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# **Relationship Between Nutrition Knowledge and Obesity in Southern California Adults**



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## **Abstract**

### Background

Over one third of the adult population in the U.S. are obese placing them at higher risk for morbidity or mortality.

### Objective

To determine if lack of nutrition knowledge has a positive impact on eating behaviors using obesity status as an indicator.

### Design

Participants completed the General Nutrition Knowledge Questionnaire (GNKQ), Anonymous Demographic Questionnaire (ADQ), and anthropometric measurements were taken during a one-time meeting lasting about one hour.

### Participants/Setting

Data collection was completed on 334 participants between the ages of 18-55 years in a southern California community sample.

### Intervention

Anthropometric measurements were collected by the research team and consisted of waist circumference, height, weight, and Bio-impedance analysis.

### Main Outcome Measures

Questionnaires were scored by the researchers using a predefined answer guide.

### Statistical Analyses Performed

Statistical analysis was completed using Mann-Whitney Test for multiple comparisons.

### Results

There was no significant difference between mean GNKQ % score for gender ( $p=.21$ ); Table 1. There was a significant difference between mean GNKQ % score for the age group and income ( $p=.02$  and  $p=.04$ , respectively); Table 1. There was a significant difference between mean GNKQ % score for normal vs. overweight BMI class ( $p=.001$ ) and with overweight vs obese BMI class ( $p=.001$ ); Table 2. There was no significant difference between mean GNKQ % score for male waist circumference  $< 40$  vs.  $\geq 40$  ( $p=.49$ ). However, there was a significant difference between mean GNKQ % score for female waist circumference  $< 35$  vs.  $\geq 35$  ( $p=.002$ ); Table 2.

### Conclusions

Obesity is multifactorial and thus cannot be pinned on any one factor such as diet, exercise or nutrition knowledge. There is potential benefit to implement nutrition intervention during this obesity epidemic. Our findings suggest that participants who were obese, had lower nutrition knowledge than those who were of normal BMI. Lack of nutrition knowledge may be one of the many contributing factors for obesity.

## Introduction

Over one third of the adult population in the U.S. are obese.<sup>1</sup> According to the CDC, California is one of six states that has an adult obesity prevalence of 20-25%.<sup>2</sup> With multiple different interventions over the decades, there have been no changes in obesity prevalence between 2003-2004 and 2011-2012.<sup>1</sup> The importance of addressing obesity is vital due to obesity being associated with disease states such as dyslipidemia, high blood pressure, type 2 diabetes, heart attack, and stroke.<sup>3</sup> There have been challenges in the prevention of obesity nationally and globally. Many describe obesity as a public health crisis that impairs quality of life and adds to healthcare costs.<sup>4</sup> Interventions related to obesity and obesity prevention need to be addressed so the trends may reverse.<sup>4</sup>

Accumulation of abdominal fat, particularly in the visceral area may confer the majority of obesity-associated health risks.<sup>5</sup> Anthropometric measurements for body fat percentages are more feasible techniques compared to complex systems such as underwater weight or dual-energy x-ray absorptiometry (DXA).<sup>6</sup> Anthropometric measurements are quick, inexpensive and are reliable for distinguishing those at high risk for morbidity or mortality as a result of obesity.<sup>6</sup> Types of anthropometric measurements include body mass index (BMI), waist circumference, and bio-electrical impedance (BIA).<sup>6</sup>

Body mass index (BMI) is calculated by taking an individual's body weight in kilograms divided by height in meters squared.<sup>6</sup> The individual is weighed without any excess heavy garments or shoes.<sup>6</sup> For height measurement, an individual stands against a wall with their heels pushed back standing completely upright.<sup>6</sup> BMI correlates well with the percentage body fat in large populations, but is not as accurate since it does not take into account an individual's lean mass and muscle tone.<sup>6</sup> BMI predicts increased mortality, morbidity, and disability; with a

stronger relationship with morbidity and disability. <sup>6</sup> Normal BMI classification is between 18.5(kg/m<sup>2</sup>) to 24.9(kg/m<sup>2</sup>). <sup>7</sup> Overweight classification is between 25(kg/m<sup>2</sup>) to 29.9(kg/m<sup>2</sup>) and greater than 30(kg/m<sup>2</sup>) is classified as obese.

Waist circumference is positively correlated with abdominal fat content.<sup>7</sup> The presence of excess fat in the abdomen out of proportion to total body fat is an independent predictor of risk factors and morbidity. <sup>7</sup> According to Visscher, longitudinal studies show that greater waist circumference are associated with a decline in quality of life and an increased risk of chronic diseases.<sup>6</sup> Cut-off waist circumference guidelines for metabolic syndrome for men are greater than 102 cm (> 40 inches) and women greater than 88 cm (>35 inches), respectively. <sup>7</sup> The best option until scientific evidence proves otherwise, is to measure midway between iliac crest and lower rib.<sup>6</sup> This measurement is not complicated requiring only a tape measurement without calculations.<sup>6</sup> Physical activity and other lifestyle changes will effect weight circumference and BMI. Furthermore, physical activity leads to a reduction of waist circumference, whereas BMI may increase due to muscle gain which actually may increase body mass.<sup>6</sup>

Bio-electrical impedance (BIA) is a noninvasive anthropometric tool designed to measure body composition, specifically, the relationship between body fat in relation to lean body mass. <sup>8</sup> Body composition estimation using bio-impedance measurements is based on determination of body volume ( $V_b$ ) through the basic means of resistance measurement. <sup>8</sup> Analysis of bio-impedance, that is obtained at more than two frequencies, is known as multiple-frequency bio-impedance analysis (MF-BIA). <sup>8</sup> Fat mass, skeletal muscle mass, bone minerals, and total body water, which is composed of intercellular fluid and extracellular fluid, are compartments that can be predicted and analyzed using suitable bio-impedance measurement techniques. <sup>8</sup>

