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UNDERNUTRITION IN SUB-SAHARAN AFRICA: IS THERE A SEX BIAS?

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1. INTRODUCTION

In recent years, empirical findings have been reported which suggest that female children in **South Asia** are more frequently undernourished than male children (Chen et al., 1983; Sen and Sengupta, 1983; Sen, 1984; Behrman, 1988), although there are a few counter indications (Kakwani, 1986a; Harriss, 1987). Schofield's (1979, pp. 82-83) 'analysis of data from 94 *Latin American* villages showed that females aged 0-4 years fulfilled 87 percent of their expected weight/age measurements compared with the 90 percent level achieved by boys of the same age. The differences (measured by the t-paired test) was found to be significant at the 0.5 percent level.' That women are at a disadvantage in terms of nutrition and/or health care in India at large is corroborated by the fact that infant and pre-school child mortality is significantly higher for girls than for boys in but a few of the states. Up to very recently, estimated life expectancy at birth has also been higher for men than for women in South Asia, while the opposite is the case almost everywhere else. In his inauguration address before the International Economic Association meeting in Dehli, professor Amartya Sen brought attention to the 'thirty million missing women in India' (Dreze and Sen, 1989).

The evidence presently at hand on gender differences in nutrition and health in **Sub-Saharan Africa** is extremely scant. The quantitatively most comprehensive published information is supplied by Schofield (1979, p. 87) in her assessment of 'village nutrition studies' in the third world. Her analysis of data from 11 African villages showed that adult males fulfilled 101 percent of their calorie requirement while women only 96 percent, but that the difference was not significant. This evidence is thus not statistically conclusive and, moreover, based on the dietary approach which, as argued at length in a previous paper (Svedberg, 1988), is very unreliable.

The objective of this paper is, first, to present previously not published data on sex differentials in the nutritional status of a large number of populations in Sub-Saharan Africa (SSA), based on anthropometric measures. More than ***fifty different data sets*** have been compiled from secondary sources where this material has not been used to highlight possible sex differentials. The data are from 20 SSA countries, which together have more than 80 percent of the population in the region. ***Almost all the data sets show the same thing: females are not at a nutritional disadvantage in Sub-Saharan Africa.*** In many populations there is no difference whatsoever between males and females in anthropometric performance. In most of the samples however, there is a slight bias against males. The second objective of this paper is to provide an explanation for these findings, which are in stark contrast to what has been found in India and most other countries.

The plan of the paper is as follows. In section two, the methods and the data used to estimate sex differentials in anthropometric performance are presented. In section three, the new anthropometric evidence from the SSA countries is reported. In section four, these findings are contrasted to data on sex differentials in infant and child mortality in the region. In section five to seven, various explanations for the poorer anthropometric performance ***and*** the higher mortality of boys are 'tested' in more or less formal ways. The main hypotheses are that the explanation lies in (i) ***measurement biases***, (ii) that there are ***cultural/religious*** motives behind the preference for girls and, finally, (iii) that the ***expected economic return*** to the family of girls is higher than for boys.

2. ANTHROPOMETRIC PERFORMANCE; MEASURES AND DATA

Height and weight for age are the two measures that will be used to assess the anthropometric performance of non-adult males and females in SSA. For adults, weight for height square, the body mass index (BMI), will also be used. These are the by far most commonly used anthropometric indicators of the nutrition and health status in deprived populations. In this section, the measures that will be used to estimate sex differentials in anthropometric performance are presented, along with the sources of the base data and the height and weight norms that will be used in the estimations.

2.1. Measures of Sex Differentials

Two different measures of differences in anthropometric performance between males and femles will be used in the following. The first is the ***share*** of males and females in the various populations who have heights and weights for age below what are considered consistent with health and physical and mental fitness. (Unfortunately, such data are only available for pre-school boys and girls.) The second is the ***average*** height and weight for age of males and females relative to what is normal in nutritionally unconstrained populations. The difference between male and female heights and weights (for age) will be measured by what we shall call the 'differential height ratio' (DHR) and the 'differential weight ratio' (DWR).

The DHR measures the height (h_{mi}) of the average male of age i in the population relative to the male age-specific norm (H_{mi}) as a ratio of the equivalent relative fulfillment of the norm for girls:

$$DHR_i = \frac{h_{mi}/H_{mi}}{h_{fi}/H_{fi}}, \quad \text{for } i = 1,\ldots..t \text{ year olds; } m = \text{males}, f = \text{females}$$

The DWR is the equivalent differential weight ratio.

What, then, does a DHR of, say, 0.97 for a specific age group tell us? Assume that the average boy of a certain age in a population is found to have a stature corresponding to 94 percent of the norm (cf. below) for healthy and normally growing boys and that the equivalent figure for the equally old girl in the same population is estimated at 97 percent. Dividing the two percentages and we arrive at a DHR of 0.97. The ratio thus tells us that boys fall short of the norm by 3 percentage points more than girls do. That is, while boys were found to be 6 percent below the norm, girls were only 3 percent below. If the 'gap' between actual height and the norm is taken to be a reflection of the relative degree of (food) deprivation, boys are thus twice as deprived as girls in this population.

2.2. Height and Weight Data

In their monumental work on 'worldwide variations in human growth', Eveleth and Tanner (1976) brought together data from all the studies they could find on height and weight (for age) of children, adolescents and adults in Sub-Saharan Africa (and elsewhere). The authors do not claim to have covered all existing studies, but the strive was in that vein and their coverage up to the mid 1970s is impressive. Most of the raw data on heights and weights for age used in the following section have been taken from tables in Eveleth and Tanner, although some more recent data have also been included.

2.3. The Anthropometric Norms

The data on the average height and weight of males and females in the various SSA populations reported by Eveleth and Tanner are not related to any norm for 'normal' heights and weights. In order to be able to calculate sex differential ratios, we thus have to find appropriate norms against which the height and weight measurements can be related. The norms used here for ***children*** are from the US National Center for Health Studies. The NCHS height and weight norms are age and sex specific and are endorsed and used by the FAO/WHO. They are very similar to most other norms, e.g. the Denver and Harvard ones.

