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# Multiple Regression of Body Weight on Stature and Waist for Estimation in Forensic Anthropology

Eldred L. Pierce
*University of Tennessee, Knoxville*

To the Graduate Council:

I am submitting herewith a thesis written by Eldred L. Pierce entitled "Multiple Regression of Body Weight on Stature and Waist for Estimation in Forensic Anthropology." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Lyle W. Konigsberg, Major Professor

We have read this thesis and recommend its acceptance:

Murray K. Marks, William M. Bass

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Associate Vice Chancellor and
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# Multiple Regression Of Weight On Stature And Waist For Estimation In Forensic Anthropology

A Thesis
Presented for the
Master of Arts
Degree
The University of Tennessee, Knoxville

Eldred L. Pierce, Jr.
August 1999

# DEDICATION

This thesis is dedicated to my wife

Melinda Barrett Pierce

and my daughter

Amanda Lea Pierce

both of whom bring great joy to my life

## ACKNOWLEDGEMENTS

There have been many people who had an early influence on my career as an anthropologist. First I would like to thank Dr. Harry Holstein, Dr. James Sewastanowicz, and Chris Hill for their guidance and patience with me as a young undergraduate. I would also like to thank Ms. Linda Hopkins and Dr. Ron Young for passing on their knowledge in my undergraduate major, which was the Biological Sciences.

For my graduate training in Anthropology, I owe a debt to Dr. Lyle Konigsberg, Dr. Murry Marks, and Dr. William Bass. I also appreciate all of the training in archaeology that I gained from Dr. William Faulkner and Dr. Walter Klippel. I hope that my career in Anthropology and Forensic Science will be a credit to both my undergraduate and graduate departments.

# ABSTRACT

Questions have been present in the forensic literature for many years about the most proper and accurate method for calculation of human body weight. Many have tried and failed to measure aspects of the human skeleton and find some correlation with body weight at the time of death. This has never been possible and selected skeletal measurements regressed against known weight will bear this out. Simple measurements of the femur were regressed with weight and with stature to show that skeletal measurements in general have a higher correlation with stature than with weight. The bulk of this thesis will deal with comparison of five methods of weight regression. Body weight from a skeletal data set, the Terry collection, and a living data set, was regressed with five sets of parameters to see which method would prove to be most accurate. The multiple regression of weight on stature and waist proved to be superior and more accurate than regression with stature alone, waist alone, age, or a more obscure parameter called the index of obesity. Multiple regression proved to have the highest $R^2$ overall for the five regression methods.

# PREFACE

Originally it was hoped that data from the William M. Bass III donated skeletal collection could be used in this thesis. Many of the skeletons have had autopsies and have a recorded body weight. Most have race, age, and other vital data as well. The one missing element, which was not found on any data sheet from this collection, was a recorded waist circumference measurement. Because of this, no data from the Bass donated collection could be used.

Chapter I is the introduction to this thesis and will begin discussion of the central question at hand, how do you estimate body weight from the human skeleton? An explanation of how I started my investigation of the problem and how I found a solution will be presented. Objectives for how the problem of weight estimation will be accomplished will be presented.

Chapter II will present a brief review of the literature surrounding estimation of human body weight. Sources from the Anthropological, Forensic, and Medical literature are mentioned to give the reader a feel for what has been done in the past and perhaps where the research seems to be headed. A brief formal definition of waist will be further added to in the materials and methods on how waist was measured.

Chapter III will give the materials and methods used in this thesis to obtain the needed measurements, analysis, and conclusions. The two data sets will be presented in this section along with why each was used. The Terry skeletal collection provides measurements from cadavers and a data set from the living serves as a comparison.

Both sets of data will show that forensic weight can be estimated using the same methods on two very different types of samples.

Chapter IV is the results section and will show how the data was analyzed, graphed, and grouped for comparison. This chapter is subdivided into three sections: Terry skeletal measurements, Terry cadaver measurements, and Living body measurements. All analysis of the results will be summed up in Chapter V, the conclusions. Raw data for both of the data sets is located in appendices at the end of this thesis.

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# CHAPTER I

## INTRODUCTION

We have all seen the gentleman in the carnival side show who, for a small fee, will guess your age within a given range of years and your weight to the nearest, let us say 10 pounds. If he gets it right, he keeps your money. If he gets it wrong, you get some sort of prize. As campy as this example sounds, he really has it easy when he makes his estimate.

He has all of the flesh, hair, wrinkles, and other clues to help make an accurate guess. What would he say if you asked him to do the same thing on a skeleton? He could not be anywhere near as accurate on the dead as he could be on the living. But, a physical anthropologist could tell you a lot from just a skeleton. This is not to suggest that an anthropologist should be equated with a carnival side show performer.

For all of the things that a physical anthropologist can predict with reasonable accuracy from the skeleton, the statistic of human body weight has continued to be elusive. The ideal situation would be to find a single bone or measurements on that bone which changes in response to changes in body weight. This would mean that bone would have to remodel at a fast enough rate to keep up with loss and gain of weight. However, this will not work because bone remodels and reshapes itself much too slowly to ever be reliable in this manner. Just because the skeleton has yet to offer a reliable correlation with weight does not mean that it will never be done, but it is not likely.

When this study began, I used a more traditional approach in my attempt to estimate forensic weight from the skeleton. It seemed logical that all weight in a standing

human body rests on the legs and feet. If measurements of these bones could be found to correlate reasonably well with weight, then the objective would be accomplished. Unfortunately, all attempts to derive an accurate regression line between measurements of the femur, talus, and calcaneus with weight were unsuccessful. The first part of the conclusions will demonstrate this using measurements from the femur.

After becoming convinced that skeletal measurements would not provide a weight estimate, I was lead to try a statistical method involving the regression of body weight on stature and waist. The second part of the conclusions will discuss comparisons of several weight estimation methods. The statistical parameter $R^2$ was used to show which method is the most accurate. $R^2$ is a parameter that shows how well the generated regression line fits the data points, and must be between -1.0 and 1.0, with 0.0 indicating no correlation and 1.0 indicating perfect positive correlation. The square root of $R^2$ is the correlation coefficient (Iman, 1994). The method with the highest $R^2$ will be shown to be the best and most accurate method for estimation of forensic weight.

The estimation of weight is not the most exciting topic of discussion in forensic anthropology. Some laypersons may even avoid the discussion for fear that they may end up being asked to reveal their own body weight. One of the data sets in this thesis involved asking many ordinary people not only their weight, but a number of other potentially "taboo" personal statistics. In any case, the more widely researched topics of race, age, sex, and skeletal pathology have much more bearing on how an unknown body is identified. The body weight of a deceased individual is seldom discussed in the literature, but enough has been written to give a brief overview of past research.

# CHAPTER II

## REVIEW OF THE LITERATURE

Many of the initial weight estimates from the human skeleton have been based on simple stature regression. The idea is to simply assume that as people get taller, they also get heavier. This has lead to standardized charts constructed to show what a person should weigh for a given stature. Some have even used anthropological stature estimates based on skeletal remains to predict a given weight for an individual (Wells, 1969). Stature regression has also been used for hominid weight estimation (McHenry, 1992). This may work well as long as one assumes that the hominids in question had very little body fat and were very active. A variation of stature regression relies on an exponential equation with constants that change from one human racial group to another (Henneberg et al.,1989). The regression equation takes the form of :

$$\text{weight} = (\text{Constant 1})e^{(\text{Constant 2} * (\text{Stature}))} \text{ or } Y = ae^{bx}$$

This formula has been used on archaeological remains to calculate the body weight of pre-Roman skeletons in southern Italy (Henneberg et al., 1992).

The ideal regression formula for forensic weight of an individual would come from measurements taken directly from the skeleton. Most attempts have focused attention on the bones of the lower limbs. The femur has been recognized as one of the major weight bearing bones of the body and has thus been the subject of most studies. Efforts to correlate femoral head diameter, femoral neck width, and femoral shaft width have all met

with limited results. Simple regression of each of these variables in one study yielded correlation coefficients between 0.48 and 0.62 (Ruff et al., 1991). Femoral shaft width has also been studied in a forensic context to estimate the weight of children (Sciulli and Pfau, 1994). In archaeological contexts, femoral shaft width has been used to estimate weight and body size in prehistoric native Americans. This in turn has been used to comment on subsistence patterns (Larson et al., 1992). Moving inferiorly in the lower limbs, the feet have also been the focus of one study. Results to predict weight were found to have correlation coefficients between 0.17 and 0.48 based on measurements from the talus. Further, measurements were found to correlate more closely with stature (Huxley, 1992).

Dry weight estimates are done on desssicated or cremated remains. Mummies found in either cold or hot climates can fall into the former category. In all living organisms, the tissues are composed of about 70% water by weight (Lehninger et al., 1993). All or most of what remains of the body are the solid organic and inorganic tissues. From this assumption, mummified remains are assumed to represent the rest of the weight. Egyptian mummies have been given forensic weight estimates by assuming that the corpse is about 25- 30 % of the living weight (Reyman et al., 1998). The living weight of the Tyrolean Iceman of the European Alps was calculated using similar assumptions (Spindler, 1994). Dry weight estimates in one study of cremated remains found that cremains represent about 3.5% of total body weight in adults and about 2.5% in children (Warren and Maples, 1997).

Other weight estimation studies have recognized that tissue measurements are important in addition to skeletal measurements. The tissue measurement that seems to

work best for weight estimation comes from the waist region. One study (Kannel and Gordon, 1980) states that waist circumference is highly correlated with weight/stature$^2$. This relationship is referred to as a general index of obesity. Other waist measurements that may have been used to estimate weight have come from articles of clothing. Studies have been attempted to correlate pants and belt size to weight directly, but sources in the literature are scarce (Bass, pc 1999).

The problem with using waist as a variable in weight estimation is that the definition of waist measurement is somewhat unclear. Waist is defined as "the part of the body between the ribs and the hips". For our purposes the specific region that is measured as waist is actually the waistline, defined as " the line at the narrowest part of the waist " (Webster's, 1984: 671). The United States Army defines waist as the full circumference around the torso at the navel (Gordon et al., 1989). One anthropometric standards manual defines the 'waist circumference' measurement as the area of the narrowest part of the waist (Lohman et. al, 1991). The area that most people think of as waist is the highest point at which they wear a pair of pants or where they would put on a belt. This area of the waist region is referred to as the "natural waist"(Garret and Kennedy, 1971). More specifics on what constitutes a waist will be presented in the chapter on materials and methods.

# CHAPTER III

## METHODS AND MATERIALS

Two groups of data were used in this thesis, one taken from the living and the other from the dead. The Terry collection (Terry, 1940) contains data for the dead group. Data from the living group was taken for comparison with the same statistical methods. Most data was measured similarly to the Terry collection, but the method for obtaining waist measurement by Terry is unknown.

### THE TERRY COLLECTION

In the early part of the twentieth century Robert J. Terry gathered a collection of donated bodies for anatomical and skeletal research. Most of the individuals that comprise this collection come from lower socio-economic classes (Kelley et al., 1994). This collection bears his name and is today housed in the Smithsonian Institution Museum of Natural History in Washington D.C.. Initially, measurements were made on the cadavers, then the bodies were macerated and the skeletal remains collected for storage. Each body was catalogued as to cause of death, age at death, occupation, and any other relevant life history information. Racial group, sex, stature, and even post-mortem weight were recorded on data sheets for most bodies.

The relevant information for this study are the categories of age, race, sex, stature,

weight, and waist circumference. Of the over 1600 bodies in the collection, a few hundred had body weights recorded. Only 201 of the bodies had a waist circumference recorded on data sheets. For the most part, all had stature, sex, and race recorded. Most bodies have age recorded, but in three categories: chronological, morgue, and anatomical age. For this thesis, only chronological age was used.

Only those individuals with a weight recorded were considered for use in this study. Of that number, the individuals with recorded waist circumferences were chosen for final consideration. The individuals with waist circumferences break down as 10 white females, 23 black females, 91 white males, and 76 black males. Unfortunately, Dr. Terry never clearly defines how he measured " waist circum " (Terry, 1940). Instead, we must assume that 'waist circum' was measured in the same way as waist circumference defined in standard anthropometric measurements. All data in its raw form is in metric units, so no conversion was necessary. The useful Terry collection data will be presented in the results section, then compared to data from living groups in the conclusions.

Information in each of the desired categories was obtained from either data sheets or computer files. In addition to this information, selected measurements were taken on the femurs of each of the 200 selected individuals. The femoral head widths and the femoral condyle widths were chosen for comparison to weight and stature. All measurements were made with standard calipers and an osteometric board according to standard data collection procedures (Moore-Jansen and Jantz, 1990). This was done to show that measurements taken on the skeleton will yield little or no correlation with weight, but may correlate better with stature.

## DATA FROM LIVING PERSONS

After gathering usable data from the Terry collection, it was decided that data from contemporary living persons would be needed as well. This was done for two reasons. First of all, the birthdates of the people from the Terry collection are anywhere from the middle nineteenth to early twentieth century (Ubelaker, 1992). Any conclusions reached from data taken from the Terry collection would not be entirely applicable to people today. The second reason is that measurement of the waist is different for both data sets. As explained earlier, the method of waist measurement for the Terry collection is in question. Waist for the living data set was determined by the individual in question.

It was also made clear to each respondent in the living data set that if they could not provide truthful information, they should not participate in the study. Males were easy enough to get data from without too much explanation. Females on the other hand were given a full description of the purpose for this data. Everyone was assured that no names would appear in this thesis. Each individual was asked to provide four pieces of information. These included: age, weight, stature, and waist. Age was given as the current age in years on the day the person was asked. Weight was given to the nearest five pounds. If the person did not know, a simple bathroom scale measurement was sufficient.

Waist was determined by handing the person a tape measure and asking them to measure. When a few individuals asked exactly where to measure waist, they were told to measure it where they would wear a belt. When asked where they might put on a belt or pants, males and females will give differing answers. Personal conversations with female

participants revealed that they tend to wear pants up to the navel, while males tend to wear pants much lower. In the case of stature, most people knew it readily without consulting a driver's license or measuring.

Data for living individuals is presented in the same order as data for the Terry collection. All raw data was collected in feet, inches, and pounds. Data was converted to metric for direct comparison with Terry Collection data. Weight is the dependent variable, and the other three parameters are each used as the independent variable to show which of them best correlates with weight. All graphs of data and some of the calculations were done using Lotus 1-2-3 release 5. Additional calculations were done using SAS release 6.12, version 4.0.95. Statistics from each of the graphic representations will be compared to one another in the results section.

# CHAPTER IV

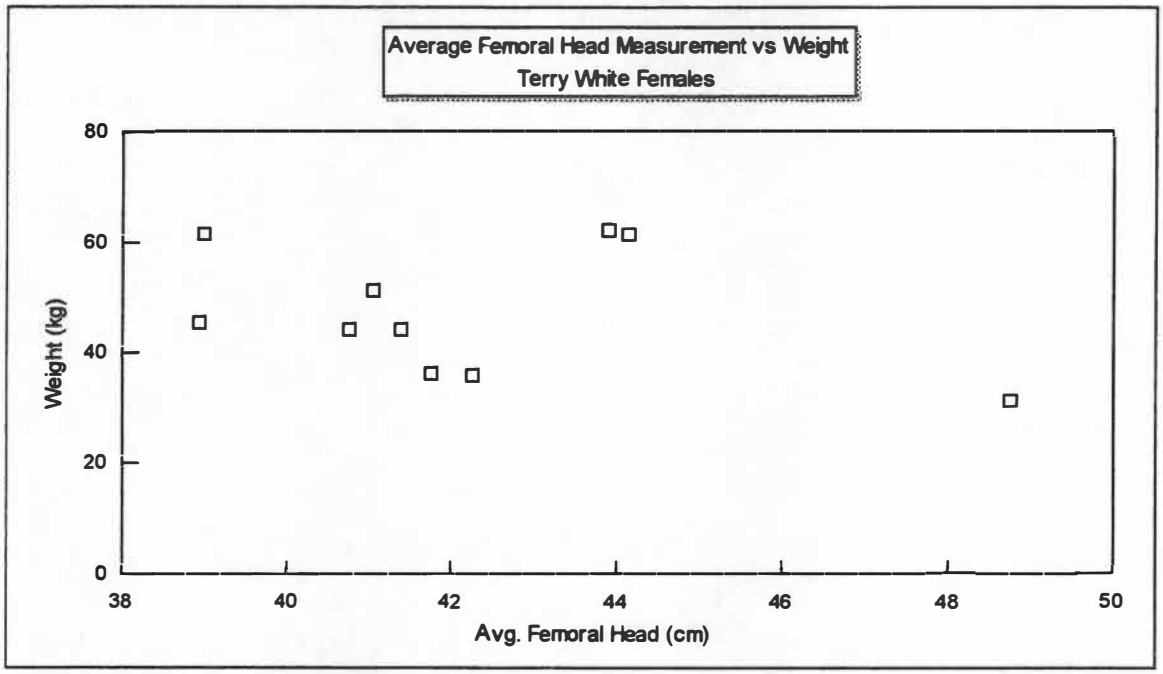
## RESULTS

This chapter is subdivided into four major sections: Terry skeletal data, Terry cadaver mesurements, Living body measurements, and Summary of statistics. Graphs and regression equations will constitute the bulk of what is presented in this chapter. The Terry skeletal measurements of femoral head and femoral condyle are regressed against body weight and stature separately. This was done to illustrate how effective, or ineffective, skeletal measurements are at estimating body weight. The purpose of the Terry cadaver measurement and Living body measurement graphs is to show how each of the parameters of waist, stature, and age regress against human body weight. All raw data for the Terry collection and for living persons is presented in appendices at the end of this thesis.

The first section is the Terry skeletal data. It will become apparent from the way the data points line up with weight and again with stature that skeletal measurements are not good estimators of human body weight. The graphic representations of each regression for femoral head measurements will be shown in Figures 1A through 1J. Graphic representations for femoral condyle measurements will be shown in Figures 2A through 2J. Terry skeletal data is available in appendix A at the end of this thesis. All measurements appear in centimeters.

## TERRY SKELETAL MEASUREMENTS

### Average femoral head measurement regressions




Model Equation

**Weight = 95.4002 - 1.1376 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.0830** |
| Root MSE | 11.5554 | Adj R-Sq | 0.0 |

Analysis of Variance

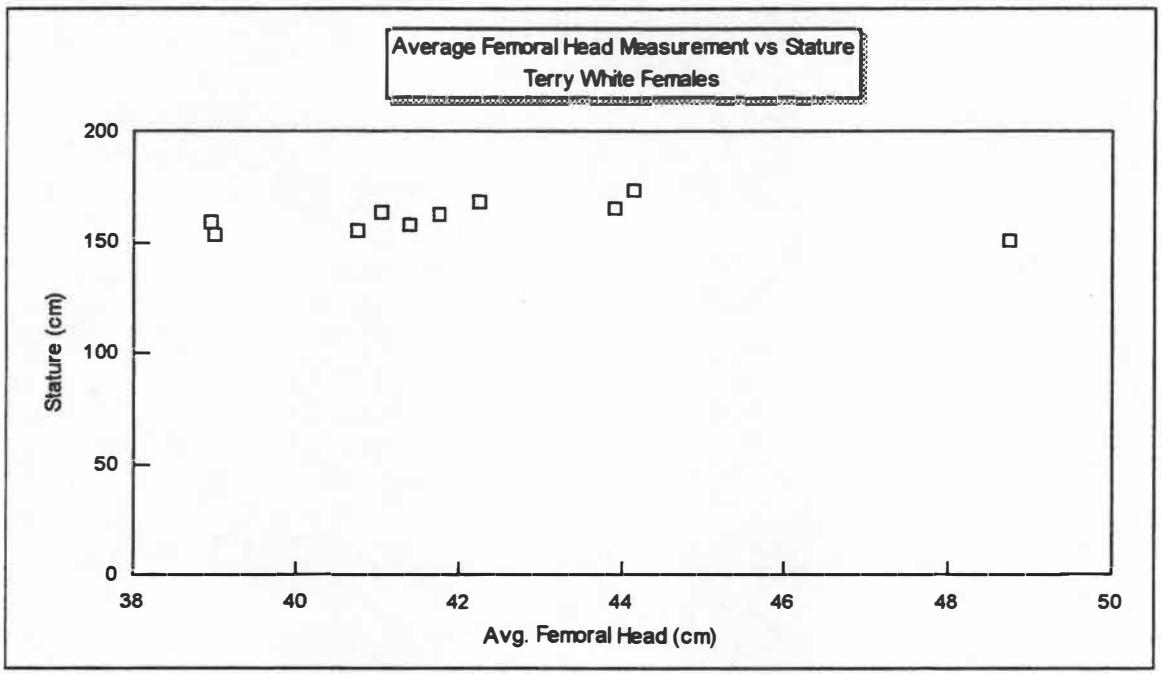
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 96.6261 | 96.6261 | 0.7236 | 0.4197 |
| Error | 8 | 1068.2139 | 133.5267 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 95.4002 | 56.5443 | 1.6872 | 0.1301 | - | 0 |
| Avg Head | 1 | -1.1376 | 1.3373 | -0.8507 | 0.4197 | 1.0000 | 1.0000 |

**A. Regression on weight for Terry white females**

**Figure 1. Average femoral head measurement against weight and stature.**




Model Equation

**Stature = 161.122 + 0.0042 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 161.3000 | **R-Square** | **3.1E -6** |
| Root MSE | 7.3109 | Adj R-Sq | 0.0 |

Analysis of Variance

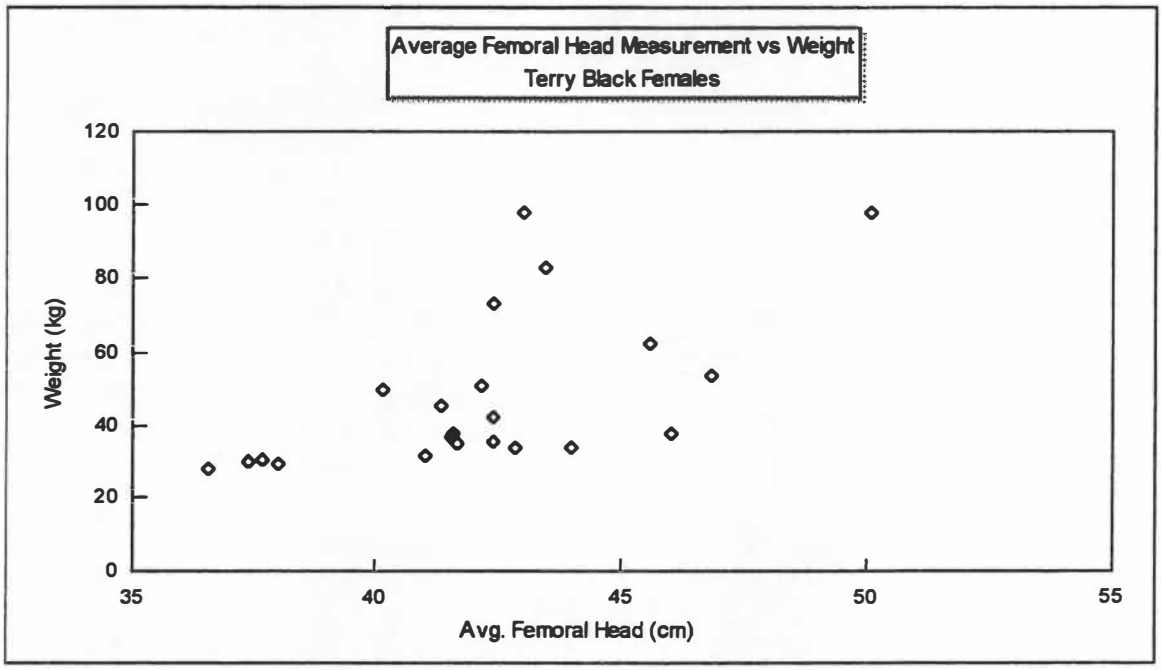
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 0.0013 | 0.0013 | 2.486E -5 | 0.9961 |
| Error | 8 | 427.5987 | 53.4498 | | |
| C Total | 9 | 427.6000 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 161.1220 | 35.7749 | 4.5038 | 0.0020 | - | 0 |
| Avg Head | 1 | 0.0042 | 0.8461 | 0.0050 | 0.9961 | 1.0000 | 1.0000 |

**B. Regression on stature for Terry white females**

**Figure 1 (Continued).**




Model Equation

**Weight = -121.996 + 4.0316 * Avg Femoral Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 48.0818 | **R-Square** | **0.3596** |
| Root MSE | 17.7459 | Adj R-Sq | 0.3276 |

Analysis of Variance

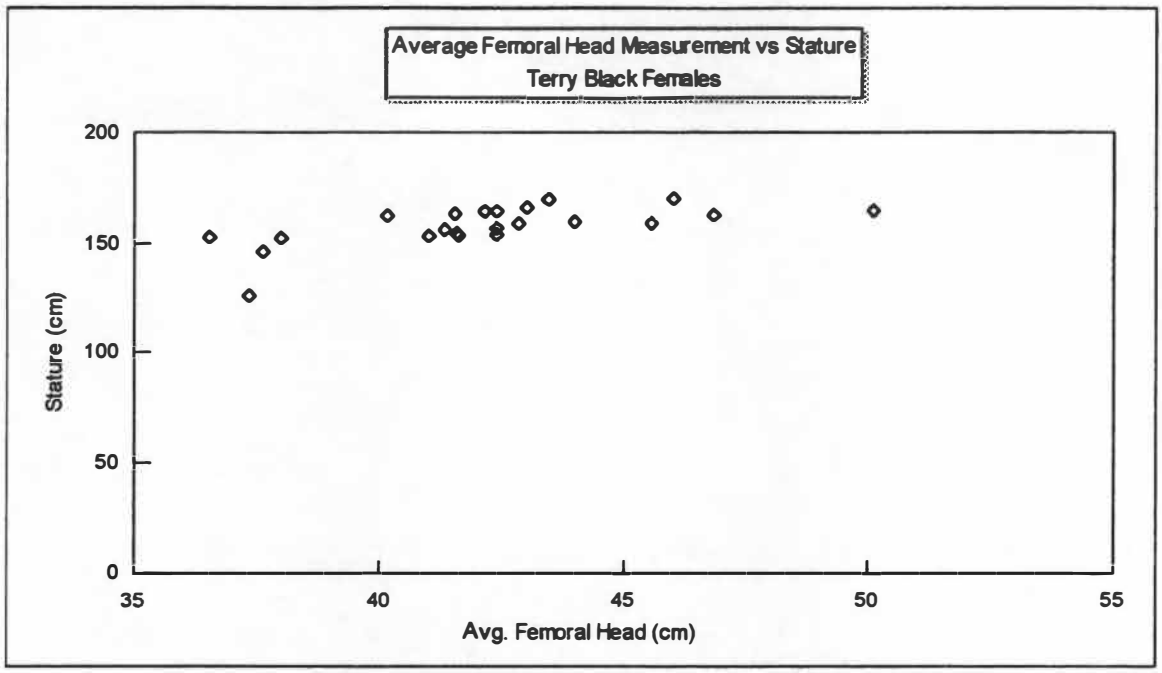
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 3537.3991 | 3537.3991 | 11.2327 | 0.0032 |
| Error | 20 | 6298.3737 | 314.9187 | | |
| C Total | 21 | 9835.7727 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -121.9965 | 50.8873 | -2.3974 | 0.0264 | - | 0 |
| Avg Head | 1 | 4.0316 | 1.2029 | 3.3515 | 0.0032 | 1.0000 | 1.0000 |

**C. Regression on weight for Terry black females**

**Figure 1 (Continued).**




Model Equation

**Weight = 77.4885 + 1.8986 * Avg Femoral Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 157.5818 | **R-Square** | **0.4250** |
| Root MSE | 7.2846 | Adj R-Sq | 0.3963 |

Analysis of Variance

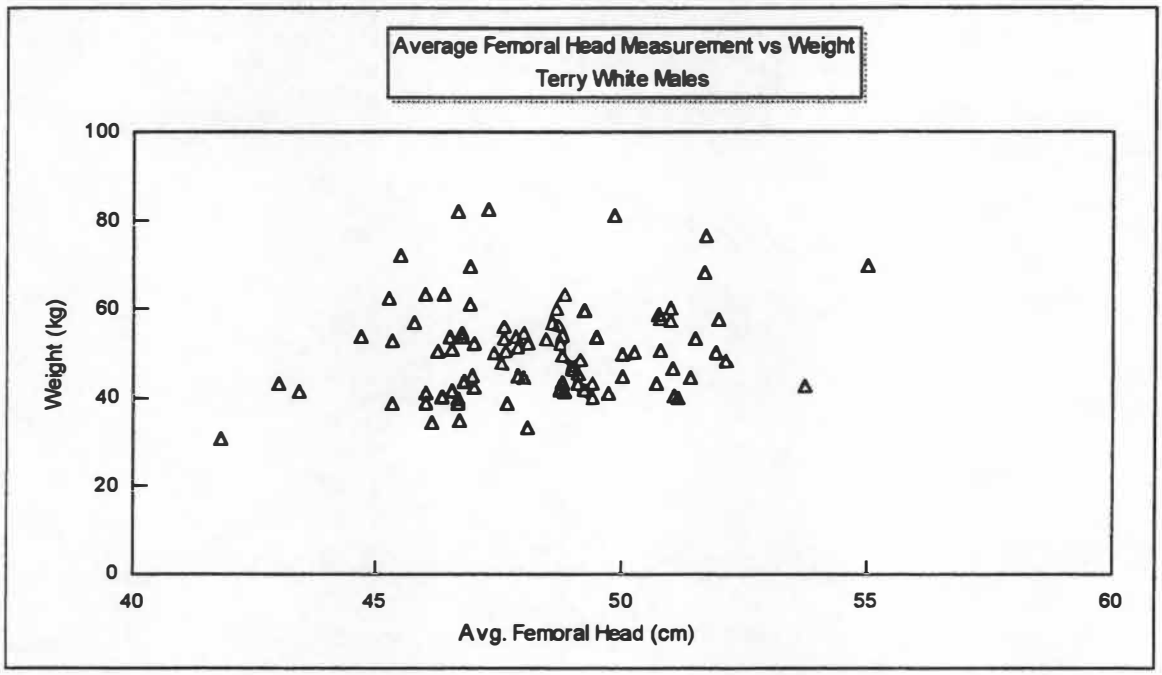
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 784.4741 | 784.4741 | 14.7830 | 0.0010 |
| Error | 20 | 1061.3186 | 53.0659 | | |
| C Total | 21 | 1845.7927 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 77.4885 | 20.8890 | 3.7095 | 0.0014 | - | 0 |
| Avg Head | 1 | 1.8986 | 0.4938 | 3.8449 | 0.0010 | 1.0000 | 1.0000 |

**D. Regression on stature for Terry black females**

**Figure 1 (Continued).**




Model Equation

**Weight = 14.0027 + 0.7660 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.0315 | **R-Square** | **0.0271** |
| Root MSE | 10.7139 | Adj R-Sq | 0.0160 |

Analysis of Variance

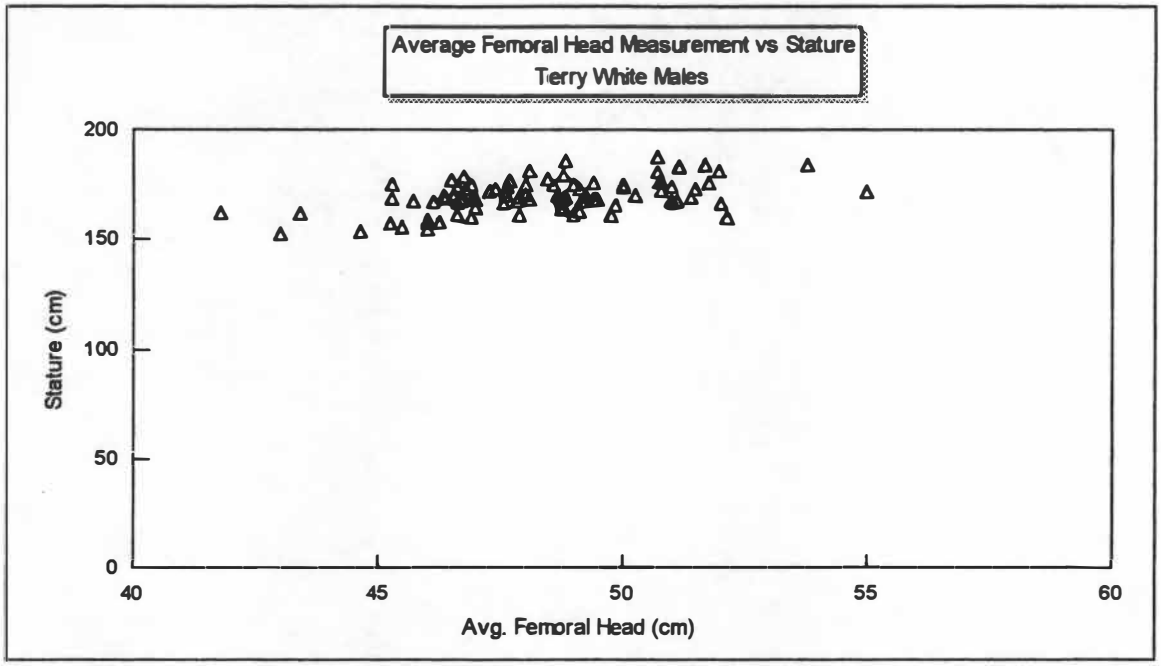
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 278.5536 | 278.5536 | 2.4267 | 0.1229 |
| Error | 87 | 9986.5583 | 114.7880 | | |
| C Total | 88 | 10265.1119 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 14.0027 | 23.7974 | 0.5884 | 0.5578 | - | 0 |
| Avg Head | 1 | 0.7660 | 0.4917 | 1.5578 | 0.1229 | 1.0000 | 1.0000 |

