

Identifying the Effects of a High-fat Diet on Atherosclerosis and MiR-21 in Female Mice

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Abstract

- This study aims to understand the effect of a high-fat diet on atherosclerosis in female mice and recognize its role in miR-21.
- TGF-beta, a cytokine, induces fibrosis through an increase in collagen accumulation and inflammation.
- The Smad pathways get activated, phosphorylating Smad2 and Smad3, allowing the transcription of genes like CTGF, fibronectin, and type 1 collagen.
- TGF-beta increases the expression of miR-21, further promoting fibrosis.
- In this experiment, 8-week-old mice were separated into two groups: wild-type and miR-21 KO.
- They were further split into groups that were fed high-fat diets which consisted of 0.2% total cholesterol and 42% kcal from fat.
- After 28 weeks and 36 weeks of age, the aorta, carotid, and mesenteric arteries were collected and analyzed using Masson's trichrome and Verhoeff Van Gieson staining to distinguish collagen from vascular smooth muscle.
- This allowed for the assessment of fibrosis, elastin degradation, and the role of miR-21.

Body Composition

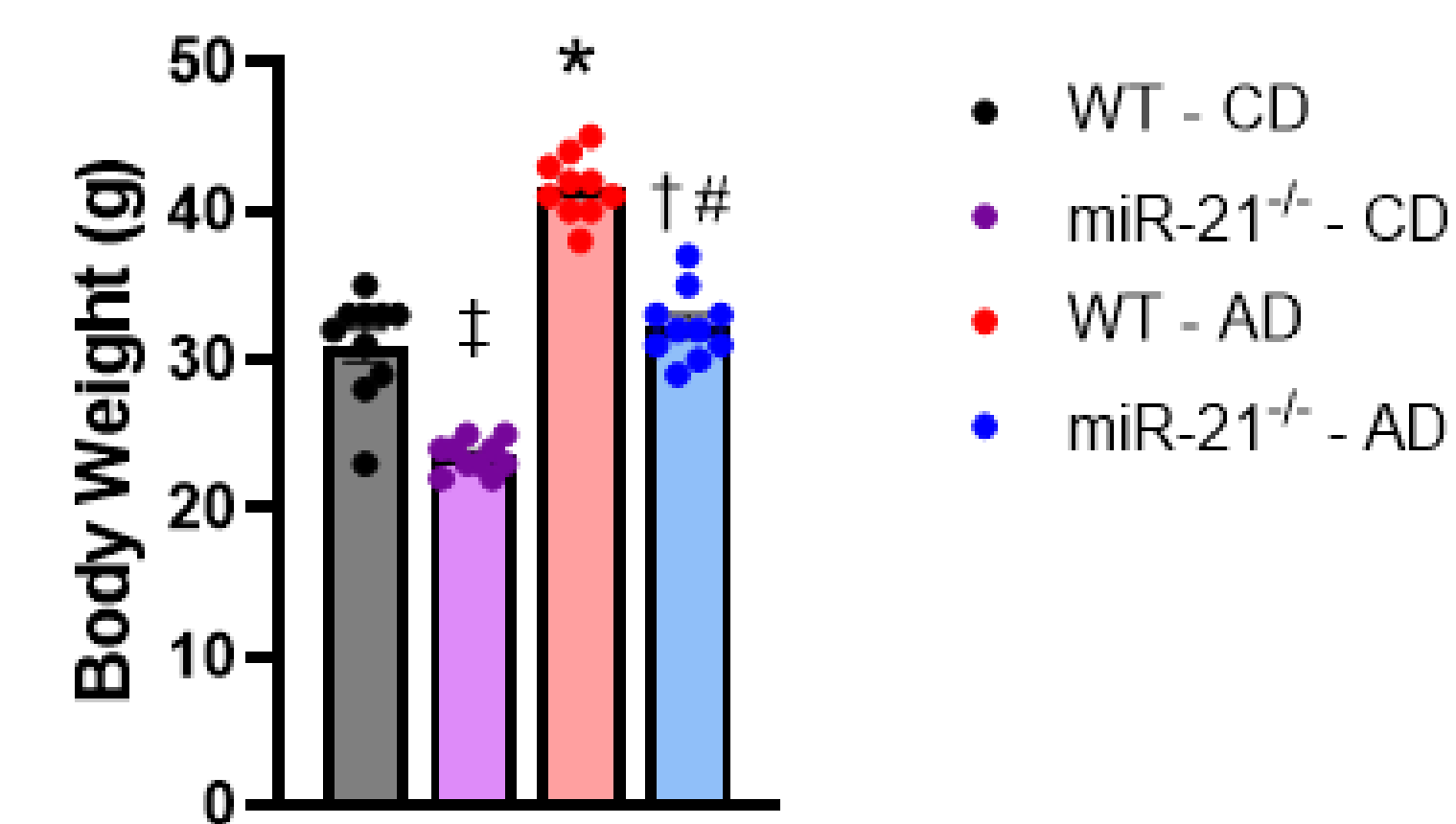


Figure 1. The statistics show that WT-AD is correlated with having a higher body weight. In contrast, WT- CD shows to have a lower body weight. In comparison to miR-21 KO, WT shows a higher body weight. The body weight is measured by a scale.

