CHAPTER 4

RESULTS of METRIC ANALYSIS

The basis of this study was to use three distinct methodologies to test whether sexual dimorphism increases or decreases with the onset of advanced age. The first objective was to metrically compare males and females, and these metric analyses are summarized here.

Metric data was collected from 25 regions in the long bones of the postcranial skeleton and from the pelvis. One pelvic index (the ischio-pubic index) was also calculated. The dimensions were subjected to statistical analysis to determine the differences between groups. This was done in order to ascertain if significant differences do, indeed, exist among the sexes for the selected measurements. Data from the two different groups was then compared. White females were compared to black females, and white males compared to black males. If no significant differences were found, they were pooled into a "male" and "female" group. If, however, metric differences were found to be present, the two populations were kept separate for the remainder of the analysis.

Young and old individuals from the same sex were then compared. Each metric value from a skeletal trait that changed significantly from "young" to "old" was compared to the same skeletal metric value in the opposite sex. This was to clearly define the magnitude of changes that occurred at that site, and to visualize whether the male and female values were diverging upon each other. Age ranges were categorized into 10-year divisions to illuminate possible trends in size changes with the onset of incremental age.

4.1

Comparison of postcranial metric data: all populations

Descriptive statistics were first employed to determine if any difference in size was observed between males and females in the long bone measurements. The vast majority of past studies indicated that significant differences would be observed (e.g., Bass 1995; Holliday and Falsetti 1999; Holman 1991; Imrie 1958; King *et al.* 1998; Krogman 1962; Rother *et al.* 1977; White 2000). Table 4.1 summarizes the basic descriptive statistics, including standard deviation and standard error. The significance of differences between means was tested by ANOVA analysis, and were also indicated in the table. In this table, data from all males and females were pooled, regardless of their biological affiliation.

All male dimensions were larger than female dimensions. The F-value in Table 4.1 indicates the large distance between metric distributions of all males and females, which designated a clear and significant difference between the groups for all 23 measurements. All p-values, therefore, were at the level of <0.05, thus the distinct differences in size between males and females can once again be confirmed through this study. Inter-observer data exhibited virtually the same results, and statistical analyses were analogous to the original data analyses.

Intra-observer data collection exhibited similar results in measurement parameters. Representative samples of measurements were collected by an independent observer, and descriptive statistics in addition to ANOVA analysis were primarily analogous to the original data analyses. Pelvic measurements taken from the independent observer showed a smaller amount of variation between the sexes than found with the original researcher and the subsequent re-collection of measurements by the original researcher. See Appendix J for specific statistical results from the independent observer in metric analysis.

4.1.1

Comparison of postcranial metric data between sexes and populations

Males and females within different population affinities may also show marked sexual dimorphism in metric values, or may show a less distinct occurrence of sexually dimorphic metric traits, i.e., comparably similar in size dimensions. Because this study sample consisted of both black South African specimens and white South African specimens, each population was analyzed to observe the relative sexual dimorphism for each group.

Table 4.2 illustrates the differences between black South African males and females. The differences between males and females within this group are also significant on a statistically significant level. Sexual dimorphism was evident and manifested as, once again, males being metrically larger than females.

Table 4.3 illustrates the differences in measurements between white males and females for this sample population, with males appearing also to be dramatically larger than their female counterparts. Sexual dimorphism thus existed on a marked, statistically significant level in the both the black and white samples.

4.2

Comparison of female postcranial data between populations and age groups

Distinctions between populations within the categories of “male” and “female” were examined. An assessment was done in order to establish whether significant differences existed between the black and white South African populations. If not, they can be pooled, but otherwise should be kept separate in future analyses. Reiteration should be made, however, that population categories have always been regarded as a secondary consideration in this study. The division of “black female ”,“ white female ”,“ black male and “white male” were made only in an effort to attempt to pool the aggregate data together, when and if they were shown to be statistically congruent with each other, i.e., the null hypothesis could be accepted and no differences existed. The metric data of black females were therefore compared to that of white females and differences noted where applicable. Comparison of the descriptive statistics (mean, standard deviation, ranges between minimum and maximum measurements) illustrated distinct differences between the population categories of "black" and "white" within the female population in certain locations of measurement, but not all.

Table 4.4 represents the differences in metric dimensions between black females and white females. As can be seen, the dimensions of the bones of white females tended to be, in general, larger than that of the black females. White females were significantly larger on a statistical level ($p<0.05$) at the vertical head diameter of the humerus, the maximum midshaft diameter of the ulna, the distal diameter of the ulna, the olecranon-coronoid distance of the ulna, the maximum midshaft diameter of the radius, the vertical head diameter of the femur, the distal epicondylar breadth of the femur, the midshaft circumference of the femur, the proximal and distal diameters of the tibia, the maximum head diameter of the fibula, and the maximum midshaft diameter of the fibula.

Humeral head measurements, as well as ulnar dimensions, a radial dimension, and lower leg dimensions appear to be the most dissimilar between the females of the two populations. Specifically, the most distinct differences appeared to be in that of the measurements regarding diaphyses, i.e., diameters at midshaft and circumferential data. The ulna, radius, and fibula diameters were statistically distinct between black and white females, while the femoral circumference was also different between the two female groups. Additionally, another noteworthy location of statistical significant differences was in the knee joint articular surfaces, i.e. distal epicondylar breadth of the femur and its counterpart, the proximal condylar breadth of the tibia. Other measurements, mostly located within the upper appendicular skeleton of the female specimens appeared quite congruent and would not be considered significantly dissimilar from one another in absolute size. Table 4.5 demonstrates the cataloguing of metrical traits found to be statistically significantly different or similar in the female skeleton between the populations "black" and "white".

The distribution of statistically significant differences appeared to be largely random; no pattern developed except those subtle arrangements listed above and no consequential evidence led to certain element measurements as standing out as discernibly "black female" or discernibly "white female". One possible trend was seen in four measurements from the humero-radio-ulnar joint; these all appeared metrically similar between black and white females. Because the majority of measurements are of statistical significance, however, it was concluded that the female groups should remain separate for the remainder of statistical analysis for subsequent queries placed upon metric data. As it was expected that metric changes in size with age may be subtle, pooling the data would obscure these changes, especially due to the dissimilar sample sizes between the populations.

The purpose of this study was to determine if skeletal elements change with age; if so, were the changes great enough to observe and substantial enough to quantify? With the resulting black females separated from the white females, analyses were then performed on each group to determine if either population changed with age; if there were statistically significant changes as age advanced, the next step would be to interpret the changes and to interpret why these transformations were taking place. Dimensions of individuals younger than 50 were therefore compared to those of individuals older than 50 to observe differences in metric proportions.

4.2.1

Metric changes in long bone measurements with the onset of age: black females

Black females appeared to stay relatively static in their measurements of long bones with the onset of advanced age (Table 4.6). Only one skeletal site, the circumference at midshaft of the humerus, appeared to be statistically distinct between young and old individuals. The midshaft circumference of the humerus in black females showed a decrease in size with age. Young black females exhibited a mean humeral midshaft circumference of 60.35 mm (with a standard deviation of 4.27 mm) as opposed to a significantly smaller humeral midshaft diameter in the older black females of 58.15 (with a standard deviation of 4.77 mm).

As can be seen from Table 4.6, black females change very little in metric values with the advancement of age. Older individuals are approximately the same size in all measurements as their younger counterparts.

4.2.2

Metric changes in long bone measurements with the onset of age: white females

White females, in contrast to black females, appeared distinctly different in regards to their long bone metric values and thus size with the onset of age. White females were significantly different between the age groups of "50 years of age and younger" and "over 50 years of age" in several sites of the postcranial skeleton. Table 4.7 illustrates these mean-based size differences and their statistical significance.

Old white females were shown to increase in size with all postcranial measurements. Statistical significance of these findings was tested with an ANOVA statistical test. F-values demonstrated that several postcranial skeletal measurements were significant at $p < 0.05$. In those long bone measurements, again, the change was a distinctive increase in skeletal size among midshaft circumferences, diameters, and proximal/ distal articular surface data. These results showed a clear and unmistakable trend in white females becoming metrically larger in their postcranial dimensions with age.

4.3

Comparison of male postcranial data between populations and age groups

Males and females were found to be unique from each other in their morphological size when comparing postcranial measurements. Sexual dimorphism between males and females was quite apparent, but once again it was necessary to question possible differences between black and white South Africans, in this case between males. Because the female population was further divided into separate groups, the same was attempted with males.

Measurable differences were observed between the black male population and the white male population in 18 out of 23 postcranial measurements (Table 4.8). The only sites in which both groups appeared similar were dimensions located at the ulnar head, and the midshaft dimensions of both lower leg bones, the tibia and fibula. All other skeletal sites of the male postcranium bore differences that were statistically significant. These variations between the groups manifested themselves as size differences, as was the case with the female populations; white males tended to be larger than black males in their postcranial/ long bone skeletal features.

The F-values depicted in Table 4.8 signify the distance between individual distributions and their significance level. White males, with few exceptions, were significantly larger than their black male counterparts.

The significantly larger skeletal sites of white males as compared to black males included the maximum head diameter of the humerus, radius, femur and fibula, as well as the proximal breadth of the tibia, and one proximal measurement of the ulna. Midshaft diameters of all long bones were significantly larger in white males than in black males, except for both midshaft diameters of the lower leg bones (tibia and fibula); the midshaft circumferences of both the humerus and femur were larger as well. In addition, the distal diameters of all six long bones were significantly larger in white males than in their black counterparts. Table 4.9 demonstrates the list of metrical traits found to be statistically significantly different or similar in the male skeleton between the populations "black" and "white".

Because of these statistically significant metric differences between populations, it was concluded that the groups should remain separate for the remainder of statistical analyses.

4.3.1

Metric changes in long bone measurements with the onset of age: black males

Following this, a comparison of young specimens and old specimens from each population was done, as was the case with the female sample. Data collected on black males indicated that indeed black males increased in size with age; certain sites on the skeleton, more than others, were observed as being significantly larger, producing statistically noteworthy results. As seen in Table 4.10, black males increased with age at 21 skeletal measurement sites. Seven of these differences were statistically significant when subjected to an ANOVA.

Table 4.10 illustrates that the majority of statistically significant skeletal sites in which young black males and old black males differ were the midshaft diameters of the appendicular skeleton and the elbow and knee joint locations. The midshaft diameters of the humerus, ulna, and femur in black males were the most obvious measurements changing with the onset of age. Additionally, the proximal tibia and the proximal fibula, being an integral component of the knee joint, increased with size when young and old black males were evaluated, as well as the distal epicondylar breadth of the humerus and the superior diameter of the head of the ulna (comprising two-thirds of the bony structures of the elbow).

4.3.2

Metric changes in long bone measurements with the onset of age: white males

White males also increased in size with the onset of age, although not with any statistical significance at the majority of skeletal measurement sites (Table 4.11). The locations of the significant changes, however, parallel those seen in the black male skeleton. The white males increased in metric dimensions on a statistically significant level with one location at the elbow joint (inferior diameter of the head of the ulna), and a component of the knee joint (the proximal bicondylar breadth of the tibia). In addition, the distal diameter of the radius increased significantly with age. These locations (elbow and knee joints) are the same areas that increased in dimension with the black male skeleton.

4.4

Implications of metric changes with age between males and females: long bone measurements

When statistically significant changes with age were observed in the skeletal measurements for each biological affiliation, that particular measurement site was compared to the opposite sex and their corresponding measurement to visualize whether the male and female values were diverging upon each other. Male metric measurements were consistently larger than their female counterparts with the young populations studied. However, females (specifically, white females) were observed to increase in size in a number of skeletal measurement sites. They were subsequently compared to their male counterparts to detect the differences between the metric values. These differences were important to note, based on the possibility of metric misclassification between males and females if measurements were seen to increase, especially in the female population. In addition, metric decreases in the postcranial skeleton were observed and compared. Age categories were determined on a ten-year incremental scale basis after the age of 20. Ages 18 to 20 were pooled for the first age category. Table 4.21 shows the age categories on which all Figures were based upon.

4.4.1

Statistically significant long bone changes in black females with age

The only site seen as statistically different with the onset of age in black females was the circumference of the humerus at midshaft. The humeral circumference of black females was then compared to that of black males in order to visualize the possible convergence of sexual dimorphism in this group (Figure 4.1). Various observations were made from Figure 4.1. No black female specimens 18-20 years of age were obtained for this study, thus the break in the line of data throughout that time period. In addition, no black females over the age of 80 were analyzed. Black males and females appeared to change in different ways through time in regard to this isolated measurement site, with males decreasing in size early in age and females increasing in size late in age (age category 6, 61-70 years of age). Based on comparison of means and classic statistical analyses, black males and females change in age but do not come close to converging to the point that misclassification would be possible.

4.4.2

Statistically significant long bone changes in white females with age

Numerous sites were seen as statistically different with the onset of age in white females. These specific measurement sites were compared to white males to visualize the changes with this group through time. White females were observed to increase in size with the onset of age at the humeral head, especially from the age of 41 through their 70s (Figure 4.2). White males increased in size during their 20s through their 40s, stayed relatively static from the age of 50 to the age of 70, and then gradually increased in size with advanced age. Metric values for white females and males appeared close in the second age category of life, but never converge with an incremental progression of age. However, old females and young males, when compared, were becoming very similar metrically.

Figure 4.3 shows the second statistically significant measurement site for white females, namely the diameter of the humerus at midshaft. Again, white females are seen to metrically become larger with age, with a slight decrease in the advanced age category of 70 years to 80 years. These changes occurred gradually. White males were statistically larger than their white female counterparts and continued to grow slightly or stay static with the onset of age. A distinct size increase was seen in the advanced age categories of white males.

The distal epicondylar breadth of the humerus was the third statistically significant measurement site in which white females increased with age. Figure 4.4 illustrates the differences between white females and white males with the advancement of age. White females were seen to gradually increase with age at the distal humerus, but never approach the metric mean of white males even with the advancement of age. White males continued to increase in size somewhat through their last decade of advanced age.

The diameter of the superior ulnar head (Figure 4.5), the diameter of the inferior ulnar head (Figure 4.6), the diameter of the ulna at midshaft (Figure 4.7), the distal diameter of the ulna (Figure 4.8) and the olecranon-coronoid distance (Figure 4.9) were statistically significant between young and old white females, and thus compared to white males to observe the magnitude of changes. White females again never approach the metric mean of white males with this skeletal measurement, since both females and males are increasing in size with age. However, the female measurement in old age is becoming very close to the male measurement mean in age category two.

The distal diameter of the ulna was shown to increase in size with age as well in both white females and white males, with white males in age category 2 being metrically close to the dimensions of white females (Figure 4.8). Males in this group increase in size dramatically throughout the 3rd category of age and continue to stay metrically larger than their white female counterparts for the duration of the age categories. Both males and females decreased slightly in size during the onset of advanced age in the distal diameter of the ulna, specifically, age categories eight and nine. However, the general increase in size for white females over time was statistically significant.

Every measurement collected from the radius resulted in statistically significant increases in size with white females. Figures 4.10, 4.11 and 4.12 show this increase in size compared to the radial measurements of white males. These sites may increase in size with the onset of age in white females, but they do not come close to diverging with the white male mean. However, the measurements of old white females were approaching those of young males.

The maximum diameter of the femoral head, the diameter of the femur at midshaft, and the distal epicondylar breadth of the femur were also sites of significant change with age in white females. The white female mean of the femoral head increased gradually, particularly through the age categories four, five, six, and seven

(40 years of age through 70 years of age, Figure 4.13). A slight decrease in femoral head size in white females was observed after 71 years of age. The mean of the femoral head diameter of white females did not, however, near the size dimensions of the white male femoral head diameter. This pattern was also seen in the femoral shaft diameter and distal epicondylar breadth, although the old females and young males are converging somewhat. Figures 4.14 and 4.15 illustrate differences seen between males and females with these two metric values.

The tibia and fibula were sites of significant size changes with the onset of advanced age in white females as well (Figures 4.16-4.19). The proximal measurement site of the tibia (the bicondylar breadth, Figure 4.16) increased in size as white females progressed through age categories 4, 5, 6, and 7 (40 years of age through 70 years of age). A slight decrease in size was noted between 71 and 80 years of age.

The diameter of the tibia at midshaft showed a definite increase in size as white females advanced through age (Figure 4.17). This increase in the metric midshaft of the tibia began at age category two (21 years of age) and continued through age category seven (70 years of age), where it then decreased slightly with advanced age. The diameter of the tibia at midshaft did not reach a size dimension close to that of white males.

The white female fibula showed signs of increased dimensions with the onset of age at both the proximal and distal measurement sites (Figures 4.18 and 4.19). The proximal fibular diameter was noticeably larger than the white male mean at the beginning of age category 2, and did diverge with the white male mean within this same age category (21 years of age until 30 years of age).

