The Relationship Between Soft Body Composition And Bone Mineral Density In Premenopausal Hispanic And Caucasian Women

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THE RELATIONSHIP BETWEEN SOFT BODY COMPOSITION AND BONE MINERAL DENSITY IN PREMENOPAUSAL HISPANIC AND CAUCASIAN WOMEN

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THE RELATIONSHIP BETWEEN SOFT BODY COMPOSITION AND BONE MINERAL DENSITY IN PREMENOPAUSAL HISPANIC AND CAUCASIAN WOMEN

by

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THESIS

Presented to the Faculty of the Graduate School of The University of Texas at El Paso in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

Department of Kinesiology
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I would like to start by thanking my wonderful husband, Trevor Highfield, whose support and encouragement made this achievement possible. Also, I would like to thank my parents, especially my mom, Sheila Spence, who continually mentioned that I needed to complete this task. To my kids, Haylijane and Kade, I hope this accomplishment will encourage you to strive for higher education. I would like to thank my committee members, Dr Darla Smith and Dr Joe Tomaka, your efforts, kindness, and flexibility are much appreciated. My deepest gratitude and appreciation are for my committee chair, Dr. George King, whose patients and knowledge extends further than most. Thank you for keeping me on task and guiding me throughout the entire process. I would also like to thank Sarah Deemer, Bernadette Franco, Charlie Potter, Danya Saad, Carlos Sifuentes, Randy Solis, Loretta Maldonado, and Misty Babbey for their help with data collection for this study. Finally, this study was supported with funds from the National Institutes of Health: NIH-NCMHH (P20 MD000548-01) & NIH 5-612-RR008124.
ABSTRACT

Investigating the relationship between soft body composition and bone mineral density of premenopausal Hispanic and Caucasian women may help in determining strategies to lower the risk of osteoporosis in postmenopausal women. PURPOSE: To investigate the relationship between BMD and soft tissue body composition, including lean mass and fat mass, of premenopausal Caucasian and Hispanic women. METHODS: Participants were 76 Hispanic [mean ± SD age: 42.7 ± 4.6 y; ht: 161.3 ± 5.66 cm; body mass: 70.14 ± 15.09 kg; BMI: 26.92 ± 15.09 kg/m²] and 46 White [age: 43.8 ± 4.3 y; ht: 165.5 ± 6.16 cm; body mass: 66.37 ± 12.08 kg; BMI: 24.19 ± 3.95 kg/m²] women. Bone mineral density (BMD), percentage of body fat (%BF), fat mass (FM), and lean body mass (LBM) were measured by DEXA. Statistical Analyses included descriptives, Pearson Correlation, and stepwise linear regression. RESULTS: With all women combined, there was a significant relationship between BMD and body mass (r = 0.442, P < 0.001), BMI (r = 0.428, P < 0.001), FM (r = 0.370, P < 0.001), %BF (r = 0.365, P < 0.001), and LBM (r = 0.303, P < 0.001). When the Ethnicities were split, BMD for Caucasian women had a significant relationship with BMI (r = 0.617, P < 0.001), body mass (r = 0.597, P < 0.001), %BF (r = 0.547, P < 0.001), and FM (r = 0.476, P = 0.001), but not with LBM (P = 0.072). For Hispanic women, BMD had a significant relationship with body mass (r = 0.346, P = 0.002), LBM (r = 0.342, P = 0.002), BMI (r = 0.301, P = 0.008), and FM (r = 0.279, P = 0.015), but not with %BF (P = 0.093). Linear regression revealed the best predictors for BMD were body mass (beta = 0.442, F = 29.39, P < 0.001) in all women, body mass (beta = 0.346, F = 10.08, P = 0.002) in Hispanic women, and BMI (beta = 0.617, F = 27.61, P < 0.001) in Caucasian women. CONCLUSION: These data indicate a positive relationship between body mass and BMD, and between BMI and BMD for premenopausal Hispanic and Caucasian women respectively. Low body mass and lower BMI should be discouraged to avoid increased risk of developing osteoporosis. Further research examining the relationship between BMD and ethnic differences in Hispanic and Caucasian women is warranted.
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INTRODUCTION

Osteoporosis is a health risk and the prevalence of osteoporosis is anticipated to increase as the population ages. Classified as a metabolic bone disease, osteoporosis is highly correlated to fracture risk, due to the increase in the fragility of the bone from microarchitectural deterioration of the bone tissue (Bohannon, 1999). The fracture risk of osteoporosis is associated with mortality and disability in the elderly population, as well as higher medical cost (Choi & Pai, 2004). Karasik, Cupples, Hannan and Kiel (2003) stated that fractures associated with osteoporosis occur at a rate of 1.5 million per year in the United States, which have an annual related health care cost of $13 billion.

Bone mineral density (BMD) is a predictor for the development of osteoporosis (Karasik et al., 2003) and is commonly determined by dual energy x-ray absorptiometry (DEXA) (Mitchell, Kammerer, Schneider, Perez, & Bauer, 2003). Low bone density and low peak bone mass are associated with a higher risk for developing osteoporosis (Lewiecki, 2004). Determinants of BMD include heredity, which is considered to be a genetic factor, and age, diet, lifestyle, and soft tissue composition, which are considered to be environmental factors (Winters & Snow, 2000). Genetic influence on BMD is estimated to be around 60% to 80% (Karasik et al., 2003). Increased age is associated with an increase in the incidence of osteoporotic related fractures (Choi & Pai, 2003). One of the major predictors related to BMD is soft tissue body composition including fat mass (Lim et al., 2004) and lean mass (Li, Wagner, Holm, Lehotsky, & Zinaman., 2004; Winters & Snow, 2000).

Reid, Evans, Cooper, Ames, and Stapleton (1993) suggested that fat mass was more strongly correlated with BMD than fat free mass, whereas LBM has been suggested as the best predictor of total body BMD (Winters & Snow, 2000). Taaffe, Villa, Holloway, and Marcus (2000) found that lean mass was a better predictor of BMD than fat mass in postmenopausal
women of both Mexican-American and Caucasian descent. The stress load placed on bones by the contracting muscle during physical activity may increase BMD, and with greater amounts of lean mass, stress loads and BMD may improve (Taaffe et al. 2000). Many researchers support the theory that higher total body weight is associated with higher BMD (Bohanon, 1999; Lim et al., 2004; Papakitsou et al., 2004; Taaffe et al., 2000). Following a longitudinal descriptive design, Holm, Dan, Wilbur, Li, and Walker (2002) suggested that an increase in body weight and mechanical stress were associated with an increase in bone density, whereas a loss in body mass was associated with a loss in BMD.

According to the American Society for Bone Mineral Research and the International Bone and Mineral Society (1999) and Pothiwala, Evans, & Chapman-Novakofski (2006), BMD varies among ethnic groups across all ages. Age and menopause are significantly correlated to spine BMD (Deng et al., 2000) and stage of life has a positive relationship to the risk of developing osteoporosis (Bohanon, 1999). Women tend to be more prone to developing lower bone mineral density compared to men (Karasik et al., 2003). Winters and Snow (2000) mentioned that peak bone mass was acquired by the third decade of life and Zhoa et al. (2004) stated that menopause is associated with a loss in bone density. Lewiecki (2004) stated that 85% of premenopausal women have normal BMD, whereas 15% are osteopenic (at risk for developing osteoporosis) and 0.6% are osteoporotic. Caucasian women seem to have lower BMD and higher fracture risk than other ethnicities including African-American and Hispanic women (American Society for Bone Mineral Research and the International Bone and Mineral Society, 1999).

Soft tissue body composition, including fat mass (FM) and lean body mass (LBM), are factors that may predict BMD in Caucasian women (Holm et al., 2002). Bone mineral density has been widely researched among Caucasian women, whereas there is a lack of bone mineral
density research on Hispanic women (Holm et al., 2002; Pothiwala et al., 2006). Therefore, the purpose of this study was to investigate the relationship between BMD and soft tissue body composition, including lean mass and fat mass, of premenopausal Caucasian and Hispanic women.
METHODS

PARTICIPANTS

Participants consisted of 123 premenopausal women between the ages of 35 and 51 years. The sample included 76 women of Hispanic ethnicity and 47 women of Caucasian ethnicity. Newspaper advertisements, flyers, and emails were used to inform interested potential participants of the study. Volunteers were interviewed by telephone prior to scheduling a laboratory visit to determine eligibility. Inclusion criteria for participation in the study were regular menstrual cycles, free of all known metabolic conditions, free of metabolic altering medications, and being of Hispanic or Caucasian ethnicity. Ethnic criteria for participation was defined as both parents and three of four grandparents being of Hispanic only, or Caucasian only descent. Individuals of mixed descent or of ethnicities other than Hispanic or Caucasian were excluded from the study. Eligible participants were scheduled for a single three to four hour testing session early in the morning. Scheduled testing times included 0600h, 0700h, 0800h, and 0900h throughout the week. Prior to any data collection, the participants provided written consent to participate on an Informed Consent form approved by the IRB at the University of Texas at El Paso.

Following the consent form, participants completed a 21-page questionnaire. Participants were asked to change into clothing consisting of a t-shirt and shorts, size appropriate. Footwear was at the discretion of the participant, however, slippers were provided if the subject desired. Sweatshirts and pants were available to the subject if necessary. Anthropometric measurements of participants including height and weight, without footwear, were recorded.

SURVEY

Participants completed a 21-page survey containing questions regarding their medical history, activity patterns, eating patterns, and ethnic origin. The survey contained specific
questions on smoking, alcohol, oral contraceptive use, menstrual history, physical activity, diet, and dietary supplements. Information from the survey was used to determine ethnic origin.

**DUAL ENERGY X-RAY ABSORPTIOMETRY**

The GE Lunar DPX-NT Dual Energy X-Ray Absorptiometer (DEXA) was used to measure the bone mineral density, percentage body fat (%BF), FM, and LBM of the participants. Measurements of total body BMD were recorded and standard positioning was used for all participants according to the manufacturer’s guidelines. The investigator instructed the participants to remain as still as possible and not talk during the procedure. Regional body segments were visually analyzed and adjusted by a trained technician, the data were processed by the DEXA systems associated software, and BMD was reported as mass per bone surface area (g/cm²). For each participant, a comparison value relative to population based mean peak bone mineral density (T-score) was generated from the software program.

**STATISTICAL ANALYSIS**

Descriptive data for height and age were compared between ethnic groups, using an independent sample $t$-test. The independent variables included body mass, BMI, %BF, FM, and LBM. The dependent variable was BMD. One-way ANOVA two-tailed test was used to determine differences in the variables between the groups. Pearsons correlation was used to determine the relationship of the independent variables to BMD for all women and for each ethnicity. Stepwise linear regression was used to determine the variable with the greatest influence on BMD for all women and for each ethnicity. Mahalanobis and Cook’s distances, collinearity diagnostics, descriptive, and part and partial correlations were included in the linear regression tests. Regression coefficient included estimates and confidence intervals set at 95% level. Alpha level was set at 0.05. SPSS v17.0 software was used for statistical analysis.
RESULTS

DESCRIPTIVE

A total of 123 pre-menopausal women participated in the study. Descriptive characteristics for the Caucasian (N = 47) and Hispanic (N = 76) women of this study are displayed in Table 1. There was no significant difference in mean (± SD) age between Caucasian women (43.8 ± 4.3 y; range: 35-51 y) and Hispanic women (42.7 ± 4.6 y; range: 35-50 y) (P = 0.173). The results of the one-way ANOVA indicated that there was no significant difference between Caucasian and Hispanic women for body mass (66.37 ± 12.08 kg and 70.14 ± 15.09 kg, respectively; P = 0.150), FM (25.87 ± 10.74 kg and 29.15 ± 11.58 kg, respectively; P = 0.121), or LBM (37.54 ± 6.33 kg and 37.66 ± 5.22 kg, respectively; P = 0.907). However, Caucasian women (165.5 ± 6.16 cm) were significantly taller than Hispanic women (161.3 ± 5.66 cm) (P < 0.001). Compared to Caucasian women, Hispanic women had significantly greater BMI (24.19 ± 3.95 kg/m² and 26.92 ± 5.39 kg/m², respectively; P = 0.003), %BF (37.60 ± 8.08% and 41.9 ± 8.14%, respectively; P = 0.005), and BMD (1.175 ± 0.084 g/cm² and 1.210 ± 0.080 g/cm², respectively; P = 0.023).
Table 1. Descriptive characteristics for Caucasian and Hispanic Women.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (N = 123)</th>
<th>Caucasian (N = 47)</th>
<th>Hispanic (N = 76)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>43.1 ± 4.5</td>
<td>43.8 ± 4.3</td>
<td>42.7 ± 4.6</td>
<td>P = 0.173</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>162.92 ± 6.19</td>
<td>165.5 ± 6.16-</td>
<td>161.3 ± 5.66</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Body Mass (kg)</td>
<td>68.70 ± 14.09</td>
<td>66.37 ± 12.08</td>
<td>70.14 ± 15.09-</td>
<td>P = 0.173</td>
</tr>
<tr>
<td>BMD (g/cm²)</td>
<td>1.20 ± 0.083</td>
<td>1.175 ± 0.084</td>
<td>1.210 ± 0.080-</td>
<td>P = 0.023</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.88 ± 5.06</td>
<td>24.19 ± 3.95-</td>
<td>26.92 ± 5.39-</td>
<td>P = 0.003</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>40.26 ± 8.35</td>
<td>37.60 ± 8.08-</td>
<td>41.9 ± 8.14-</td>
<td>P = 0.005</td>
</tr>
<tr>
<td>Fat Mass (kg)</td>
<td>27.90 ± 11.33</td>
<td>25.87 ± 10.74</td>
<td>29.15 ± 11.58-</td>
<td>P = 0.121</td>
</tr>
<tr>
<td>Lean Body Mass (kg)</td>
<td>37.62 ± 5.65</td>
<td>37.54 ± 6.33</td>
<td>37.66 ± 5.22-</td>
<td>P = 0.907</td>
</tr>
</tbody>
</table>

Values are expressed as Mean ± SD. Bone Mineral Density (BMD); Body Mass Index (BMI).

