AGE DIFFERENCES IN THE ANDROGYNY SCORE

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It has been suggested that the androgyny score, computed to estimate the degree of femininity of build in the male (Tanner, 1951), diminishes with increasing age (Kelsey, 1965; Henderson and Dugard, 1968). This paper describes age differences in the androgyny score in a cross-sectional study of men and women aged 20-90 years.

METHODS

The sample examined consisted of 413 men and 406 women aged 20-90 years. This sample was obtained in two parts. The first contained 215 men and 272 women aged 62-90 years, who formed a simple random sample of the 27,000 older people living in a defined area of Edinburgh. The method of sampling these subjects, who are taking part in a longitudinal study of ageing persons, has been described elsewhere (Milne, Maule, and Williamson, 1971). The second part was composed of 198 men and 134 women aged 20-65 years, who were donors providing blood at the Regional Blood Transfusion Service in Edinburgh. I attended donor sessions and circulated a leaflet requesting volunteers for anthropometry. More people volunteered than could be measured in the time available. Bias was introduced by the Blood Transfusion Service policy of rejecting donors under 5 feet (1.5 m) in height or 8 stone (50.8 kg) in weight. This sample, although not random, is from the population living in Edinburgh. The distribution of Landsteiner blood groups in the samples of older people and of blood donors, who were measured, did not differ significantly from that published for Edinburgh (Kopć, 1970). In this respect, therefore, the samples do not differ from the population of Edinburgh. The age distribution of the combined samples of older people and blood donors is given in Table I.

Measurements of biacromial (BAD) and bi-iliac (BID) diameters were made from behind with the subjects standing, using the Harpenden anthropometer (Tanner and Whitehouse, 1957). Care was taken that the shoulders were in a relaxed position when measuring BAD, and that firm pressure was exerted with the branches of the anthropometer when measuring BID. The right suprailiac skinfold thickness was measured using the Harpenden caliper as described by Tanner (1959).

The androgyny score was calculated as $3 \times$ BAD minus $1 \times$ BID (Tanner, 1951). Since the diameters were measured in millimetres, the androgyny score is 10 times the figure as originally described by Tanner.

RELIABILITY

This was studied by measuring the same 12 subjects on two occasions. A reliability coefficient was calculated, using the analysis of variance, by dividing the variance for persons by the sum of the variances due to persons, occasions, and error. Variance due to error was the residual mean square after removing variance due to persons and occasions. Coefficients for the author’s variance determined in this way before and after the survey are given in Table II.

<table>
<thead>
<tr>
<th>Table I</th>
<th>AGE AND SEX DISTRIBUTION OF SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Range</td>
<td>Men</td>
</tr>
<tr>
<td>20-24</td>
<td>33</td>
</tr>
<tr>
<td>25-29</td>
<td>33</td>
</tr>
<tr>
<td>30-34</td>
<td>28</td>
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<tr>
<td>35-39</td>
<td>30</td>
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<td>40-44</td>
<td>15</td>
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<tr>
<td>45-49</td>
<td>17</td>
</tr>
<tr>
<td>50-54</td>
<td>20</td>
</tr>
<tr>
<td>55-59</td>
<td>12</td>
</tr>
<tr>
<td>60-64</td>
<td>55</td>
</tr>
<tr>
<td>65-69</td>
<td>77</td>
</tr>
<tr>
<td>70-74</td>
<td>39</td>
</tr>
<tr>
<td>75-79</td>
<td>34</td>
</tr>
<tr>
<td>$\geq$ 80</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>413</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table II</th>
<th>INTRA-OBSERVER AND INTER-OBSERVER RELIABILITY STUDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Coefficients</td>
<td>Number of Subjects</td>
</tr>
<tr>
<td>Biacromial Diameter</td>
<td>Bi-iliac Diameter</td>
</tr>
<tr>
<td>One observer Before survey</td>
<td>0.98</td>
</tr>
<tr>
<td>After survey</td>
<td>0.98</td>
</tr>
<tr>
<td>Two observers</td>
<td>0.86</td>
</tr>
</tbody>
</table>
An inter-observer study was carried out by the author and another observer measuring another 12 subjects on one occasion. Measurements were made so that one observer did not see the other at work. The coefficient was calculated with variance due to observers substituted for variance due to occasions. The results of this study (BAD and BID only) are also shown in Table II.

