Proteins in modern pet foods: nutrient quality, processing and shelf-life considerations.

Greg Aldrich and Collaborators

K-State Pet Food Experience

September 14, 2016

KANSAS STATE UNIVERSITY | Department of Grain Science and Industry

Outline

- K-State Pet Food Program
- Introduction
  - The Pet Food Market
  - Pet Food Trends
- “Proteins” in Pet Foods
  - Functionality (gelatin)
  - Processing (amino acids)
  - Quality (oxidation)
- Summary and Implications

Pet Food & Nutrition Science

- Established KSU 2011
- Grain Science & Industry
  - Feed Science & Mgt
- Training: Short courses, Minor, BS, MS, PhD
- The impact producing safe pet food has on nutrient composition and shelf-life


LOVE 2 LIFT
DAVIS
AERO

Pets and Pet Food

- US – $60 B pet supplies, $ 24 B Pet Food
  - Estimated 8.5 MMT - $1 billion export
  - Dogs and cats – 164 million (APPA, 2015)
  - 150 million more including the birds, fish, horses, rodents
  - Pets live in 65% of homes
- Global Pet Food – $ 56 billion – 4% growth (Packaged Facts, 2011)
- Pet food manufacturing jobs – 22,420 (US; BLS March 2014) 50,000 (FEDIAF, 2010)

Pet Food Trends/Market Pressures

- Increased offerings of **high protein low carbohydrate** "no-grain" diets
- Growth in **minimally processed**, fresh, refrigerated-frozen, & raw diets
- Increasing number of "**limited ingredient**" and "**novel ingredient**" diets
- Expanding **"NO" list** (no corn, wheat, soy, beef, byproducts, beet pulp, menadione, etc.)
- Increased drive for **natural/non-synthetic**, domestic (non-China), and **species specific ingredients**
- Demand by retailers and distributors for **longer shelf-life**
- **Fragmentation** - life-stage, breed, (in)activity targeted, and special purpose foods

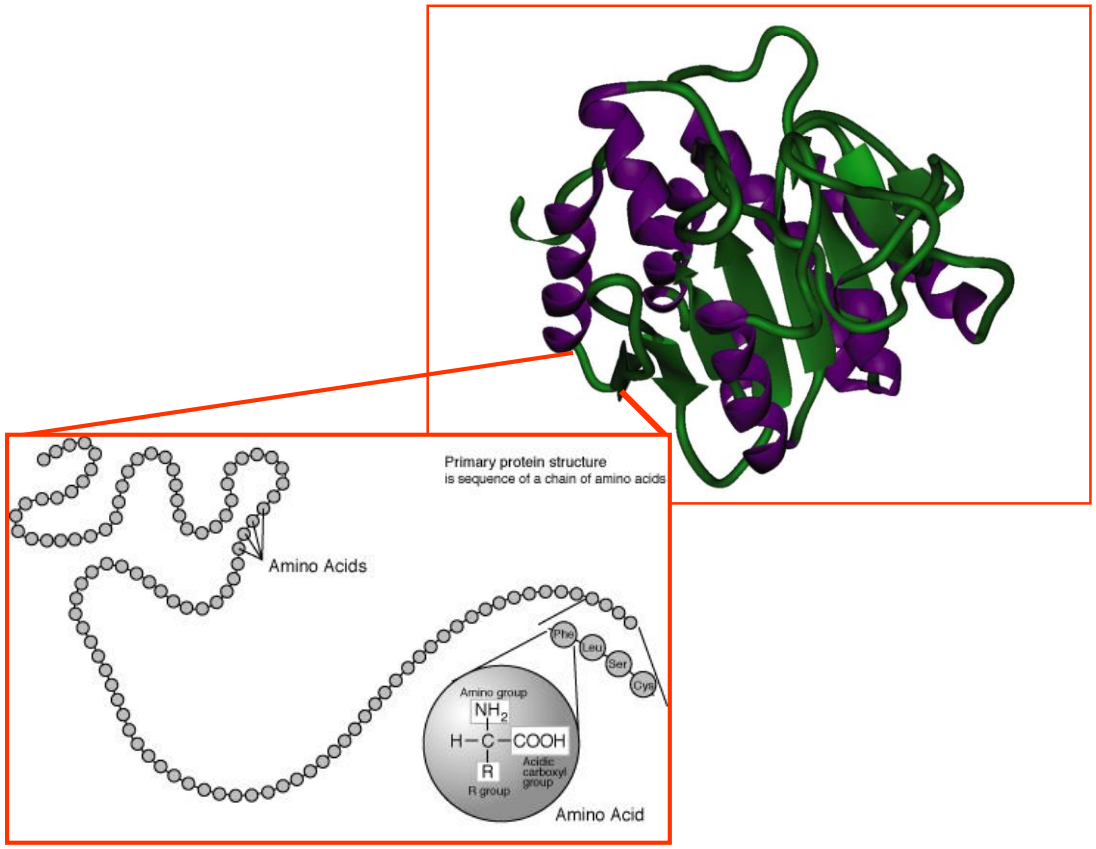
Animal based proteins in pet foods

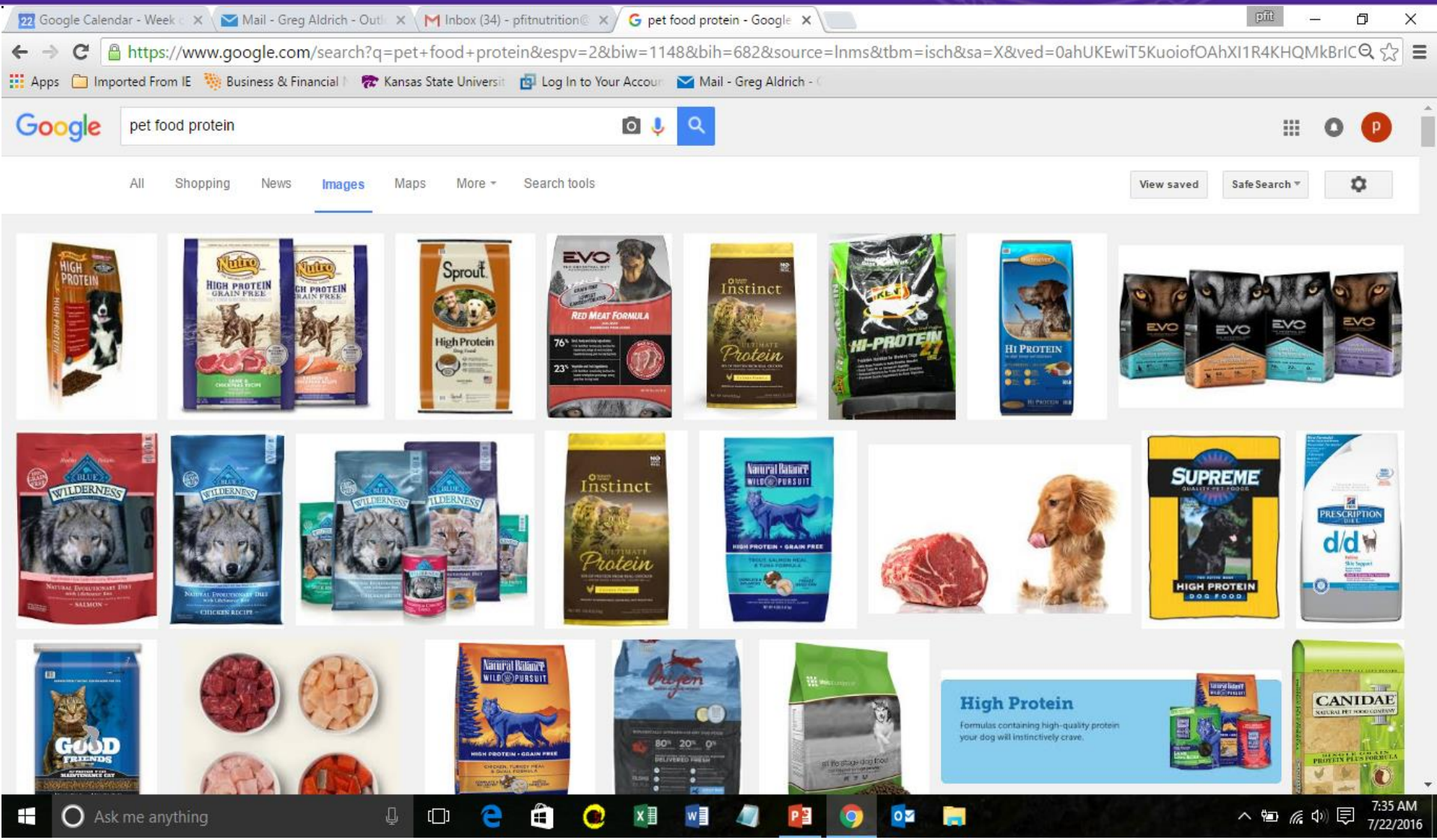
- Research into protein ingredients in pet food has been of interest for decades.
- Early work focused on meeting minimum amino acid needs, issues of elimination in disease states, and characterizing safe upper limits.
- More recently the pet food industry has linked proteins to the carnivore as a vital source of nourishment (e.g. taurine) and dramatically expanded the repertoire of options.

