

Protein Oxidation and Pet Food

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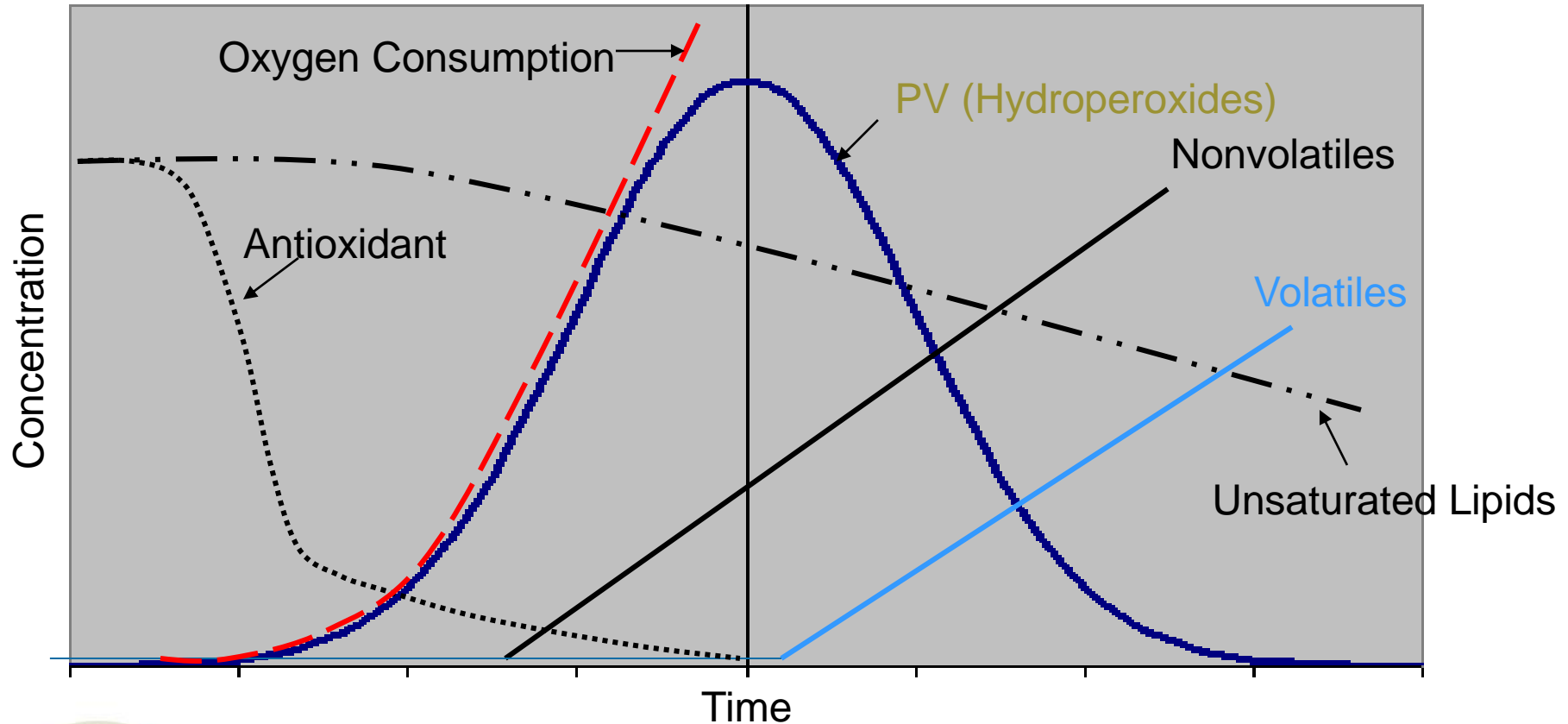


Introduction

- Lipid oxidation focus for number of years
- Recent research shows interaction between protein and lipid oxidation
- Research done in meat samples, not pet food



Lipid Oxidation



Lubuza, T. P. 1971. Kinetics of Lipid Oxidation in Foods
CRC Crit. Rev. Food Technol. 2: 355-405.

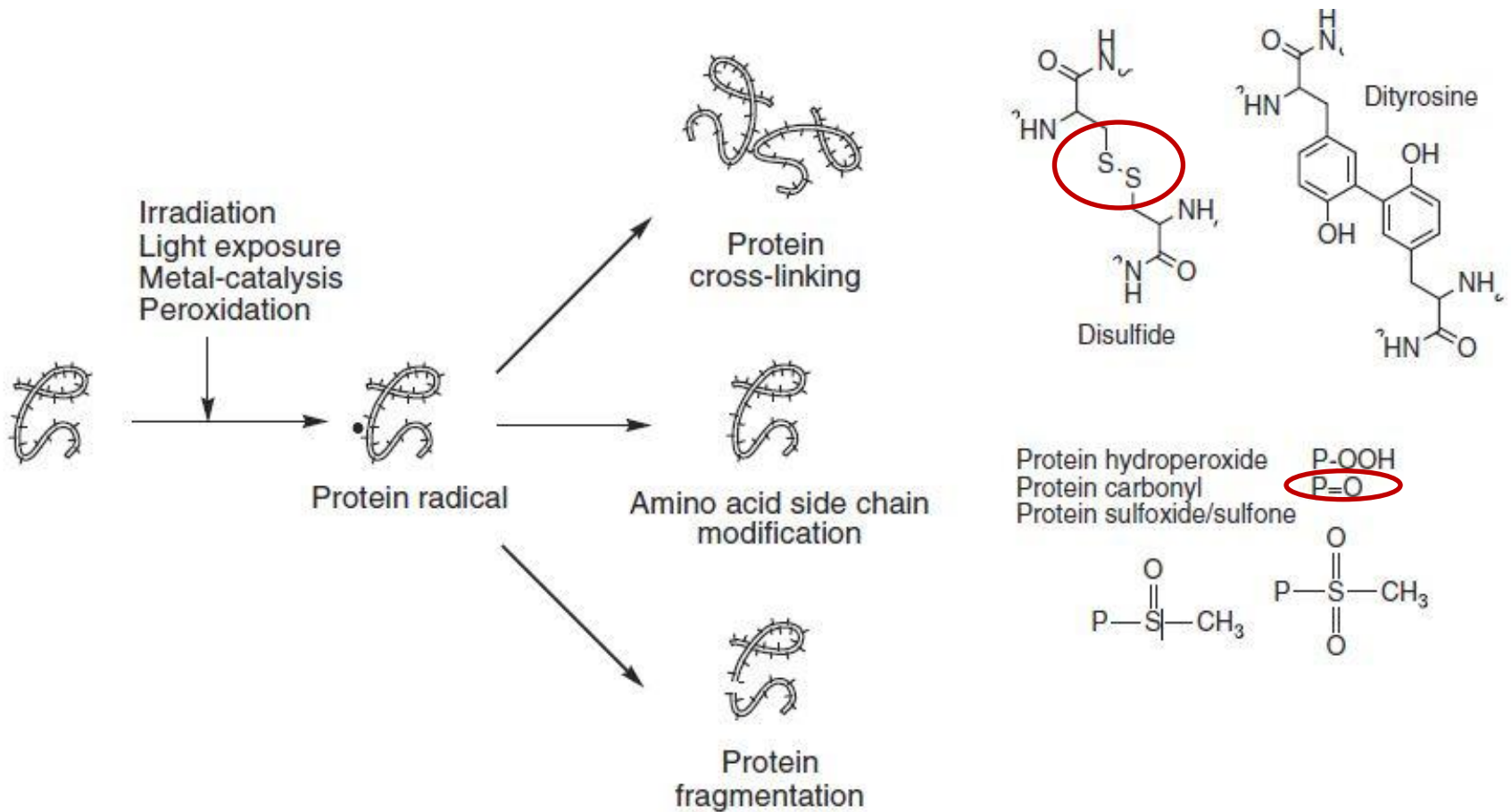


Pet Food and Protein

- Grain free, high protein diets popular
 - Fresh meat or rendered meals as protein source
- If protein oxidized, nutritional value decreases
- Cats are obligate carnivores, have amino acid requirements



Protein Oxidation



Lund, et.al., Protein Oxidation in Muscle Foods: A Review. Mol. Nutr. Food Res. 2011, 55, 83-95.