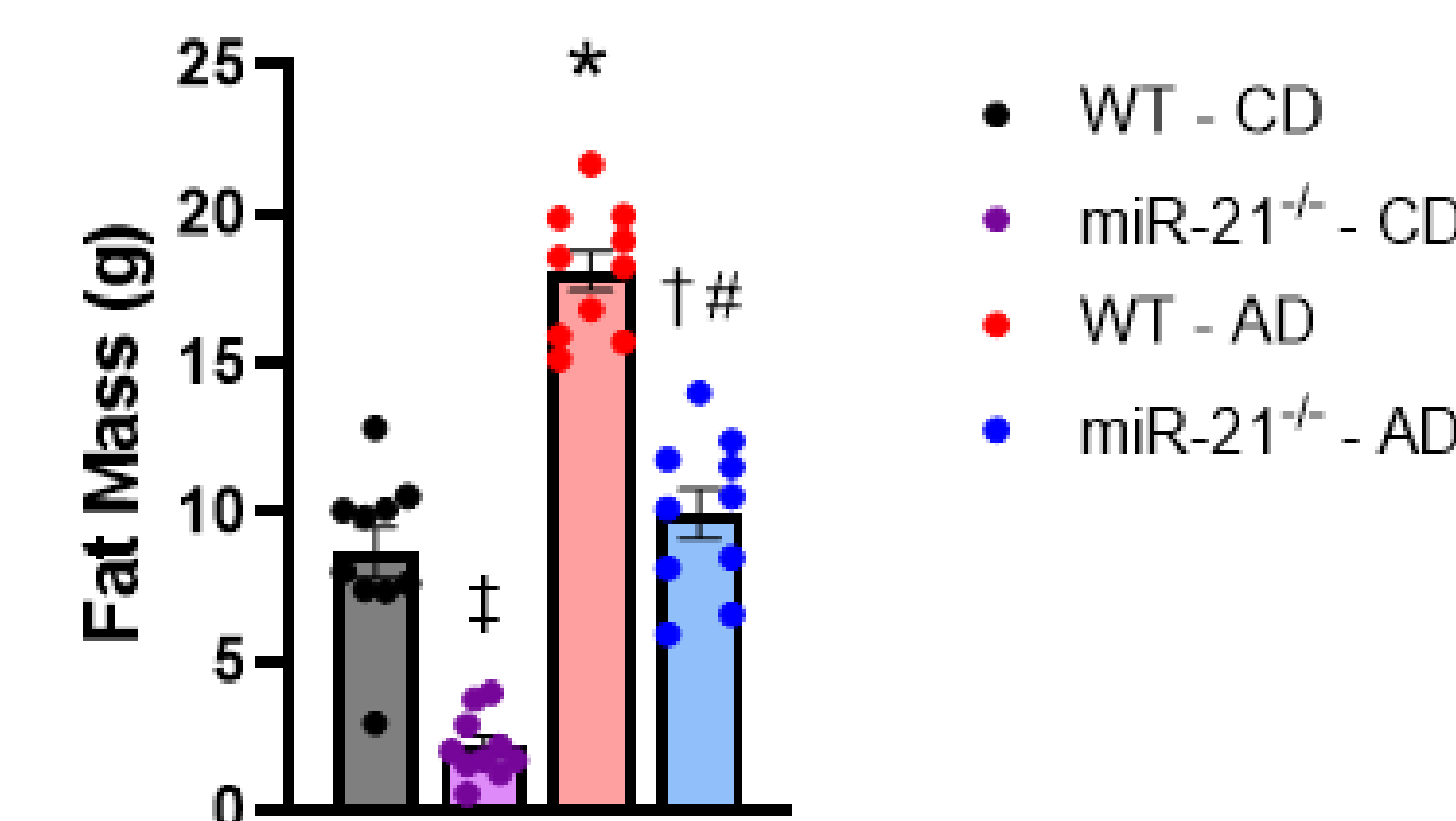


Figure 2. The statistics show that WT-AD is correlated with having the greatest amount of fat mass. Conversely, miR-21 KO with both a CD and AD show significantly lower fat. The fat mass is measured by an echo MRI machine.