In the analysis of variance, the contributions to the total variance made by persons and occasions were examined using the F test. In all variables in the inter-observer and intra-observer studies the ratio of mean square for persons to mean square for error was significant at the 1% level. The corresponding ratio for occasions was significant only for bi-iliac diameter in 1970 and that just reached the 5% level. With this exception the principal contributor to the total variance was persons, and the observations can be accepted as reproducible.

RESULTS

Frequency distributions of androgyny score, BAD, and BID are given by decade for men and women separately in Figures 1, 2, and 3. For ease of comparison the values used are percentages. The modal value of androgyny score and BAD in both sexes decreases in persons of 60 years and over, while the modal value of BID is greater in older people.

Mean values of the three variables with standard deviations and standard errors are given in five-year age groups in Table III. Inspection suggests little change in androgyny score or BAD in the age range from 20 to the fifties. Women thereafter show a gradual diminution in mean values up to old age, but men have a sharp fall in mean values from the fifties to the mid-seventies and thereafter the fall levels off. The mean values of BID in both sexes increase gradually from 20 years of age to the fifties, after which the values seem relatively constant.

These age differences have been described using linear regressions. For each of the three variables, in women, two regression lines have been computed, one from 20 to 49 years and the other from 50 years to old age. In men, similar lines have been used for the regression of BID on age, but for androgyny score and BAD three lines were used covering age ranges 20-59, 55-74, and 70-80 years. The age ranges

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**Fig. 1.** Frequency distribution of androgyny score (percentages) by decade in men and women.

**Fig. 2.** Frequency distribution (percentages) of biacromial diameter by decade in men and women.
AGE DIFFERENCES IN THE ANDROGNY SCORE

Fig. 3. Frequency distribution (percentages) of bi-iliac diameter by decade in men and women.

Fig. 4. Frequency distribution (percentages) of right suprailiac skinfold thickness (log transformation) in men and women.

Fig. 5. Regression of androgyny score on age in men and women (± 1 standard error).

Fig. 6. Regression of biacromial diameter on age in men and women.
### Table III

**MEAN VALUES WITH STANDARD DEVIATIONS AND STANDARD ERRORS FOR ANDROGYNY SCORE AND RELATED VARIABLES IN MEN AND WOMEN**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Androgynty Score Mean</th>
<th>Biacromial Diameter (mm) Mean</th>
<th>Bi-ilac Diameter (mm) Mean</th>
<th>Suprailiac Skinfold (log) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td>908 ± 52.3</td>
<td>397.9 ± 20.5</td>
<td>285.5 ± 23.4</td>
<td>0.1987</td>
</tr>
<tr>
<td>25-29</td>
<td>927 ± 41.1</td>
<td>404.7 ± 16.2</td>
<td>286.5 ± 23.9</td>
<td>0.3754</td>
</tr>
<tr>
<td>30-34</td>
<td>928 ± 47.4</td>
<td>406.5 ± 18.3</td>
<td>291.3 ± 16.2</td>
<td>0.4227</td>
</tr>
<tr>
<td>35-39</td>
<td>916 ± 51.4</td>
<td>403.2 ± 20.6</td>
<td>293.2 ± 17.0</td>
<td>0.5460</td>
</tr>
<tr>
<td>40-44</td>
<td>892 ± 40.6</td>
<td>396.9 ± 18.4</td>
<td>298.5 ± 31.2</td>
<td>0.6460</td>
</tr>
<tr>
<td>45-49</td>
<td>916 ± 35.4</td>
<td>404.9 ± 12.7</td>
<td>299.1 ± 17.5</td>
<td>0.7425</td>
</tr>
<tr>
<td>50-54</td>
<td>906 ± 49.4</td>
<td>400.2 ± 14.7</td>
<td>295.4 ± 17.2</td>
<td>0.8448</td>
</tr>
<tr>
<td>55-59</td>
<td>822 ± 83.4</td>
<td>408.5 ± 27.7</td>
<td>303.4 ± 15.6</td>
<td>0.9465</td>
</tr>
<tr>
<td>60-64</td>
<td>857 ± 48.5</td>
<td>386.2 ± 18.9</td>
<td>301.5 ± 16.1</td>
<td>1.0435</td>
</tr>
<tr>
<td>65-69</td>
<td>843 ± 53.1</td>
<td>380.9 ± 19.6</td>
<td>299.6 ± 14.3</td>
<td>1.1460</td>
</tr>
<tr>
<td>70-74</td>
<td>815 ± 54.9</td>
<td>371.5 ± 19.6</td>
<td>291.3 ± 13.4</td>
<td>1.2493</td>
</tr>
<tr>
<td>75-79</td>
<td>815 ± 45.2</td>
<td>374.1 ± 18.2</td>
<td>307.3 ± 19.5</td>
<td>1.3515</td>
</tr>
<tr>
<td>80+</td>
<td>811 ± 43.5</td>
<td>371.1 ± 15.3</td>
<td>302.8 ± 21.9</td>
<td>1.4539</td>
</tr>
</tbody>
</table>