Goal

- To evaluate [animal] proteins intended for modern pet food and treats
  - Structural support
  - Nutritional quality
  - Shelf-life and sensory attributes.

What is a Protein ??????

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pet food protein - Google
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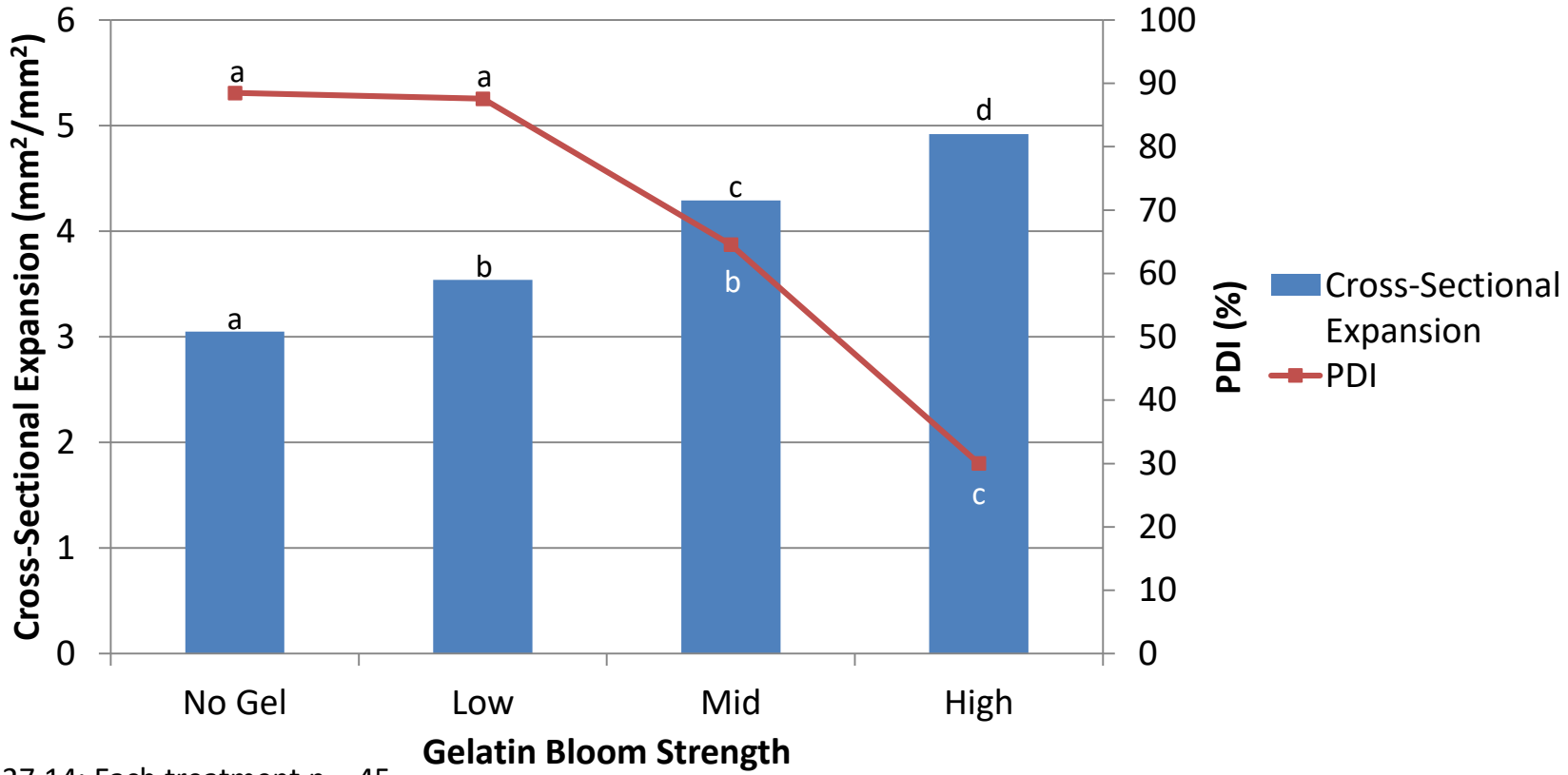
Natural Balance
WILD PURSUIT
HIGH PROTEIN · GRAIN FREE
SUPREME
HIGH PROTEIN
DOG FOOD
PRESCRIPTION
d/d
GOOD FRIENDS
Natural Balance
WILD PURSUIT
HIGH PROTEIN · GRAIN FREE
Orijen
High Protein
Formulas containing high-quality protein your dog will instinctively crave.
CANIDAE
Ask me anything
7:35 AM
7/22/2016

Structure

Main effect means of cross-sectional expansion* and PDI+



*MSE = 27.14; Each treatment n = 45

+MSE = 7374.40; No Gel n = 10, Low n = 9, Mid n = 10, High n = 10

[abcd]Columns or data points with unlike superscripts differ (P<0.05)