This result is also seen with the distal portion of the fibula, as the mean measurement for white females is larger than the white males at the beginning of age category 2. White male means in both skeletal locations went on to increase in size more than white female means at the same locations; white females were seen to increase in age during the advanced age categories, but are still smaller in size than their white male counterparts.

In summary, white females show significant signs of becoming larger in size with the onset of age when observing long bone measurements. Males and females within this group were getting closer metrically. However, these measurements rarely came close to the white male mean, although some metric dimensions of old white females often approached that of young males.

4.4.3

Statistically significant long bone changes in black males with age

Black males increased in size with age in 21 skeletal sites of measurement, with seven measurement locations increasing on a statistically significant level (Table 4.10). Specifically, the midshaft diameter of the humerus, ulna, and femur increased significantly (Figures 4.20, 4.23 and 4.24) in addition to the distal epicondylar breadth of the humerus and the superior head diameter of the ulna (Figures 4.21 and 4.22, respectively). These last two measurements show that a distinct incremental size change was occurring in the elbow joint with the onset of age. This increase continued to be metrically well above the values black females exhibited in all measurements. Finally, the proximal bicondylar breadth of the tibia and the proximal diameter of the fibula exhibited a size increase in the black male skeleton (Figure 4.25 and Figure 4.26, respectively).

The diameter of the humerus at its midshaft increased in size with the onset of advanced age in the black male skeleton. Figure 4.20 illustrates the gradual increase in the element's size as age categories increase. The measurement site rarely decreases at any of the age category locations; only a gradual increase in the humeral dimension is observed. In this site, sexual dimorphism thus appeared to increase with age.

Sexual dimorphism was apparent in the articular surfaces of the elbow joint of black males, and measurements of two locations increased significantly with the onset of age. The distal articular surface of the humerus increased in size with age, but only in the late old age category. This value appeared above the black female mean and never came close to converging with female metric values (Figure 4.21). This was an expected result. In addition, black males increased in size at the superior head of the ulna (Figure 4.22). Figures 4.21 and 4.22 show parallel increases with the age, with the distal epicondylar breadth of the humerus diverging in old age. Thus, two out of three bony elements of the elbow joint were affected and manifested themselves as an increase in dimension that was statistically significant. The black male metric means for both locations were well above that of the black female mean, which eliminated any possible misclassification of this measurement if it was used in isolation to determine sex.

The diameter of the ulna (Figure 4.23) as well as the femur at midshaft increased on a statistically significant level in black males with the onset of age (Figure 4.24). This metric value was observed to far exceed that of the black female metric value, thus the possibility of misclassification from the metric value of the femoral shaft diameter is unlikely. Interestingly, the mean metric value of the diameter of the femur at midshaft decreased briefly between the early age categories of one (18-20 years of age) and two (21-30 years of age).

The bicondylar breadth of the proximal tibia became larger with age, but did appear fairly close metrically to black females in earlier age categories (Figure 4.25). Although the two values between age categories one and two began relatively close together (73.19 mm for black males and 69.22 mm for black females) the metric values for this skeletal site remained separate during the incremental increase in age.

The corresponding articular feature of the inferior knee joint, the proximal fibula, also increased significantly in size with the onset of age. Again, black males and females were closest metrically during age categories 1 and 2, with males becoming significantly larger than females through time (Figure 4.26). The two metric values for the diameter of the fibular head in black males and females never came close to converging after age category 2.

In summary, the measurements between males and females in this population remain largely parallel to one another (with the black male value being significantly above that of the black female mean). Each actually increases with the incremental progression of age. Males and females do not converge in dimension with one another when compared; this reduces the chance of misclassification through metric means, even with the onset of age and the increase in size.

4.4.4

Statistically significant long bone changes in white males with age

White males increased in size with age at three skeletal measurement sites. The diameter of the inferior head of the ulna became larger in white males through time, but appeared close metrically to that of white females throughout the duration of each age category. The two groups paralleled each other in their direction and magnitude of change, both gradually becoming larger with age (Figure 4.27). The diameter of the old female, however, approached that of the young male sample. Dimensions of the distal radius also increased in size with the onset of age in white males (Figure 4.28). This metric value always appeared above the white female mean, which indicated significant sexual dimorphism in this site and its continuation during advanced age categories.

Finally, another articular joint location was seen as increasing significantly in white males with the onset of age (Figure 4.29). The maximum bicondylar breadth of the tibia became larger with age, but did appear close metrically to white females in age category 2. This result is similar to those seen in black males with the proximal tibia; both male groups increased significantly in at least one metric measurement of the knee joint. White males in this skeletal location increase most dramatically in the last age category of life. This could possibly be due to arthritic changes.

4.4.5

Summary

It is apparent that males and females stayed metrically separate in their sexual dimorphism when comparing long bone measurements, even when an increase in size was observed at numerous skeletal sites for the females. Metric means of the old female sample came closer to the young male metric means. Midshaft diameters/ circumferences of long bones were the most common measurement to increase, especially in males. The humero-radial-ulnar joint and its articulated surfaces also showed increased size with age in both males and females, as did the tibia-fibular articular surfaces. This indicated that structural modification was occurring at these well-used and weight-bearing skeletal sites with the onset of age. Results also indicated that females do not collectively decrease in their skeletal dimensions with age, even though bone mineral density may very well be decreasing. Skeletal remodelling and aggregate bone gain in various forms was observed in all skeletal samples, manifesting itself in an increase in skeletal dimensions. The female skeleton (especially the white population) exhibited the most remarkable changes.

4.5

Comparison of pelvic metric data between sexes

Four pelvic measurements (coxal length, coxal breadth, pubis length and ischium length) were taken for males and females. The ischio-pubic index was calculated as well. Descriptive statistics can be seen in Table 4.12, and includes the combination of the two ancestry groups. The significance of differences between means was tested by ANOVA analysis, and is also indicated in the table. As expected, males and females are sexually dimorphic for all four dimensions as well as the ischio-pubic index. In general, males tended to have longer pelvic lengths and wider pelvic breadths. Pubis lengths in males were shorter than those of females, ischium lengths were longer in males than those of females, and the subsequent ischio-pubic index calculated was much smaller in males than in females. The F-value in Table 4.12 indicates the large distance between metric distributions of males and females, which designated a clear and significant difference between the groups for the measurements and the calculated index. All p-values, therefore, were at the level of <0.05, thus the distinct differences in size between males and females can once again be confirmed through this study.

These results were expected based on the considerable amount of past data dedicated to documenting the shape of the pelvic girdle in males and females, morphology that must exist in the act of child-bearing with females, and general sexual dimorphism of the os coxae and the pelvic region.

4.5.1

Comparison of pelvic metric data between sexes and populations

As expected, measurements of the pelvis corresponded to the known probability that black males would exhibit significantly larger coxal lengths, breadths, and ischium lengths; shorter pubis lengths (although not statistically significant); and a smaller ischio-pubic index than their female counterparts (Table 4.13).

White South Africans were observed to be metrically larger than their black counterparts for all values. In addition, the white population adhered to the same results as observed in the black South African sample; males were substantially (and significantly) different in their metric dimensions than the female sample. Table 4.14 illustrates the differences in males and females in the white South African population. Males were significantly larger in three metric values, and exhibited a smaller ischio-pubic index than their female counterparts. In addition, the pubis length of white males was the only value smaller than that of the females, a characteristic that is distinctly sexually dimorphic. These differences show the quantitative disparity between males and females that make each sex overwhelmingly different in their morphology when observing metric characteristics of the pelvis. Metric differences were seen between females and males of both biological affiliations, and thus remained separated for the remainder of the analyses.

4.6

Comparison of female pelvic data between populations and age groups

Even though comparison of females from different population affinities was not the purpose of this study, it was necessary to first establish whether they were similar enough to pool all data. When pelvic measurements from the categories "black female" and "white female" were evaluated, it was clear that size differences existed between all measurements in the two groups on a statistically significant level (Table 4.15). White females tended to be larger on a general scale than their black female counterparts. All of these size discrepancies, as well as the ischio-pubic index, were great enough to quantify as statistically significant.

Metric data collected from the pelvis provided more than just variation in the size of the pelvic girdle dimensions; it provided a measurement of proportion differences, whether between males and females or divergent groups of the same sex. As seen above, females are most alike within the proportion of their ischio-pubic index, the holistic index value that makes these specimens uniquely "female". Because size differences were present when comparing black females and white females, it was essential to observe each population as discrete entities to distinguish differences with the onset of age. Since the two groups were observed to be different metrically, they remained separated for the remainder of the analyses.

4.6.1

Metric changes in pelvic measurements with the onset of age: black females

Much like in the other postcranial measurements of the black female sample, measurements of the pelvis remained static and largely unchanged with advanced age (Table 4.16).

Although not statistically significant, it was interesting to note that three measurements decreased slightly as well as the ischio-pubic index. Only coxal breadth increased in size. Since pubic lengths are usually longer in females than they are in males, the decrease in pubic length with black females indicated a decrease in sexual dimorphism with this isolated measurement. All males have a mean pubic length of 73.2 mm (refer to Table 4.12), while young black females have a mean pubic length of 73.0 mm and old black females have a mean pubic length of 71.6 mm (Table 4.16). This indicated that black females, with this particular skeletal site, might be nearer to males in skeletal size with regards to pubic length and thus misclassified as males more often if this measurement is utilized in isolation.

4.6.2

Metric changes in pelvic measurements with the onset of age: white females

None of the changes in white female pelvic measurements taken in this study were significant on a statistical level when comparing young white females to old white females over the age of 50 (Table 4.17).

However, an important observation was made when the metric data from the white female os coxae was examined. All pelvic measurements increased as age increased. Changes towards larger metric values in white females indicated a possibility for misclassification of females older than 50 years of age. For example, the general male pelvic length mean was 207.8 mm (Table 4.12) while the "old white female" pelvic length mean was 208. 2 mm, larger in size than the general male mean with all male data pooled. In addition, the general male ischial length mean was 88.2 mm; the "old white female" ischial length mean was 87.1 mm, close to the general male mean. These two measurements were the only two that moved close to the general male means in pelvic measurements, but they were significant enough to note here. In fact, pelvic measurements from all white females (young and old) were larger than pelvic metric data from all black males (young and old) See Tables 4.13 and 4.14 for comparison.

In addition, the ischio-pubic index of white females decreased with age, although not significantly. Although the "male" and "old white female" means for this index were not close (83.0 mm and 93.8 mm, respectively) the decrease in the index suggested that this ratio was becoming less sexually dimorphic in white females. These results indicated a decrease in sexual dimorphism of the white female with the onset of age; that is, their metric values appear more male.

4.7

Comparison of male pelvic data between populations and age groups

The same approach was followed for males as for females. Analysis was performed to determine if the male pelvis is modified with the advancement of age, and if so, where those changes were taking place. The two biological affiliations of "black male", "white male" and their pelvic girdle measurements were left separate and subsequently compared. A statistically significant distinction was found between the two groups of male specimens; in general, white males tended to be larger in size than their black male counterparts (Table 4.18). When an analysis of variance of the means of each group was performed (ANOVA), the results were, as suspected, significant statistically except for the ischio-pubic index. Males categorized as "black" and “white” were no different from each other when comparing this index, which assesses proportion or shape.

White male pelvic measurements (coxal length, coxal breadth, pubis length, and ischium length) were decidedly larger than their black male counterparts, confirming the past conclusion that these populations compared only differ in the principle component of size. The statistical insignificance of the ischio-pubic index between male populations indicated that male pelvic morphology is similar and non-population-specific. The important result here was the existence of marked sexual dimorphism between all males and all females in pelvic measurements.

4.7.1

Metric changes in pelvic measurements with the onset of age: black males

Black males increased slightly in their pelvic size dimensions with age on all metric measurements, although the increase in dimensions was not large enough to be deemed statistically significant (Table 4.19). The one metric value that was deemed statistically significant was the ischio-pubic index of the black male pelvis. This index increased significantly with the onset of age. All other metric dimensions of the black male pelvis increased, but not on a level deemed statistically significant.

4.7.2

Metric changes in pelvic measurements with the onset of age: white males

White males increased in size within the length and breadth of the pelvis, and measurements decreased with age in regard to pubis length and ischial length. Because it is comprised of the pubis and ischial lengths, the ischio-pubic index decreased significantly (Table 4.20).

The pubis length and ischio-pubic index in the white male pelvis changed the most with the onset of advanced age, with both being significantly different. Since male ischio-pubic indices were smaller than female ischio-pubic indices in general (see Table 4.12) it appeared possible that white male pelves were becoming more "male" with age. Old white males had a smaller ischio-pubic index than the male population when pooled (82.55 mm for old white males and 83.01 mm for general males).

4.8

Implications of metric changes with age between males and females: the pelvis

When statistically significant changes with age were observed in the pelvic measurements for biological affiliation, that particular measurement site was compared to the opposite sex and their corresponding measurement to visualize whether the male and female values were diverging upon each other. Female and male groups were observed to increase in several pelvic measurement sites. They were subsequently compared to their male or female counterparts to observe the differences between the metric values. These differences were important to note, based on the possibility of metric misclassification between males and females if measurements were seen to increase, especially in the female population. In addition, metric decreases in pelvic measurements were observed and compared as well.

There were no statistically significant changes in the metric values of pelvic measurements between young females and those females over the age of 50 for either the black or white biological groups. The female pelvis appeared virtually unchanged with the advancement of age.

4.8.1

Statistically significant pelvic changes in black males with age

Black males did change in a statistically significant way in the ischio-pubic index, the numerical equivalent of proportion in the innominate. The ischio-pubic index of the black male increased with the onset of age, and was therefore compared to the black female ischio-pubic index to observe possible convergence of metric data (Figure 4.30).

Female ischio-pubic indices are significantly larger than any male group. Even though the ischio-pubic index of black males increased with the onset of age, it still does not metrically approach the general female ischio-pubic index mean (83.26 mm for old black males and 92.30 mm for old black females). Metric data between males and females was observed to near each other through age category five (51 years of age through 60 years of age); however the black male mean did not converge with the black female mean. In older ages, sexual dimorphism seemed to diverge from each other between males and females.

4.8.2

Statistically significant pelvic changes in white males with age

One measurement location and the ischio-pubic index in the white male pelvis changed significantly in metric size with the onset of age. The mean pubis length became smaller as white males increased with age (Figure 4.31). These changes were compared to white female pubis length measurement means to observe possible convergence.

The male mean closely paralleled the female mean within age category two (21 years of age through 30 years of age), and exceeded the white female mean within age category three (31 years of age through 40). In age category seven (71 - 80 years) the male mean again exceeded the female mean, demonstrating two occasions where the white male mean intersected with the white female mean in this location of skeletal measurement. In addition, white male pubis length increased during the last age category. Pubic morphology is important because the pubis plays a major role in skeletal sex determination, influencing such element morphology as the subpubic concavity and the subpubic angle. The intersection of metric values from white male and female pubis length may indicate the possibility of misclassification.

The second location of significant metric change in the white male pelvis was the ischio-pubic index. Unlike the black male ischio-pubic index, this white male mean decreased metrically with the onset of advanced age since the pubis length decreased (Figure 4.32). The metric decrease in the ischio-pubic index demonstrated the continuance of established sexual dimorphism in the male and female pelvis; the white female mean began (as anticipated) well above the male mean and the two metric values did not come quantifiably close to each other at any age category.

4.9

Visual summary of metric results

Results obtained from metric data with regard to how the human skeleton changes with age were varied. The male skeleton showed different metric modifications with age than did the female skeleton. In addition, each ancestral group appeared different (although sometimes parallel) in their skeletal changes. Figures 4.33 – 4.36 were created to summarize these age-related changes in a skeleton in anatomical position, to better observe the location of such changes. These changes illustrate the most common location of skeletal size change within each biological group.

Table 4.1: Means, standard deviations, and univariate F-ratios for postcranial measurements of males and females.