Data missing in 2 men and 6 women

### Table IV

**REGRESSIONS OF ANDROGYNY SCORE AND RELATED VARIABLES ON AGE IN MEN AND WOMEN**

<table>
<thead>
<tr>
<th>Sex and Age Range</th>
<th>Androgynty Score</th>
<th>Biacromial Diameter</th>
<th>Bi-ilac Diameter</th>
<th>Suprailiac Skinfold (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>Regression Coefficient (age)</td>
<td>S.E. Regression Coefficient</td>
<td>SE of Regression</td>
</tr>
<tr>
<td>Men</td>
<td>+925.3325</td>
<td>-0.2605</td>
<td>0.3360</td>
<td>50.4</td>
</tr>
<tr>
<td>55-74</td>
<td>+1236.6228</td>
<td>-5.9085**</td>
<td>0.9695</td>
<td>54.4</td>
</tr>
<tr>
<td>70+ &gt; 80</td>
<td>+844.2635</td>
<td>-0.3956</td>
<td>1.0326</td>
<td>48.9</td>
</tr>
<tr>
<td>Women</td>
<td>+817.6824</td>
<td>-0.0556</td>
<td>0.5127</td>
<td>42.8</td>
</tr>
<tr>
<td>50+ &gt; 80</td>
<td>+898.0156</td>
<td>-2.2453**</td>
<td>0.5127</td>
<td>42.8</td>
</tr>
</tbody>
</table>

* P < 0.05
** P < 0.01
used in the regression of these dependent variables on age were selected by examining the table of five-year means (Table III) to discover the age ranges with the greatest and least variation for each dependent variable.

The regressions of androgyny score, BAD, and BID on age are given in Table IV and in Figures 5, 6, and 7. For androgyny score and BAD in women, the regression coefficients for age are significant in the age range 50 to old age but not in the age range 20-49. In men these coefficients are significant in the range 55-74 years but not in range ages 20-59 and 70 to old age. In men and women the regression coefficient for age in respect of BID is significant in the age range 20-49 but not in older people.

The fall in BAD and the rise in BID with increasing age both tend to lower the androgyny score. The rise in BID with age might be due to increasing obesity. This possibility was investigated by measuring the right suprailiac skinfold thickness. Five-year means of the log transformation of this variable (Edwards et al., 1955) are reported in Table III and its regression on age in Table IV for age ranges 20-49 and 50 to old age (Figure 8). This analysis reveals an increase in the skinfold thickness with increasing age in men, but not in women, up to age 50. Thereafter in both sexes the fall with increasing age is significant. At ages when the androgyny score is falling in value and the BID appears constant, the suprailiac skinfold thickness is also decreasing (Figure 8).

**DISCUSSION**

This cross-sectional study confirms that there is an age difference in the androgyny score, the decrease in both sexes beginning in the fifties. A sex difference is also present in that the score in women continues to fall up to old age, while in men a steep fall in the years 55-74 levels off in old age. Because the study is cross-sectional, the differences found are likely to have been greatly influenced by the effects of mortality. The mortality rates for 1969 in Scotland for men aged 55-64 and 65-74 are respectively 24.7 and 59.2 per 1,000, the corresponding figures in women being 12.9 and 32.9 (Registrar General for Scotland, 1971). It is possible that an association between these greater mortality, in men compared with women, and the androgyny score in these age groups explains the steep fall, found in men only, in the regression of androgyny on age from 55-74 years. Figure 5 shows that the men who survive this period tend towards 'femaleness' as measured by the androgyny score. Greater 'maleness' as measured by this score may militate against survival in middle age.