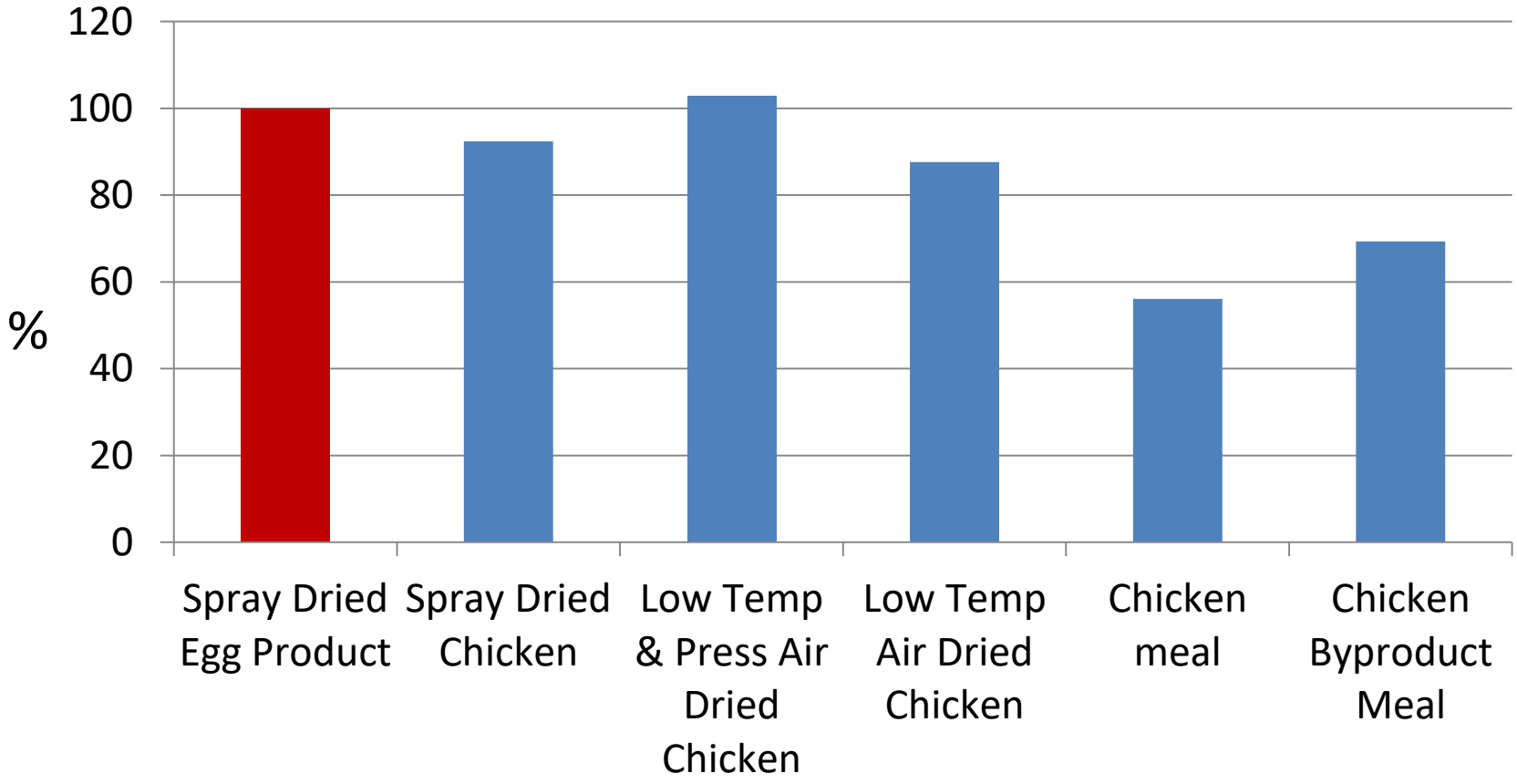
Injection Molded Treats

Main effect means of gelatin type on physical characteristics of injection molded treats.

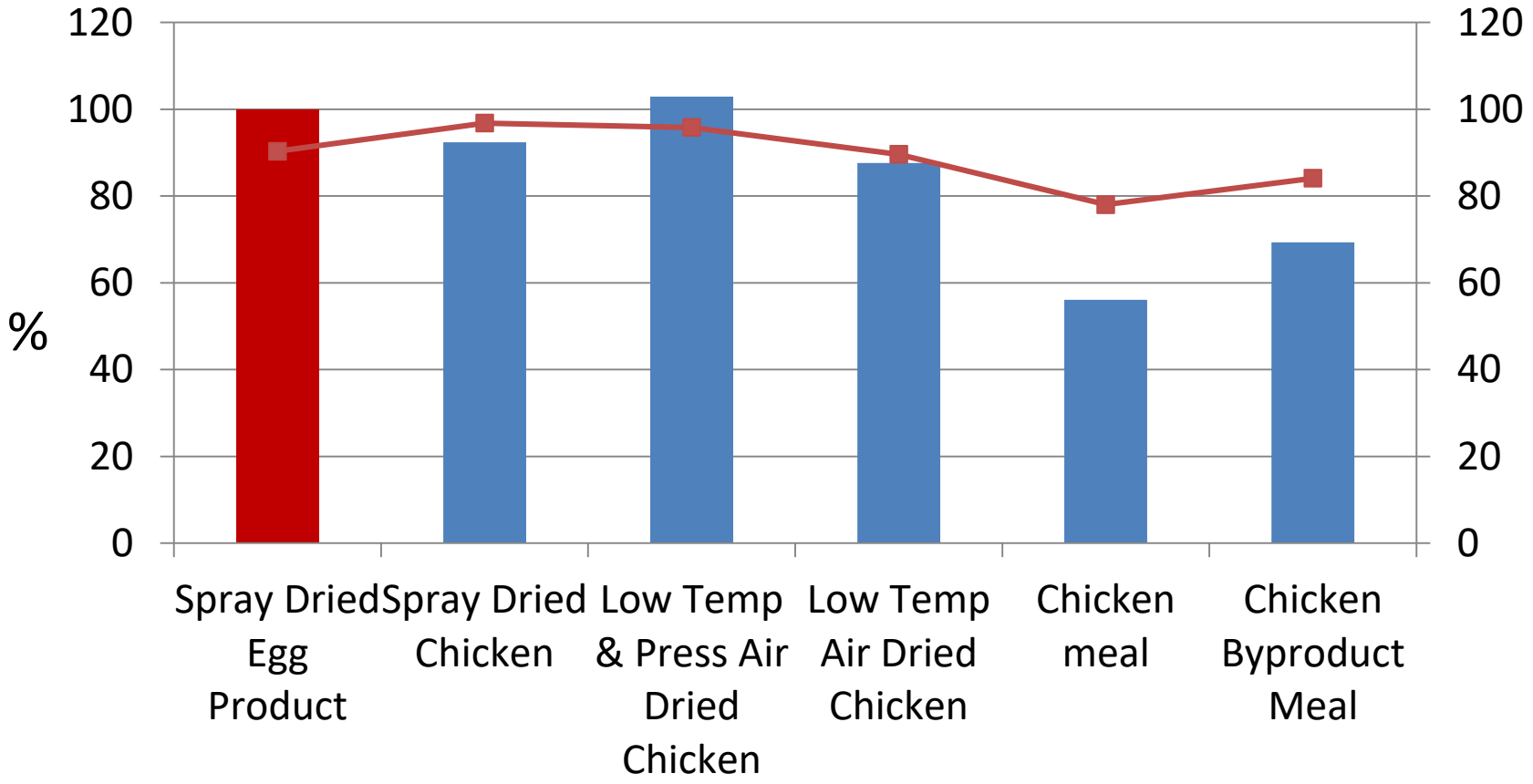
Variable	PB100	PS175	PS250	SEM	P
Puncture Force (kg)	15.46[a]	14.11[ab]	12.59[b]	0.80	0.06
Tensile Strength (MPa)	3.03	2.53	2.33	0.27	0.20
Strain at Break (%)	7.43[b]	5.94[b]	14.08[a]	0.78	<0.0001
Young's Modulus (MPa)	128.11[a]	97.81[a]	44.21[b]	14.15	0.004

Raw or Processed: Does it Matter?

