Utilization of Waist Circumference to Determine Type 2 Diabetes Risk Among Normal and Overweight Individuals
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1. Are the measurements of waist circumferences and waist-to-hip ratios strong predictors of type 2 diabetes among normal to overweight individuals?
2. If so, which measurement will significantly correlate more to the risk of type 2 diabetes?

Introduction
The purpose of this study is to investigate whether noninvasive measurements such as waist circumference (WC) and waist-to-hip ratio (WHR) are effective for people who have a normal to overweight BMI in determining risk for type 2 diabetes. 29 million US adults have diabetes and 86 million have prediabetes. Numerous studies have indicated waist circumference as a strong predictor of type 2 diabetes in obese individuals. However there are few that research the effects of these anthropometric measurements with individuals who look lean but are potentially metabolically obese.

Hypotheses
1. WC will have a strong correlation with fasting insulin levels in normal weight individuals
2. WC alone will be a better predictor of diabetes risk than WHR

Literature Review
Waist Circumference
- There is a strong correlation between central adiposity and type 2 diabetes
- Multiple studies indicated significant relations between type 2 diabetes and the measurement of waist circumference

Waist-to-Hip Ratio
- While WHR is also a predicting factor, previous studies have shown that it is not as significant as WC
- However, in studies where WC is not taken into consideration, WHR is the best predicting factor for the instance of type 2 diabetes

Blood Glucose
- Due to ineffective use of insulin, blood glucose increases causing hyperglycemia
- Fasting blood glucose levels strongly correlate with WC

Methodology

Procedures
1. Upon initial contact of the volunteer, a prescreening email is sent to determine whether or not the volunteer meets the required BMI range
2. Subjects are instructed to avoid food and beverage consumption (except water), and physical activity for a minimum of 8 hours
3. A trained research assistant collects demographic data, health history, anthropometric measurements (h/t/waist/hips/BPR), and a fasting blood glucose measurement via fingerstick blood draw

Data Analysis

Pearson's Correlation Coefficient
- Analyzes the correlation between all variables
- Compares three groups: WC vs. FBG (y)
  - WHR vs. FBG (y)
  - BMI vs. FBG (z)
In order to determine which groups are more strongly correlated

Receiver Operating Characteristic curves
- Evaluates the performance of diagnostic tests
- Calculates which test is better (WC or WHR)
- Indicates whether a subject is at risk (FBG>100) or not at risk (FBG<100)
- Determines possible cut off points for waist circumferences among the target population

Simple Regression
- Determines if a change in one variable leads to a change in another variable
- For example, a change in WC may lead to a change in FBG

Future Plans

• After this experiment, researchers will include a test for insulin levels in order to investigate its relationship with WC and WHR among the normal weight to overweight population
• Evaluating insulin levels as another variable is important because insulin levels rise before blood glucose does
• This means that there may potentially be a more accurate prediction for type 2 diabetes
• Due to the lack of budget for this present experiment, this test was excluded

Subject Demographics

100 participants
18.5-29.9 BMI
Weight stable for the past 3 months
No unresolved medical conditions

Conclusion and Discussion
The importance of central fat distribution in the prediction of type 2 diabetes is much more prominent than total fat distribution. Therefore, the anthropometric ratio will potentially indicate results relevant to a strong correlation for the instances of type 2 diabetes. The use of blood glucose levels will help show metabolically whether an individual with a blood glucose level of over 100 at risk for type 2 diabetes. Through these cost-effective and noninvasive measurements, it may be applied in clinical settings for screening or for early intervention.

This present study serves to add to a small body of research that studies individuals who appear to be physically lean but who may be metabolically obese. It is important for future studies to explore subjects of different ethnicities, sexes, and age groups to have more of the general population. Furthermore, additional research could be done to explain the mechanisms of how individuals who are physically lean develop type 2 diabetes even with the association that obesity and type 2 diabetes are related to each other. Moreover, even though central adiposity plays a role in the development of type 2 diabetes, it is not the only factor. Collecting data on choices will also aid research in this field more in depth.

References