

# The Impact of Bariatric Surgery on Influenza Vaccination and Host Metabolism

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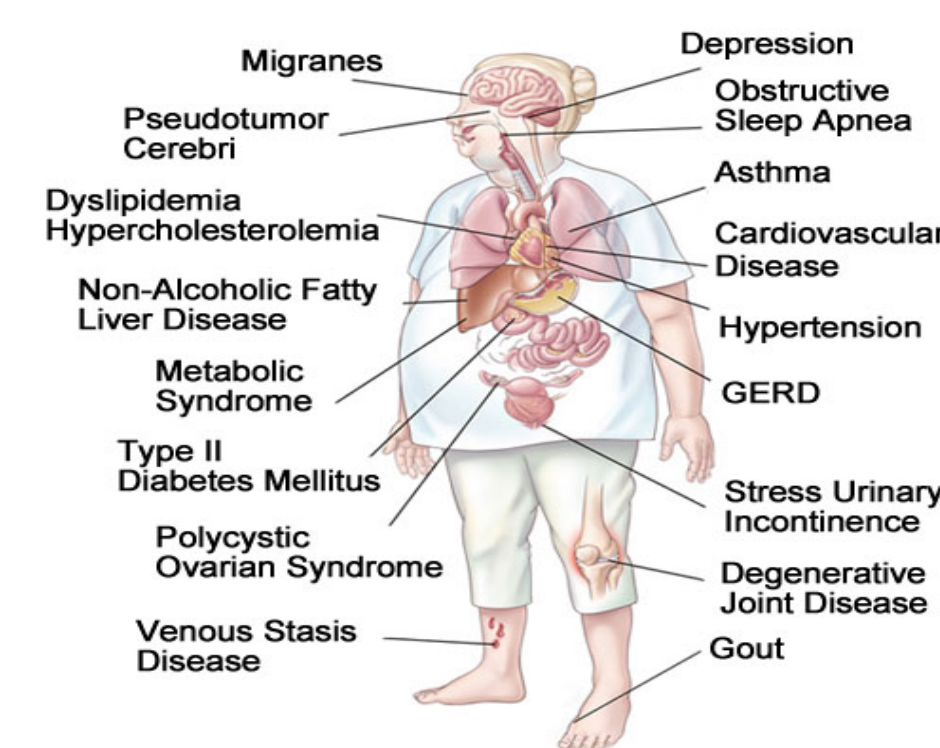
## ABSTRACT

Bariatric surgery is the most effective method for weight loss in obese individuals. This is significant because obesity is associated with several co-morbidities, many of which have metabolic dysfunction as an underlying cause. One major co-morbidity seen in obese individuals is a compromised response to the influenza vaccine. Therefore, we asked if weight loss could improve the vaccine response. In our study, we analyzed the impact of bariatric surgery on vaccine induced serum antibody levels and circulating nutrient and metabolic hormone/peptide levels. Our results indicated that bariatric surgery had no significant impact on vaccine induced serum antibody levels, and additionally, that vaccine induced serum antibody levels were not significantly different in obese individuals compared to healthy individuals. We further determined that bariatric surgery did indeed return certain metabolic factors to normalcy. Finally, we deduced that vaccine induced serum antibody levels had no significant relationship with the host metabolic profile. Taken together, our findings allow us to rule out altered serum antibody levels as the mechanism through which obesity compromises the host response to influenza vaccination. Additionally our findings highlight the remedial effect of bariatric surgery on host metabolism.