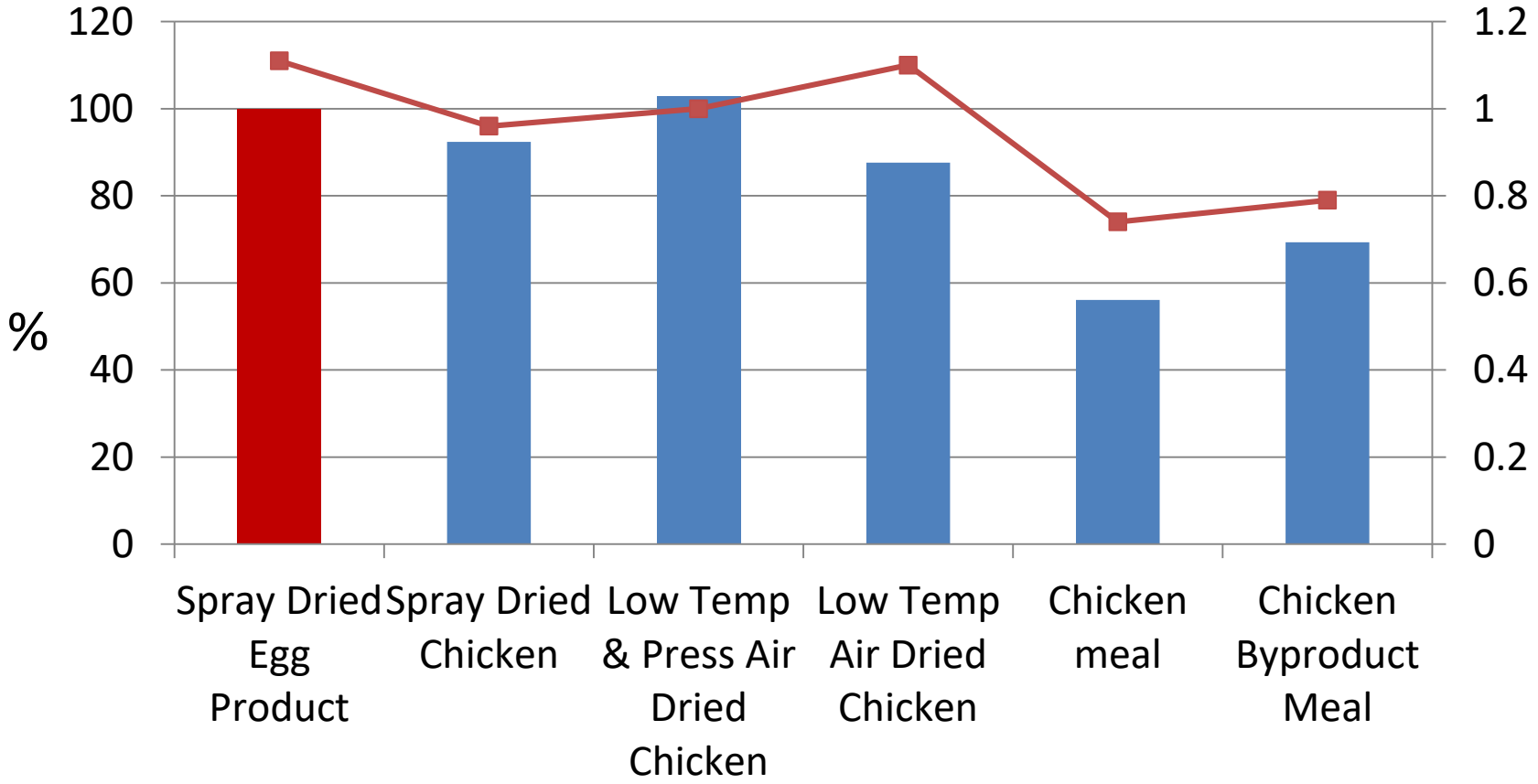
Protein Quality Influenced by Processing: Chick PER



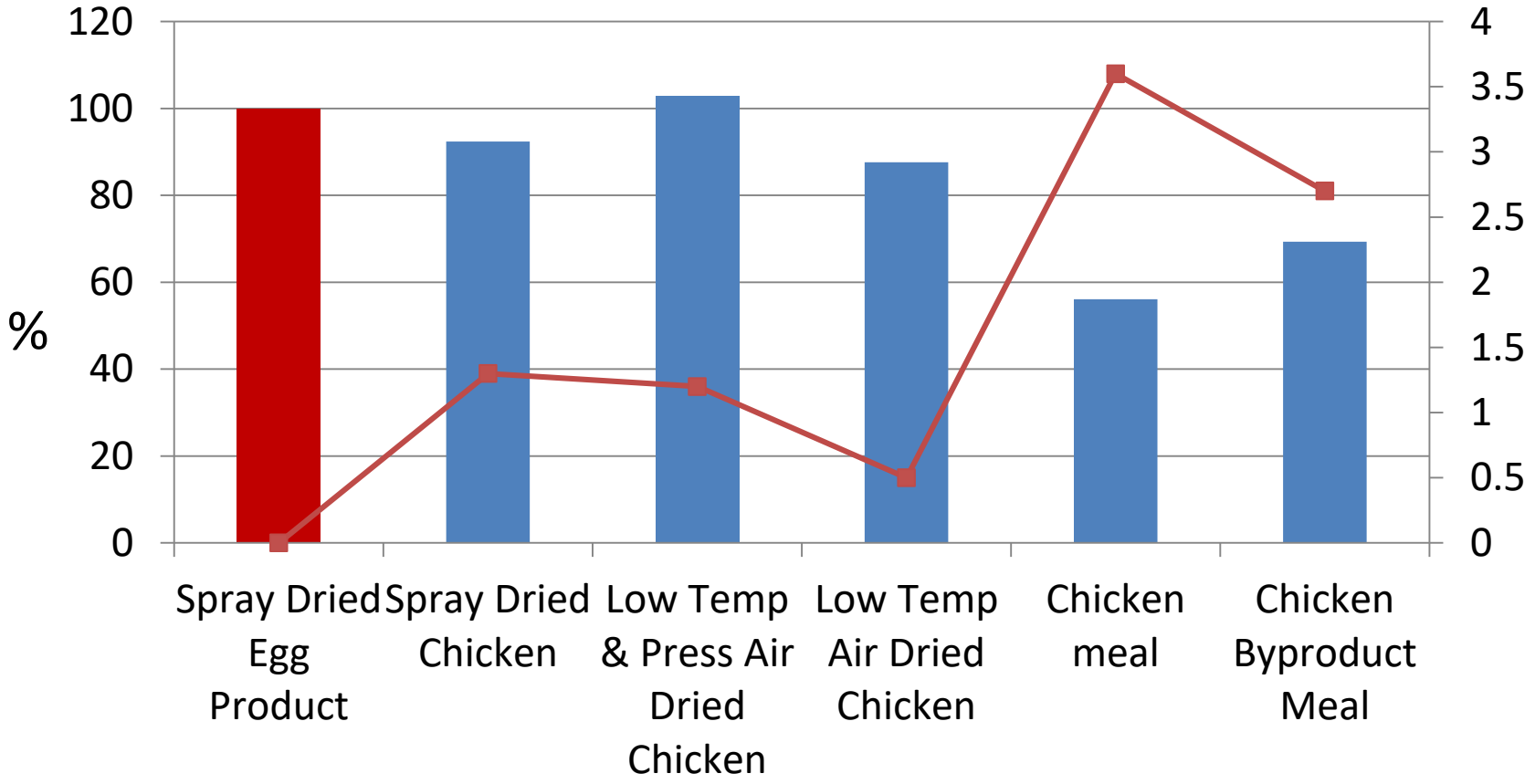
Protein Quality Influenced by Processing: Available Lysine, %