The ***height norms*** we have chosen for ***adults*** are the observed average stature of men and women in the European countries with the tallest people, the Nordic countries, reaching 180 and 167 cm above the ground. The choice of this norm is based on the assumption is that men and women in each and every SSA population have a genetic potential for growth that is ***proportional*** to these reference heights. It is thus assumed that if men, on the average, in a population have 97 percent of the potential for growth of the reference man, women in the same population have 97 percent of the potential of the reference woman.[1]

The reference ***weights*** used here for adults are not from the NCHS or any other norm derived from ***observed*** weights of actual populations. For adults (as opposed to children), the norms have been constructed from a combination of the (i) observed ***heights*** (cf. above) and (ii) estimates of ***minimum weights*** (for height) that are consistent with health and full functional capability. The latter were derived from the lower end of the range of Body Mass Indexes (weight for height^2) which the FAO/WHO/UNU (1985) latest expert committee considers satisfactory, i.e. a BMI of 20.1 for men and 18.7 for women. The advantages with this

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1 Since we are interested in the relative performance of men and women within the various populations, not their performance in relation to the reference population, we need not make the stronger assumption that all populations in Sub-Saharan Africa have the same genetical potential for final growth in stature as the reference population.

approach are (i) that the ***obesity*** which prevails in all observed populations is corrected for and (ii) that the reference weights are ***height-specific***. For adults, we have thus not calculated DWRs, as for children and adolescents, but differential BMI ratios, DBMIRs. For our reference man and woman, standing 180 and 167 cm tall, respectively, the reference weights are thus 65 and 51.5 kilos. (In section 5.2., all results are subjected to sensitivity analysis, using alternative height and weight norms.)

When it comes to the reference weight for height (BMI) of women, there is one slight complications. Although it is not explicitly said by the FAO/WHO/UNU committee, its BMI estimates are for ***non-pregnant*** women. Considering the frequent pregnancies in most of SSA, as manifested in an average fertility rate of 6.7 in 1985 (World Bank, 1987, annex table 28), there seems to be reason to adjust the lowest 'desirable' BMI upwards. Given a fecundity span of 30 years and assuming a pregnancy rate of 10 (6.7 plus an allowance for stillbirths), the average African woman between 15 and 45 is pregnant every fourth year. We assume that a normal pregnancy implies a weight increase of 8 kilos at the end of the 280 days, and an average of 4 kilos during the ***year*** she is pregnant (the latter is a very high estimate, but in this case, it seems desirable to err on the high rather than the low side). This would mean that, on the average year, one kilo should be added to the reference woman's weight, increasing her lowest 'desirable' BMI from 18.7 to 19.0. The BMI for men and women used as a norm in calculating the DBMIRs are thus 20.1 and 19.0.

3. ANTHROPOMETRIC PERFORMANCE BY SEX: THE ESTIMATES

The anthropometric data to be presented below allow a comparison of anthropometric performance between males and females in three age groups: pre-school children, school children/adolescents and adults.

3.1. Pre-School Children

Shares. There are six data sets, obtained in countries in Western, Central, Eastern, and Southern Africa, for which the *share* of children of the two sexes who fall below the standard anthropometric cut-off points for height and weight for age can be estimated (Table 1). In five of these six data sets, the samples are very large and, as it seems, representative for the national populations (the exception being that from a region in Tanzania). The picture that emerges is the same in all the six cases. There is no single indication that female children are at a disadvantage vis-a-vis male children. All measures show the shares of stunting and wasting to be higher among boys than girls.

It is further notable that the 'excess' prevalence of stunting and wasting in boys is quite similar, in the 10-20 percent range, in all the five countries for which the data have a national coverage. (In the sixth country, Tanzania, the negative differential for boys is even larger.) Unfortunately, the base data are not presented in a form that permits tests of statistical significance, but considering the size of the samples (1,500-4,800), there is strong reason to think that the difference is statistically ascertained in most cases. (The exception is probably in weight-for-height, for which the prevalence of children of both sexes below the cut-off point is very low, a few percent at the most.)

Table 1

Prevalence of Undernutrition among Children in Selected Sub-Saharan African Countries, by Sex

			Percent of Children Suffering from:		
			Chronic Under-nutrition	Acute Under-nutrition	Chronic/Acute Under-nutrition
Country Year and Age (months)	Sample Size	Sex	Height for age (<-2 SD or < 90% of Ref. Stand.)	Weight for height (< 80% of Ref. Stand.)	Weight for age (< 80% of Ref. Stand.)
Swaziland	2,375	Male	31.1	1.1	10.6
1983	2,416	Female	27.5	0.6	8.2
(0-59)	4,791	Total	29.3	0.9	9.6
Liberia	1,703	Male	20.0	1.9	..
1976	1,776	Female	16.5	1.2	..
(0-59)	3,479	Total	18.2	1.6	..
Cameroon	1,669	Male	..	..	20.1
1978	1,656	Female	..	..	17.0
(24-59)	3,325	Total	..	..	18.5
Lesotho	690	Male	25.3	1.5	24.3
1976	812	Female	22.6	0.5	21.6
(0-59)	1,502	Total	23.9	1.0	22.9
Togo[a]	..	Male	..	..	..
1977	..	Female	..	..	..
(0-59)	..	Total	..	..	..
Tanzania	..	Male	xx	xx	xx
1976	..	Female	xx	xx	xx
(0-60)	..	Total	xx	xx	xx

[a]. The study for Togo has not been available from USAID; they simply cannot find it in their files.

Sources: USAID, 1986, tables 4.3, 4.4, 4.67, 4.68, 4.73, 4.74, (Swaziland); USAID, 1976, table 20 (Liberia); USAID, 1978a, table 102 (Cameroon); USAID, 1977, table 28 (Lesotho); Cqrswell et al, 1981 (Tanzania)

Averages. Data on the average height and weight in 17 pre-school (1-6 years) child populations in nine SSA countries underlie the results reported in Table 2 (columns 1 and 2). The (average) DHR and DWR for ***pre-school children*** is above unity in one of the ten countries, **Nigeria**, signifying that boys here are closer to their norm than girls are. For two of the countries, **Malawi and Senegal**, the DHRs are unity, implying no difference between boys and girls in relative heights; in Malawi, also the DWR is unity, but below in Senegal. In the sample populations in the remaining seven countries, **Gambia, Kenya, Liberia, Mozambique, Sudan, Tanzania and Uganda**, both ratios are less than unity. The ***height*** differential is in the 1-3 percentage point range in all these countries, which means that boys at the age of 6 are 1-4 cm more below the norm than girls are. The ***weight*** differential is somewhat larger than the height differential in five of the six countries, the exception is the Uganda sample for which they are the same. Six year old boys (with a norm weight of 16.7 kilos) are thus up to half a kilo more below their norm than girls are in these seven sample populations.

Nigeria thus stands out as the only country in which young boys have an anthropometric performance which is better then, or at par with, that of girls. It is notable that the results for Lagos, based on three different sub-populations, i.e. from well-off, worker and slum-dwelling families, show the ***differential ratios*** to be the same for all economic classes. Behind these differential ratios are large differences in the absolute anthropometric performance of both boys and girls, however. The children from well-to-do families in Lagos are, in fact, taller and heavier than the reference children (the NCHS norms). The children from working class families are about 6 percent shorter (e.g. 6-7 cm for five-year olds) and 8-10 percent lighter (e.g. 1.5-2.0 kilos for five-

Table 2
Average Height and Weight of Children and Adolescents in Relation to NCHS 50th Percentiles. Ratio of Male to Female Performance.