**E. Regression on weight for Terry white males**

**Figure 1 (Continued).**




Model Equation

**Stature = 97.3169 + 1.5020 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 169.9258 | **R-Square** | **0.2279** |
| Root MSE | 6.4589 | Adj R-Sq | 0.2190 |

Analysis of Variance

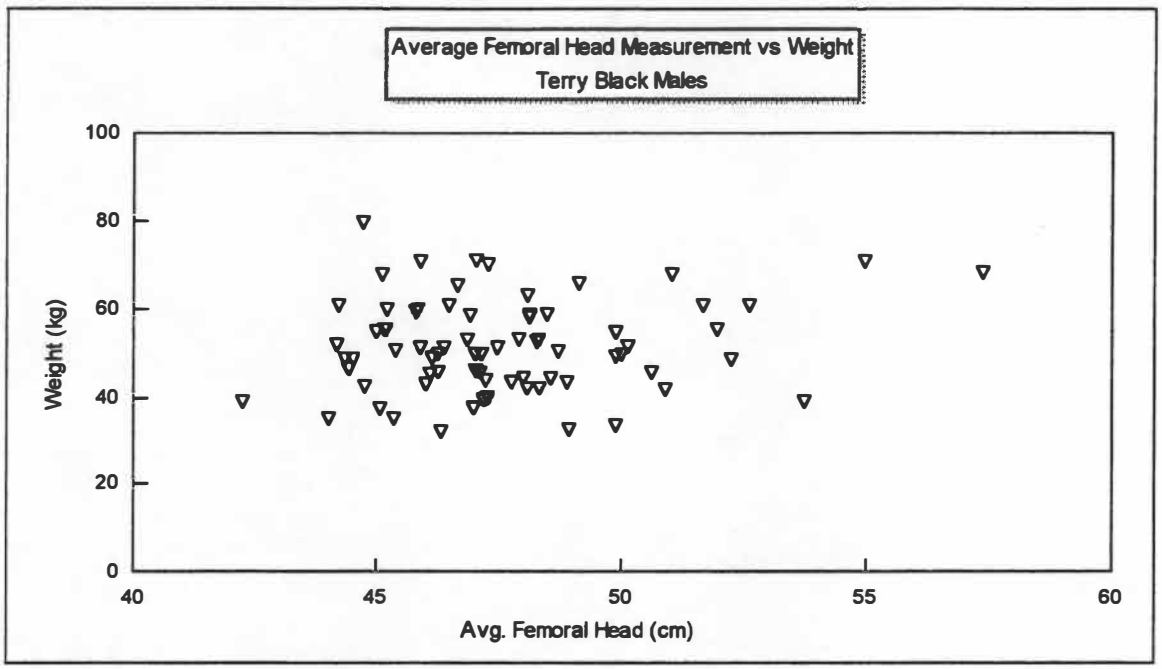
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1071.0505 | 1071.0505 | 25.6736 | 0.0001 |
| Error | 87 | 3629.4601 | 41.7179 | | |
| C Total | 88 | 4700.5106 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 97.3169 | 14.3464 | 6.7834 | 0.0001 | - | 0 |
| Avg Head | 1 | 1.5020 | 0.2964 | 5.0669 | 0.0001 | 1.0000 | 1.0000 |

**F. Regression on stature for Terry white males**

**Figure 1 (Continued).**




Model Equation

**Weight = 25.0374 + 0.5580 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5986 | **R-Square** | **0.0206** |
| Root MSE | 10.4678 | Adj R-Sq | 0.0070 |

Analysis of Variance

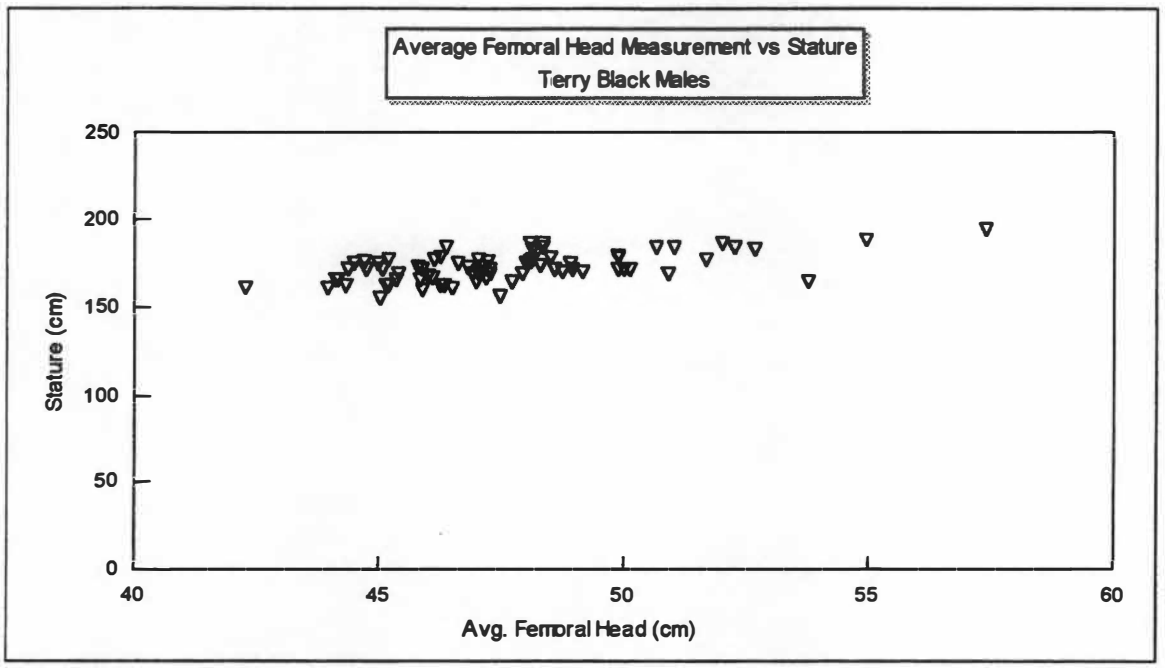
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 166.0555 | 166.0555 | 1.5154 | 0.2223 |
| Error | 72 | 7889.4344 | 109.5755 | | |
| C Total | 73 | 8055.4899 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 25.0374 | 21.6106 | 1.1586 | 0.2505 | - | 0 |
| Avg Head | 1 | 0.5580 | 0.4532 | 1.2310 | 0.2223 | 1.0000 | 1.0000 |

**G. Regression on weight for Terry black males**

**Figure 1 (Continued).**




Model Equation

**Stature = 88.4723 + 1.7715 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 172.8054 | **R-Square** | **0.3609** |
| Root MSE | 6.4169 | Adj R-Sq | 0.3520 |

Analysis of Variance

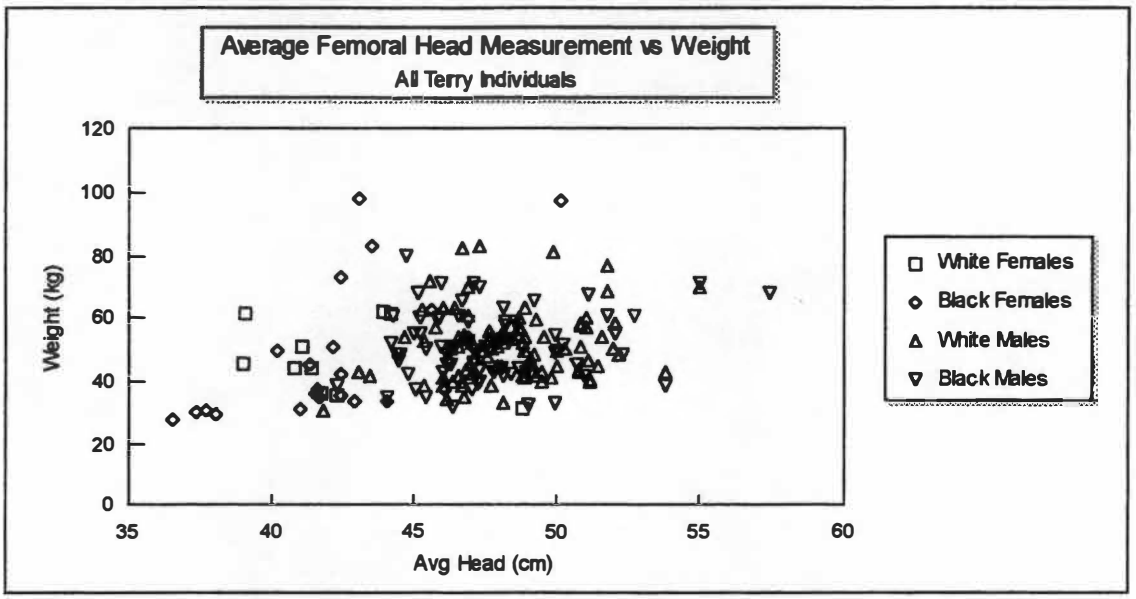
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1673.9927 | 1673.9927 | 40.6541 | 0.0001 |
| Error | 72 | 2964.7052 | 41.1765 | | |
| C Total | 73 | 4638.6978 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 88.4723 | 13.2475 | 6.6784 | 0.0001 | - | 0 |
| Avg Head | 1 | 1.7715 | 0.2778 | 6.3761 | 0.0001 | 1.0000 | 1.0000 |

**H. Regression on stature for Terry black males**

**Figure 1 (Continued).**




Model Equation

**Weight = 9.1359 + 0.8840 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 50.7277 | **R-Square** | **0.0587** |
| Root MSE | 12.0254 | Adj R-Sq | 0.0538 |

Analysis of Variance

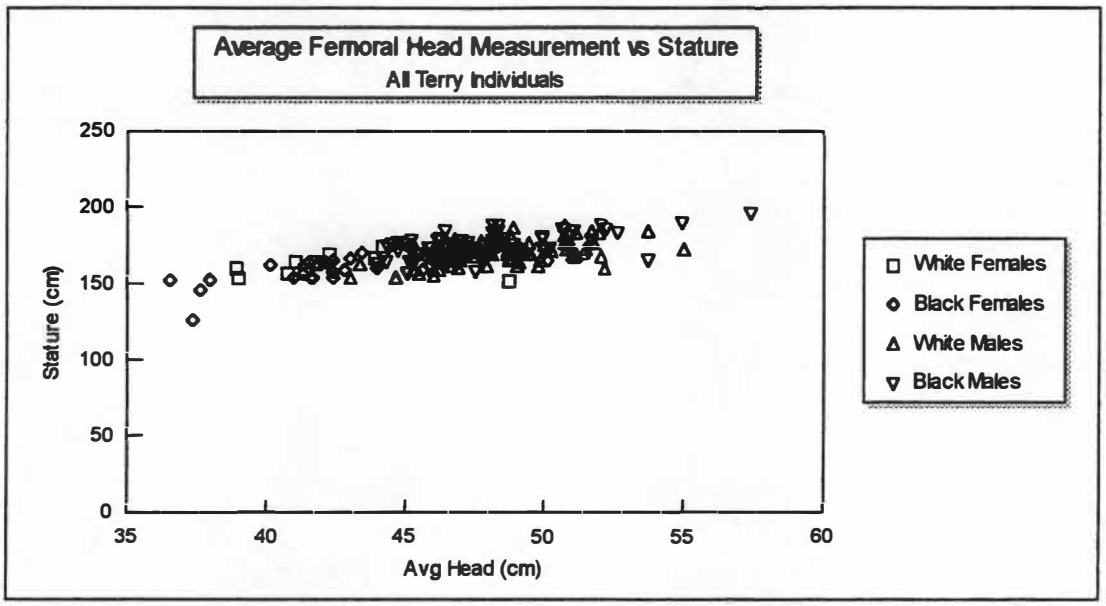
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1740.5550 | 1740.5550 | 12.0362 | 0.0006 |
| Error | 193 | 27909.7555 | 144.6101 | | |
| C Total | 194 | 29650.3105 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 9.1359 | 12.0193 | 0.7601 | 0.4481 | - | 0 |
| Avg Head | 1 | 0.8840 | 0.2548 | 3.4693 | 0.0006 | 1.0000 | 1.0000 |

**I. Regression on weight for all Terry individuals**

**Figure 1 (Continued).**




Model Equation

**Stature = 86.1801 + 1.7641 * Avg Head**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 169.1836 | **R-Square** | **0.4275** |
| Root MSE | 6.9353 | Adj R-Sq | 0.4245 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 6932.1277 | 6932.1277 | 144.1247 | 0.0001 |
| Error | 193 | 9282.9397 | 48.0981 | | |
| C Total | 194 | 16215.0675 | | | |

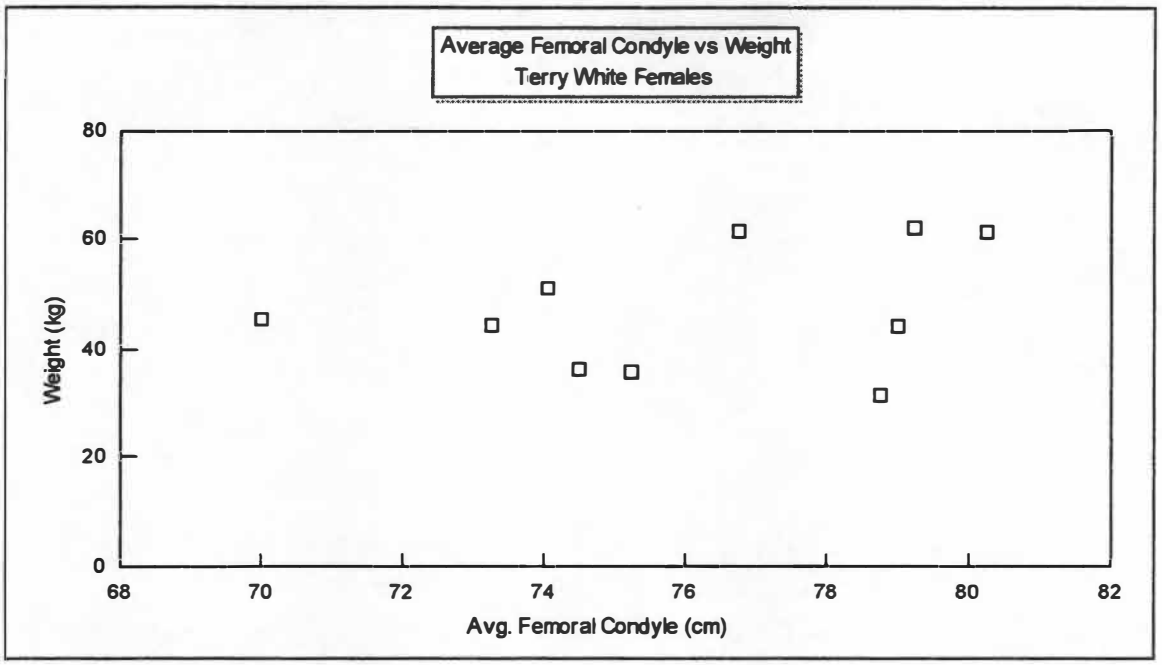
Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 86.1801 | 6.9318 | 12.4326 | 0.0001 | - | 0 |
| Avg Head | 1 | 1.7641 | 0.1469 | 12.0052 | 0.0001 | 1.0000 | 1.0000 |

**J. Regression on stature for all Terry individuals**

**Figure 1 (Continued).**

Average femoral condyle measurement regressions




Model Equation

**Weight = -33.7905 + 1.0668 * Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | R-Square | 0.0936 |
| Root MSE | 11.4880 | **Adj R-Sq** | **0.0** |

Analysis of Variance

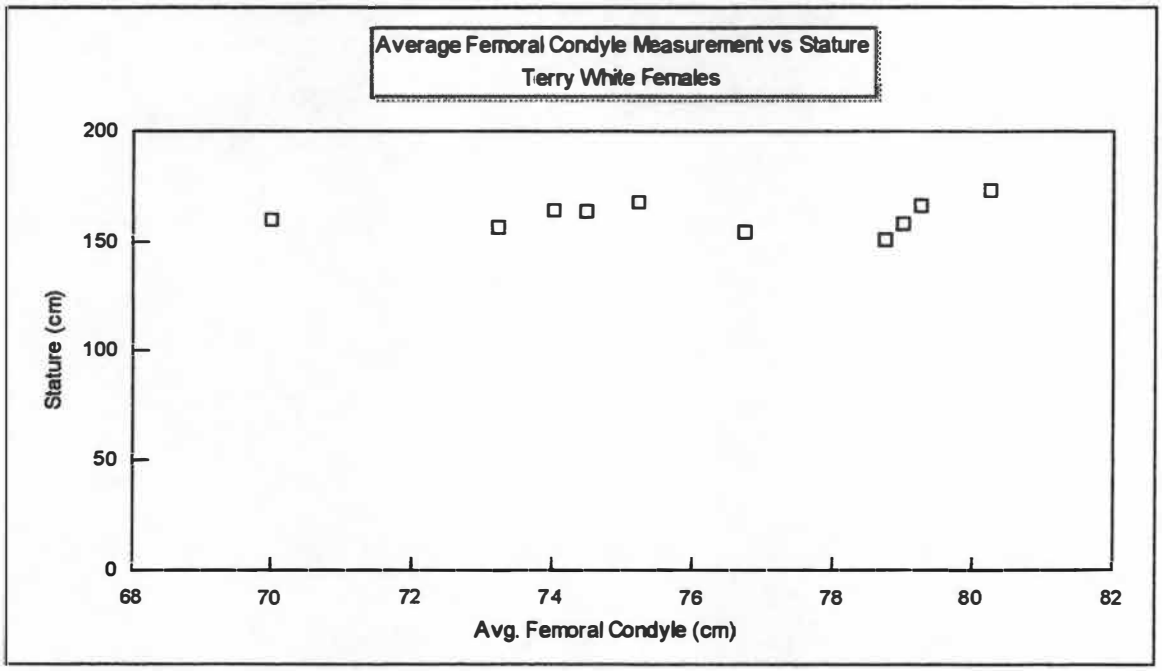
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 109.0506 | 109.0506 | 0.8263 | 0.3899 |
| Error | 8 | 1055.7894 | 131.9737 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -33.7905 | 89.3910 | -0.3780 | 0.7153 | - | 0 |
| Avg Cond | 1 | 1.0668 | 1.1736 | 0.9090 | 0.3899 | 1.0000 | 1.0000 |

**A. Regression on weight for Terry white females**

**Figure 2. Average femoral condyle mesurement against weight and stature.**




Model Equation

**Stature = 132.738 + 0.3753 * Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 161.3000 | **R-Square** | **0.0316** |
| Root MSE | 7.1947 | Adj R-Sq | 0.0 |

Analysis of Variance

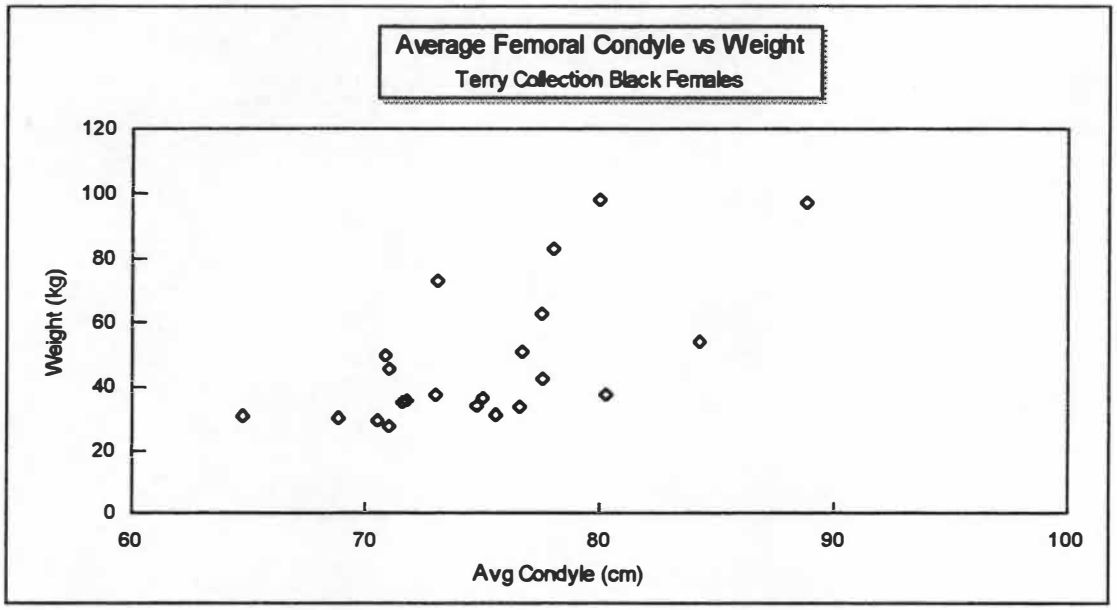
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 13.4957 | 13.4957 | 0.2607 | 0.6234 |
| Error | 8 | 414.1043 | 51.7630 | | |
| C Total | 9 | 427.6000 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 132.7380 | 55.9835 | 2.3710 | 0.0452 | - | 0 |
| Avg Cond | 1 | 0.3753 | 0.7350 | 0.5106 | 0.6234 | 1.0000 | 1.0000 |

**B. Regression on stature for Terry white females**

**Figure 2 (Continued).**




Model Equation

**Weight = -146.005 + 2.5852 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 48.0818 | **R-Square** | **0.4088** |
| Root MSE | 17.0514 | Adj R-Sq | 0.3792 |

Analysis of Variance

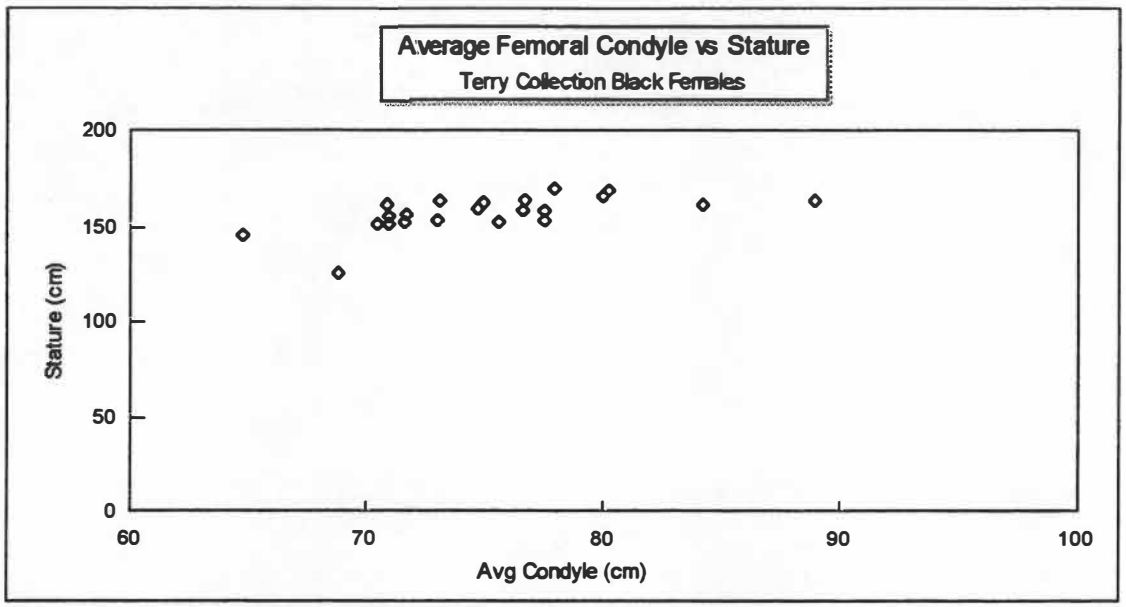
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 4020.7794 | 4020.7794 | 13.8290 | 0.0014 |
| Error | 20 | 5814.9933 | 290.7497 | | |
| C Total | 21 | 9835.7727 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -146.0054 | 52.3182 | -2.7907 | 0.0113 | - | 0 |
| Avg Cond | 1 | 2.5852 | 0.6952 | 3.7187 | 0.0014 | 1.0000 | 1.0000 |

**C. Regresssion on weight for Terry black females**

**Figure 2 (Continued).**




Model Equation

**Weight = 77.4481 + 1.0668 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 157.5818 | **R-Square** | **0.3710** |
| Root MSE | 7.6193 | Adj R-Sq | 0.3395 |

Analysis of Variance

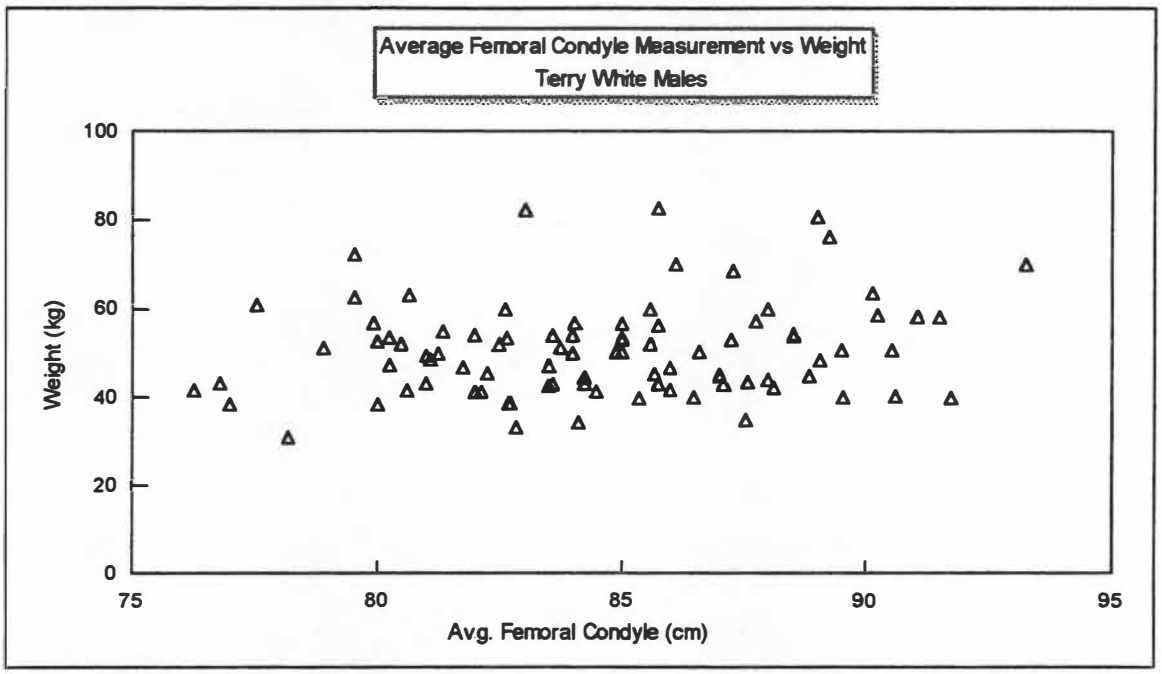
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 684.7197 | 684.7197 | 11.7946 | 0.0026 |
| Error | 20 | 1161.0731 | 58.0537 | | |
| C Total | 21 | 1845.7927 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 77.4881 | 23.3780 | 3.3146 | 0.0035 | - | 0 |
| Avg Cond | 1 | 1.0668 | 0.03106 | 3.4343 | 0.0026 | 1.0000 | 1.0000 |

**D. Regression on stature for Terry black females**

**Figure 2 (Continued).**




Model Equation

**Weight = 14.6961 + 0.4295 * Avg Condyle**

Summary of Fit

| | | |
|---|---|---|
| Mean of Response | 50.9911 | **R-Square 0.0232** |
| Root MSE | 10.6810 | Adj R-Sq 0.0121 |

Analysis of Variance

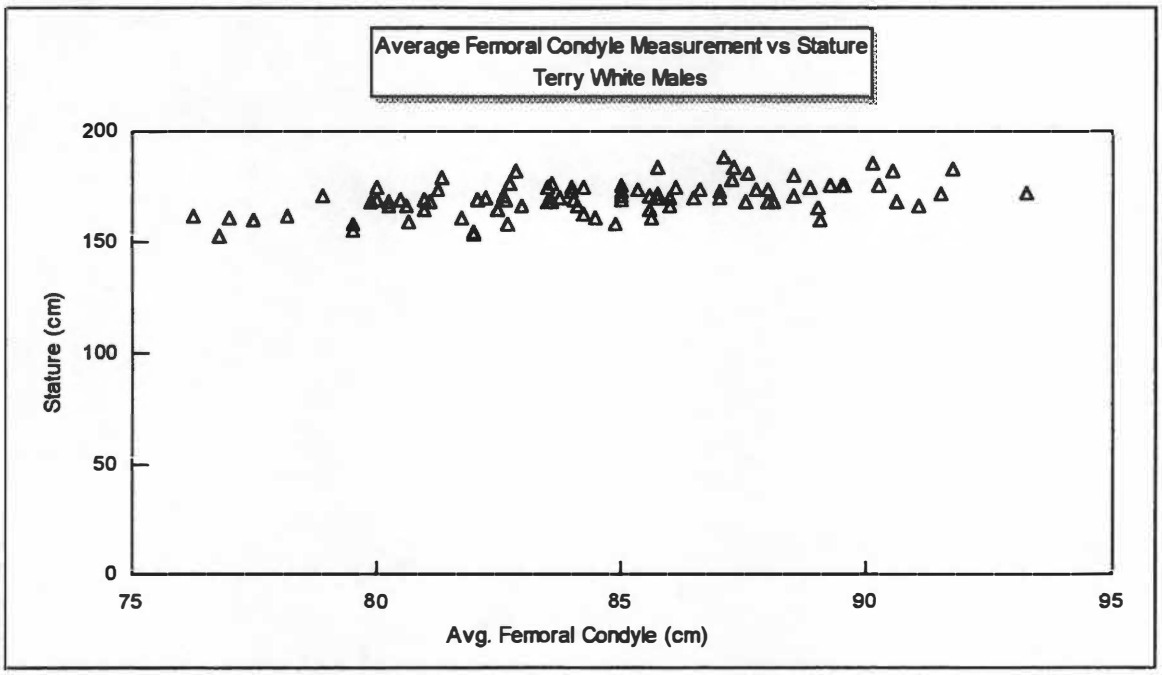
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 238.7072 | 238.7072 | 2.0924 | 0.1516 |
| Error | 88 | 10039.4457 | 114.0846 | | |
| C Total | 89 | 10278.1529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 14.6961 | 25.1168 | 0.5851 | 0.5600 | - | 0 |
| Avg Cond | 1 | 0.4295 | 0.2969 | 1.4465 | 0.1516 | 1.0000 | 1.0000 |

**E. Regression on weight for Terry white males**

**Figure 2 (Continued).**




Model Equation

**Stature = 90.1652 + 0.9444 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 168.9822 | **R-Square** | **0.2443** |
| Root MSE | 6.3707 | Adj R-Sq | 0.2357 |