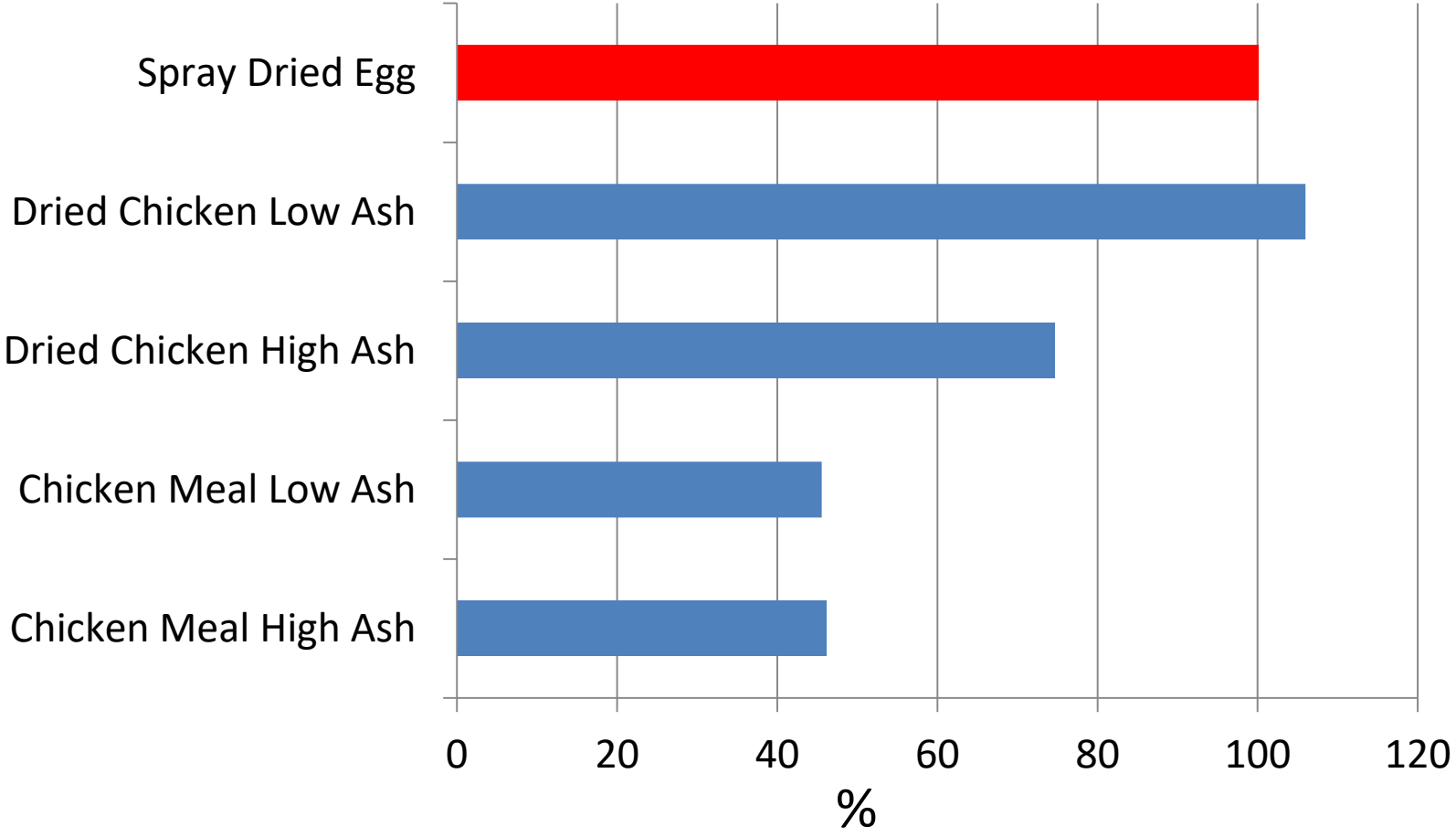
Protein Quality Influenced by Processing: EAA:NEAA



Protein Quality Influenced by Processing: OH-Proline, %



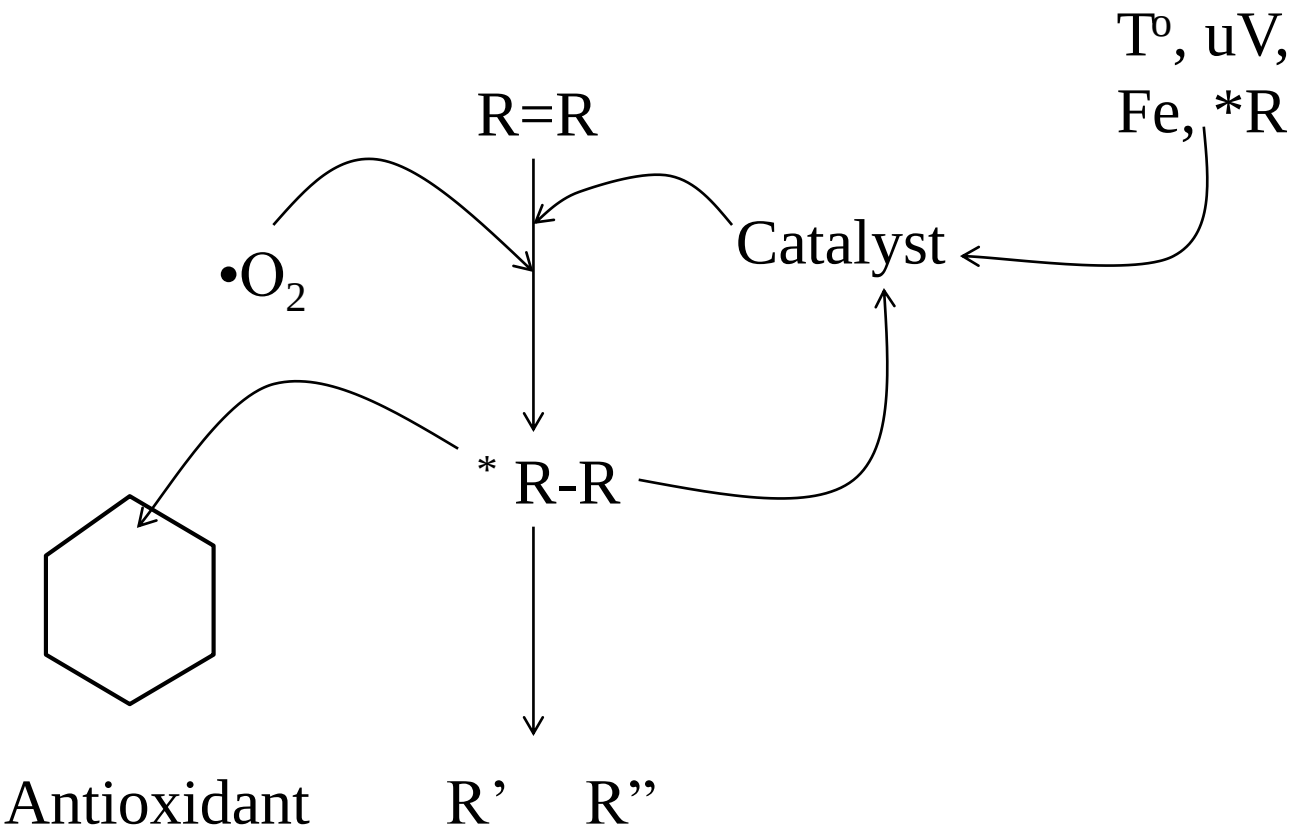
Protein Quality Influenced by Processing