## BACKGROUND

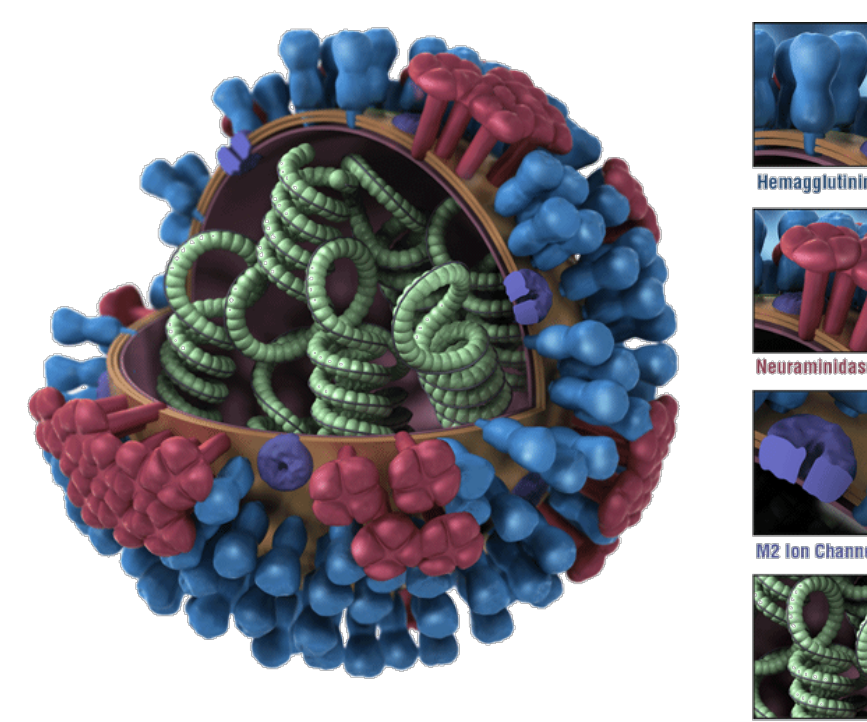
### What is Obesity?

- Obesity is characterized as a state of low grade chronic inflammation.
- It has many associated co-morbidities such as diabetes and elevated triglycerides
- Many of its associated co-morbidities are caused by underlying metabolic dysfunction.
  - Altered levels of circulating nutrients and metabolic hormones.



### An Increased Susceptibility to Influenza

- During the 2009 influenza pandemic, obesity was recognized as an independent risk factor for increased mortality due to infection.
- Evidence suggests that obese individuals do not respond to vaccination as effectively as healthy weight individuals.
- Despite vaccination, obese adults are twice as likely to develop influenza and influenza like symptoms compared to healthy weight adults.



### Bariatric Surgery and the Resolution of Obesity associated Co-morbidities

- The long term results yielded by traditional weight loss methods such as dieting, exercise, or medications are typically poor.
- Bariatric surgery is recognized as the most effective treatment for weight loss and the resolution of obesity associated co-morbidities.

## OBJECTIVES

We hypothesize that if obese individuals undergo bariatric surgery, their immune response to the influenza vaccine will become similar to the response seen in healthy individuals and the body will be returned to a state of metabolic normalcy.

