Durban Zulu and Canadian figures represent median values. The top age-group in each instance is as follows: Durban Zulu, 50 years or over (men) 55 years or over (women). Rural Zulu, 70 years or over (men), 60 years or over (women). Canadian, 65 years or over.

the Durban and Canadian groups, but not in the rural Zulu group, there is a tendency for persons in early or late middle age to be heavier than younger adults. Among the Durban men, the weight peak occurs at about the same age as among the Canadian men. Among the Durban women, it occurs earlier than among Canadian women.

Comparative data on the heights of our subjects and other Zulu groups[8,11] are presented in Table VI. While there is no appreciable difference, in either sex, from rural Zulus studied in 1940 - 45, the heights of the Durban men are significantly lower than those of rural Zulus studied in 1927 ($P<0{\cdot}001$). The number of Zulu women studied in 1927 is too small to merit a similar comparison.

TABLE VI. MEAN HEIGHT: COMPARISON WITH OTHER ZULU GROUPS (PERSONS AGED 20 YEARS OR OVER)

	Men				*Women*		
Place and Date	*No.*	*Median age (yrs.)*	*Height (ins.)* *Mean*	*S.D.*	*No.*	*Median age (yrs.)*	*Mean height (ins.)*
Durban 1958 ..	106	36·8	65·4	2·4	219	35·1	61·4
Pholela* 1940 - 5	696	39·0	65·5	—	1,846	32·3	61·6
Eshowe[11] 1927 ..	30	34·5	67·1	2·3	12	25·0	61·9

* Figures derived from Kark.[8]

Arm Skinfold Thickness

The mean skinfold thickness measurements are presented in Table VII, and the distribution of measurements in Table VIII.

TABLE VII. ARM SKINFOLD THICKNESS (MM.) BY AGE AND SEX

	Men			*Women*		
Age (yrs.)	*No.*	*Mean*	*S.D.*	*No.*	*Mean*	*S.D.*
20 or over* ..	106	9·39	5·60	219	21·56	8·88
20 - 29 ..	33	8·56	3·43	69	20·32	8·94
30 - 39 ..	32	8·38	1·42	67	21·08	8·50
40 - 49 ..	20	9·00	5·61	44	24·90	7·50
50 + ..	21	11·55	8·50	39	22·12	9·36

*Combined.

TABLE VIII. ARM SKINFOLD MEASUREMENTS: DISTRIBUTION

	Men (No: 106)			*Women (No: 219)*		
Interval (mm.)	*Frequency*	*Cumulative frequency* *No.*	*%*	*Frequency*	*Cumulative frequency* *No.*	*%*
0 - 4·9	10	10	9·4	0	0	0
5 - 9·9	69	79	74·5	15	15	6·8
10 - 14·9	14	93	87·7	40	55	25·1
15 - 19·9	8	101	95·3	50	105	47·9
20 - 24·9	3	104	98·1	38	143	65·3
25 - 29·9	1	105	99·1	31	174	79·5
30 - 34·9	0	105	99·1	25	199	90·9
35 - 39·9	0	105	99·1	18	217	99·1
40 - 44·9	1	106	100·0	1	218	99·5
45 - 49·9	0	106	100·0	1	219	100·0

The values for the women are considerably higher than those for the men. Under 5% of the men have measurements of 20 mm. or more, compared with 52% of the women.

Comparative data for other groups[10,12,13] are presented in Tables IX and X. The Durban women tend to have higher values than Whites in Cape Town, Minnesota, or Sardinia, and slightly higher levels than Canadian men. The Durban

TABLE IX. ARM SKINFOLD THICKNESS: PERCENTAGE OF MEN WITH MEASUREMENTS OF 9 MM. OR LESS, COMPARED WITH OTHER GROUPS

Group	*Age (yrs.)*	*No. in group*	*Percentage with skinfold thickness of 9 mm. or less*	*P (compared with the Durban group)*
Durban Zulu	20 or over	106	72·6	—
African agricultural workers in S.A.[13] ..	20 or over	118	100	<0·001
Cape Town African[12] ..	40 - 55	113	60	<0·10
Cape Town Coloured[12]	40 - 55	93	56	<0·05
Sardinian police[12] ..	30 - 60	97	51	<0·01
Minnesota fireman[12] ..	25 - 63	238	20	<0·001
Cape Town White[12] ..	40 - 55	67	19	<0·001

TABLE X. ARM SKINFOLD THICKNESS: MEAN VALUE, BY AGE AND SEX, COMPARED WITH OTHER GROUPS

Durban Zulu		*African agr. workers in South Africa**		*Canadian*[10]	
Age (yrs.)	*Mean arm skinfold (mm.)*	*Age (yrs.)*	*Mean arm skinfold (mm.)*	*Age (yrs.)*	*Mean arm skinfold (mm.)*
Men					
20 - 29	8·56	20 -29	5·52	20 - 24	6·3
30 - 39	8·38	30 - 39	4·72	25 - 29	7·0
40 - 49	9·00	40 or over	4·78	30 - 34	8·2
50 or over	11·55			35 - 44	7·7
				45 - 54	7·5
				55 - 64	6·9
				65 or over	5·6
Women					
20 - 29	20·32			20 - 24	12·4
30 - 39	21·08			25 - 29	13·0
40 - 49	24·90			30 - 34	14·3
50 or over	22·12			35 - 44	15·5
				45 - 54	17·7
				55 - 64	17·7
				65 or over	15·5