To be able to accurately measure nutrition knowledge, and gain a better understanding of the connection between food and health status, a General Nutrition Knowledge Questionnaire (GNKQ) was used. The GNKQ was validated by a former research group, and is a great tool to assess the food knowledge of adults in many communities in Southern California.<sup>9</sup>

Research on the relationship between food knowledge and obesity has been conducted in other countries and in specific age groups. Based on Thakur N, D'Amico's study conducted on high school students in Europe, overall nutrition knowledge did not differ between obese and non-obese adolescents.<sup>10</sup> However, Fitzgerald N, Damio states that there is a need to improve nutrition knowledge and skills, specifically for Latina women with and without diabetes.<sup>11</sup> Yet, Parmenter and Wardle conducted in England found that knowledge was significantly associated with healthy eating.<sup>12</sup> However, none were conducted in the U.S. looking at the broad population's anthropometrics.

According to Mattes R, Foster, a number of studies have shown that food environment can be independent determinants of obesity.<sup>13</sup> Food environment is physical presence of food that affects a person's diet, person's proximity to food store locations, and any physical entity by which food may be obtained, or a connected system that allows access to food.<sup>14</sup> The purpose of this graduate student research is to determine if nutrition knowledge has a relationship to obesity using anthropometric measurements and a valid food knowledge questionnaire in individuals in Southern California. We propose that adults with little food knowledge might exhibit high anthropometric measurements. If this correlation between food knowledge and anthropometric measurements exist, interventions in teaching nutrition can be considered.

## **Methods**

All methods and procedures were approved by the Institutional Review Board of Loma Linda University. Researchers recruited 334 participants who reside in Southern California. Locations included community colleges, universities, churches, and fitness gyms. Within these locations, participants were from 42 different cities in Southern California. This included both male and female participants between the ages of 18 and 55. Recruitment was conducted through flyers, sign-up sheets, social media and word of mouth. Inclusion criteria included being 18-55 years of age, resident of Southern California, and able to read and write English independently. Exclusion criteria included any physical disability that hindered a participant being able to stand up independently and self-reported pregnancy.

All questionnaires and information collected were anonymous. Subjects were given identification numbers which were consistent across the GNKQ, demographic questionnaire and anthropometric measurements. Subjects were identified only by this unique study ID. The master code key for study ID's was only accessible to the principle investigator and co-investigators. This master code key was kept in principal investigator, Cory Gheen's office in Loma Linda University School of Allied Health. In the event there was a loss of electronic data, a hardcopy of the code was also maintained in the same secure office.

The General Nutrition Knowledge Questionnaire was developed originally in the UK, but was modified to suit the current Dietary Guidelines for Americans and current public health nutrition recommendations. It was developed by Parmenter and Wardle (1999) in a southern California community sample. This valid tool will help to identify the current level of understanding of healthy eating in accordance with United States Department of Agriculture (USDA) Dietary Guidelines.

The GNKQ which was given in paper format, consisted of 113 total questions which took participants about 15-30 minutes to complete. The questionnaire was divided into four dimensions: dietary recommendations, food sources, choosing your foods, and diet-disease relationships. One point was given for each question and a higher percent score was indicative of higher dietary knowledge.

Anonymous Demographic Questionnaire (ADQ) was developed by the student researchers. Total time to complete this portion was five minutes. The ADQ was used to assess the participants' gender, age, occupation, employment status, education level, household income, and any medical conditions of family members.

Participant's anthropometric measurements were taken by researchers after completion of the GNKQ and ADQ. Height was measured using a free-standing stadiometer with shoes off. Weight and body fat percentage were taken using a Tanita bio-impedance analysis scale. The Tanita BIA brand uses very low and safe electrical signals. Body Mass Index (BMI) was then calculated by researchers after height and weight were obtained. Finally, waist circumference was measured using a flexible cloth tape measure midline between iliac crest and lowest rib.

Although there were no personal benefits to participants, the scientific knowledge gained from this study may help with the understanding of how the effects of nutrition knowledge can impact a person's weight and possibly their food choices. The risks that might result from study-related procedures included breach of confidentiality and potential social stigmatization.

Kruskal-Wallis and Mann-Whitney Test were used to compare GNKQ percent mean score of the three BMI groups (normal, overweight, and obese). Pearson's correlation coefficient was used to find relationship between a score on the GNKQ and anthropometric measurements, both of which were numerical. When looking at other comparisons between groups, one-way



ANOVA was used. In total, 334 participants completed the study in full, however some were excluded due to age and missing information, leaving 328 available for data analysis. Responses from the ADQ were statistically analyzed with percent score on the GNKQ.

Participants were allotted one hour for data collection. This was a one-time meeting. Participants read the information sheet before signing the protected health information (PHI) form. By signing, participants gave consent to participate in the study. After signing, participants completed the GNKQ and ADQ. Height, weight, waist circumference, and body fat percentage were taken using a bio-impedance scale, stadiometer, and tape measurer with assistance of student researchers. BMI was calculated by researchers after height and weight were obtained. Measurement data was written on the back of the GNKQ/ADQ booklet. Participants were given their anthropometric measurements on a separate designated card if they chose.

## Results

There was no significant difference between mean GNKQ % scores for males and females (Table 1). There was a difference in mean GNKQ % score between the age groups ( $p=.02$ ) (Table 1). Participants with lower household income showed lower nutrition knowledge when compared to participants who make \$100,00 or more (Table 1). There was a correlation, as expected, between the levels of education and GNKQ % score. Those with the lowest level of education had a mean score of 41% on the GNKQ in relation to participants that were college graduates who had a mean score of 65% (Table 2).