Variables (mm)	Males N	Mean	Range	s.d.	S.E.	Females N	Mean	Range	s.d.	S.E.	Univariate F-ratio
Humerus:											
Vertical head diameter	403	45.2	32-55	3.55	0.2	189	41.0	34-52	3.26	0.2	**191.38***
Maximum midshaft diameter	404	22.4	17-29	1.94	0.1	189	20.0	16-29	1.76	0.1	**211.91***
Epicondylar breadth	404	63.2	49-73	3.90	0.2	189	56.1	49-68	3.36	0.2	**469.77***
Midshaft circumference	404	67.3	52-82	5.33	0.3	189	60.0	50-77	4.52	0.3	**264.48***
Ulna:											
Superior head diameter	402	27.1	21-34	2.16	0.1	189	26.0	18-34	2.59	0.1	**356.10***
Medial head diameter	402	20.8	15-30	2.02	0.1	189	18.5	14-23	1.54	0.1	**200.12***
Inferior head diameter	402	29.9	19-45	3.58	0.2	189	25.4	19-33	2.78	0.2	**241.22***
Maximum midshaft diameter	402	16.8	11-22	1.56	0.1	189	14.7	11-19	1.43	0.1	**242.25***
Distal diameter	401	20.2	15-25	1.54	0.1	189	18.1	14-26	1.59	0.1	**238.26***
Olecranon-coronoid	402	23.9	18-33	2.23	0.1	189	21.3	15-27	2.15	0.2	**186.57***
Radius:											
Head diameter	401	23.6	18-29	1.67	0.1	189	21.0	17-26	1.4	0.1	**358.77***
Maximum midshaft diameter	402	15.6	11-20	1.50	0.1	189	13.9	10-19	1.37	0.1	**198.67***
Distal diameter	402	34.8	26-45	2.37	0.1	189	30.7	25-38	2.09	0.2	**422.31***
Femur:											
Vertical head diameter	402	46.5	37-57	3.06	0.2	189	41.7	34-54	2.85	0.2	**341.00***
Maximum midshaft diameter	403	30.8	23-38	2.54	0.1	189	27.9	23-34	2.13	0.2	**194.71***
Distal bicondylar breadth	403	80.8	55-93	4.84	0.2	189	73.5	63-89	4.44	0.3	**314.63***
Midshaft circumference	403	91.6	75-110	6.22	0.3	189	83.9	69-100	5.81	0.4	**208.05***
Tibia:											
Proximal bicondylar breadth	403	77.2	66-90	4.12	0.2	189	69.3	60-81	3.77	0.3	**503.48***
Maximum midshaft diameter	403	30.9	23-42	2.51	0.1	189	27.7	22-35	2.11	0.2	**234.10***
Distal diameter	403	52.4	41-62	3.18	0.2	189	47.2	40-56	2.95	0.2	**360.40***
Fibula:											
Maximum proximal diameter	400	28.4	21-37	2.61	0.1	183	25.1	18-33	2.54	0.2	**194.12***
Maximum midshaft diameter	404	15.9	11-22	1.93	0.1	189	14.6	11-18	1.57	0.1	**58.44***
Distal diameter	404	27.8	21-38	2.44	0.1	189	25.2	20-35	2.19	0.2	**166.14***

***p*-values significant at <0.05**

Table 4.2: Means, standard deviations, and univariate F-ratios for postcranial measurements of black males and black females.

	Black males					Black females					Univariate
Variables (mm)	*n*	Mean	Range	s.d.	S.E.	*n*	Mean	Range	s.d.	S.E.	F-ratio
Humerus:											
Vertical head diameter	298	44.0	32-53	2.77	0.2	107	39.1	34-52	2.49	0.2	**264.68***
Maximum midshaft diameter	298	22.6	17-29	1.92	0.1	107	20.0	16-29	1.99	0.2	**109.13***
Epicondylar breadth	298	62.7	49-71	3.66	0.2	107	56.0	49-68	3.28	0.3	**288.43***
Midshaft circumference	298	66.7	53-82	5.17	0.3	107	59.5	50-77	4.57	0.4	**162.87***
Ulna:											
Superior head diameter	298	27.1	21-34	2.14	0.1	107	24.0	20-29	1.73	0.2	**187.74***
Medial head diameter	298	20.7	15-30	2.01	0.1	107	18.6	15-23	1.59	0.2	**101.48***
Inferior head diameter	298	29.7	20-46	3.56	0.2	107	25.6	20-32	2.74	0.3	**117.29***
Maximum midshaft diameter	298	16.6	11-22.0	1.55	0.1	107	14.4	11-18.0	1.34	0.1	**160.40***
Distal diameter	298	19.9	15-24	1.36	0.1	107	17.8	14-23	1.37	0.1	**179.16***
Olecranon-coronoid	298	23.9	18-33	2.22	0.1	107	21.8	15-27	2.3	0.2	**72.96***
Radius:											
Head diameter	298	23.3	18-29	1.55	0.1	107	20.9	17-26	1.48	0.1	**199.81***
Maximum midshaft diameter	298	15.4	11-20.0	1.49	0.1	107	13.7	10-19.0	1.39	0.1	**105.18***
Distal diameter	298	34.6	26-40	2.26	0.1	107	30.7	27-38	2.15	0.2	
Femur:											
Vertical head diameter	298	45.8	37-57	2.64	0.2	107	40.5	34-51	2.41	0.2	**332.11***
Maximum midshaft diameter	298	30.6	23-37	2.47	0.1	107	27.6	23-34	2.28	0.2	**123.11***
Distal bicondylar breadth	298	79.7	66-92	4.05	0.2	107	71.7	63-89	4.31	0.4	**299.52***
Midshaft circumference	298	90.6	75-107	5.85	0.3	107	82.1	69-100	5.49	0.5	**177.02***
Tibia:											
Proximal bicondylar breadth	298	76.6	66-89	3.85	0.2	107	68.6	60-81	3.99	0.4	**337.75***
Maximum midshaft diameter	298	30.8	23-42	2.47	0.1	107	27.8	22-35	2.08	0.2	**132.23***
Distal diameter	298	52.1	43-62	3.07	0.2	107	46.7	40-56	3.06	0.3	**243.64***
Fibula:											
Maximum proximal diameter	298	28.2	21-37	2.58	0.2	107	24.8	18-33	2.53	0.2	**137.13***
Maximum midshaft diameter	298	15.8	11-22.0	1.93	0.1	107	14.4	18-Nov	1.59	0.2	**43.37***
Distal diameter	298	27.6	21-38	2.46	0.1	107	25.1	20-35	2.49	0.2	**82.44***

***** ***p-values significant at <0.05***

Table 4.3: Means, standard deviations, and univariate F-ratios for postcranial measurements of white males and white females.

Variables (mm)	White males *n*	Mean	Range	s.d.	S.E.	White females *n*	Mean	Range	s.d.	S.E.	Univariate F-ratio
Humerus:											
Vertical head diameter	105	48.7	41-55	3.12	0.3	82	43.4	38-49	2.38	0.3	**169.32***
Maximum midshaft diameter	106	22.9	16-27	1.95	0.2	82	20.1	16-23	1.45	0.2	**124.68***
Epicondylar breadth	106	64.5	52-73	4.32	0.4	82	56.3	49-68	3.48	0.4	**198.66***
Midshaft circumference	106	68.8	52-80	5.56	0.5	82	60.7	52-71	4.41	0.5	**119.19***
Ulna:											
Superior head diameter	104	27.2	21-33	2.19	0.2	82	23.5	18-28	1.83	0.2	**156.44***
Medial head diameter	104	21.2	16-27	1.98	0.2	82	18.4	14-22	1.48	0.2	**112.99***
Inferior head diameter	104	30.4	21-42	3.66	0.4	82	25.1	19-33	2.83	0.3	**123.79***
Maximum midshaft diameter	104	17.3	12-21.0	1.48	0.1	82	15.0	12-9.0	1.49	0.2	**109.89***
Distal diameter	103	21.1	17-25	1.68	0.2	82	18.4	14-26	1.81	0.2	**111.11***
Olecranon-coronoid	104	24.0	19-30	2.18	0.2	82	20.7	15-25	1.77	0.2	**126.77***
Radius:											
Head diameter	103	24.4	20-29	1.78	0.2	82	21.1	17-25	1.32	0.1	**204.22***
Maximum midshaft diameter	104	16.4	13-20	1.38	0.1	82	14.1	11-18.0	1.31	0.1	**136.95***
Distal diameter	104	35.7	31-45	2.42	0.2	82	30.7	25-37	2.06	0.2	**227.45***
Femur:											
Vertical head diameter	104	48.7	40-57	3.14	0.3	79	43.2	38-54	2.68	0.3	**164.29***
Maximum midshaft diameter	105	31.4	24-38	2.56	0.3	81	28.2	23-32	1.91	0.2	**90.39***
Distal bicondylar breadth	105	84.1	55-93	5.39	0.5	81	75.7	67-84	3.51	0.4	**152.73***
Midshaft circumference	105	94.3	77-110	6.39	0.6	81	86.2	73-100	5.38	0.6	**85.14***
Tibia:											
Proximal bicondylar breadth	106	79.0	67-90	4.3	0.4	80	70.2	62-80	3.27	0.4	**237.97***
Maximum midshaft diameter	106	31.2	25-37	2.56	0.3	81	27.7	22-34	2.46	0.2	**105.35***
Distal diameter	106	53.2	41-60	3.31	0.3	80	47.8	42-54	2.69	0.3	**149.68***
Fibula:											
Maximum proximal diameter	102	29.0	22-35	2.6	0.3	76	25.6	19-31	2.49	0.3	**75.74***
Maximum midshaft diameter	106	16.1	11-21	1.87	0.2	82	14.9	11-18	1.49	0.2	**21.89***
Distal diameter	106	28.5	23-36	2.19	0.2	78	25.3	21-31	1.74	0.2	**123.01***

***p*-values significant at <0.05**

Table 4.4: Means, standard deviations, and univariate F-ratios for postcranial measurements of black females and white females.

	Black females					White females					Univariate
Variables (mm)	*n*	Mean	Range	s.d.	S.E.	*n*	Mean	Range	s.d.	S.E.	F-ratio
Humerus:											
Vertical head diameter	107	39.1	34-52	2.49	0.2	82	43.4	38-49	2.38	0.3	**147.50***
Maximum midshaft diameter	107	20.0	16-29	1.99	0.2	82	20.1	16-23	1.45	0.2	0.08
Epicondylar breadth	107	56.0	49-68	3.28	0.3	82	56.3	49-68	3.48	0.4	0.59
Midshaft circumference	107	59.5	50-77	4.57	0.4	82	60.7	52-71	4.41	0.5	3.48
Ulna:											
Superior head diameter	107	24.0	20-29	1.73	0.2	82	23.5	18-28	1.83	0.2	3.06
Medial head diameter	107	18.6	15-23	1.59	0.2	82	18.4	14-22	1.48	0.2	0.38
Inferior head diameter	107	25.6	20-32	2.74	0.3	82	25.1	19-33	2.83	0.3	1.87
Maximum midshaft diameter	107	14.4	11-18	1.34	0.1	82	15.0	9-21	1.49	0.2	**6.87***
Distal diameter	107	17.8	14-23	1.37	0.1	82	18.4	14-26	1.81	0.2	**6.36***
Olecranon-coronoid	107	21.8	15-27	2.3	0.2	82	20.7	15-25	1.77	0.2	**13.55***
Radius:											
Head diameter	107	20.9	17-26	1.48	0.1	82	21.1	17-25	1.32	0.1	0.41
Maximum midshaft diameter	107	13.7	10-19	1.39	0.1	82	14.1	11-18	1.31	0.1	**4.22***
Distal diameter	107	30.7	27-38	2.15	0.2	82	30.7	25-37	2.06	0.2	0.04
Femur:											
Head diameter	107	40.5	34-51	2.41	0.2	79	43.2	38-54	2.68	0.3	**52.25***
Maximum midshaft diameter	107	27.6	23-34	2.28	0.2	81	28.2	23-32	1.91	0.2	3.18
Distal bicondylar breadth	107	71.7	63-89	4.31	0.4	81	75.7	67-84	3.51	0.4	**47.95***
Midshaft circumference	107	82.1	69-100	5.49	0.5	81	86.2	73-100	5.38	0.6	**27.92***
Tibia:											
Proximal bicondylar breadth	107	68.6	60-81	3.99	0.4	80	70.2	62-80	3.27	0.4	8.65*
Maximum midshaft diameter	107	27.8	22-35	2.08	0.2	81	27.7	22-34	2.46	0.2	0.08
Distal diameter	107	46.7	40-56	3.06	0.3	80	47.8	42-54	2.69	0.3	**6.43***
Fibula:											
Maximum proximal diameter	107	24.8	18-33	2.53	0.2	76	25.6	19-31	2.49	0.3	**5.08***
Maximum midshaft diameter	107	14.4	11-18	1.59	0.2	82	14.9	11-18	1.49	0.2	**5.54***
Distal diameter	107	25.1	20-35	2.49	0.2	78	25.3	21-31	1.74	0.2	0.63

p-values significant at <0.05

Table 4.5: Statistical comparison of size differences between black and white females in the postcranial skeleton.

Variables (mm)	Statistically Significant p-value	Not statistically significant p-value
Humerus:		
Vertical head diameter	0.00	
Maximum midshaft diameter		0.77
Epicondylar breadth		0.44
Midshaft circumference		0.06
Ulna:		
Superior head diameter		0.80
Medial head diameter		0.54
Inferior head diameter		0.17
Maximum midshaft diameter	0.00	
Distal diameter	0.03	
Olecranon-coronoid	0.00	
Radius:		
Head diameter		0.53
Maximum midshaft diameter	0.04	
Distal diameter		0.85
Femur:		
Head diameter	0.00	
Maximum midshaft diameter		0.07
Distal bicondylar breadth	0.00	
Midshaft circumference	0.00	
Tibia:		
Proximal bicondylar breadth	0.00	
Maximum midshaft diameter		0.78
Distal diameter	0.01	
Fibula:		
Maximum proximal diameter	0.03	
Maximum midshaft diameter	0.02	
Distal diameter		0.55

Table 4.6: Means, standard deviations, and univariate F-ratios for postcranial measurements of young black females (50 years and younger) and old black females (over 50 years).

Variables (mm)	n	Young black females Mean	Range	s.d.	S.E.	n	Old black females Mean	Range	s.d.	S.E.	Univariate F-ratio
Humerus:											
Vertical head diameter	66	38.9	34-43	2.09	0.3	40	39.4	35-52	3.03	0.5	1.15
Maximum midshaft diameter	66	20.1	16-29	2.09	0.3	40	19.8	17-26	1.82	0.3	0.73
Epicondylar breadth	66	55.9	49-63	3.07	0.4	40	56.1	50-68	3.62	0.6	0.04
Midshaft circumference	66	60.4	50-70	4.27	0.5	40	58.2	52-77	4.77	0.7	**6.15***
Ulna:											
Superior head diameter	66	23.9	20-29	1.62	0.2	40	24.1	21-28	1.91	0.3	0.50
Medial head diameter	66	18.7	15-23	1.58	0.2	40	18.3	15-23	1.61	0.3	1.60
Inferior head diameter	66	25.8	20-32	2.58	0.3	40	25.4	20-31	2.99	0.5	0.56
Maximum midshaft diameter	66	14.5	11-17	1.33	0.2	40	14.4	11-18	1.37	0.2	0.35
Distal diameter	66	17.9	15-20	1.12	0.1	40	17.8	14-23	1.69	0.3	0.13
Olecranon-coronoid	66	21.9	15-27	2.28	0.3	40	21.6	16-27	2.36	0.4	0.31
Radius:											
Head diameter	66	20.7	17-24	1.29	0.2	40	21.3	19-26	1.7	0.3	3.29
Maximum midshaft diameter	66	13.6	10-16	1.62	0.2	40	13.8	12-19	1.52	0.2	0.37
Distal diameter	66	30.8	27-35	1.94	0.2	40	30.7	27-38	2.48	0.4	0.05
Femur:											
Vertical head diameter	65	40.4	35-44	2.03	0.3	41	40.7	34-51	2.92	0.5	0.38
Maximum midshaft diameter	65	27.6	23-34	2.14	0.3	41	27.7	23-33	2.49	0.4	0.03
Distal bicondylar breadth	65	71.9	63-81	3.59	0.5	41	71.5	64-89	5.27	0.8	0.24
Midshaft circumference	65	82.5	72-100	4.93	0.6	41	81.4	69-99	6.26	0.9	0.95
Tibia:											
Proximal bicondylar breadth	65	68.6	60-77	3.43	0.4	41	68.6	60-81	4.77	0.7	0.00
Maximum midshaft diameter	65	27.9	22-32	1.88	0.2	41	27.5	23-35	2.35	0.4	0.91
Distal diameter	65	46.7	40-53	2.89	0.4	41	46.7	42-56	3.34	0.5	0.00
Fibula:											
Maximum proximal diameter	65	24.74	18-30	2.37	0.3	41	24.9	18-33	2.79	0.4	0.07
Maximum midshaft diameter	65	14.63	11-17	1.49	0.2	41	14.1	11-18	1.69	0.3	3.54
Distal diameter	65	25.13	20-35	2.68	0.3	41	25.0	30-31	2.68	0.4	0.11

p-values significant at <0.05

Table 4.7: Means, standard deviations, and univariate F-ratios for postcranial measurements of young white females (50 years and younger) and old white females (over 50 years).