* Derived from a study by Abramson, Slome and Ward.[13]

men tend to have lower values than Cape Town Africans and Coloured men; it is possible, however, that this difference is partly due to the fact that the Cape Town data refer to men aged 40 - 55 only. The Durban men tend to have higher values than a group of African agricultural workers in South Africa. Though these latter workers were of varied ethnic origins (mainly Pondo and Zulu), they exhibited no ethnic variation in skinfold thickness. It is noteworthy that the weights of 75% of these agricultural workers (compared with 52·8% of the Durban men) fell below the US standard for their height and age.

There was a high correlation, in the persons studied, between relative weight and skinfold thickness ($P<0·001$). As it is accepted that skinfold measurements provide a good estimate of the quantity of fat in the body,[14] it can be concluded that the differences in the weights of the men and women largely reflect differences in their adiposity.

DISCUSSION

For practical purposes it can be accepted that, although many factors may influence caloric intake and utilization, in general 'obesity results only from eating more than is required to meet the energy requirements of the body'.[15] It is likely that the considerably greater adiposity of the women is largely a reflection of sex variation in diet and physical activity.

The differences found from rural Zulu adults indicate that ethnic factors alone do not account for our findings. It is not unlikely that non-ethnic factors may play an important role in explaining the differences from non-African groups, viz. the lesser adiposity of the Durban men, and the greater adiposity of the women, particularly in early middle age.

The higher weights and skinfold thicknesses of the Durban subjects, by comparison with rural Zulu adults and African agricultural workers, indicate the probable importance of the role played by the urban environment. It is noteworthy that in this housing scheme, schoolgirls have been shown to be taller and heavier than rural Zulu girls.[16] It appears likely that urban life is characterized by a greater caloric intake than rural life, in relation to the level of physical exertion. For women in particular, town life means relative freedom from the strenous agricultural and other duties which characterize the life of the rural Zulu woman.[8]

In order to clarify the possible role played by the urban environment a comparison was undertaken of the measurements of persons, within the sample studied, who had spent most of their lives in rural or urban areas respectively. The data for persons who had been born in a rural area, and had spent 80% or more of their lives in such an area, were compared with those who had been born in an urban area, and had spent over 80% of their lives in an urban area. The numbers of persons for whom data were available enabled such a comparison to be made only among the women aged 20 - 34, among whom there were 38 'predominantly rural' and 24 'predominantly urban'. This comparison revealed no appreciable differences between the two groups, in respect of crude weight, relative weight, or skinfold thickness.

This surprising finding raises two possibilities. First, it is possible that the effect of the urban environment is one which can be rapidly produced, so that a relatively short time in town may be associated with a considerable increase in adiposity. The median time spent in town by the 38 'predominantly rural' women was 2·4 years. In addition, it is not impossible that there may be a selective factor in townward migration. There may be a tendency, somewhat analogous to that of relatively tall Aberdeen women to marry into a high social class,[17,18] for relatively stout Zulu women to move into an urban area, particularly into a neighbourhood such as the one studied, which is characterized by relatively stable family living.

The shortness of the men, compared with Zulu men studied 31 years previously,[11] is of considerable interest. It has been stated that 'a number of older (Zulu) men consider that the young adult of today is shorter than those of years ago'.[8] Our findings lend some substantiation to this belief. If the modern Zulu adult is in fact shorter than the Zulu adult of a generation ago, this may well indicate a deterioration, in the early part of this century, in nutrition during prenatal life and childhood.

The high relative weights and high skinfold thicknesses of the women should not be construed as evidence of good health. Not only are the hazards of obesity well recognized, but it is known that a higher weight is not necessarily associated with a low prevalence of skin and mucosal signs of malnutrition;[19] it has in fact been found, in a group of Africans moving into a changed environment, that an increase in adiposity may be accompanied by an increase in a variety of mucocutaneous signs of malnutrition.[13] There is a high prevalence of such signs of malnutrition among both sexes in this community.[6]

The weight, height and skinfold norms presented can in no sense be regarded as representing 'healthy' or 'optimal' values.

SUMMARY

A study was carried out, in October-December 1958, of the weight, height and arm skinfold thickness of a population sample of Zulu adults in Durban.

Data are presented in respect of these measurements, according to age and sex, and in respect of weight for height. These findings are compared with data for other groups.

The women were considerably more adipose than the men, as reflected both in their relative weights and in their skinfold

thickness measurements. A high proportion of the women were over-weight, by comparison with US women, and their skinfold measurements were higher than those of Canadian women. The men were under-weight and lean by comparison with most White groups. The large sex difference is ascribed to sex variation in diet and physical activity.

Both men and women tended to be heavier than rural Zulus. This difference is ascribed partly to the effect of the urban environment, and partly to a possible selective factor in townward migration.

There is evidence suggesting that the modern Zulu adult is shorter than the Zulu of a generation previously. This difference, if real, may indicate a deterioration, in the first part of this century, in nutrition during prenatal life and childhood.

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