Research Goals

- Presence and extent of protein oxidation in pet food and pet food raw materials
- Antioxidant efficacy at preventing lipid as well as protein oxidation
- Determine if prior protein oxidation in a raw material translates to protein oxidation in kibble



Methods

- **Lipid Oxidation**

- Peroxide Values (Fox II)

- Fe^{2+} + hydroperoxide + xylenol orange \rightarrow Fe^{3+} xylenol orange complex (UV 560 nm)

- **Protein Oxidation**

- Carbonyl values (Levine et. al, 1990)

- 2,4 Dinitrophenylhydrazine- acid derivatization with extracted protein, TCA precipitation (360nm)

- Thiols 5,5' dithiobis-2-nitrobenzoic acid (Ellman, 1959)

- Ellman's reagent- protein extracted and DTNB added, (410nm)

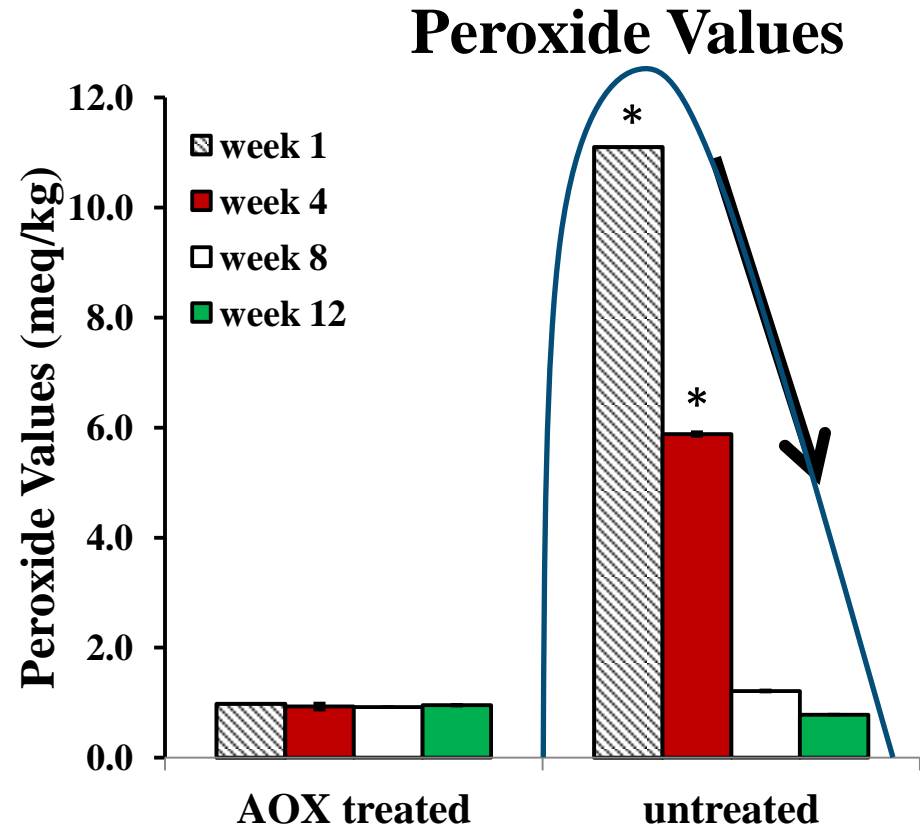
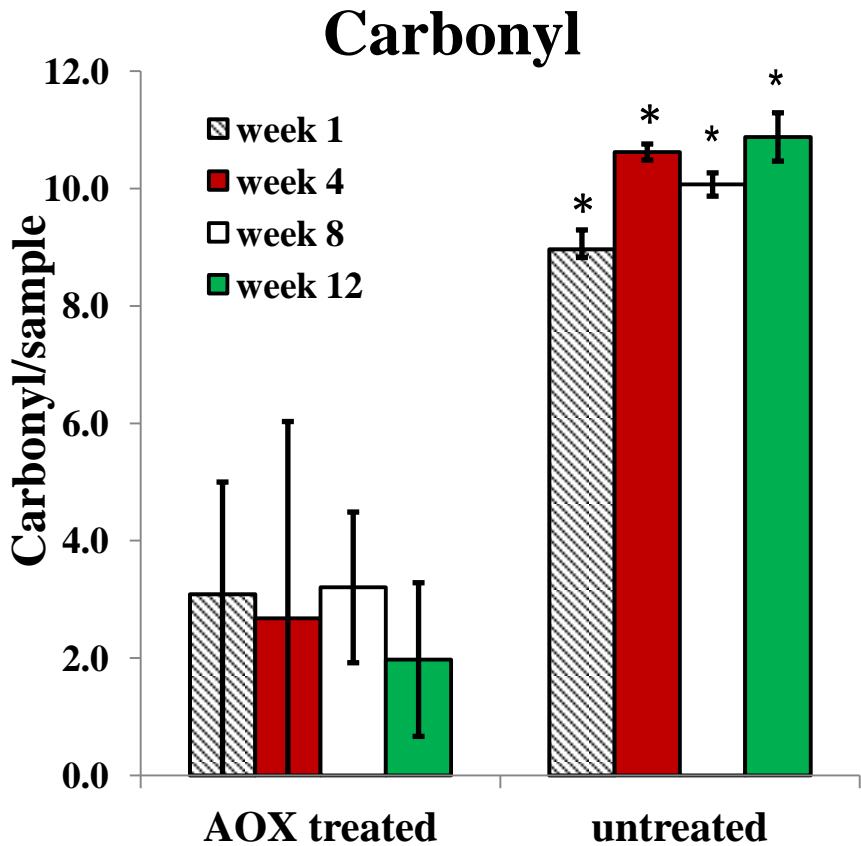


Study 1 Design- Dog Kibble

- Chicken by product meal treated with Naturox™ TX (1200 ppm) or untreated
- Meals then extruded into chicken/corn kibble (30% meal)
- Kibble cores then left uncoated, coated with canola oil, or chicken fat (6% fat/oil coating)
- All samples were stored at 37°C for 12 weeks



