Moving Away From BMI: Lifestyle and Biological Factors Impacting Health

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Introduction

Our research questions are derived from a Health At Every Size (HAES) perspective.[1] Measures like the BMI, that focus merely on a height versus weight ratio, are too narrow of a measure to be used in medical practices in determining a person's health status. We are interested in the association between BMI and other biomarkers because people who fall into a "normal or healthy weight" BMI category (18.5 – 24.9) may not necessarily have other health status indicators (such as normal or healthy cholesterol levels, higher number of minutes exercised, or better systolic blood pressure measures).

Research Questions

- Does BMI correlate with other health factors such as total cholesterol and cholesterol ratios?
- How does measured BMI of participants compare across individuals who participate in vigorous or moderate activity at work versus vigorous or moderate recreational activity? How does BMI and cholesterol ratios change given marital status and gender?

Methods

This is a retrospective study of the data collected by NHANES. Sample weights were included to better represent the target population and continuous variables including BMI and cholesterol ratios were log transformed to satisfy normality requirements. Cholesterol ratio is determined by an individuals HDL count divided by their total cholesterol (higher ratios are indicative of high LDL levels or low HDL levels). ANOVA and linear regression tests were conducted in R Studio.®[4]

Sample Characteristics

- Gender
- Marital Status
- BMI
- High Density Lipoprotein (HDL)
- Low Density Lipoprotein (LDL)
- Cholesterol Ratio
- Activity Level for Work and Recreation.

BMI Results

Majority of the population fall outside "healthy" BMI category

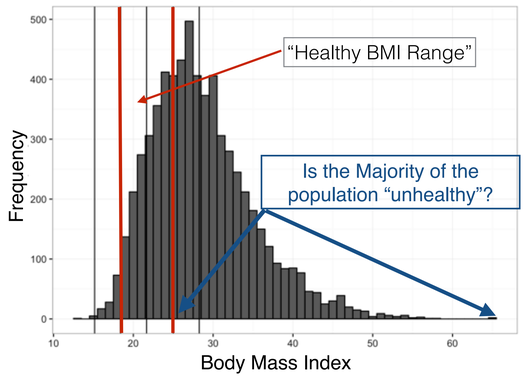

Figure 1. The frequency of NHANES participants and their BMI category. These categories suggest that most of the population is "overweight."

Impact of biological and lifestyle factors on BMI

	Percent Change	P-Value
Lifestyle Factors		
Vigorous Work Activities	-0.98	0.162
Moderate Work Activities	-0.99	0.962
Vigorous Exercise	1.04	≤0.001
Moderate Exercise	1.03	≤0.001
Biological Factors		
Gender	1.02	≤0.001
Age	1.00	≤0.001
Cholesterol Ratio	1.24	≤0.001

Table 1. Identification of lifestyle and biological factors associated with BMI. Gender is reported as females compared to males and lifestyle factors are compared to sedentary individuals.

Marital Status Significantly Affects BMI

Figure 2. Percent change compared to married individuals.

Cholesterol Results

Cholesterol ratios suggest majority of the population are within healthy guidelines

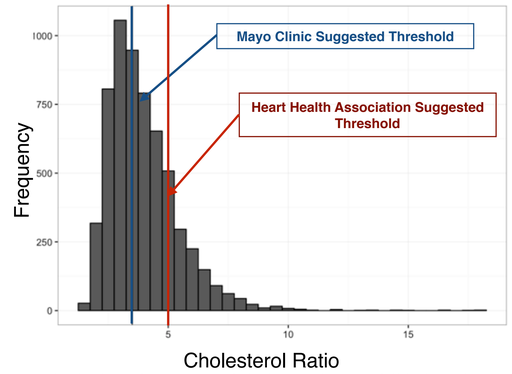

Figure 3. The highest frequency of cholesterol ratios fall below the Mayo Clinic[5] suggested guidelines, whereas the majority of all data falls below the Heart Health Association's[6] threshold.

Impact of biological and lifestyle factors on cholesterol

	Percent Change	P-Value
Lifestyle Factors		
Vigorous Work Activities	-1.04	≤0.001
Moderate Work Activities	-1.01	0.230
Vigorous Exercise	1.08	≤0.001
Moderate Exercise	1.01	0.400
Biological Factors		
Gender	-1.19	≤0.001
Age	-1.00	0.492
Body Mass Index	1.64	≤0.001

Table 2. Identification of lifestyle and biological factors associated with cholesterol ratios (percent change) identified by linear regression modeling and Analysis of Variance.

Marital status significantly affects cholesterol ratios

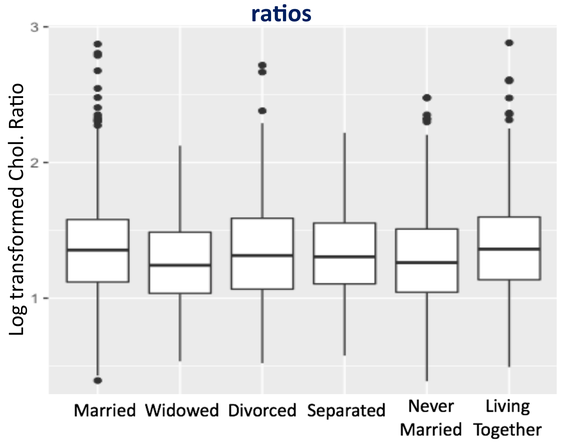

Figure 4. Percent change compared to married individuals.

Association between cholesterol ratio and BMI

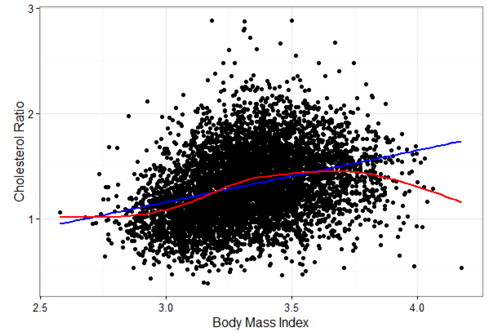

Figure 5. BMI and cholesterol ratios were log transformed to fit the assumption of normality. Local moving average line contradicts the linear model; an increase in BMI does not result in an increase in cholesterol ratio in the LOWESS line.

Conclusion

According to our research, while the average American individual appears to fall within an overweight subscale or what's otherwise considered as an "unhealthy" BMI, they also fall within the "healthy" range for cholesterol ratios (as compared to the Mayo Clinic guidelines). There is also a slight positive correlation between BMI and cholesterol ratios but cholesterol levels also start to taper off at higher levels of BMI suggesting that a higher BMI doesn't necessarily mean higher cholesterol. The results also suggest that individuals who participate in vigorous work activity and vigorous exercise fall under the "overweight" BMI category.

These results suggest that other co-factors may be associated with BMI categories including marital status and gender. Because of these co-factors and the possibility of many others such as income level, education status, access to healthy foods, or access to exercise facilities may be associated with BMI. Further research needs to be conducted to assess if BMI is in fact a good measure of health.

References

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