	Country	People/ Place	Year	Pre-School Children (1-6 years)		School Children, Adolescents (7-18 years)	
				DHR (1)	DWR (2)	DHR (3)	DWR (4)
1	Gambia	Keneba, village	1961	.99	.98	..	..
2	Malawi	Low Shire	1970	1.00*	1.00*	..	..
3	Uganda	Kampala	1965	.99	.99	..	..
4	Nigeria	Lagos, well-off	1971	1.01*	1.02*	..	..
		Lagos, workers	1971	1.01*	1.01*	..	..
		Lagos, slum	1971	1.01*	1.02*	..	..
		Lagos	1972	..	..	.97*	.89*
		Imesi, village	1968	1.00*	.98*	..	..
		Ibadan, well-off	n.d.	1.00	1.02	1.00*	1.00*
		Ibadan, slum	n.d.	1.00	.99	.99*	1.01*
5	Tanzania	National	n.d.	..	.99*	..	..
		Pangani	1971	.97*	.96*	..	..
		Nyakyusa	1971	..	..	.98*	.96*
		Kisi	1971	..	..	.99*	1.01*
6	Kenya	Machakos	1983	.99*	.98*	.97*	.91*
		Kitui	1983	..	..	.98*	.93*
		Nairobi, well-o	1983	.99*	.96*	1.00*	1.01*
7	Liberia	Monrovia	1962	.98*	.94*	.97*	.94*
8	Mozambique	Maputo	1968	.99*	.96*	.99	.95
9	Senegal	Dakar	1961	1.00	.99	.98*	.96*
10	Sudan	Khartoum	1971	.99*	.95*	.98*	.96*
11	Rwanda	Hutu	1964	..	..	.98	.99
		Tutsi	1964	..	..	.99*	.98*
12	Ghana	Accra	1967	..	..	.97	..

* The age group is smaller than 1-6 years and 7-18 years old
Source: Derived on the basis of Eveleth and Tanner, 1976, appendix tables 40-43 (height and weight data except Kenya) and Stephenson et al. 1983, tables III-5 and III-6 (NCHS norms) and IV. 3-7 (weight and height, Kenya).

year olds) than the reference children. The children from slum areas fall below the reference heights by the same amount as working class children, but they are more than 15 percent below the weight norm. The data from Ibadan reveal exactly the same picture: no or small gender differentials and huge differentials between boys/girls from well-to-do and slum families.

The only sample from *rural* Nigeria, the Ismei village, indicates no sex differentials in heights and weights. It is further notable that the average height and weight of children in this village are very similar to those of children in the slums of Lagos and Ibadan and, thus, far below those from well-off families in the two cities. The same rural/urban differential seems to apply in the other samples.

3.2. School Children and Adolescents.

Data for this age group are available for 15 populations in nine SSA countries (Table 2, columns 3 and 4). The DHR is below unity for all the populations except the well-to-do in Ibadan. The DWR is above unity in two samples from Nigeria, i.e. the well-off and the slum dwellers in Ibadan, the Nairobi well-off and in the Kisi sample (Tanzania). Male school children and adolescents thus seem to be at a disadvantage vis-a-vis females of the same age in most of the continent.

It is also notable that the weight differential for the two populations in Lagos and the one in Ibadan are very different. This may partly be explained by the fact that the samples from the two cities do not cover the same age groups. The Ibadan sample is confined to 7-9 year olds, while those from Lagos cover the 10-18 year group. The DWR for this age group in Lagos stands out in the entire data set. Not only are these boys far lighter than the girls of the same age in relation to respective norm; the data behind the ratios show them to be about 20 percent below the norm, which is exceptional in the material summarized in Table 2.

Eight of the altogether 24 samples reported from in Table 2. cover both pre-school children and school children/adolescents. In the two Nigerian (Ibadan) samples, there are no differences between the two age groups; in Nairobi, the older boys perform relatively better than the younger ones. In the remaining five populations, the negative height and weight differentials larger for the older boys than for their younger brothers. Across the 24 populations, there is also a tendency that the negative differential for boys becomes larger as they grow older, but the number of observations and the differences are too small to permit an affirmative conclusion.

3.3. Adults

The average height and weight of male and female adults in 17 populations in 10 African countries underlie the results presented in Table 3. The DHRs shown in column (5) tell us that adult men are further below the reference ***height*** than adult women in 11 of the 17 sample populations. In four samples, the DHR is unity and in the remaining two, above unity. In but two samples (Uganda and Ethiopia), the differential is not more than 1 or 2 percentage points, however, signifying rather small differences between men and women in heights relative to the norms. The DBMIRs suggest relatively large gender differentials in ***weight for height*** (Table 3, column 6). In 14 out of the 15 populations for which it has been possible to derive DBMIRs, the ratio is below unity, in the range from .89 to .99. Only for one population (in Zaire), is the ratio above unity, 1.02.

Table 3

Average Height and BMI for Adults in Relation to European Height Norms and FAO/WHO 'Desirable' Weight Norms

Country	People/ Place	Year	Height/Norm		BMI/Norm		DHR	DBMIR
			Male (1)	Female (2)	Male (3)	Female (4)	(1)/(2) (5)	(3)/(4) (6)
Botswana	Bushmen	1962	.89	.90	..	..	.99	..
Chad	Sara	1972	.96	.98	1.10	1.14	.98	.96
Zaire	Congolese	1970	.93	.94	1.05	1.03	.99	1.02
	Bunia pygm	1962	.81	.83	.95	1.03	.98	.92
Gambia	..	1952	.93	.95	.98	1.10	.98	.91
Malawi	Bantu	1970	.92	.92	1.01	1.08	1.00	.94
Nigeria	Yoruba	1970	.93	.93	1.00	1.14	1.00	.88
	Ibadan(w-o)	n.d.	.95	.96	1.18	1.33	.99	.89
	Ibadan (slum)	n.d.	.94	.95	1.05	1.11	.99	.95
	Lagos	1970	.94	.95	1.10	1.27	.99	.87
Rwanda	Tutsi	1965	.98	.97	.92	1.06	1.01	.87
	Hutu	1965	.93	.93	1.03	1.13	1.00	.91
Tanzania	Hadza	1972	.89	.90	1.04	1.12	.99	.93
	Bantu		.94	.94	..	..	1.00	..
Uganda	Baganda	1969	.91	.94	1.10	1.22	.97	.90
Ethiopia	Debarech	1969	.93	.94	1.01	1.08	.99	.94
	Adis Arkai	1969	.94	.91	.94	1.06	1.03	.90
India	National	1972	.91	.91	.91	.98	1.00	.93

Source: Height and weight data are from Eveleth and Tanner (1976, appendix tables 44, 45, 77 and 78); height norms are from, ibid, appendix table 5; weight (BMI) norms are from FAO/WHO/UNU, 1985, annex 2.c, p. 183.