*P-values between Caucasian and Hispanic women.

CORRELATIONS

Pearson Correlations were calculated to determine the relationships between the dependant variable BMD and the independent variables body mass, BMI, %BF, FM, and LBM (Table 2). With all women combined, there was a significant relationship between BMD and body mass (r = 0.442, P < 0.001), BMI (r = 0.428, P < 0.001), FM (r = 0.370, P < 0.001), %BF (r = 0.365, P < 0.001), and LBM (r = 0.303, P < 0.001). When the Ethnicities were split, BMD for Caucasian women had a significant relationship with BMI (r = 0.617, P < 0.001), body mass (r = 0.597, P < 0.001), %BF (r = 0.547, P < 0.001), and FM (r = 0.476, P = 0.001), but not with
LBM (P = 0.072). For Hispanic women, BMD had a significant relationship with body mass (r = 0.346, P = 0.002), LBM (r = 0.342, P = 0.002), BMI (r = 0.301, P = 0.008), and FM (r = 0.279, P = 0.015), but not with %BF (P = 0.093).

Table 2. Correlation between bone mineral density (BMD) and body mass, body mass index (BMI), body fat (%BF), fat mass (FM), and lean body mass (LBM) for Caucasian and Hispanic Women.

<table>
<thead>
<tr>
<th></th>
<th>Total r-value</th>
<th>Caucasian r-value</th>
<th>Hispanic r-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass (kg)</td>
<td>r = 0.442 †</td>
<td>r = 0.597 †</td>
<td>r = 0.346 *</td>
</tr>
<tr>
<td>BMI (g/cm²)</td>
<td>r = 0.428 †</td>
<td>r = 0.617 †</td>
<td>r = 0.301 *</td>
</tr>
<tr>
<td>%BF</td>
<td>r = 0.365 †</td>
<td>r = 0.547 †</td>
<td>r = 0.194</td>
</tr>
<tr>
<td>FM (kg)</td>
<td>r = 0.370 †</td>
<td>r = 0.476 †</td>
<td>r = 0.279 *</td>
</tr>
<tr>
<td>LBM (kg)</td>
<td>r = 0.303 †</td>
<td>r = 0.265</td>
<td>r = 0.342 *</td>
</tr>
</tbody>
</table>

Significantly correlated with BMD; *P < 0.01; †P < 0.001.
LINEAR REGRESSION

A standardized stepwise linear regression test was used for the whole population and then for each ethnicity to assess which variables (body mass, BMI, %BF, FM, and LBM) had the greatest influence on BMD. There was no violation of the assumption of normality, linearity, or multicollinearity within the analyses. As a whole group, body mass explained 19.5% (beta = 0.442, F = 29.39, P < 0.001) of the variance for BMD. Body mass also explained 12% (beta = 0.346, F = 10.08, P = 0.002) of the variance for BMD for Hispanic women, whereas BMI explained 38% (beta = 0.617, F = 27.61, P < 0.001) of the variance for BMD among Caucasian women (Figure 1.).
Figure 1. Graphic display of linear regression illustrating the variable with the greatest influence on between bone mineral density for (a) all women combined (body mass), (b) Hispanic women (body mass), and (c) Caucasian women (body mass index).
DISCUSSION

Participants from this study consisted of 47 Caucasian women and 76 Hispanic women, all of whom were premenopausal. The purpose of this study was to determine the relationship between BMD and soft tissue body composition, including lean mass and fat mass, of premenopausal Caucasian and Hispanic women. The results of the Pearson correlation analyses indicated that the independent variables (body mass, BMI, %BF, FM, LBM) were all significantly related to BMD for all women in the study. Once the ethnicities were separated, the correlation test indicated that all the variables (body mass, BMI, %BF, FM) except LBM were significantly related to BMD for the Caucasian women and that all the variables (body mass, BMI, FM, LBM) except %BF were related to the BMD of the Hispanic women. Data from the ANOVA indicated that BMD, BMI, and %BF were all significantly different between the two ethnicities. The major findings from the linear regression were that body mass was the primary predictor of BMD for all women in the study and for Hispanic women, whereas BMI was the primary predictor for BMD of Caucasian women.

These results for all women combined and the Hispanic women were similar to the result found by Lim et al. (2004) and Holm et al. (2002). The authors (Lim et al., 2004) stated that weight was a principal determinant of BMD for women. There is a positive relationship with increasing body mass and increasing mechanical stress on bone, which leads to reduced bone resorption and maintenance of BMD (Lim et al., 2004). Holm et al. (2002) stated that body weight had a significant influence on BMD of perimenopausal and postmenopausal African-American and Caucasian women. The authors (Holm et al., 2002) found that African-American women had significantly higher body mass and BMD compared to Caucasian women and suggested that body weight may be a contributing factor. The Hispanic women in the current study had a higher mean body mass compared to the Caucasian women, although this difference
was not statistically significant, and had significantly greater BMD (P=0.023), BMI (P=0.003), %BF (P=0.005), and were of shorter stature (P<0.001) than the Caucasian women. Hispanic women were significantly shorter in height with greater %BF and BMI suggesting that when adjusting for height the Hispanic women weighed more than the Caucasian women, this may have contributed to the higher BMD of Hispanic women. Lim et al. (2004) mentioned that cultural and ethnic factors may influence changes in body composition as people age. Similarities between the current study and that of Lim et al. (2004) and Holm et al (2002) are limited due to the differences between the populations. Lim et al. (2004) investigated Korean postmenopausal women and Holm et al (2002) investigated African-American and Caucasian women, a comparison of sample groups that vary from the current study comparing Hispanic and Caucasian premenopausal women.

The results for the Caucasian women of this study were similar to those reported by Asomaning, Bertone-Johnson, Nasca, Hooven, and Pekow (2006) and Baheiraei, Pocock, Eisman, Nguyen, and Nguyen (2005). Data from both studies indicated a relationship between BMD and BMI. The authors (Asomaning et al., 2006; Baheiraei et al., 2005) found that women with a lower BMI were associated with lower BMD. The current study did not separate the sample population by weight categories, however, a significant positive relationship was found between BMD and BMI within the Caucasian women (Figure 1c.). Data from the current study indicated that a lower BMI was associated with lower BMD and higher BMI was associated with higher BMD within the premenopausal Caucasian population. These findings are consistent with the investigation of Asomaning et al. (2006) which consisted of postmenopausal Caucasian women from the United States and to the investigation of Baheiraei et al. (2005) which consisted of Iranian women from Australia. These findings suggest that Caucasian women should be
advised to maintain a normal BMI, regardless of age and stage of menopause, to avoid the higher risk of low BMD associated with lower BMI.

The results from this study indicated a significant difference in BMD between ethnicities, which supports the findings from Taaffe et al. (2000). Despite no significant difference in %BF between the ethnicities, Taaffe et al. (2000) reported that BMD and truncal adiposity were significantly higher in Mexican-American postmenopausal women than Caucasian women and that BMD was positively associated with the ratio of truncal fat (P<0.001). Unfortunately, it is not clear if Taaffe et al. (2000) controlled for other possible confounders. For the current study, there was a significant difference in %BF between the Hispanic and Caucasian women, although we did not investigate specific body regions for difference in adiposity. For these data, the step-wise regression model controlled for each independent variable and revealed that whole-body %BF was not a significant predictor of BMD for all women combined, for Hispanic women, or for Caucasian women.

For these Hispanic women, 12% of the variance in BMD was explained by body mass. Mitchell et al. (2003) found that 78% of the variance in spine BMD and 67-76% of the variance in hip BMD of Mexican-American women was explained by heritability (genetic effects). Similarly, in a study consisting of twins, Seeman, Hopper, Young, Formica, Goss, and Tsalamandris (1996) found that approximately 80% of the variance of lean mass and 80% of the variance of BMD in Caucasian women was explained by genetic factors. The current study found that 38% of the variance in BMD was explained by BMI for the Caucasian women. Further investigations are warranted to explain more of the difference in variance between Caucasian and Hispanic premenopausal women. Investigations between both ethnicities, which include more environmental and genetic factors, are also warranted.
The current study found a significant relationship between BMD and FM for all women in the study and both ethnicities, and between BMD and LBM for all women in the study and Hispanic women (Table 2). These variables, however, were not the primary predictor of BMD for any of the groupings. Results from the current study found body mass for all women and Hispanic women, and BMI for Caucasian women to be the primary predictor of BMD, which differs from previous studies which indicated that FM (Ijuin, Douchi, Matsuo, Yamamoto, Uto, & Nagato, 2002; Mizuma, Mizuma, Yoshinaga, Iwamoto, Matsuo, & Osame, 2006; Reid et al., 1993) or LBM (Ijuin et al. 2002; Li et al, 2004; Mizuma et al., 2006; Winters and Snow, 2000) was the greatest predictor of BMD. Among postmenopausal Japanese women, it appears that FM may be a good predictor of BMD (Ijuin et al., 2002; Mizuma et al., 2006), whereas LBM may be a good predictor of BMD for premenopausal Japanese women (Ijuin et al. 2002; Mizuma et al., 2006). Reid et al. (1993) determined that FM was the best predictor of BMD in postmenopausal women. Additionally, Li et al. (2004) found that LBM was the best determinant of BMD among a mixed sample of Caucasian, African-American, and Hispanic perimenopausal women. Winters and Snow (2000) found that LBM was the best determinant of BMD in premenopausal women. The difference in findings of the current study could be a result of race, ethnicity, stage of menopause, or environmental factors.

Another theory that may partially explain the disparate findings is that this study investigated total-body BMD, whereas previous studies (Ijuin et al., 2002; Li et al., 2004; Winters and Snow, 2000) investigated the BMD of specific regions. The current study investigated BMD of the total-body, this varied from the investigation by Ijuin et al. (2002) which included associations between BMD and lumbar spine, pelvis, and legs. Other have reported that LBM was the best predictor for BMD in premenopausal women at the lumbar spine, pelvis, legs, (Ijuin et al., 2002) and femoral neck (Winters and Snow, 2000), and for BMD
in perimenopausal women at the femoral region (Li et al., 2004). Li et al. (2004) suggested that the association between BMD and soft body composition is determined by the mechanical pull on bone. By investigating specific regions of BMD, further determination of the association between LBM and BMD may differ in results to the current study, especially in regions such as the spine, pelvis, or hip bones, where on average, mechanical pull occurs often daily.

Results may have differed if the number of participants were more equal among ethnicities. The current study included 76 Hispanic women and 47 Caucasian women. The number of participants in general may have affected the results. SPSS manual suggested 40 cases per independent variable when using linear regression; this study did not have the recommended number of participants, especially when separating the ethnicities. Further, results from this study may have differed from previous studies (Holm et al., 2002; Li et al., 2004; Mudano et al., 2003; Mizuma et al., 2006; Reid et al., 1993; Taaffe et al., 2000) due to the varying characteristics of the samples. This study was limited to premenopausal Caucasian and Hispanic women; therefore, generalizations should be made within the realm of this population.

Results from the linear regression of this study indicated that for premenopausal Caucasian women, BMI was positively associated with BMD. Bass, Ford, Brown, Mauromoustakos, and Keathley (2006) found no significant difference in BMD between overweight and normal weight women, and suggested that encouraging women to be overweight or obese would be increasing the risk of cardiovascular disease. The findings from this study indicate that premenopausal Caucasian women should increase BMI to possibly attain greater BMD. Increasing BMI, however, to a category of overweight or obese increases the risk of cardiovascular disease. Therefore, premenopausal Caucasian women should be encouraged to maintain a normal BMI to avoid increased risk of developing low BMD associated with lower
BMI and should be discouraged to be overweight or obese due to the possibility of developing a higher risk of cardiovascular disease.

The linear regression revealed that body mass was the primary determinant of BMD for Hispanic women. The R-value (beta = 0.346; R = 0.346) indicated a weak relationship; however, the relationship was positive. According to Takada, Washino, and Iwata (2002), increased weight would be beneficial for BMD only if the increase resulted from higher LBM. Pearson correlation coefficient results for the current study indicated that LBM (P=0.002) and not FM was significantly related to BMD for Hispanic women. The relationship between body mass and BMD in the Hispanic women, from the current study, may be weak because some of the Hispanic women were higher in body mass because of FM and not LBM. Possibly, Hispanic women with higher body mass resulting from more LBM may have higher BMD compared to the Hispanic women with higher body mass resulting from higher FM. Theoretically, gains in BMD for Hispanic women should be obtained by increasing body mass through means of exercise to increase LBM.