Variables (mm)	*n*	Young white females Mean	Range	s.d.	S.E.	*n*	Old white females Mean	Range	s.d.	S.E.	Univariate F-ratio
Humerus:											
Vertical head diameter	13	41.5	38-43	1.62	0.4	69	43.8	38-49	2.31	0.3	**15.95***
Maximum midshaft diameter	13	19.3	17-21	1.05	0.3	69	20.3	16-23	1.48	0.2	**5.61***
Epicondylar breadth	13	54.3	49-59	2.68	0.7	69	58.9	51-68	3.49	0.4	**7.93***
Midshaft circumference	13	59.7	52-68	4.15	1.01	69	61.0	52-71	4.47	0.5	1.12
Ulna:											
Superior head diameter	13	22.7	18-28	2.19	0.5	69	23.7	20-28	1.69	0.2	**3.97***
Medial head diameter	13	18.2	16-20	1.14	0.3	69	18.5	14-22	1.56	0.2	0.62
Inferior head diameter	13	22.8	19-27	2.27	0.6	69	25.6	20-33	2.69	0.3	**15.79***
Maximum midshaft diameter	13	14.2	12-16	1.34	0.3	69	15.2	12-19.0	1.47	0.2	**5.73***
Distal diameter	13	17.1	14-19	1.33	0.3	69	18.7	14-26	1.78	0.2	**11.57***
Olecranon-coronoid	13	19.6	15-22	1.75	0.4	69	20.9	17-25	1.68	0.2	**9.13***
Radius:											
Head diameter	13	20.3	17-22	1.35	0.3	69	21.2	18-25	1.25	0.2	**8.01***
Maximum midshaft diameter	13	13.5	11-15	1.02	0.2	69	14.2	11-18.0	1.34	0.2	**4.46***
Distal diameter	13	29.3	25-31	1.65	0.4	69	31.0	26-37	2.02	0.2	**10.25***
Femur:											
Vertical head diameter	13	41.3	38-45	1.56	0.4	67	43.6	38-54	2.69	0.3	**11.08***
Maximum midshaft diameter	13	27.1	24-29	1.62	0.4	68	28.4	23-32	1.89	0.2	**6.95***
Distal bicondylar breadth	13	73.4	68-77	2.46	0.6	68	76.6	67-84	3.5	0.4	**10.69***
Midshaft circumference	13	84.4	76-93	4.54	1.1	68	86.7	73-100	5.49	0.7	2.62
Tibia:											
Proximal bicondylar breadth	13	67.8	62-71	2.16	0.5	67	70.8	63-80	3.22	0.4	**13.74***
Maximum midshaft diameter	13	26.7	22-32	2.13	0.5	68	27.9	24-34	2.11	0.3	**4.06***
Distal diameter	13	46.8	42-49	1.78	0.4	67	48.0	42-54	2.84	0.3	3.04
Fibula:											
Maximum proximal diameter	13	24.3	19-28	2.32	0.6	59	26.0	20-31	2.42	0.3	**6.98***
Maximum midshaft diameter	13	14.3	11-16	1.32	0.3	69	15.1	11-18.0	1.51	0.2	3.59
Distal diameter	13	24.2	22-25	1.22	0.3	65	25.5	21-31	1.75	0.2	**8.92***

p-values significant at <0.05

Table 4.8: Means, standard deviations, and univariate F-ratios for postcranial measurements of black males and white males.

	Black males					White males					Univariate
Variables (mm)	*n*	Mean	Range	s.d.	S.E.	*n*	Mean	Range	s.d.	S.E.	F-ratio
Humerus:											
Vertical head diameter	298	44.0	32-53	2.77	0.2	105	48.7	41-55	3.12	0.3	**212.40***
Maximum midshaft diameter	298	22.6	17-29	1.92	0.1	106	22.9	16-27	1.95	0.2	**8.52***
Epicondylar breadth	298	62.7	49-71	3.66	0.2	106	64.5	52-73	4.32	0.4	**15.92***
Midshaft circumference	298	66.7	53-82	5.17	0.3	106	68.8	52-80	5.56	0.5	**12.30***
Ulna:											
Superior head diameter	298	27.1	21-34	2.14	0.1	104	27.2	21-33	2.19	0.2	0.23
Medial head diameter	298	20.7	15-30	2.01	0.1	104	21.2	16-27	1.98	0.2	**4.03***
Inferior head diameter	298	29.7	20-46	3.56	0.2	104	30.4	21-42	3.66	0.4	3.25
Maximum midshaft diameter	298	16.6	11-22	1.55	0.1	104	17.3	12-21.0	1.48	0.1	**15.29***
Distal diameter	298	19.9	15-24	1.36	0.1	103	21.1	17-25	1.68	0.2	**54.91***
Olecranon-coronoid	298	23.9	18-33	2.22	0.1	104	24.0	19-30	2.18	0.2	0.03
Radius:											
Head diameter	298	23.3	18-29	1.55	0.1	103	24.4	20-29	1.78	0.2	**31.73***
Maximum midshaft diameter	298	15.4	11-20	1.49	0.1	104	16.4	13-20	1.38	0.1	**37.08***
Distal diameter	298	34.6	26-40	2.26	0.1	104	35.7	31-45	2.42	0.2	**18.13***
Femur:											
Vertical head diameter	298	45.8	37-57	2.64	0.2	104	48.7	40-57	3.14	0.3	**88.78***
Maximum midshaft diameter	298	30.6	23-37	2.47	0.1	105	31.4	24-38	2.56	0.3	**6.48***
Distal bicondylar breadth	298	79.7	66-92	4.05	0.2	105	84.1	55-93	5.39	0.5	**78.12***
Midshaft circumference	298	90.6	75-107	5.85	0.3	105	94.3	77-110	6.39	0.6	**28.76***
Tibia:											
Proximal bicondylar breadth	298	76.6	66-89	3.85	0.2	106	79.0	67-90	4.3	0.4	**27.17***
Maximum midshaft diameter	298	30.8	23-42	2.47	0.1	106	31.2	25-37	2.56	0.3	2.29
Distal diameter	298	52.1	43-62	3.07	0.2	106	53.2	41-60	3.31	0.3	**10.92***
Fibula:											
Maximum proximal diameter	298	28.2	21-37	2.58	0.2	102	29.0	22-35	2.6	0.3	**8.09***
Maximum midshaft diameter	298	15.8	11-22	1.93	0.1	106	16.1	11-21.0	1.87	0.2	2.22
Distal diameter	298	27.6	21-38	2.46	0.1	106	28.5	23-36	2.19	0.2	**12.38***

***p*-values significant at <0.05**

Table 4.9: Statistical comparison of size differences between black and white males in the postcranial skeleton.

	Statistically significant	Not statistically significant
Variables (mm)	p-value	p-value
Humerus:		
Vertical head diameter	0.00	
Maximum midshaft diameter	0.00	
Epicondylar breadth	0.00	
Midshaft circumference	0.00	
Ulna:		
Superior head diameter		0.64
Medial head diameter	0.04	
Inferior head diameter		0.07
Maximum midshaft diameter	0.00	
Distal diameter	0.03	
Olecranon-coronoid		0.87
Radius:		
Head diameter	0.00	
Maximum midshaft diameter	0.00	
Distal diameter	0.00	
Femur:		
Head diameter	0.01	
Maximum midshaft diameter	0.00	
Distal bicondylar breadth	0.00	
Midshaft circumference	0.00	
Tibia:		
Proximal bicondylar breadth	0.00	
Maximum midshaft diameter		0.13
Distal diameter	0.00	
Fibula:		
Maximum proximal diameter	0.01	
Maximum midshaft diameter		0.00
Distal diameter	0.00	

Table 4.10: Means, standard deviations, and univariate F-ratios for postcranial measurements of young black males (50 years and younger) and old black males (over 50 years).

	Young black males					Old black males					Univariate
Variables (mm)	*n*	Mean	Range	s.d.	S.E.	*n*	Mean	Range	s.d.	S.E.	F-ratio
Humerus:											
Vertical head diameter	125	43.7	32-50	2.81	0.3	173	44.1	37-53	2.77	0.2	1.86
Maximum midshaft diameter	125	21.9	17-26	2.01	0.2	173	22.5	18-29	1.79	0.1	**8.11***
Epicondylar breadth	125	62.3	49-71	3.8	0.3	173	63.1	51-70	3.49	0.3	**3.67***
Midshaft circumference	125	66.6	53-80	5.41	0.5	173	66.8	56-82	4.98	0.4	0.19
Ulna:											
Superior head diameter	125	26.8	21-32	2.11	0.2	173	27.4	22-34	2.16	0.2	**5.89***
Medial head diameter	125	20.6	16-26	1.74	0.2	173	20.8	15-30	2.21	0.2	0.56
Inferior head diameter	125	29.8	19-38	3.25	0.3	173	29.7	21-45	3.75	0.3	0.04
Maximum midshaft diameter	125	16.3	11-20	1.53	0.1	173	16.8	13-22	1.54	0.1	**7.94***
Distal diameter	125	19.7	15-24	1.49	0.1	173	20.0	16-23	1.23	0.1	2.65
Olecranon-coronoid	125	24.1	18-33	2.66	0.2	173	23.7	19-29	1.89	0.1	2.43
Radius:											
Head diameter	125	23.2	18-26	1.44	0.1	173	23.5	19-29	1.62	0.1	3.54
Maximum midshaft diameter	125	15.3	11-18	1.37	0.1	173	15.4	11-18	1.37	0.1	1.05
Distal diameter	125	34.5	26-39	2.31	0.2	173	34.6	28-40	2.27	0.2	0.08
Femur:											
Vertical head diameter	125	45.6	37-57	2.72	0.2	173	45.9	40-52	2.59	0.2	0.82
Maximum midshaft diameter	125	30.2	23-35	2.59	0.2	173	31.0	25-37	2.4	0.2	**6.71***
Distal bicondylar breadth	125	79.3	66-88	3.94	0.4	173	79.9	70-92	4.12	0.3	1.85
Midshaft circumference	125	90.3	75-107	6.26	0.6	173	90.9	76-106	5.61	0.4	0.67
Tibia:											
Proximal bicondylar breadth	125	76.1	66-86	3.69	0.3	172	77.0	67-89	3.97	0.3	**3.91***
Maximum midshaft diameter	125	30.7	23-37	2.51	0.2	172	30.9	26-42	2.47	0.2	0.16
Distal diameter	125	52.0	43-60	3.02	0.3	172	52.0	45-62	3.12	0.2	0.00
Fibula:											
Maximum proximal diameter	125	27.7	21-33	2.49	0.2	173	28.5	22-37	2.58	0.2	**6.94***
Maximum midshaft diameter	125	15.6	11-22	2.09	0.2	173	15.9	12-21	1.84	0.1	1.64
Distal diameter	125	27.4	22-38	2.59	0.2	173	27.8	21-36	2.39	0.2	2.02

**** p-values significant at <0.05***

Table 4.11: Means, standard deviations, and univariate F-ratios for postcranial measurements of young white males (50 and younger) and old white males (over 50 years).

Variables (mm)	Young white males					Old white males					Univariate
	n	Mean	Range	s.d.	S.E.	n	Mean	Range	s.d.	S.E.	F-ratio
Humerus:											
Vertical head diameter	26	48.5	41-53	2.51	0.6	79	48.7	41-55	3.24	0.4	0.14
Maximum midshaft diameter	26	22.7	16-26	1.99	0.4	80	23.0	17-27	1.93	0.2	0.55
Epicondylar breadth	26	63.1	52-69	3.76	0.7	80	64.9	52-73	4.42	0.5	3.44
Midshaft circumference	26	68.6	52-80	5.52	1.08	80	68.8	56-80	5.6	0.6	0.02
Ulna:											
Superior head diameter	25	26.7	24-29	1.45	0.3	79	27.4	21-33	2.36	0.3	2.13
Medial head diameter	25	20.9	16-23	1.63	0.3	79	21.2	16-27	2.08	0.2	0.55
Inferior head diameter	25	29.0	20-35	3.76	0.8	79	30.9	23-41	3.53	0.4	**5.47***
Maximum midshaft diameter	25	17.3	15-20	1.21	0.2	79	17.2	12-21	1.56	0.2	0.06
Distal diameter	25	21.0	17-25	1.67	0.3	78	21.1	17-25	1.69	0.2	0.19
Olecranon-coronoid	25	23.7	21-27	1.72	0.3	79	24.0	19-30	2.31	0.3	0.49
Radius:											
Head diameter	24	24.0	20-27	1.23	0.3	79	24.5	20-29	1.92	0.2	1.07
Maximum midshaft diameter	25	16.4	13-19	1.23	0.2	79	16.4	13-20	1.43	0.2	0.02
Distal diameter	25	34.7	31-37	1.79	0.4	79	36.0	31-45	2.52	0.3	**5.43***
Femur:											
Vertical head diameter	24	49.0	45-55	2.54	0.5	80	48.6	40-57	3.31	0.4	0.25
Maximum midshaft diameter	25	30.8	24-35	2.56	0.5	80	31.5	27-28	2.55	0.3	1.60
Distal bicondylar breadth	25	83.5	76-90	3.1	0.6	80	84.3	55-93	5.93	0.7	0.39
Midshaft circumference	25	93.4	77-110	6.8	1.4	80	94.5	80-109	6.28	0.7	0.58
Tibia:											
Proximal bicondylar breadth	26	77.5	70-83	3.16	0.6	80	79.4	67-90	4.53	0.5	**3.97***
Maximum midshaft diameter	26	31.0	25-37	2.83	0.6	80	31.3	26-37	2.48	0.3	0.18
Distal diameter	26	52.3	45-58	2.97	0.6	80	53.5	41-60	3.38	0.4	2.64
Fibula:											
Maximum proximal diameter	25	28.2	22-33	2.69	0.5	77	29.3	22-35	2.54	0.3	3.19
Maximum midshaft diameter	26	15.9	11-20.0	2.23	0.4	80	16.2	11-21.0	1.74	0.2	0.29
Distal diameter	26	28.2	23-31	1.68	0.3	80	28.6	24-36	2.33	0.3	0.82

p-values significant at <0.05

Table 4.12: Means, standard deviations, and univariate F-ratios for pelvic measurements of males and females.

Variables (mm)	*N*	Males Mean	Range	s.d.	S.E.	*N*	Females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	401	207.8	177-248	13.52	0.7	182	197.8	170-245	13.95	4.03	**68.28***
Pelvis breadth	404	204.8	125-199	10.79	0.5	182	151.0	120-185	12.04	0.9	**3.92***
Pubis length	404	73.2	52-103	4.50	0.4	180	76.6	59-94	7.74	0.6	**25.42***
Ischium length	401	88.2	72-109	6.16	0.3	180	83.0	68-102	5.95	0.4	**93.08***
Ischio-Pubic index	404	83.0	60-105	6.61	0.3	180	92.3	73-126	7.37	0.5	**231.82***

p-value significant at <0.05

Table 4.13: Means, standard deviations, and univariate F-ratios for pelvic measurements of black males and black females.

Variables (mm)	*n*	Black males Mean	Range	s.d.	S.E.	*n*	Black females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	298	202.9	177-238	10.19	0.6	96	189.3	170-245	10.59	1.1	**127.63***
Pelvis breadth	296	149.4	125-199	8.79	0.5	96	143.0	120-175	8.6	0.9	**38.64***
Pubis length	298	71.4	52-92	6.54	0.4	96	72.4	59-94	6.09	0.6	1.84
Ischium length	298	86.2	72-98	4.66	0.6	96	79.8	68-102	5.15	0.5	**131.87***
Ischio-Pubic index	298	82.8	60-103	6.61	0.4	96	90.7	73-126	7.51	0.8	**98.06***

p-value significant at <0.05

Table 4.14: Means, standard deviations, and univariate F-ratios for pelvic measurements of white males and white females.

Variables (mm)	*n*	White males Mean	Range	s.d.	S.E.	*n*	White females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	106	222.3	192-248	11.52	1.1	82	207.3	178-240	10.76	1.2	**84.99***
Pelvis breadth	105	163.5	142-183	9.06	0.9	82	159.9	140-185	8.53	0.9	**7.79***
Pubis length	106	78.6	61-103	7.56	0.7	80	81.5	66-94	6.52	0.7	**7.66***
Ischium length	106	94.2	74-109	6.19	0.6	80	86.6	74-97	4.53	0.5	**86.93***
Ischio-Pubic index	106	83.5	68-105	6.6	0.6	80	94.1	78-113	6.81	0.7	**117.11***

p-value significant at <0.05

Table 4.15: Means, standard deviations, and univariate F-ratios for pelvic measurements of black females and white females.

Variables (mm)	n	Black females Mean	Range	s.d.	S.E.	n	White females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	96	189.3	170-245	10.59	1.1	82	207.3	178-240	10.76	1.2	**129.41***
Pelvis breadth	96	143.0	120-175	8.6	0.9	82	159.9	140-185	8.53	0.9	**177.02***
Pubis length	96	72.4	59-94	6.09	0.6	80	81.5	66-94	6.52	0.7	**93.06***
Ischium length	96	79.8	68-102	5.15	0.5	80	86.6	74-97	4.53	0.5	**88.83***
Ischio-Pubic index	96	90.7	73-126	7.51	0.8	80	94.1	78-113	6.81	0.7	**9.86***

p-value significant at <0.05

Table 4.16: Means, standard deviations, and univariate F-ratios for pelvic measurements of young black females (50 years and younger) and old black females (over 50 years).