**Table 1.** Mean (SD) GNKQ % score by gender, age group, and household income.

| Gender | Mean (SD)   | p-value |
|--------|-------------|---------|
| Male   | 55.8 (13.6) | .21     |
| Female | 57.9 (15.2) |         |

| Age Group     | Mean (SD)   | p-value |
|---------------|-------------|---------|
| 18-24 (n=148) | 57.3 (13.4) | .02     |
| 25-34 (n=96)  | 60.7 (14.7) |         |
| 35-44 (n=48)  | 53.4 (15.5) |         |
| 45-55 (n=37)  | 51.5 (15.8) |         |

| Income           | Mean (SD)   | p-value |
|------------------|-------------|---------|
| Less than 25,000 | 54.7 (16.3) | .04     |
| 25,000-34,999    | 55.5 (14.3) |         |
| 35,000-49,999    | 56.7 (10.4) |         |
| 50,000-74,999    | 59.9 (11.2) |         |
| 75,000-99,999    | 58.8 (10.4) |         |
| 100,000-149,999  | 64.9 (12.5) |         |
| 150,000 or more  | 63.9 (14.1) |         |

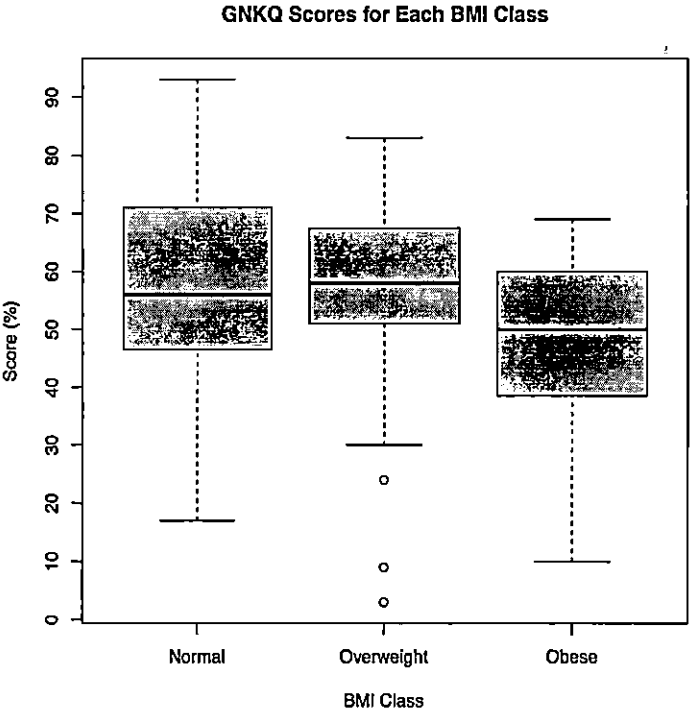
SD: Standard deviation, GNKQ: General Nutrition Knowledge Questionnaire

**Table 2.** Comparing levels of education percent score on GNKQ.

|                     | Elementary | Junior High | High School | GED  | Some college | College graduate | Graduate/Post grad |
|---------------------|------------|-------------|-------------|------|--------------|------------------|--------------------|
| Elementary          | x          | .184        | .167        | .033 | .011         | .006             | .023               |
| Junior High         |            |             | .786        | .145 | .001         | .000             | .000               |
| High school         |            |             |             | .054 | .000         | .000             | .000               |
| GED                 |            |             |             |      | .412         | .006             | .065               |
| Some college        |            |             |             |      |              | .000             | .035               |
| College graduate    |            |             |             |      |              |                  | .498               |
| Graduate/ Post Grad |            |             |             |      |              |                  | x                  |

When BMI classes were grouped into normal, overweight and obese, there was significant difference between them in regard to mean GNKQ % score ( $p=0.001$ ). Underweight (BMI <18.5) participants ( $n=4$ ) were not included in data analysis due to lower frequency compared to the other BMI classes. First, researchers tested for homogeneity between BMI classes. There was no homogeneity between normal and obese BMI classes. Therefore, obese

and overweight were grouped during statistical analysis, as well as normal and overweight. Using the Mann-Whitney Test for multiple comparison, there was significant difference in mean score between overweight (n=103) and obese (n=80) participants (p=0.001). The mean GNKQ % score for obese participants was 51.7% while for overweight participants mean rank was 57.4%. Mean GNKQ % score for normal weight participants was 60.3%. When divided into BMI classes, mean GNKQ % score of obese participants was lower than those participants within normal (n=142) BMI ranges (Table 5).



**Figure 1.** Median score and range of GNKQ percent score by BMI class (n=325)

**Table 2.** Table 2. Mean (SD) of GNKQ % score by BMI class and waist circumference

| BMI Class          | Mean        | p-value |
|--------------------|-------------|---------|
| Normal (n=142)     | 60.3 (15.3) | .001    |
| Overweight (n=103) | 57.4 (13.6) |         |

| BMI Class          | Mean        | p-value |
|--------------------|-------------|---------|
| Overweight (n=103) | 57.4 (13.6) | .001    |
| Obese (n=80)       | 51.7 (12.5) |         |

| Gender  | Waist (in.) | Mean (SD)   | p-value |
|---------|-------------|-------------|---------|
| Males   |             |             | .49     |
| n=61    | <40         | 56.7 (14.8) |         |
| n=63    | ≥40         | 55.0 (12.5) |         |
| Females |             |             | .002    |
| n=144   | <35         | 60.0 (15.9) |         |
| n=59    | ≥35         | 52.8 (12.2) |         |

SD: Standard deviation, GNKQ: General Nutrition Knowledge Questionnaire

Regarding waist circumference, males and females were analyzed differently based on recommended waist circumference for each gender. Males were divided into two groups: ≥40 inches and <40 inches waist circumference while females were divided into ≥35 inches and <35

inches. There was no difference between GNKQ % scores for men less than 40 inches and more than 40 inches, however, there was a significant difference in females ( $p= 0.005$ ). The mean GNKQ % score for females who had a waist circumference  $<35$  inches was 60% while females with a waist circumference  $\geq 35$  inches had a mean score of 52.8%.