Chicken By Product Meal Results

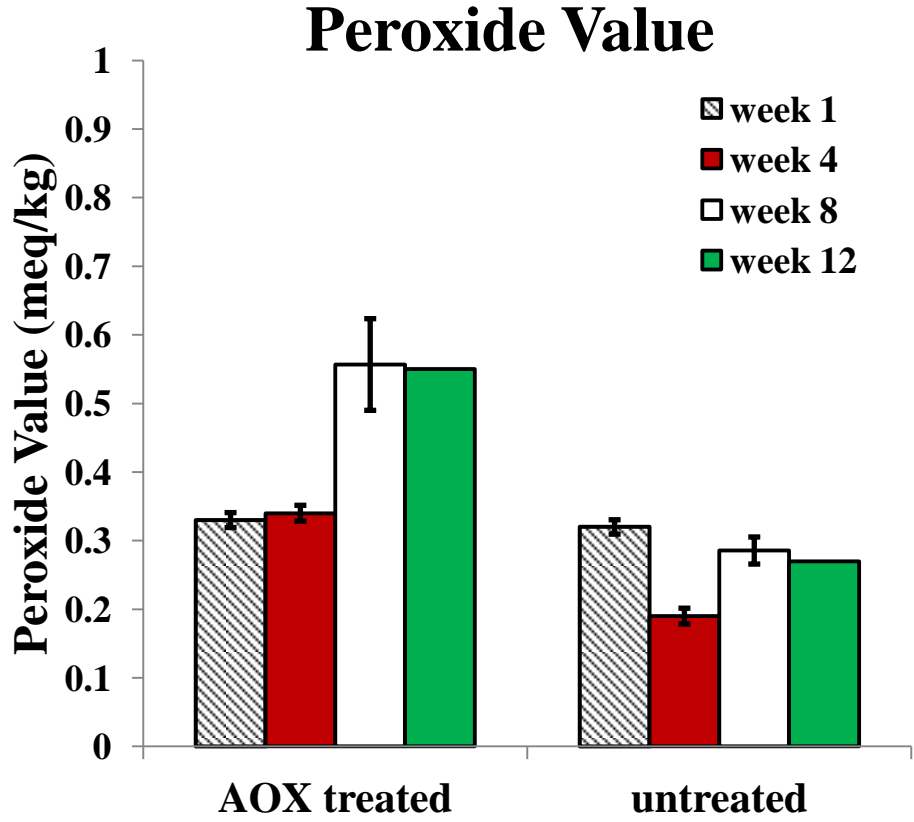
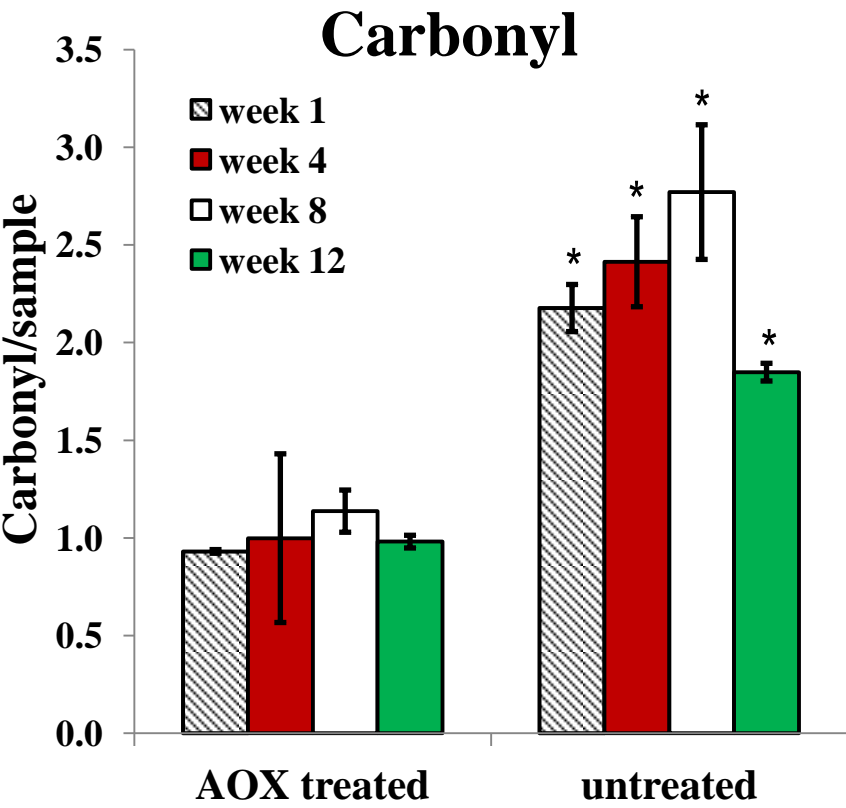