Variables (mm)	n	Young black females Mean	Range	s.d.	S.E.	n	Old black females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	56	189.3	170-207	8.33	1.1	40	189.3	171-245	13.24	2.1	0.00
Pelvis breadth	56	142.7	120-154	7.04	0.9	40	143.4	128-175	10.49	1.7	0.15
Pubis length	56	73.0	59-94	6.56	0.9	40	71.6	61-81	5.32	0.8	1.17
Ischium length	56	79.8	68-90	4.46	0.6	40	79.8	69-102	6.05	0.9	0.00
Ischio-Pubic index	56	91.4	73-126	7.71	1.03	40	89.8	76-102	4.23	1.14	1.03

p-value significant at <0.05

Table 4.17: Means, standard deviations, and univariate F-ratios for pelvic measurements of young white females (50 years and younger) and old white females (over 50 years).

Variables (mm)	n	Young white females Mean	Range	s.d.	S.E.	n	Old white females Mean	Range	s.d.	S.E.	Univariate F-ratio
Pelvis length	13	204.8	184-217	9.47	2.2	69	208.2	178-240	10.79	1.3	1.52
Pelvis breadth	13	157.9	144-171	6.93	1.6	69	160.4	140-185	8.68	1	1.22
Pubis length	13	81.5	73-89	4.72	1.1	67	81.6	66-94	6.79	0.8	0.00
Ischium length	13	85.0	77-88	3.84	0.9	67	87.1	74-97	4.54	0.5	3.19
Ischio-Pubic index	13	96.0	87-103	4.54	1.1	67	93.8	78-113	7.14	0.9	1.50

p-value significant at <0.05

Table 4.18: Means, standard deviations, and univariate F-ratios for pelvic measurements of black males and white males.

		Black males					White males				Univariate
Variables (mm)		Mean	Range	s.d.	S.E.		Mean	Range	s.d.	S.E.	F-ratio
	n					*n*					
Pelvis length	298	202.9	177-238	10.19	0.6	106	222.3	192-248	11.52	1.1	**269.00***
Pelvis breadth	296	149.4	125-199	8.79	0.5	105	163.5	142-183	9.06	0.9	**201.25***
Pubis length	298	71.4	52-92	6.54	0.4	106	78.6	61-103	7.56	0.7	**89.21***
Ischium length	298	86.2	72-98	4.66	0.6	106	94.2	74-109	6.19	0.6	**194.07***
Ischio-Pubic index	298	82.8	60-103	6.61	0.4	106	83.5	68-105	6.6	0.6	0.93

p-value significant at <0.05

Table 4.19: Means, standard deviations, and univariate F-ratios for pelvic measurements of young black males (50 years and younger) and old black males (over 50 years).

		Young black males					Old black males				Univariate
Variables (mm)		Mean	Range	s.d.	S.E.		Mean	Range	s.d.	S.E.	F-ratio
	n					*n*					
Pelvis length	123	202.6	178-226	10.31	0.9	173	203.2	177-238	10.08	0.7	1.65
Pelvis breadth	123	149.1	128-199	8.93	0.8	171	149.6	125-180	8.72	0.6	0.71
Pubis length	123	70.4	55-84	5.5	0.5	173	72.0	52-92	7.09	0.5	2.29
Ischium length	123	85.9	73-97	4.67	0.4	173	86.5	72-98	4.62	0.3	2.47
Ischio-Pubic index	123	82.1	67-96	5.73	0.5	173	83.3	60-103	7.06	0.5	**3.08***

p-value significant at <0.05

Table 4.20: Means, standard deviations, and univariate F-ratios for pelvic measurements of young white males (50 years and younger) and old white males (over 50 years).

		Young white males					Old white males				Univariate
Variables (mm)		Mean	Range	s.d.	S.E.		Mean	Range	s.d.	S.E.	F-ratio
	n					*n*					
Pelvis length	26	221.4	192-239	11.07	2.1	80	222.6	194-248	11.73	1.3	0.18
Pelvis breadth	26	163.1	142-182	11.55	2.2	79	163.7	149-183	8.12	0.9	0.09
Pubis length	26	82.1	65-95	7.56	1.5	80	77.4	61-103	7.22	0.8	**8.38***
Ischium length	26	95.1	74-107	6.9	1.3	80	93.8	80-109	5.94	0.7	0.81
Ischio-Pubic index	26	86.5	76-105	6.82	1.3	80	82.6	68-98	6.26	0.7	**7.68***

p-value significant at <0.05

Table 4.21: Classification of age groups for comparison of means with the advancement of age.

Age Category	Age in Years
1	18-20
2	21-30
3	31-40
4	41-50
5	51-60
6	61-70
7	71-80
8	81-90
9	91-100

Figure 4.1: The relationship between the circumference of the humerus with age in black females and males.

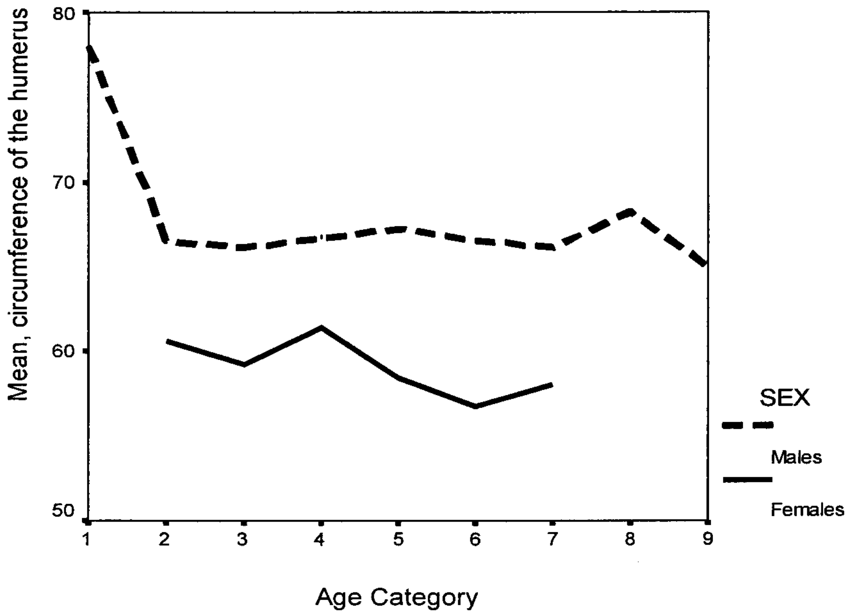

Figure 4.2: The relationship between the humeral head diameter with age in white females and white males.

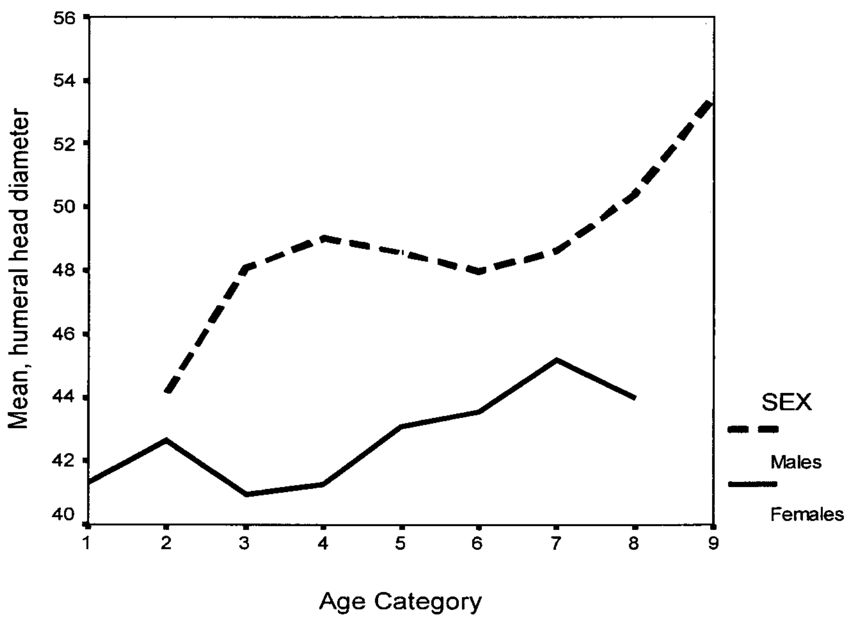

Figure 4.3: The relationship between the diameter of the humerus at midshaft with age in white females and males.

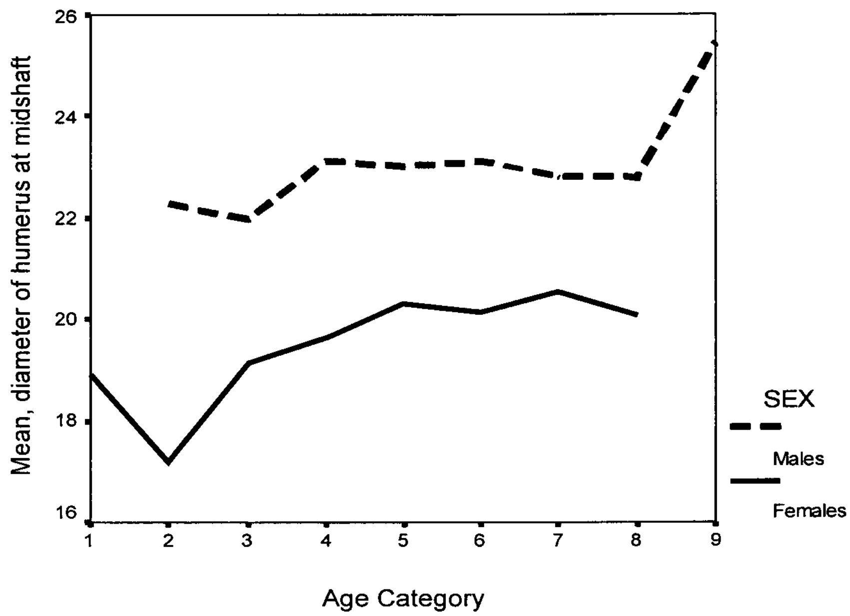

Figure 4.4: The relationship between the distal epicondylar breadth of the humerus with age in white females and white males.

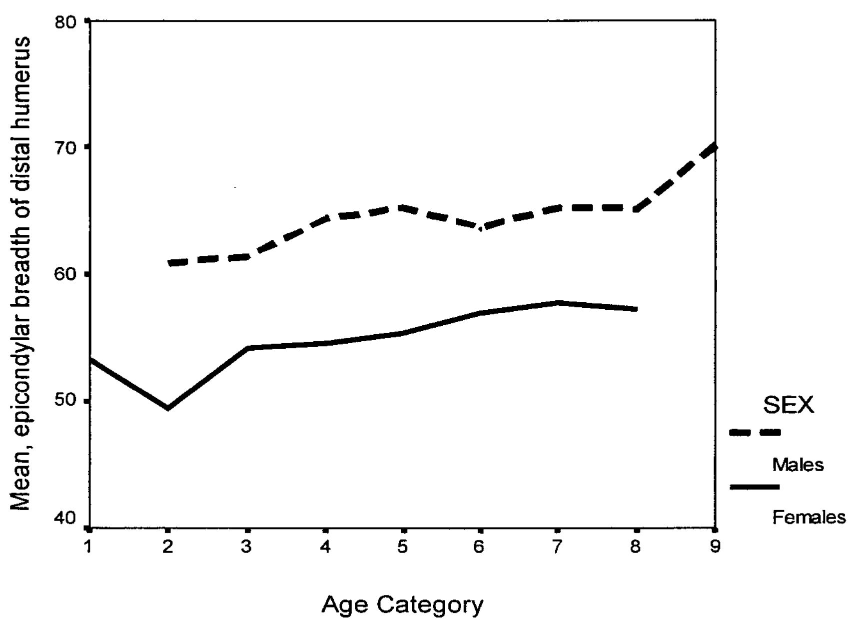

Figure 4.5: The relationship between the superior head diameter of the ulna with age in white females and white males.

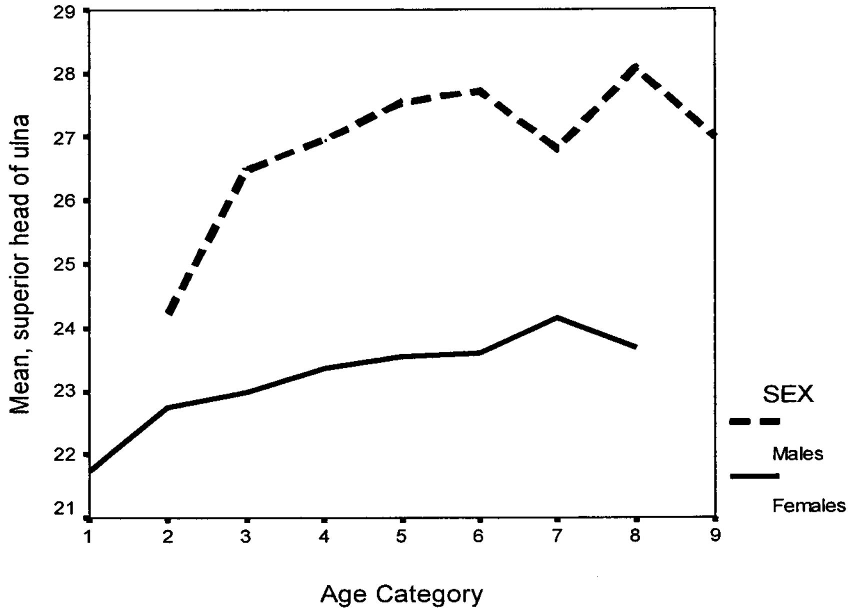

Figure 4.6: The relationship between the inferior head of the ulna with age in white females and white males.

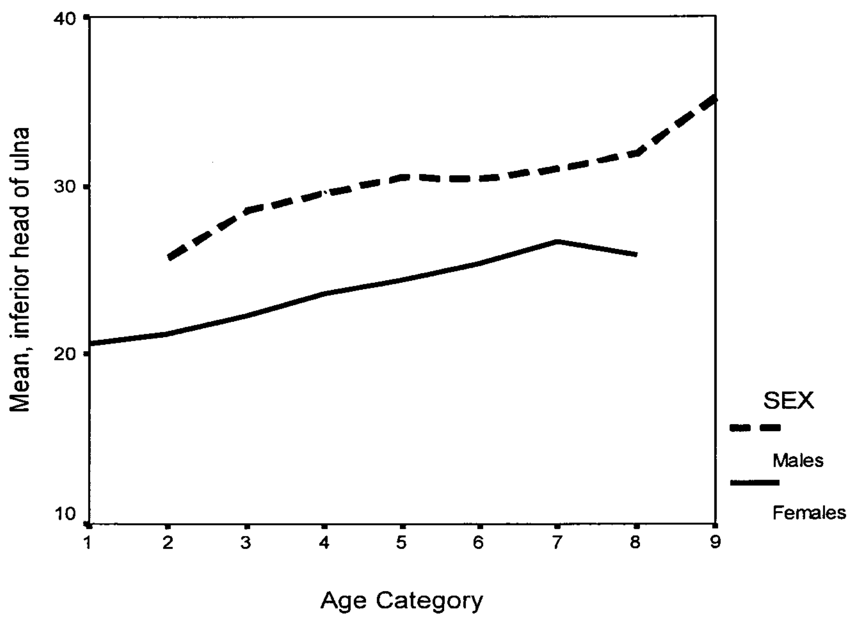

Figure 4.7: The relationship between the diameter of the ulna at midshaft with age in white females and white males.

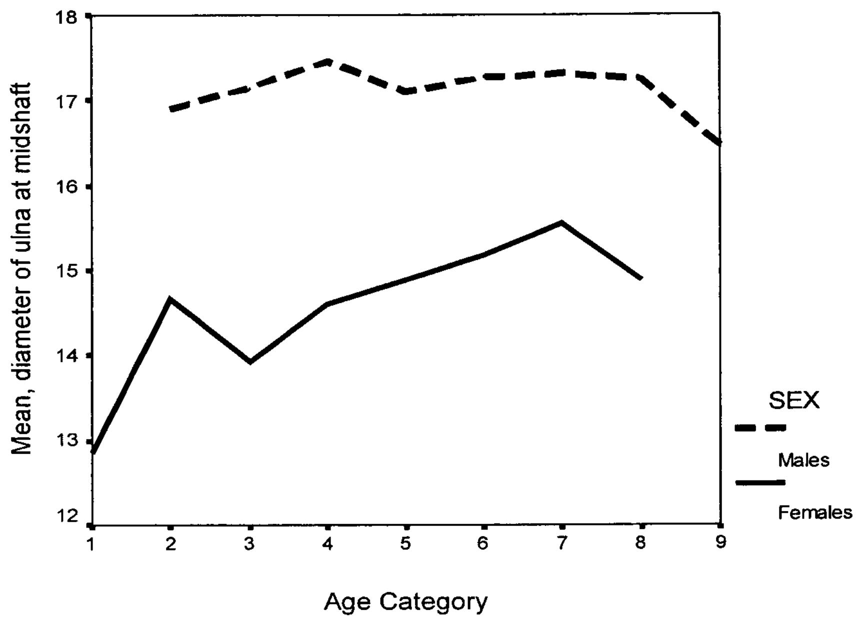

Figure 4.8: The relationship between the distal diameter of the ulna with age in white females and white males.