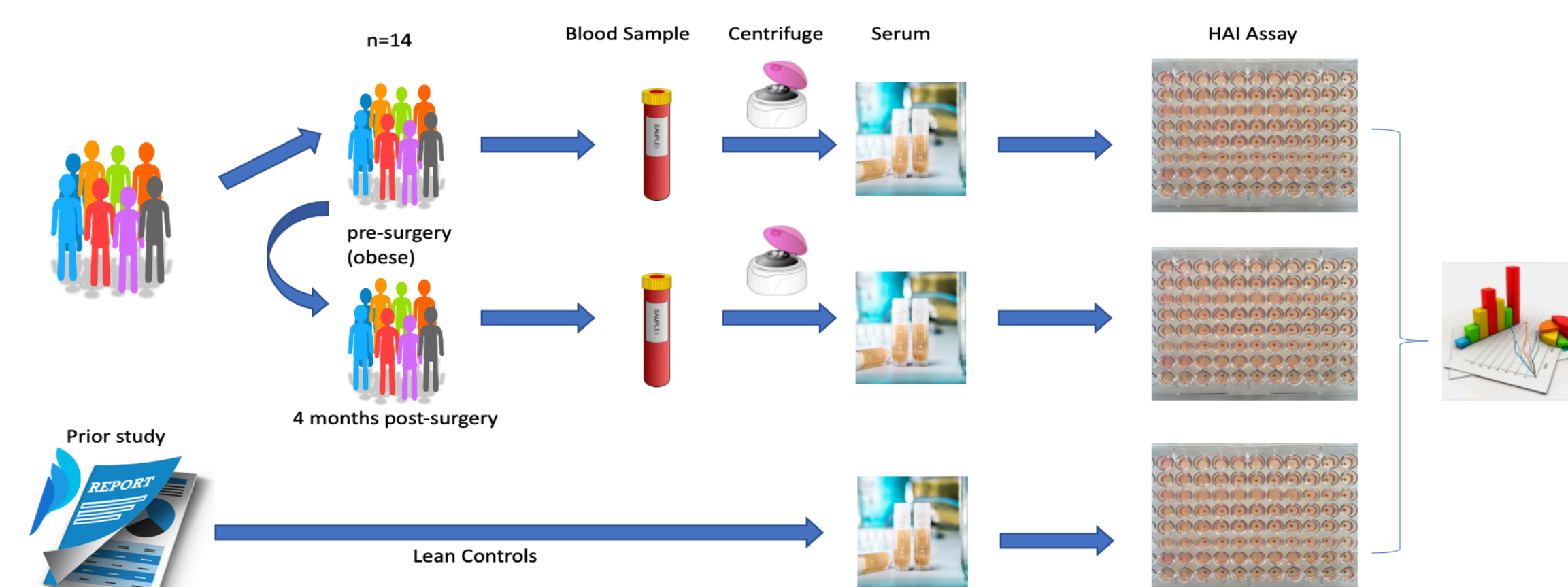
**Aim 1:** Determine the effect of bariatric surgery on vaccine induced serum antibody levels against influenza.

**Aim 2:** Determine effect of bariatric surgery on circulating nutrients and metabolic hormones/peptides.

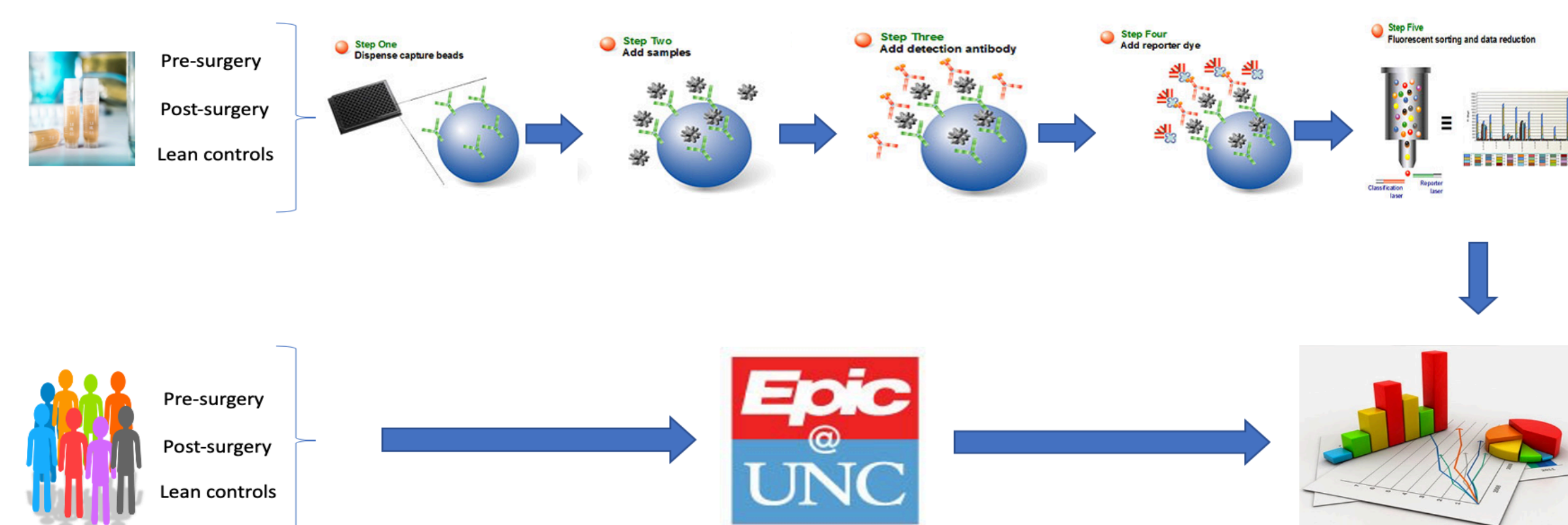
**Aim 3:** Identify if any significant correlations between antibody levels and nutrient/metabolic hormone levels exist.