* P<0.05 N=3

AOX= Antioxidant Product



Uncoated Kibble Cores Results

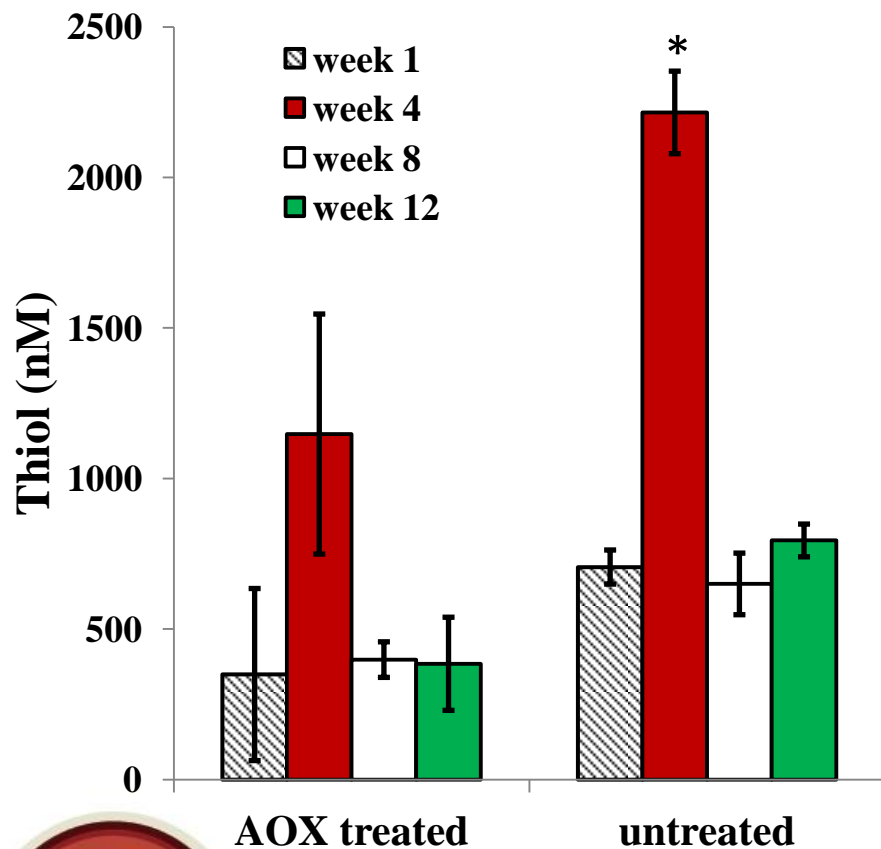


* P<0.05 N=3

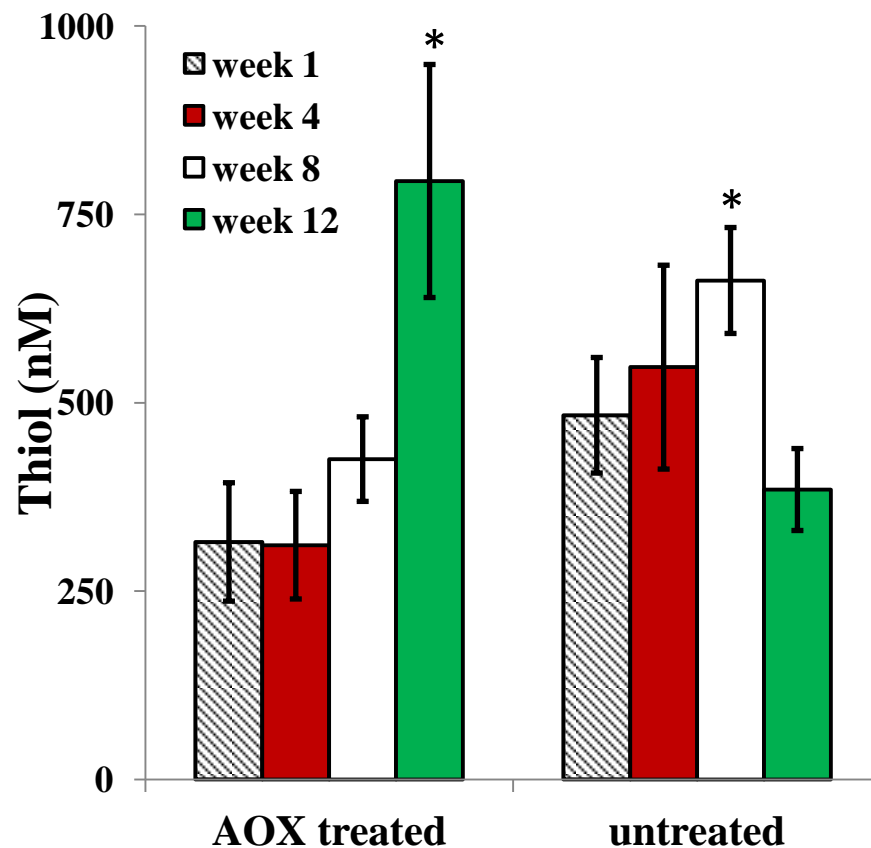


Thiol Results

Meals



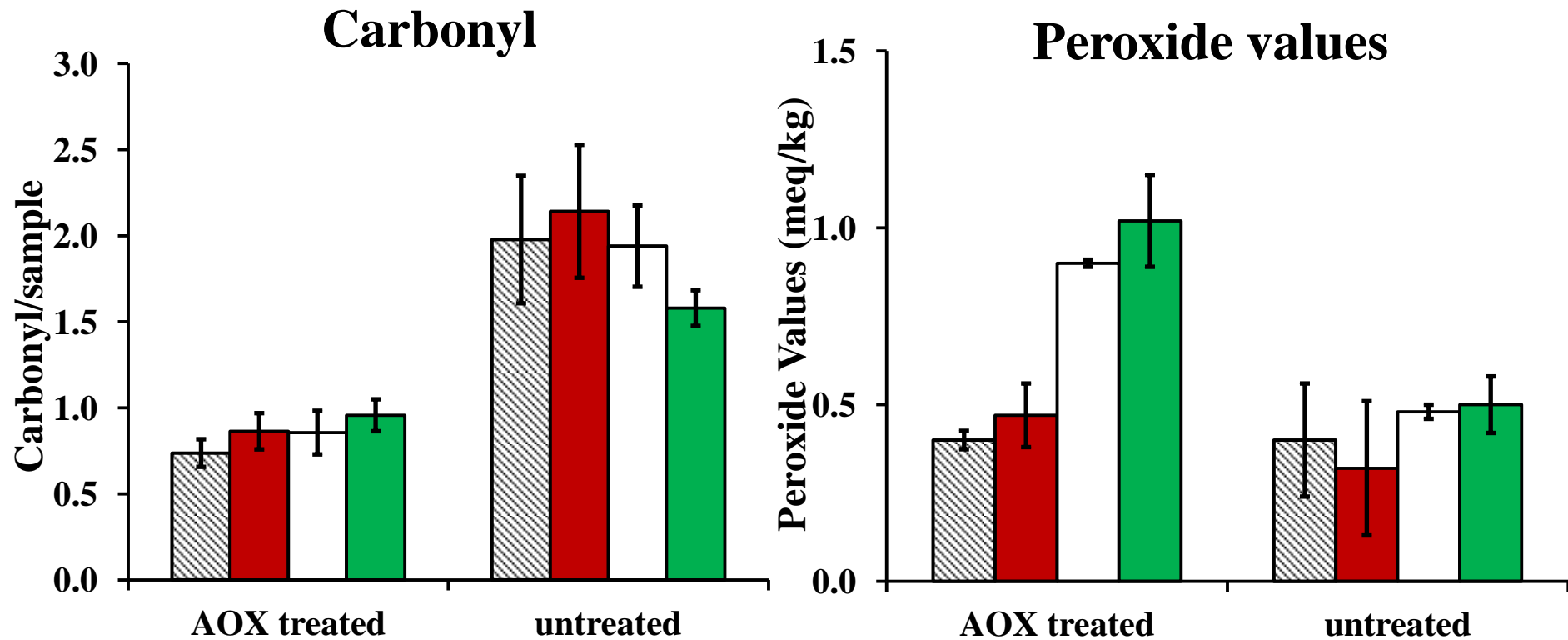
Uncoated Kibble



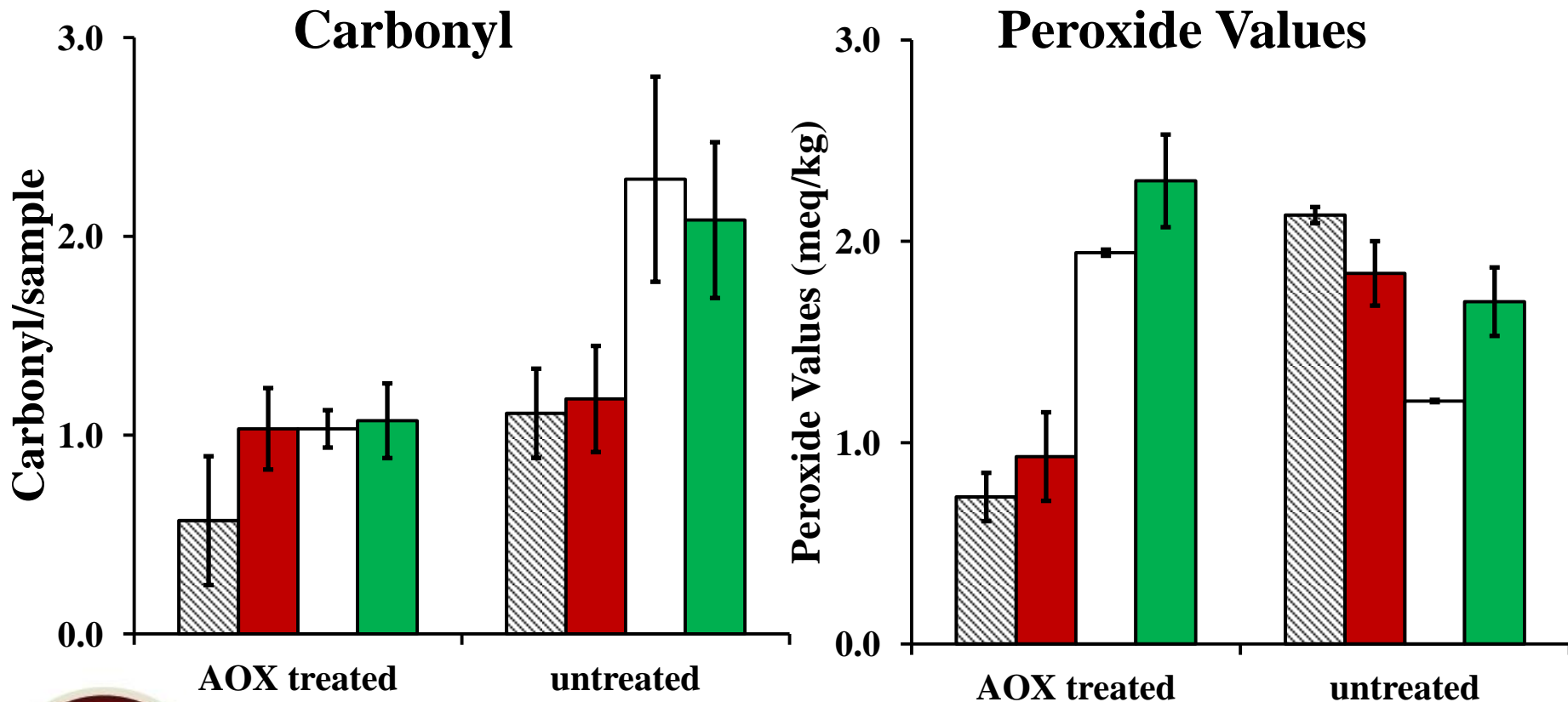
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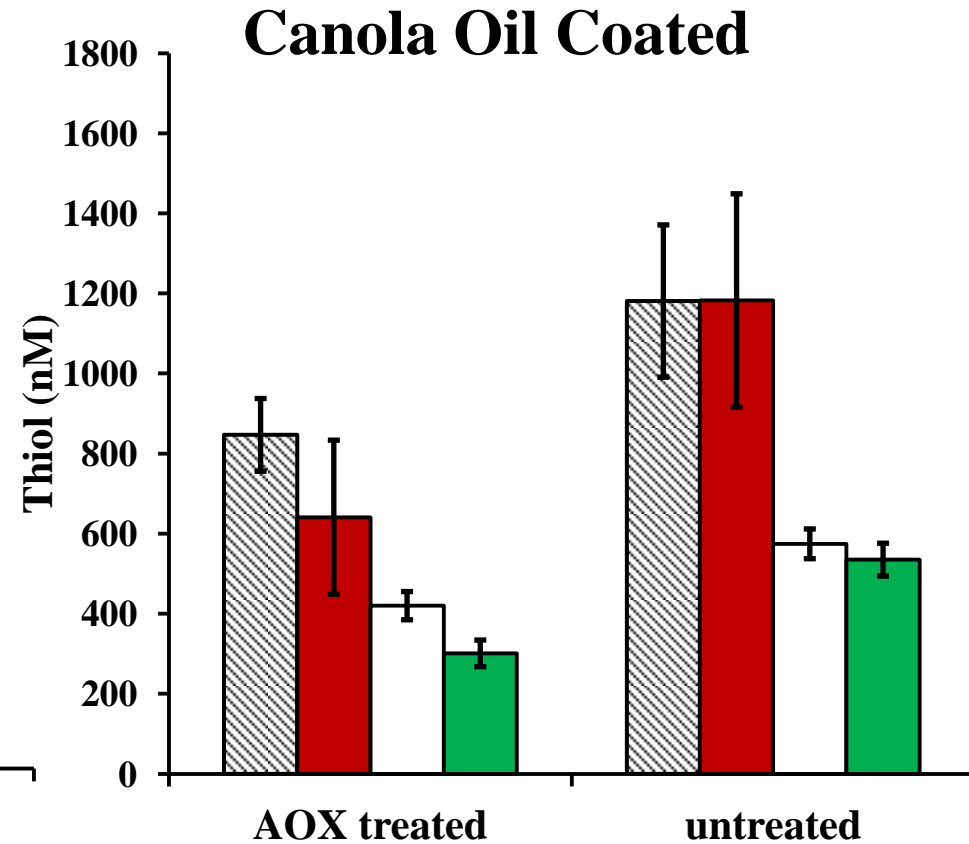
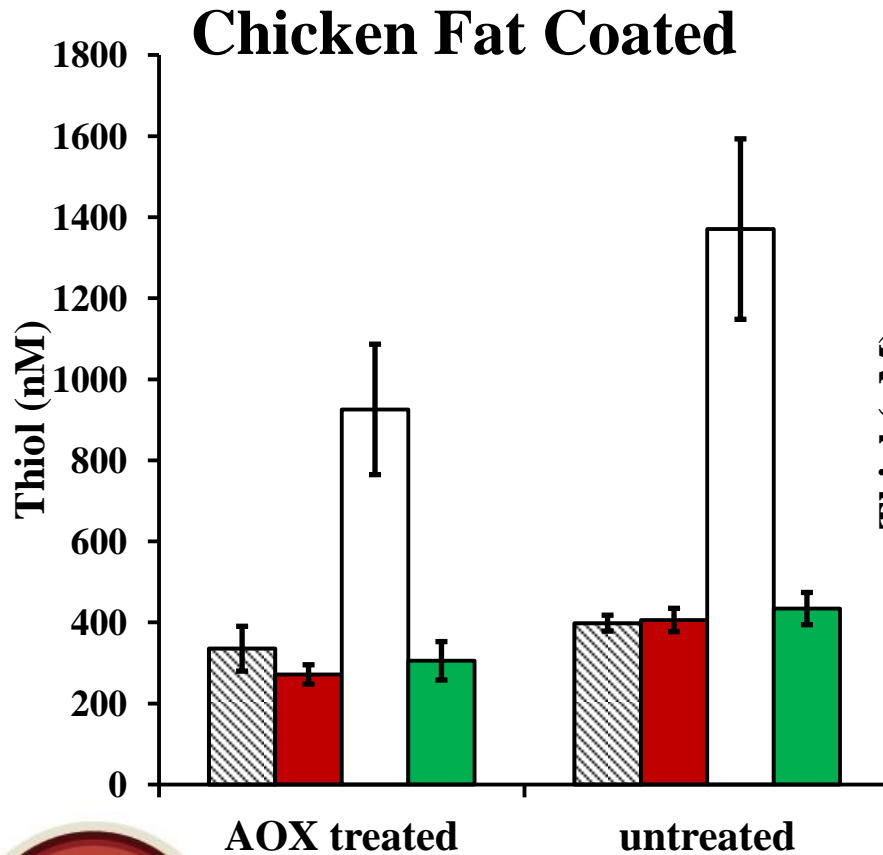
Chicken Fat Coated Kibbles



Canola Oil Coated Kibbles



Thiols



Summary Dog Kibbles

- Meal without Antioxidant Treatment has high levels of carbonyls, PV's and loss of thiols
- When meal is used in kibble, protein oxidation carries over
- Thiols increase then decrease indicating disulfide degradation
- Canola oil coated kibbles oxidize faster and carbonyl increased when fat oxidizes