When looking at the relationship between different anthropometric measurements and GNKQ % score using Spearman's Correlation, there was no significant relationship ( $r = -0.2$ ).

### **Discussion**

The age group with the highest mean GNKQ % score was 25-34 years ( $n=96$ ). College students mostly contributed to this age group. Most colleges offer a nutrition class to meet general education requirements. Perhaps the recent nutrition education for this age group resulted in a higher mean score on the GNKQ. Also, those with higher level of education demonstrated higher score on the GNKQ. Overall, general education may have a connection with nutrition knowledge.

Participants with higher household income, more than \$100,000, also demonstrated higher GNKQ % score. This may also be related to the fact that these individuals have received more education throughout life.

The results supported our hypothesis regarding an association between nutrition knowledge and obesity in Southern California adults, when grouped into BMI classes. The relationship between GNKQ % score and anthropometric measurements was not strong ( $r = -0.2$ ). However, when asked as a difference question, nutrition knowledge among the BMI classes were significantly different. Those within the normal weight (60.3%) group had statistically significantly higher mean score percent than the overweight (57.4%) and obese (51.7%) group.

Based on this data analysis, participants of normal weight have more nutrition knowledge than those who are overweight and obese.

Multiple factors play a part in obesity, such as socioeconomic status and environment. This may be why there was not a significant relationship between GNKQ % score and each anthropometric measurement (BMI, body fat percentage, and waist circumference). It is sufficient to state that alone, nutrition knowledge may not facilitate behavior change. There are other factors that are barriers to dietary behavior change.

Obesity is multifactorial and thus cannot be pinned on only one factor such as nutrition knowledge. Based on the data collected and analyzed there is a potential benefit to implement nutrition intervention in this obesity epidemic. Level of education played a role in the results of the GNKQ. The more educated the individuals, the higher their scores were.

Some of the limitations of this study was grading format and missing information. Digital formatting of the GNKQ and ADQ should be considered for future research studies to provide 100% accuracy during grading. Also, if information is missing, the electronic version would recognize what is missing before participants completed the study.

Obesity is associated with disease states and therefore decreasing obesity prevalence can improve quality of life. Obesity has a negative effect on mental status, social functioning, physical health, and emotional well-being.<sup>15</sup> By increasing knowledge in nutrition, especially in those who are at higher risk of being obese, quality of life may be improved.

## **Conclusion**

Educated, competent nutrition professionals, such as registered dietitians, can effectively share their nutrition knowledge with the public. Nutrition classes should be provided to the public, especially to those of lower-socioeconomic status to help prevent obesity and other health

complications related to obesity. Clinical interventions are also being practiced by providing nutrition knowledge to those who are obese.

Obesity is multifactorial and thus cannot be pinned on any one factor such as diet, exercise or even nutrition knowledge. There is potential benefit to implement nutrition intervention during this obesity epidemic. Lack of nutrition knowledge is a contributing factor for obesity.

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## **Appendix**

General Nutrition Knowledge Questionnaire (GNKQ)

Information Sheet

HIPAA

Flyer

Verbal Script

Anonymous Demographic Questionnaire (ADQ)

Data Sheet

Sign Up Sheet

# General Nutrition Knowledge Questionnaire

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Southern California

Instructions: please answer each line of each question by filling in the box or space corresponding to your response. Although answers to every question are important, if you choose not to answer any question, please leave it blank and go on to the next question. There is no time limit and we would be happy to answer any questions you may have.



**The first few items are about what advice you think experts are giving**

1) Do you think health experts recommend that people should be eating more, the same amount, or less of these foods? (Check one box per food)

|                  | More                  | Same                  | Less                  | Not sure              |
|------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Vegetables       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Sugary Foods     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Meat             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Starchy Foods    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fatty Foods      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| High Fiber Foods | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fruit            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Salty Foods      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

2) How many servings of fruit and vegetables a day do you think experts are advising people to eat? (One serving could be, for example, an apple or handful of chopped carrots)

.....

3) Which fats do experts say are the most important for people to cut down on? (check one)

- (a) monounsaturated fat
- (b) polyunsaturated fat
- (c) saturated fat
- (d) not sure

4) What version of dairy foods do experts say people should eat? (check one)

- (a) whole milk
- (b) lower fat
- (c) mixture of full fat and lower fat
- (d) neither, dairy foods should be cut out
- (e) not sure

**Experts classify foods into groups. We are interested to see whether people are aware of what foods are in these groups**

1) Do you think these are high or low in added sugar? (Check one per food)

|                               | High                  | Low                   | Not sure              |
|-------------------------------|-----------------------|-----------------------|-----------------------|
| Bananas                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Unflavored yogurt             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ice cream                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Orange soda                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ketchup                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Canned fruit in natural juice | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

2) Do you think these foods are high or low in fat? (Check one per food)

|                       | High                  | Low                   | Not sure              |
|-----------------------|-----------------------|-----------------------|-----------------------|
| Pasta (without sauce) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Hummus                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Baked beans           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Luncheon meat         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Honey                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Potato salad          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Nuts                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Bread                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cottage Cheese        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Margarine             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

3) Do you think experts put these in the starchy foods group? (Check one per food)

|         | Yes                   | No                    | Not sure              |
|---------|-----------------------|-----------------------|-----------------------|
| Cheese  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Pasta   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Butter  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Nuts    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Rice    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Oatmeal | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