In terms of weight for height, it thus seems that there is a relatively large differential to the disadvantage of adult males. It should be noted, however, that only in four of the 15 populations, is the average man below the reference BMI; ***the average women is above the reference BMI in all fifteen populations***. That the average man and woman is above the reference BMI does not, of course, imply that all individuals in respective population have a satisfactory height and weight. Unfortunately, estimates of the ***share*** of the sample populations that fall below the anthropometric norms used to indicate potential undernutrition (and/or illness) are only available for pre-school children (Table 1).

3.4. Summary of Evidence

The great bulk of the evidence from Sub-Saharan Africa show males of all ages to be relatively shorter and lighter than females; there are relatively few cases where the opposite applies. In the next section, the question is whether the relatively poorer anthropometric performance of males is consistent with the observed gender differences in mortality in the region. In the subsequent three sections, we shall explore different explanations to the negative height and weight differentials for males. The first is that there are biases in the norms and measurements used to derive the estimates. The second is that there are traditional cultural/religious values, formed in a distant past, which imply a preference for girls. The third hypothesis is that the expected economic return to the family of female children is higher than for boys.

4. SEX DIFFERENTIALS IN MORTALITY

If it is true that males of all ages are shorter and lighter than females in the SSA region because of poorer nutrition and/or health care, one would expect the mortality rate for males, especially in infancy and early childhood, to be higher than for females. In this section, we shall 'test' the results derived in the previous section by comparing the gender differentials in anthropometric performance to that of differences in mortality rates.

Gender specific mortality rates for infants and small children have only been estimated for the eight SSA countries listed in Table 4. The ratio of male to female mortality for *infants* is significantly above unity in all the SSA countries (as in most other developing countries). The equivalent ratio for *one and two year olds* is above unity in six of the eight countries. In Senegal it is very close to unity (0.995), while 0.96 in Nigeria. As with the anthropometric evidence, Nigeria thus stands out as the only SSA country, for which there are data, where males are at an advantage. The anthropometric and the demographic evidence are thus consistent. (An attempt to explain why Nigeria differs from the other countries in respective country sample is offered in section 6 below.)

As is evident from Table 4, there are huge differences in the extent to which male infants and toddlers are at a disadvantage in terms of mortality in the six countries where this is the case. The differential mortality ratio for the 2-3 year olds ranges from 1.02 in Cameroon to a stunning 1.27 in Lesotho. The contrast to India is also exceptional; here the ratio is far below unity, viz. 0.74. This also squares up with the observation that female children in India have a poorer anthropometric performance than males.

Table 4

Male and Female Infant and Child Mortality in

Eight Sub-Saharan Countries.

	Average Mortality 1985		Ratio of Male to Female Mortality (Early 1980s)	
	1st Yr	Average 2nd-4th Yrs	1st Yr	Average 2nd-3rd Yrs
Benin	115	19	1.18	1.08
Cameroon	89	10	1.06	1.02
Ghana	94	11	1.22	1.10
Ivory Coast	105	15	1.25	1.15
Kenya	91	16	1.10	1.09
Lesotho	106	14	1.05	1.27
Nigeria	109	21	1.19	.96
Senegal	137	27	1.16	.99
India	89	11	.91	.74

Source: Caldwell and Caldwell (1987b) based on Rutstein (1984) and Indian National Statistics (sex specific rates); World Bank (1987), appendix table 29 (average infant and child mortality)

5. ESTIMATION BIASES?

There are four possibilities for biases in the estimates reported in section 2. above. The first is that the ***sampling*** of boys an girls entails a bias towards *including* boys below average height and weight (in respective population). The second is that the measurement techniques used to estimate ***heights and weights*** give raise to sex-biased results. The third is that the height and weight ***norms*** used to estimate differentials between males and females are biased. The fourth is that the reported ***age*** of children entails a sex bias.

5.1. Biased Sampling Methods?

The selection of boys and girls in respective sample may have been conducted with non-random methods and there may have been a systematic tendency to pick boys who are shorter and thinner than the average of the population to which they belong, while girls have been accurately selected (or with a smaller bias). There is no possibility to check for such a bias, but there is little a priori reason to expect one. The intent of the base studies has been to obtain unbiased measures and there are no technical obstacles which suggest difficulties to achieve this *end*. Of course, many *of* the sample *populations* are quite small, signifying risks for errors and biases in the individual study. This, however, is not to say that there should be a systematic tendency for selection biases ***across*** the more than 50 sample population on which our evidence is based.

5.2. Biased Height and Weight Measurements?

The instruments used to obtain height and weight estimates are very reliable and give raise to exceedingly small measurement errors.

The risks for significant biases are thus very small (Bairagi, 1986). It is, indeed, difficult to think of a reason why there should be a bias towards underestimating the heights and weights of males across the studies covered. It may be that in muslim populations, weight estimates of females are upward biased because it is difficult to weigh them without cloths, but if so, this would be very easy to correct for. There thus do not seem to be any reason to expect that our results have been biased because of faulty measures of heights and weights.

5.3. Biased Height and Weight Norms?

Norms for Children. In estimating the height and weight differentials between boys and girls, the NCHS norms were used. They are the most commonly used in recent anthropometric studies, but there are others which have also been applied in many studies, e.g. the Denver and the Harvard norms. The latter are not sex-specific, which means that they cannot be used here. In order to test how sensitive our results are for the choice of reference, all results were recalculated, using two alternative norms, the Denver one, and well-to-do children in Nigeria.

Using the two alternative norms makes the negative ***height differential ratio*** for male children of all ages ***larger***. That is, the norm actually applied here, NCHS, give raise to a ***smaller*** height differential than had the Denver or Nigerian well-to-do norms been used. With the Nigerian ***weight norms***, the negative differential for boys also becomes larger. However, with the Denver ***weight norm***, which is two percent lower than the NCHS norm for 1-6 year olds (appendix table 2), the negative weight differentials for boys reported in Table 2 becomes ***smaller***, but remains negative in most cases; the exceptions are the two populations in Rwanda, where the differential disappears. (Of course, the positive weight differential for boys in Nigeria becomes larger with the Denver norms.)

For obvious reasons, it is impossible to tell which norms are the closest to 'reality'. The Denver norms are not 'smoothed', i.e. there are strange sudden 'jumps' in weights and heights as one moves up the age scale (by half a year at the time). For girls in the late teens, the Denver norms are certainly not reliable; sixteen year old girls stand two centimeters taller than the eighteen year old girls. The NCHS norms are nowadays almost universally applied; the FAO and the WHO use them (with slight alterations for very young children); the Cornell Nutrition Surveillance Program for Africa uses them after comparisons with the Denver, Harvard and indigenous norms derived from well-to-do populations in Kenya.

Norms for Adults. A crucial parameter in the estimation of height *and* weight differentials along gender lines in the African adult populations shown in Table 3 is the ***difference*** in height between the reference male and female. (Recall that the reference weights are height-specific.) Our reference male and female stand 180 and 167 cm tall, respectively, implying a difference of 7.8 percent. Quite obviously, if there is a bias in the ***relative height*** of our reference man and woman, the estimated height and BMI differentials in the African populations will also be biased. In order to investigate the possibility of such a bias, two different sets of alternative reference heights were collected and compared to the norms used here.