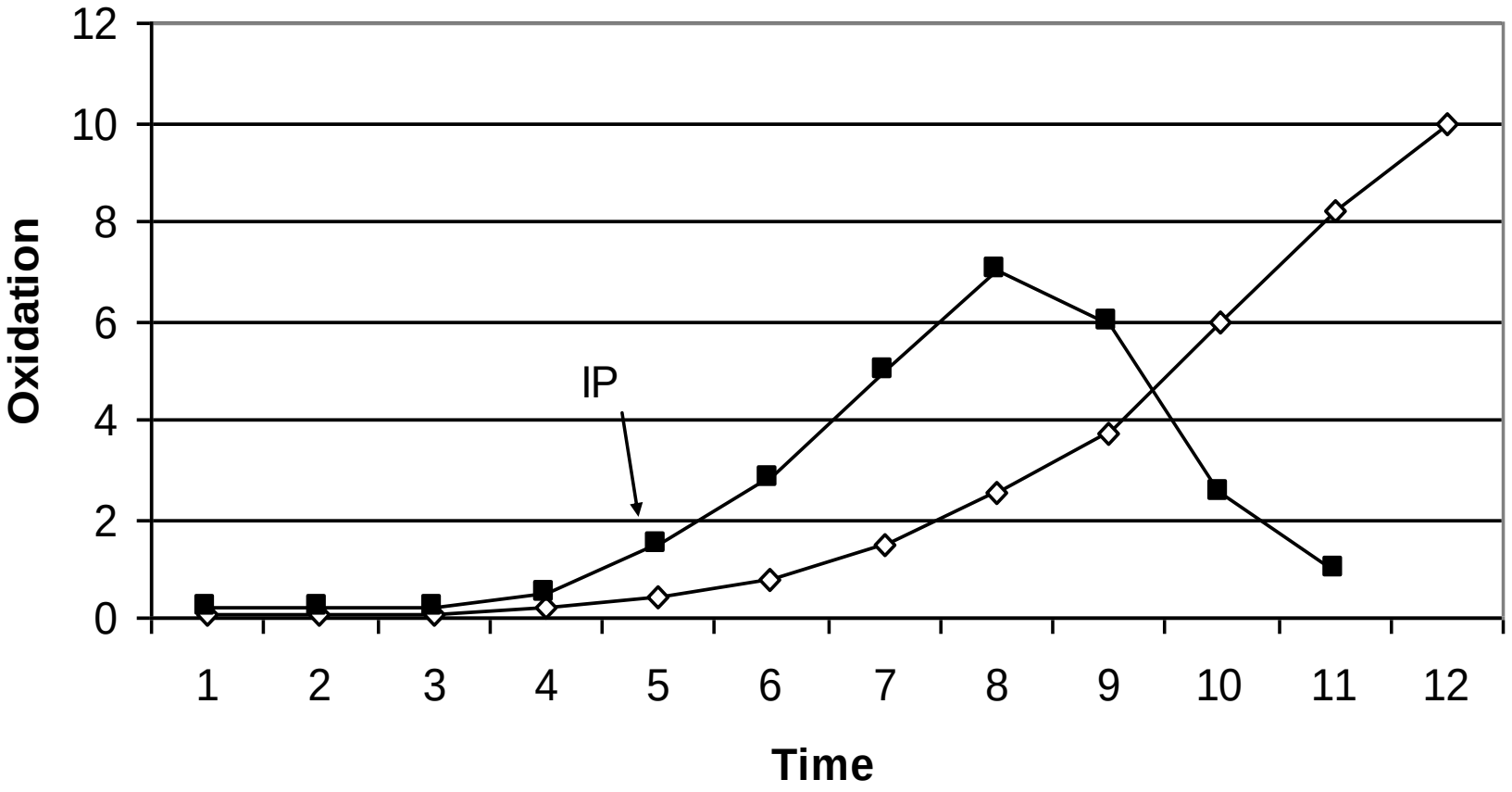
How is Pet food Shelf-Life Defined?

- The time it takes for the food to reach a point at which it becomes unacceptable
  - Offensive odor to the pet owner
  - Buildup of harmful toxins
  - Dog or cat rejects the food