In summary, the major findings for the participants of the current study were that body mass was the best predictor of BMD for all women and Hispanic women, and that BMI was the best predictor of BMD for Caucasian women. All major findings were positive relationships, indicating that higher body mass and BMI were associated with greater BMD for Hispanic and Caucasian women, respectively. The authors of this study suggest that premenopausal Caucasian women should be encouraged to avoid a lower BMI and maintain a normal BMI to obtain benefits in BMD. Higher BMI should also be discouraged to avoid increased risks of cardiovascular disease. The authors further suggest that premenopausal Hispanic women should increase body mass by increasing LBM to achieve benefits in BMD.
REFERENCES


effects of body composition on bone mineral density between pre- and postmenopausal women. *Maturitas, 43*, 239-244.


nuclear families. *Bone, 35*, 395-402.
REVIEW OF LITERATURE

Osteoporosis was described as a systemic skeletal disease (Bohanon, 1999), during which there is a deterioration of the bone tissue resulting in low bone mass (Chung et al., 2003). The risk of fractures increases following the development of osteoporosis, due to the fragility of the bone (Chung et al., 2003). Fracture sites most commonly associated with osteoporosis include the hip, spine, forearm, and proximal humerus (WHO, 2004). There are many factors that affect BMD and therefore, are associated with the development of osteoporosis. These factors include genetics, body composition, lifestyle, activity patterns, and ethnicity (Winters & Snow, 2000).

OSTEOPOROSIS

Osteoporosis is described as a chronic degenerative disease of the bone commonly found in elderly populations. Bohanon (1999) defined osteoporosis as a systemic skeletal disease, which results in micro-architectural deterioration of the bone (Figure 1 & 2). Osteoporosis is characterized by insufficient capability of the bone to maintain mechanical support function (Choi & Pai, 2004). Bone density is commonly determined by dual energy x-ray absorptiometry (DEXA) (Mitchell, Kammerer, Schneider, Perez, & Bauer, 2003), and is commonly expressed as units of standard deviation above or below the population based mean peak bone mineral density (T-score). A T-score between -1.0 and -2.5 standard deviations defines osteopenia (Lewieki, 2004), whereas diagnosed cases of osteoporosis are described as greater than 2.5 standard deviations below expected peak bone mass (T-score < -2.5) (Lewieki, 2004; Mitchell et al., 2003).
Figure 2. Bone loss due to osteoporosis over several decades. [www.menaq7.com/?page=bone-health](http://www.menaq7.com/?page=bone-health) © Nutricon 2008

Figure 3. Normal Bone and Bone with Osteoporosis with a close-up view of the difference between normal and an osteoporotic bone. [www.abc.net.au/.../2004/04/29/1831468.htm](http://www.abc.net.au/.../2004/04/29/1831468.htm)
The risk of developing osteoporosis is positively correlated with senescence (Taaffe, Villa, Holloway, & Marcus, 2000) and in 2003 osteoporosis was affecting 10 million people in the United States (Michell et al., 2003). With the current projected growth of the older adult population (Choi & Pai, 2004) this number is likely to increase because individuals experience a 30% loss in bone mass by age 70 years (Holm, Dan, Wilbur, Li, & Walker et al., 2002).

Osteoporosis is associated with low bone mass and low bone density, resulting with a greater risk of bone fractures (Bohanon, 1999; Holm et al., 2002; Lloyd, Chinchilli, Johnson-Rollings, Kieselhorst, Eggli, & Marcus, 2000). Mitchell et al. (2003) stated that the majority of bone fractures related to osteoporosis occur in the vertebrae and the hip. People suffering from fractures caused by osteoporosis are predisposed to higher health care costs, mortality, and disabilities (Choi & Pai, 2004; Taffe, Lang, Fuerst, Cauley, Nevitt, & Harris, 2003). Karasik, Cupples, Hannan, and Kiel (2003) stated that fractures associated with osteoporosis occur at a rate of 1.5 million per year in the United States, which have an annual related health care cost of $13 billion. In the United States, the development of osteoporosis is four-fold greater in women than in men and may be attributed to a generally larger bone mass and bone size in men (Karasik et al., 2003), which translates to a lower bone area in women (Taffe et al., 2003). Although Caucasian women have a higher rate of hip fractures (Taaffe et al., 2003), African-American women have a higher mortality and disability rate following a hip fracture (Bohanon, 1999; Mudano et al., 2003). According to Mitchell et al. (2003), Mexican-American women seem to have a lower risk of vertebral and hip fractures when compared to the non-Hispanic White population. The authors speculated that the lower risk of bone fracture may be related to the higher rate of obesity in the Mexican-American population.
One of the major predictors of osteoporosis is bone density (Karasik et al., 2003). Low bone density and low peak bone mass are associated with a higher risk for developing osteoporosis (Lewiecki, 2004). Factors associated with osteoporosis are the peak bone mass achieved (Sirola, Kroger, Honkanen, Jurvelin, Sandini, Tuppurainen, & Saarikoski, 2003), and the rate at which bone loss occurs (Mitchell et al., 2003).

Osteoporosis is described as a systemic skeletal disease (Bohanon, 1999) which increases the risk of fracture (Bohanon, 1999; Holm et al., 2002; Lloyd et al., 2000). Bone density is used to determine the stage of osteoporosis (Karasik et al., 2003). Women tend to be more prone to developing lower bone mineral density compared to men (Karasik et al., 2003) and BMD seems to vary between races and ethnicity (Taaffe et al., 2003).

**BONE DENSITY**

Once the epiphyseal plates close, bone has matured and bone remodeling is determined by the activity of osteoblasts and osteoclasts, which are responsible for osteogenesis and bone resorption, respectively (Arnheim & Prentice, 1993 p:168). Bone loss occurs when resorption exceeds the osteogenic gains resulting in endosteal surface loss, decreased bone thickness, and increased bone porosity (Arnheim & Prentice, 1993, p:168) (Figure 2 & 3). Bone mineral content is comprised of 80-90% calcium and phosphorus (Ilich, Brownbill, & Tamborini, 2003) and these minerals are partly responsible for the mass and rigidity of bone (Van de Graaff, 1984). Bone mineral density is expressed as weight per unit surface area (g/cm²). According to Wang, Lei, Dvornyk, Sun, Jiang, Li, and Deng (2006), BMD is mathematically expressed as bone mineral content (BMC) divided by bone size (mass divided by surface area). By the end of adolescence, 40-50% of bone mass has been achieved (Lloyd et al., 2000) and bone mineral continues to increase reaching a peak in the third decade of life for females (Winters & Snow, 2000).
Figure 4. Anatomy of bone with close up of inside of the bone.

http://homepage.mac.com/myers/misc/bonefiles/bonestruct.html
Females generally have less bone mass and smaller bone size compared to males (Karasik et al., 2003), which may account for the lower BMD observed in females (Taffe et al., 2003). Along with gender differences in BMD, there are also differences seen between ethnicities (Bohanon, 1999; Chung et al., 2003; Dibba, Prentice, Laskey, Stirling, & Cole, 1999; Holm et al., 2002; Mitchell et al., 2003; Mudano et al., 2003; Taffe, 2003; Taffe et al., 2000). The prevalence of low BMD seems to be higher in female Caucasians compared to African-Americans (Bohanon 1999; Dibba et al., 1999; Holm et al., 2002; Mudano et al., 2003; Taffe, 2003; Taffe et al., 2000) and Mexican-American (Mitchell et al., 2003).

Approximately 10 million people in the United States have low bone density and an additional 18 million individuals are at risk (Mitchell et al., 2003). Lewiecki (2004) stated that 85% of premenopausal women have normal BMD, whereas 15% are osteopenic (at risk for developing osteoporosis) and 0.6% are osteoporotic. Low BMD is associated with genetic variables and environmental risk factors (Karasik et al., 2003). The genetic variables include age and sex, and the environmental risk factors include diet, lifestyle, soft tissue composition, and ethnicity (Winters & Snow, 2000).

**GENETIC FACTORS INFLUENCING BONE MINERAL DENSITY**

Genetic influence is regarded as one of the most important factors affecting BMD and a variable that cannot be manipulated. Research suggests that 80% of bone strength (Ilich et al., 2003), as much as 80% (Seeman, Hopper, Young, Formica, Goss, & Tsalamandris, 1996) to 85% (Bohanon, 1999) of the variance in BMD, and 60-70% of the variance in peak bone mass (Lewiecki, 2004) are genetically determined.

Lewiecki (2004) suggested that the genetic variability of peak bone mass was included in phenotypes determining ethnicity, gender, and body size. Mitchell et al. (2003) further explained that genes may influence BMD at different stages of life and emphasized that genetics may have
a greater influence on peak bone mass of females compared to males because females have higher heritability and greater genetic effect in respect to BMD. The authors found that variation in BMD at the spine was related to heritability in 85% of women compared to only 55% of men (Mitchell et al., 2003).

Chung et al. (2003) completed a study to identify a possible genetic link to bone loss and suggested that the cytokine interleukin-6 may be associated with osteoporosis. Interleukin-6 is partly responsible for the development of osteoclasts and the stimulation of bone resorption (Chung et al., 2003). Chung et al. (2003) stated that the alleles of interleukin-6 are population specific and differed in Asian women compared to Caucasian women, suggesting that interleukin-6 may be a possible factor contributing to the varying levels of BMD between populations. This study was further supported by the statement of Lewiecki (2004) who suggested that ethnicity was a genetic factor affecting BMD. Pothiwala, Evans, and Chapman-Novakofski (2006) further stated that ethnic variance in the incidence and prevalence of osteoporosis is associated with genetics.

Mitchell et al. (2003) also stated that BMD varied between ethnicities by suggesting that Caucasians have a lower BMD and higher risk of fracture than both Mexican-Americans and African-Americans. Genetic influence may affect the rate of bone loss and the maintenance of bone (Mitchell et al., 2003), therefore there is a possibility that the rate of bone loss and maintenance of bone may vary between ethnic groups.

Rapuri, Gallagher, Knezetic, Kinyamu, & Ryschon (2004) further found that genetic variances exist within the same ethnic group as seen by a higher rate of bone loss in Caucasian women with the vitamin D receptor (VDR) polymorphisms genotype BB/tt compared to those with the genotype of bb/TT. According to Langeman (2005), loss and increase in bone density are determined by genetics. Genetics are involved with osteoclast and osteoblast development,
as well as mineral homeostasis. Langemen (2005) mentioned that accumulation of bone density was associated with a quantitative trait loci (QTL). Autosomes associated with the QTL have varied within the Caucasian population. Dvornyk et al. (2003) further explained that genes are responsible for not only the majority of BMD differences within an ethnic group but also the differences between various ethnic groups. The authors (Dvornyk et al., 2003) observed a difference in the allele of the VDR gene between Asian women and Caucasian women. Related to the genetic influence of BMD, age and biological events such as menopause and menarche may also affect BMD.

AGE AND BONE MINERAL DENSITY

Genetic influence on BMD also continues with age. Cagnacci, Bagni, Zini, Cannoletta, Geneerali, and Volpe (2008) stated that compared to younger women, postmenopausal women have higher levels of homocysteine, which increases with age and is associated with low BMD. The factors that affect BMD differ with age (Douchi et al., 2004). Age and menopause are significantly correlated to spine BMD (Deng et al., 2000) and stage of life has a positive relationship to the risk of developing osteoporosis (Bohanon, 1999). Lloyd et al. (2000) stated that 40-50% of adult peak bone mass is acquired during adolescence. Lopez-Caudana et al. (2004) found that there was an association with age of menarche and BMD in premenopausal women. Similarly, Galuska and Sower (1999) found that age at menarche and the regularity of menses were “predictors of BMD at the lumbar spine.” Women achieve peak BMD during the third decade of life (Winters & Snow, 2000) and the rate of bone loss observed with normal aging increases greatly following menopause. Holm et al. (2002) suggested that important factors for BMD in the elderly include peak bone mass and the rate of bone loss. Similarly, Deng et al. (2000) stated that once peak bone mass is obtained, it is maintained through remodeling until age 50 years, at which point there is a decline for the remainder of life. By age
70 years, up to 30% of bone mass may be lost (Holm et al., 2002). Among the general 70 year old population, the most common fracture sites are the spine and hip (Winters & Snow, 2000), which are associated with mortality and morbidity (Taaffe et al., 2003). Postmenopausal women also exhibit less balance stability, so they are more prone to falls thereby increasing their risk of fracture (Winters & Snow, 2000).

Postmenopausal women are at higher risk of fracture due to greater fragility of bone through low bone density (Winters & Snow, 2000). The correlation between circulating estrogen and BMD is lower in postmenopausal women compared to premenopausal women (Reid, Evans, Copper, Ames, & Stapleton, 1993). Holm et al. (2002) and Zhoa et al., (2004) suggested that the decrease in estrogen following menopause is associated with bone turnover and bone loss.