Analysis of Variance

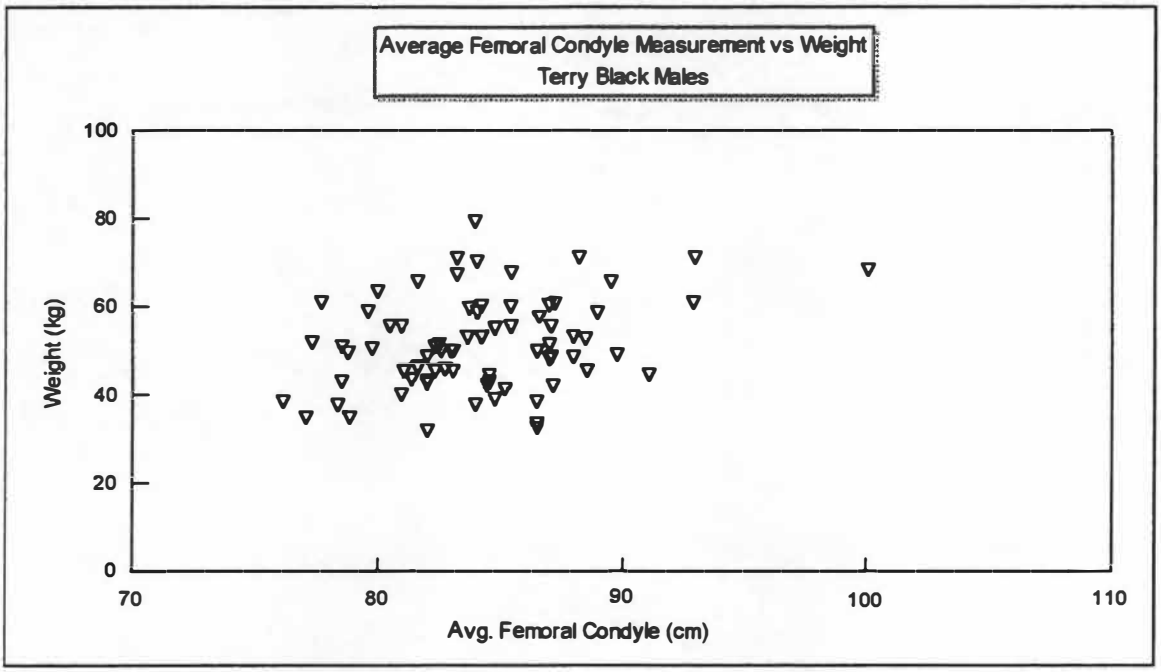
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1154.4171 | 1154.4171 | 28.4438 | 0.0001 |
| Error | 88 | 3571.5544 | 40.5858 | | |
| C Total | 89 | 4725.9716 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 90.1652 | 14.9809 | 6.0187 | 0.0001 | - | 0 |
| Avg Cond | 1 | 0.9444 | 0.1771 | 5.3333 | 0.0001 | 1.0000 | 1.0000 |

**F. Regression on stature for Terry white males**

**Figure 2 (Continued).**




Model Equation

**Weight = - 13.5622 + 0.7738 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5986 | **R-Square** | **0.0917** |
| Root MSE | 10.0808 | Adj R-Sq | 0.0791 |

Analysis of Variance

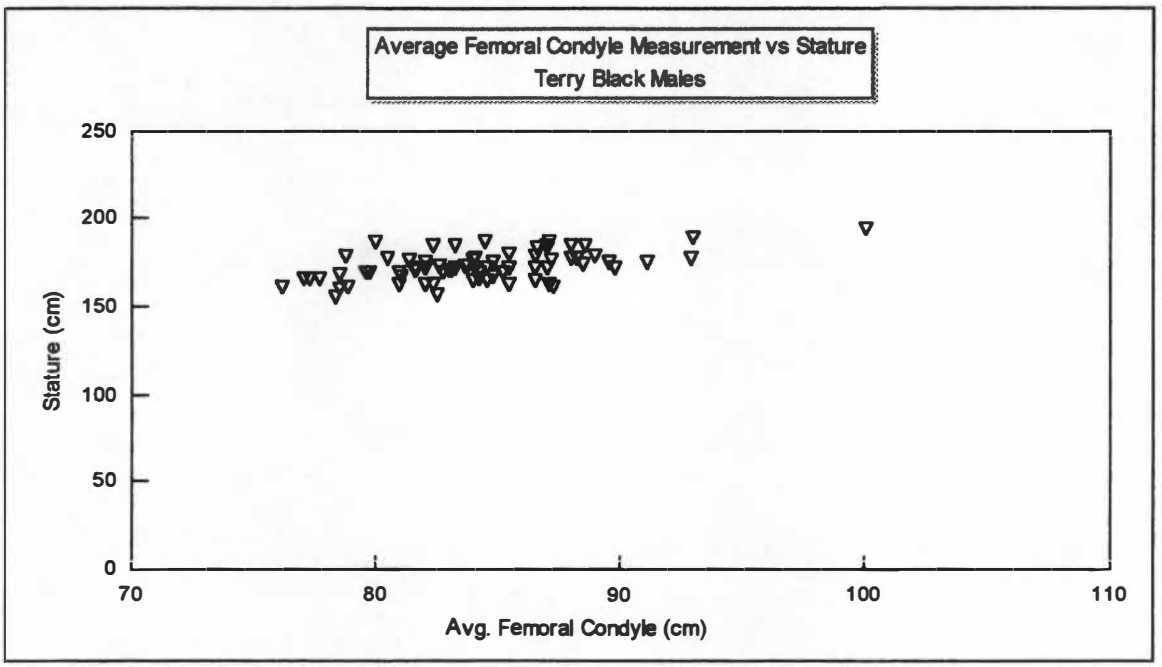
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 738.6728 | 738.6728 | 7.2688 | 0.0087 |
| Error | 72 | 7316.8171 | 101.6225 | | |
| C Total | 73 | 8055.4899 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 13.5622 | 24.1972 | - 0.5605 | 0.5769 | - | 0 |
| Avg Cond | 1 | 0.7738 | 0.2870 | 2.6961 | 0.0087 | 1.0000 | 1.0000 |

**G. Regression on weight for Terry black males**

**Figure 2 (Continued).**




Model Equation

**Stature = 85.2627 + 1.0396 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 172.8054 | **R-Square** | **0.2874** |
| Root MSE | 6.7756 | Adj R-Sq | 0.2775 |

Analysis of Variance

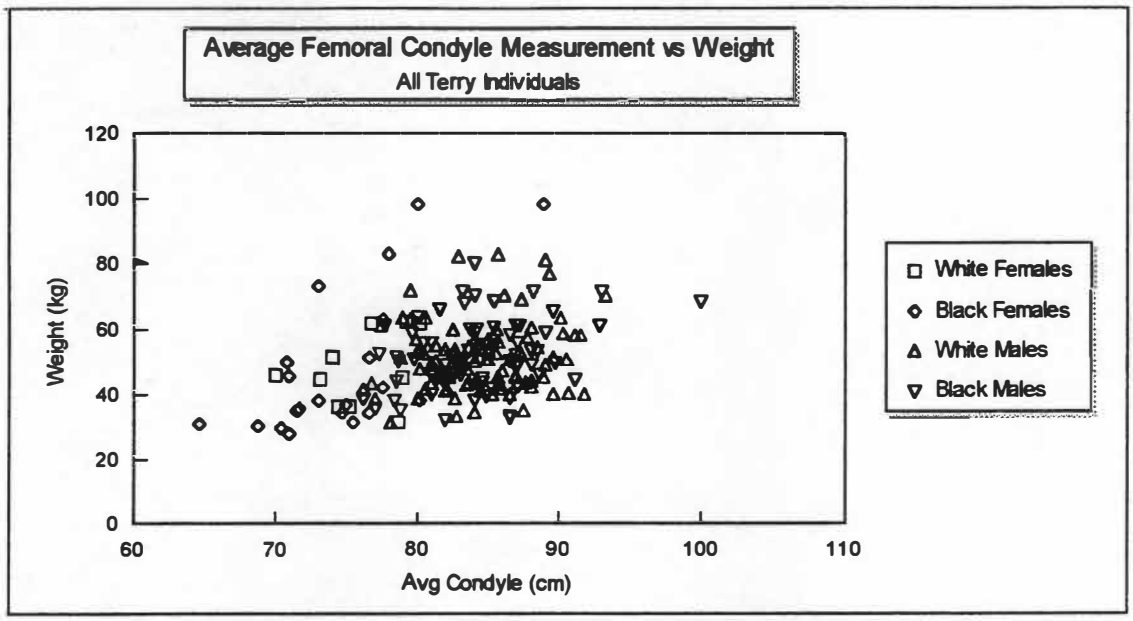
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1333.2741 | 1333.2741 | 29.0419 | 0.0001 |
| Error | 72 | 3305.4238 | 45.9087 | | |
| C Total | 73 | 4638.6978 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 85.2627 | 16.2636 | 5.2425 | 0.0001 | - | 0 |
| Waist | 1 | 1.0396 | 0.1929 | 5.3891 | 0.0001 | 1.0000 | 1.0000 |

**H. Regression on stature for Terry black males**

**Figure 2 (Continued).**




Model Equation

**Weight = - 10.5790 + 0.7392 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 50.7116 | **R-Square** | **0.1001** |
| Root MSE | 11.6806 | Adj R-Sq | 0.0956 |

Analysis of Variance

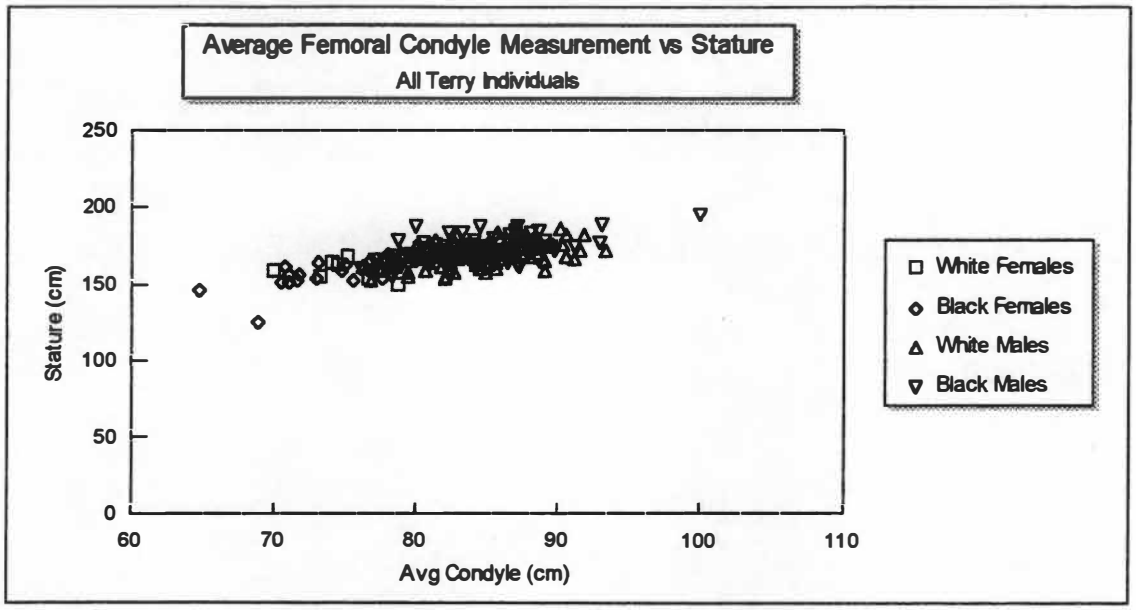
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2976.0111 | 2976.0111 | 21.8125 | 0.0001 |
| Error | 196 | 26741.5122 | 136.4363 | | |
| C Total | 197 | 29717.5233 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 10.5790 | 13.1495 | - 0.8045 | 0.4221 | - | 0 |
| Avg Cond | 1 | 0.7392 | 0.1583 | 4.6704 | 0.0001 | 1.0000 | 1.0000 |

**I. Regression on weight for all Terry individuals**

**Figure 2 (Continued).**




Model Equation

**Stature = 73.8600 + 1.1497 * Avg Condyle**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 169.1808 | **R-Square** | **0.4390** |
| Root MSE | 6.8508 | Adj R-Sq | 0.4361 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 7198.1661 | 7198.1661 | 153.3689 | 0.0001 |
| Error | 196 | 9199.0009 | 46.9337 | | |
| C Total | 197 | 16397.1671 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 73.8600 | 7.7123 | 9.5769 | 0.0001 | - | 0 |
| Avg Cond | 1 | 1.1497 | 0.0928 | 12.3842 | 0.0001 | 1.0000 | 1.0000 |

**J. Regression on stature for all Terry individuals**

**Figure 2 (Continued).**

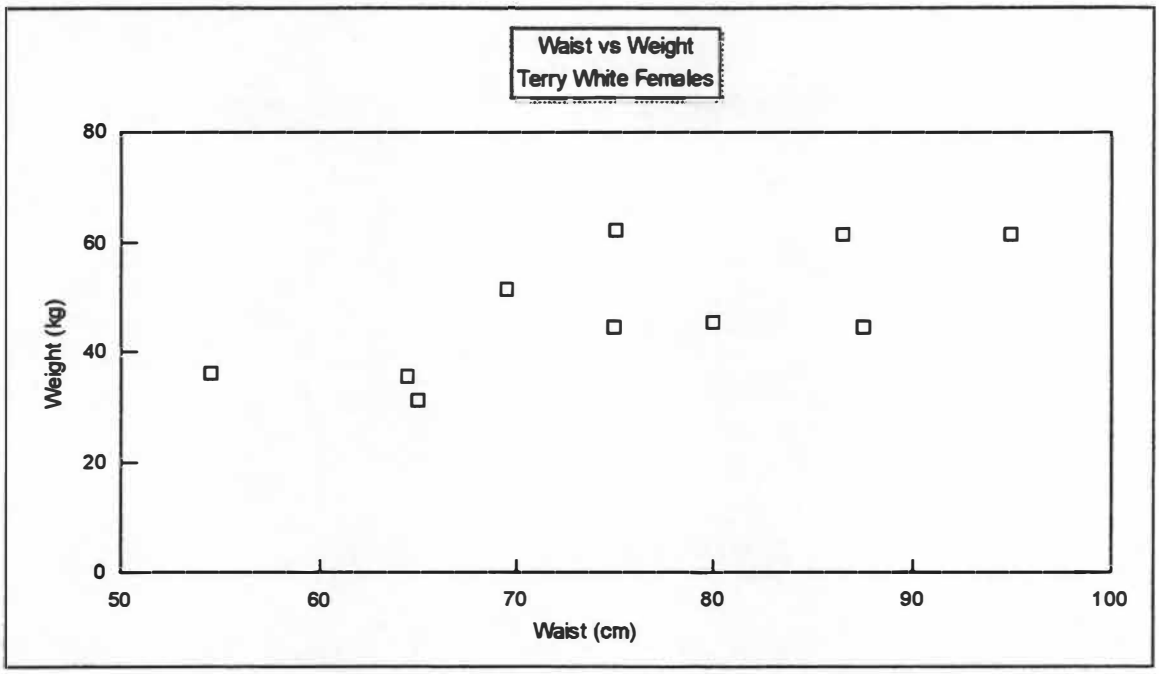
## TERRY CADAVER MEASUREMENTS

### White females

The white females make up the smallest group in the Terry collection. They also make up the smallest group for which waist circumference was recorded on the collections data sheets. There are only 10 white females total; too small of a group to have much statistical significance. The average age for this group is 64.4 years, with a high of 84 years and a low of 30 years. The average weight is 47.4 kilograms (kg), with a high of 62.2 kg and a low of 31.3 kg. The average waist is 75.2 centimeters (cm), with a high of 95 cm and a low of 54.5 cm. The average stature is 161.3 cm, with a high of 173.5 cm and a low of 154 cm. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 3A through 3E.

### Black females

Black females make up the second smallest group for which " waist circum " is recorded in the Terry collection. There are 23 individuals listed below; again too small for statistical significance. The average age for this group is 40.8 years, with a high of 101 years and a low of 17 years. The average weight is 47.4 kg, with a high of 98.0 kg and a low of 27.8 kg. The average waist measurement is 72.0 cm, with a high of 127.0 cm and a low of 52.0 cm. The average stature is 157.8 cm, with a high of 170.0 cm and a low of 126.0 cm. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 4A through 4E.




Model Equation

**Weight = - 0.9750 + 0.6429 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.4875** |
| Root MSE | 8.6385 | Adj R-Sq | 0.4234 |

Analysis of Variance

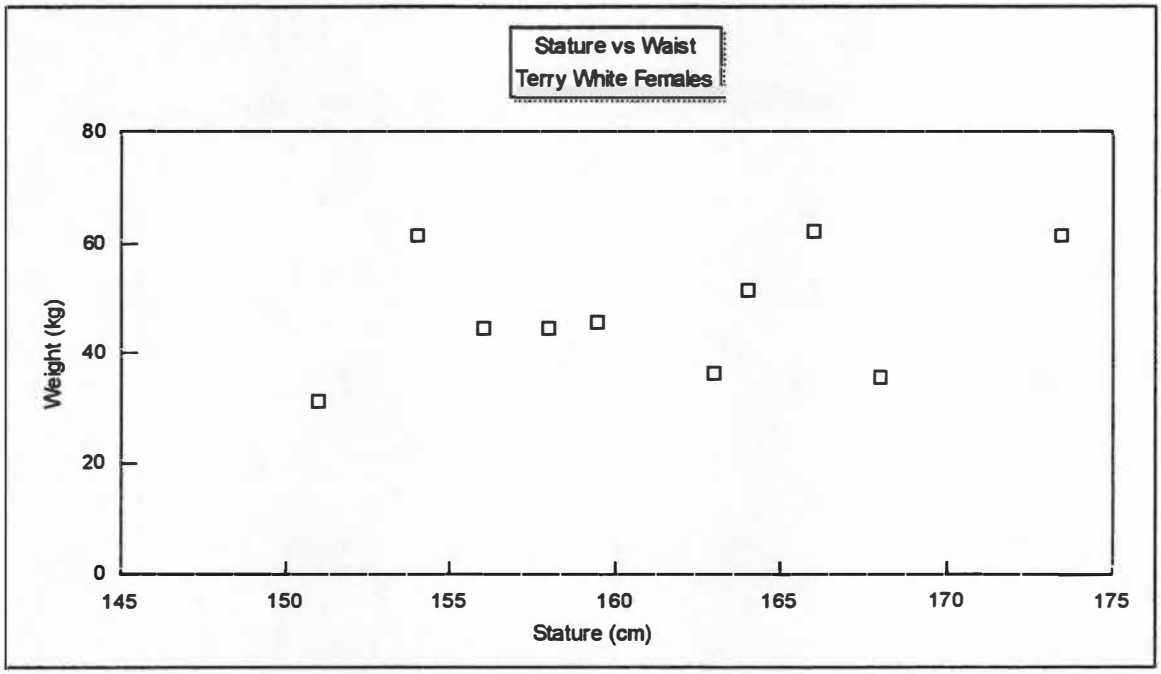
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 567.8469 | 567.8469 | 7.6094 | 0.0247 |
| Error | 8 | 596.9931 | 74.6241 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -0.9750 | 17.7481 | -0.0549 | 0.9575 | - | 0 |
| Waist | 1 | 0.6429 | 0.2331 | 2.7585 | 0.0247 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 3. Weight Estimation For Terry White Females.**




Model Equation

**Weight = - 45.8303 + 0.5780 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.1226** |
| Root MSE | 11.3026 | Adj R-Sq | 0.0130 |

Analysis of Variance

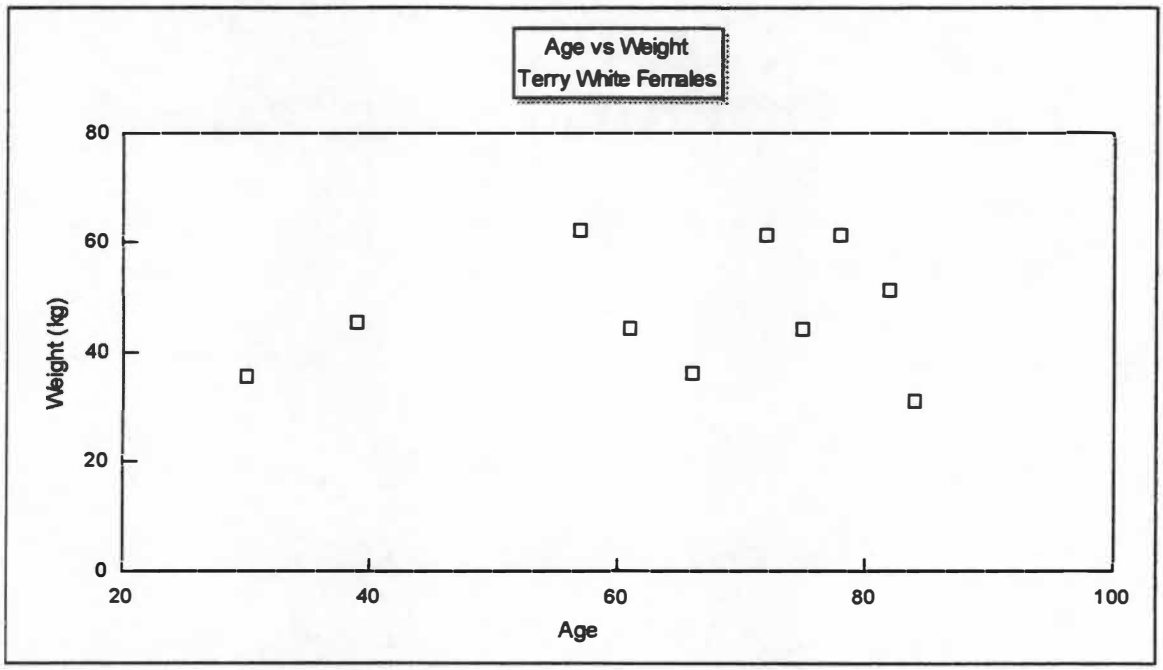
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 142.8511 | 142.8511 | 1.1182 | 0.3212 |
| Error | 8 | 1021.9889 | 127.7486 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -45.8303 | 88.2369 | -0.5194 | 0.6175 | - | 0 |
| Stature | 1 | 0.5780 | 0.5466 | 1.0575 | 0.3212 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 3 (Continued).**




Model Equation

**Weight = 39.7871 + 0.1182 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.0353** |
| Root MSE | 11.8515 | Adj R-Sq | 0.0 |

Analysis of Variance

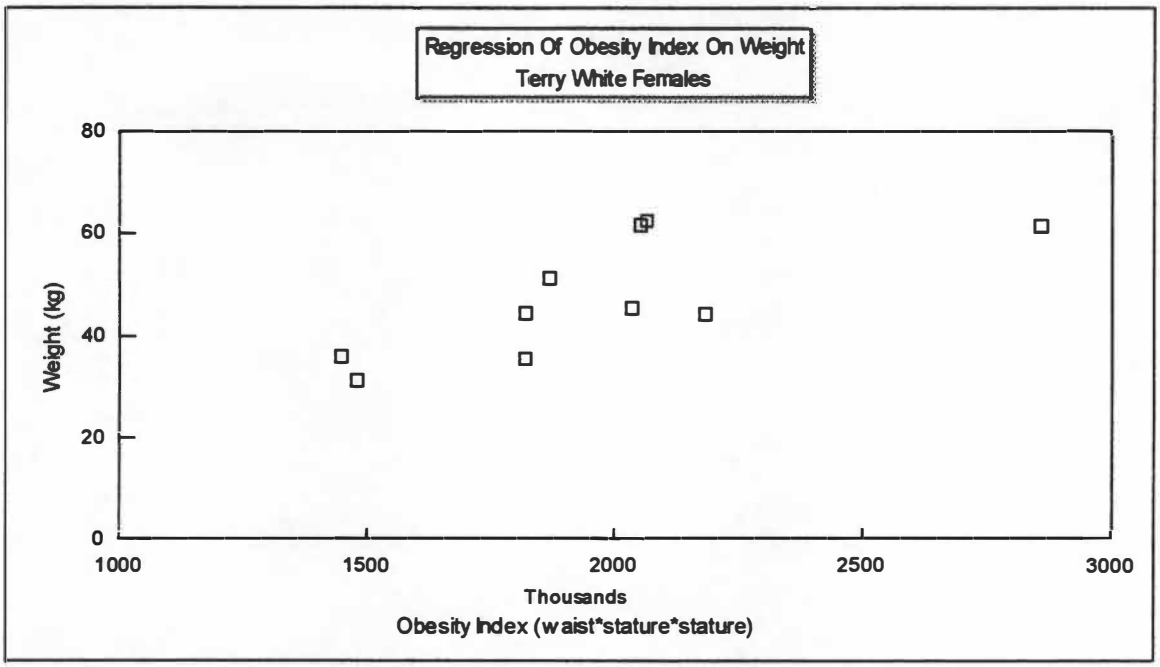
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 41.1733 | 41.1733 | 0.2931 | 0.6030 |
| Error | 8 | 1123.6667 | 140.4583 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 39.7871 | 14.5518 | 2.7342 | 0.0257 | - | 0 |
| Age | 1 | 0.1182 | 0.2183 | 0.5414 | 0.6030 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 3 (Continued).**




**Obesity Index**
Index = Waist * $(Stature)^2$

Model Equation
**Weight = 6.3929 + 2.1E -5 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.5323** |
| Root MSE | 8.2527 | Adj R-Sq | 0.4738 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 619.9881 | 619.9881 | 9.1032 | 0.0166 |
| Error | 8 | 544.8519 | 68.1065 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 6.3929 | 16.8396 | 0.04619 | 0.6564 | - | 0 |
| Index | 1 | 2.088E -5 | 6.92E -5 | 3.0172 | 0.0166 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight**

**Figure 3 (Continued).**

**Multiple Regression of Weight on Stature and Waist**

Model Equation

**Weight = - 70.3735 + 0.4443 * Stature + 0.6128 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4000 | **R-Square** | **0.5589** |
| Root MSE | 8.5676 | Adj. R-Sq | 0.4329 |

Analysis of Variance

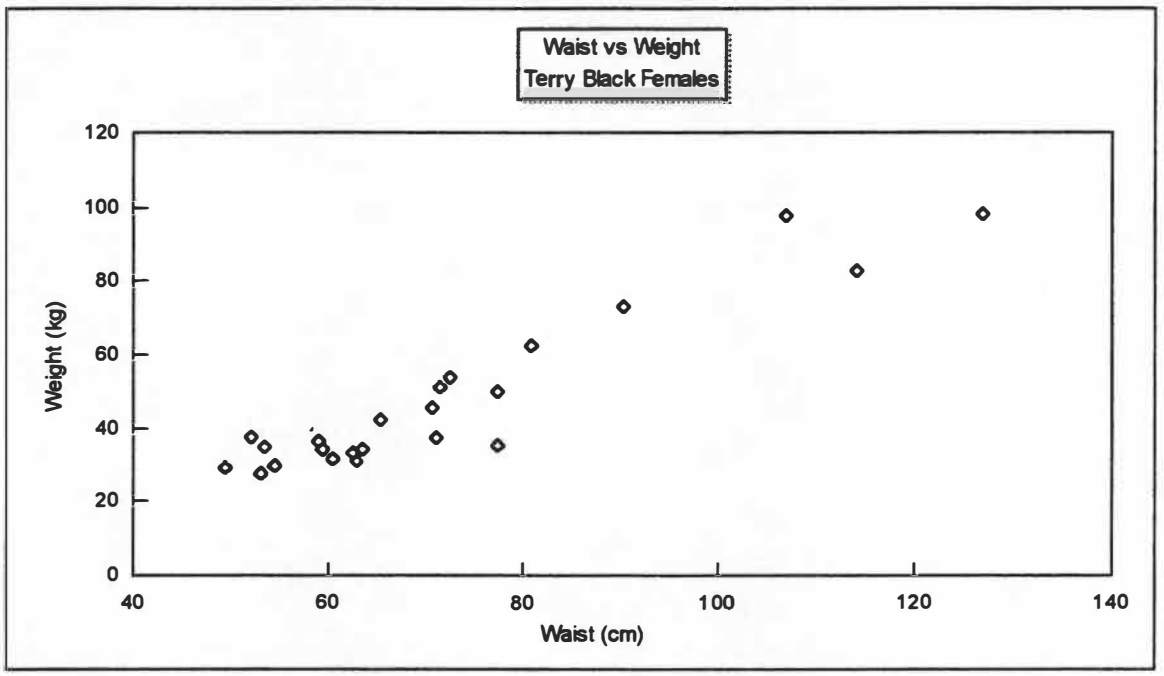
| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 651.0129 | 325.5064 | 4.4345 | 0.0570 |
| Error | 7 | 513.8271 | 73.4039 | | |
| C Total | 9 | 1164.8400 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -70.3735 | 67.5328 | -1.0421 | 0.3320 | - | 0 |
| Stature | 1 | 0.4443 | 0.4174 | 1.0644 | 0.3225 | 0.9852 | 1.0150 |
| Waist | 1 | 0.6128 | 0.2329 | 2.6311 | 0.0339 | 0.9852 | 1.0150 |

**E. Multiple regression of stature and waist on weight**

**Figure 3 (Continued).**




Model Equation

**Weight = -23.6321 + 0.9874 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4435 | **R-Square** | **0.8875** |
| Root MSE | 7.3343 | Adj R-Sq | 0.8822 |

Analysis of Variance

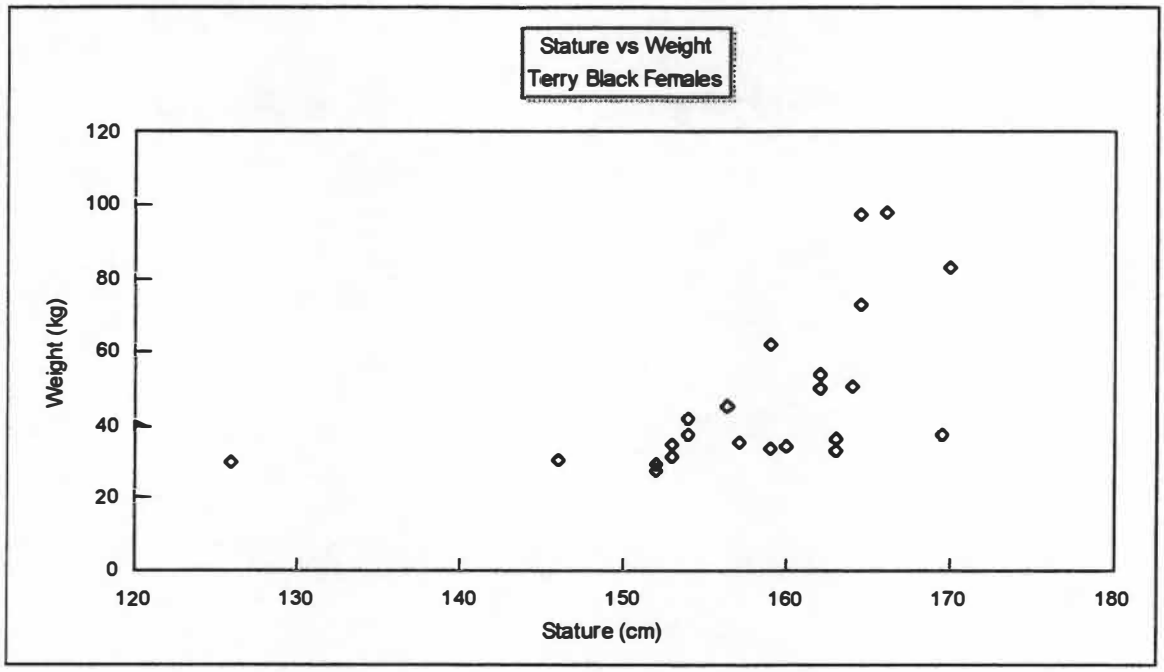
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 8912.3332 | 8912.3332 | 165.6827 | 0.0001 |
| Error | 21 | 1129.6234 | 53.7916 | | |
| C Total | 22 | 10041.9565 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -23.6321 | 5.7297 | -4.1245 | 0.0005 | - | 0 |
| Waist | 1 | 0.9874 | 0.0767 | 12.8718 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight.**

**Figure 4. Weight estimation for Terry black females**




Model Equation

**Weight = -148.289 + 1.2402 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4435 | **R-Square** | **0.2870** |
| Root MSE | 18.4643 | Adj R-Sq | 0.2531 |