## METHODS

- Measured vaccine induced serum antibody levels before and after surgery.



- Measured Circulating Nutrient and Metabolic Hormone/Peptide levels before and after surgery.



## RESULTS

Figure 1: Median Influenza A(H1N1) HAI titers for the pre-bariatric surgery, post bariatric surgery, and lean control participants. Pre and Post surgery titers were not statistically different from one another. Pre and Post surgery titers were each not statistically different from lean control participant titers.

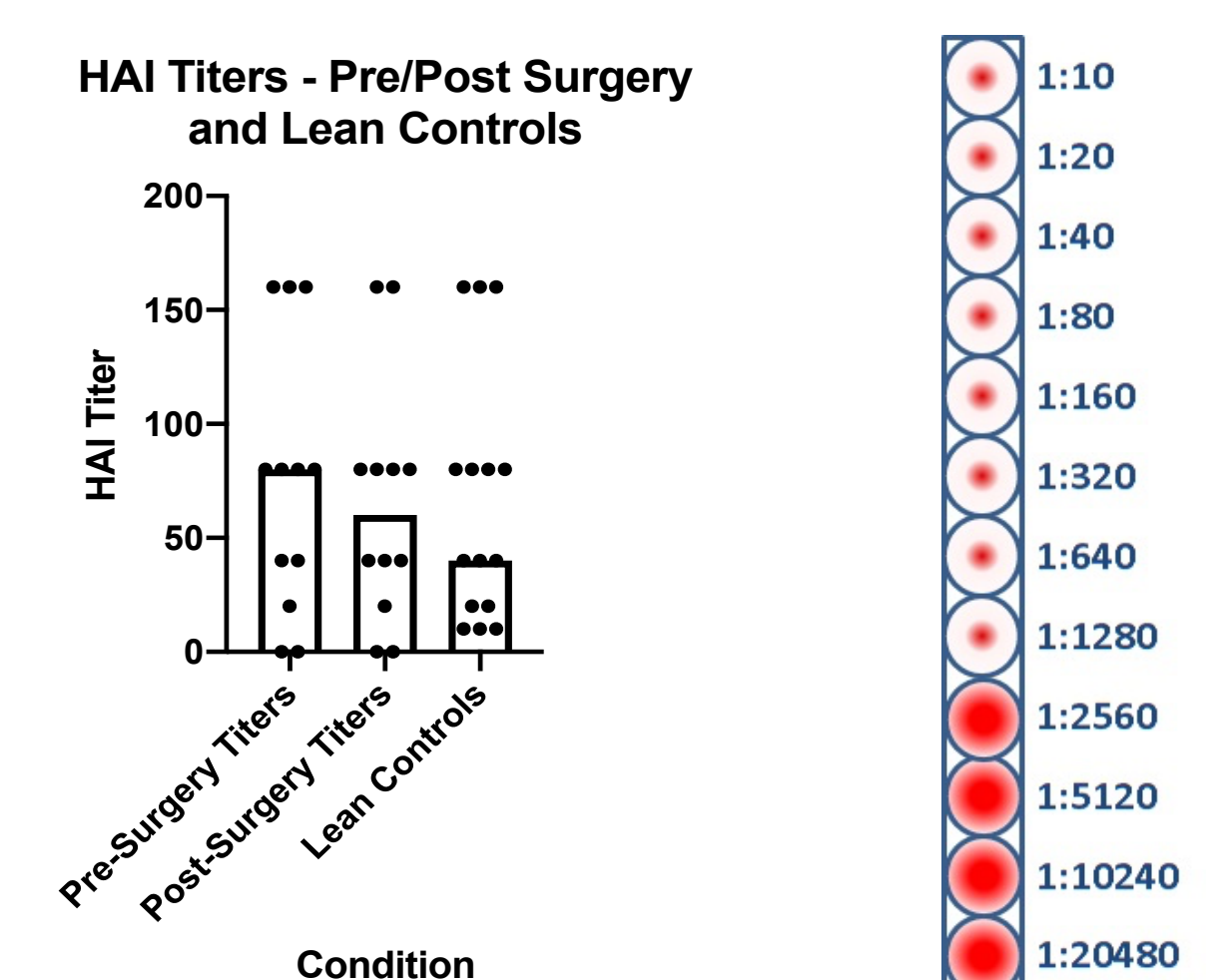


Figure 2: An example of how to read an HAI assay. The point at which agglutination (cloudy well) begins is the end point of titration. Based on the dilution of the serum initially put in the first well, we can determine the antibody titer of the original serum.