Kritz-Silverstein, von Muhlen, and Barrett-Connor (2004) suggested that estrogen replacement therapy (ERT) possibly decreases the rate of bone loss; therefore, the use of ERT could facilitate a decrease in the risk of osteoporosis. Li, Wagner, Holm, Lehotsky, and Zinaman (2004), however, found that their subjects who were using ERT had lower fat free mass (FFM), body weight, and BMD compared to non-users. The use of oral contraceptive (OC) in postmenopausal women may be beneficial for bone maintenance, whereas the use of OC by premenopausal women, may negatively effect peak bone mass (Prior et al., 2001). Prior et al. (2001) mentioned that “OC interferes with the achievement of peak bone mass” (p. 1024) in OC users between the teen years and early twenties. The lower BMD of OC users translated into higher risk of fractures following menopause. Prior et al. (2001) found that premenopausal women who used OC had a significantly lower BMD of the greater trochanter (P=0.01) and lumbar spine (P<0.001) compared to non-users. Prior et al. (2001) further stated that the reason for the differences in BMD between users and non-users of OC was still unclear. Possible reasons for the difference may include other lifestyle choices such as smoking and use of
alcohol. Elgan, Samsioe, and Dykes (2003) suggested that OC use may positively affect BMD in young women with menstrual irregularities and that OC may help to offset the negative effects of smoking on BMD. The use of oral contraceptives should be noted when comparing BMD of varying ethnic groups to account for possible alterations in peak bone mass.

Winters and Snow (2000) mentioned that peak bone mass was acquired by the third decade of life and Zhoa et al. (2004) stated that menopause is associated with a loss in bone density. This warrants research in the premenopausal stage to fully understand the changes that are occurring in bone mass from the third decade of life to the menopausal.

**DIET**

According to Lloyd et al. (2000), nutrition is a modifiable determinant of peak bone mass. The nutrients necessary for bone metabolism include the minerals calcium, magnesium, and zinc, and the vitamins A, D, C, K, and folate (Ilich et al., 2003). Soroko, Holbrook, Edelstein, and Barrett-Connor (1994) stated that the consumption of milk dairy products were the source of half of the dietary calcium intake in North America and found that adults with diets containing ample calcium had higher bone mass. This may be the result of either less bone loss or the ability to achieve a higher peak bone mass. Calcium metabolism varies between African-American and Caucasian women where African-American women had a higher rate of calcium absorption and lower urinary calcium excretion than Caucasian women (Bohanon, 1999). Ilich et al. (2003) further stated that protein is important for calcium absorption suggesting that the elderly may need to ensure adequate protein levels in their diet. This data also indicated that Vitamin C may have a preventative role against osteoporosis explained by its antioxidant properties.
Lin et al. (2003) stated that a reduced sodium diet lowers the excretion of calcium. Sellmeyer, Schloetter, and Sebastian (2002) further found that potassium citrate lowered urinary calcium excretion of postmenopausal women consuming a high sodium chloride diet, therefore maintaining the calcium turnover. The authors suggested that postmenopausal women do not demonstrate the correct hormonal response to compensate for urinary calcium loss following an increased sodium diet and further suggested that postmenopausal women should consume more dietary potassium alkaline salts (Sellmyer et al., 2002). Ryder et al. (2005) stated that magnesium is linked to BMD through the effect it has on calcium retention via the calcitropic hormones.

Bone mineral density has been linked indirectly to other vitamins and minerals such as A, K, folate, and zinc. A folate deficiency, measured by plasma folate, has been related to low BMD in postmenopausal women due to its relationship with homocysteine (Baines et al., 2007; Cagnacci et al., 2008; Cagnacci, Baldassari, Rivolta, Arangino, & Volpe, 2003; Golbahar, Hamidi, Aminzadeh, & Omrani, 2004). Maggio et al. (2006) found that vitamin A was not directly correlated to BMD; however, it may be linked to increased hip fractures through its role in osteoclastogenic activities. The authors suggested that insufficient and excessive amounts of retinol may increase bone loss and suggested that supplementation of vitamin A should be in the form of carotenoids, which may have bone conserving benefits (Maggio et al., 2006). Bonjour, Schurch, and Rizzoli (1996) suggested that vitamin K was linked to BMD through its production of osteocalcin. Ilich et al. (2003) found that zinc was significantly associated with BMD of the trabecular bones when using a multiple regression model. Further, Ilich et al. (2003) stated that the relationship with zinc and BMD was through the role of zinc in collagenous formation and bone mineralization.
Some authors have investigated the role of dieting in relation to BMD (Bacon, Stern, Keim, & Van Loan, 2004; Nakata, Okawara, Lee, Okura, & Tanaka, 2008). In a study by Nakata et al. (2008), there was no significant difference in BMD loss found between premenopausal Japanese women who lost weight dieting and those who lost weight dieting with resistance training over a fourteen week period. Further, Nakata et al. (2008) stated that the loss was only in whole-body BMD and was minimal (0.3%), suggesting that dieting for weight loss slightly decreases BMD in this population. Bacon et al. (2004) suggested that chronic dieting throughout adolescent and young adulthood, with a history of fifteen or more incidences of restraint eating, would increase the risk for low BMD in premenopausal obese Caucasian women. Data indicated an inverse relationship between amount of past dieting and BMC (Bacon et al., 2004).

Investigators have been searching for the link between vitamin D and the vitamin D receptor gene for any significant relationships to BMD (Zajickova, Hill, Vankova, & Zofkova, 2006). In a study by Zajickova et al. (2006), there was no association found between vitamin D receptor gene polymorphism IVS8+443G>A and BMD in perimenopausal or postmenopausal women.

Poli, Bruschi, Cesana, Rossi, Paoletti, and Crosignani (2003) found that postmenopausal women with higher levels of plasma LDL cholesterol were associated with a higher risk of osteopenia at the lumbar spine. The authors suggested that varying intake of cholesterol could possibly affect BMD. Dietary intake may differ between ethnicities; therefore when comparing BMD between ethnic groups, further investigation into varying diets is warranted.
LIFESTYLE

Similar to diet, lifestyle behaviours are also modifiable and may influence BMD. The lifestyle factors that affect BMD include smoking and alcohol consumption, and physical activity patterns (Deng et al., 2000; Takada, Washino, & Iwata, 1997).

Smoking and Alcohol Consumption

Data from the experiment of Deng et al. (2000) indicated that moderate consumption of alcohol had a beneficial affect on hip BMD for both sexes and smoking alone showed no significant affect on BMD; however, when participants with low body mass consumed alcohol and smoked there was a negative affect on hip BMD. Deng et al. (2000) suggested that BMD was affected by smoking only when other factors were involved. Smoking and body mass combined affected spine BMD, whereas a combination of smoking with alcohol consumption and body mass affected the hip; the difference was noted in those with a low body mass, which cannot counteract the negative effects of smoking (Deng et al., 2000). Similarly, Takada et al. (1997) suggested that smoking and consuming alcohol, even three or less days a week, increased the risk of low BMD for women in their sixth decade or older.

Sewon, Laine, Karjalainen, Doroguinskaia, and Lehtonen-Veromaa (2004), however, stated that there was a difference in heel BMD between smokers and non-smokers. The data indicated that smokers had higher calcium levels within their saliva, suggesting that smokers may have increased calcium turnover (Sewon et al., 2004). Oncken, Prestwood, Kleppinger, Wang, Cooney, and Raisz (2006) reported in their study of postmenopausal women that following one-year of smoking cessation, BMD at the hip improved when compared to continuing smokers. Rapuri, Gallagher, Balhorn, and Ryschon (2000) suggested that the decrease in BMD found in smokers was due to a decrease of calcium absorption. The study by Rapuri et al. (2000) consisted of postmenopausal women and data indicated that significant
differences in bone loss were seen in participants who smoked more than one pack per day. Elgan et al. (2003) suggested that the negative effect of smoking on BMD may be associated with decreased estrogen levels in smokers. Similarly Holm et al. (2002) stated that cigarette smoking and caffeine intake may have negative effects on BMD by lowering calcium absorption.

Some authors have found that smoking (Holm et al., 2002; Sewon et al., 2004), and smoking with alcohol consumption (Deng et al., 2000; Takada et al., 1997) may increase the risk of developing low BMD; therefore, when researching BMD, a history of cigarette and alcohol use is warranted.

**Activity Patterns**

The influence of physical activity on BMD depends upon the extent of weight-bearing, the amount of impact, and is specific to the involved bone (Ulrich, Georgiou, Gillis, & Snow, 1999). Physical activity stimulates the development and maintenance of BMD (Ulrich et al., 1999) and the extent of the increase is positively related with high-impact exercise (Lloyd et al., 2000). Holm et al. (2002) also found that mechanical stress involved in high impact exercise has a positive relationship with bone mass. Seeman et al. (1996) stated that athletes have higher BMD, muscle mass, and muscle strength compared to non-athletes.

In a study by Lloyd et al. (2000), data indicated that adolescents involved in sport activity showed a positive correlation between hip BMD and exercise; however there was no correlation between the activity and total BMD, suggesting that BMD was site and sport-specific. Similarly, Vicente-Rodriguez, Ara, Perez-Gomez, Serrano-Sanchez, Dorado, and Calbet (2004) found that weight-bearing exercise most benefited BMD of the weight-loaded skeletal regions. Seeman et al. (1996) suggested that gains in muscle strength have no effect on BMD at the lumbar spine or
femoral neck and that in order to change BMD a minimum gain of ten percent in lean muscle mass is necessary.

Exercise during childhood has a strong influence on BMD by facilitating the attainment of greater peak bone mass during early adulthood (Vicente-Rodriguez et al., 2004), which helps to attenuate the development of osteoporosis with senescence (Ulrich et al., 1999). Ulrich et al. (1999) suggested that household chores and child care are correlated to BMD along with weight bearing exercise. They further found that exercise performed before menopause more positively influenced BMD compared with exercise beginning following menopause. Ryan, Nicklas, and Dennis (1998) found that aerobic exercise and resistance exercise help to maintain BMD of elderly women on a weight loss diet. Further, Kohrt, Ehsani, and Birge (1998) found that the use of estrogen replacement therapy (ERT) in combination with weight bearing exercise had a positive affect on BMD in postmenopausal women. The positive influence of exercise on BMD for older women was indirectly related to the changes that occurred to body composition, specifically lean body mass (Takada et al., 1997).

Some authors suggest that weight bearing exercise may be beneficial to BMD (Kohrt et al., 1998; Ulrich et al., 1999). Exercise seems to be beneficial for BMD in postmenopausal women (Kohrt et al., 1998; Ryan et al., 1998) and during childhood (Vicente-Rodriguez et al., 2004). Further examination into the benefits of exercise on BMD for premenopausal women is warranted.

BODY COMPOSITION

There appears to be a lack of consensus about the influence of soft tissue mass on bone density. While some authors suggest that fat mass is more strongly correlated to BMD (Mizuma,
Mizuma, Yoshinaga, Iwamoto, Matsuo, & Osame, 2006; Reid et al., 1993), others suggest that fat free mass is a better predictor of BMD (Seeman et al., 1996; Winters & Snow, 2000).

*Body Weight*

Bone mineral density is highly related to body mass (Taaffe et al., 2000). Following a longitudinal descriptive design, Holm et al. (2002) suggested that an increase in body weight and mechanical stress were associated with an increase in bone density, whereas a loss in body weight was associated with a loss in BMD. The increased load induced by a gain in body mass increases the stress on weight-bearing bones (Taaffe et al., 2000) and provides the necessary stimulus for the maintenance of bone mass (Bohanon, 1999).

In a study by Van Langendonck, Claessens, Lysens, Koninckx, and Beunen (2004), data indicated that body mass was a significant indicator for BMD in premenarcal girls, whereas lean mass was the significant indicator for BMD in postmenopausal women on ERT. Bass, Ford, Brown, Mauromoustakos, and Keathley (2006) differed in stating that weight was an indicator of BMD in the femoral bone for women over age 20 years. The authors (Bass et al. 2006) used the Third National Health and Nutrition Examination Survey and DEXA measurements to suggest that BMD was higher in obese, overweight, and normal weight women compared to underweight women. Further, Bass et al. (2006) found no significant difference in BMD between overweight and normal weight women, suggesting that women should be encourage to maintain an appropriate body mass. Lim et al. (2004) also suggested that the risk of osteoporosis may be lower for women who maintain an optimal weight compared to underweight women.

Some authors suggesting that body weight is correlated to BMD have found that the components of body composition, including fat mass (FM) (Reid et al., 1993) and lean mass
(LM) (Li et al., 2004; Winters & Snow, 2000), have a greater influence on BMD than just body weight.