Analysis of Variance

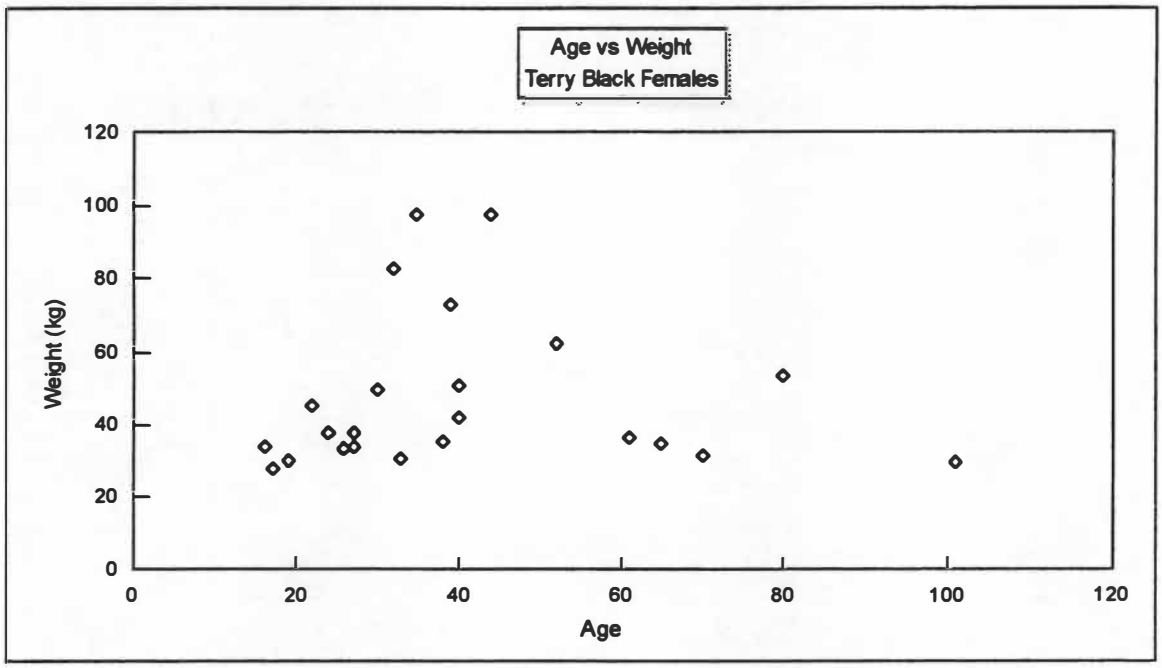
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2882.4082 | 2882.4082 | 8.4545 | 0.0084 |
| Error | 21 | 7159.5483 | 340.9309 | | |
| C Total | 22 | 10041.9565 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -148.2888 | 67.4260 | -2.1993 | 0.0392 | - | 0 |
| Stature | 1 | 1.2402 | 0.4265 | 2.9077 | 0.0084 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 4 (Continued).**




Model Equation

**Weight = 47.8013 - 0.0088 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4435 | **R-Square** | **7.9E -5** |
| Root MSE | 21.8667 | Adj R-Sq | 0.0 |

Analysis of Variance

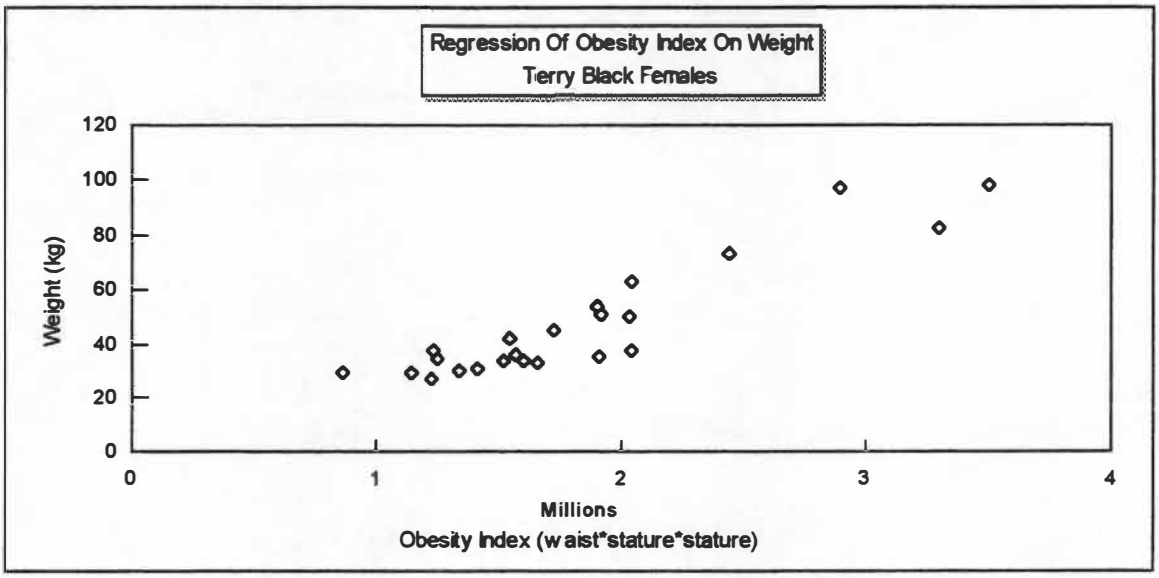
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 0.7956 | 0.7956 | 0.0017 | 0.9678 |
| Error | 21 | 10041.1609 | 478.1505 | | |
| C Total | 22 | 10041.9565 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 47.8013 | 9.8859 | 4.8353 | 0.0001 | - | 0 |
| Age | 1 | -0.0088 | 0.2151 | -0.0408 | 0.9678 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 4 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = - 6.8084 + 3.0E -5 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4435 | **R-Square** | **0.8561** |
| Root MSE | 8.2947 | Adj R-Sq | 0.8493 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 8597.1213 | 8597.1213 | 124.9551 | 0.0001 |
| Error | 21 | 1444.8352 | 68.8017 | | |
| C Total | 22 | 10041.9565 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 6.8084 | 5.1523 | - 1.3214 | 0.2006 | - | 0 |
| Index | 1 | 2.964E -5 | 2.652E -5 | 11.1783 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight**

**Figure 4 (Continued).**

**Multiple Regression of Weight on Stature and Waist**

Model Equation

**Weight = - 25.9614 + 0.0167 * Stature + 0.9831 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 47.4435 | **R-Square** | **0.8875** |
| Root MSE | 7.5142 | Adj. R-Sq | 0.8763 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 8912.6899 | 4456.3450 | 78.9246 | 0.0001 |
| Error | 27 | 1129.2666 | 56.4633 | | |
| C Total | 29 | 10041.9565 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -25.9614 | 29.8838 | - 0.8687 | 0.3953 | - | 0 |
| Stature | 1 | 0.0167 | 0.2101 | 0.0795 | 0.9374 | 0.6825 | 1.4652 |
| Waist | 1 | 0.9831 | 0.0951 | 10.3344 | 0.0001 | 0.6825 | 1.4652 |

**E. Multiple regression of stature and waist regressed on weight**

**Figure 4 (Continued).**

White males

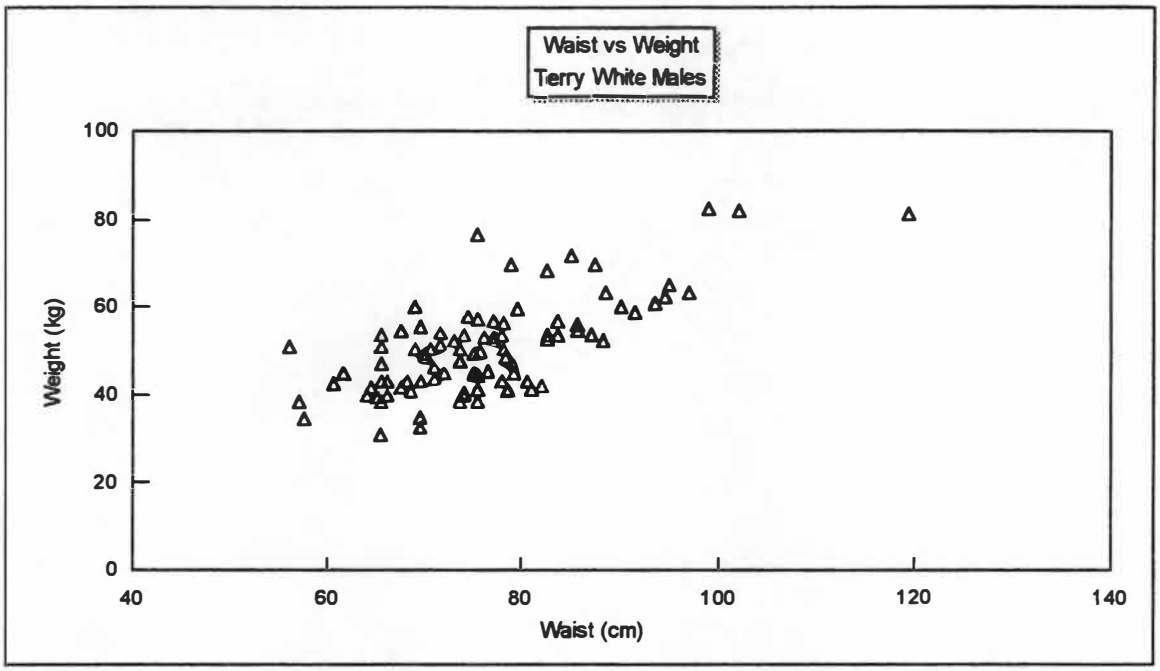
White males constitute the largest group in the Terry collection for which a waist circumference measurement is recorded; there are 91 individuals. The average age for the group is 58.9 years, with a high of 85 years and a low of 28 years. The average weight is 51.1 kg, with a high of 82.8 kg and a low of 31.0 kg. The average waist measurement is 76.1 cm, with a high of 119.5 cm and a low of 57.0 cm. The average stature is 170.0 cm, with a high of 186.0 cm and a low of 153.0 cm. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 5A through 5E.

Black males

There are 76 individuals in this group for which waist circum was recorded. The average age is 46.5 years, with a high of 88 years and a low of 17 years. The average weight is 51.5 kg, with a high of 79.6 kg and a low of 32.4 kg. The average waist measurement is 71.9 cm, with a high of 96.0 cm and a low of 48.5 cm. The average stature is 172.8 cm, with a high of 195.0 cm and a low of 156.0 cm. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 6A through 6E.

All Terry individuals

The following series of graphs contain all data from the four Terry collection groups combined. It can be argued that each individual Terry group may have a peculiar influence on how the regression methods compare to one another. Several reasons such as number of data points, sex differences, or racial differences in physical




Model Equation

**Weight = -3.8373 + 0.7221 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.1946 | **R-Square** | **0.4893** |
| Root MSE | 7.7182 | Adj R-Sq | 0.4836 |

Analysis of Variance

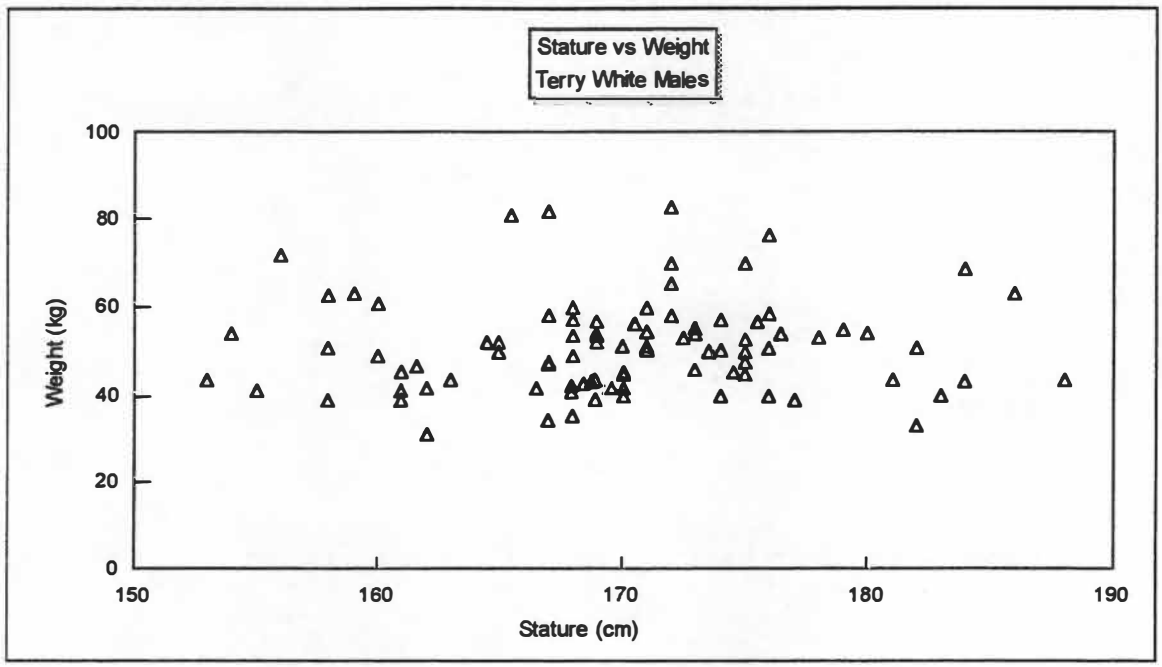
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 5137.1390 | 5137.1390 | 86.5326 | 0.0001 |
| Error | 90 | 5361.3883 | 59.5710 | | |
| C Total | 91 | 10498.5273 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 3.8373 | 5.9805 | - 0.6416 | 0.5227 | - | 0 |
| Waist | 1 | 0.7221 | 0.0778 | 9.2863 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 5. Weight estimate for Terry white males.**




Model Equation

**Weight = 40.2049 + 0.0646 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.1946 | **R-Square** | **0.0019** |
| Root MSE | 10.7903 | Adj R-Sq | 0.0 |

Analysis of Variance

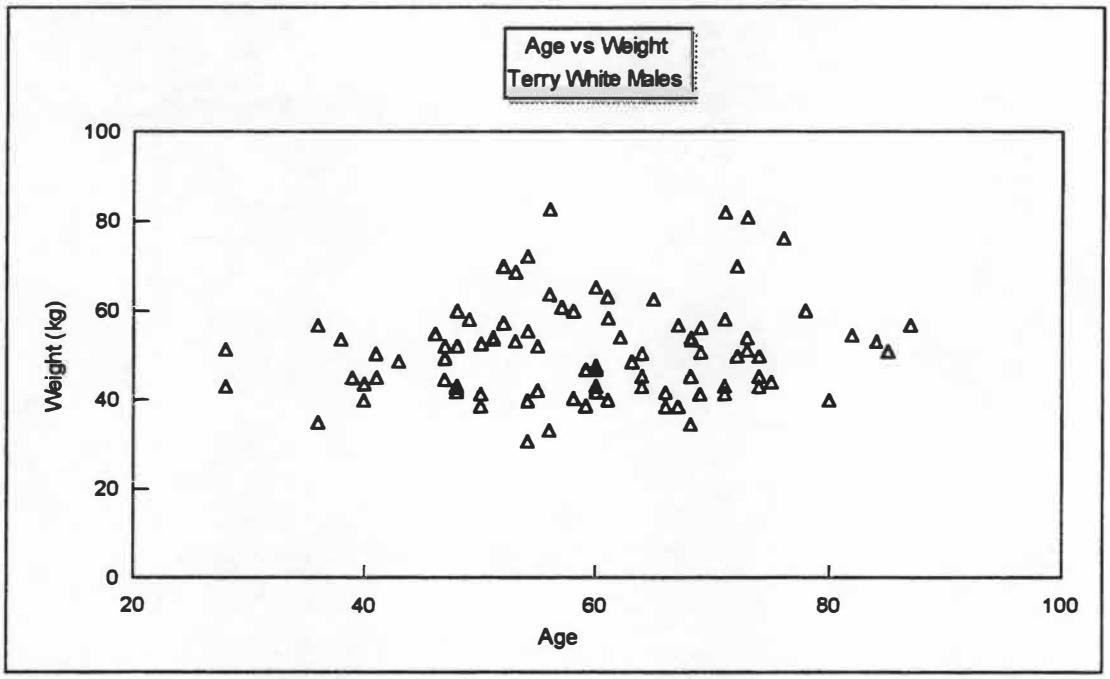
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 19.7951 | 19.7951 | 0.1700 | 0.6811 |
| Error | 90 | 10478.7322 | 116.4304 | | |
| C Total | 91 | 10498.5273 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 40.2049 | 26.6763 | 1.5071 | 0.1353 | - | 0 |
| Stature | 1 | 0.0646 | 0.1567 | 0.4123 | 0.6811 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 5 (Continued).**




Model Equation

**Weight = 43.6960 + 0.1250 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.0615 | **R-Square** | **0.0225** |
| Root MSE | 10.6618 | Adj R-Sq | 0.0116 |

Analysis of Variance

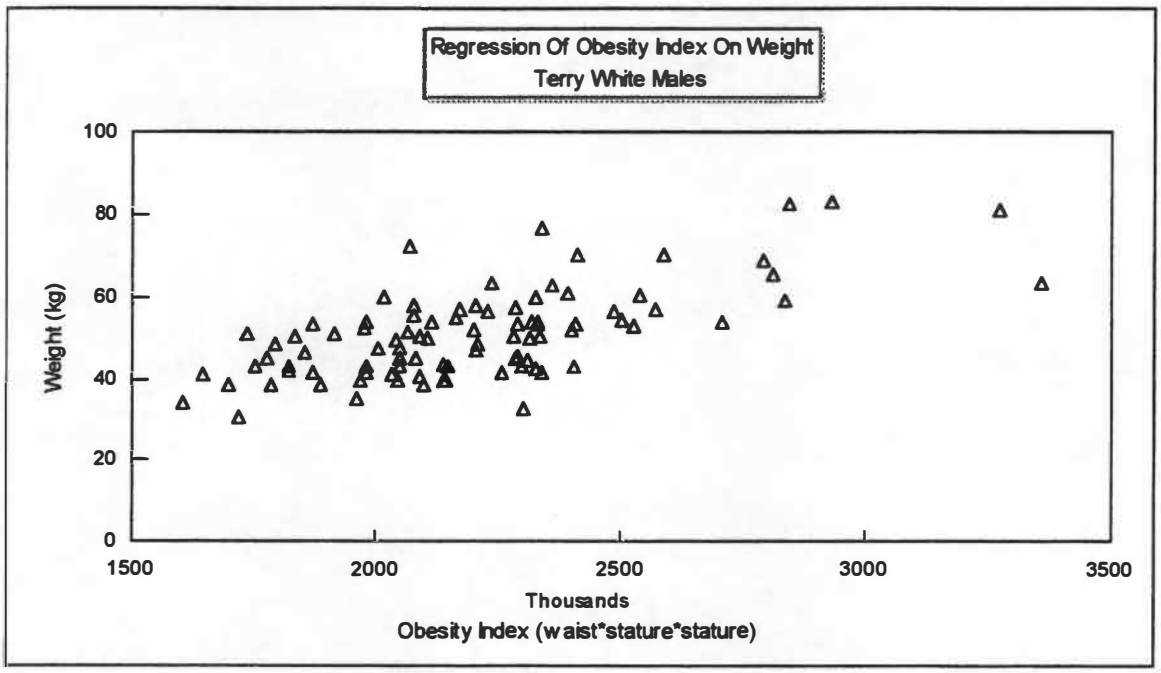
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 233.3743 | 233.3743 | 2.0530 | 0.1554 |
| Error | 90 | 10117.0011 | 113.6742 | | |
| C Total | 91 | 10350.3754 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 43.6960 | 5.2607 | 8.3062 | 0.0001 | - | 0 |
| Age | 1 | 0.1250 | 0.0873 | 1.4328 | 0.1554 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 5 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = 2.9168 + 2.2E -5 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.1946 | **R-Square** | **0.4429** |
| Root MSE | 8.0615 | Adj R-Sq | 0.4367 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 4649.6355 | 4649.6355 | 71.5464 | 0.0001 |
| Error | 90 | 5848.8918 | 64.9877 | | |
| C Total | 91 | 10498.5273 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 2.9168 | 5.7691 | 0.5056 | 0.6144 | - | 0 |
| Index | 1 | 2.192E -05 | 2.591E -06 | 8.4585 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight**

**Figure 5 (Continued).**

**Multiple Regression of Weight on Stature and Waist**

Model Equation

**Weight = - 49.8249 + 0.2564 * Stature + 0.7535 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.1946 | **R-Square** | **0.5181** |
| Root MSE | 7.5398 | Adj. R-Sq | 0.5072 |

Analysis of Variance

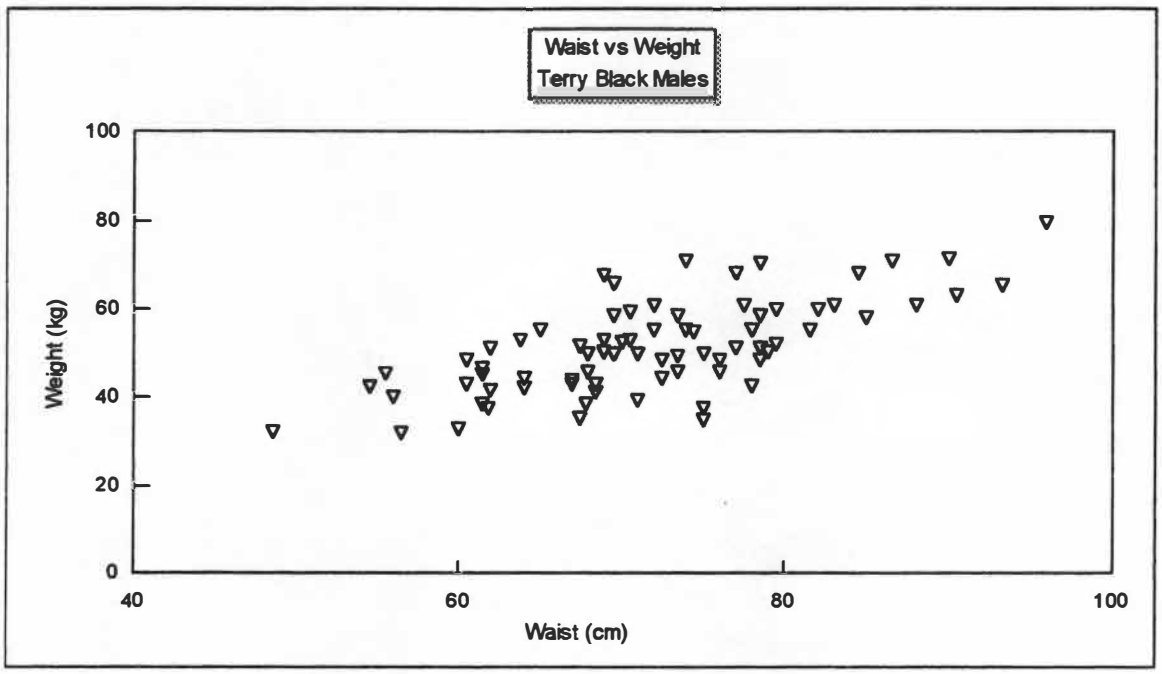
| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 5438.9467 | 2719.4734 | 47.8366 | 0.0001 |
| Error | 89 | 5059.5806 | 56.8492 | | |
| C Total | 91 | 10498.5273 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 49.8249 | 20.7964 | - 2.3958 | 0.0187 | - | 0 |
| Stature | 1 | 0.2564 | 0.1113 | 2.3041 | 0.0235 | 0.9668 | 1.0322 |
| Waist | 1 | 0.7535 | 0.0772 | 9.7635 | 0.0001 | 0.9668 | 1.0322 |

**E. Multiple regression of stature and waist on weight**

**Figure 5 (Continued).**




Model Equation

**Weight = - 4.4588 + 0.7782 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5118 | **R-Square** | **0.4811** |
| Root MSE | 7.5740 | Adj R-Sq | 0.4741 |

Analysis of Variance

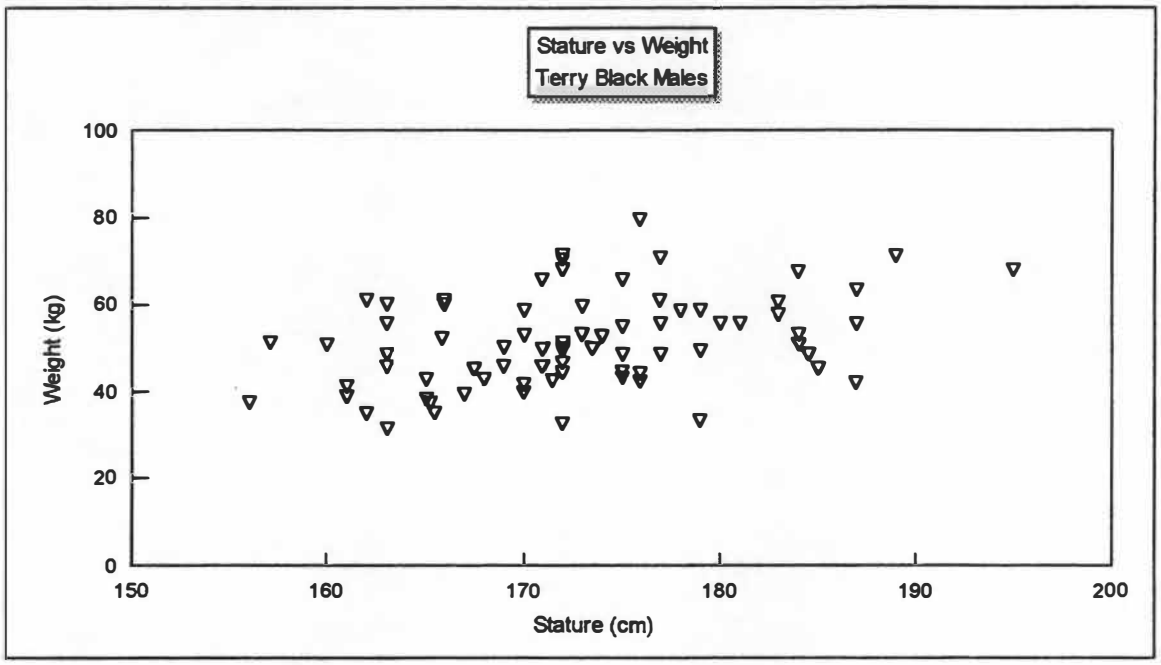
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 3935.3039 | 3935.3039 | 68.6004 | 0.0001 |
| Error | 74 | 4245.0555 | 57.3656 | | |
| C Total | 75 | 8180.3593 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 4.4588 | 6.8133 | - 0.6544 | 0.5149 | - | 0 |
| Waist | 1 | 0.7782 | 0.0940 | 8.2825 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 6. Weight estimate for Terry black males.**




Model Equation

**Weight = - 34.0155 + 0.4951 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5118 | **R-Square** | **0.1452** |
| Root MSE | 9.7210 | Adj R-Sq | 0.1336 |

Analysis of Variance

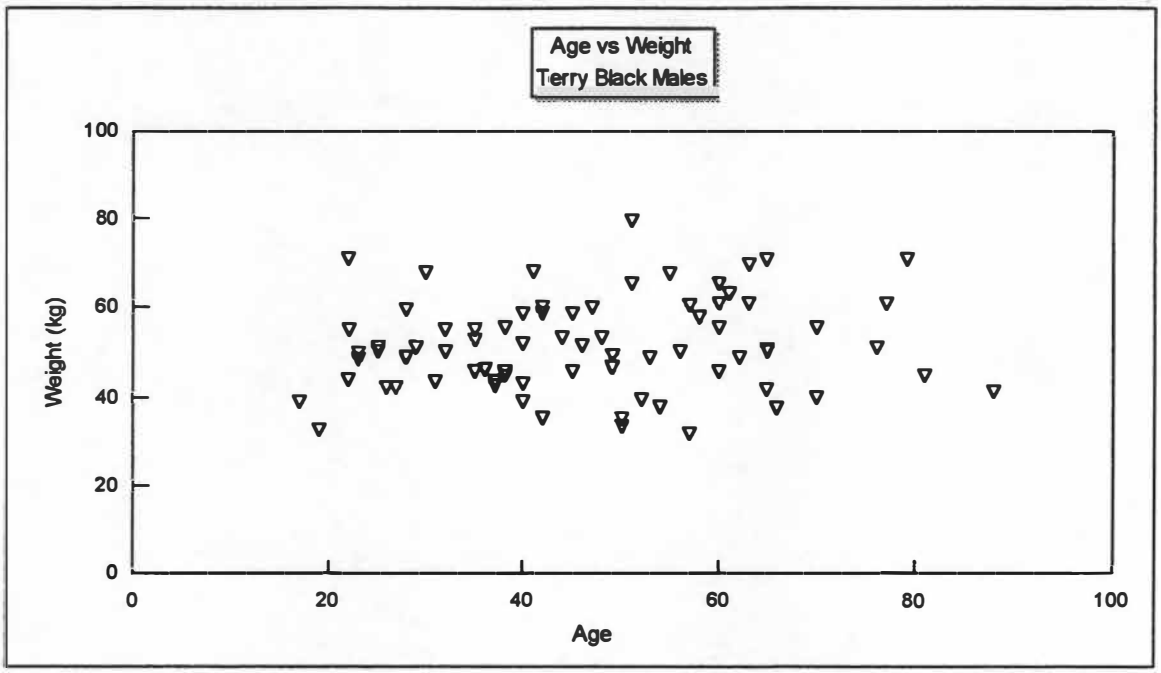
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1187.4943 | 1187.4943 | 12.5663 | 0.0007 |
| Error | 74 | 6992.8650 | 94.4982 | | |
| C Total | 75 | 8180.3593 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 34.0155 | 24.1526 | - 1.4084 | 0.1632 | - | 0 |
| Stature | 1 | 0.4951 | 0.1397 | 3.5449 | 0.0007 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 6 (Continued).**




Model Equation

**Weight = 47.2453 + 0.0916 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5053 | **R-Square** | **0.0210** |
| Root MSE | 10.4008 | Adj R-Sq | 0.0077 |

Analysis of Variance

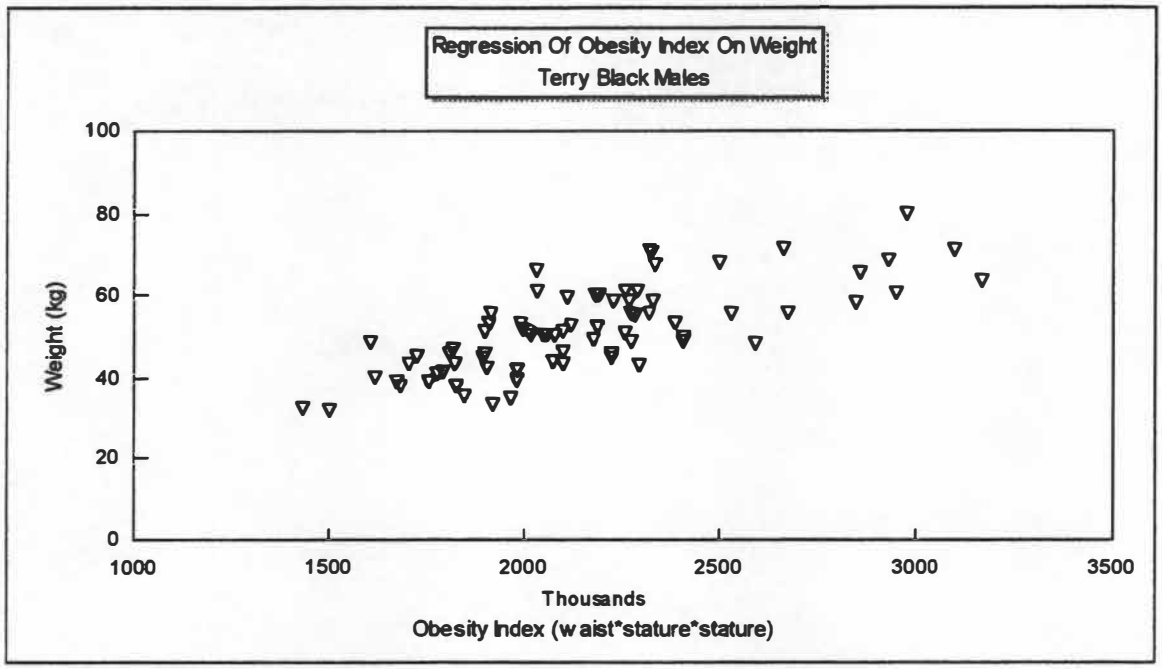
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 171.4878 | 171.4878 | 1.5852 | 0.2120 |
| Error | 74 | 8005.1301 | 108.1774 | | |
| C Total | 75 | 8176.6179 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 47.2453 | 3.5876 | 13.1691 | 0.0001 | - | 0 |
| Age | 1 | 0.0916 | 0.0728 | 1.2591 | 0.2120 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 6 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = - 3.0408 + 0.0044 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5118 | **R-Square** | **0.5657** |
| Root MSE | 6.9291 | Adj R-Sq | 0.5598 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 4627 .4508 | 4627.4508 | 96.3806 | 0.0001 |
| Error | 74 | 2325.1085 | 77.5036 | | |
| C Total | 75 | 15309.9010 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 3.0408 | 5.6133 | - 0.5417 | 0.5896 | - | 0 |
| Index | 1 | 0.0044 | 0.0004 | 9.8174 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight**

**Figure 6 (Continued).**

**Multiple Regression of Stature and Waist on Weight**

Model Equation

**Weight = - 71.3197 + 0.4026 * Stature + 0.7407 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 51.5118 | **R-Square** | **0.5760** |
| Root MSE | 6.8933 | Adj. R-Sq | 0.5643 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 4711.5744 | 2355.7872 | 49.5771 | 0.0001 |
| Error | 73 | 3468.7849 | 47.5176 | | |
| C Total | 75 | 8180.3593 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 71.3197 | 17.6662 | - 4.0371 | 0.0001 | - | 0 |
| Stature | 1 | 0.7137 | 0.0996 | 4.0418 | 0.0001 | 0.9884 | 1.0118 |
| Waist | 1 | 0.7407 | 0.0860 | 8.6118 | 0.0001 | 0.9884 | 1.0118 |

**E. Multiple regression of stature and waist on weight**

**Figure 6 (Continued).**

measurements may play a part in determining how accurate a particular regression method is at estimating forensic weight. Differences in sex are more obvious because males and females differ in both average stature and general body fat distribution. Racial differences may be less useful, although there are known differences in fat distribution of the hips for one group of southern African females (Molinar, 1992). Putting all data points together will help to show the generalized trends in overall comparison of weight regression methods. Figures 7A through 7E will show the data in the same graphic detail as the figures for each of the four groups individually.