4) Do you think these are high or low in salt? (Check one per food)

|                   | High                  | Low                   | Not sure              |
|-------------------|-----------------------|-----------------------|-----------------------|
| Sausages          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Pasta             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Deli meat         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Red meat          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Frozen vegetables | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cheese            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

5) Do you think these are high or low in protein? (Check one per food)

|             | High                  | Low                   | Not sure              |
|-------------|-----------------------|-----------------------|-----------------------|
| Chicken     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cheese      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fruit       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Baked beans | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Butter      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cream       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

6) Do you think these are high or low in fiber? (Check one per food)

|                           | High                  | Low                   | Not sure              |
|---------------------------|-----------------------|-----------------------|-----------------------|
| Cornflakes                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Bananas                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Eggs                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Red meat                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Broccoli                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Nuts                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fish                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Baked potatoes with skins | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Chicken                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Baked beans               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

7) Do you think these fatty foods are *high or low in saturated fat*?  
(Check one per food)

|            | High                  | Low                   | Not sure              |
|------------|-----------------------|-----------------------|-----------------------|
| Sardines   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Whole milk | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Olive oil  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Red meat   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Margarine  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Chocolate  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

---

8) Some foods contain a lot of fat, but no cholesterol.

- (a) agree   
(b) disagree   
(c) not sure

9) Do you think experts call these *a healthy alternative to red meat*?  
(Check one per food)

|                | Yes                   | No                    | Not sure              |
|----------------|-----------------------|-----------------------|-----------------------|
| Pork chops     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Luncheon meat  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Baked beans    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Nuts           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Low fat cheese | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Omelet         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

---

10) A glass of unsweetened fruit juice counts as a serving of fruit

- (a) agree   
(b) disagree   
(c) not sure
- 

11) Saturated fats are mainly found in (check one):

- (a) vegetable oils   
(b) dairy products   
(c) both (a) and (b)   
(d) not sure
- 

12) Brown sugar is a healthy alternative to white sugar.

- (a) agree   
(b) disagree   
(c) not sure
- 

13) There is more protein in a glass of whole milk than in a glass of fat free milk.

- (a) agree   
(b) disagree   
(c) not sure
- 

14) Margarine contains less fat than butter.

- (a) agree   
(b) disagree   
(c) not sure
- 

15) Which of these breads contain the most vitamins and minerals?  
(check one)

- (a) white   
(b) brown   
(c) whole grain   
(d) not sure
- 

16) Which do you think is higher in calories: butter or regular margarine? (check one)

- (a) butter   
(b) margarine   
(c) both are the same   
(d) not sure
- 

17) A type of oil which contains mostly monounsaturated fat is (check one):

- (a) coconut oil   
(b) sunflower oil   
(c) olive oil   
(d) palm oil   
(e) not sure
- 

18) There is more calcium in a glass of whole milk than a glass of fat free milk

- (a) agree   
(b) disagree   
(c) not sure
-

19) Which *one* of the following has the most calories for the same weight? (*check one*)

- (a) sugar
  - (b) starchy foods
  - (c) fiber
  - (d) fat
  - (e) not sure
- 

20) Solid fats contain more: (*check one*)

- (a) monounsaturated fat
  - (b) polyunsaturated fat
  - (c) saturated fat
  - (d) not sure
- 

21) Polyunsaturated fats are mainly found in: (*check one*)

- (a) vegetable oils
  - (b) dairy products
  - (c) both (a) and (b)
  - (d) not sure
- 

### The next few items are about choosing foods

Please answer what is being asked and not whether you like or dislike the food.

1) Which would be the best choice for a low fat, high fiber snack? (*check one*)

- (a) diet strawberry yogurt
  - (b) raisins
  - (c) granola bar
  - (d) whole wheat crackers and cheddar cheese
- 

2) Which would be the best choice for a low fat, high fiber light meal? (*check one*)

- (a) grilled chicken
  - (b) cheese on whole wheat toast
  - (c) beans on whole wheat toast
  - (d) omelet
- 

3) Which kind of sandwich do you think is healthier? (*circle one*)

- (a) two *thick* slices of bread with a *thin* slice of cheddar cheese filling
  - (b) two *thin* slices of bread with a *thick* slice of cheddar cheese filling
- 

4) Many people eat spaghetti bolognese (pasta with a tomato and meat sauce). Which do you think is healthier? (*check one*)

- (a) a *large amount* of pasta with a *little* sauce on top
  - (b) a *small amount* of pasta with a *lot* of sauce on top
- 

5) If a person wanted to reduce the amount of fat in their diet, which would be the best choice? (*check one*)

- (a) steak, grilled
  - (b) sausages, grilled
  - (c) chicken, grilled
  - (d) pork chop, grilled
- 

6) If a person wanted to reduce the amount of fat in their diet, but didn't want to give up French fries, which one would be the best choice? (*check one*)

- (a) thick cut fries
  - (b) thin cut fries
  - (c) crinkle cut fries
- 

7. If a person felt like something sweet, but was trying to cut down on sugar, which would be the best choice? (*check one*)

- (a) honey on toast
  - (b) a cereal snack bar
  - (c) graham cracker
  - (d) banana with plain yogurt
- 

8) Which of these would be the healthiest dessert (*check one*)

- (a) baked apple
  - (b) strawberry yogurt
  - (c) whole meal cracker and cheddar cheese
  - (d) carrot cake with cream cheese topping
-

9) Which cheese would be the best choice as a lower fat option? (check one)

- (a) plain cream cheese
  - (b) mozzarella
  - (c) cheddar
  - (d) parmesan
- 

10) If a person wanted to reduce the amount of fat in their diet, which would be the best choice? (check one)

- (a) readymade frozen pot pie
  - (b) ham with pineapple
  - (c) mushroom omelets
  - (d) stir fry vegetables with soy sauce
- 

**This section is about health problems or disease**

1) Are you aware of any major health problems or diseases that are related to a low intake of fruit and vegetables?