Fat Oxidation



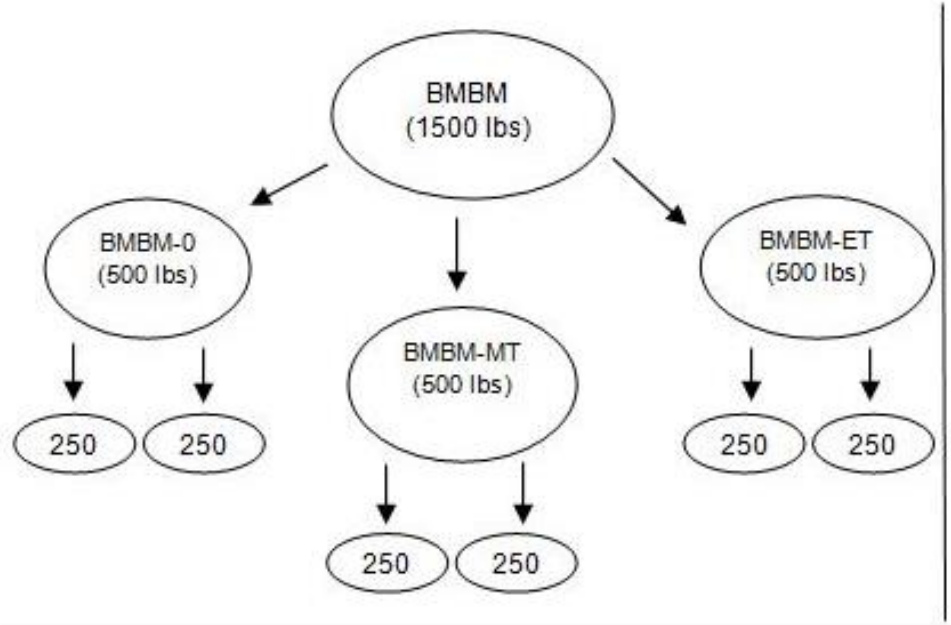
Oxidation Reaction

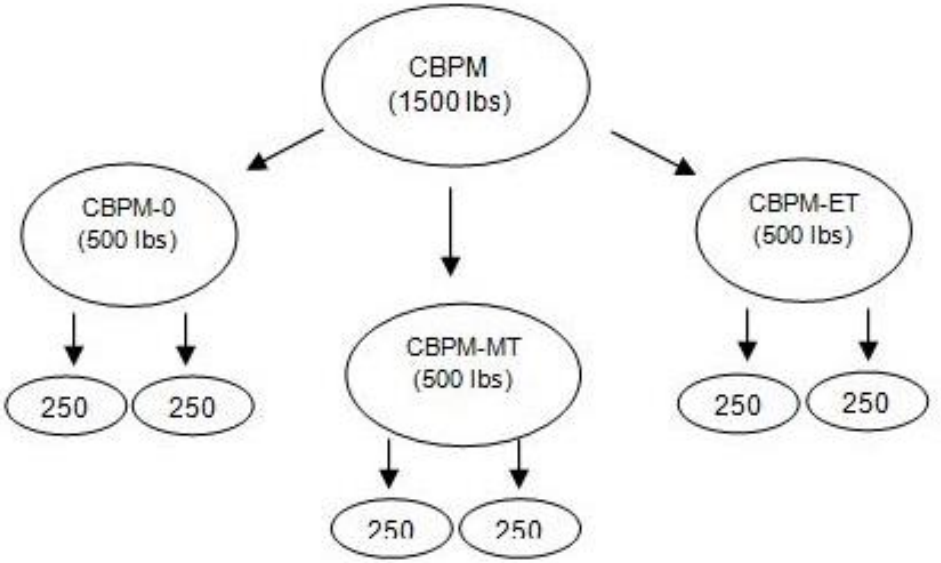


Evaluation of the Use of Oxidized Rendered Protein Meal in an Extruded Pet Food

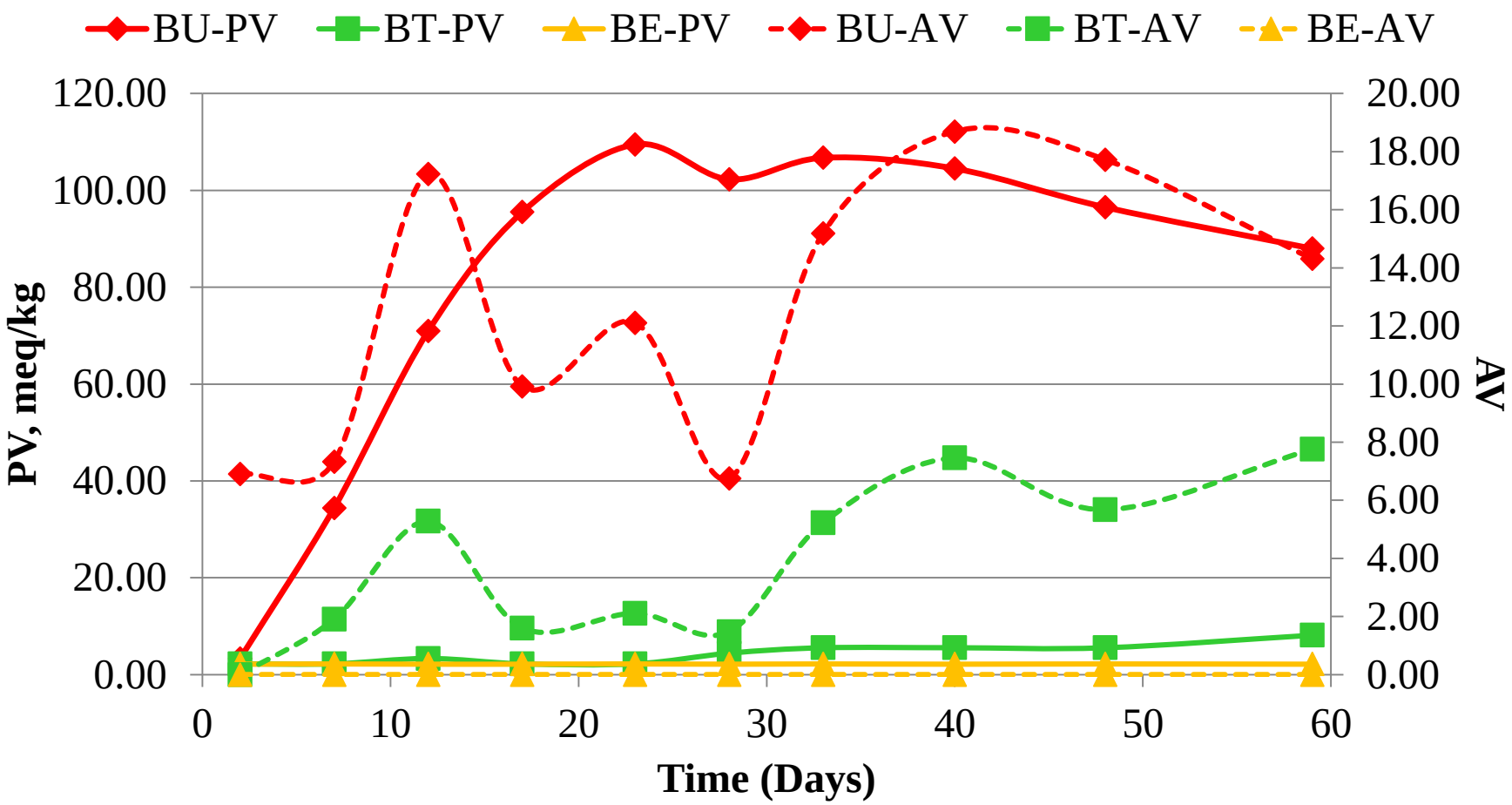
1. Oxidize rendered protein meal
2. Produce pet food & measure oxidation products
3. Oxidize pet food
4. Measure oxidation products and sensory attributes