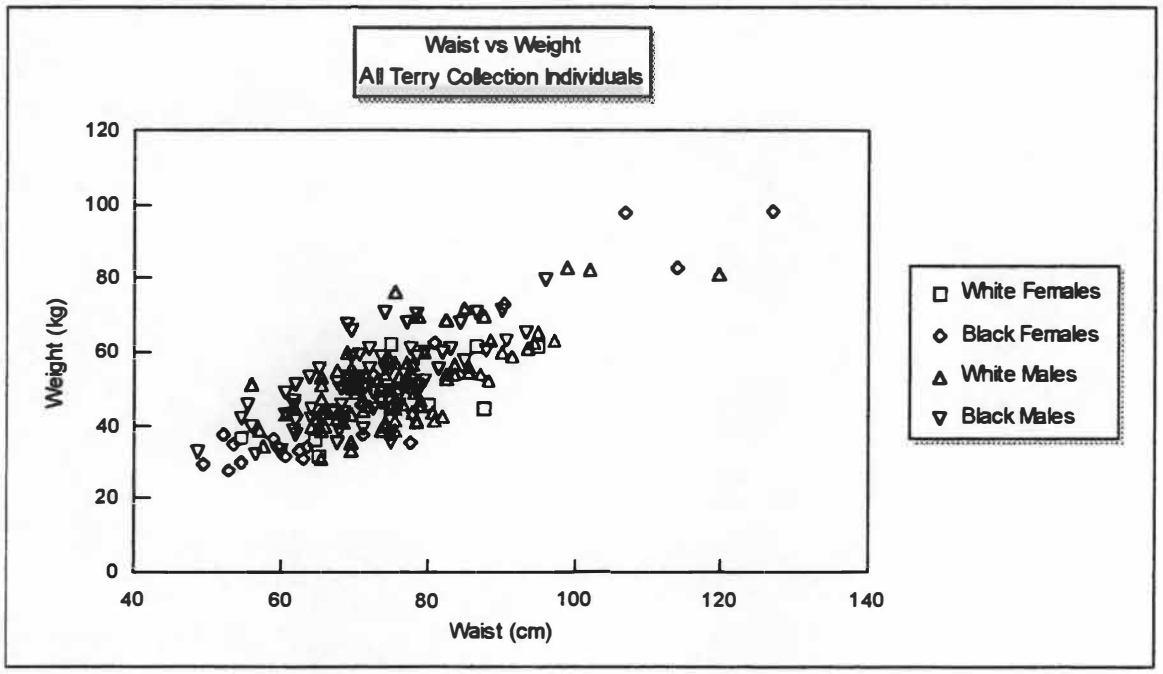
## LIVING BODY MEASUREMENTS

### White Females

Data for the living white females consists of a total of 30 individuals. The average age is 35.3 years, with a high of 74 and a low of 20. The average weight is 77.06 kg, with a high of 121.6 kg and a low of 53.97 kg. The average waist is 84.5 cm, with a high of 132.1 cm and a low of 59.69 cm. The average stature is 167.3 cm, with a high of 177.8 cm and a low of 152.4 cm. All data in its raw form and in the metric conversion will appear in appendix C at the end of this thesis. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 8A through 8E.

### Black Females

Data for the living black females consists of 31 individuals. The average age is 29.8 years, with a high of 54 and a low of 18. The average weight is 70.8 kg, with a high of




Model Equation

**Weight = - 8.1917 + 0.7959 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 50.6975 | **R-Square** | **0.5808** |
| Root MSE | 7.9585 | Adj R-Sq | 0.5787 |

Analysis of Variance

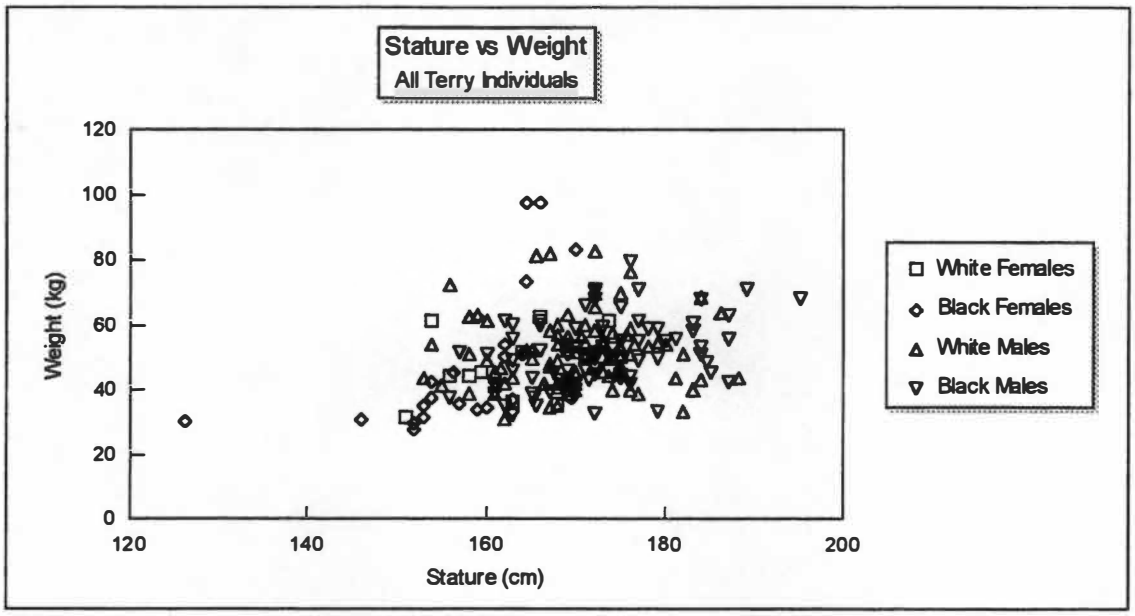
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 17636.4161 | 17636.4161 | 278.4506 | 0.0001 |
| Error | 201 | 12730.8726 | 63.3377 | | |
| C Total | 202 | 30367.2888 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 8.1917 | 3.5730 | - 2.2927 | 0.0229 | - | 0 |
| Waist | 1 | 0.7959 | 0.0477 | 16.6868 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 7. Weight estimation for all Terry individuals collectively.**




Model Equation

**Weight = -17.6466 + 0.4039 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 50.6975 | **R-Square** | **0.0895** |
| Root MSE | 11.7284 | Adj R-Sq | 0.0850 |

Analysis of Variance

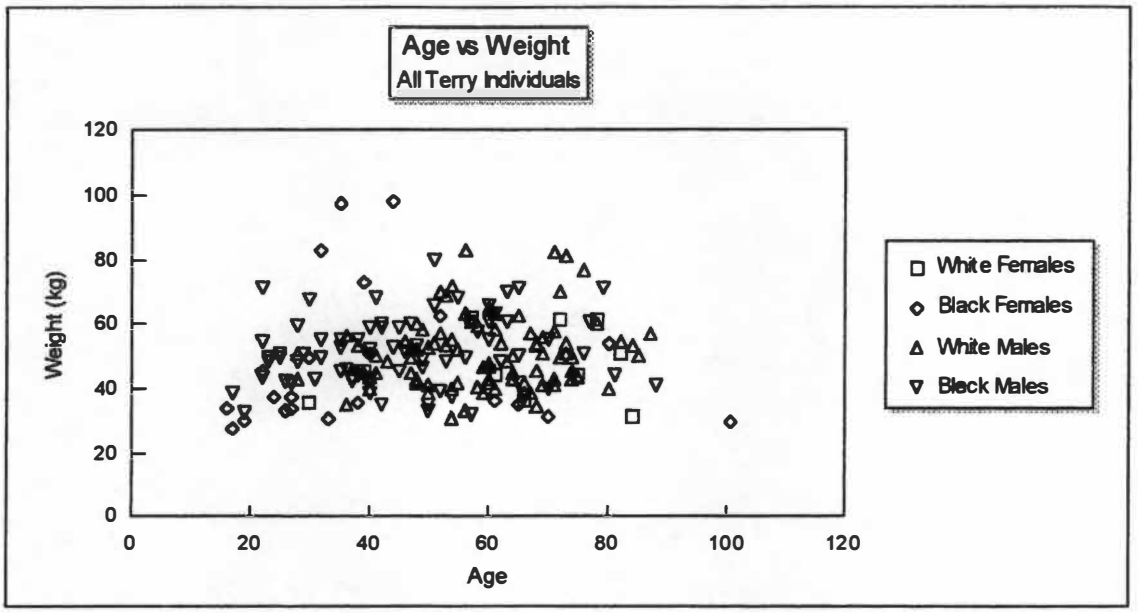
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2718.8665 | 2718.8665 | 19.7658 | 0.0001 |
| Error | 201 | 27648.4223 | 137.5543 | | |
| C Total | 202 | 30367.2888 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -17.6466 | 15.3945 | - 1.1463 | 0.2530 | - | 0 |
| Stature | 1 | 0.0439 | 0.0909 | 4.4459 | 0.0001 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 7 (Continued).**




Model Equation

**Weight = 46.8370 + 0.0724 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 50.6310 | **R-Square** | **0.0104** |
| Root MSE | 12.2750 | Adj R-Sq | 0.0054 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 313.0873 | 313.0873 | 2.0779 | 0.1510 |
| Error | 198 | | | | |
| C Total | 199 | | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 46.8370 | 2.7715 | 16.8998 | 0.0001 | - | 0 |
| Age | 1 | 0.0724 | 0.0502 | 1.4415 | 0.1510 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 7 (Continued).**


**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = 1.0603 + 6.9E - 07 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 25.0408 | **R-Square** | **0.5867** |
| Root MSE | 3.9030 | Adj R-Sq | 0.5846 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 4346 .4788 | 4346.4788 | 285.3199 | 0.0001 |
| Error | 201 | 3061.9707 | 15.2337 | | |
| C Total | 202 | 7408.4534 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 1.0603 | 1.4459 | 0.7333 | 0.4642 | - | 0 |
| Index | 1 | 6.88E - 07 | 4.073E - 08 | 16.8914 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight.**

**Figure 7 (Continued).**

**Multiple Regression of Stature and Waist on Weight**

Model Equation

**Weight = - 29.6288 + 0.6014 * Stature + 0.1506 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 25.0408 | **R-Square** | **0.6350** |
| Root MSE | 6.8933 | Adj. R-Sq | 0.6313 |

Analysis of Variance

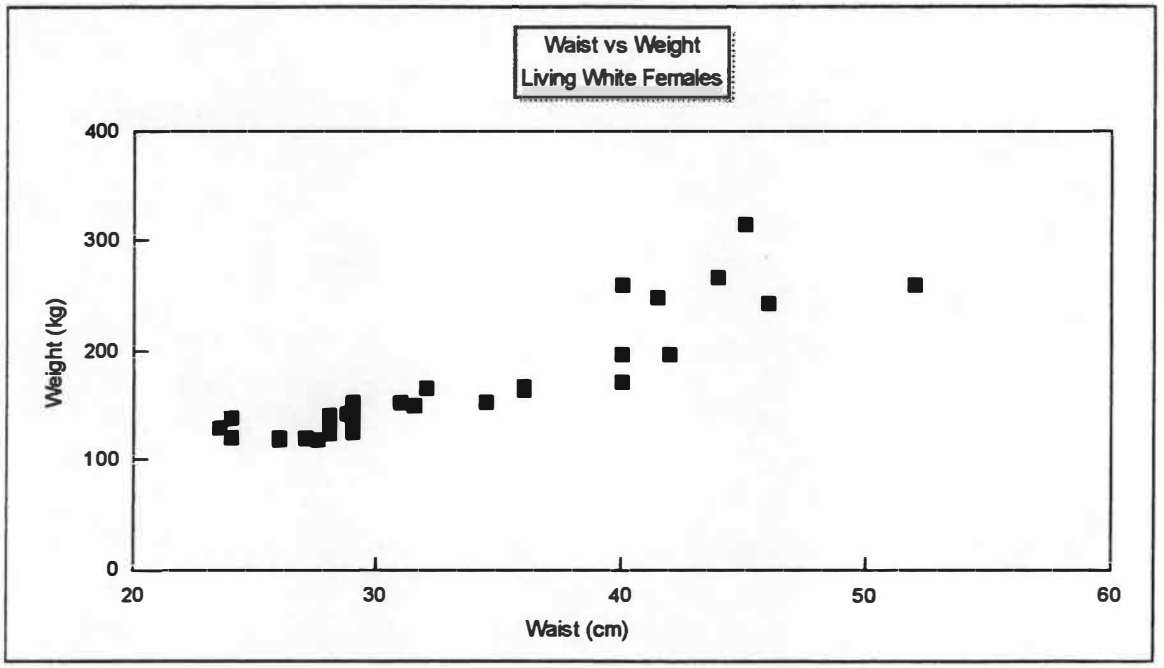
| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 4704.2371 | 2352.1186 | 173.9594 | 0.0001 |
| Error | 201 | 2704.2163 | 13.5211 | | |
| C Total | 202 | 7408.4543 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 29.6288 | 4.9758 | - 5.9546 | 0.0001 | - | 0 |
| Stature | 1 | 0.0614 | 0.0113 | 5.4501 | 0.0001 | 0.9922 | 1.0079 |
| Waist | 1 | 0.1506 | 0.0087 | 17.2876 | 0.0001 | 0.9922 | 1.0079 |

**E. Multiple regression of stature and waist on weight**

**Figure 7 (Continued).**




Model Equation

**Weight = - 19.0501 + 1.1371 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.0586 | **R-Square** | **0.8078** |
| Root MSE | 10.9570 | Adj R-Sq | 0.8010 |

Analysis of Variance

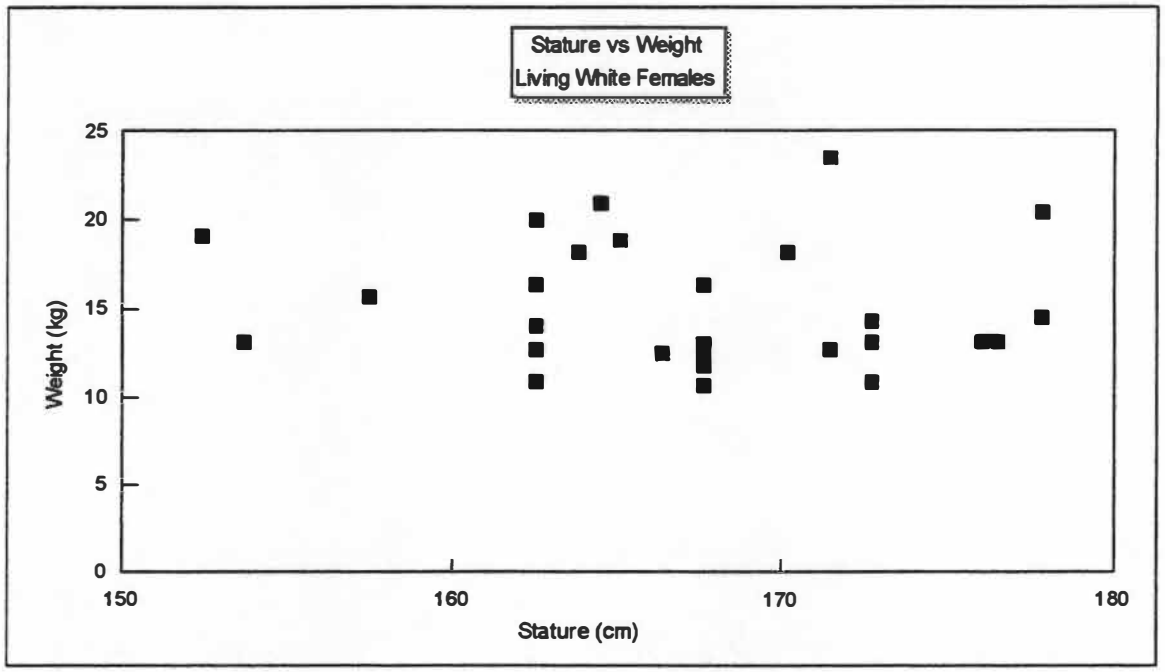
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 14132. 3411 | 14132.3411 | 117.7155 | 0.0001 |
| Error | 28 | 3361.5423 | 120.0551 | | |
| C Total | 29 | 17493.8833 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 19.0501 | 9.0813 | -2.0977 | 0.0451 | - | 0 |
| Waist | 1 | 1.1371 | 0.1048 | 10.8497 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight.**

**Figure 8. Weight estimate for living white females.**




Model Equation

**Weight = 12.3067 + 0.3870 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.0586 | **R-Square** | **0.0100** |
| Root MSE | 24.8707 | Adj R-Sq | 0.0 |

Analysis of Variance

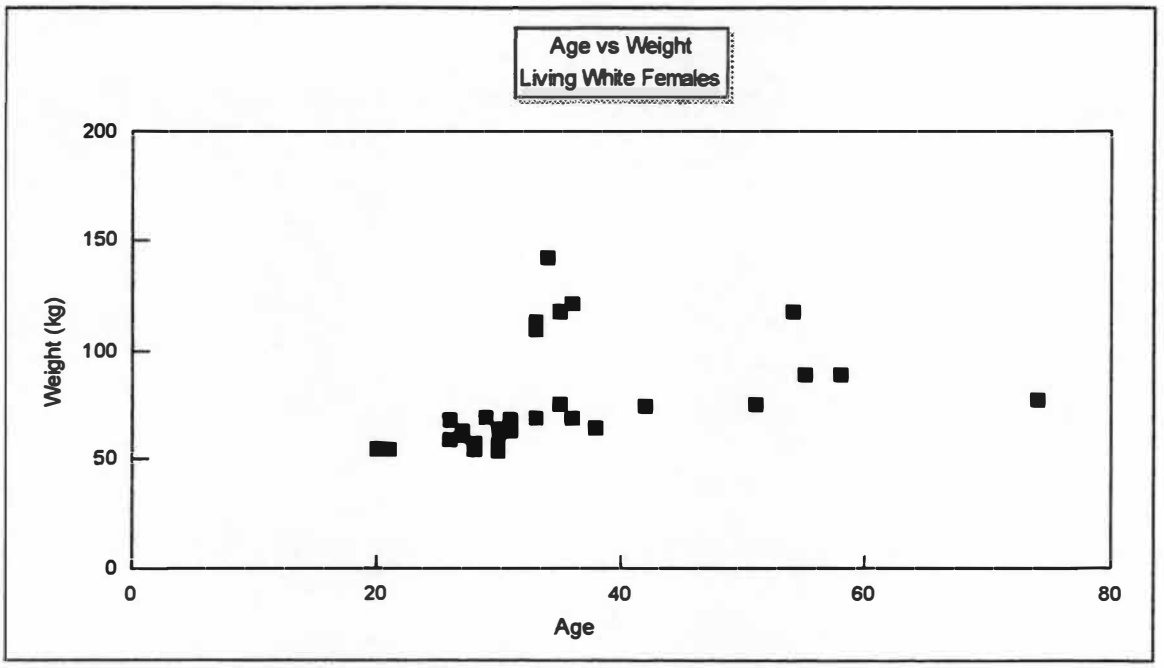
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 174.3678 | 174.3678 | 0.2819 | 0.5996 |
| Error | 28 | 17319.5155 | 618.5541 | | |
| C Total | 29 | 17493.8833 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 12.3067 | 122.0419 | 0.1008 | 0.9204 | - | 0 |
| Waist | 1 | 0.3870 | 0.7290 | 0.5309 | 0.5996 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 8 (Continued).**




Model Equation

**Weight = 50.3007 + 0.7566 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.0586 | **R-Square** | **0.1346** |
| Root MSE | 23.2529 | Adj R-Sq | 0.1037 |

Analysis of Variance

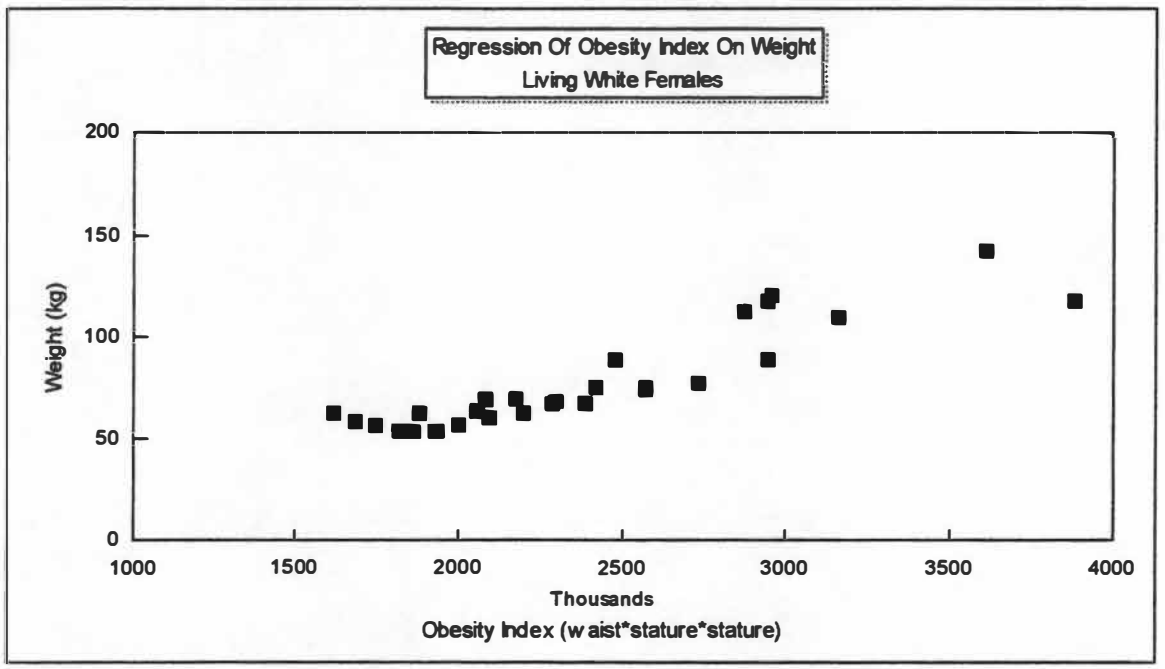
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2354.3407 | 2354.3407 | 4.3543 | 0.04061 |
| Error | 28 | 15139.5426 | 540.6980 | | |
| C Total | 29 | 17493.8833 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 50.3007 | 13.5076 | 3.7239 | 0.0009 | - | 0 |
| Age | 1 | 0.7566 | 0.3626 | 2.0867 | 0.0461 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 8 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = - 16.1917 + 0.000039 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.0586 | **R-Square** | **0.8278** |
| Root MSE | 10.3727 | Adj R-Sq | 0.8216 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 14481.2597 | 14481.2597 | 134.5921 | 0.0001 |
| Error | 28 | 3012.6236 | 107.5937 | | |
| C Total | 29 | 17493.8833 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 16.1917 | 8.2579 | - 1.9607 | 0.0599 | - | 0 |
| Index | 1 | 3.3941E - 05 | 3.397E -5 | 11.6014 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight.**

**Figure 8 (Continued).**

**Multiple Regression of Weight on Stature and Waist**

Model Equation

**Weight = - 130.792 + 0.6595 * Stature + 1.1537 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.0586 | **R-Square** | **0.8366** |
| Root MSE | 10.2899 | Adj. R-Sq | 0.8245 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 14635.6511 | 7317.8255 | 69.1271 | 0.0001 |
| Error | 27 | 2858.2322 | 105.8605 | | |
| C Total | 29 | 17493.8833 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -130.7918 | 51.9512 | -2.5176 | 0.0181 | - | 0 |
| Stature | 1 | 0.6595 | 0.3025 | 2.1805 | 0.0381 | 0.9941 | 1.0060 |
| Waist | 1 | 1.1537 | 0.0987 | 11.6879 | 0.0001 | 0.9941 | 1.0060 |

**E. Multiple regression of stature and waist on weight**

**Figure 8 (Continued).**

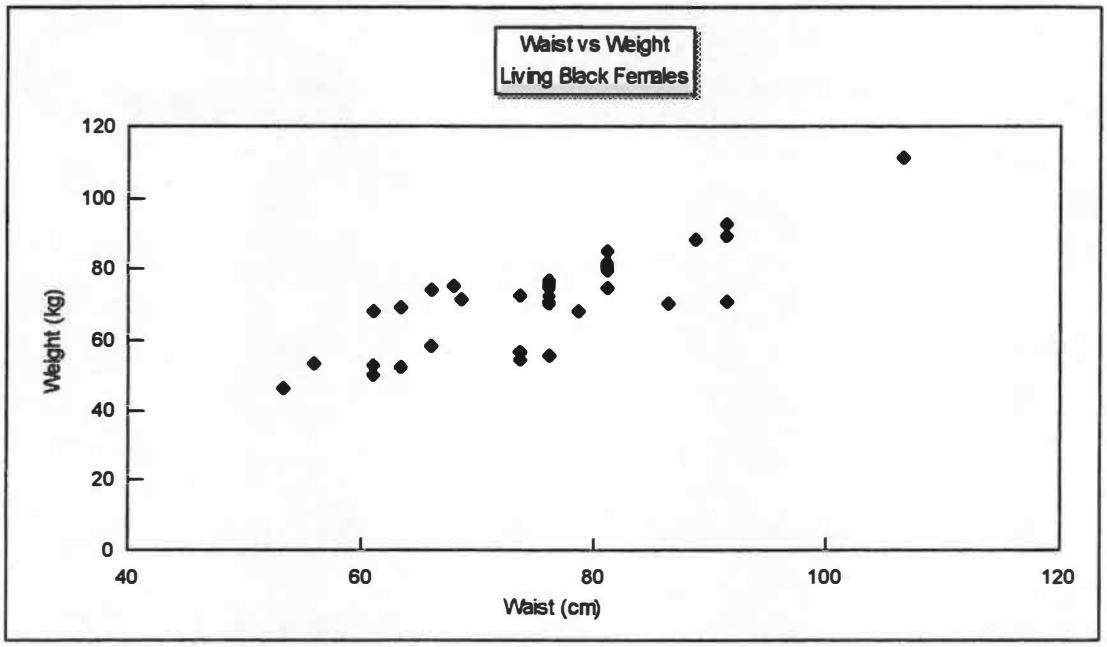
111.1 kg and a low of 46.3 kg. The average waist is 74.5 cm, with a high of 106.7 cm and a low of 53.3 cm. The average stature is 168.5 cm, with a high of 180.3 cm and a low of 157.5 cm. It should also be noted that at least 10 of the 30 black females questioned were born in various countries of the continent of Africa. The data in its raw form and in metric conversion, appears in appendix C at the end of this thesis. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 9A through 9E.

White males

Data for living white males was gathered from a total of 32 individuals. The average age is 33.7 years, with a high of 57 and a low of 18. The average weight is 93.2 kg, with a high of 152.4 kg and a low of 68.0 kg. The average waist is 94.2 cm, with a high of 137.2 cm and a low of 76.2 cm. The average stature is 180.4 cm, with a high of 193.0 cm and a low of 165.1 cm. The raw data and the metric conversion appear in appendix C at the end of this thesis. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 10A through 10E.