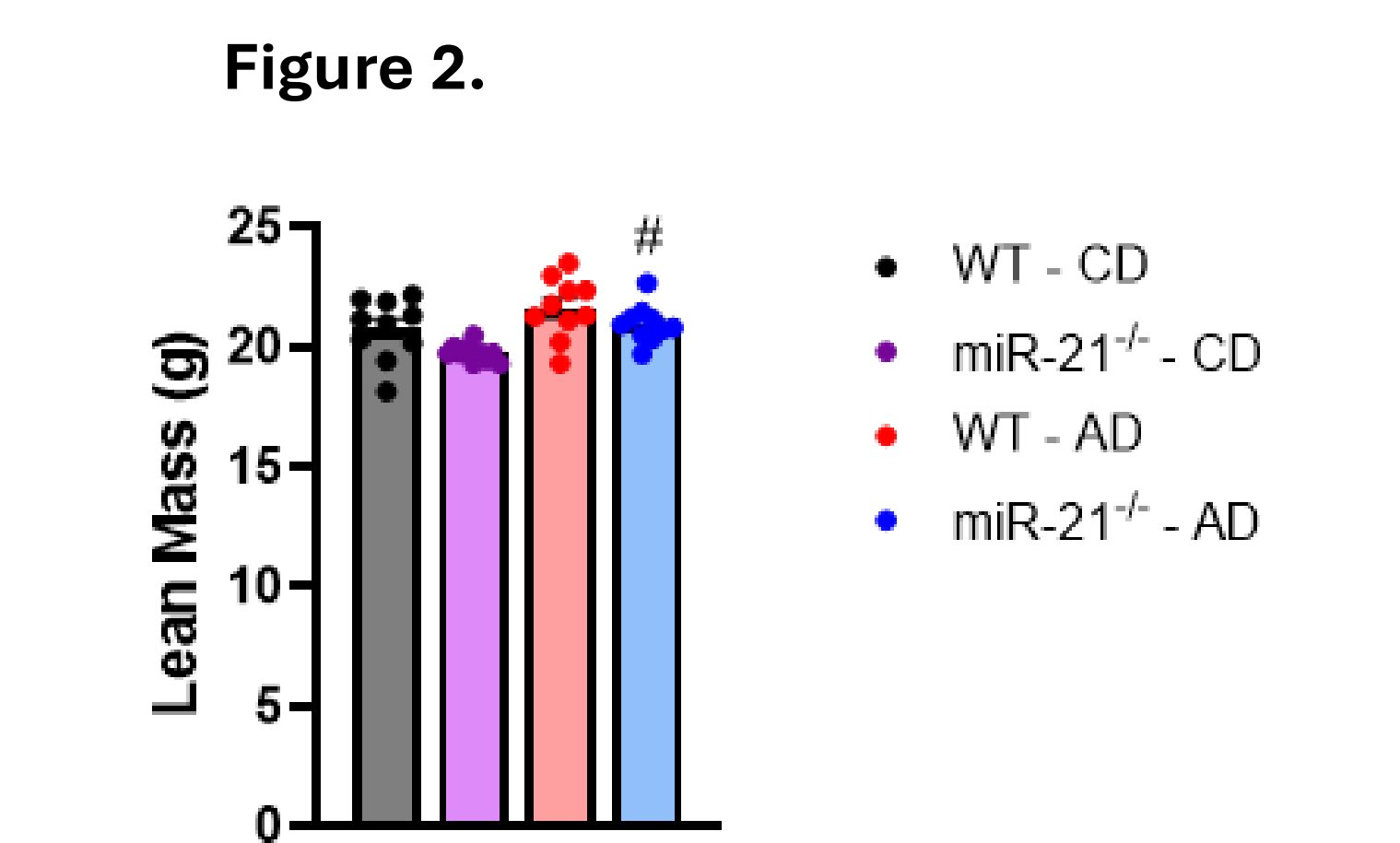


Figure 3. The statistics show that the lean mass stays fairly consistent between the CD and AD, along with the WT and miR-21 KO.

The * represents the WT-CD vs. the WT-AD. † represents WT-AD vs. miR-21 KO- AD. ‡ represents WT-CD vs miR-21 KO-CD. # represents miR-21 KO-CD vs. miR-21 KO-AD.