**Fat Mass**

Some authors (Felix, McCubbin, & Shaw, 1998; Li et al., 2004; Takada et al., 1997; Winters & Snow, 2000) reported that fat mass was not a good predictor of BMD: whereas, Lim et al. (2004) suggested that fat mass was an independent contributor of BMD. One possible explanation for the correlation between fat mass and BMD is that overweight women were usually associated with an increased ratio of adrenal androgens to estrogen compared to nonobese women (Holm et al. 2002). Estrogen is a factor in maintaining bone mass (Li et al., 2004) and adipose tissue is a source of estrogen for postmenopausal women (Bohanon, 1999). Mizuma et al. (2006) found that BMD was correlated to fat mass and not lean mass in postmenopausal Japanese women, who were over the age of 60 years. The authors suggested that these women may be less active and, therefore, would not rely on weight-bearing stress to maintain BMD. Further, the author suggested that the additional adipose tissue of the obese women may have provided an increased source of estrogen compared to nonobese postmenopausal women, which would be a beneficial factor in maintaining BMD. Mizuma et al. (2006) suggested that ovarian estrogen benefits may mask the benefits of adipose estrogen on bone maintenance in premenopausal women and that once menopause occurs the benefits of adipose estrogen are noticeable. Further, Mizuma et al. (2006) suggested that fat free mass has a greater influence on BMD than fat mass in Japanese women under the age of 60 and the benefits of fat mass were due to both weight-bearing and nonweight-bearing effects. The nonweight-bearing effects of fat tissue are theorized to be the aromatized estrogen from the peripheral adipose tissue (Mizuma et al., 2006). The authors suggested that in premenopausal women, with
a normal menstrual cycle, the ovarian estrogen would conceal the estrogen derived from fat. Further the authors suggested that premenopausal women would not need the extra estrogen as other factors, such as age and physical activity, maintain BMD. Elgan et al. (2004) suggested that the use of oral contraceptives in younger premenopausal women had a negative effect on BMD, specifically when the women were smokers or consumed alcohol.

Kohrt et al. (1998) found that HRT and exercise was beneficial for BMD. The authors noted that postmenopausal women who used HRT and exercised resulted in gains in BMD that were maintained for six months after exercise was ceased when compared to those who exercised or used HRT only (Kohrt et al., 1998). Kritz-Silverstein et al. (2004) also found that women who were 25 years postmenopausal and used HRT had greater BMD and less bone loss than those women who did not use HRT. Li et al. (2004) found that in perimenopausal women, HRT users had lower BMD compared to nonusers. The authors (Li et al., 2004) noted that HRT users had only been on the supplement for one to two years prior to the investigation and that HRT users had a lower body weight. Prior et al. (2001) found that BMD was lower in premenopausal women who had used oral contraceptives for 3 or more months than premenopausal women who had never used oral contraceptives. The benefits or hindrance of administered estrogen seems to depend on the stage of life of the women who are using the artificial hormone.

Nonobese women tend to have lower spine bone density when compared to obese women (Holm et al., 2002). Reid et al. (1993) suggested that fat mass was more strongly correlated with BMD than fat free mass. The relationship between bone and fat mass was hypothesized to be associated with increased insulin levels found in obese individuals. Specifically, the selective insulin Amylin has been indicated to inhibit bone resorption (Reid et al. 1993) suggesting that an increase in certain types of insulin may help to prevent bone loss.
Reid et al. (1993) suggested that a long term study is warranted to further investigate the effect of the relationship between insulin and fat mass on BMD.

According to some authors (Lim et al., 2004; Reid et al., 1993), fat mass has a positive influence on BMD. The estrogen derived from fat mass is speculated to have a positive influence on BMD in Japanese women over the age of 60 years (Mizuma et al., 2006). Correlation of fat mass and BMD in Hispanic women needs further investigation.

*Lean Body Mass*

Lean body mass has been suggested as the best predictor of total body BMD (Winters & Snow, 2000) and BMD of the femoral neck (Seeman et al., 1996; Winters & Snow, 2000). Taaffe et al. (2000) found that lean mass was a better predictor of BMD than fat mass in postmenopausal women of both Mexican-American and Caucasian descent. However, Mizuma et al. (2006) stated that lean mass was correlated to BMD of premenopausal Japanese women but not of postmenopausal Japanese women over the age of 60 years. The authors stated that the correlation was due to premenopausal Japanese women using a primary source of estrogen from their ovaries and were more active than postmenopausal Japanese women in their sixties (Mizuma et al. 2006). The stress load placed on bones by the contracting muscle during physical activity may increase BMD, and with greater amounts of lean mass, stress loads and BMD may improve (Taaffe et al. 2000). Conversely, Seeman et al. (1996) argued that both BMD and lean mass were 80% genetically determined and that muscle strength was not correlated to BMD, suggesting that weight-bearing exercise would result in strength gains but would not be beneficial for BMD.

Taaffe et al. (2000) compared BMD, lean mass, and fat mass of postmenopausal Mexican-American and Caucasian women and reported a significant difference in BMD and core
adiposity between the two groups. When bone density, of the whole body and hip, were adjusted for height, Taaffe et al. (2000) found there was no significant effect of lean mass or fat mass on BMD and suggested that tissue mass is not a predictor of BMD. Taaffe et al. (2000) stated further investigation of both the biochemical and biomechanical mechanisms on BMD are warranted to explore differences in bone density between Mexican-American and Caucasian women.

ETHNICITY

Several authors have suggested that diversity of BMD exists among ethnic groups, including African-Americans compared to Caucasians (Bohanon, 1999; Holm et al., 2002; Taaffe et al., 2003), and Hispanics compared to Caucasians (Mitchell et al., 2003; Taaffe et al., 2000). As previously mentioned, Lewiecki (2004) suggested that the variance in BMD between ethnicities is explained by differences in genetic phenotype. The majority of studies that considered ethnicity have found that Caucasians were at greatest risk of fracture associated with osteoporosis compared to African-Americans (Bohanon, 1999; Mudano et al., 2003; Taaffe et al., 2003), Asians (Dennison, Yoshimura, Hashimoto, & Cooper, 1998), and Hispanics (Taaffe et al., 2000).

The differences in BMD between African-American and Caucasian women become apparent as early as adolescents (Bohanon, 1999). Caucasian women tend to have lower BMD compared to African-American women, possibly due to the differences in body mass, lifestyle, genetics, intake of vitamin D, and culture (Holm et al. 2002; Taaffe, 2003). In general, African-American women have a greater body mass and due to the darker skin pigmentation, have higher levels of vitamin D (Holm et al., 2002). Bohanon (1999) suggested that differences in BMD between the two ethnicities may be partly due to a variance in calcium metabolism indicated by
African-American women having lower urinary calcium and higher BMD compared to Caucasian women. The author (Bohanon, 1999) speculated that the lower urinary calcium and higher BMD measurements may indicate a possibility of preservation of calcium from nonskeletal sources, which may help to maintain bone mass.

According to Mudano et al. (2003), African-American women tend to sustain hip fractures at a later age than Caucasian women. African-American women develop a greater peak bone mass and have different bone geometry than that of Caucasian women, which may potentially explain the varying BMD between the two races (Mudano et al., 2003). Taaffe et al. (2003) stated that African-American women have higher percentage body fat and cortical bone area compared to Caucasian women. Similarly, Holm et al. (2002) found differences in BMD measurements among premenopausal Caucasian and African-American women and suggested that the variance between the races may be due to differences in body mass.

Dibba et al. (1999) suggested that African-American women have a slower rate of bone loss compared to Caucasian women. However, Dibba et al. (1999) found no significant difference in BMD between British Caucasian women and Giamban African women. Dibba et al. (1999) further suggested that Giamban women and African-American women may be from different regions of Africa and therefore have varying mineral and bone metabolism. Similarly, Holm et al. (2002) stated that African-American women have higher BMD when compared to native African women. This suggests that there may be a variance of BMD within a race. Possible explanations for the BMD variance within women of African origin may be differences in lifestyle and genetic variance within the ethnicity (Holm et al., 2002).

Taaffe et al. (2000) found that hip and total BMD were greater in postmenopausal Mexican-American women than Caucasian women and suggested that the lower rate of hip fractures in Hispanic women compared to Caucasian women could be related to hip geometry.
The authors found that the length of the axis was shorter at the hip in Hispanic women compared to Caucasian women (Taaffe et al. 2000). Other ethnic differences included Mexican-American women having greater bone density measurements in the upper thigh and whole body, and greater upper body adipose tissue than Caucasian women following menopause. There is a lack of investigations in the area of BMD for Hispanic women compared to Caucasian women (Taaffe et al., 2000) suggesting that further investigation of Hispanic BMD is warranted.

**SUMMARY**

As the elderly population increases, osteoporosis is becoming more of a concern in the health and financial industries. The prevalence of osteoporosis is correlated with an increased risk of associated fractures, which possibly leads to morbidity, disability, and higher health care cost. The major predictor of osteoporosis is BMD, which is determined from genetic and environmental factors. Genetic factors, such as age, sex, and race are not modifiable; the environmental factors, however, may be altered to help maintain BMD. Environmental factors affecting BMD include diet, lifestyle, ethnicity and other external conditions that may influence soft tissue body composition. The components of soft tissue that may influence BMD seem to be lean mass and fat mass.

The composition of soft tissue that exerts the most influence on BMD continues to be the subject of controversy. Bohanon (1999) and Lim et al. (2004) suggested that fat mass contributed to BMD, whereas, Seeman et al. (1996), Taaffe et al. (2000), and Winters & Snow (2000) suggested that fat free mass was the best predictor of BMD. However, most of the relevant research supports the theory that higher total body weight is associated with higher BMD (Bohanon, 1999; Lim et al., 2004; Papakitsou et al., 2004; Taaffe et al., 2000).
Bone mineral density seems to vary between ethnicities (Bohanon, 1999; Dennison et al., 1998; Dibba, 1999; Holm et al., 2002; Lewiecki, 2004; Mudano et al., 2003; Taaffe et al., 2003). American Caucasian women on average tend to be at greatest risk for low BMD and osteoporosis compared to African-American, and Hispanic women. There is, however, a lack of research that includes BMD and premenopausal Hispanic women. The purpose of this study is to investigate the relationship between BMD and soft tissue body composition, including lean mass and fat mass, of premenopausal Caucasian and Hispanic women.
REFERENCES


oophorectomy are unrelated to bone loss in older women. *Maturitas, 47*, 61-69.


involutional osteoporosis. *Bone, 39*, 244-248.


Taaffe, D. R., Lang, T. F., Fuerst, T., Cauley, J. A., Nevitt, M. C., & Harris, T. B. (2003). Sex- and race-related differences in cross-sectional geometry and bone density of


APPENDIX A

INFORMED CONSENT FORM

TITLE OF THE STUDY:  Body Composition, Hormones, and Health Risk Factors in Middle-Aged Hispanic, African-American, and Caucasian Women

PURPOSE

You are invited to participate in a study, the purpose of which is to examine the relationship between body fat percentage and heart disease risk factors such as blood pressure and cholesterol in middle-aged women. This form explains the procedures, risks and benefits of participation. If you have any questions about the information found in this form, please ask a member of the research team before signing.

PROCEDURES

You are asked to attend 1 testing session in the Human Performance Laboratory in the Memorial Gymnasium (MGYM) Building on the University of Texas at El Paso campus. The session will last approximately 3 hours. The test will be performed in the morning, and we ask that you do not eat or drink anything other than water on the morning you come in for testing. During the session, several different measurements will be made: (1) body fat measurement using the Bod Pod; (2) body fat measurement using electrical currents in your body (bioelectrical impedance); (3) body fat measurement using underwater weighing; (4) measurements such as your height, weight, skinfolds, and waist circumference (anthropometric measurements); (5) blood pressure measurement; (6) measurement of cholesterol, blood sugar, and insulin; (7) survey information on medical history and activity level; (8) resting caloric expenditure measurement; (9) diet analysis; and (10) bone density measurement. Each of these is explained below.

**Bod Pod**

For this test you must be wearing either a swimsuit or your undergarments. This machine measures your body fat as you sit for approximately 3 minutes in a sealed chamber. While in the chamber, you will be able to breathe normally and see your surroundings.

**Bioelectrical Impedance**

For this test you will stand on a set of scales that estimates your body fatness through the movement of electrical currents in your body. This test is harmless and takes about 30 seconds. Women with an implanted defibrillator or pacemaker will not participate in this test.

**Underwater Weighing**

The first step in this procedure will be to measure the volume of your lungs. To do this, you will be asked to breathe through a mouthpiece while wearing a noseclip into a machine called a spirometer. During this procedure you will inhale a small amount (less than 6 liters) of pure oxygen while performing a series of breathing maneuvers. You will also be weighed underwater. To measure underwater weight, you will sit on a platform in a tank of warm water, exhale as much air as you can and dunk your head underwater for a few seconds.

**Anthropometric Measurements**

These tests include: measurement of height, measurement of weight, measurements of the distance around your waist and hips, and the thickness of skinfolds at various sites on your body. These measurements will provide valuable information about your body fatness.

**Blood Pressure**

Your blood pressure will be taken as you sit in a chair. The procedure is like what you may have experienced in a doctor’s office. We will place a cuff around your upper arm, pump the cuff full of air, and then slowly allow the air to leave while listening to changes in the sound of the pulse in your arm.

**Cholesterol, Blood Sugar, and Insulin Measurement**
A trained technician will withdraw a small amount of blood (25 ml or approximately 5 teaspoons) from a vein in your arm. This blood will be analyzed for fatty substances such as cholesterol and triglycerides as well as blood sugar and insulin.