Black males

Data for living black males was gathered from a total of 32 individuals. The average age is 42.2 years, with a high of 80 and a low of 19. The average weight is 98.1 kg, with a high of 165.5 kg and a low of 64.2 kg. The average waist is 94.9 cm, with a high of 142.2 cm and a low of 73.7 cm. The average stature is 179.0 cm, with a high of 193.0 cm and a low of 165.1 cm. The raw data and the metric conversion appear in




Model Equation

**Weight = - 4.8866 + 1.0903 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.3568 | **R-Square** | **0.6809** |
| Root MSE | 8.7411 | Adj R-Sq | 0.6706 |

Analysis of Variance

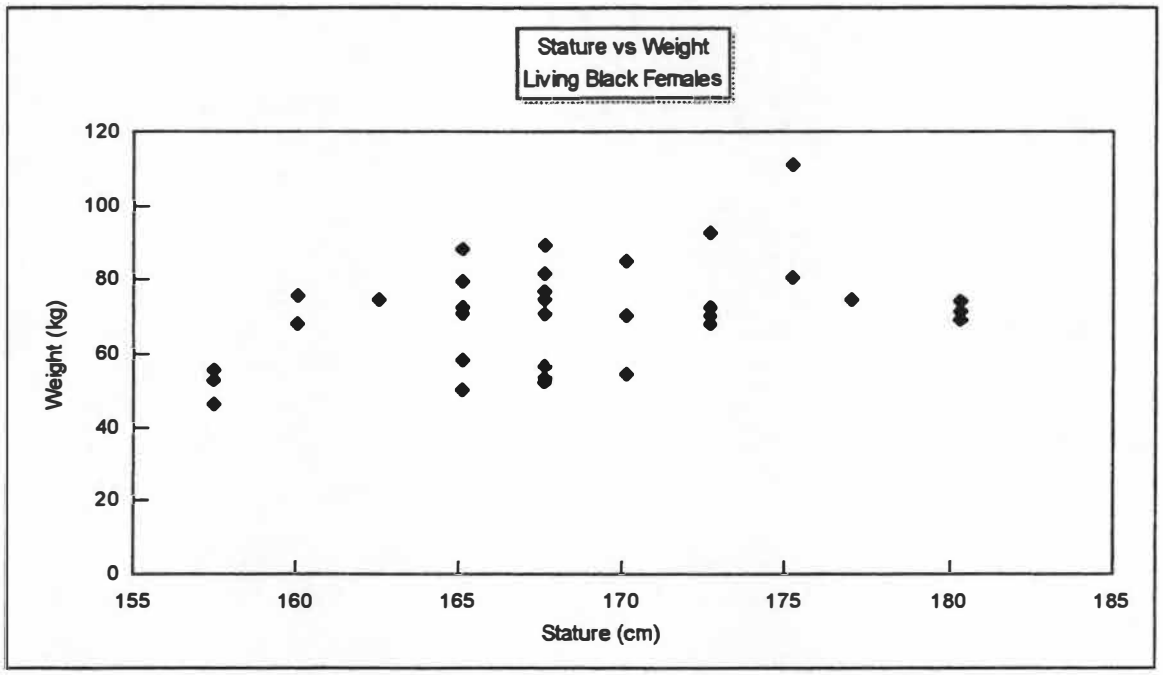
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 5054.0868 | 5054.0868 | 66.1463 | 0.0001 |
| Error | 31 | 2368.6377 | 76.4077 | | |
| C Total | 32 | 7422.7245 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 4.8866 | 10.2261 | - 0.4779 | 0.6361 | - | 0 |
| Waist | 1 | 1.0903 | 0.1341 | 8.1330 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 9. Weight estimate for living black females.**




Model Equation

**Weight = - 85.3451 + 0.9679 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.3568 | **R-Square** | **0.1522** |
| Root MSE | 14.2479 | Adj R-Sq | 0.1248 |

Analysis of Variance

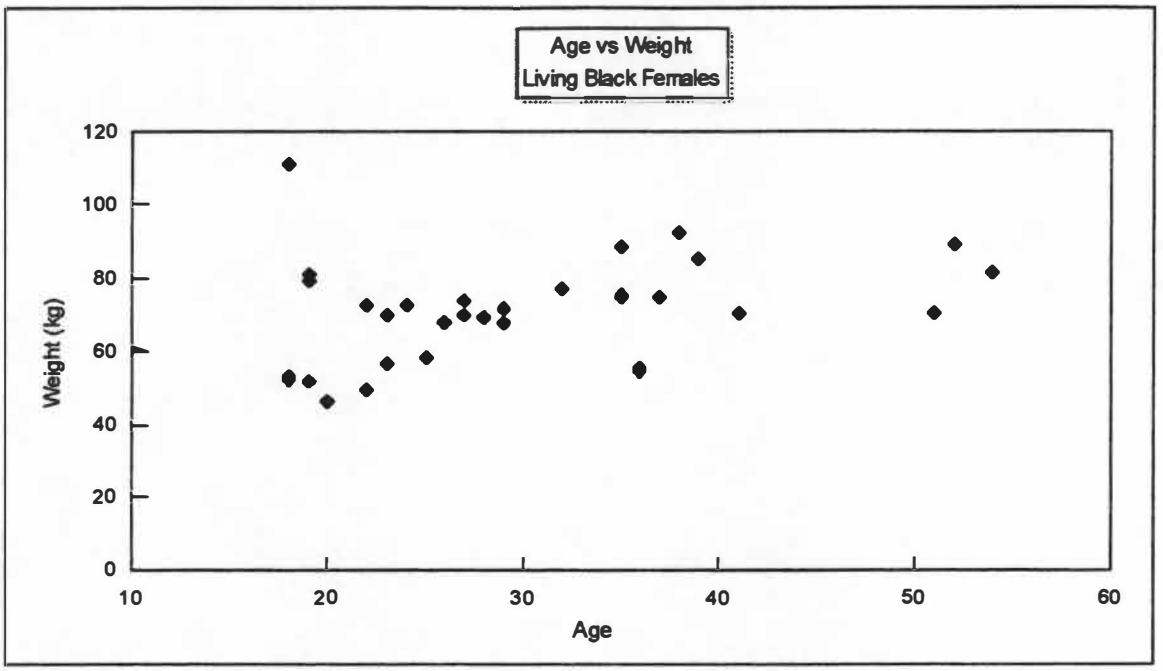
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 1129.6346 | 1129.6346 | 5.5646 | 0.0248 |
| Error | 31 | 6293.0899 | 203.0029 | | |
| C Total | 32 | 7422.7245 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 85.3451 | 69.0169 | -1.2366 | 0.2255 | - | 0 |
| Stature | 1 | 0.9679 | 0.4103 | 2.3589 | 0.0248 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 9 (Continued).**




Model Equation

**Weight = 62.2842 + 0.5004 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.3568 | **R-Square** | **0.1092** |
| Root MSE | 14.6045 | Adj R-Sq | 0.0805 |

Analysis of Variance

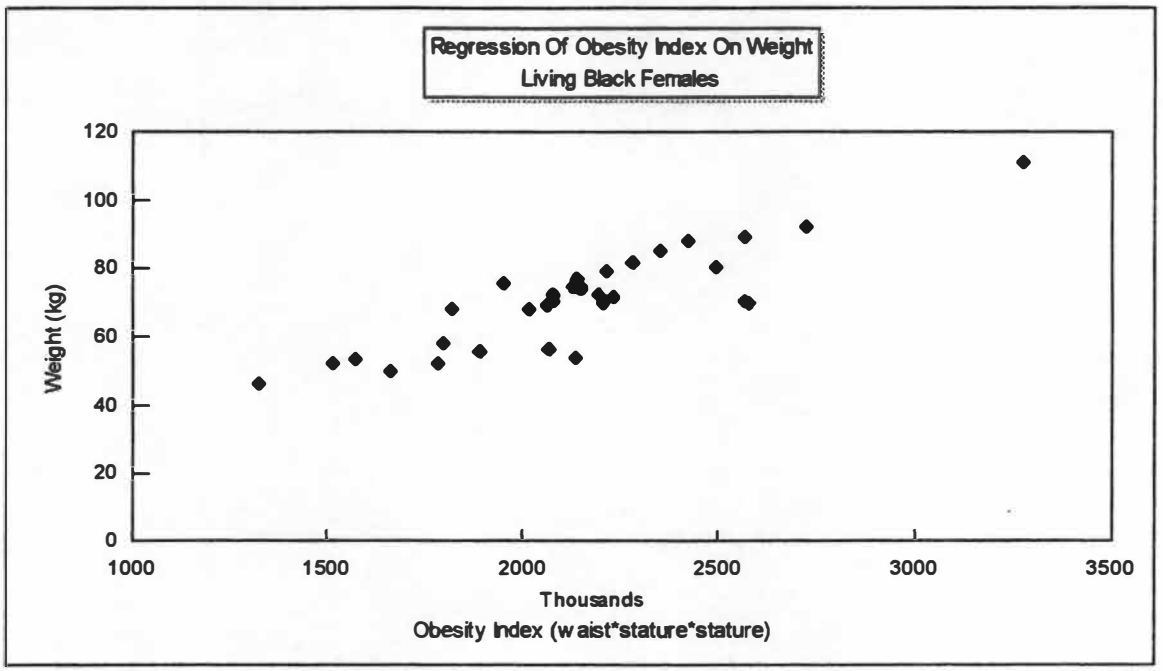
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 810.6696 | 810.6696 | 3.8007 | 0.0603 |
| Error | 31 | 6612.0549 | 213.2921 | | |
| C Total | 32 | 7422.7245 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 62.2842 | 8.1386 | 7.6529 | 0.0001 | - | 0 |
| Age | 1 | 0.5004 | 0.2527 | 1.9496 | 0.0603 | 1.0000 | 1.0000 |

**C. Age regressed on weight.**

**Figure 9 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = 2.6258 + 0.00035 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.3568 | **R-Square** | **0.7562** |
| Root MSE | 7.6402 | Adj R-Sq | 0.7484 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 5613.1771 | 5613.1771 | 96.1613 | 0.0001 |
| Error | 31 | 1809.5474 | 58.3725 | | |
| C Total | 32 | 7422.7245 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 2.6248 | 7.7360 | 0.3394 | 0.7366 | - | 0 |
| Index | 1 | 3.497E - 05 | 3.566E -05 | 9.8062 | 0.0001 | 1.0000 | 1.0000 |

**D. Obesity index regressed on weight**

**Figure 9 (Continued).**

**Multiple Regression of Stature and Waist on Weight**

**Weight = - 120.003 + 0.7074 * Stature + 1.0401 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 77.3568 | **R-Square** | **0.7607** |
| Root MSE | 7.6942 | Adj. R-Sq | 0.7448 |

Analysis of Variance

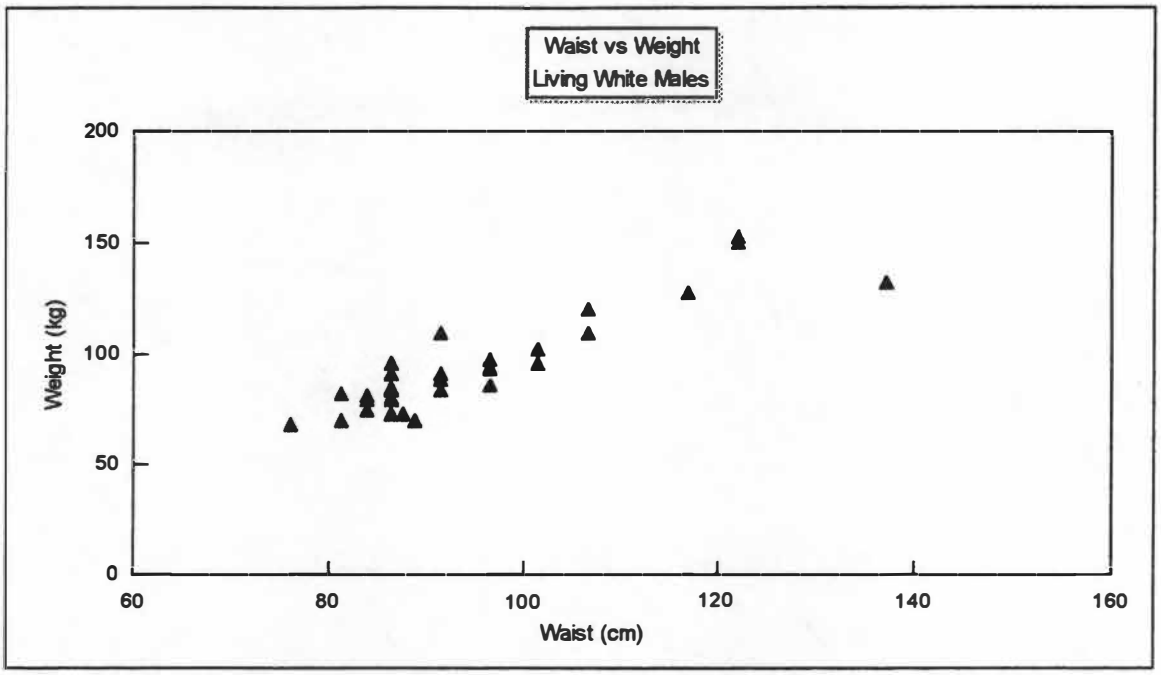
| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 5646.7028 | 2823.3514 | 47.6912 | 0.0001 |
| Error | 30 | 1776.0217 | 59.2007 | | |
| C Total | 32 | 7422.7245 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 120.003 | 37.4813 | - 3.2017 | 0.0032 | - | 0 |
| Stature | 1 | 0.7074 | 0.2236 | 3.1639 | 0.0036 | 0.9822 | 1.0181 |
| Waist | 1 | 1.0401 | 0.1191 | 8.7350 | 0.0001 | 0.9822 | 1.0181 |

**E. Multiple regression of stature and waist on weight**

**Figure 9 (Continued).**




Model Equation

**Weight = - 44.3733 + 1.5369 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 100.3712 | **R-Square** | **0.8205** |
| Root MSE | 10.3126 | Adj R-Sq | 0.8145 |

Analysis of Variance

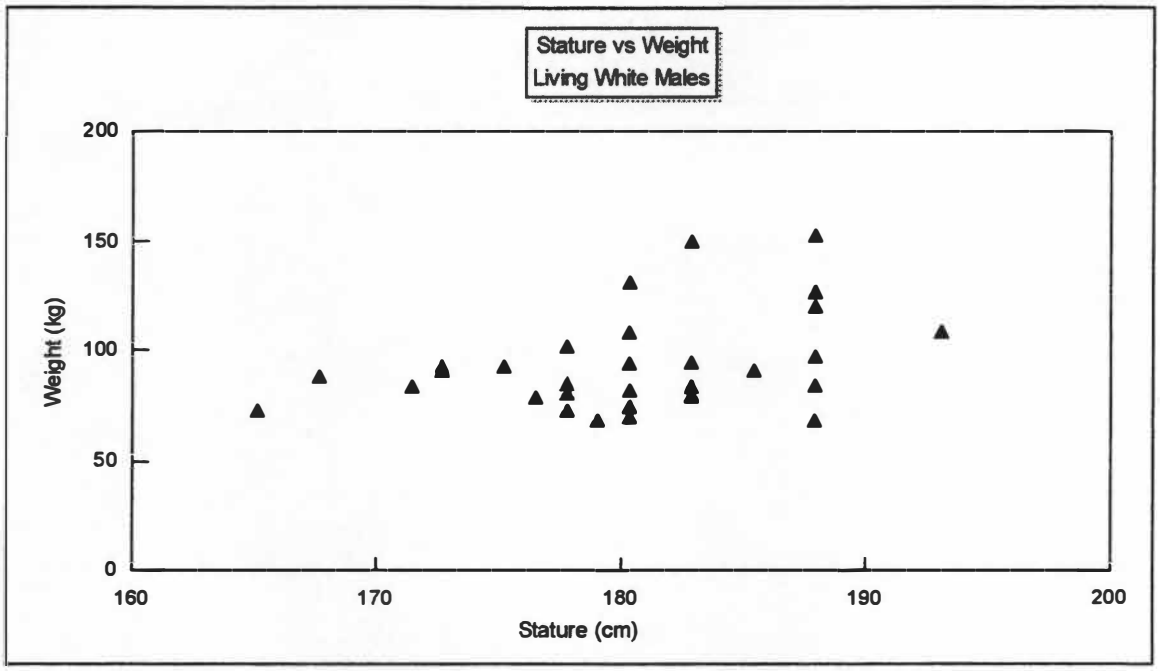
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 14584.9480 | 14584.9480 | 137.1407 | 0.0001 |
| Error | 30 | 3190.5072 | 106.3502 | | |
| C Total | 31 | 17775.4551 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 44.3733 | 12.4937 | -3.5516 | 0.0013 | - | 0 |
| Waist | 1 | 1.5369 | 0.1312 | 11.7107 | 0.0001 | 1.0000 | 1.0000 |

**A. Waist regressed on weight**

**Figure 10. Weight estimate for living white males.**




Model Equation

**Weight = - 150.337 + 1.3893 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 100.371 | **R-Square** | **0.1329** |
| Root MSE | 22.6668 | Adj R-Sq | 0.1040 |

Analysis of Variance

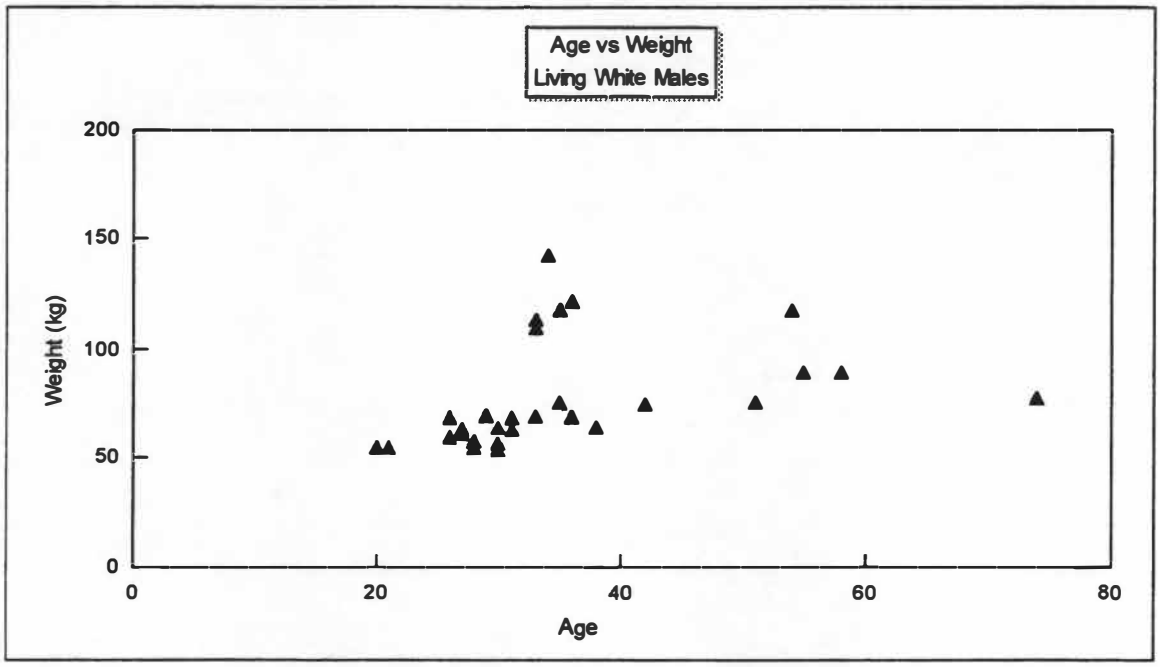
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2361.9310 | 2361.9310 | 4.5971 | 0.0402 |
| Error | 30 | 15413.5421 | 513.7841 | | |
| C Total | 31 | 17775.4551 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 150.3368 | 116.9984 | -1.2849 | 0.2086 | - | 0 |
| Stature | 1 | 1.3893 | 0.6480 | 2.1441 | 0.0402 | 1.0000 | 1.0000 |

**B. Stature regressed on weight**

**Figure 10 (Continued).**




Model Equation

**Weight = 100.016 + 0.0105 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 100.371 | **R-Square** | **2.05E -5** |
| Root MSE | 24.341 | Adj R-Sq | 0.0 |

Analysis of Variance

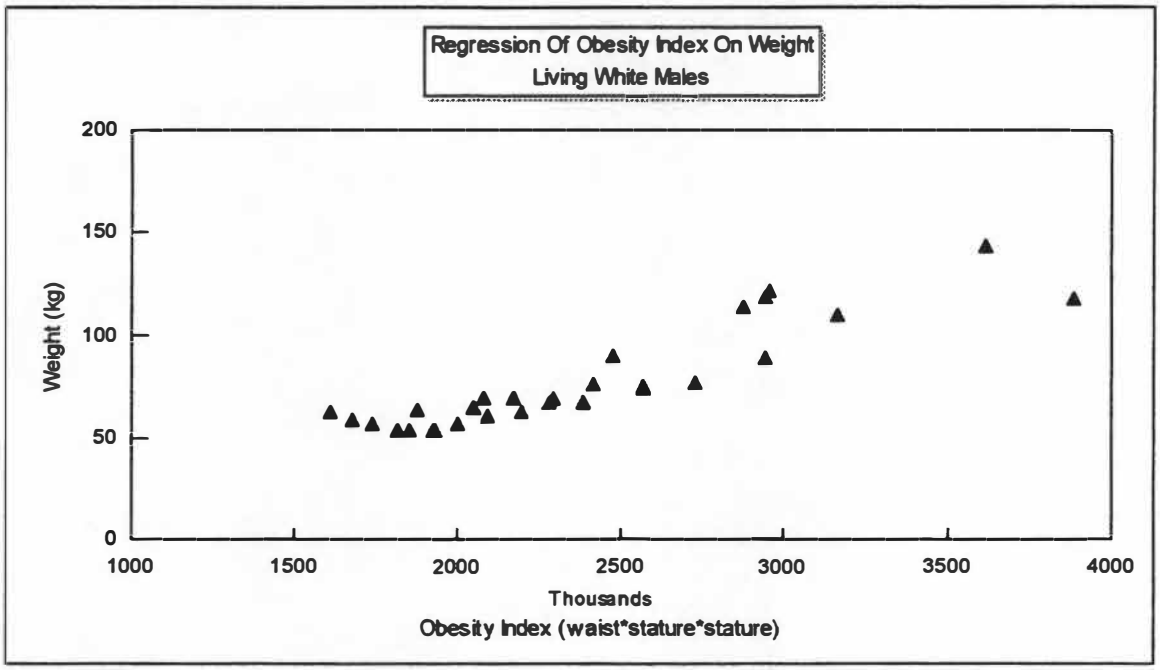
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 0.3537 | 0.3537 | 0.0006 | 0.9807 |
| Error | 30 | 17775.1014 | 592.5034 | | |
| C Total | 31 | 17775.4551 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 100.0161 | 15.1545 | 6.5997 | 0.0001 | - | 0 |
| Age | 1 | 0.0105 | 0.4309 | 0.0244 | 0.9807 | 1.0000 | 1.0000 |

**C. Age regressed on weight**

**Figure 10 (Continued).**




**Obesity Index**
Index = Waist * (Stature)$^2$

Model Equation
**Weight = - 22.8816 + 0.00004 * Index**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 100.3712 | **R-Square** | **0.8481** |
| Root MSE | 9.4860 | Adj R-Sq | 0.8431 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 15075.9039 | 15075.9039 | 167.5379 | 0.0001 |
| Error | 30 | 2699.5512 | 89.9850 | | |
| C Total | 31 | 17775.4551 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 22.8816 | 9.6688 | - 2.3665 | 0.0246 | - | 0 |
| Index | 1 | 4.006E -05 | 3.095E -06 | 12.9436 | 0.0001 | 1.0000 | 1.0000 |

**C. Obesity index regressed on weight.**

**Figure 10 (Continued).**

**Multiple Regression of Stature and Waist on Weight**

**Weight = - 177.109 + 0.7690 * Stature + 1.4797 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 100.3712 | **R-Square** | **0.8598** |
| Root MSE | 9.2703 | Adj. R-Sq | 0.8501 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 15283.2644 | 7641.6322 | 88.9207 | 0.0001 |
| Error | 29 | 2492.1908 | 85.9376 | | |
| C Total | 31 | 17775.4551 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 177.1093 | 47.8997 | - 3.6975 | 0.0009 | - | 0 |
| Stature | 1 | 0.7690 | 0.2698 | 2.8506 | 0.0080 | 0.9648 | 1.0364 |
| Waist | 1 | 1.4727 | 0.1201 | 12.2620 | 0.0001 | 0.9648 | 1.0364 |

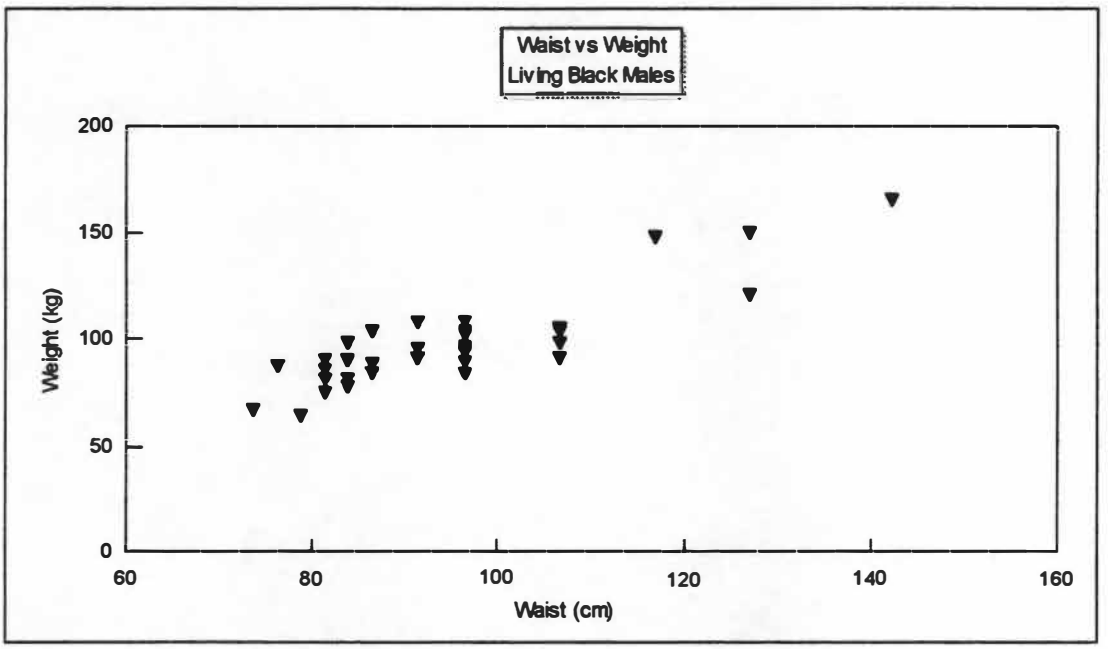
**E. Multiple regression of stature and waist on weight.**

**Figure 10 (Continued).**

appendix C at the end of this thesis. Graphic representations of the parameters age, waist, and stature regressed separately and together on body weight are presented in Figures 11A through 11E.

## SUMMARY OF STATISTICS

This section of the thesis will present data from the Terry collection, and data collected from living persons together to show how each group compares to the other. The purpose of this is to provide better context for the conclusions which will be discussed later. The comparisons presented here will be divided into two parts. The first comparison will attempt to show that skeletal measurements do not correlate well with body weight and in fact correlate instead with stature. The second comparison will attempt to show which regression equation or method is the most accurate at predicting weight from the parameters measured. Figure 12A through 12K will present a suumary of the important statistics from the previous figures. The multiple regression method is abbreviated as MR, but all other regression methods are written out.




Model Equation

**Weight = -17.2124 + 1.2039 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 97.0797 | **R-Square** | **0.7613** |
| Root MSE | 10.9446 | Adj R-Sq | 0.7533 |

Analysis of Variance

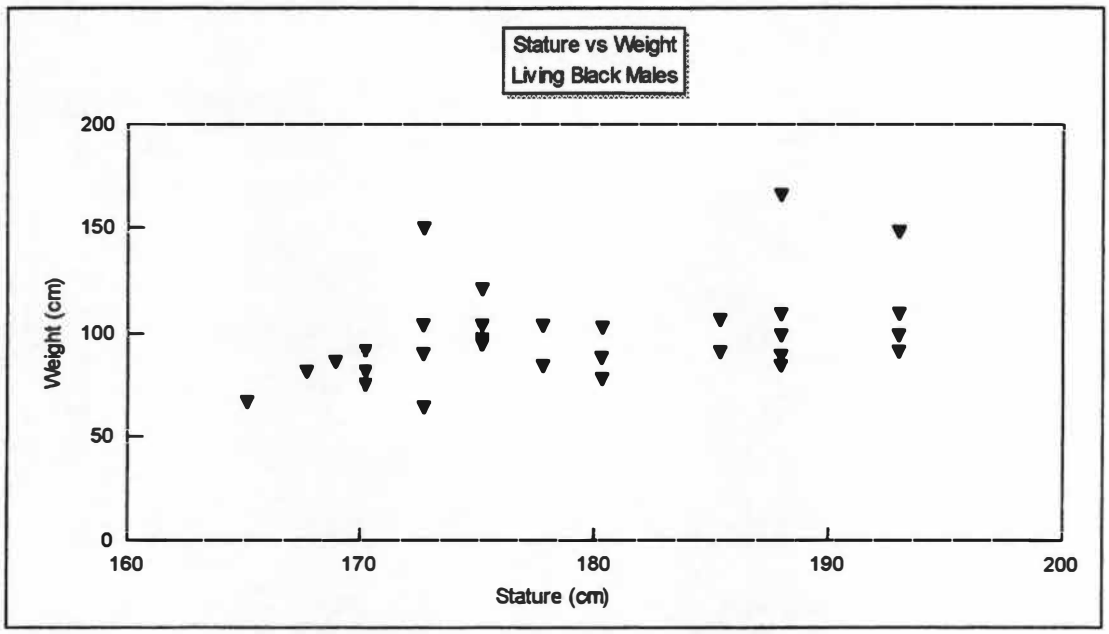
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 11459.9572 | 11459.9572 | 95.6725 | 0.0001 |
| Error | 30 | 3593.4957 | 119.7832 | | |
| C Total | 31 | 15053.4529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -17.2124 | 11.8439 | -1.4533 | 0.1565 | - | 0 |
| Waist | 1 | 1.2039 | 0.1231 | 9.7812 | 0.0001 | 1000 | 1000 |

**A. Waist regressed on weight**

**Figure 11. Weight estimate for living black males.**




Model Equation

**Weight = - 81.4208 + 0.9770 * Stature**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 97.0797 | **R-Square** | **0.1482** |
| Root MSE | 20.6746 | Adj R-Sq | 0.1198 |

Analysis of Variance

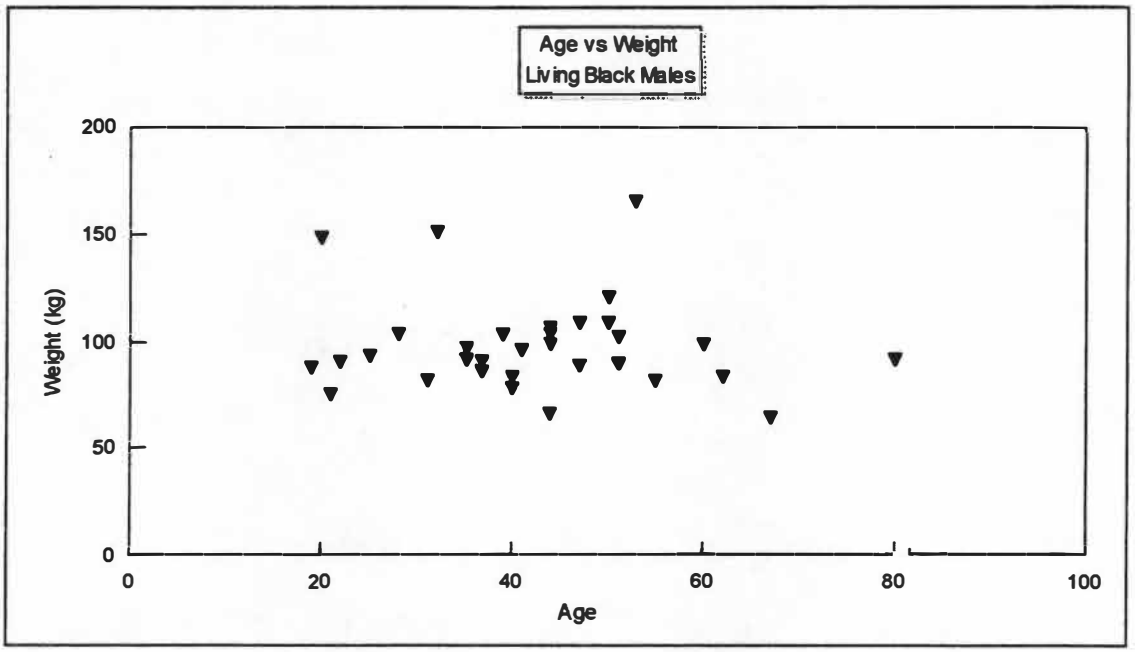
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 2230.2346 | 2230.2346 | 5.2176 | 0.0296 |
| Error | 30 | 12863.2183 | 427.4406 | | |
| C Total | 31 | 15053.4529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | -81.4208 | 78.2306 | -1.0408 | 0.3063 | - | 0 |
| Waist | 1 | 0.9970 | 0.4365 | 2.2842 | 0.0296 | 1000 | 1000 |

**B. Stature regressed on weight**

**Figure 11 (Continued).**




Model Equation

**Weight = 104.008 - 0.1641 * Age**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 97.0797 | **R-Square** | **0.0110** |
| Root MSE | 22.2767 | Adj R-Sq | 0.0 |

Analysis of Variance

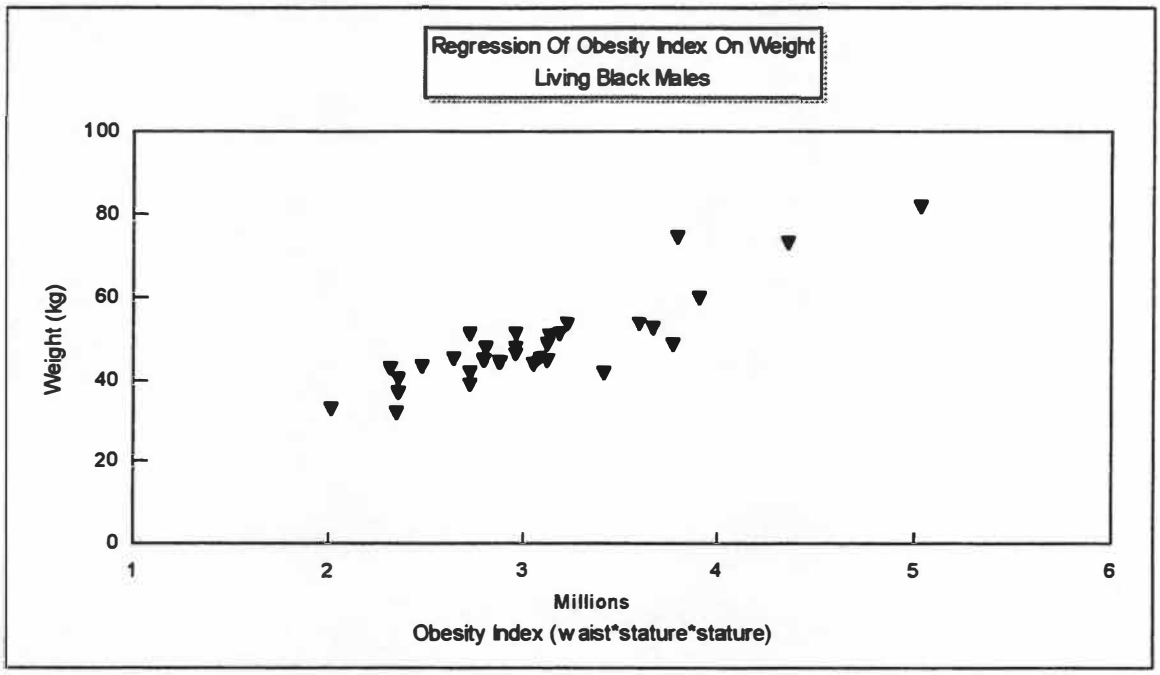
| Source | Df | Sum of Squares | Mean Square | F-Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 165.9747 | 165.9747 | 0.3345 | 0.0001 |
| Error | 30 | 14887.4782 | 496.2493 | | |
| C Total | | 15053.4529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [ T ] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 104.0078 | 12.6103 | 8.2479 | 0.0001 | - | 0 |
| Waist | 1 | -0.1641 | 0.2338 | -0.5783 | 0.5674 | 1000 | 1000 |