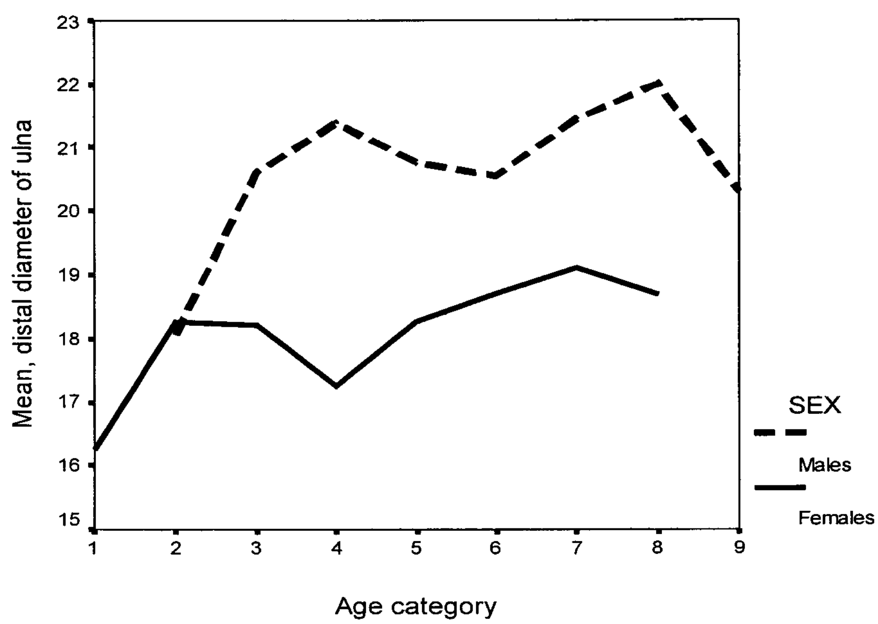

Figure 4.9: The relationship between the olecranon-coronoid diameter with age in white females and white males.

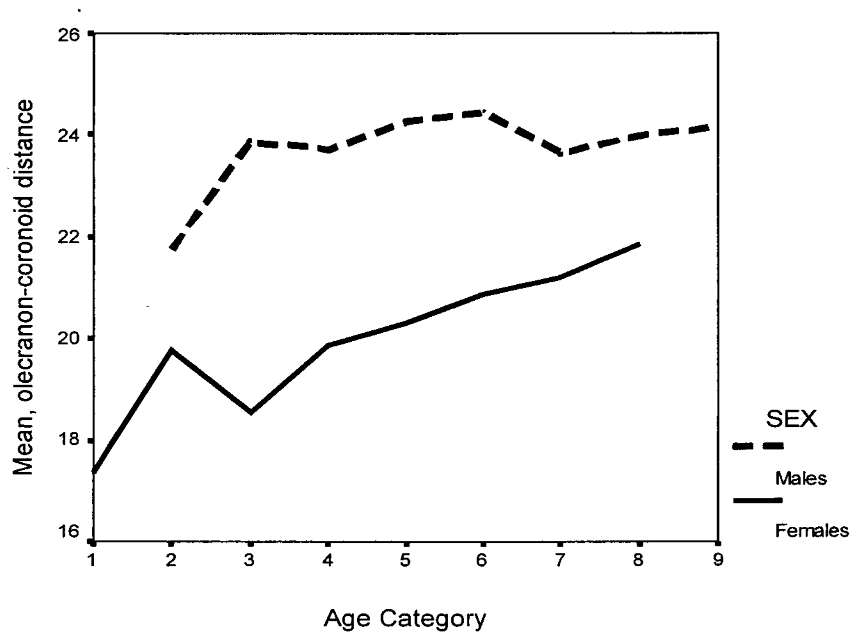

Figure 4.10: The relationship between the head of the radius with age in white females and white males.

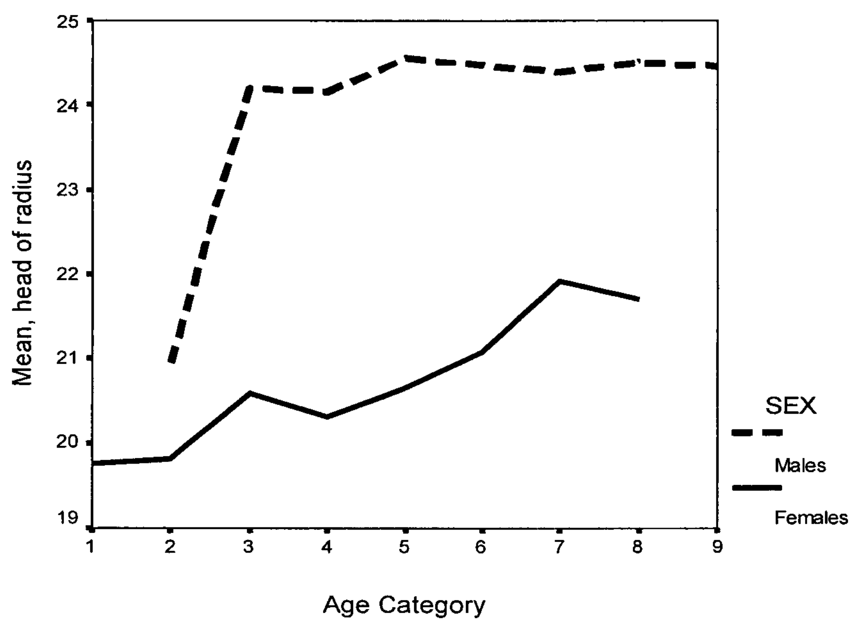

Figure 4.11: The relationship between the diameter of the radius at midshaft with age in white females and white males.

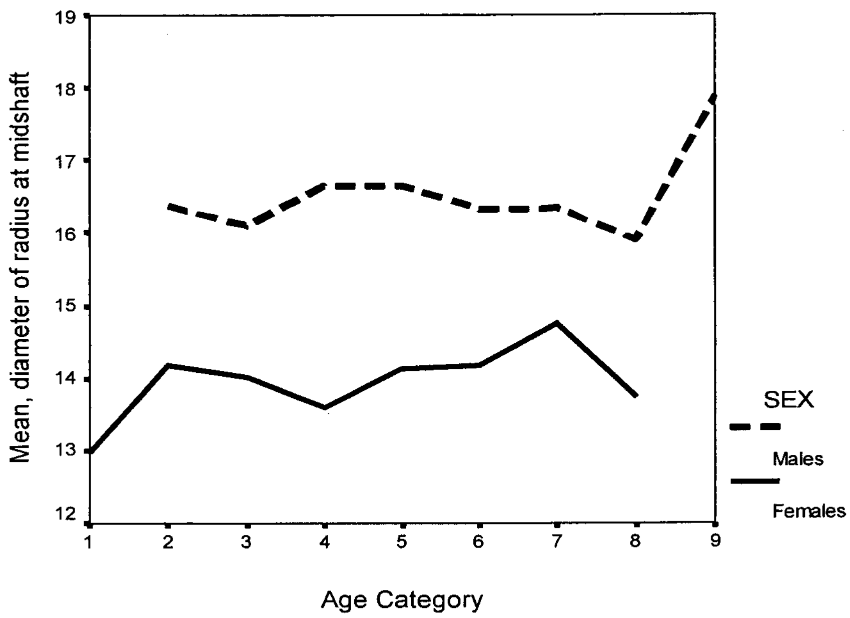

Figure 4.12: The relationship between the diameter of the distal radius with age in white females and white males.

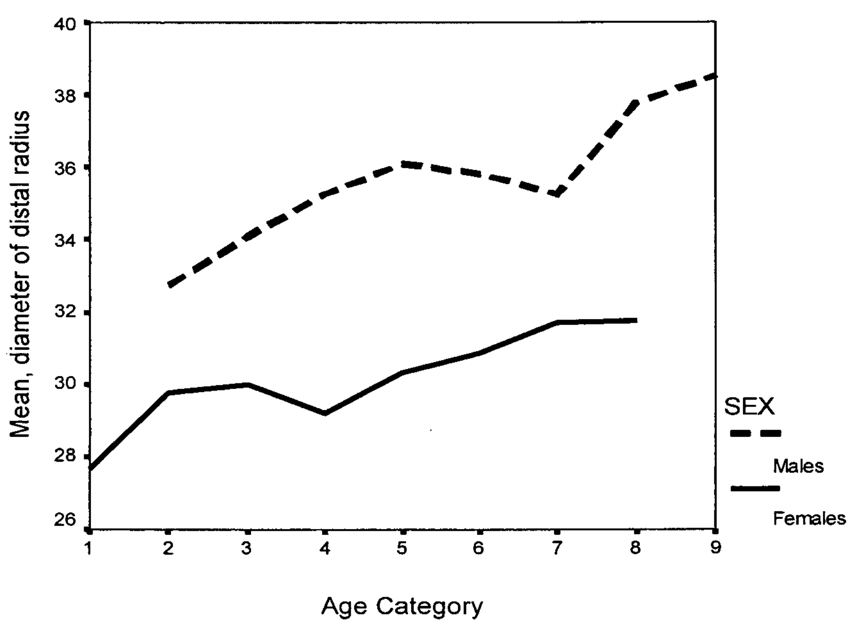

Figure 4.13: The relationship between the vertical diameter of the femoral head with age in white females and white males.

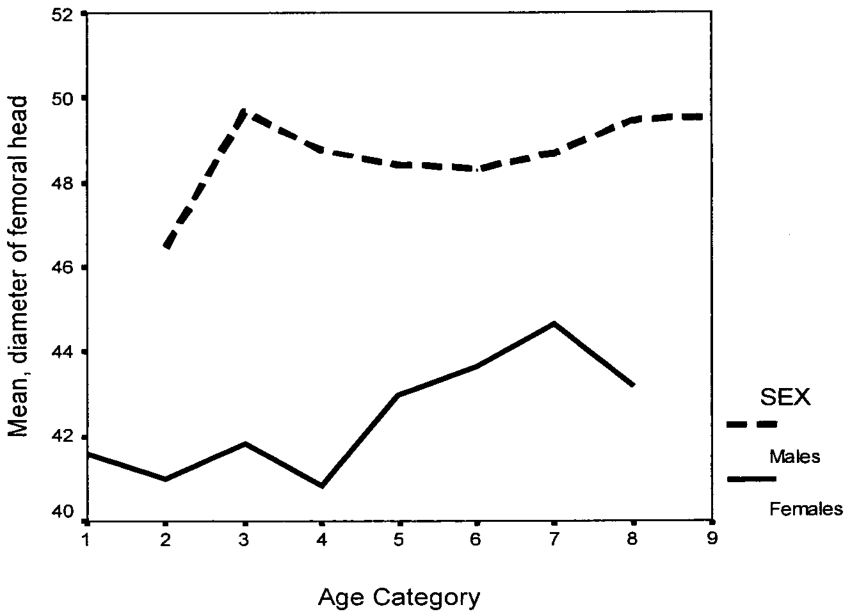

Figure 4.14: The relationship between the diameter of the femur at midshaft with age in white females and white males.

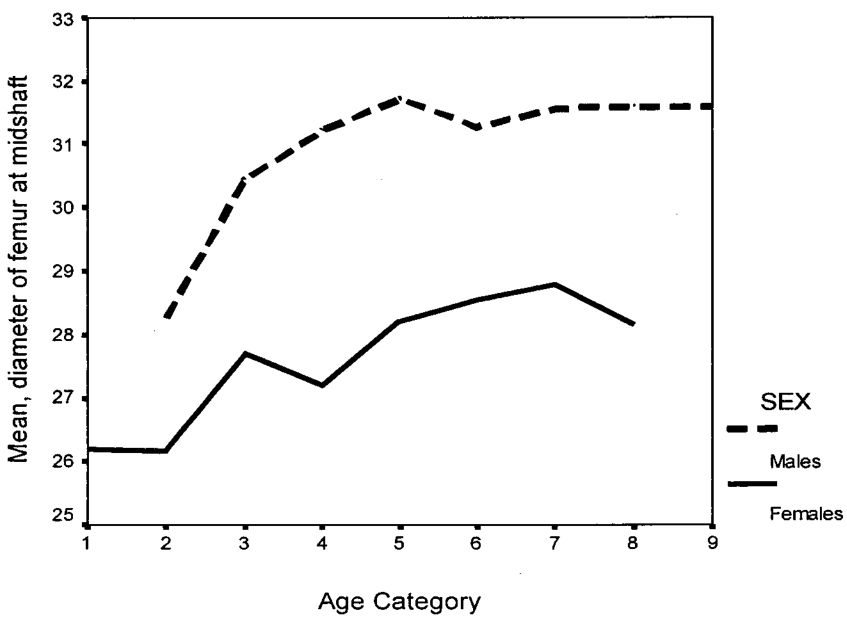

Figure 4.15: The relationship between the maximum bicondylar breadth of distal femur with age in white females and white males.

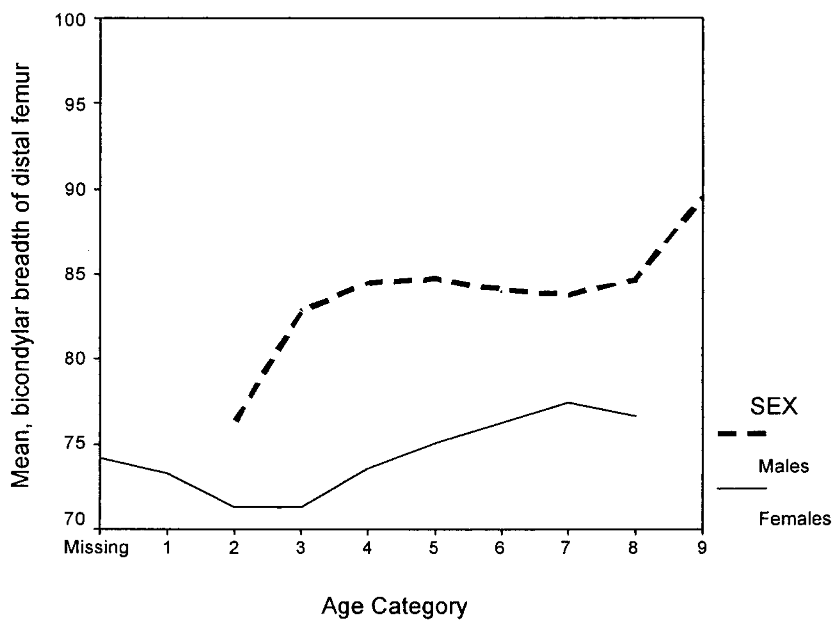

Figure 4.16: The relationship between the bicondylar breadth of the proximal tibia with age in white females and white males.

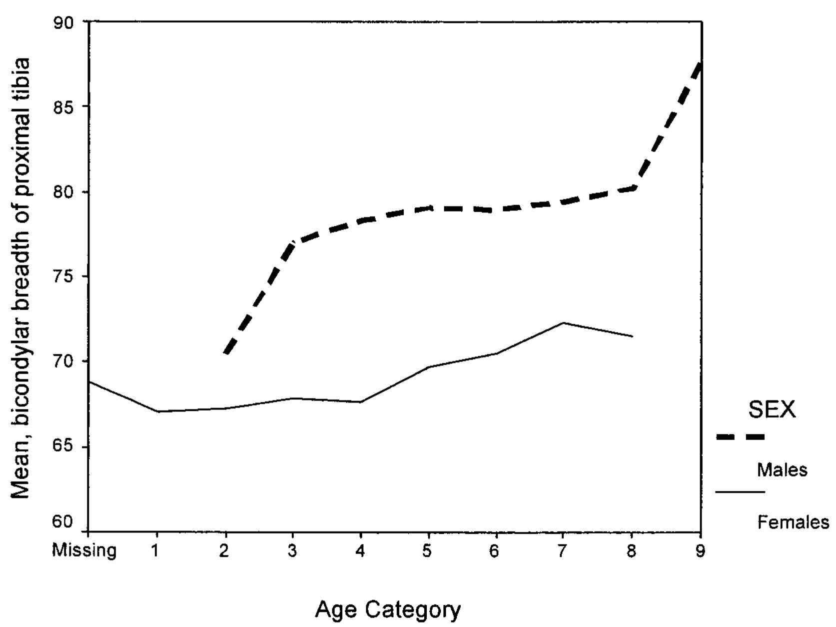

Figure 4.17: The relationship between the diameter of the tibia at midshaft with age in white females and white males.