Survey Information
For our study we will ask that you provide information about your medical history, your family’s medical history, ethnic origin, and your activity patterns. Surveys will be used for us to gather this information. This private information will be held in the utmost confidence. These surveys will not include your name and will be coded by a subject number to which only the researchers have access.

Resting Caloric Expenditure
You will be asked to sit in a reclined position for approximately 20 minutes. During this time, you will breathe through a mouthpiece so that we can collect all of your expired air. This information will be used to determine the number of calories used by your body at rest.

Diet Analysis
You will be asked to write down everything you eat and drink on three different days. Once the day before you are tested, a second day about one week later, and a third day in about another week. This information will be used to determine the number of calories you take in on an average day.

Bone Density (DEXA)
The DEXA is a machine that will take an x-ray of your entire body and measure your bone density. During this procedure you will lie on your back on a padded table for approximately 15 minutes. The amount of radiation that you will be exposed to is safe and very small. If you are pregnant or think you may be pregnant, you should not be tested.

BENEFITS OF PARTICIPATION
From the results of your tests, you will be told your body fat percentage, your blood pressure, your blood cholesterol, and your blood sugar levels, your resting caloric expenditure, your diet analysis, and your bone density. These values are important for good health. Some of your results will be immediately available at the time of testing (body fat for example) while others will be provided later. It may take up to 6 months for all of your information to be provided. Dr. King will provide your results to you in the manner you find most convenient, either regular mail, e-mail, or a telephone call. These results are not medical diagnoses and should only be used as general information. With your results you may also be sent up to fifty dollars (US) in appreciation for your participation.

RISKS OF PARTICIPATION
There are very few potential risks that may occur with participating in this research and the doors to the laboratory will be locked for your privacy. There are no known physical risks to any of the body fat and caloric expenditure measurements. However, some people feel uncomfortable while sitting inside the Bod Pod. While inside the Bod Pod, you will be able to see through a large window and you will be able to breathe normally. Also, some people are not comfortable in water. Your head will be above the water while you are sitting up and your head will only be a few inches under the water when you dunk your head. For your safety, a technician will be with you at all times during all test procedures. You are free to stop a procedure at any time. The withdrawal of a small amount of blood from a vein in your arm involves minimal risk. When a blood sample is withdrawn, there is always a risk of bruising and/or infection. To minimize these risks, blood will be collected in sterile conditions by a trained technician.

As a participant in this research, you will be exposed to a very small amount of radiation during the DEXA procedures. The total amount of radiation that you will receive for the entire project is less than 4% of the radiation received from a chest x-ray, less than 2% of the radiation received from a dental x-ray, and less than half the radiation you would receive if you were to spend a day outdoors. You are free to stop a procedure at any time. If you are pregnant or think you may be pregnant, immediately notify a research team member because you should not be tested.

RIGHT TO ASK QUESTIONS AND/OR WITHDRAW FROM THIS STUDY
If you have questions or concerns at any time during the course of this investigation or after you complete this study, you may contact George A. King, Ph.D. at (915) 747-7284. Dr. King's office is located in room 515 College of Health Sciences (CHS) Building. As a volunteer in this study, it is your right to withdraw from this investigation at any time. If you decide to withdraw from this study, you will in no way be penalized.

PRIVACY OF RECORDS
Only you, Dr. King, and members of the research team will have access to your results. All data collected in this study will be kept in a locked file in Dr. King's office and will be coded by subject number rather than by name. The results of the research will be published; however, no publication will contain information which will allow you to be identified.

AUTHORIZATION
By signing this form, I am indicating that I have read this form, understand its contents, and have received a copy of this form for my files. I have also been given the opportunity to ask questions to clarify my role in the study. My signature indicates that I agree to serve as a subject in this research study.

Participant's signature ___________________________ Date ___________________________

Investigator ___________________________ Date ___________________________
APPENDIX B

FORMA INFORMADA DEL CONSENTIMIENTO

TITULO DEL ESTUDIO: Factores de Riesgo de la Composición y de Salud del Cuerpo en Hispanicas de Mediana Edad, Aficana-Americana, y Caucasicas Mujeres

PROPÓSITO
Le invitan que participe en un estudio, el propósito del cual es examinar el lazo entre el porcentaje de las grasas de cuerpo y los factores de riesgo de la enfermedad cardíaca tales como presión arterial y colesterol en mujeres de mediana edad. Esta forma explica los procedimientos, los riesgos y las ventajas de la participación. Si usted tiene cualesquiera preguntas sobre la información encontrada en esta forma, por favor pregunte a un miembro del equipo de investigación antes de firmar.

LOS PROCEDIMIENTOS
Se le pide que asista a una sesión de pruebas en el Laboratorio de Desempeño Humano (Human Performance Laboratory) en el edificio del Gimnasio Memorial (MGYM) en el campus de la Universidad de Texas en El Paso. La sesión durará aproximadamente una hora. La prueba se llevará a cabo durante la mañana, por lo que le pedimos que el día de la prueba no desayune o tome nada, excepto agua. Durante la sesión se le harán diferentes tipos de mediciones: (1) medición de la grasa corporal utilizando el aparato Bod Pod, que es un analizador de grasa; (2) medición de la grasa corporal utilizando corriente eléctrica en su cuerpo (impedancia bioeléctrica); (3) medición de la grasa corporal utilizando el sistema de peso bajo el agua (Hidrodensimetría); (4) Otras mediciones como el peso, altura, tejido adiposo y la circunferencia de la cintura (medidas antropométricas); (5) medición de la presión sanguínea; (6) medición del colesterol, del azúcar e insulina; (7) encuesta informativa sobre antecedentes médicos y nivel de actividades; (8) medición del desgaste calórico al estar en reposo y (9) medición de la densidad ósea. A continuación se explica cada una de estas mediciones.

**Vaina del Tío**
Para esta prueba usted debe usar un traje de baño o sus ropas interiores. Esta máquina mide sus grasas de cuerpo mientras que usted se sienta por aproximadamente 3 minutos en un compartimento sellado. Mientras que en el compartimento, usted podrá respirar normalmente y podrá ver sus alrededores.

**Impedancia de Bioelectrical**
Para esta prueba que usted estará parado en un conjunto de escalas que estime su gordura del cuerpo a través del movimiento de corrientes eléctricas en su cuerpo. Esta prueba es inofensiva y toma cerca de 30 segundos. Las mujeres con un defibrillator o los marcapasos implantado no participarán en esta prueba.

**Peso bajo el agua (Hidrodensimetría)**
El primer paso de este procedimiento será medir el volumen de sus pulmones, por lo que se le pedirá que cerrando su nariz, respire por medio de una boquilla a una máquina llamada espirómetro. Durante este procedimiento usted inhalará una pequeña cantidad (menos de tres litros) de oxígeno puro mientras realiza una serie de respiraciones. También se le pesará bajo el agua. Para realizar lo anterior, se sentará sobre una plataforma dentro de una tina de agua tibia, exhalará tanto aire como le sea posible y sumergirá su cabeza por unos cuantos segundos.

**Medidas Antropométricas**
Que estas pruebas incluyen: medida de la altura, medida de peso, medidas de la distancia alrededor de su cintura y caderas, y su dobes de la piel en varios partes de su cuerpo. Estas medidas proporcionarán a la información valiosa sobre su gordura del cuerpo.

**La Persión Arterial**
Su persión arterial será tomada con usted sentada en una silla. El procedimiento es como lo que usted pudo haber experimentado en la oficina de un doctor. Colocaremos una bocamanga alrededor de su brazo superior, bombeamos la bocamanga por completo de aire, y después permitimos lentamente que el aire se vaya mientras que escuchamos los cambios en el sonido del pulso en usted.

**El Colesterol, Azúcar en la Sangre, y La Insulina**
La medida de la insulina retirarán una cantidad pequeña de sangre (25 ml o aproximadamente 5 cucharillas) de una vena en su brazo. Esta sangre será analizada para colesterol y triglicérides así como el azúcar y...
la insulina de la sangre. Información de la encuesta para nuestro estudio preguntaremos que usted proporcione a la información sobre su historial médico, el historial médico de su familia, el origen étnico, y sus modelos de la actividad. Las encuestas serán utilizadas para nosotros para recopilar esta información. Esta información privada será llevada a cabo en la confianza extrema. Estas encuestas no incluirán su nombre y serán cifradas por un número sujeto a el cual solamente los investigadores tengan acceso.

**GASTO CALORICO DE RECLINACION**

Le pediran sentarse en una posición descansada por aproximadamente 20 minutos. Durante este tiempo, usted respirara a través de una boquilla de modo que poder recoger todo su aire expirado. Esta información será utilizada para determinar el número de las calorías usadas por su cuerpo al descansar.

**Densidad Ósea (DEXA)**

DEXA es una máquina que tomará una radiografía de todo su cuerpo y medirá su densidad ósea. Durante este procedimiento se recostará boca arriba en una mesa acojinada por aproximadamente quince minutos. La cantidad de radiación a la que estará expuesto es mínima y no presenta peligro. Si está embarazada o piensa que pudiera estar embarazada, no debe someterse a la prueba.

**LAS VENTAJAS DE LA PARTICIPACIÓN DE LOS RESULTADOS DE SUS PRUEBAS**

En base a los resultados de estas pruebas se le informará su porcentaje de grasa corporal, su presión sanguínea, sus niveles de colesterol en la sangre, su desgaste calórico al estar en reposo y la densidad de sus huesos. Estas lecturas son importantes para una buena salud. Algunos de los resultados se le darán a conocer en el momento de practicársele la prueba (como por ejemplo el de grasa corporal), mientras que otros le serán proporcionados después. Podría tomar hasta seis meses para que le llegue toda la información. El Dr. King le hará llegar sus resultados en la forma que considere más conveniente, ya sea por correo, correo electrónico o por teléfono. Estos resultados no son diagnósticos médicos y solo deben utilizarse como información general.

**LOS RIESGOS DE LA PARTICIPACIÓN**

Son muy pocos los riesgos potenciales que podrían presentarse al participar en esta investigación y para su mayor privacidad, puertas del laboratorio permanecerán cerradas. No existe ningún riesgo físico conocido, que esté relacionado con ninguna de las mediciones de grasa corporal o de desgaste calórico. Sin embargo algunas personas pueden sentirse incomodas mientras se encuentran dentro del Bod Pod, usted podrá ver a través de una gran ventana y respirar en forma normal. También hay personas que no se sienten a gusto en el agua. Su cabeza estará fuera del agua mientras esté sentada y solo serán unas cuantas pulgadas lo que la sumerja. Para su mayor seguridad, un técnico estará con usted en todo momento durante todos los procedimientos de las pruebas. Usted está en libertad de detener el procedimiento en cualquier momento.

La toma de una pequeña muestra de sangre de una vena en su brazo implica un riesgo mínimo. Cuando se toma una muestra de sangre, siempre hay el riesgo de un moretón y/o de una infección. Para reducir estos riesgos, un técnico experimentado tomará la muestra de sangre, en condiciones completamente antisépticas.

Como participante en esta investigación, usted se expondrá a una cantidad muy pequeña de radiación durante el procedimiento DEXA. La cantidad total de radiación que recibirá durante todo el procedimiento es menos del 4% de la que se recibe por una radiografía de tórax, menos del 2% de la que se recibe al tomarse una placa dental y menos de la mitad de la radiación que recibiría si fuera a pasar el día al aire libre. Usted está en libertad de detener el procedimiento en cualquier momento. Si está embarazada o piensa que podría estar embarazada, debe notificarlo inmediatamente a un miembro del equipo de investigación pues no debe someterse a esta prueba.

**DERECHO HACER PREGUNTAS y/o RETIRARSE DE ESTE ESTUDIO**

Si usted tiene preguntas o preocupaciones en cualquier momento durante el curso de esta investigación o después de que usted termine este estudio, usted puede entrar en contacto con George A. King, Ph.D., al (915) 747-7284. La oficina del Dr. King está localizada en el 515 de El Colegio de Ciencias de Salud (CHS) en la Universidad de Tejas en El Paso.

Como voluntario en este estudio, se puede retirar de esta investigación en cualquier momento. Si usted decide retirarse de este estudio, de ningún modo será penalizado.

**AISLAMIENTO DE EXPEDIENTES**

Solamente usted, el Dr. King, y los miembros del equipo de investigación tendrán acceso a sus resultados. Todos los datos recogidos en este estudio serán mantenidos en un fichero bloqueado en oficina del Dr. King y cifrados por número sujeto mas bien que por nombre. Los resultados de esta investigación serán publicados; sin embargo, ninguna publicación contendrá la información que permitirá que usted sea identificado.
Firmando esta forma, estoy indicando que he leído esta forma, entiendo el contexto, y ha recibido una copia de esta forma para mis ficheros. También me han dado la oportunidad de hacer preguntas para clarificar mi papel en el estudio. Mi firma indica que estoy de acuerdo servir como tema en este estudio de investigación.