**C. Age regressed on weight.**

**Figure 11 (Continued).**




**Obesity Index**
Waist * (Stature)$^2$

Model Equation
**Weight = 4.7126 + 0.00003 * Index**

| | | | |
|---|---|---|---|
| Mean of Response | 97.0797 | **R-Sq.** | **0.7755** |
| Root MSE | 10.6137 | Adj. R-Sq. | 0.7680 |

Analysis of Variance

| Source | Df | Sum of Sq. | Mean Sq. | F-Stat. | Prob > F |
|---|---|---|---|---|---|
| Model | 1 | 11673.9510 | 11673.9510 | 103.6302 | 0.0001 |
| Error | 30 | 3379.5019 | 112.6501 | | |
| C-Total | 31 | 15053.4529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std. Error | T-Stat. | Prob > [ T ] | Tolerance | Var. Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 4.7126 | 9.2654 | 0.5086 | 0.6147 | - | 0 |
| Index | 1 | 3.020E - 05 | 2.966E - 06 | 10.1799 | 0.0001 | 1000 | 1000 |

**D. Obesity index regressed on weight.**

**Figure 11 (Continued).**

**Multiple Regression of Stature and Waist on Weight**

Model Equation

**Weight = - 113.036 + 0.5673 * Stature + 1.1434 * Waist**

Summary of Fit

| | | | |
|---|---|---|---|
| Mean of Response | 97.0797 | **R-Square** | **0.8073** |
| Root MSE | 10.0006 | Adj. R-Sq | 0.7940 |

Analysis of Variance

| Source | Df | Sum of Squares | Mean Square | F Stat | Prob > F |
|---|---|---|---|---|---|
| Model | 2 | 12153.0907 | 6076.5454 | 60.7579 | 0.0001 |
| Error | 29 | 2900.3622 | 100.0125 | | |
| C Total | 31 | 15053.4529 | | | |

Parameter Estimates

| Variable | Df | Estimate | Std Error | T Stat | Prob > [T] | Tolerance | Var Inflation |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | - 113.0365 | 37.9742 | - 3.3975 | 0.0058 | - | 0 |
| Stature | 1 | 0.5673 | 0.2155 | 2.8506 | 0.0134 | 0.9599 | 1.0418 |
| Waist | 1 | 1.1434 | 0.1148 | 12.2620 | 0.0001 | 0.9599 | 1.0418 |

**E. Multiple regression of stature and waist on weight.**

**Figure 11 (Continued).**

| Group | Dep. Var. | Sample Size | R-Sq. | Root MSE | Std. Error of Coefficients | Prob > F |
|---|---|---|---|---|---|---|
| Terry WF | Stature | 10 | 3.1E - 6 | 7.3109 | 0.8451 | 0.9961 |
| | Weight | 10 | 0.0830 | 11.5554 | 1.3373 | 0.4197 |
| Terry BF | Stature | 22 | 0.3963 | 7.2846 | 0.4938 | 0.0010 |
| | Weight | 22 | 0.3276 | 17.7459 | 1.2029 | 0.0032 |
| Terry WM | Stature | 89 | 0.2190 | 6.4589 | 1.5020 | 0.0001 |
| | Weight | 89 | 0.0160 | 10.7139 | 0.4917 | 0.1229 |
| Terry BM | Stature | 74 | 0.3520 | 6.4169 | 0.2778 | 0.0001 |
| | Weight | 74 | 0.0070 | 10.4678 | 0.4532 | 0.2223 |
| All Terry Indv. | Stature | 195 | 0.4245 | 6.9353 | 0.1469 | 0.0001 |
| | Weight | 195 | 0.0538 | 12.0254 | 0.2548 | 0.0006 |

**A. Average femoral head regressed on stature and on weight separately**

**Figure 12. Comparison of statistics**

| Group | Dep. Var. | Sample Size | R-Sq. | Root MSE | Std. Error of Coefficients | Prob > F |
|---|---|---|---|---|---|---|
| Terry WF | Stature | 10 | 0.0316 | 7.1947 | 0.7350 | 0.6234 |
| | Weight | 10 | 0.0936 | 11.4880 | 1.1736 | 0.3899 |
| Terry BF | Stature | 22 | 0.3395 | 7.6193 | 0.03106 | 0.0026 |
| | Weight | 22 | 0.3792 | 17.0514 | 0.6952 | 0.0014 |
| Terry WM | Stature | 89 | 0.2357 | 6.3707 | 0.1771 | 0.0001 |
| | Weight | 89 | 0.0121 | 10.6810 | 0.2969 | 0.1516 |
| Terry BM | Stature | 74 | 0.2770 | 6.7756 | 0.1929 | 0.0001 |
| | Weight | 74 | 0.0791 | 10.0808 | 0.2870 | 0.0087 |
| All Terry Indv. | Stature | 195 | 0.4361 | 6.8508 | 0.0928 | 0.0001 |
| | Weight | 195 | 0.0956 | 11.6806 | 0.7392 | 0.0001 |

**B. Average femoral condyle regressed on stature and on weight separately**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std. Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **10** | **0.5589** | **8.5676** | **0.4174(waist)** | **0.0570** |
| | | | | **0.2329(stature)** | |
| Obes. Index | 10 | 0.5323 | 8.2527 | 6.92E -5 | 0.0166 |
| Waist | 10 | 0.4875 | 8.6385 | 0.2331 | 0.0247 |
| Stature | 10 | 0.1226 | 11.3026 | 0.5466 | 0.321 |
| Age | 10 | 0.0353 | 11.8515 | 0.2183 | 0.6030 |
| Avg. Head | 10 | 0.0830 | 11.5554 | 1.3373 | 0.4197 |
| Avg. Condyl | 10 | 0.0936 | 17.7459 | 1.2029 | 0.0032 |

**C. Weight estimation for Terry white female**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std. Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **30** | **0.8366** | **10.2899** | **0.3025(waist)** | **0.0001** |
| | **30** | | | **0.0987(stature)** | |
| Obes. Index | 30 | 0.8278 | 10.3727 | 5.567E -5 | 0.0001 |
| Waist | 30 | 0.8078 | 10.9570 | 0.1048 | 0.0001 |
| Stature | 30 | 0.0100 | 24.8707 | 0.7290 | 0.5996 |
| Age | 30 | 0.1346 | 23.2529 | 0.3626 | 0.04061 |

**D. Weight estimation for living white females**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **Waist** | **23** | **0.8875** | **7.3343** | **0.0767** | **0.0001** |
| MR | 23 | 0.8875 | 7.5142 | 0.2101(waist)<br>0.0951(stature) | 0.0001 |
| Obes. Index | 23 | 0.8561 | 8.2947 | 2.652E -5 | 0.0001 |
| Stature | 23 | 0.2870 | 18.4643 | 0.4265 | 0.0084 |
| Age | 23 | 7.9E - 5 | 21.8667 | 0.2151 | 0.9678 |
| Avg. Condyl | 22 | 0.4088 | 17.0514 | 0.6952 | 0.0014 |
| Avg. Head | 22 | 0.3596 | 17.7459 | 1.2029 | 0.0032 |

**E. Weight estimate for Terry black females**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **31** | **0.7607** | **7.6942** | **0.2236(waist)** | **0.0001** |
| | **31** | | | **0.1191(stature)** | |
| Obes. Index | 31 | 0.7562 | 7.6402 | 5.843E - 05 | 0.0001 |
| Waist | 31 | 0.6809 | 8.7411 | 0.1341 | 0.0001 |
| Stature | 31 | 0.1522 | 14.2479 | 0.4103 | 0.0248 |
| Age | 31 | 0.1092 | 14.6045 | 0.2527 | 0.0603 |

**F. Weight estimate for living black females.**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **91** | **0.5181** | **7.5398** | **0.1113(waist) 0.0772(stature)** | **0.0001** |
| Waist | 91 | 0.4893 | 7.7182 | 0.7721 | 0.0001 |
| Obes. Index | 91 | 0.4429 | 8.0615 | 2.59E -06 | 0.0001 |
| Age | 91 | 0.0225 | 10.6618 | 0.0873 | 0.1554 |
| Stature | 91 | 0.0019 | 10.7903 | 0.1567 | 0.6811 |
| Avg. Condyl | 89 | 0.0121 | 10.6810 | 0.2969 | 0.1516 |
| Avg. Head | 89 | 0.0160 | 10.7139 | 0.4917 | 0.1229 |

**G. Weight estimate for Terry white males.**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **32** | **0.8598** | **9.2703** | **0.2698(waist) 0.1201(stature)** | **0.0001** |
| Obes. Index | 32 | 0.8481 | 9.4860 | 3.095E - 05 | 0.0001 |
| Waist | 32 | 0.8205 | 10.3126 | 0.1312 | 0.0001 |
| Stature | 32 | 0.1329 | 22.6668 | 0.6480 | 0.0402 |
| Age | 32 | 2.05E - 5 | 22.3414 | 0.4309 | 0.9807 |

**H. Weight estimate for living white males.**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **76** | **0.5760** | **6.8933** | **0.0996(waist) 0.0860(stature)** | **0.0001** |
| Obes. Index | 76 | 0.5657 | 6.9291 | 0.0004 | 0.0001 |
| Waist | 76 | 0.4811 | 7.5398 | 0.0940 | 0.0001 |
| Stature | 76 | 0.1452 | 9.7210 | 0.1397 | 0.0007 |
| Age | 76 | 0.0210 | 10.4008 | 0.0728 | 0.2120 |
| Avg. Condyl | 74 | 0.0791 | 10.0808 | 0.2870 | 0.0087 |
| Avg. Head | 74 | 0.0070 | 10.4678 | 0.4532 | 0.2223 |

**I. Weight estimate for Terry black males.**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **32** | **0.8073** | **10.0006** | **0.2155(waist) 0.1148(stature)** | **0.0001** |
| Obes. Index | 32 | 0.7755 | 10.6137 | 9.946E -05 | 0.0001 |
| Waist | 32 | 0.7613 | 10.9446 | 0.1231 | 0.0001 |
| Stature | 32 | 0.1482 | 20.6746 | 0.4365 | 0.0296 |
| Age | 32 | 0.0110 | 22.2767 | 0.2838 | 0.5674 |

**J. Weight estimate for living black males.**

**Figure 12 (Continued).**

| Regression Method | Sample Size | R-Sq | Root MSE | Std Error of Coefficients | Prob > F |
|---|---|---|---|---|---|
| **MR** | **200** | **0.6350** | **3.6771** | **0.0113(waist) 0.0087(stature)** | **0.0001** |
| Obes. Index | 200 | 0.5867 | 3.9030 | 4.073E - 08 | 0.0001 |
| Waist | 200 | 0.5808 | 7.9585 | 0.0477 | 0.0001 |
| Stature | 200 | 0.1452 | 9.7210 | 0.1397 | 0.0007 |
| Age | 200 | 0.0210 | 10.4008 | 0.0728 | 0.2120 |
| Avg. Head | 195 | 0.0587 | 12.0254 | 0.2540 | 0.0006 |
| Avg. Condyl | 195 | 0.1001 | 11.6806 | 0.1583 | 0.0001 |

**K. Weight estimate for all Terry individuals.**

**Figure 12 (Continued).**

# CHAPTER VII

# CONCLUSIONS

## FEMORAL MEASUREMENTS AS ESTIMATORS OF FORENSIC WEIGHT

The statistics for femoral head and condyle measurements regressed with weight and stature are shown in Figure 12.A. and 12.B. of the summary of statistics section. For the two Terry groups with smaller numbers of data points, the white females and the black females, the results are varied. For white females , the $R^2$ is higher for weight with femoral head and condyle measurements. With the black females, the $R^2$ is only higher for weight with condylar measurements. I believe that the mixed results may be due to the low number of data points for both groups. If more data were available for each of the female sets of data, I believe that the $R^2$ would consistently be higher for stature.

The male data groups, white male and black male, are consistent throughout for results. For regression with stature, the $R^2$ is always higher. When all four groups are combined, again the results are consistent with those for the males. For the combined groups, stature regressed with femoral measurements always produced a higher $R^2$. In essence, the lower $R^2$ for femoral measurements means that there is less correlation with weight. Femoral measurements seemed to be confirmed here to correlate better with stature than with weight. Now that it has been established that one cannot get a weight estimate directly from the skeleton, some other method must be developed and used to obtain weight information when needed.

## REGRESSION METHODS AND ESTIMATION OF FORENSIC WEIGHT

For this thesis, five regression formulas were generated from the data collected. These five methods were compared side by side to see which was most accurate. The regression formulas generated against weight included those for waist, stature, age, obesity index, and multiple regression of stature and waist. As stated in the methods and materials section, the criteria for judging the best regression method would be the highest $R^2$. A summary of results is recorded in the tables of the summary of statistics in the results section.

Starting with the worst results, age regression against weight performed as expected. There was very little correlation with weight and none was expected. If there were a real correlation between age and weight, then all children should have the least body weight. Conversely, senior citizens would all have to be extremely obese. The data samples used included older people who were thin and younger people who were fat, which I believe reflects a normal distribution in the population. If anything, the age regression serves as a control method to see what a negative correlation would look like.

Surprisingly, the next poorest weight correlation came from the simple stature regression method. The fact that this is the most used and quoted method in the literature makes this even more interesting. The stature regression method was actually surpassed by age regression in two groups, living white females (Figure 12.D.) and Terry white males (Figure 12.G.). Age regression in both cases had a higher $R^2$. Even worse, many of the femoral measurements shown in the tables from the Terry collection results also surpass stature regression for estimation of weight. As stated in the review of the literature

previously, stature regression might work better if everyone was lean and devoid of excessive body fat. Proportion of fat on the body in one particular area leads us to a regression method based on width just above the hips.

The waist measurement is of particular interest here because it gives some indicator of how the body distributes fatty tissue in the lower abdomen and upper pelvic region. Simple waist regression seems to have consistently given average results when compared to all the other regression methods. It was almost always the third most accurate method of weight estimation. In the case of Terry black females (Figure 12.E.), it actually turned out to be as good as multiple regression. The $R^2$ for both methods was identical. In the case of living white males (Figure 12.H.), waist regression was the second best weight estimation method.

Combining weight with stature, we come to the last two methods in this thesis. The first of these is the obesity index, illustrated by the following equation:

$$\text{waist} = \text{weight}/\ \text{stature}^2$$

As stated earlier in the weight studies section, this method is supposed to be highly correlated with waist (Kannel and Gordon, 1980). In the above equation, an equals sign is substituted for correlation, with the understanding that the two are not the same. For purposes of regression, the equation was rearranged in the following manner:

$$\text{weight} = \text{waist} \times \text{stature}^2$$

It turns out that obesity index was the second best method in this thesis. For the most part it consistently appeared to have a slightly lower $R^2$ than multiple regression. A notable exception was that for Terry white males (Figure 12.G.), obesity index came in third

behind multiple regression and waist regression. As close as it could come each time, obesity index never had the highest $R^2$.

Overall review clearly shows that multiple regression of weight on stature and waist was the best method for estimation of forensic weight. With the notable exceptions that have been mentioned for the other methods, multiple regression nearly always had the highest $R^2$ for all of the regression methods. This point is made once again by the combination of all the Terry collection data sets (Figure 12.K) for comparison to each of the five weight regression methods. The breakdown in this table is a good summary for the general accuracy of these methods.

What all of this means is that in the future it may be easier to estimate the weight at death of an unknown individual. When some indicator of the waist measurement can be found, such as pants or a belt around the waist, the multiple regression method could be employed. The estimated weight results would have to be compared to some body of weight, waist, and stature data collected for the appropriate sex and racial affiliation of the individual in question. If no waist measurement can be obtained, one is stuck using a stature based estimate for weight. When a weight result is compared to a general regression formula for the appropriate data group, the exact weight for the individual may still not be obtainable, but a much more accurate estimate is possible.

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# APPENDICES

## Appendix A

## Terry Collection Skeletal Measurements

### White Females

| Catalogue Key | Left Head (cm) | Right Head (cm) | Average Head (cm) | Left Condyle (cm) | Right Condyle (cm) | Average Condyle (cm) |
|---|---|---|---|---|---|---|
| P0000580 | 40.5 | 41 | 40.75 | 72.5 | 74 | 73.25 |
| P0000601 | 41 | 41.8 | 41.4 | 78 | 80 | 79 |
| P0000639 | 41.2 | 40.9 | 41.05 | 74.1 | 74 | 74.05 |
| P0000680 | 42 | 42.5 | 42.25 | 74.5 | 76 | 75.25 |
| P0000686 | 38.5 | 39.5 | 39 | 76.5 | 77 | 76.75 |
| P0000692 | 48.8 | 48.7 | 48.75 | 79 | 78.5 | 78.75 |
| P0000736 | 43.8 | 44 | 43.9 | 78.5 | 80 | 79.25 |
| P0000791 | 41.8 | 41.7 | 41.75 | 75 | 74 | 74.5 |
| P0000847 | 38.9 | 39 | 38.95 | 70 | 70 | 70 |
| P0000854 | 44.5 | 43.8 | 44.15 | 80 | 80.5 | 80.25 |

### Black Females

| Catalogue Key | Left Head (cm) | Right Head (cm) | Average Head (cm) | Left Condyle (cm) | Right Condyle (cm) | Average Condyle (cm) |
|---|---|---|---|---|---|---|
| P0000561 | 41.2 | 41.5 | 41.35 | 71 | 71 | 71 |
| P0000562 | 37 | 36.1 | 36.55 | 71 | 71 | 71 |
| P0000567 | 37.7 | 37 | 37.35 | 68.5 | 69.2 | 68.85 |
| P0000568 | 42.5 | 43.2 | 42.85 | 76.1 | 77.2 | 76.65 |
| P0000583 | 41.7 | 41.5 | 41.6 | 73 | 73 | 73 |
| P0000584 | 42 | 42.8 | 42.4 | 77.1 | 78.1 | 77.6 |
| P0000586 | 42 | 42.3 | 42.15 | 77.1 | 76.3 | 76.7 |
| P0000587 | 41.1 | 42 | 41.55 | 75 | 75 | 75 |
| P0000610 | 42.8 | 42 | 42.4 | 73 | 73.2 | 73.1 |
| P0000615 | 50 | 50.2 | 50.1 | 88.5 | 89.3 | 88.9 |
| P0000632 | 45.1 | 47 | 46.05 | 79.5 | 81 | 80.25 |
| P0000640 | 40.9 | 41.1 | 41 | 76 | 75.2 | 75.6 |
| P0000666 | 45.5 | 45.7 | 45.6 | 77.1 | 78 | 77.55 |
| P0000679 | 37.5 | 37.8 | 37.65 | 64.5 | 65 | 64.75 |
| P0000706 | 41.8 | 43 | 42.4 | 71.5 | 72 | 71.75 |
| P0000761 | 46.5 | 47.2 | 46.85 | 84 | 84.5 | 84.25 |
| P0000775 | 37.5 | 38.5 | 38 | 71 | 70 | 70.5 |
| P0000815 | 43 | 43.9 | 43.45 | 77.5 | 78.5 | 78 |
| P0000819 | 41 | 42.3 | 41.65 | 71.2 | 72 | 71.6 |
| P0000822 | 43.2 | 44.8 | 44 | 74.5 | 75 | 74.75 |
| P0000824 | 40 | 40.3 | 40.15 | 71.2 | 70.5 | 70.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P0000831 | 43 | 43 | 43 | 80 | 80 | 80 |
| P0000844 | **** | **** | 0.0 | **** | **** | 0.0 |

**White Males**

| Catalogue Key | Left Head (cm) | Right Head (cm) | Average Head (cm) | Left Condyle (cm) | Right Condyle (cm) | Average Condyle (cm) |
|---|---|---|---|---|---|---|
| P0000563 | 51.6 | 51.2 | 51.4 | 87 | 87 | 87 |
| P0000564 | 42.5 | 43.5 | 43 | 76.5 | 77.1 | 76.8 |
| P0000566 | 48.8 | 50 | 49.4 | 89.1 | 90 | 89.55 |
| P0000569 | 51.5 | 52.8 | 52.15 | 88 | 90.1 | 89.05 |
| P0000572 | 52 | 50.3 | 51.15 | 91.5 | 92 | 91.75 |
| P0000573 | 51 | 51.1 | 51.05 | 85.5 | 86.5 | 86 |
| P0000575 | 48.2 | 48 | 48.1 | 80 | 81 | 80.5 |
| P0000577 | 46.2 | 47.1 | 46.65 | 76.9 | 77.1 | 77 |
| P0000585 | 49 | 49.8 | 49.4 | 83.2 | 84 | 83.6 |
| P0000588 | 48.1 | 47 | 47.55 | 79.5 | 81 | 80.25 |
| P0000590 | 50.8 | 52.2 | 51.5 | 84 | 84 | 84 |
| P0000591 | 46 | 47.1 | 46.55 | 78.8 | 79 | 78.9 |
| P0000596 | 48.2 | 49.1 | 48.65 | 81.2 | 84 | 82.6 |
| P0000598 | 45.5 | 46.5 | 46 | 79.8 | 81.5 | 80.65 |
| P0000599 | 49.1 | 49.2 | 49.15 | 80 | 82.2 | 81.1 |
| P0000602 | 52.5 | 51.5 | 52 | 91 | 91.1 | 91.05 |
| P0000608 | 46.8 | 47 | 46.9 | 86 | 86.2 | 86.1 |
| P0000630 | 50.5 | 49.5 | 50 | 85.5 | 82.5 | 84 |
| P0000633 | 51.7 | 51.8 | 51.75 | 89.5 | 89 | 89.25 |
| P0000634 | 49 | 49.2 | 49.1 | 84 | 84.5 | 84.25 |
| P0000636 | 49 | 50 | 49.5 | 80.8 | 84.5 | 82.65 |
| P0000641 | 47.5 | 48.2 | 47.85 | 79.5 | 81 | 80.25 |
| P0000644 | 41.8 | 41.8 | 41.8 | 78.2 | 78.1 | 78.15 |
| P0000645 | 50.7 | 50.7 | 50.7 | 87.1 | 87.1 | 87.1 |
| P0000651 | 46.5 | 46 | 46.25 | 86.3 | 83.5 | 84.9 |
| P0000665 | 46.8 | 47.1 | 46.95 | 82 | 82.5 | 82.25 |
| P0000670 | 49 | 49 | 49 | 82 | 81.5 | 81.75 |
| P0000671 | 45 | 45.5 | 45.25 | 81 | 78 | 79.5 |
| P0000672 | 50.8 | 51.2 | 51 | 87.5 | 88 | 87.75 |
| P0000674 | 49 | 49.5 | 49.25 | 85 | 86.2 | 85.6 |
| P0000681 | 51.1 | 52.3 | 51.7 | 87.5 | 87.1 | 87.3 |
| P0000691 | 48 | 48 | 48 | 89 | 88 | 88.5 |
| P0000693 | 47 | 46.8 | 46.9 | 77 | 78 | 77.5 |
| P0000697 | 55 | 55 | 55 | 93 | 93.5 | 93.25 |
| P0000701 | 46.2 | 47.8 | 47 | 82 | 83 | 82.5 |
| P0000708 | 46 | 46.3 | 46.15 | 84.2 | 84 | 84.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P0000709 | 46 | 46 | 46 | 82 | 82 | 82 |
| P0000713 | 50.3 | 51.3 | 50.8 | 89 | 90 | 89.5 |
| P0000714 | 47.8 | 49.8 | 48.8 | 81 | 81 | 81 |
| P0000720 | 46 | 45 | 45.5 | 77 | 82 | 79.5 |
| P0000721 | 53 | 54.5 | 53.75 | 86.5 | 85 | 85.75 |
| P0000730 | 46.5 | 46.8 | 46.65 | 83 | 83 | 83 |
| P0000739 | 50.4 | 51 | 50.7 | 88.1 | 87.1 | 87.6 |
| P0000743 | 48.4 | 48.5 | 48.45 | 88 | 86.5 | 87.25 |
| P0000746 | 50 | 49.5 | 49.75 | 86 | 83 | 84.5 |
| P0000748 | 51.8 | 52.1 | 51.95 | 90 | 91 | 90.5 |
| P0000750 | 47.5 | 45.8 | 46.65 | 84.5 | 86.2 | 85.35 |
| P0000751 | 47.5 | 47.8 | 47.65 | 87 | 86.2 | 86.6 |
| P0000752 | 51.1 | 50.5 | 50.8 | 90 | 93 | 91.5 |
| P0000755 | 49.2 | 48.2 | 48.7 | 83 | 85.1 | 84.05 |
| P0000756 | 49.8 | 47.8 | 48.8 | 81 | 81 | 81 |
| P0000758 | 48.3 | 47.5 | 47.9 | 84 | 83.5 | 83.75 |
| P0000762 | 48.2 | 47.2 | 47.7 | 83.5 | 82 | 82.75 |
| P0000763 | 46.5 | 47 | 46.75 | 81.5 | 81.2 | 81.35 |
| P0000764 | 51.7 | 50.5 | 51.1 | 90.2 | 91 | 90.6 |
| P0000772 | 49.2 | 48.5 | 48.85 | 90.2 | 90 | 90.1 |
| P0000778 | 49 | 49.5 | 49.25 | 88 | 88.2 | 88.1 |
| P0000784 | 46.5 | 47 | 46.75 | 84 | 86 | 85 |
| P0000785 | **** | **** | **** | **** | **** | **** |
| P0000787 | 45.8 | 44.8 | 45.3 | 80 | 80 | 80 |
| P0000795 | 48.8 | 48.8 | 48.8 | 88.5 | 88.5 | 88.5 |
| P0000802 | 46.5 | 46.9 | 46.7 | 87 | 88.1 | 87.55 |
| P0000803 | 48 | 47.8 | 47.9 | 86 | 85.3 | 85.65 |
| P0000805 | 45 | 46.5 | 45.75 | 79.8 | 80 | 79.9 |
| P0000806 | 50.5 | 51.5 | 51 | 87.5 | 88.5 | 88 |
| P0000810 | 46.5 | 46.2 | 46.35 | 86 | 87 | 86.5 |
| P0000812 | 47.8 | 46.8 | 47.3 | 85.5 | 86 | 85.75 |
| P0000813 | 49 | **** | 49 | 84 | 83 | 83.5 |
| P0000827 | 47.8 | 47 | 47.4 | 82.5 | 80 | 81.25 |
| P0000828 | 49 | 48.5 | 48.75 | 85.2 | 86 | 85.6 |
| P0000832 | 47 | 48.2 | 47.6 | 85 | 85 | 85 |
| P0000835 | 50.5 | 51 | 50.75 | 90.5 | 90 | 90.25 |
| P0000838 | 49 | 48.2 | 48.6 | 85 | 85 | 85 |
| P0000839 | 50 | 50.5 | 50.25 | 85 | 85 | 85 |
| P0000841 | 49 | 49.2 | 49.1 | 86.5 | 87.5 | 87 |
| P0000842 | 49.8 | 49.9 | 49.85 | 88 | 90 | 89 |
| P0000846 | 48 | 49.5 | 48.75 | 80.2 | 81 | 80.6 |
| P0000848 | 49.2 | 50.8 | 50 | 87.2 | 90.5 | 88.85 |
| P0000849 | 47.5 | 48.5 | 48 | 84 | 84.5 | 84.25 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P0000852 | 45.6 | 45 | 45.3 | 80 | 80 | 80 |
| P0000853 | 46 | 47 | 46.5 | 83 | 84.2 | 83.6 |
| P0000855 | 46 | 46 | 46 | 82.2 | 83.2 | 82.7 |
| P0000857 | 47.2 | 48 | 47.6 | 84.5 | 87 | 85.75 |
| P0000858 | 44 | 42.8 | 43.4 | 76 | 76.5 | 76.25 |
| P0000863 | 44.5 | 44.8 | 44.65 | 81 | 83 | 82 |
| P0000865 | 48.2 | 49.5 | 48.85 | 81 | 83.2 | 82.1 |
| P0000868 | **** | **** | 0.0 | **** | **** | 0.0 |
| P0000870 | 46.8 | 46.3 | 46.55 | 87 | 85 | 86 |
| P0000871 | 47.7 | 48.5 | 48.1 | 83.2 | 82.5 | 82.85 |
| P0000872 | 47 | 47 | 47 | 83 | 84 | 83.5 |
| P0000874 | 47.1 | 46.5 | 46.8 | 85 | 91 | 88 |