- (a) yes
- (b) no
- (c) not sure

If yes, what diseases or health problems do you think are related to a low intake of fruit and vegetables?

.....

2) Are you aware of any major health problems or diseases that are related to a low intake of fiber?

- (a) yes
- (b) no
- (c) not sure

If yes, what diseases or health problems do you think are related to a low intake of fiber?

.....

3) Are you aware of any major health problems or diseases that are related to how much sugar people eat?

- (a) yes
- (b) no
- (c) not sure

If yes, what diseases or health problems do you think are related to sugar?

.....

4) Are you aware of any major health problems or diseases that are related to how much salt or sodium people eat?

- (a) yes
- (b) no
- (c) not sure

If yes, what diseases or health problems do you think are related to salt?

.....

5) Are you aware of any major health problems or diseases that are related to the amount of fat people eat?

- (a) yes
- (b) no
- (c) not sure

If yes, what diseases or health problems do you think are related to fat?

.....

6) Do you think these help to reduce the chances of getting certain kinds of cancer? (answer each one)

|                                     | Yes                   | No                    | Not sure              |
|-------------------------------------|-----------------------|-----------------------|-----------------------|
| eating more fiber                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less sugar                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less fruit                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less salt                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating more fruits and vegetables   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less preservatives/additives | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

---

7) Do you think these help prevent heart disease? (answer each one)

|                                     | Yes                   | No                    | Not sure              |
|-------------------------------------|-----------------------|-----------------------|-----------------------|
| eating more fiber                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less saturated fat           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less salt                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating more fruit and vegetables    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| eating less preservatives/additives | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

---

8) Which one of these is more likely to raise people's blood cholesterol level? (check one)

- (a) antioxidants
  - (b) polyunsaturated fats
  - (c) saturated fats
  - (d) cholesterol in the diet
  - (e) not sure
-

9) Have you heard of *antioxidant* vitamins?

- (a) yes
- (b) no

10) If YES to question 9, do you think these are *antioxidant* vitamins?  
(answer each circle)

|                    | Yes                   | No                    | Not sure              |
|--------------------|-----------------------|-----------------------|-----------------------|
| Vitamin A          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| B Complex Vitamins | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Vitamin C          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Vitamin D          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Vitamin E          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Vitamin K          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Finally, we would like to ask you a few questions about yourself

1) Are you male or female?

- (a) Male
- (b) Female

2) How old are you?

- (a) less than 18
- (b) 18-24
- (c) 25-34
- (d) 35-44
- (e) 45-54
- (f) 55-64
- (g) 65-74
- (h) 75 and older

3) Are you:

- (a) single
- (b) married
- (c) living as married
- (d) separated
- (e) divorced
- (f) widowed

4) What is your ethnic origin (check one)

- (a) African American
- (b) Asian
- (c) Hispanic or Latino
- (d) Native American
- (e) Native Hawaiian or other Pacific Islander
- (f) White

5) How many children do you have?

- (a) None
- (b) 1
- (c) 2
- (d) 3
- (e) 4
- (f) more than 4

6) Do you have any children, under 18 years, living with you?

- (a) Yes
- (b) No

7) What is the highest level of education you have completed?

- (a) elementary school
- (b) junior high
- (c) high school
- (d) GED
- (e) some college
- (f) college graduate
- (g) graduate or post grad

8) Do you have any health or nutrition related qualifications?

- (a) Yes   
Please specify:  
.....
- (b) No

9) What is your occupation? If you are not working now, what is your usual job? (please be specific)

.....  
\_\_\_\_\_

10) Are you on a special diet?

- (a) Yes   
Please specify:  
.....
- (b) No



**LOMA LINDA UNIVERSITY**  
School of Allied Health Professions

**INFORMATION SHEET**

I, Claudinne Herrera of Loma Linda University School of Allied Health Department of Nutrition and Dietetic, am a co-investigator in a graduate student research study titled "Relationship Between Nutrition Knowledge and Obesity in Southern California Adults". The Principal Investigator of the research study is Mr. Cory Gheen, MS, RD, Assistant Professor in Nutrition and Dietetics at Loma Linda University. The graduate students in the Department of Nutrition and Dietetics, Loma Linda University, will be receiving credit towards their Master degree.

**WHY IS THIS STUDY BEING DONE?**

The purpose of this graduate student research study is to identify a relationship between nutrition knowledge and obesity using anthropometric measurements (height, weight, body fat percentage, and waist circumference). Secondary outcomes include nutrition education to residents in Southern California.

You are invited to be in this study because you are:

- 18-55 years of age
- Resident of Southern California
- Able to read and write English independently
- Have no physical disability
- Not pregnant (self-reported)

Approximately 1000 subjects will participate.

Your participation in this study will be no longer than one hour for only one day.

**HOW WILL I BE INVOLVED?**

**Loma Linda University  
Adventist Health Sciences Center  
Institutional Review Board  
Approved 9/27/2017  
#5170301 Chair**

*Lori Loney*

After reading the information sheet and by signing the Protected Health Information document, you agree to participate in this study. This study involves the following: allow researchers to measure your height, weight, waist circumference, and body fat percentage and answering a food knowledge questionnaire.

Other information to be collected:

- Age
- Gender
- Occupation
- Education
- Past and Current Medical History (cancer, heart disease, high blood pressure, liver disease, chronic pain, diabetes)

Your name will be coded with a unique study ID so that all information will be kept confidential.

**WHAT ARE THE REASONABLY FORESEEABLE RISKS OR DISCOMFORTS I MIGHT HAVE?**

This study poses no greater risk to you than what you routinely encounter in day-to-day life.