The first alternative set of norms comprise estimated heights of adult men and women in 25 European populations for which there is little reason to believe that males and females face different constraints on their ability to fulfill their genetic potential for growth in stature.

Across these 25 populations, the adult male is 7.9 percent taller than the female on the average (cf. appendix table 3), which is almost identical to the difference between the reference man and woman used in our calculations (7.8 percent).[2]

The second set of alternative height differential norms was obtained from observed heights in four black adult populations in which one would not expect differential treatment in terms of nutrition and health care along gender lines. Across these four populations, the average man is 7.8 percent taller than the average women. exactly the same differential as for our reference individuals. The check with, altogether, 29 alternative reference populations, does, thus, not suggest a bias in the relative height of our reference man and woman. The estimated height (and weight) differentials, mostly to the disadvantage of men, reported in Table 3, are robust on that account.

5.4. Biased Age Estimates?

All the anthropometric data on which our results for children and adolescents are derived are *age-specific*. If the reported age of the children in the various samples contains a gender bias, our results will also be biased. As is well known, the exact age of children is not recorded properly in most 'primitive' societies, neither by parents, nor by officials. Under such circumstances, the age of a child included in an anthropometric study should be estimated from at least two independent sources and the results must be consistent; if not, the child should be excluded from the sample. Especially in the early

2 The variance in the 25 populations is relatively small; in 17 of the samples, the height differential deviates by half a percentage point or less from the average (7.9 percent). The smallest difference observed is 6.9 percent; the largest is 9.0 percent.

studies, it seems that little care was taken to ensure that the age of the children were estimated accurately.

The important question here, however, is not whether there are errors in the age classification of the children in the sample data used; certainly there are. The crucial question is whether there is a bias along gender lines. If there is a systematic tendency to ***overestimate*** the age of ***boys*** relative to girls, this could explain the negative height and weight differentials for boys that we have observed.

Caldwell and Caldwell (1987b, p. 12), drawing on the findings of van de Walle (1968), notes that in the 'parts of the world where females marry very early, Sub-Saharan Africa, there is some ***overstatement*** of girls' ages' (italics added). The fact that bride price, rather than dowry, is the predominant practice throughout SSA (to be discussed further in section 6 below), reinforces the economic incentive for parents to have their daughters married early and to overstate their ages.

A simple simulation exercise could be useful for finding out by how much our results may have been biased through an overstatement of the age of girls. Assume that the average girl reported to be six years old, is only 5.5 years in reality, while the reported age of boys are accurate on the whole. According to the NCHS height-for-age charts, the difference in the height norm between a 5.5 and a 6 year old girl is 3 cm (3.5 with the Denver norm), or 2.5 percent. Correcting for a hypothetical age-bias of this order of magnitude would mean that the DHRs in Table 2 should be ***lowered*** by two percentage points, i.e., a DHR of .98 becomes .96.

In summary, there are four possible sources of measurement biases in our results. There seem to be no reason to expect that (i) the sampling methods and (ii) the height and weight estimates contain gender biases. The NCHS norms used here imply a ***smaller*** negative differential for boys in heights than when the Denver and Nigerian well-to-do norms were used; the weight differential remained negative, but became smaller with the Denver norms for 1-6 year olds. Furthermore, relatively small overstatements of girls' ages may substantially ***underestimate*** the negative height- and weight-for-age differentials for boys.

6. CULTURAL AND RELIGIOUS PREFERENCES FOR GIRLS?

The evidence on anthropometric performance and mortality rates reported above, showing sex neutrality or, in most instances, males to be at a disadvantage, span almost the entire SSA continent. This suggests that the preference for girls, or at least, the equal treatment of male and female children, has an explanation that is common to most of the region. The first such explanations that come to one's mind are religion and culture, which, as in most non-Western societies, are almost synonymous in much of Africa.

6.1. Traditional Religion in Africa[3]

In contemporary Africa, less than one-third of the population would now claim to be neither Christian nor Muslim. However traditional religion still strongly condition many areas of behaviour and, not the least, that of piety within the kinship group (Caldwell and Caldwell, 1987a). In the words of the Caldwells (ibid, pp. 409-10), 'culture, both

3 This and the following sub-section draw almost entirely on the works of John and Pat Caldwell, especially (1987a), from which all the quotations in this section are, unless otherwise stated. However, the discussion of the ***implications*** of the traditional beliefs for the question of differential treatment within the family of males and females in terms of nutrition and health care is the responsibility of the present author.

with regard to this world and the next, has been a seamless whole,....molded by stress on ancestry and descent. The essence of the traditional belief system is the importance attributed to the succession of the generations, with the old tending to acquire even greater and more awe-inspiring powers after death than in this world and with the most frequent use of these powers being to ensure the survival of the family of descent'.

6.2. Differential Treatment and Religion

With the traditional religion in perspective, it is difficult to think that there should be a differential treatment in terms of nutrition and health care within the family, either along age or gender lines in Africa. 'The fact that one's living ancestors will one day become powerful shades strongly reinforces the earthly power of the old /and/ to have many children is not merely social and economic matters, but issues of central religious importance.' No or few surviving children mean that the perceived chances for the parents and their ancestors to be reborn are reduced. The social penalty for women whose children die frequently, is often hash. They face the risk of being accused of witchcraft and to 'become increasingly isolated so that they will not contaminate others or cause the death of children, and they may be sent back to their homes of origin, where they may be kept from children and pregnant women.' In some places, 'childless women at death are buried secretly in an isolated place with only their female relatives attending. The archetypal African institution is the patrilinage, but the concern for family descent and survival is almost as strong among groups placing less organizational emphasis on the lineage structure and among matrilineal peoples.'

When it comes to differential treatment of children depending on sex, it seems that one surviving son is a must. He has special duties during 'the mortuary ceremony, for, without adequate ritual, the dead become unhappy wondering ghosts.' But this does not seem to be an incentive for preferential treatment of sons in general. Part of the belief is also that ancestors are reborn as descendants, and they are given their names, which necessitates a large and sex-diversified group of children.

6.3. The Islamic Influence

Although the traditional religious beliefs still linger strong in most of Africa, the influence of non-indigenous religions is more marked in some parts of the continent than in others. This is particularly so in the northern parts of West Africa, where Islam has a strong grip and where muslim 'fundamentalism' is not uncommon. In most non-African countries where Islam is the dominant, or only religion, female mortality in the 2-3 year age group (which is the most sensitive to differential treatment in nutrition and health care) exceeds that of males (Caldwell and Caldwell, 1987b, table 1). The predominance of Islam in Nigeria may thus explain why this country stands out from the rest in our sample, both in terms of better anthropometric performance and lower mortality for boys than for girls.[4]

In summary, religion is essentially the reproduction of the lineage in most of African and there seem to be no or few cultural or religious reasons to expect differential treatment within the family, either along age or gender lines.