______________________________
Firma de Participante

______________________________
Fecha

______________________________
Investigador

______________________________
Fecha
APPENDIX C

LIFESTYLE SURVEY

The questions in this survey are designed to help us understand the health of women in El Paso. Try to answer each question truthfully. There are no right or wrong answers. If you are not sure, try your best guess. If you have any questions please ask the research assistant. You do not have to answer any of the questions if they make you uncomfortable. YOUR ANSWERS WILL BE KEPT STRICTLY CONFIDENTIAL. The Mexican and United States governments cannot have access to any of this information.

HEALTH HABITS

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days did you have poor physical health?</td>
<td>Number of days</td>
</tr>
<tr>
<td>2. Now thinking about your mental health, which includes stress, depression, and emotional problems, for how many days during the past 30 days did you have poor mental health?</td>
<td>Number of days</td>
</tr>
<tr>
<td>3. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work or recreation?</td>
<td>Number of days</td>
</tr>
<tr>
<td>4. Have you smoked at least 100 cigarettes (5 packs) in your whole life? (IF NO, GO TO QUESTION #7)</td>
<td>YES NO</td>
</tr>
<tr>
<td>5. About how many cigarettes do you now smoke each day?</td>
<td>Cigarettes /day</td>
</tr>
<tr>
<td>a. If 0, how long has it been since you quit smoking?</td>
<td>years /months</td>
</tr>
<tr>
<td>6. About how old were you when you started smoking cigarettes regularly? (at least one cigarette per week)</td>
<td>years old</td>
</tr>
<tr>
<td>7. A drink is 1 can or bottle of beer, 1 glass of wine, 1 can or bottle of wine cooler, 1 cocktail or 1 shot of liquor. About how many days a week do you have an alcoholic drink?</td>
<td>days /week</td>
</tr>
<tr>
<td>8. On the days that you drink, about how many drinks do you have (on average)?</td>
<td>drinks each time I drink</td>
</tr>
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</table>
9. How would you consider your health? (Please mark one only)

<table>
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<tr>
<th>HEALTH</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERY GOOD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOOD</td>
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<tr>
<td>AVERAGE</td>
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</tr>
<tr>
<td>POOR</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>VERY POOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Have you ever had or do you have the following? If you check YES, please provide an additional explanation.

<table>
<thead>
<tr>
<th>Health Conditions</th>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
<th>(CHECK ALL THAT APPLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free or easy bleeding (hemophilia)</td>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Low blood iron (anemia)</td>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Sickle cell anemia</td>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Rheumatic fever</td>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Heart murmur</td>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Irregular heart beat</td>
<td></td>
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<td>Please Explain:</td>
</tr>
<tr>
<td>Mitral valve prolapse</td>
<td></td>
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<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Any heart problem</td>
<td></td>
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<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td>Pacemaker or implanted defibrillator</td>
<td></td>
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<td>Please Explain:</td>
</tr>
<tr>
<td>High blood pressure</td>
<td></td>
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<td>Please Explain:</td>
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<tr>
<td>High blood cholesterol</td>
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<td>Please Explain:</td>
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<tr>
<td>Varicose veins</td>
<td></td>
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<td>Please Explain:</td>
</tr>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
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<td>Please Explain:</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
<td>DON’T KNOW</td>
<td>(CHECK ALL THAT APPLY)</td>
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<td></td>
<td>Emphysema</td>
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<td>Please Explain:</td>
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<td></td>
<td>Chronic bronchitis</td>
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<td>Please Explain:</td>
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<td></td>
<td>Asthma</td>
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<td>Please Explain:</td>
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<td>Lung disease</td>
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<td>Please Explain:</td>
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<td>Seizures</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td>Stroke</td>
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<td>Please Explain:</td>
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<td></td>
<td>Low blood sugar</td>
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<td>Please Explain:</td>
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<td></td>
<td>Diabetes</td>
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<td>Please Explain:</td>
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<td>Kidney Disease</td>
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<td>Please Explain:</td>
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<td>Hepatitis</td>
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<td>Please Explain:</td>
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<td>Liver Disease</td>
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<td>Please Explain:</td>
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<td>Eye problems</td>
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<td>Please Explain:</td>
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<td>Hearing problems</td>
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<td>Please Explain:</td>
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<td>Thyroid problems</td>
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<td>Please Explain:</td>
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<td>Orthopedic problems</td>
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<td>Please Explain:</td>
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<td>Back problems</td>
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<td>Please Explain:</td>
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<td>Joint problems</td>
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<td>Please Explain:</td>
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<td></td>
<td>Arthritis</td>
<td>Please Explain:</td>
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<tr>
<td></td>
<td>AIDS</td>
<td>Please Explain:</td>
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<td></td>
<td>Alcoholism</td>
<td>Please Explain:</td>
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<tr>
<td></td>
<td>Other medical problems</td>
<td>Please Explain:</td>
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</tr>
</tbody>
</table>

11. Have you recently (within the last year) had any of the following symptoms? If you check YES, please provide an additional explanation.

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>DON’T KNOW</th>
<th>(CHECK ALL THAT APPLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chest pain</td>
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<td>Please Explain:</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Shortness of breath</td>
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<td></td>
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<td></td>
<td>Please Explain:</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Heart palpations or fast heartbeat</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Arm or shoulder pain</td>
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<td></td>
<td>Please Explain:</td>
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<td></td>
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<td></td>
<td>Burning sensations</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Unusual fatigue with slight exertion</td>
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<td>Please Explain:</td>
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<td></td>
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<td></td>
<td>Severe headache</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Blurred vision</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Low or high blood sugar</td>
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<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Frequent urination</td>
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<td></td>
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<td></td>
<td>Please Explain:</td>
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<td></td>
<td></td>
<td></td>
<td>Blood in urine</td>
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<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Coughing of blood</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Please Explain:</td>
</tr>
</tbody>
</table>
Feeling faint or dizzy  
Please Explain:

Difficulty walking  
Please Explain:

Low bone density (osteoporosis)  
Please Explain:

Leg or ankle swelling  
Please Explain:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
<th>(CHECK ALL THAT APPLY)</th>
</tr>
</thead>
</table>
|     |    |            | Swelling in your joints  
Please Explain: |
|     |    |            | Low-back pain  
Please Explain: |
|     |    |            | Weakness in arm  
Please Explain: |
|     |    |            | Leg numbness  
Please Explain: |
|     |    |            | Significant emotional problem  
Please Explain: |
|     |    |            | Other medical problems  
Please Explain: |

12. Are you taking any medications or supplements?  
If yes, please list and describe below.

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
13. Of the following members of your family, describe any cardiovascular disease, heart disease, stroke, or diabetes each has (or had).

<table>
<thead>
<tr>
<th></th>
<th>NO</th>
<th>DON’T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s Mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s Father</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father’s Mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father’s Father</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mother
Please Explain:

Father
Please Explain:

Mother’s Mother
Please Explain:

Mother’s Father
Please Explain:

Father’s Mother
Please Explain:

Father’s Father
Please Explain:
<table>
<thead>
<tr>
<th>MENSTRUAL HISTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. What is your date of birth?</td>
</tr>
<tr>
<td>15. At approximately what age (year and months) did you begin menstruating?</td>
</tr>
<tr>
<td>16. Do you currently have regular menstrual cycles (i.e., regularly spaced periods of menstrual bleeding)?</td>
</tr>
</tbody>
</table>

If you answered “YES” to question #16:

| a. Approximately how many days separate your periods? | Less than 25 days | 25-32 days | More than 32 days |
| b. Approximately how many days does your bleeding last? | Less than 3 days | 3-7 days | More than 7 days |
| c. When did your most recent period begin? | MM | DD | YY |
| d. Is there any reason to believe that you are pregnant? | YES | NO |

If you answered “NO” to question #16:

| a. Have your menstrual periods stopped completely? | YES | NO |
| b. When did your most recent period begin? | MM | DD | YY |
| c. If you still occasionally have menstrual bleeding, describe the pattern. | | | |
17. How would you consider your eating habits? (PLEASE MARK ONE ONLY)

<table>
<thead>
<tr>
<th>VERY GOOD</th>
<th>GOOD</th>
<th>AVERAGE</th>
<th>POOR</th>
<th>VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

18. How often do you eat the following foods? (CIRCLE ONE NUMBER FOR EACH ITEM)

<table>
<thead>
<tr>
<th>FOOD</th>
<th>never or few times a year</th>
<th>about once a month</th>
<th>several times a month</th>
<th>few times a week</th>
<th>once a day</th>
<th>3 or 4 times a day</th>
<th>5 times a day or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRESH FRUITS AND VEGETABLES</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>PASTRIES (pie, cake, cookies, brownies, sweet rolls, donuts)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>BREAD (bread, pasta, tortilla)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>POULTRY</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>FISH</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>PORK</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>RED MEATS (beef, lamb, lunch meats)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>WHOLE MILK</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>FRIED FOOD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>HOW OFTEN DO YOU EAT AT RESTAURANTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
These next few questions are about exercise, recreation and physical activities other than your regular job duties. For each of the following activities, please tell us how many times you did them in the past MONTH. For each activity that you did in the last MONTH, please tell us how much time on average in hours or minutes you spent doing the activity EACH TIME YOU DID IT.

<table>
<thead>
<tr>
<th>Activity</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19. First we will start with typical sport activities like basketball, volleyball and soccer and fitness related activities like jogging, running, riding a bike, dancing, and aerobics. These are NOT activities you do during work. These are NOT activities you do with your children either; only with other adults or by yourself.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. In the past MONTH, have you done any typical sport or fitness related activities? (if “NO”, go to Question #20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. If Yes, please tell us how many times in the past MONTH you have done the sport or fitness related activities listed below. If you did the activity every day then you would say you did it 30 times in the last MONTH. Then tell us how much time ON AVERAGE in minutes or hours you spent doing each sport or fitness related activity each time you did it.</td>
<td></td>
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<tr>
<td>Aerobics/Aerobic Dance (using a video during a class in a gym)</td>
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<tr>
<td>Other Dancing (for fun with friends and family)</td>
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<td></td>
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<tr>
<td>Jogging or Running</td>
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<td></td>
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<tr>
<td>Golf</td>
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<tr>
<td>Bowling</td>
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<tr>
<td>Tennis</td>
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</tr>
<tr>
<td>Basketball</td>
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<td></td>
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<tr>
<td>Baseball or Softball</td>
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<td></td>
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<tr>
<td>Soccer</td>
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<tr>
<td>Weight lifting/training</td>
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<tr>
<td>Riding a bike outside or a stationary bike inside</td>
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<tr>
<td>Swimming</td>
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<tr>
<td>Yoga</td>
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<tr>
<td>Roller skating or blading</td>
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<tr>
<td>Other1:</td>
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<td>Other2:</td>
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<tr>
<td>Other3:</td>
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</tbody>
</table>
20. Now we would like to know about recreational activities that you do when you have free time like watching television, reading, and spending time with your family. These are NOT activities you do during work.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Times in past MONTH</th>
<th>Avg Hours/Minutes Each Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using a computer</td>
<td></td>
<td></td>
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<tr>
<td>Going to church</td>
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<tr>
<td>Quiet play with children (board games, drawing, coloring, reading stories)</td>
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<td></td>
</tr>
<tr>
<td>Active play with children (playing tag, soccer, baseball, hide and seek)</td>
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<tr>
<td>Talking on the telephone</td>
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<td></td>
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<tr>
<td>Listening to music</td>
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<td></td>
</tr>
<tr>
<td>Watching television or videos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching a movie in a theater</td>
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<td></td>
</tr>
<tr>
<td>Visiting with friends (in person, not on the phone)</td>
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<td></td>
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<tr>
<td>Playing games (dominos, checkers, boardgames, cards)</td>
<td></td>
<td></td>
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<tr>
<td>Reading</td>
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<td></td>
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<tr>
<td>Other 1:</td>
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<td>Other 2:</td>
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<td>Other 3:</td>
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<tr>
<td>Other 4:</td>
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</tr>
</tbody>
</table>

a. In the past MONTH, have you participated in any recreational activities? (IF “NO” go to Question #21)

b. If Yes, please tell us how many times in the past MONTH you have done the following recreational activities. If you did the activity once every day then you would say you did it 30 times in the last MONTH. Then tell us how much time ON AVERAGE in minutes or hours you spent doing each recreational activity each time you did it.
21. Now we would like to know about household activities that you do such as cleaning, gardening, and taking care of children. These are NOT activities you do during work.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Times in past MONTH</th>
<th>Average Hours/Minutes Each Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(picking up the house, dusting, sweeping, ironing, dishes)</td>
<td></td>
<td></td>
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<tr>
<td>Hard Cleaning</td>
<td></td>
<td></td>
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<tr>
<td>(scrub floors, move objects, carry loads up stairs)</td>
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<td></td>
</tr>
<tr>
<td>Childcare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(feeding, bathing, dressing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gardening or Yardwork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(grocery, clothes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light home repair/maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(changing light bulbs, fixing loose fixtures)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy home repair/maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(carpentry, lifting large objects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(time loading, unloading, hanging, folding only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cooking, serving)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other 1:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other 3:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other 4:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
22. ON AVERAGE, how would you describe your walking pace when you walk? (PLEASE CHECK ONLY ONE)

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow, like taking a leisurely stroll.</td>
</tr>
<tr>
<td>Moderate, like you had somewhere to go.</td>
</tr>
<tr>
<td>Fast, like walking (without jogging) to catch a bus or make an appointment.</td>
</tr>
</tbody>
</table>