Participating in this study will involve the following risks:

- Possible breach of confidentiality
- Discomfort in body measurement results

All records and research materials that identify you will be held confidential. Any published document resulting from this study will not disclose your identity without your permission. Information identifying you will only be available to the study personnel.

Upon entering the study, you will be assigned a study ID. Thereafter, you will only be identified by your unique study ID. The master code key with your study ID will only be accessible to the primary investigator and co-investigators. This master code key will be kept in principal investigator, Cory Gheen's office in Loma Linda University School of Allied Health. In the

event there is a loss of electronic data, a hardcopy of this code will also be maintained in the same secure office.

The use of your Protected Health Information is explained in the separate authorization form.

#### **WILL THERE BE ANY BENEFIT TO ME OR OTHERS?**

Although there will be no personal benefits to participants, the scientific knowledge gained from this study may help with the understanding of how the effects of nutrition knowledge will impact a person's weight and possibly their food choices.

#### **WHAT ARE MY RIGHTS AS A SUBJECT?**

Your participation in this study is entirely voluntary. You may refuse to participate or withdraw once the study has started. Your decision whether or not to participate or terminate at any time will not affect your standing with the researchers. If at any time you feel uncomfortable, you may refuse to answer questions. You do not give up any legal rights by participating in this study.

#### **WHAT COSTS ARE INVOLVED?**

There is no cost to you for participating in this study.

#### **WILL I BE PAID TO PARTICIPATE IN THIS STUDY?**

You will not be paid to participate in this research study. However, you have the option to leave your contact information on a sheet provided to be entered into a raffle to win 4 tickets to Scandia Amusement Park.

#### **WHO DO I CALL IF I HAVE QUESTIONS?**

Call (909)558-4647 or e-mail [patientrelations@llu.edu](mailto:patientrelations@llu.edu) for information and assistance with complaints or concerns about your rights in this study.

Thank you in advance for considering this invitation to participate. If you have any questions, please give the Principal Investigator Cory Gheen a call during routine office hours at (909) 558-4593 ext. 42727.



If you wish to proceed and participate in this study after reading this information letter, please complete the attached Protected Health Information Form. By completing the Protected Health Information Form, you are giving your consent to participate.

Sincerely,

Claudinne Herrera, Tatiana Keay, Tonya Larson: Graduate student researchers



**INSTITUTIONAL REVIEW BOARD**  
**Authorization of Use of**  
**Protected Health Information (PHI)**

*Per 45 CFR §164.508(b)*

**RESEARCH PROTECTION PROGRAM**

*Loma Linda University / Office of the Vice President*

*• 24887 Taylor Street, Suite 202 • Loma Linda, CA 92350  
(909) 558-4531 (voice) / (909) 558-0131 (fax) e-mail: irb@llu.edu*

**TITLE OF STUDY:** The Relationship Between Nutrition Knowledge and Obesity in Southern California  
**PRINCIPAL INVESTIGATOR:** Cory Gheen, MS, RD Associate chair, Professor, Department of Nutrition and Dietetic

**Others who will use, collect, or share PHI:** All authorized personal

The study may be performed only by using professional information relating to your health. National and international data protection regulations give you the right to control the use of your medical information. Therefore, by signing this form you specifically authorized your medical information to be used or shared as described below.

The following personal information considered "Protected Health Information" (PHI) is needed to conduct this study and may include, but is not limited to: name, age, gender, income, education, past and present medical history, such as cancer, heart disease, high blood pressure, liver disease, chronic pain, diabetes, and physical activity.

The individual(s) listed above will use or share this PHI in the course of this study with the Institutional Review Board (IRB) and the Office of Research Affairs of Loma Linda University.

The main reason for sharing this information is to be able to conduct the study described earlier in the consent form. In addition, it is shared to ensure that the study meets legal, institutional, and accredited standards. Information may also share to report adverse events or situations that may help prevent placing other individuals at risk.

All reasonable efforts will be used to protect the confidentiality of your PHI, which may be shared with others to support this study, to carry out their responsibilities, to conduct public health reporting and to comply with the law as applicable. Those how receive PHI may share with other even if they are required by the law, and they may share it with other who may not be required to follow national and international "protection health information" (PHI) regulations such as the federal privacy rule.

Subject to any legal limitation, you have the right to access any protected health information created during this study. You may request this information from the Principal Investigator named above but it will only become available after the study analysis is complete.

- This authorization does not expire, and will continue indefinitely unless you notify the researcher that you wish to revoke it.

You may change your mind about this authorization at any time. If this happens, you must withdrawal your permission in writing.

*Loma Linda University  
Adventist Health Science Center  
Institutional Review Board  
Approved 9/27/17 Void after 9/26/2018  
#5170301 Chair *Irvin Looney**

The relationship between food knowledge and obesity in Southern California

Beginning the date, you drew your permission, no new professional health information will be used for this study. However, study personal may continue to use the health information that was provided before you withdrew your permission. If you sign this form and enter this study, but later change your mind and withdraw your permission, you will be removed from the study at that time. To withdraw your permission please contact the Principal Investigator or study personal at (909)558-4300 ext. 42727.

You may refuse to sign this authorization. Refusing to sign will not affect the present or future care you receive at this institution and will not cause you any penalty or loss of benefits with you are entitled. However, if you do not sign this authorization form, you will not be able to take part in this study for which you are being considered. You will receive a copy of this signed and dated authorization prior to your participation to the study.

-----  
I agree that my personal health information may be used for the study purpose described in this form.