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4 It is notable that in Senegal, which also has a large Muslim population, the mortality differential for 2-3 years old is slightly to the advantage of boys (table 4), while not in the other countries with small or no Islamic congregations.

7. ECONOMIC PREFERENCES FOR GIRLS?

In the spirit of Becker (1981) and, adapted to the developing country context, Rosenzweig and Schultz (1982), one may expect that the better anthropometric performance and lower mortality rate for girls in Africa have 'intra-family' economic reasons. First it must be noted, however, that there seem to be little economic reason to 'discriminate' children in general in SSA. Throughout the region there is an upward flow of wealth, to the older generation /which/ 'is a strongly socially sanctioned and religiously expected tribute' (Caldwell and Caldwell, 1987a, p. 421). The Caldwells go as far as claiming that in Sub-Saharan Africa, 'wealth flows beyond the nuclear family are almost certainly greater than in any other society in the world'. The 'life-cycle' economic cost of having children, if ever explicitly considered in Africa, is thus very small or negative. This may be one of the reasons why the SSA region has the highest fertility (6.7) and crude birth rates (48) in the world; the former has remained unchanged for the last twenty years, while it has dropped significantly in the rest of the third world (World Bank, 1987, appendix tables 28 and 29).

7.1. Economic Valuation: Bride Price vs. Dowry

The economic benefit of having children in general is one thing; the relative benefit of having girls rather than boys, is another. It is notable, though, that almost all marriages in the region are arranged and considered to be contracts between families (Caldwell and Caldwell, 1987a). With arranged marriages, seen as a purely economic transaction, it is notable that throughout SSA, the wealth goes from the prospective husband's family to the bride's, i.e. bride price rather than dowry is the practice. According to the most comprehensive estimate, 'compensation is provided in almost 90 percent of African societies; 80 percent in the form of bridewealth payments and 10 percent is in bride-service arrangements. For only one percent of the societies sampled, is marriage inception accompanied with a payment (dowry) from the bride's group' (Cohen, 1986, p. 140). In India, on the other hand, the predominant, but not exclusive, practice, is dowry.[5]

In the archetypal patrilinear African societies, the value of the bride to the man's family comprise two items: her fertility and her own contribution to the family's income (production). Her fertility, which is necessary to ensure the lineage, and which also generates future income through the upward wealth flow, is always a positive item. The bride's *contribution to the family's current income can* be either positive or negative on a net basis, depending on whetner her gross contribution to income is larger or smaller than her consumption of food and other items. Her overall net contribution to the husband's family can thus also be either positive or negative.[6]

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5 There are no reliable estimates of the relative importance of dowry and bride-price, respectively, in India, but it is generally accepted that dowry is the most common practice, at least among the middle and upper casts. The contemporary controversies seem to be focused on what tradition predominated historically and whether significant changes have taken place in recent times in the wake of economic change and the influence of 'Western' culture (Rajaman, 1983; Randeria and Visaria, 1984). The reasons why dowry is the tradition in parts of India and bride-price in other parts, and whether this difference is related to differences in child mortality along gender lines, which are very marked across the Indian states (Caldwell and Caldwell, 1987a, table 2), have not been investigated as far as I know.

6 As noted by Cohen (1986, p. 141), 'the great majority of marriages /in SSA/ are patrilocal, or virilocal, which means that the wife moves to live with her husband, who may be living with a group of his agents.'

7.2. Women in Agriculture

At least for an economist, it is tempting to see the wealth transfer in connection with marriages as a compensation for the expected overall net contribution of the bride to the husband family's overall income. If it is expected to be positive, a bride-price is paid; if negative, a dowry is demanded. Why then, should the predominant expectation be that the woman's net contribution to the income of her husband s family is positive throughout Africa? The only plausible answer must be that there is one main economic activity in the region in which the women is highly productive. The by far largest economic activity, not only historically, when present believes and values were formed, but also in contemporary SSA, is non-mechanized, land-extensive (often slash and burn), rainfed agriculture on the family farm basis, producing mainly food for subsistence (Eicher and Baker, 1982). In this economic activity, employing between 60 and 80 percent of the population in most SSA countries, (unskilled) human labor is the scarce factor of production, especially during the peak season.

In family-based farm production, an important relationship is that between the individual family member's contribution to production and her/his own consumption of food. If women are more 'efficient' producers of food than men are, and food production is the main economic activity in a society, their net contribution to family income is likely to be larger than that of men. That is, if the woman consumes relatively less in relation to what she produces, she is a net contributor to family income - for which a bride price is paid.

7.3. Biology and Economics

In the household version of a formal model set up in a previous paper (Svedberg, 1988), two important assumptions were made. One was that that male and female labor are perfect substitutes, i.e, neither possesses sex-specific skills. The other was that the male and female calorie expenditure functions are identical in shape for given body size. Given these assumptions, it was shown that ***when the woman is shorter***, the optimal allocation of work effort and food consumption within the family means that, per unit of labor effort expended, the woman needs fewer calories than the man. That is, in the kind of joint production considered, being smaller, women are relatively more efficient than men, disregarding other biological differences in the way the body transforms energy contained in food into physical work. Men and women are not equal in these respects, however. Women are more 'efficient' in at least two additional ways.

First, the lowest weight for height that is consonant with health and physical fitness, is smaller for women than for men. According to the latest FAO/WHO/UNU (1985) expert committee, this weight corresponds to a body mass index of 18.7 for women and 20.1 for men. For a man and a woman, both 165 cms tall, these indexes correspond to a weight of approximately 55 and 51 kilos, respectively. In an economy where the production of food, based on unskilled labor, is the main economic activity, a lower body weight and, thus, calorie expenditure, is an economic advantage.

Second, women 'burn' less calories per kilo of body weight than men do. The BMR for a woman between the age of 18 and 30, weighing 65 kilos, is estimated at 22.5 calories per kilo; the equally old and heavy man burns 26 calories per kilo (FAO/WHO/UNU, 1985, tables 42 and

45). Since the calorie expenditure for physical work is thought to be a multiple of the BMR, the female body is thus an estimated 15 percent more efficient than the male body when it comes to physical work.

For at least three reasons, women have an (biological) ***absolute*** advantage in the kind of economic activity that predominates in SSA (whether she also has a comparative advantage one cannot say without specifying the alternative). This squares up with the observation that bride price is the by far most common form of transaction in connection with marriages. The biological advantages are also consistent with the observation that women account for the bulk of food production in the region; 70 percent according to a UN report (1974). Later estimates from various individual SSA countries corroborate this figure (Spring, 1986).