**Black Males**

| Catalogue Key | Left Head (cm) | Right Head (cm) | Average Head (cm) | Left Condyle (cm) | Right Condyle (cm) | Average Condyle (cm) |
|---|---|---|---|---|---|---|
| P0000565 | 45.2 | 45.2 | 45.2 | 80 | 81 | 80.5 |
| P0000570 | 48.8 | 49 | 48.9 | 82 | 82 | 82 |
| P0000571 | 48 | 47.5 | 47.75 | 84 | 85.2 | 84.6 |
| P0000574 | 46 | 46.2 | 46.1 | 81 | 81.2 | 81.1 |
| P0000576 | 56.9 | 57.9 | 57.4 | 100 | 100.1 | 100.05 |
| P0000578 | 46.1 | 48 | 47.05 | 82.2 | 84 | 83.1 |
| P0000579 | 42.7 | 41.8 | 42.25 | 75.2 | 77.2 | 76.2 |
| P0000581 | 51.1 | 51 | 51.05 | 83.5 | 83.1 | 83.3 |
| P0000582 | 44 | 44.8 | 44.4 | 81.2 | 82 | 81.6 |
| P0000592 | 46.5 | 47.8 | 47.15 | 83.1 | 82.2 | 82.65 |
| P0000593 | 46.1 | 47.6 | 46.85 | 83 | 84.3 | 83.65 |
| P0000594 | 46.1 | 48 | 47.05 | 88 | 88.5 | 88.25 |
| P0000595 | 46.8 | 46 | 46.4 | 82.5 | 82.2 | 82.35 |
| P0000600 | 51.9 | 52.1 | 52 | 87.2 | 87 | 87.1 |
| P0000618 | **** | **** | 0.0 | **** | **** | 0.0 |
| P0000628 | 46.3 | 47 | 46.65 | 89 | 90 | 89.5 |
| P0000635 | 46.8 | 47.2 | 47 | 83 | 85 | 84 |
| P0000643 | 50.9 | 52.5 | 51.7 | 93.2 | 92.5 | 92.85 |
| P0000646 | 50 | 49.8 | 49.9 | 87 | 86 | 86.5 |
| P0000648 | 47.1 | 47.5 | 47.3 | 84 | 84.2 | 84.1 |
| P0000649 | 45.2 | 44.2 | 44.7 | 84 | 84 | 84 |
| P0000663 | 48.5 | 47.4 | 47.95 | 84 | 84.5 | 84.25 |
| P0000664 | 48.2 | 48.5 | 48.35 | 87 | 89 | 88 |
| P0000673 | 49.8 | 51.5 | 50.65 | 88 | 89.2 | 88.6 |
| P0000675 | 48 | 48.2 | 48.1 | 87.2 | 87.1 | 87.15 |
| P0000676 | 50.1 | 50.2 | 50.15 | 86 | 88 | 87 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P0000677 | 46.5 | 46 | 46.25 | 82.2 | 82.5 | 82.35 |
| P0000683 | 50 | 50 | 50 | 87.1 | 86 | 86.55 |
| P0000684 | 48.8 | 47.8 | 48.3 | 88 | 89 | 88.5 |
| P0000690 | 44.7 | 44 | 44.35 | 87 | 87.2 | 87.1 |
| P0000694 | 47 | 47.4 | 47.2 | 84.2 | 85.5 | 84.85 |
| P0000698 | 49 | 47.3 | 48.15 | 84.1 | 84 | 84.05 |
| P0000700 | 47.1 | 47.5 | 47.3 | 81.5 | 80.5 | 81 |
| P0000703 | **** | **** | 0.0 | **** | **** | 0.0 |
| P0000704 | 44.3 | 44 | 44.15 | 77.2 | 77.5 | 77.35 |
| P0000707 | 48 | 48.7 | 48.35 | 84 | 85 | 84.5 |
| P0000711 | 48 | 48.2 | 48.1 | 80 | 80 | 80 |
| P0000712 | 45.5 | 46.2 | 45.85 | 83.5 | 85 | 84.25 |
| P0000717 | 45.8 | 46 | 45.9 | 81 | 76 | 78.5 |
| P0000718 | 49.8 | 50 | 49.9 | 86 | 85 | 85.5 |
| P0000724 | 46 | 47.8 | 46.9 | 81 | 78.2 | 79.6 |
| P0000725 | 46 | 46.7 | 46.35 | 82 | 82 | 82 |
| P0000726 | 46 | 46.3 | 46.15 | 87 | 89 | 88 |
| P0000731 | 44.2 | 44.2 | 44.2 | 77.5 | 78 | 77.75 |
| P0000735 | 44.5 | 45.6 | 45.05 | 77.5 | 79.2 | 78.35 |
| P0000742 | 55 | 54.9 | 54.95 | 92 | 94 | 93 |
| P0000753 | 48.5 | 48.5 | 48.5 | 88 | 90 | 89 |
| P0000754 | 52.8 | 52.5 | 52.65 | 86 | 88 | 87 |
| P0000760 | 48.9 | 49 | 48.95 | 87 | 86.1 | 86.55 |
| P0000767 | 45.8 | 45.8 | 45.8 | 82.5 | 85 | 83.75 |
| P0000770 | 45 | 45.8 | 45.4 | 79.5 | 80 | 79.75 |
| P0000773 | 48 | 47 | 47.5 | 83 | 82 | 82.5 |
| P0000776 | 53.7 | 53.8 | 53.75 | 86 | 87 | 86.5 |
| P0000786 | 51 | 50.8 | 50.9 | 86 | 84.5 | 85.25 |
| P0000788 | 49.5 | 48 | 48.75 | 83 | 83 | 83 |
| P0000789 | 45.8 | 46.2 | 46 | 78 | 79 | 78.5 |
| P0000790 | 45.5 | 47.5 | 46.5 | 87 | 87.5 | 87.25 |
| P0000793 | 45.2 | 45.2 | 45.2 | 86 | 85 | 85.5 |
| P0000796 | 48.5 | 47.5 | 48 | 92.2 | 90 | 91.1 |
| P0000798 | 47 | 47.1 | 47.05 | 82 | 83.5 | 82.75 |
| P0000799 | 48.7 | 48.5 | 48.6 | 84 | 85.2 | 84.6 |
| P0000801 | 45.8 | 46 | 45.9 | 83 | 83.5 | 83.25 |
| P0000811 | 48.8 | 49.5 | 49.15 | 81.2 | 82 | 81.6 |
| P0000817 | 44.2 | 46 | 45.1 | 85 | 86 | 85.5 |
| P0000823 | 46.7 | 47.5 | 47.1 | 83.2 | 83 | 83.1 |
| P0000825 | 49.8 | 50 | 49.9 | 89 | 90.5 | 89.75 |
| P0000826 | 44.8 | 45.5 | 45.15 | 81 | 81 | 81 |
| P0000829 | 48 | 48.3 | 48.15 | 86.2 | 87 | 86.6 |
| P0000836 | 45 | 45 | 45 | 84.5 | 85.2 | 84.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P0000850 | 46 | 46.5 | 46.25 | 78.5 | 79 | 78.75 |
| P0000856 | 44.5 | 44.5 | 44.5 | 81.5 | 82.5 | 82 |
| P0000859 | 52 | 52.5 | 52.25 | 86.5 | 87.5 | 87 |
| P0000862 | 44.5 | 45 | 44.75 | 83 | 81 | 82 |
| P0000864 | 45.5 | 45.2 | 45.35 | 76 | 78.2 | 77.1 |
| P0000875 | 43 | 45 | 44 | 78.2 | 79.5 | 78.85 |
| P0000876 | 47 | 47.5 | 47.25 | 81.2 | 81.5 | 81.35 |

**** = Missing or not measured data

## Appendix B

## Terry Collection Data

### White Females

| Catalogue Key | Age | Stature(cm) | Waist (cm) | Weight (kg) |
|---|---|---|---|---|
| P0000580 | 61 | 156 | 74.9 | 44.4 |
| P0000601 | 75 | 158 | 87.5 | 44.4 |
| P0000639 | 82 | 164 | 69.5 | 51.3 |
| P0000680 | 30 | 168 | 64.5 | 35.8 |
| P0000686 | 78 | 154 | 86.5 | 61.4 |
| P0000692 | 84 | 151 | 65 | 31.3 |
| P0000736 | 57 | 166 | 75 | 62.2 |
| P0000791 | 66 | 163 | 54.5 | 36.3 |
| P0000847 | 39 | 159.5 | 80 | 45.5 |
| P0000854 | 72 | 173.5 | 95 | 61.4 |

### Black Females

| Catalogue Key | Age | Stature (cm) | Waist (cm) | Weight (kg) |
|---|---|---|---|---|
| P0000561 | 22 | 156.3 | 70.7 | 45.5 |
| P0000562 | 17 | 152 | 53 | 27.8 |
| P0000567 | 19 | 126 | 54.5 | 30 |
| P0000568 | 27 | 159 | 63.5 | 34 |
| P0000583 | 24 | 154 | 52 | 37.7 |
| P0000584 | 40 | 154 | 65.3 | 42.3 |
| P0000586 | 40 | 164 | 71.5 | 51.1 |
| P0000587 | 61 | 163 | 59 | 36.6 |
| P0000610 | 39 | 164.5 | 90.3 | 73.3 |
| P0000615 | 35 | 164.5 | 106.8 | 97.7 |
| P0000632 | 27 | 169.5 | 71 | 37.7 |
| P0000640 | 70 | 153 | 60.5 | 31.5 |
| P0000666 | 52 | 159 | 81 | 62.6 |
| P0000679 | 33 | 146 | 63 | 30.8 |
| P0000706 | 38 | 157 | 77.5 | 35.5 |
| P0000761 | 80 | 162 | 72.5 | 54 |
| P0000775 | 101 | 152 | 49.5 | 29.5 |
| P0000815 | 32 | 170 | 114 | 83 |
| P0000819 | 65 | 153 | 53.5 | 34.9 |
| P0000822 | 16 | 160 | 59.5 | 34.2 |
| P0000824 | 30 | 162 | 77.5 | 50.1 |
| P0000831 | 44 | 166 | 127 | 98 |

| | | | | |
|---|---|---|---|---|
| P0000844 | 26 | 163 | 62.5 | 33.4 |

White Males

| Catalogue Key | Age | Stature (cm) | Waist(cm) | Weight (kg) |
|---|---|---|---|---|
| P0000563 | 41 | 170 | 72 | 45 |
| P0000564 | 48 | 153 | 77.8 | 43.3 |
| P0000566 | 40 | 176 | 66 | 40 |
| P0000569 | 63 | 160 | 70 | 48.8 |
| P0000572 | 61 | 183 | 64 | 40 |
| P0000573 | 59 | 167 | 79 | 47 |
| P0000575 | 47 | 169 | 77 | 52.2 |
| P0000577 | 50 | 161 | 65.5 | 38.8 |
| P0000585 | 64 | 168.8 | 69.5 | 43.1 |
| P0000588 | 60 | 167 | 73.5 | 47.7 |
| P0000590 | 68 | 173 | 77.8 | 53.9 |
| P0000591 | 28 | 171 | 65.5 | 51.1 |
| P0000596 | 48 | 171 | 69 | 60 |
| P0000598 | 61 | 159 | 88.5 | 63.3 |
| P0000599 | 43 | 168 | 78.3 | 48.8 |
| P0000602 | 49 | 167 | 74.5 | 58.1 |
| P0000608 | 52 | 175 | 78.8 | 69.9 |
| P0000630 | 72 | 175 | 75.6 | 50 |
| P0000633 | 76 | 176 | 75.5 | 76.6 |
| P0000634 | 74 | 163 | 66 | 43.3 |
| P0000636 | 51 | 169 | 74 | 53.8 |
| P0000641 | 38 | 168 | 82.5 | 53.7 |
| P0000644 | 54 | 162 | 65.5 | 31 |
| P0000645 | 28 | 188 | 68 | 43.3 |
| P0000651 | 64 | 158 | 73.5 | 50.6 |
| P0000665 | 74 | 170 | 61.5 | 45.3 |
| P0000670 | 60 | 161.6 | 71 | 46.6 |
| P0000671 | 65 | 158 | 94.5 | 62.7 |
| P0000672 | 52 | 174 | 75.5 | 57.4 |
| P0000674 | 58 | 171 | 79.5 | 59.9 |
| P0000681 | 53 | 184 | 82.5 | 68.6 |
| P0000691 | 82 | 171 | 85.5 | 54.5 |
| P0000693 | 57 | 160 | 93.5 | 61 |
| P0000697 | 72 | 172 | 87.5 | 70 |
| P0000701 | 55 | 165 | 88.2 | 52.2 |
| P0000708 | 68 | 167 | 57.5 | 34.4 |
| P0000709 | 50 | 155 | 68.5 | 41.1 |
| P0000713 | 69 | 176 | 56 | 51 |

| | | | | |
|---|---|---|---|---|
| P0000714 | 71 | 169 | 80.5 | 43.3 |
| P0000720 | 54 | 156 | 85 | 72.1 |
| P0000721 | 60 | 184 | 60.5 | 43 |
| P0000730 | 71 | 167 | 102 | 82.1 |
| P0000739 | 40 | 181 | 65.5 | 43.4 |
| P0000743 | 53 | 178 | 76 | 53.3 |
| P0000746 | 71 | 161 | 78.5 | 41.1 |
| P0000748 | 85 | 182 | 70.5 | 50.7 |
| P0000750 | 80 | 174 | 65 | 39.8 |
| P0000751 | 41 | 174 | 69 | 50.5 |
| P0000752 | 71 | 172 | 74.5 | 58 |
| P0000755 | 36 | 169 | 78 | 56.6 |
| P0000756 | 47 | 165 | 75 | 49.7 |
| P0000758 | 73 | 170 | 71.5 | 51.3 |
| P0000762 | 59 | 177 | 57 | 38.8 |
| P0000763 | 46 | 179 | 67.5 | 54.8 |
| P0000764 | 58 | 168 | 74 | 40.6 |
| P0000772 | 56 | 186 | 97 | 63.4 |
| P0000778 | 55 | 168 | 64.5 | 42 |
| P0000784 | 68 | 169 | 65.5 | 53.6 |
| P0000785 | 54 | 173 | 69.5 | 55.4 |
| P0000787 | 50 | 175 | 82.5 | 52.8 |
| P0000795 | 51 | 180 | 71.5 | 54.1 |
| P0000802 | 36 | 168 | 69.5 | 35.1 |
| P0000803 | 64 | 161 | 79 | 45.2 |
| P0000805 | 87 | 168 | 77 | 57 |
| P0000806 | 78 | 168 | 90 | 60.1 |
| P0000810 | 54 | 170 | 74 | 39.9 |
| P0000812 | 56 | 172 | 99 | 82.8 |
| P0000813 | 60 | 175 | 65.5 | 47.4 |
| P0000827 | 74 | 173.5 | 70 | 49.9 |
| P0000828 | 48 | 164.5 | 73 | 52.3 |
| P0000832 | 84 | 172.5 | 77 | 53.3 |
| P0000835 | 61 | 176 | 91.5 | 58.7 |
| P0000838 | 67 | 175.5 | 83.5 | 56.9 |
| P0000839 | 41 | 171 | 78 | 50.5 |
| P0000841 | 68 | 173 | 76.5 | 45.6 |
| P0000842 | 73 | 165.5 | 119.5 | 81 |
| P0000846 | 48 | 166.5 | 67.5 | 41.7 |
| P0000848 | 39 | 174.5 | 75 | 45.1 |
| P0000849 | 47 | 175 | 75.5 | 44.7 |
| P0000852 | 66 | 169 | 73.5 | 38.7 |
| P0000853 | 62 | 176.5 | 87 | 54 |

| | | | | |
|---|---|---|---|---|
| P0000855 | 67 | 158 | 75.5 | 38.7 |
| P0000857 | 69 | 170.5 | 85.5 | 56.2 |
| P0000858 | 66 | 162 | 75.5 | 41.6 |
| P0000863 | 73 | 154 | 83.5 | 53.9 |
| P0000865 | 69 | 169.5 | 78.5 | 41.5 |
| P0000868 | 60 | 172 | 95 | 65.3 |
| P0000870 | 60 | 170 | 81 | 41.6 |
| P0000871 | 56 | 182 | 69.5 | 33 |
| P0000872 | 48 | 168.5 | 82 | 42.6 |
| P0000874 | 75 | 173.5 | 71 | 43.9 |

## Black Males

| Catalogue Key | Age | Stature(cm) | Waist(cm) | Weight(kg) |
|---|---|---|---|---|
| P0000565 | 32 | 177 | 74 | 55.4 |
| P0000570 | 37 | 175 | 68.5 | 43.3 |
| P0000571 | 31 | 165 | 67 | 43.3 |
| P0000574 | 35 | 167.5 | 61.5 | 45.5 |
| P0000576 | 41 | 195 | 77 | 68.2 |
| P0000578 | 32 | 171 | 71 | 50 |
| P0000579 | 17 | 161 | 67.8 | 38.8 |
| P0000581 | 30 | 184 | 69 | 67.7 |
| P0000582 | 49 | 172 | 61.5 | 46.6 |
| P0000592 | 25 | 173.5 | 68 | 50 |
| P0000593 | 44 | 173 | 63.8 | 53.2 |
| P0000594 | 22 | 177 | 74 | 71 |
| P0000595 | 25 | 184 | 62 | 51.1 |
| P0000600 | 70 | 187 | 65 | 55.5 |
| P0000618 | 60 | 181 | 81.5 | 55.5 |
| P0000628 | 60 | 175 | 93.3 | 65.5 |
| P0000635 | 54 | 165.2 | 61.8 | 37.7 |
| P0000643 | 60 | 177 | 72 | 61 |
| P0000646 | 50 | 179 | 60 | 33.3 |
| P0000648 | 63 | 172 | 78.5 | 70.3 |
| P0000649 | 51 | 176 | 96 | 79.6 |
| P0000663 | 44 | 170 | 69 | 53.2 |
| P0000664 | 48 | 184 | 70.5 | 53.3 |
| P0000673 | 38 | 185 | 55.5 | 45.6 |
| P0000675 | 27 | 176 | 64 | 42 |
| P0000676 | 46 | 172 | 67.5 | 51.6 |
| P0000677 | 45 | 163 | 68 | 45.8 |
| P0000683 | 56 | 172 | 69.5 | 50 |

| | | | | |
|---|---|---|---|---|
| P0000684 | 35 | 174 | 70 | 52.8 |
| P0000690 | 28 | 163 | 60.5 | 48.8 |
| P0000694 | 52 | 167 | 71 | 39.3 |
| P0000698 | 40 | 178 | 73.5 | 58.8 |
| P0000700 | 70 | 170 | 56 | 40 |
| P0000703 | 88 | 161 | 68.5 | 41.1 |
| P0000704 | 40 | 165.9 | 79.4 | 52.2 |
| P0000707 | 26 | 187 | 54.5 | 42.2 |
| P0000711 | 61 | 187 | 90.5 | 63.3 |
| P0000712 | 47 | 166 | 79.5 | 60 |
| P0000717 | 29 | 160 | 78.5 | 51.1 |
| P0000718 | 22 | 180 | 78 | 55 |
| P0000724 | 42 | 170 | 78.5 | 58.8 |
| P0000725 | 57 | 163 | 56.5 | 31.8 |
| P0000726 | 62 | 177 | 72.5 | 48.8 |
| P0000731 | 63 | 166 | 83 | 61 |
| P0000735 | 66 | 156 | 75 | 37.7 |
| P0000742 | 79 | 189 | 86.6 | 71.1 |
| P0000753 | 45 | 179 | 69.5 | 58.8 |
| P0000754 | 57 | 183 | 88 | 60.7 |
| P0000760 | 19 | 172 | 48.5 | 32.4 |
| P0000767 | 28 | 173 | 70.5 | 59.6 |
| P0000770 | 65 | 169 | 79 | 50.6 |
| P0000773 | 76 | 157 | 77 | 51.3 |
| P0000776 | 40 | 165 | 61.5 | 38.7 |
| P0000786 | 65 | 170 | 62 | 41.6 |
| P0000788 | 65 | 171 | 69 | 50.2 |
| P0000789 | 40 | 168 | 60.5 | 43.2 |
| P0000790 | 77 | 162 | 77.5 | 61.1 |
| P0000793 | 42 | 163 | 82 | 60.1 |
| P0000796 | 81 | 175 | 72.5 | 44.6 |
| P0000798 | 36 | 169 | 73.5 | 46.1 |
| P0000799 | 38 | 172 | 64 | 44.6 |
| P0000801 | 65 | 172 | 90 | 71.2 |
| P0000811 | 51 | 171 | 69.5 | 65.8 |
| P0000817 | 55 | 172 | 84.5 | 68 |
| P0000823 | 60 | 171 | 76 | 45.8 |
| P0000825 | 49 | 172 | 73.5 | 49.4 |
| P0000826 | 38 | 163 | 72 | 55.6 |
| P0000829 | 58 | 183 | 85 | 58 |
| P0000836 | 35 | 175 | 74.5 | 55.1 |
| P0000850 | 23 | 179 | 75 | 49.8 |
| P0000856 | 53 | 175 | 78.5 | 48.8 |

| | | | | |
|---|---|---|---|---|
| P0000859 | 23 | 184.5 | 76 | 48.5 |
| P0000862 | 37 | 171.5 | 78 | 42.7 |
| P0000864 | 42 | 165.5 | 67.5 | 35.3 |
| P0000875 | 50 | 162 | 75 | 35.1 |
| P0000876 | 22 | 176 | 67 | 43.9 |

## Appendix C

## Living Persons Data

## White Females

| Age | Stature | | Waist | | Weight | |
|---|---|---|---|---|---|---|
| | (in.) | (cm) | (in.) | (cm) | (lbs.) | (kg) |
| 36 | 64 | 162.56 | 31 | 78.7 | 154 | 69.85 |
| 31 | 69.3 | 176.02 | 29 | 73.66 | 150 | 68.04 |
| 38 | 66 | 167.64 | 28.75 | 73.03 | 142 | 64.41 |
| 33 | 69.5 | 176.53 | 29 | 73.66 | 153 | 69.4 |
| 29 | 62 | 157.48 | 34.5 | 87.63 | 154 | 69.85 |
| 30 | 64 | 162.56 | 28 | 71.12 | 140 | 63.5 |
| 28 | 60.5 | 153.67 | 29 | 73.66 | 126 | 57.15 |
| 20 | 68 | 172.72 | 24 | 60.96 | 120 | 54.43 |
| 33 | 64.75 | 164.47 | 46 | 116.84 | 243 | 110.22 |
| 26 | 68 | 172.72 | 31.5 | 80.01 | 150 | 68.04 |
| 31 | 64 | 162.56 | 24 | 60.96 | 138 | 62.6 |
| 21 | 66 | 167.64 | 27 | 68.58 | 120 | 54.43 |
| 30 | 66 | 167.64 | 28 | 71.12 | 125 | 56.7 |
| 35 | 67.5 | 171.45 | 52 | 132.08 | 259.5 | 117.71 |
| 58 | 67 | 170.18 | 40 | 101.6 | 197 | 89.36 |
| 34 | 70 | 177.8 | 45 | 114.3 | 315 | 142.88 |
| 36 | 64 | 162.56 | 44 | 111.76 | 268 | 121.56 |
| 51 | 70 | 177.8 | 32 | 81.28 | 167 | 75.75 |
| 42 | 66 | 167.64 | 36 | 91.44 | 165 | 74.84 |
| 28 | 66 | 167.64 | 26 | 66.04 | 120 | 54.43 |
| 26 | 66 | 167.64 | 23.5 | 59.69 | 130 | 58.97 |
| 74 | 64.5 | 163.83 | 40 | 101.6 | 172 | 78.02 |
| 30 | 66 | 167.64 | 26 | 66.04 | 119 | 53.98 |
| 30 | 65.5 | 166.37 | 27.5 | 69.85 | 119 | 53.98 |
| 27 | 68 | 172.72 | 29 | 73.66 | 138 | 62.6 |
| 33 | 65 | 165.1 | 41.5 | 105.41 | 250 | 113.4 |
| 54 | 67 | 170.18 | 40 | 101.6 | 261 | 118.39 |
| 35 | 64 | 162.56 | 36 | 91.44 | 168 | 76.2 |
| 27 | 67.5 | 171.45 | 28 | 71.12 | 135 | 61.24 |
| 55 | 60 | 152.4 | 42 | 106.68 | 198 | 89.81 |

## Black Females

| Age | Stature | | Waist | | Weight | |
|---|---|---|---|---|---|---|
| | (in.) | (cm) | (in.) | (cm) | (lbs.) | (kg) |
| 36 | 62 | 157.48 | 30 | 76.2 | 123 | 55.79 |
| 38 | 68 | 172.72 | 36 | 91.44 | 204 | 92.53 |
| 39 | 67 | 170.18 | 32 | 81.28 | 188 | 85.28 |
| 41 | 65 | 165.1 | 30 | 76.2 | 156 | 70.76 |
| 18 | 69 | 175.26 | 42 | 106.68 | 245 | 111.13 |
| 27 | 68 | 172.72 | 34 | 86.36 | 155 | 70.31 |
| 52 | 66 | 167.64 | 36 | 91.44 | 197 | 89.36 |
| 19 | 69 | 175.26 | 32 | 81.28 | 178 | 80.74 |
| 23 | 67 | 170.18 | 30 | 76.2 | 155 | 70.31 |
| 19 | 66 | 167.64 | 25 | 63.5 | 115 | 52.16 |
| 18 | 66 | 167.64 | 22 | 55.88 | 118 | 53.52 |
| 22 | 65 | 165.1 | 24 | 60.96 | 110 | 49.9 |
| 20 | 62 | 157.48 | 21 | 53.34 | 102 | 46.27 |
| 22 | 68 | 172.72 | 29 | 73.66 | 160 | 72.58 |
| 25 | 65 | 165.1 | 26 | 66.04 | 129 | 58.51 |
| 54 | 66 | 167.64 | 32 | 81.28 | 180 | 81.65 |
| 35 | 66 | 167.64 | 30 | 76.2 | 165 | 74.84 |
| 26 | 68 | 172.72 | 24 | 60.96 | 150 | 68.04 |
| 28 | 71 | 180.34 | 25 | 63.5 | 153 | 69.4 |
| 32 | 66 | 167.64 | 30 | 76.2 | 170 | 77.11 |
| 24 | 65 | 165.1 | 30 | 76.2 | 160 | 72.58 |
| 29 | 71 | 180.34 | 27 | 68.58 | 158 | 71.67 |
| 27 | 71 | 180.34 | 26 | 66.04 | 163 | 73.94 |
| 18 | 62 | 157.48 | 24 | 60.96 | 116 | 52.62 |
| 37 | 66 | 167.64 | 29 | 73.66 | 165.35 | 75 |
| 23 | 66 | 167.64 | 29 | 73.66 | 125 | 56.7 |
| 35 | 65 | 165.1 | 35 | 88.9 | 195 | 88.45 |
| 35 | 63 | 160.02 | 30 | 76.2 | 167 | 75.75 |
| 37 | 64 | 162.56 | 32 | 81.28 | 165 | 74.84 |
| 36 | 67 | 170.18 | 29 | 73.66 | 120 | 54.43 |
| 29 | 63 | 160.02 | 31 | 78.74 | 150 | 68.04 |
| 19 | 65 | 165.1 | 32 | 81.28 | 175 | 79.38 |
| 51 | 66 | 167.64 | 36 | 91.44 | 156 | 70.76 |

## White Males

| Age | Stature | | Waist | | Weight | |
|---|---|---|---|---|---|---|
| | (in.) | (cm) | (in.) | (cm) | (lbs.) | (kg) |
| 23 | 71 | 180.34 | 32 | 81.28 | 155 | 70.31 |
| 31 | 67.5 | 171.45 | 36 | 91.44 | 185 | 83.92 |
| 32 | 70.5 | 179.07 | 30 | 76.2 | 150 | 68.04 |
| 26 | 74 | 187.96 | 38 | 96.52 | 215 | 97.52 |
| 31 | 72 | 182.88 | 34 | 86.36 | 176.5 | 80.06 |
| 56 | 74 | 187.96 | 42 | 106.68 | 265 | 120.2 |
| 34 | 72 | 182.88 | 34 | 86.36 | 210 | 95.26 |
| 32 | 65 | 165.1 | 34.5 | 87.6 | 160 | 72.58 |
| 27 | 66 | 167.64 | 36 | 91.44 | 195 | 88.45 |
| 28 | 71 | 180.34 | 54 | 137.16 | 290 | 131.54 |
| 57 | 73 | 185.42 | 36 | 91.44 | 200 | 90.72 |
| 25 | 74 | 187.96 | 30 | 76.2 | 150 | 68.04 |
| 54 | 71 | 180.34 | 33 | 83.82 | 165 | 74.84 |
| 18 | 76 | 193.04 | 36 | 91.44 | 240 | 108.86 |
| 25 | 70 | 177.8 | 40 | 101.6 | 225 | 102.06 |
| 27 | 70 | 177.8 | 33 | 83.82 | 179 | 81.19 |
| 36 | 69.5 | 176.53 | 33 | 83.82 | 175 | 79.38 |
| 32 | 69 | 175.26 | 38 | 96.52 | 204 | 92.53 |
| 27 | 71 | 180.34 | 32 | 81.28 | 180 | 81.65 |
| 26 | 72 | 182.88 | 34 | 86.36 | 175 | 79.38 |
| 24 | 72 | 182.88 | 48 | 121.92 | 330 | 149.69 |
| 34 | 71 | 180.34 | 42 | 106.68 | 240 | 108.86 |
| 31 | 74 | 187.96 | 46 | 116.84 | 280 | 127.01 |
| 30 | 72 | 182.88 | 34 | 86.36 | 185 | 83.92 |
| 38 | 68 | 172.72 | 34 | 86.36 | 200 | 90.72 |
| 44 | 71 | 180.34 | 40 | 101.6 | 210 | 95.26 |
| 43 | 70 | 177.8 | 34 | 86.36 | 160 | 72.58 |
| 38 | 74 | 187.96 | 34 | 86.36 | 187 | 84.82 |
| 56 | 68 | 172.72 | 38 | 96.52 | 206 | 93.44 |
| 30 | 70 | 177.8 | 38 | 96.52 | 188 | 85.28 |
| 37 | 74 | 187.96 | 48 | 121.92 | 336 | 152.41 |
| 27 | 71 | 180.34 | 35 | 88.9 | 155 | 70.31 |

## Black Males

| Age | Stature | | Waist | | Weight | |
|---|---|---|---|---|---|---|
| | (in.) | (cm) | (in.) | (cm) | (lbs.) | (kg) |
| 44 | 70 | 177.8 | 34 | 86.36 | 210 | 103.72 |
| 22 | 73 | 185.42 | 32 | 81.28 | 184 | 90.88 |
| 44 | 76 | 193.04 | 33 | 83.82 | 200 | 98.78 |
| 19 | 71 | 180.34 | 30 | 76.2 | 178 | 87.92 |
| 47 | 74 | 187.96 | 36 | 91.44 | 220 | 108.66 |
| 40 | 70 | 177.8 | 34 | 86.36 | 170 | 83.97 |
| 47 | 74 | 187.96 | 34 | 86.36 | 180 | 88.91 |
| 60 | 74 | 187.96 | 42 | 106.68 | 200 | 98.78 |
| 50 | 69 | 175.26 | 50 | 127 | 245 | 121.01 |
| 80 | 67 | 170.18 | 42 | 106.68 | 185 | 91.38 |
| 35 | 67 | 170.18 | 36 | 91.44 | 185 | 91.38 |
| 40 | 71 | 180.34 | 33 | 83.82 | 158 | 78.04 |
| 37 | 66.5 | 168.91 | 32 | 81.28 | 175 | 86.44 |
| 44 | 65 | 165.1 | 29 | 73.66 | 135 | 66.68 |
| 32 | 68 | 172.72 | 50 | 127 | 305 | 150.65 |
| 62 | 74 | 187.96 | 38 | 96.52 | 170 | 83.97 |
| 67 | 68 | 172.72 | 31 | 78.74 | 130 | 64.21 |
| 20 | 76 | 193.04 | 46 | 116.84 | 300 | 148.18 |
| 50 | 76 | 193.04 | 38 | 96.52 | 220 | 108.66 |
| 44 | 73 | 185.42 | 42 | 106.68 | 210 | 106.19 |
| 28 | 69 | 175.26 | 38 | 96.52 | 210 | 103.72 |
| 53 | 74 | 187.96 | 56 | 142.24 | 335 | 165.46 |
| 31 | 66 | 167.64 | 33 | 83.82 | 165 | 81.5 |
| 37 | 76 | 193.04 | 33 | 83.82 | 183 | 90.39 |
| 35 | 69 | 175.26 | 38 | 96.52 | 196 | 96.81 |
| 25 | 69 | 175.26 | 38 | 96.52 | 190 | 93.85 |
| 41 | 69 | 175.26 | 36 | 91.44 | 195 | 96.32 |
| 51 | 71 | 180.34 | 38 | 96.52 | 208 | 102.74 |
| 55 | 67 | 170.18 | 32 | 81.28 | 165 | 81.5 |
| 51 | 68 | 172.72 | 38 | 96.52 | 182 | 89.89 |
| 21 | 67 | 170.18 | 32 | 81.28 | 152 | 75.08 |
| 39 | 68 | 172.72 | 42 | 106.68 | 210 | 103.72 |

# VITA

I was born February 17, 1967 in Huntsville, Alabama. I moved around the southeastern United States during my childhood, but ended up back in Huntsville again to attend high school there. I graduated in June 1985 from Grissom High School in Huntsville, Alabama. After a brief two quarters at the University of Alabama in Huntsville, I moved to Weaver, Alabama and began attending Jacksonville State University in Jacksonville, Alabama.

I began taking anthropology classes and quickly found that I liked it a lot. Unfortunately, Jacksonville State did not offer a major in anthropology and I was forced to get my undergraduate degree in another area. I finally settled on biology because I found that I had an interest in it as well. Before long I had two minors in anthropology and history as well. I graduated in April of 1990 with my first bachelor of science in biological sciences. During my time at Jacksonville, Dr. William Bass came to lecture in the forensic science department. It was after hearing his lecture on forensic anthropology that I knew what I wanted to pursue for my graduate studies.

After graduation from Jacksonville State, I went back to the University of Alabama in Huntsville for a brief one year stint as a graduate teaching assistant in biology. I soon found that biological sciences alone could not hold my interest. I had set my mind on attending the University of Tennessee to study physical anthropology because that is what I felt I wanted to do as a career. I did not get into the graduate program immediately, but in the years before I did, I picked up two additional bachelors degrees. I completed a

bachelor of arts in anthropology and another bachelor of science in microbiology. I also added chemistry, biochemistry, and ancient mediterranean civilizations to my list of minors. At the same time, I worked five and one half years in Oak Ridge, Tennessee as a laboratory technician full-time.

During the last three years, I have been a graduate student with the department of anthropology at the University of Tennessee. I have been married to my wife Mendy for the last five years and we have a sixteen month old daughter named Amanda. I have recently been hired as a forensic scientist for the Alabama Department of Forensic Sciences in Montgomery, Alabama. I will be working in forensic biology and eventually learn the skills needed to become an expert with forensic DNA. I may also be helping the medical examiner on cases with skeletal remains from time to time.