\_\_\_\_\_  
Signature of Patient  
Or Patient's legal Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name of Legal Representative  
(if any)

\_\_\_\_\_  
Representative's Authority  
to act for Patient

\_\_\_\_\_  
Signature of Investigator Obtaining  
Authorization

\_\_\_\_\_  
Date

Loma Linda University  
Adventist Health Science Center  
Institutional Review Board  
Approved 9/27/17 Void after 9/26/2018  
# 9170301 Chair *Lorri Looney*

# Are you knowledgeable in Nutrition?



## Relationship Between Nutrition Knowledge and Obesity in Southern California Adults

Participate in a Graduate Student Research Study

Food Knowledge questionnaire and receive a

**FREE** Body fat analysis

as well as a chance to win

**4 FREE** tickets to SCANDIA AMUSEMENT PARK!

**Principal Investigator:** Cory Gheen, MS, RD Assistant Professor

- Interested participants will fill out an anonymous General Nutrition Knowledge Questionnaire & anonymous demographic questionnaire
- Height, weight, waist circumference, and body fat analysis

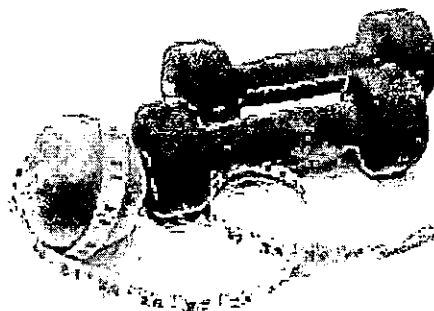
### **Inclusion:**

- 18-55 years of age
- Residence of Southern California
- Able to read and write English independently

### **Exclusion:**

- Physical disability
- Self reported pregnant women

**Sponsor by:** Loma Linda University School of Allied Health Department of Nutrition and Dietetics



Loma Linda University  
Adventist Health Science Center  
Institutional Review Board  
Approved 9/21/2017  
#5170301 Chair

*Loni Lozoff*



**Contact:** Graduate Student Investigator  
Claudinne Herrera- [cherrera@llu.edu](mailto:cherrera@llu.edu)  
(909)362-7010

## Verbal Model Script Elements

- Hello, my name is (Tonya, Tatiana or Claudinne) with Loma Linda University's Department of Nutrition and Dietetics.
- I would like to tell you about a graduate student research study that is being done by our program.
- Would it be convenient for me to talk to you about this study right now?
- The purpose of this study is to see if a person's basic knowledge of nutrition affects obesity
- We are looking for participants that are residents of Southern California between the ages of 18-55 who can read and write English independently. Exclusions include any physical disability or self-report pregnancy.
- If you agree to participate, you will be asked to fill out a questionnaire and answer some basic questions about nutrition. Along with the questionnaire, we will need to get your height, weight, and waist measurements as well as your body fat composition from a bio-electric impedance scale. In its entirety, the duration of this meeting will be up to one hour. We will only need to meet with you one time.
- You will not be paid for your participation in this study, however, you will have the opportunity to get a reading of your body fat composition and BMI.
- This study poses no greater risk to you than what you routinely encounter in day to-day life. Additionally, there is a risk of breach of confidentiality and social stigmatization.
- Although participants may not benefit from this study, researchers may benefit by understanding if nutrition knowledge has an effect on obesity.
- Do you have any questions?
- You can contact the principle investigator, Cory Gheen at (909)-558-4300 ext. 42727 if you have questions about this study.
- Participation is voluntary.
- Would you like to participate in this study? (If yes, select a time). You are not officially enrolled until you sign the protected health information document.
- Thank you for your time.

*Loma Linda University  
Adventist Health Science Center  
Institutional Review Board*

Approved 9/27/2017

# 5170301 Chair

*Shari Lacey*

Subject # \_\_\_\_\_

**Anonymous Demographic Questionnaire:**

Age: \_\_\_\_\_

City you reside in: \_\_\_\_\_

Occupation: \_\_\_\_\_

**\*Please circle one for each of the following questions:**

**Current employment status:**

- |  |                                      |
|--|--------------------------------------|
| <input type="radio"/> Employed full time (40 or more hours per week) | <input type="radio"/> Student        |
| <input type="radio"/> Employed part time (up to 39 hours or more)    | <input type="radio"/> Retired        |
| <input type="radio"/> unemployed                                     | <input type="radio"/> Homemaker      |
|  | <input type="radio"/> Self-employed  |
|  | <input type="radio"/> Unable to work |

**Household Income:** *What was your total household income before taxes during the past 12 months?*

- |  |  |
|--|--|
| <input type="radio"/> Less than \$25,000   | <input type="radio"/> \$75,000 to \$99,999   |
| <input type="radio"/> \$25,000 to \$34,999 | <input type="radio"/> \$100,000 to \$149,999 |
| <input type="radio"/> \$35,000 to \$49,999 | <input type="radio"/> \$150,000 or more      |
| <input type="radio"/> \$50,000 to \$74,999 |  |

**Do you or a member of your family have any of the following medical condition?**

- Diabetes Type 1
- Diabetes Type 2
- Chronic pain
- Cancer
- High blood pressure
- Heart disease
- Liver Disease

Loma Linda University  
Adventist Health Science Center  
Institutional Review Board  
Approved 9/27/2017  
# 5170301 Chair

*Loni Looney*

Anthropometrics  
Data Sheet - EXAMPLE

| ID | Weight | Height | BMI | Body Fat % | Waist Circumference |
|----|--------|--------|-----|------------|---------------------|
| 1  |        |        |     |            |                     |
| 2  |        |        |     |            |                     |
| 3  |        |        |     |            |                     |
| 4  |        |        |     |            |                     |
| 5  |        |        |     |            |                     |
| 6  |        |        |     |            |                     |
| 7  |        |        |     |            |                     |
| 8  |        |        |     |            |                     |
| 9  |        |        |     |            |                     |
| 10 |        |        |     |            |                     |

Loma Linda University  
Adventist Health Science Center  
Institutional Review Board

Approved 9/27/2017

# 5120301 Chair

*Innie Looney*