8. SUMMARY AND QUALIFICATIONS

Summary. In pre-school child populations from six countries in SSA, extensive and seemingly reliable samples show the ***share*** of boys who are stunted and wasted to be significantly higher than for girls. Other sample studies from 10 countries show that the ***average height and weight*** of pre-school boys are below that of girls in relation to the norms in seven of the countries; in two they are at par, and in one, Nigeria, above. For ***school children, adolescents and adults***, only average height and weight differentials can be estimated. In the great majority of the 17 samples of school children and adolescents, the height differential is to the disadvantage of boys; in terms of weight, the same applies to all samples except for the well-to-do in Ibadan in Nigeria. Finally, when it comes to adults, males are relatively shorter and lighter than females in 11 and 16, respectively, out of the seventeen populations examined. In three populations there is no height difference between the sexes; men are relatively taller than women in the remaining three populations. The great bulk of the evidence from Sub-Saharan Africa thus shows males of all ages to be relatively shorter and lighter than females; there are only a few cases where the opposite applies.

The data on sex differentiated mortality rates in SSA are consistent with the gender differentials in anthropometric performance. In six of the eight countries, for which there are data, the infant and child mortality rates for males are higher than for females. In one country, there is no gender differential in mortality and in yet another country, Nigeria, boys survive more often than girls. Nigeria was also found to be exceptional in that the anthropometric performance of males were better than that of females.

The possibility of biases in the reference norms used for ***children***, was tested by using two alternative height and weight norms. The negative differentials for boys became somewhat ***larger*** with children from well-to-do families in Nigeria as the norms. With the Denver norms, the height differential remained intact, but the weight differential to the disadvantage of boys became somewhat ***smaller***. Several checks with alternative height norms for ***adults*** did nothing to change the results. It is widely acknowledged that in societies where females marry very young, such as in the SSA ones, there is an upward bias in the reported age of girls. Sensitivity analysis suggested that relatively small overstatements of girls' ages produce rather large biases in the estimated height and weight differential ratios, i.e. ***towards underestimating the negative differentials for boys.***

The checks with mortality data and alternative anthropometric norms make it safe to conclude that females are not at a nutritional disadvantage vis-a-vis males, as measured by anthropometric standards, in most of SSA. If there is a sex differential, which the bulk of the evidence reported above suggests, it is to the advantage of girls. Nothing we have found, however, suggests that there should be ***cultural and religious*** motivated preferences for girls. In fact, the predominant religious belief in lineage and descendants, makes it difficult to expect any differential treatment within families, neither along age nor gender lines.

Considering economics, however, there is reason to expect that females are favored. Throughout the entire SSA region, bride price, rather than dowry, is the practice in connection with marriages. This suggests that females, or rather female labor, is seen as a valuable economic asset. On purely biological grounds, we have found females to be more efficient producers of food than men are on a net basis, i.e. in relation to the food they need to consume in order to produce.

Qualifications. Evidence on gender differentials in the nutritional status of the populations in SSA is almost non-existent in the earlier literature. In this paper we have collected and analyzed data from more than 50 populations in the region. An obvious shortcoming of the present study is, nevertheless, that the data have been taken mainly from secondary sources, where they are presented in a form that does not permit tests of statistical significance of the gender differentials ***within*** respective sample. It has been beyond the scope of the present study to go back to the primary sources and undertake the enormous job to find out in what cases tests of statistical significance is possible and to conduct these tests. This may be the theme for future research.

A second qualification pertains to the explanations offered for the favored position of women in Africa. More detailed study of cultural and religious motives for different treatments of boys and girls are needed before more definitive conclusions about the weight of such explanations can be reached. The same applies to economic explanations, whether based in biological or other differences between men and women. It is, however, notable that the model developed in a previous chapter give predictions which square up with the empirical results obtained here, i.e., the theory and the stylized facts are fully consistent.

The final question is perhaps not so obvious: is a gender differential in nutritional status a matter of *policy* concern? In the previous literature on the issue, almost exclusively focused on South Asia, this question has not been explicitly addressed, although answered in the affirmative by implication.[7] If 'discrimination' of boys in Africa is advantageous for the survival of the family, which is the overriding concern according to traditional believes, it seems difficult to advice against it. On the other hand, if it can be shown that the fulfillment of the objective function that governs social and economic life in the region would be higher, were boys given the same priority as girls, there is a case for concern and policy advice.

7 See Sen (1984, chapter 15) for a further discussion of the implications of intra-family disparities in nutrition and health for welfare analysis and policy.

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Appendix table 1: Nigerian Well-off Children in Comparison with Denver and NCHS Height Norms

Age Group	Boys			Girls			Boys			Girls			Boys/Girls		
	Nigerian* well-off	Denver	NCHS	Nigerian* well-off	Denver	NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS
							(1)/(2)	(1)/(3)	(2)/(3)	(4)/(5)	(4)/(6)	(5)/(6)	(7)/(10)	(8)/(11)	(9)/(12)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	77.0	-	76.1	75.2	-	74.3	-	1.01	-	-	1.01	-	-	1.00	-
2	89.3	86.3	86.8	86.2	85.5	86.8	1.03	1.03	.99	1.01	.99	.98	1.02	1.04	1.01
3	96.4	95.2	94.9	95.8[a]	93.8	94.1	1.01	1.02	1.00	1.02	1.02	1.00	.99	1.00	1.00
4	104.7	102.7	102.9	102.9	102.3	101.6	1.02	1.02	1.00	1.01	1.01	1.01	1.01	1.01	.99
5	111.5	109.5	109.9	109.4	109.4	108.4	1.02	1.01	1.00	1.00	1.01	1.01	1.02	1.00	.99
6	116.7[a]	116.2	116.1	116.0[a]	116.0	114.6	1.00	1.00	1.00	1.00	1.01	1.01	1.00	.99	.99
7	122.3[a]	122.7	121.7	121.5[a]	122.4	120.6	.99	1.00	1.01	.99	1.01	1.01	1.00	.99	1.00
8	127.4[a]	128.8	127.0	127.1[a]	128.0	126.4	.98	1.01	1.01	.99	1.00	1.01	.98	1.01	1.00
9	133.1[a]	134.1	132.2	131.8[a]	132.5	132.2	.99	1.01	1.01	.99	.99	1.00	1.00	1.02	1.01
10	-	139.0	137.5	137.2[a]	138.7	138.3	-	1.01	1.01	.98	.99	1.00	-	1.02	1.01
Average 1-6 yrs							1.02	1.02	1.00	1.01	1.01	1.00	1.01	1.01	1.00
Average 7-10 yrs							99	1.01	1.01	.99	1.00	1.01	1.00	1.01	1.00

* Average of two samples of well-off families from Ibadan and Lagos.

[a] Figure refers to samples from Ibadan only.

Source: Eveleth and Tanner (1976), appendix tables 40-43 and Stephanson et al (1983), tables III-2 and III-5.