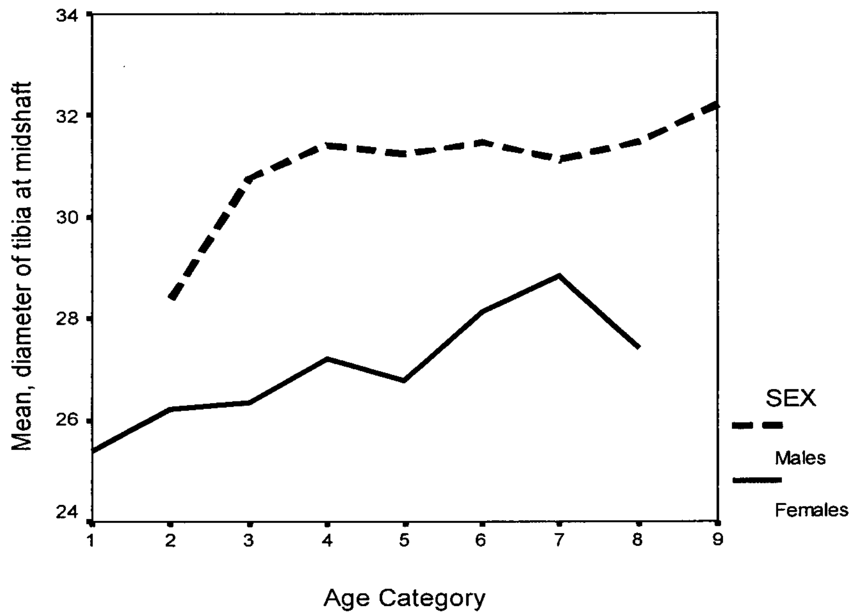

Figure 4.18: The relationship between the diameter of the head of the fibula with age in white females and white males.

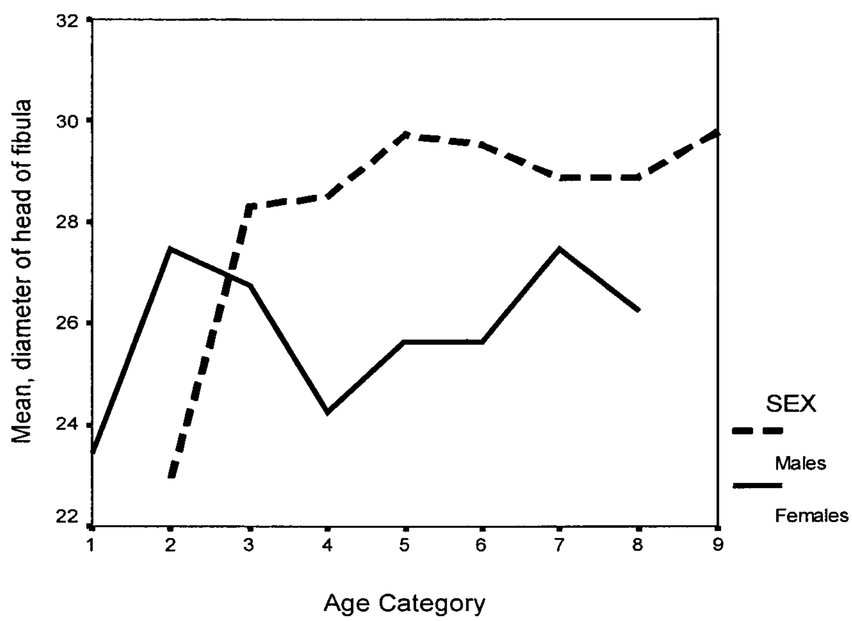

Figure 4.19: The relationship between the diameter of the distal fibula with age in white females and white males.

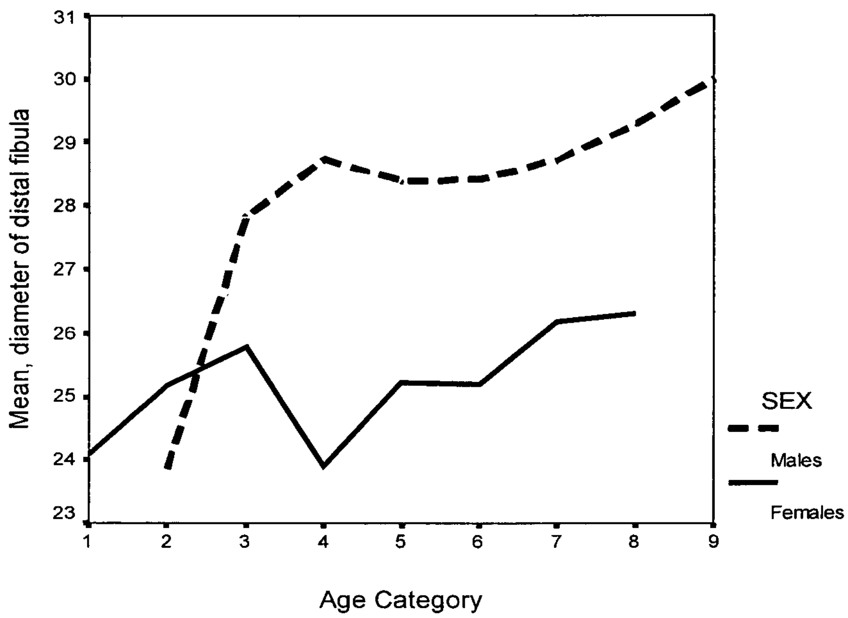

Figure 4.20: The relationship between the diameter of the humerus at midshaft with age in black males and black females.

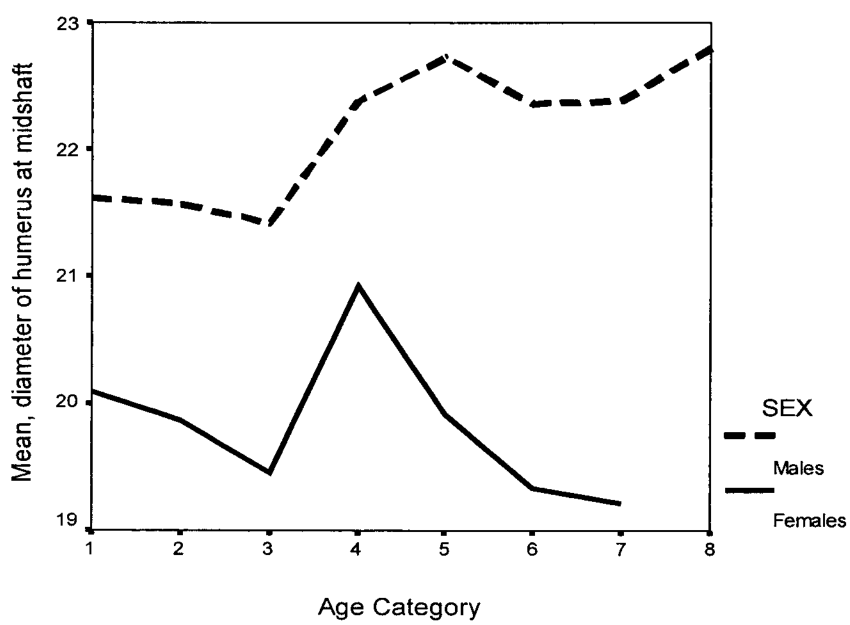

Figure 4.21: The relationship between the epicondylar breadth of the distal humerus with age in black males and black females.

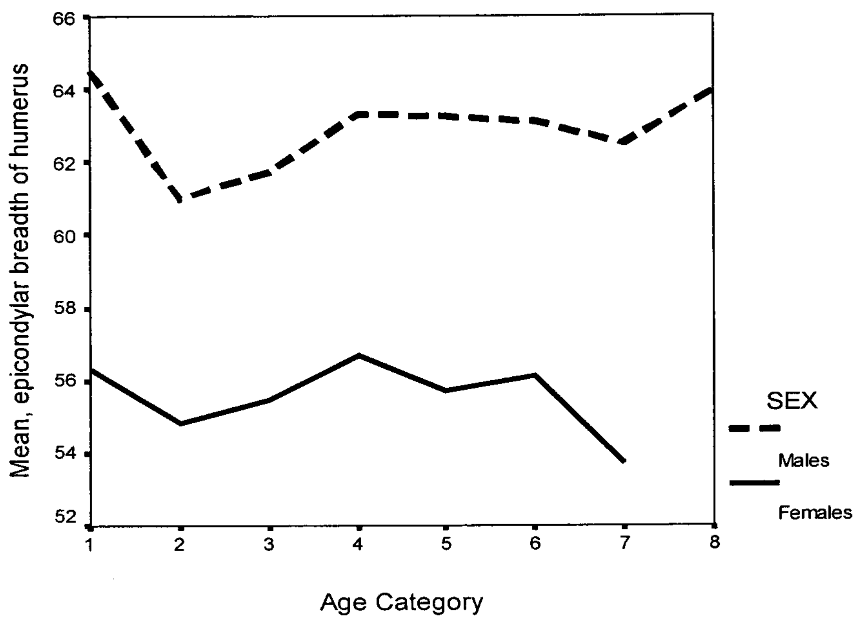

Figure 4.22: The relationship between the diameter of the superior head of the ulna with age in black males and black females.

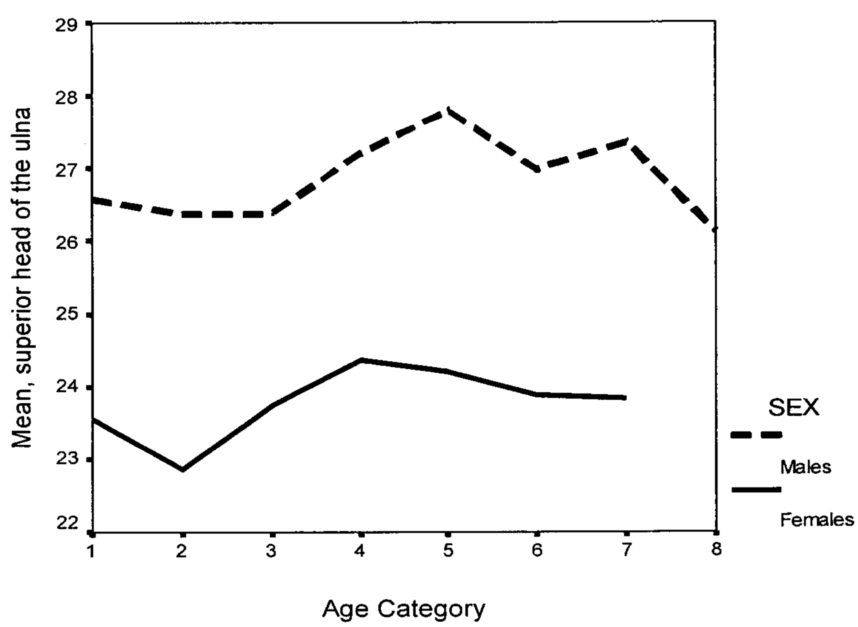

Figure 4.23: The relationship between the diameter of the ulna at midshaft with age in black males and black females.

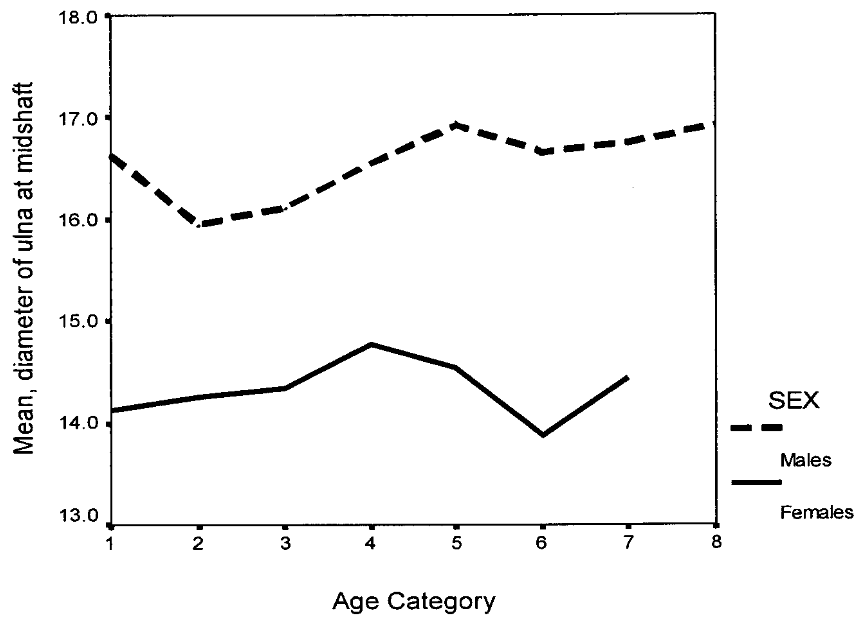

Figure 4.24: The relationship between the diameter of the femur at midshaft with age in black males and black females.

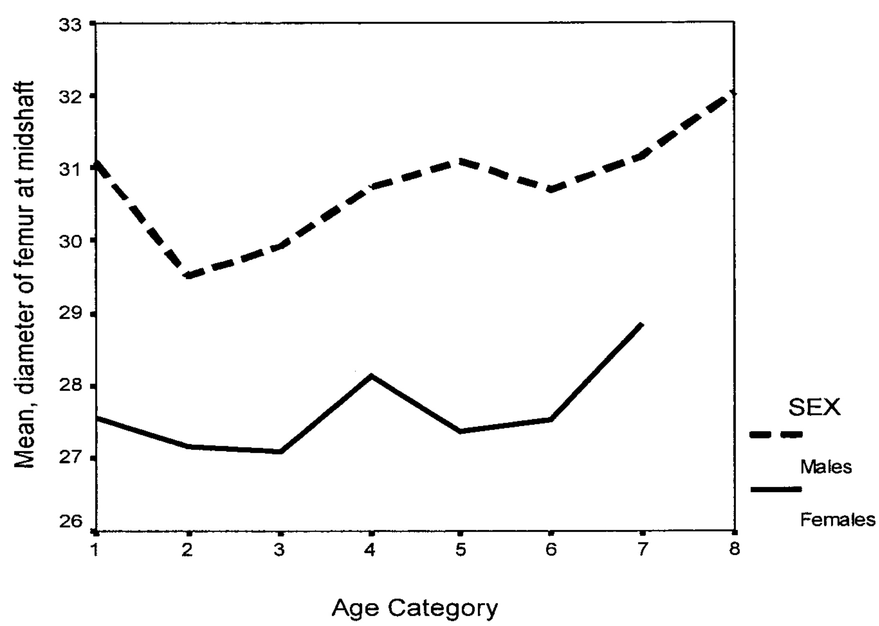

Figure 4.25: The relationship between the bicondylar breadth of the proximal tibia with age in black males and black females.

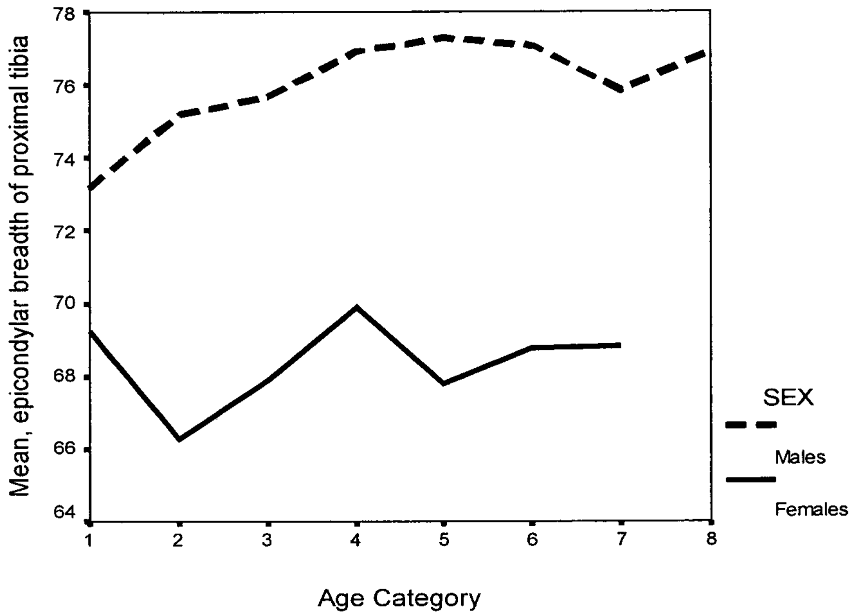

Figure 4.26: The relationship between the diameter of the head of the fibula with age in black males and black females.