Some support is given to this hypothesis by the author's unpublished data concerning men, in the present study, aged 62-74 years. These men form part of the sample being studied longitudinally and have had a full clinical examination including electrocardiography. No comparable information is available about men younger than 62 who were blood donors not studied in such detail. The men aged 62-74 can be divided into those with probable and possible ischaemic heart disease, as defined by Reid, Holland, Humerfelt, and Rose (1966), and those with no evidence of such disease. The mean androgyny score in 20 men with probable ischaemic heart disease is 855 (SE 11.3) compared with 836 (SE 5.1) in 106 men with no evidence of such disease. The possible group has a mean value between these figures. Although the confidence limits of these means overlap, possibly because of small sample sizes, the figures suggest that during the age period where the regression line of androgyny on age falls steeply, men with a disease known to be an
important contributor to middle-aged mortality have
a higher mean androgyne score than men with no
evidence of this disease. Longitudinal study would
be needed to examine properly this apparent
association between maleness, measured by the
androgyne score, and middle-aged mortality. Such a
study would also show whether the age differences
described in this paper overestimate age changes.

With increasing age, biacromial diameter and
bi-iliac diameter both show differences in directions
which lower the androgyne score. The bi-iliac
diameter, after increasing up to age 50, remains
constant thereafter. The fall in the androgyne score
in older people is therefore due to a decrease in the
biacromial diameter. The constancy of the bi-iliac
diameter in persons above 50 years of age and the
decrease in suprailliac skinfold thickness in this age
group suggest that an increase in bi-iliac diameter
due to obesity is not an important cause of the lower
androgyne scores in older people. Kelsey (1965)
showed in the relatives of schizophrenic patients that
an increase with age in bi-iliac diameter was not
associated with an increase in weight.

Androgyne score has been studied in relation to
mental illness (Ray and Coppen, 1959; Kelsey, 1965;
Henderson and Dugard, 1968; Price, 1969) and to
sexual disorders (Coppen, 1959; Johnston, 1965).
Men who were hypogonadal or who had female sex
chromatin were found to have decreased biacromial
diameters (Rabooh, 1957) while women with
hirsuties and increased urinary 17-ketosteroid
excretion had an increase in this measurement
(Ferriman, Thomas, and Purdie, 1957). The findings
in respect of age differences in the present study emphasize the need, mentioned by Kelsey, to allow
for age when relating any disorder to the androgyne
score.

Measurement figures in the present study agree
fairly well with control figures given by other authors
(Ray and Coppen, 1959; Kelsey, 1965; Johnston,
1965). One large study (Board of Trade, 1957) in
women, of anthropometry in relation to clothing
sizes, included the biacromial but not the bi-iliac
diameter. In women aged 20-54, the BAD was found
to be very close to 350 mm. In corresponding five-
year age groups this figure is 15-20 mm less than in
the present study. The Board of Trade report gives
a clear description of how the BAD was measured
but does not mention any instruction to make the
measurement with the shoulders of the subject
relaxed. This difference in technique may explain the
difference in results.

The fall in the androgyne score as age increases
may result from changes in the shape of the thorax.
The anteroposterior diameter of the thorax is known
to increase and the transverse diameter to diminish
with increasing age. Increase in anteroposterior
diameter is associated with increased kyphosis,
in turn associated with changes in the shape of vertebral
bodies resulting from senile osteoporosis. These
vertebral changes begin after 50 years in women and
after 60 years in men. The effect of the change in
shape of the thorax is to bring the scapulae closer
together with a decrease in biacromial diameter and
androgyne score.

SUMMARY
The androgyne score was calculated from
biacromial and bi-iliac diameters measured in
Edinburgh in 413 men and 406 women aged 20-90.
The score showed a fall in both sexes beginning in
the fifties. The fall was gradual in women and
steeper, with later levelling off, in men. The steep
fall in men may be associated with increased
mortality among those men with greater degrees of
maleness as measured by the androgyne score.
Reduction in biacromial diameter was the main
factor in the fall of the score. Larger bi-iliac
diameters in older people were not associated with
increased subcutaneous fat.

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and accuracy of calipers for measuring subcutaneous
in adolescent psychiatric patients and in delinquents.