Results

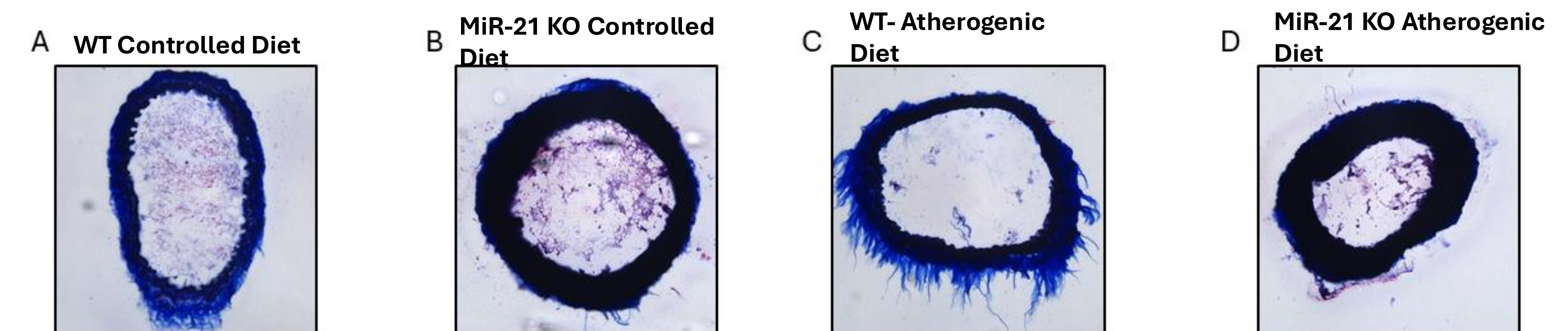


Figure 3: Carotid artery prepared using Masson's Trichrome staining. Collagen stained in blue and smooth muscle in pink. (Images taken at 10x)

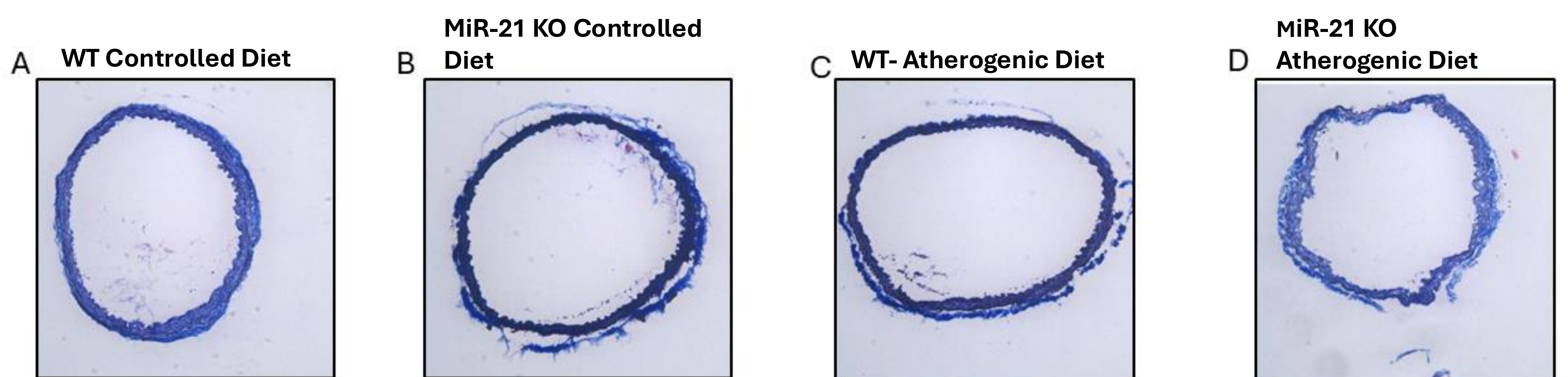


Figure 4: Aorta prepared using Masson's Trichrome staining. (Images taken at 20x)

Previous studies on Histology

- In Sprague-Dawley rats, a diet high in fat in females led to endothelial dysfunction in mesenteric arteries, which caused the arteries to lose elasticity and develop fibrosis (Zimmerman et al., 2021)
- It was found that 5-month-old male mice, who were fed a WD had an increased incremental stiffness compared to carotid arteries from mice fed control chow (Foote et al., 2016).
- Another study determining fibrosis in the aorta, conducted over the course of 16 weeks and had mice being fed a WD found increased PWVs. PWV is a measurement of arterial stiffness, so an increase in PWV in the aorta indicates an increase in fibrosis and degradation of elastin (Bender et al., 2015).

References

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Methods