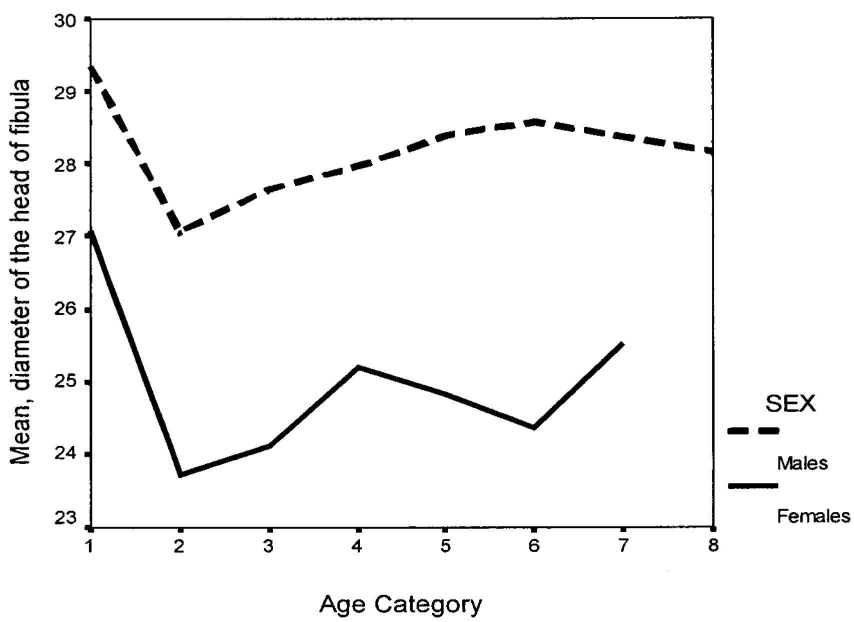

Figure 4.27: The relationship between the diameter of the inferior head of the ulna with age in white males and white females.

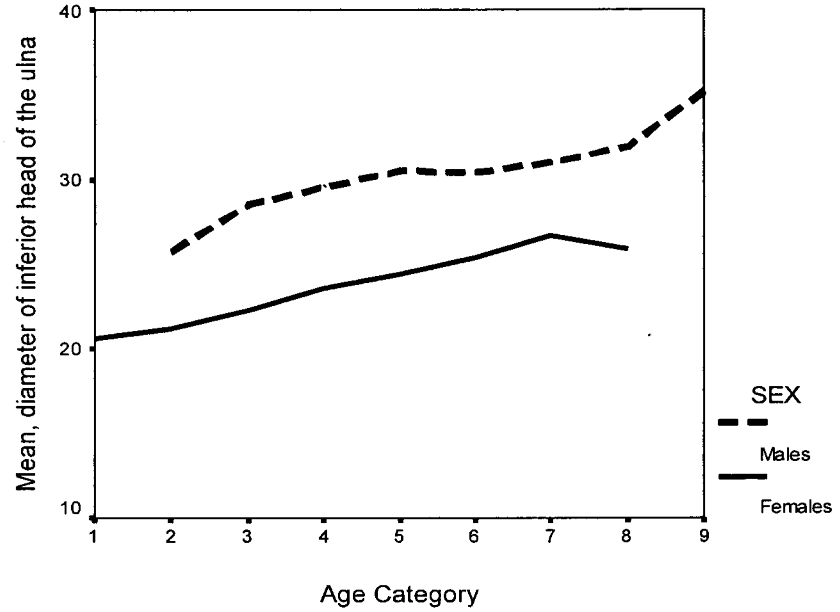

Figure 4.28: The relationship between the diameter of the distal radius with age in white males and white females.

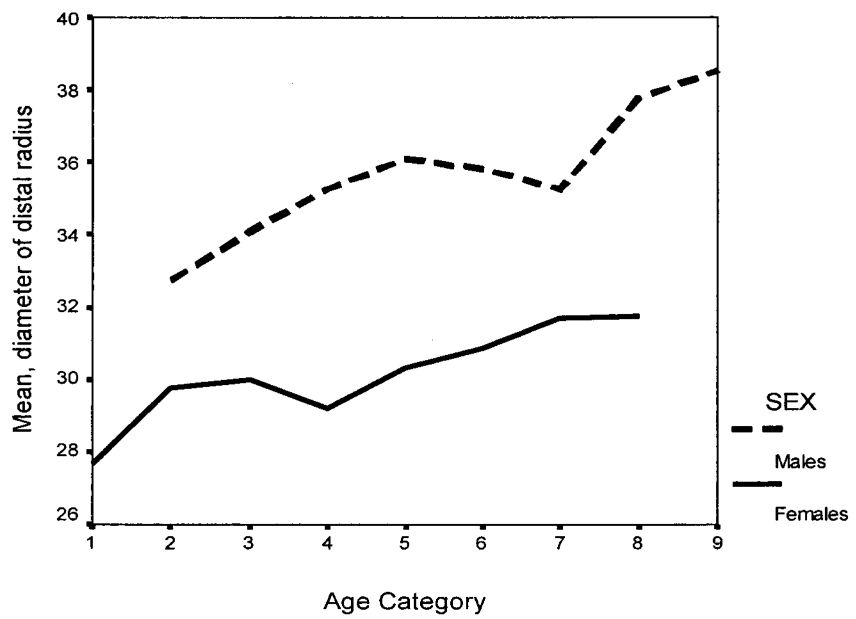

Figure 4.29: The relationship between the bicondylar breadth of the proximal tibia with age in white males and white females.

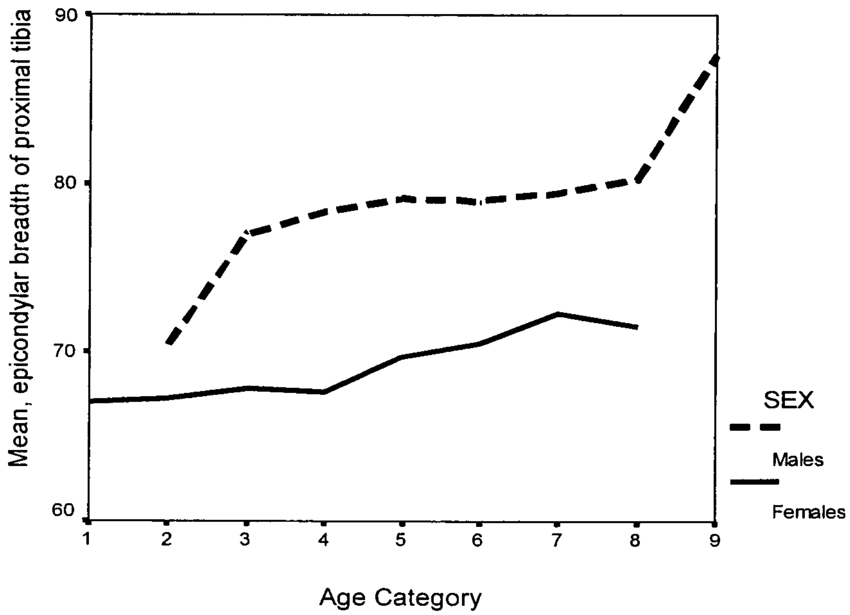

Figure 4.30: The relationship between the ischio-pubic index with age in black males and black females.

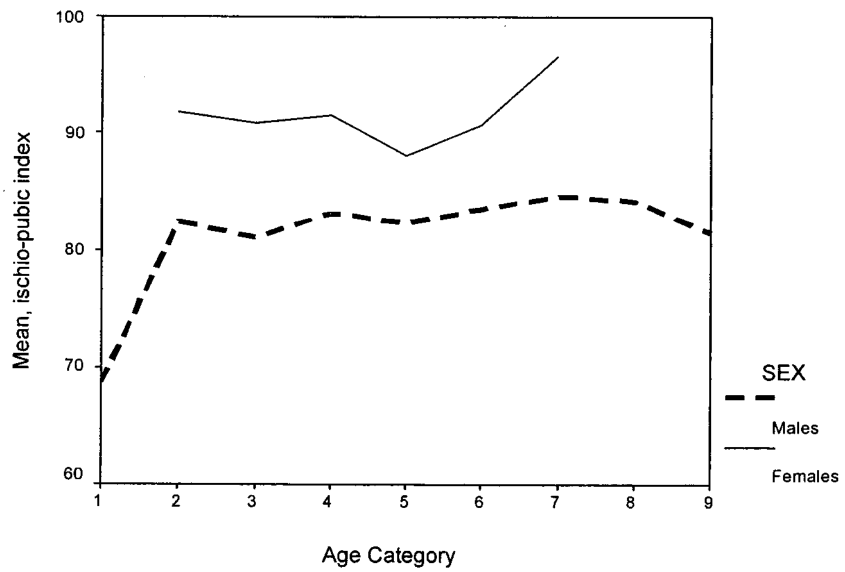

Figure 4.31: The relationship between the pubis length with age in white males and white females.

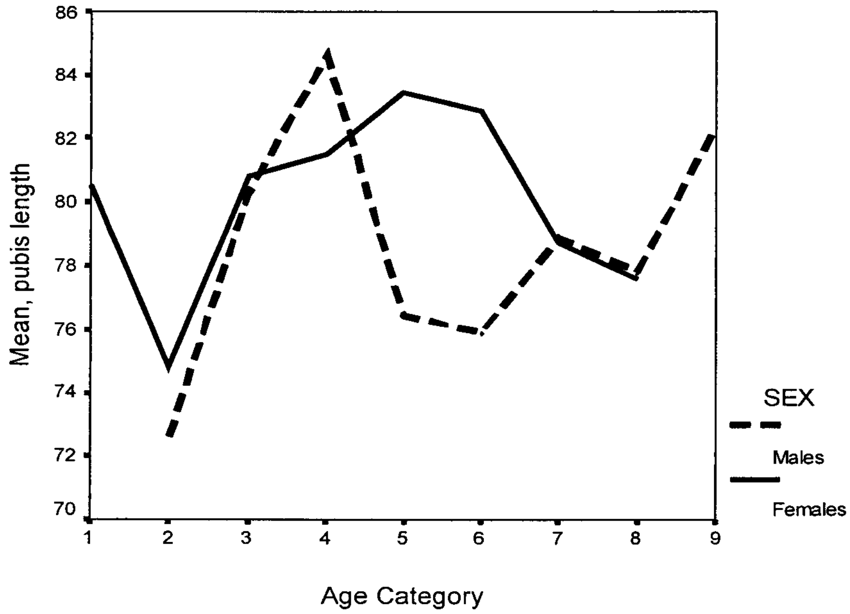

Figure 4.32: The relationship between the ischio-pubic index with age in white males and white females.

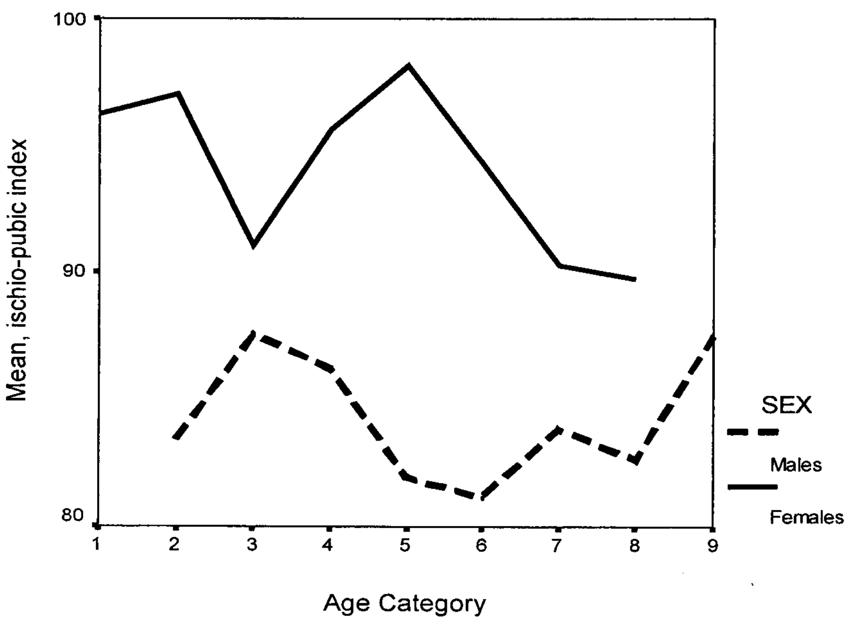

Figure 4.33: Statistically significant measurements that *decreased* (in blue) for the black female skeleton from the young age group (50 years and younger) to the old age group (over 50 years). None increased with age.

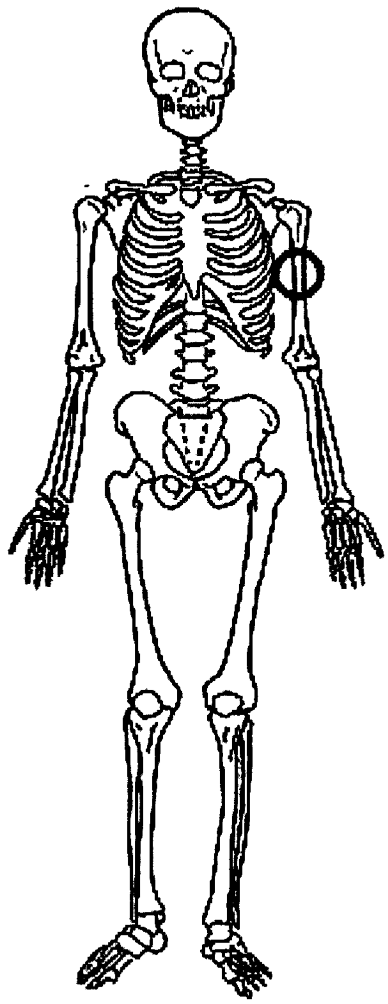

Figure 4.34: Statistically significant measurements that *increased* (in red) for the white female skeleton from the young age group (50 years and younger) to the old age group (over 50 years).

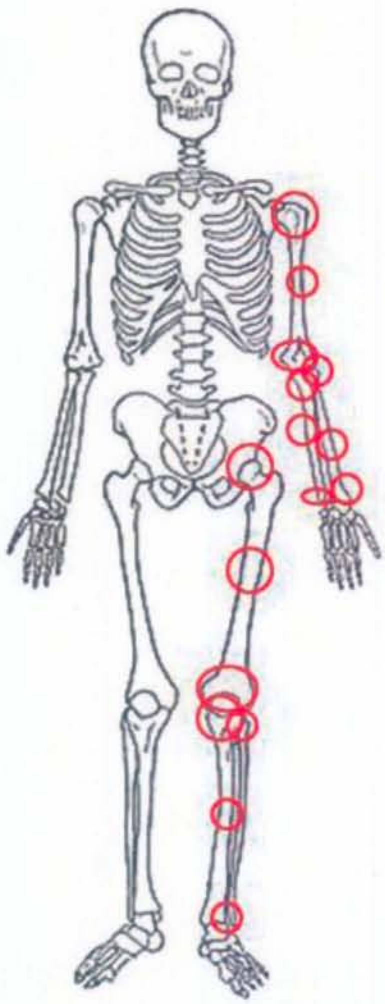

Figure 4.35: Statistically significant measurements that *increased* (in red) for the black male skeleton from the young age group (50 years and younger) to the old age group (over 50 years).

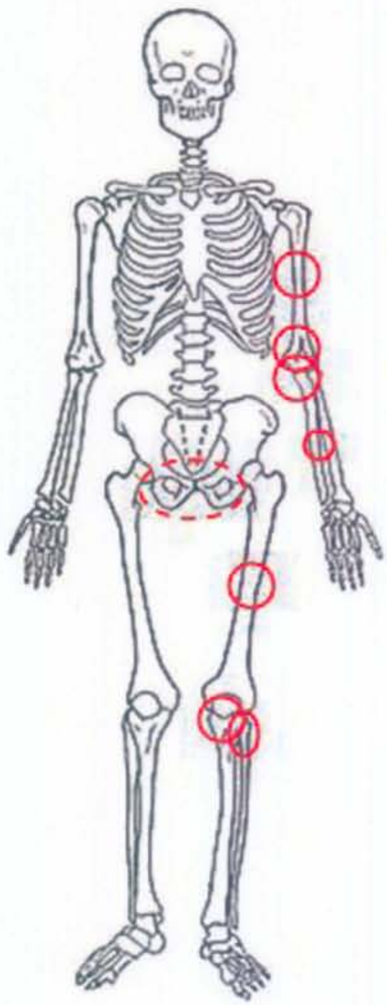

Figure 4.36: Statistically significant measurements that *increased* (in red) and *decreased* (in blue) for the white male skeleton from the young age group (50 years and younger) to the old age group (over 50 years).