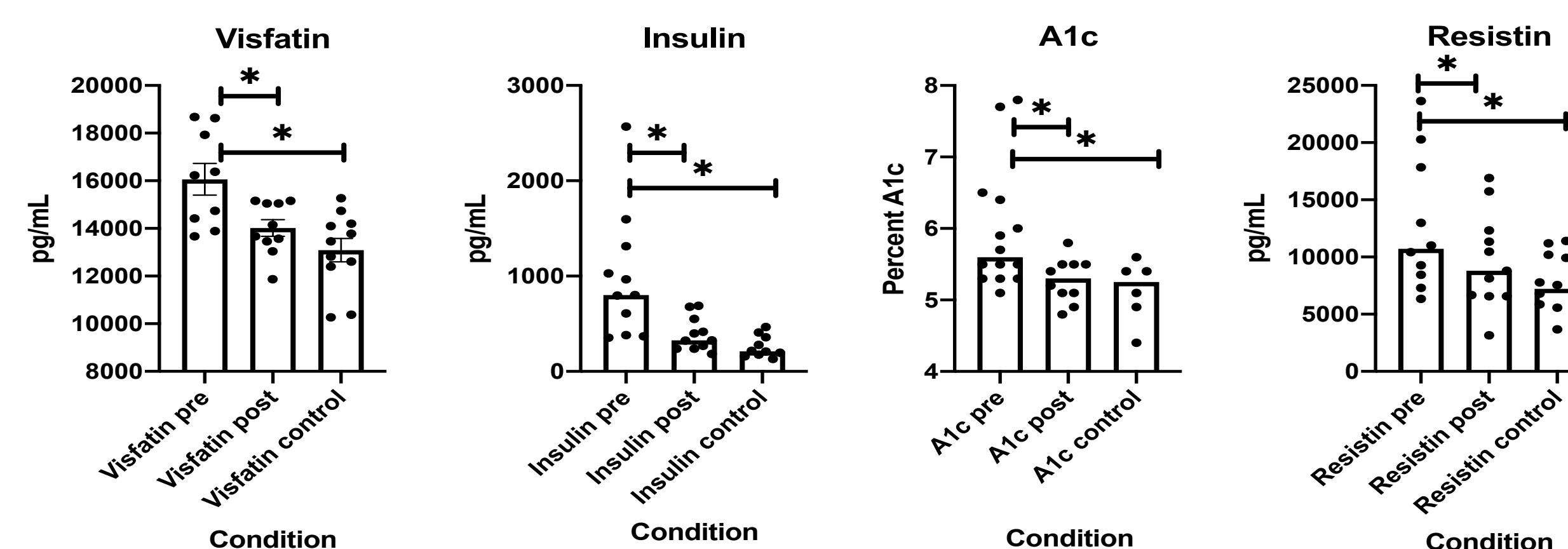


Figure 3: The four metabolic variables depicted by this figure each saw a return to normalcy after bariatric surgery. Data for each variable was statistically different pre vs. post-surgery. The pre-surgery data was shown to be statistically different from the control group. However, the post-surgery data for each variable was not statistically different from the control group. For visfatin, the mean with standard error is shown since the data for visfatin was normally distributed. The other three variables show the median levels since they did not display a Gaussian distribution.

## CONCLUSIONS

Our findings suggest that bariatric surgery does not have a significant impact on the body's production of antibodies against influenza. Furthermore, antibody titers of obese and lean individuals post vaccination were not significantly different. These findings would suggest that serum antibody levels induced by vaccination may not be an accurate measure of the body's ability to protect itself from the influenza virus in an obese population.

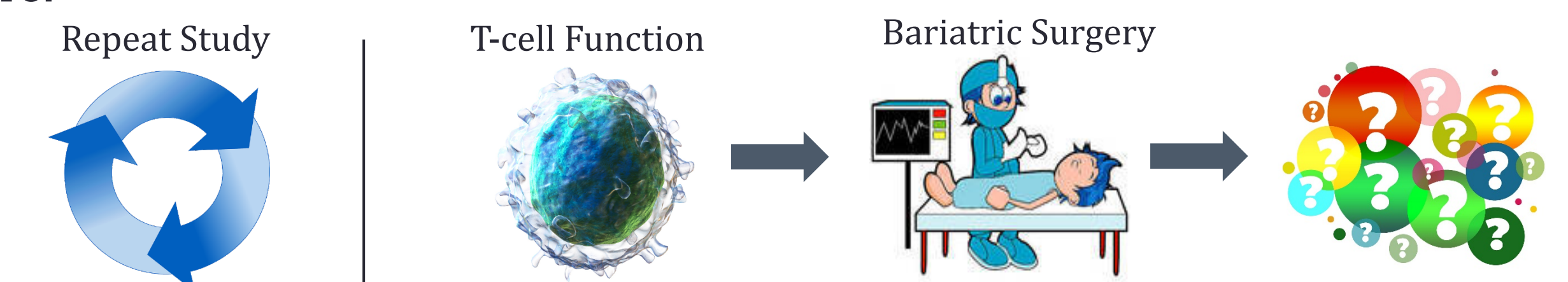
Our results also showed that obesity led to trends in circulating nutrient and metabolic hormone/peptide levels that indicate a shift toward normalcy. It can be said that 4 metabolic variables (see Figure 3) did return to a state of normalcy following surgery. The overall trend seen in the metabolic variables implies a remedial effect of bariatric surgery on the host metabolic profile.

Our study also evaluated the relationship between vaccine induced serum antibody levels and metabolic parameters in order to determine if the compromised response to the influenza vaccine seen in obese individuals could be linked to their altered metabolic profile. However, our findings indicated that no significant correlations were found between HAI titers and the nutrients or metabolic hormones/peptides measured.

## SUMMARY

- Serum antibody levels induced by vaccination may not be an accurate measure for influenza protection in an obese population.
- Bariatric surgery helped shift or return metabolic parameters to a state of normalcy.
- Serum antibody levels were not significantly correlated with any of the nutrients or metabolic hormones/proteins measured.

### Future:



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