Appendix table 2: Nigerian Well-off Children in Comparison with Denver and NCHS Weight Norm

Age Group	Boys			Girls			Boys			Girls			Boys/Girls		
	Nigerian* well-off	Denver	NCHS	Nigerian* well-off	Denver	NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS	Nigeria/ Denver	Nigeria/ NCHS	Denver/ NCHS
							(1)/(2)	(1)/(3)	(2)/(3)	(4)/(5)	(4)/(6)	(5)/(6)	(7)/(10)	(8)/(11)	(9)/(12)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	10.2	-	10.2	9.3	-	9.5	-	1.00	-	-	.98	-	-	1.02	-
2	13.1	12.4	12.3	11.6	11.9	11.8	1.06	1.06	1.01	.97	.98	1.01	1.09	1.08	1.00
3	14.6	14.5	14.6	14.5	14.0	14.1	1.01	1.00	.99	1.04	1.03	.99	.97	.97	1.00
4	17.1	16.5	16.7	16.1	16.3	16.0	1.04	1.02	.99	.99	1.01	1.02	1.05	1.01	.97
5	19.8	18.6	18.7	17.8[a]	18.5	17.7	1.06	1.06	.99	.96	1.00	1.04	1.10	1.06	.95
6	20.7[a]	20.8	20.7	19.8[a]	20.5	19.5	.99	1.00	1.00	.97	1.02	1.05	1.02	.98	.95
7	22.9[a]	23.7	22.8	22.1[a]	22.7	21.8	.97	1.00	1.04	.97	1.01	1.04	1.00	.99	1.00
8	25.4[a]	26.3	25.3	24.8[a]	25.6	24.8	.97	1.00	1.04	.97	1.00	1.03	1.00	1.00	1.01
9	28.0[a]	29.5	28.1	26.6[a]	28.7	28.5	.95	.99	1.05	.93	.93	1.01	1.02	1.06	1.04
10	-	32.8	31.4	31.4[a]	32.0	32.6	-	-	1.04	-	-	.98	-	-	-
Average 1-6 yrs							1.05	1.05	1.00	.99	1.00	1.02	1.06	1.05	.98
Average 7-12 yrs							.96	1.00	1.04	.96	.98	1.02	1.00	1.02	1.02

* Average of two samples of well-off families from Ibadan and Lagos.

a Figure refers to samples from Ibadan only.

Source: Eveleth and Tanner (1976), apendix tables 40-43 and Stephenson et al (1983), tables III-1 and III-4

Appendix Table 3: Heights of Males and Females

Country	Year	Place/ Subjects	Height (cm) Male	Height (cm) Female	Height ratio
Caucasian Populations					
Belgium	1967	Brussels/students	175.5	163.1	1.076
	1969	Students/workers	174.5	162.0	1.077
Bulgaria	1965	Sofia	171.3	160.2	1.069
	1965	National	169.8	157.7	1.076
Czechoslovakia	1962	Czechs	173.5	161.0	1.078
	1972	National	172.0	159.5	1.078
Estonia	1968	National	172.6	160.2	1.077
France	1967	Paris/students	174.3	161.4	1.080
	1961	Paris	172.0	157.8	1.090
	1963	Basques	169.2	156.4	1.082
DDR	1967	Leipzig/students	175.0	163.4	1.071
	1969	Urban	173.1	161.6	1.071
	1969	Rural	173.5	160.6	1.080
Greece	1970	Students	172.2	159.1	1.082
Italy	1970	Naples	174.4	162.5	1.073
Netherlands	1971	Students/health service	177.7	166.3	1.069
Norway	1962/4	Students	179.7	166.6	1.079
Poland	1962	Warsaw	173.0	158.9	1.089
	1972	Cracow	173.2	160.2	1.081
Rumania	1964	Bucarest/students	171.2	157.1	1.090
		Iasi/clerks	170.4	156.6	1.088
		metal workers	168.7	155.2	1.087
Spain	1963	Basques	170.0	157.3	1.081
UK	1968	BP staff	176 5	163.6	1.079
USSR	1966	Moscow	171 8	159.8	1.075
Non-caucasian Populations					
Cuba	1967	Havana	171.1	158.7	1.078
Nigeria	(unpbl)	Ibadan well-off	171.5	160.1	1.071
USA, blacks	1962	Military/students	176.3	162.6	1.084
USA, blacks	..	National	175.9	163.2	1.078

Source: Eveleth and Tanner, 1976, appendix table 5(a), 44 and 45.

Appendix Table 4: Mean Size of Adult Males and Females in Sub-Saharan Africa

Country	People/ Place	Males: Average Estimated Height and Weight						Females: Estimated Average Height and Weight					
		n	H cm (1)	W kg (2)	H/ 180 (3)	BMI (4)	BMI/ 20.1 (5)	n	H cm (6)	W kg (7)	H/ 167 (8)	BMI (9)	BMI/ 19.0 (10)
Botswana	Bushmen	292	159.4	..	.89	..	..	346	150.0	..	.90	..	..
Chad	Sara	238	173.5	66.8	.96	22.2	1.10	269	163.9	58.0	.98	21.7	1.09
Zaire	Congolese	32	167.8	59.1	.93	21.0	1.04	26	156.7	48.2	.94	19.6	1.03
	Bunia pygmies	14	145.0	40.0	.81	19.0	.95	21	138.0	37.0	.83	19.5	1.03
Gambia	-	..	166.6	54.9	.93	19.7	.98	..	158.0	52.2	.95	20.9	1.10
Malawi	Bantu	23	165.7	55.7	.92	20.3	1.01	119	154.1	48.6	.92	20.5	1.08
Nigeria	Yoruba	340	167.5	56.2	.93	20.0	1.00	205	155.0	51.8	.93	21.6	1.14
	Ibadan (rich)	40	171.5	70.0	.95	23.8	1.18	82	160.1	64.6	.96	25.2	1.33
	Ibadan (slum)	101	168.7	60.1	.94	21.1	1.05	239	158.3	52.9	.95	21.1	1.11
	Lagos	89	168.9	62.7	.94	22.0	1.09	131	158.5	60.5	.95	24.1	1.27
Rwanda	Tutsi	177	176.5	57.4	.98	18.4	.92	28	161.8	52.8	.97	20.2	1.06
	Hutu	184	167.1	57.5	.93	20.6	1.02	25	155.9	52.1	.93	21.4	1.13
Tanzania	Hadza	36	160.5	53.6	.89	20.8	1.03	31	150.0	47.7	.90	21.2	1.12
	Bantu	43	168.6	..	.94	..	1.09	72	156.2	..	.94	..	..
Uganda	Bagare (rural)	61	163.6	59.0	.91	22.0	1.01	66	156.2	56.3	.94	23.1	1.22
Ethiopia	Debarech	81	167.3	56.8	.93	20.3	.94	37	156.6	50.1	.94	20.5	1.08
	Adi-Arkai	68	168.8	53.6	.94	18.8	.91	35	152.6	47.0	.91	20.2	1.06
India	National	1757	164.1	49.2	.91	18.3	.91	951	151.7	43.5	.91	18.9	.99

Source: Eveleth and Tanner, 1976, Appendix Tables 44, 45, 77 and 78.

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