23. ON AVERAGE, how would you describe the intensity with which you clean the house or do other work around the house? (PLEASE CHECK ONLY ONE)

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light, like taking a leisurely stroll.</td>
</tr>
<tr>
<td>Moderate, like walking to get somewhere.</td>
</tr>
<tr>
<td>Hard, like fast walking (without jogging) to catch a bus or make an appointment.</td>
</tr>
</tbody>
</table>

24. Compared to others of your age and gender, would you say you are: (PLEASE CHECK ONE ONLY)

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUCH LESS ACTIVE</td>
</tr>
<tr>
<td>SOMEWHAT LESS ACTIVE</td>
</tr>
<tr>
<td>ABOUT AS ACTIVE</td>
</tr>
<tr>
<td>SOMEWHAT MORE ACTIVE</td>
</tr>
<tr>
<td>MUCH MORE ACTIVE</td>
</tr>
</tbody>
</table>

25. For each of the following statements, please indicate how often they prevent you from exercising on a scale of one to five. One represents Never, three represents Sometimes and
five represents Always. Two is in between Never and Sometimes. Four is in between Sometimes and Always.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>I do not have a safe place to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b.</td>
<td>I feel self-conscious about exercising because I am too overweight.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c.</td>
<td>My health prevents me from exercising. Please Explain:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d.</td>
<td>I do not enjoy exercising.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e.</td>
<td>I cannot motivate myself to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f.</td>
<td>I do not have anyone to exercise with.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>g.</td>
<td>I do not have time to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>h.</td>
<td>I do not have the energy to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>i.</td>
<td>I am afraid I will hurt myself when I exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>j.</td>
<td>It is too hot or too cold to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>k.</td>
<td>My spouse/significant other does not want me to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>l.</td>
<td>I cannot find anyone to watch my children while I exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>m.</td>
<td>I cannot walk/jog/run in my neighborhood. Please Explain:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>n.</td>
<td>I do not have clothes and/or shoes to exercise in.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>o.</td>
<td>Other. Please Explain:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
PERSONAL INFORMATION

1. Please check the ethnic group that you most identify with:

   If you are Hispanic, please check one of the following:

   □ Mexican National  □ Mexican American  □ Chicana/o
   □ Latina/o  □ Other, please detail: _______________________

   If you are NOT Hispanic, please check one of the following:

   □ American Indian  □ Alaskan Native  □ Asian or Pacific Islander
   □ African American, not of Hispanic Origin  □ Caucasian, not of Hispanic Origin
   □ Other, please detail: _______________________

2. When were you born? ______ / ______ / ______
   Month   Day   Year

3. What is your gender?  □ Female  □ Male

4. How tall are you? _____ Feet AND _____ inches OR _____ meters

5. How much do you weigh? _____ pounds OR _____ kilograms

6. Please check marital status:  □ SINGLE  □ MARRIED  □ DIVORCED
   □ WIDOWED  □ COMMON LAW  □ OTHER: ______

7. Please check highest level of education COMPLETED:

   □ Less than 7th Grade
   □ Junior High/Secondary School (9th Grade)
   □ Some High School (10th or 11th Grade)
   □ Completed High School
   □ Some College or Vocational Training
   □ Completed Associate Degree
   □ Completed Bachelor Degree
   □ Completed Graduate Degree
8. Status of employment:  ☐ Full Time  ☐ Part Time  ☐ Unemployed

9. If student, give status of schooling:  ☐ Full Time  ☐ Part Time

10. Please describe your job in one sentence. If you have more than one job, please describe your primary source of income:

____________________________________________________________________________________

11. Check approximate combined monthly income from all sources:

☐ less than 850/month  ☐ 3,351-4,150/month  ☐ 6,651-7,500/month

☐ 851-1,650/month  ☐ 4,151-5,000/month  ☐ 7,501–8,350/month

☐ 1,651-2,500/month  ☐ 5,001–5,850/month  ☐ over 8,351/month

☐ 2,501–3,350/month  ☐ 5,851-6,650/month

ACCULTURATION

1. Of the following options, which language do you speak most of the time?

☐ SPANISH ONLY (1)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6) (please specify: ____________________________)

2. Of the following options, which language do you prefer to speak?

☐ SPANISH ONLY (1)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6) (please specify: ____________________________)
3. Of the following options, which language do you use with your spouse?

☐ SPANISH ONLY (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6)  (please specify: ______________________)

4. Of the following options, which language do you use with your children?

☐ SPANISH ONLY (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6)  (please specify: ______________________)

5. Of the following options, which language do you use with your parents?

☐ SPANISH ONLY (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6)  (please specify: ______________________)

6. Of the following options, which language do you use with your coworkers?

☐ SPANISH ONLY (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6)  (please specify: ______________________)

7. Of the following options, which language do you use with your friends?

☐ SPANISH ONLY (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY SPANISH (2)
☐ ABOUT THE SAME (3)
☐ MOSTLY ENGLISH (4)
☐ ENGLISH ONLY (5)
☐ OTHER LANGUAGE (6)  (please specify: ______________________)
8. Of the following options, in which language do you most often watch television?
- [ ] SPANISH ONLY (1)
- [ ] DOES NOT APPLY TO ME (7)
- [ ] MOSTLY SPANISH (2)
- [ ] ABOUT THE SAME (3)
- [ ] MOSTLY ENGLISH (4)
- [ ] ENGLISH ONLY (5)
- [ ] OTHER LANGUAGE (6) (please specify: ________________)

9. Of the following options, in which language do you most often listen to the radio?
- [ ] SPANISH ONLY (1)
- [ ] DOES NOT APPLY TO ME (7)
- [ ] MOSTLY SPANISH (2)
- [ ] ABOUT THE SAME (3)
- [ ] MOSTLY ENGLISH (4)
- [ ] ENGLISH ONLY (5)
- [ ] OTHER LANGUAGE (6) (please specify: ________________)

10. Of the following options, in which language do you most often think?
- [ ] SPANISH ONLY (1)
- [ ] DOES NOT APPLY TO ME (7)
- [ ] MOSTLY SPANISH (2)
- [ ] ABOUT THE SAME (3)
- [ ] MOSTLY ENGLISH (4)
- [ ] ENGLISH ONLY (5)
- [ ] OTHER LANGUAGE (6) (please specify: ________________)

11. Of the following options, which language do you read better?
- [ ] SPANISH ONLY (1)
- [ ] DOES NOT APPLY TO ME (7)
- [ ] MOSTLY SPANISH (2)
- [ ] ABOUT THE SAME (3)
- [ ] MOSTLY ENGLISH (4)
- [ ] ENGLISH ONLY (5)
- [ ] OTHER LANGUAGE (6) (please specify: ________________)

12. Of the following options, in which language do you most often read (newspaper, books, magazines)?
- [ ] SPANISH ONLY (1)
- [ ] DOES NOT APPLY TO ME (7)
- [ ] MOSTLY SPANISH (2)
- [ ] ABOUT THE SAME (3)
- [ ] MOSTLY ENGLISH (4)
- [ ] ENGLISH ONLY (5)
- [ ] OTHER LANGUAGE (6) (please specify: ________________)
13. Of the following options, in which language do you write better?

- SPANISH ONLY (1)
- MOSTLY SPANISH (2)
- ABOUT THE SAME (3)
- MOSTLY ENGLISH (4)
- ENGLISH ONLY (5)
- OTHER LANGUAGE (6) (please specify: ________________________)

14. To the best of your knowledge, what is the ethnicity of most people in your neighborhood?

- ALL HISPANIC (1)
- MOSTLY HISPANIC (2)
- HALF HISPANIC (3)
- SOME HISPANIC (4)
- NO HISPANIC (5)
- DOES NOT APPLY TO ME (7)
- I DO NOT KNOW (8)

15. To the best of your knowledge, what is the ethnicity of most of your coworkers?

- ALL HISPANIC (1)
- MOSTLY HISPANIC (2)
- HALF HISPANIC (3)
- SOME HISPANIC (4)
- NO HISPANIC (5)
- DOES NOT APPLY TO ME (7)
- I DO NOT KNOW (8)

16. To the best of your knowledge, what is the ethnicity of most of your close friends?

- ALL HISPANIC (1)
- MOSTLY HISPANIC (2)
- HALF HISPANIC (3)
- SOME HISPANIC (4)
- NO HISPANIC (5)
- DOES NOT APPLY TO ME (7)
- I DO NOT KNOW (8)

17. How often do you eat Hispanic foods?

- ALL OF THE TIME (1)
- MOST OF THE TIME (2)
- HALF OF THE TIME (3)
- SOMETIMES (4)
- NEVER (5)
- DOES NOT APPLY TO ME (7)
- I DO NOT KNOW (8)
18. How often do you listen to Latin music?

☐ ALL OF THE TIME (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOST OF THE TIME (2)  ☐ I DO NOT KNOW (8)
☐ HALF OF THE TIME (3)  
☐ SOMETIMES (4)  
☐ NEVER (5)

19. How often do you celebrate in a traditional Hispanic way (birthdays, holidays, weddings)?

☐ ALL OF THE TIME (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOST OF THE TIME (2)  ☐ I DO NOT KNOW (8)
☐ HALF OF THE TIME (3)  
☐ SOMETIMES (4)  
☐ NEVER (5)

20. What is the ethnicity of your leisure-time social environment (dance clubs, restaurants, parties)?

☐ ALL HISPANIC (1)  ☐ DOES NOT APPLY TO ME (7)
☐ MOSTLY HISPANIC (2)  ☐ I DO NOT KNOW (8)
☐ HALF HISPANIC (3)  
☐ SOME HISPANIC (4)  
☐ NO HISPANIC (5)

21. What is your mother’s ethnic background?

☐ MEXICAN (1)  
☐ CHICANA (2)  
☐ MEXICAN AMERICAN (3)  
☐ LATINA, CUBANA, PUERTO RICAN, OTHER HISPANIC (4)  
☐ ANGLO AMERICAN OR OTHER (5) (please specify: ____________________)

☐ DO NOT KNOW (8)

22. What is your father’s ethnic background?

☐ MEXICAN (1)  
☐ CHICANO (2)  
☐ MEXICAN AMERICAN (3)  
☐ LATINO, CUBANO, PUERTO RICAN, OTHER HISPANIC (4)  
☐ ANGLO AMERICAN OR OTHER (5) (please specify: ____________________)

☐ DO NOT KNOW (8)
23. In what country did you spend your childhood?

☐ MEXICO (1)
☐ UNITED STATES (4)
☐ OTHER (2) (please specify: ____________________)

☐ DO NOT KNOW (8)

24. What is the estimated time you have lived in the United States as compared to a Hispanic country?

☐ 100% IN A HISPANIC COUNTRY (1)
☐ MOSTLY IN A HISPANIC COUNTRY, PARTLY IN THE UNITED STATES (2)
☐ HALF IN A HISPANIC COUNTRY, HALF IN THE UNITED STATES (3)
☐ MOSTLY IN THE UNITED STATES, PARTLY IN A HISPANIC COUNTRY (4)
☐ 100% IN THE UNITED STATES (5)

☐ DO NOT KNOW (8)
ETHNIC ORIGIN

Some research has suggested that the relationship between weight and heart disease risk factors may vary among women of different racial backgrounds. Therefore, we would like for you to provide the following information.

1. **I consider my biological mother:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

2. **I consider my biological father:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

3. **I consider my biological mother’s mother:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

4. **I consider my biological mother’s father:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

5. **I consider my biological father’s mother:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

6. **I consider my biological father’s father:**
   - African-American
   - Caucasian
   - Native American (American Indian or Eskimo)
   - None of the above
   - Please specify:

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!
CURRICULUM VITA

Clarelouise Anita Highfield (nee Spence) was born in Middlesex, England. At the age of one year, Clarelouise with her sister, and parents moved to Canada, later to be joined by her brother, born in Calgary. Clarelouise attended public school in Calgary, Alberta and graduated with an advanced bilingual diploma from William Aberhart High School in 1991. Following graduation, Clarelouise studied Kinesiology at the University of Calgary and Mount Royal College. While studying, Clarelouise trained as a student Athletic Trainer, working with various sports teams. Clarelouise graduated with a Diploma in Athletic Therapy from Mount Royal College in 1996 and a degree in Kinesiology from the University of Calgary in 1997. In 2001, Clarelouise certified as an Athletic Therapist in Canada and in 2002 Clarelouise certified as an Athletic Trainer in the United States. Clarelouise decided to return to university to pursue her Masters of Science degree in 2003 at the University of Texas at El Paso (UTEP). While completing her course work, Clarelouise worked as a graduate assistant Athletic Trainer, teaching assistant, and research assistant. Her experience, while at UTEP, helped Clarelouise to obtain the Head Athletic Trainer position at Northwestern Oklahoma State University, where she worked from 2005 to 2007. Clarelouise was married in 2005 and spends her time caring for her two children. Clarelouise’s thesis investigated the relationship between soft body composition and bone mineral density in premenopausal Hispanic and Caucasian women.

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This thesis was typed by Clarelouise A Highfield.