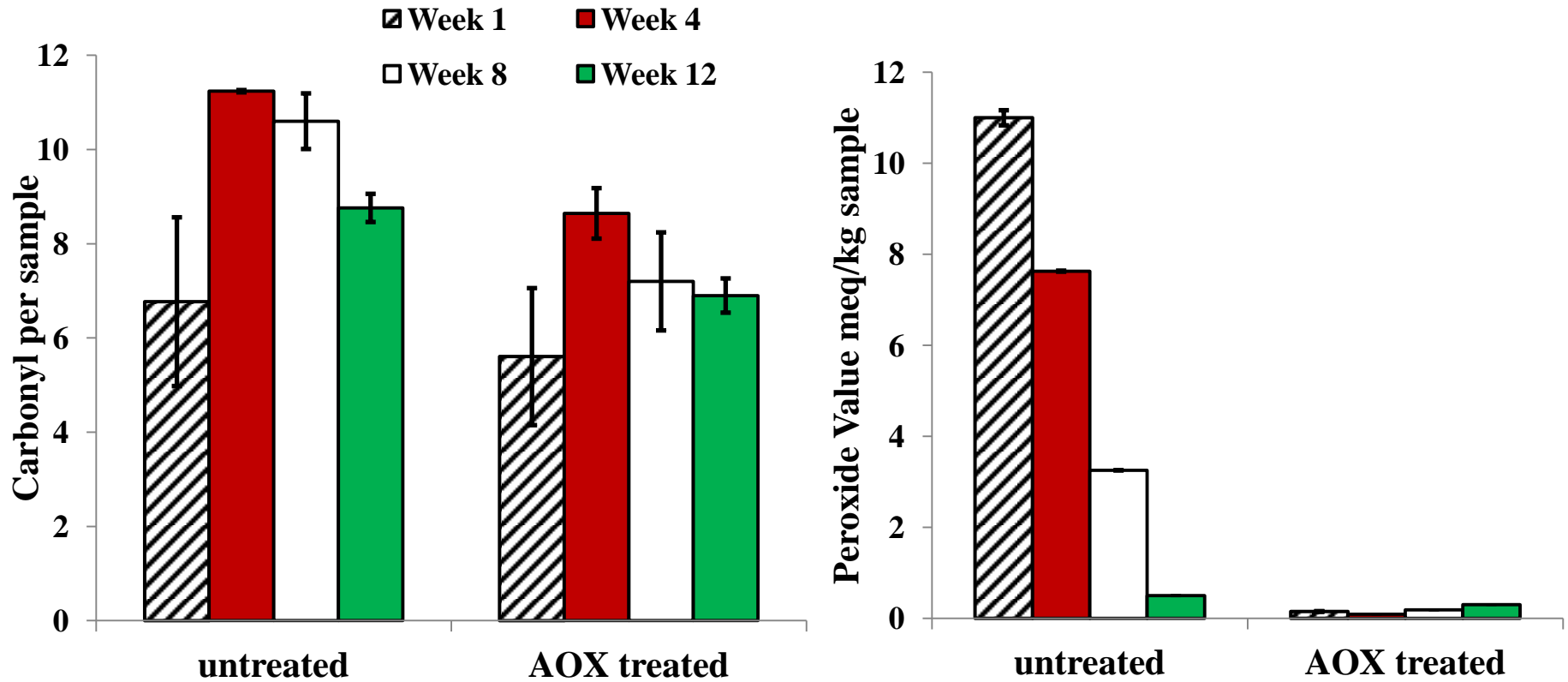


Cat Kibble

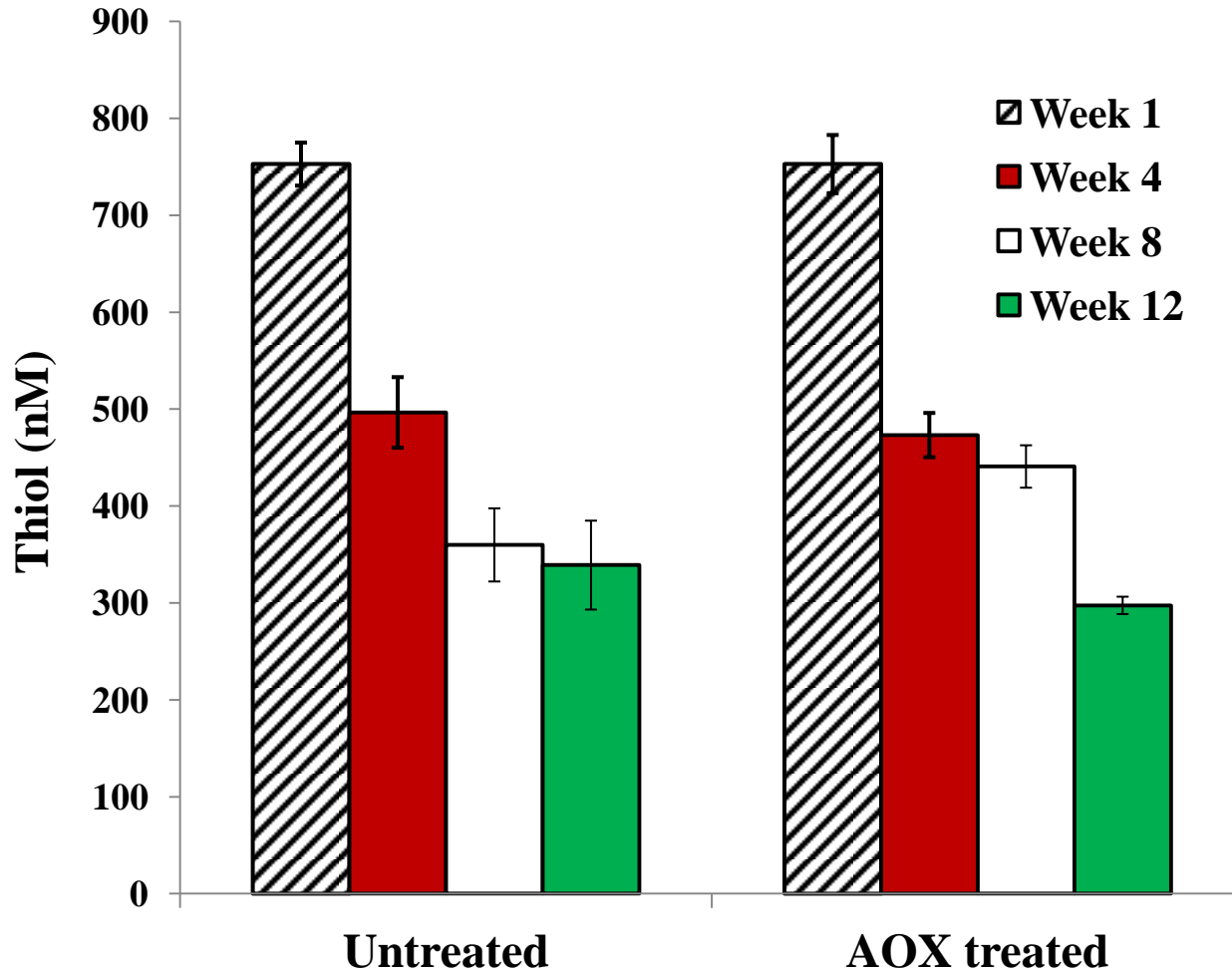
- Cat kibbles were formulated with the same recipe as previous dog study
- Initial differences in raw material not as large this time



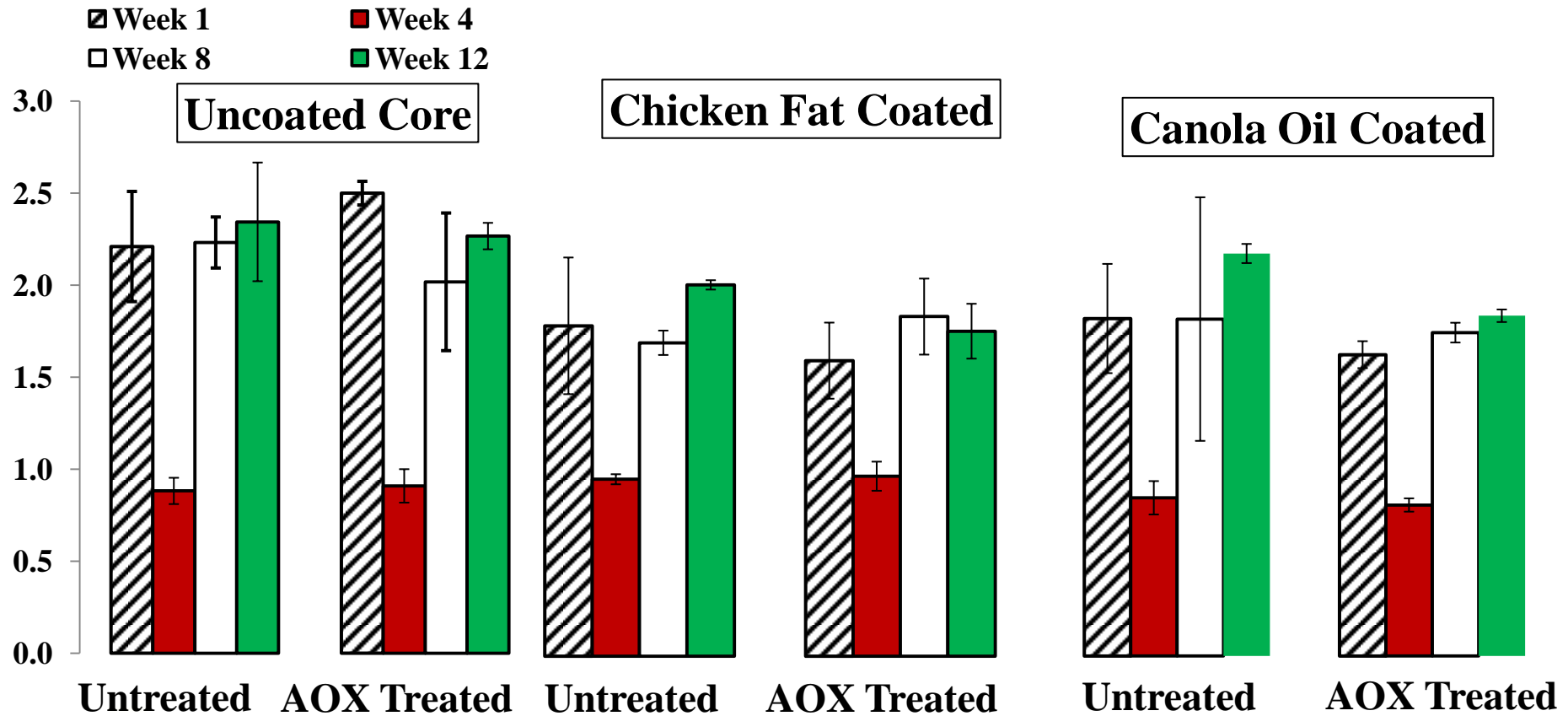
Carbonyl and PV Chicken By Product Meal



Thiol Chicken By Product Meal

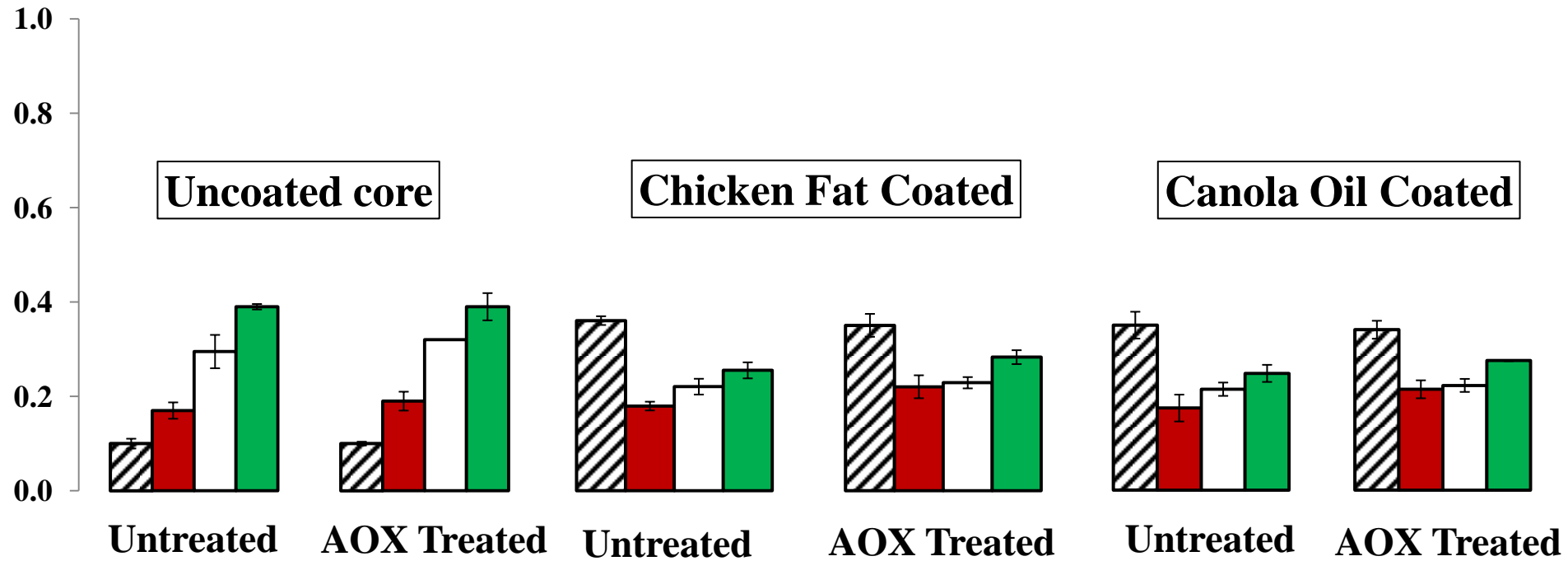


Carbonyl in Kibbles

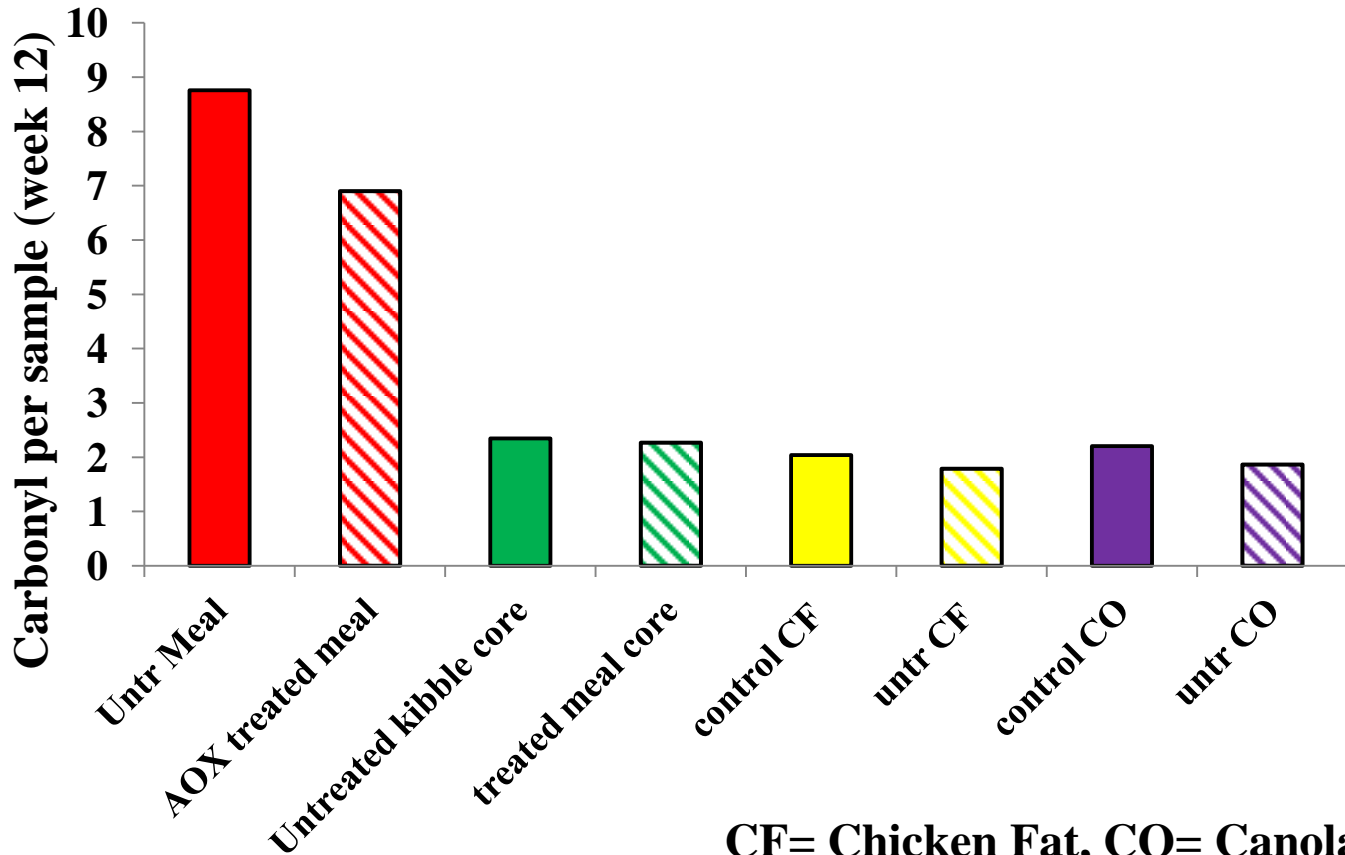


PV in Kibbles

week 1
 week 4
 week 8
 week 12



Cat Raw Materials and Kibble Carbonyl

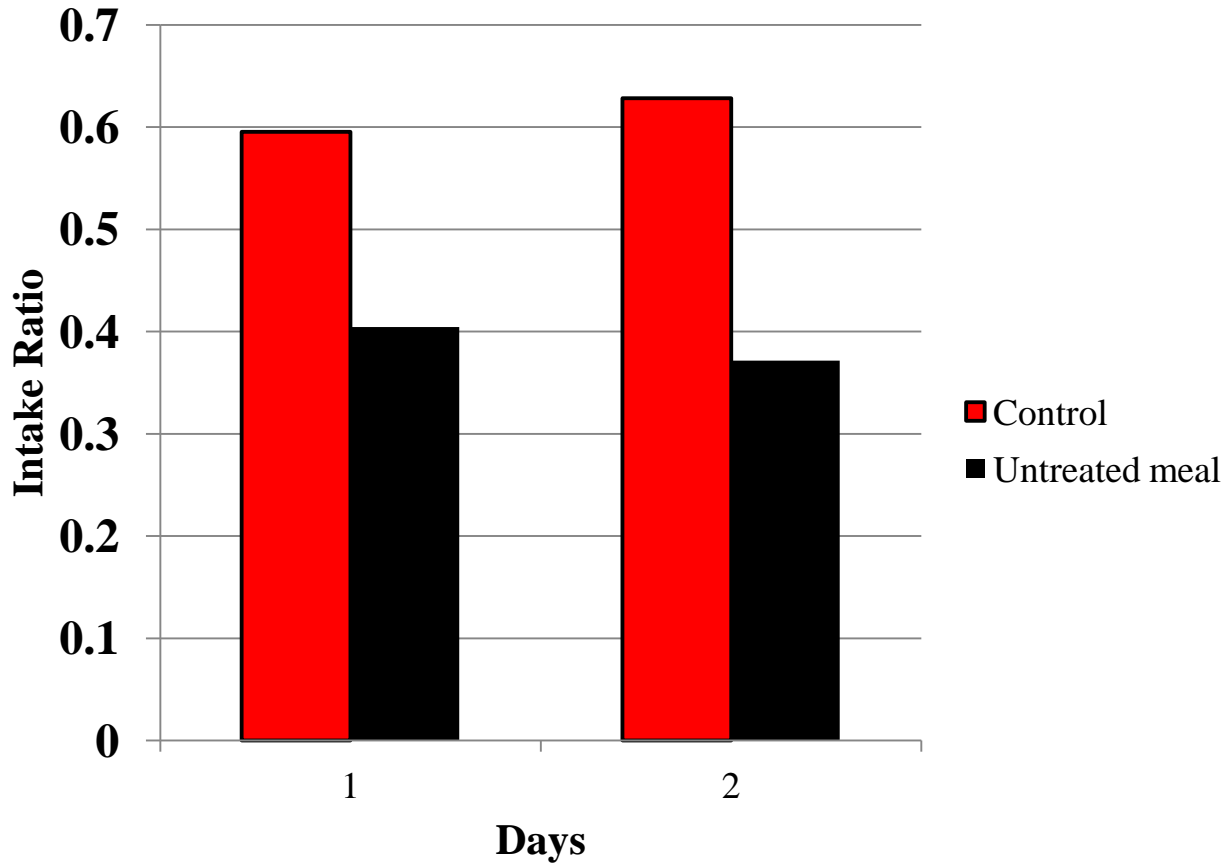


Summary Cat Kibbles

- Meals were different in PV but kibbles were not as different as dog kibble
- Cat kibbles did not oxidize as rapidly as dog kibbles
- But cats could tell the difference?



Cat Palatability Results



Average Intake ratio
61% Control, 39% Untreated meal



Cat Palatability

- Cats may be able to tell the difference in oxidized meal inclusion even though the PV of the kibbles was not different
- Cat Food for thought



Overall Observations

- Methods used to evaluate protein oxidation in meat can also be used for pet food kibble
- If raw material is not handled properly, not just the lipids are compromised
- Oxidation products from protein and lipid interact



Acknowledgments

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