Materials & Methods

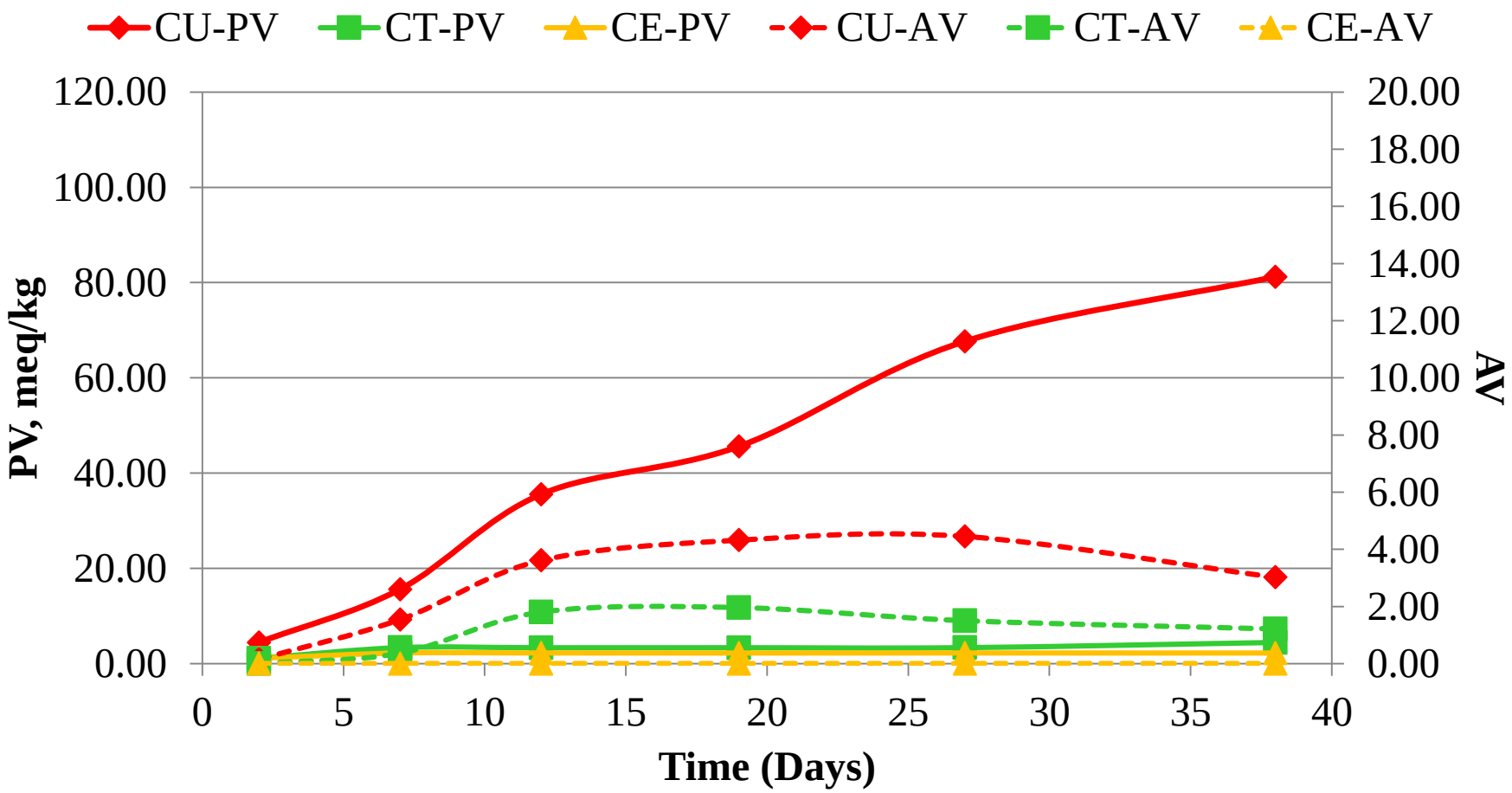




Materials & Methods - BMBM



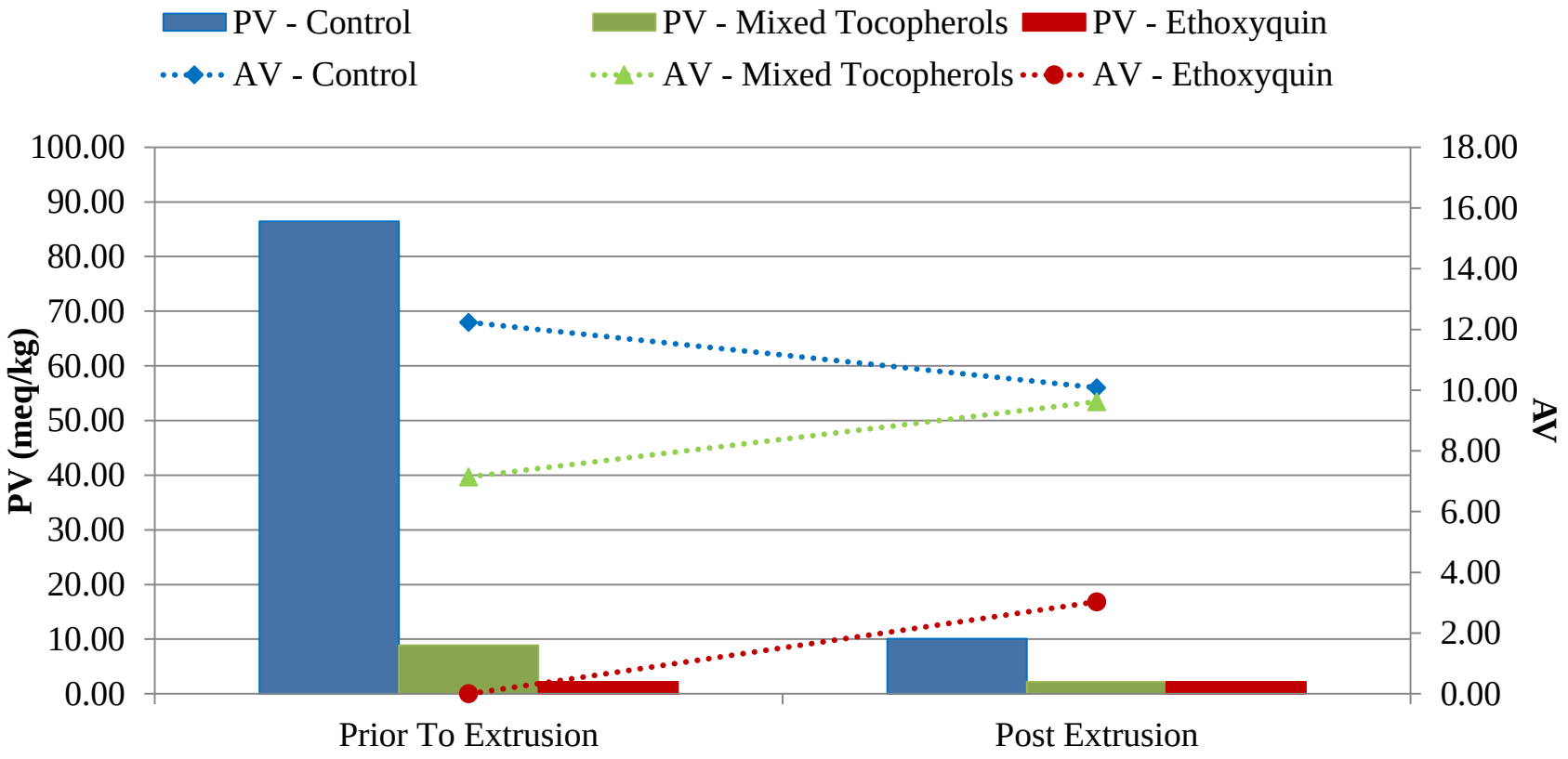
Materials & Methods - CBPM



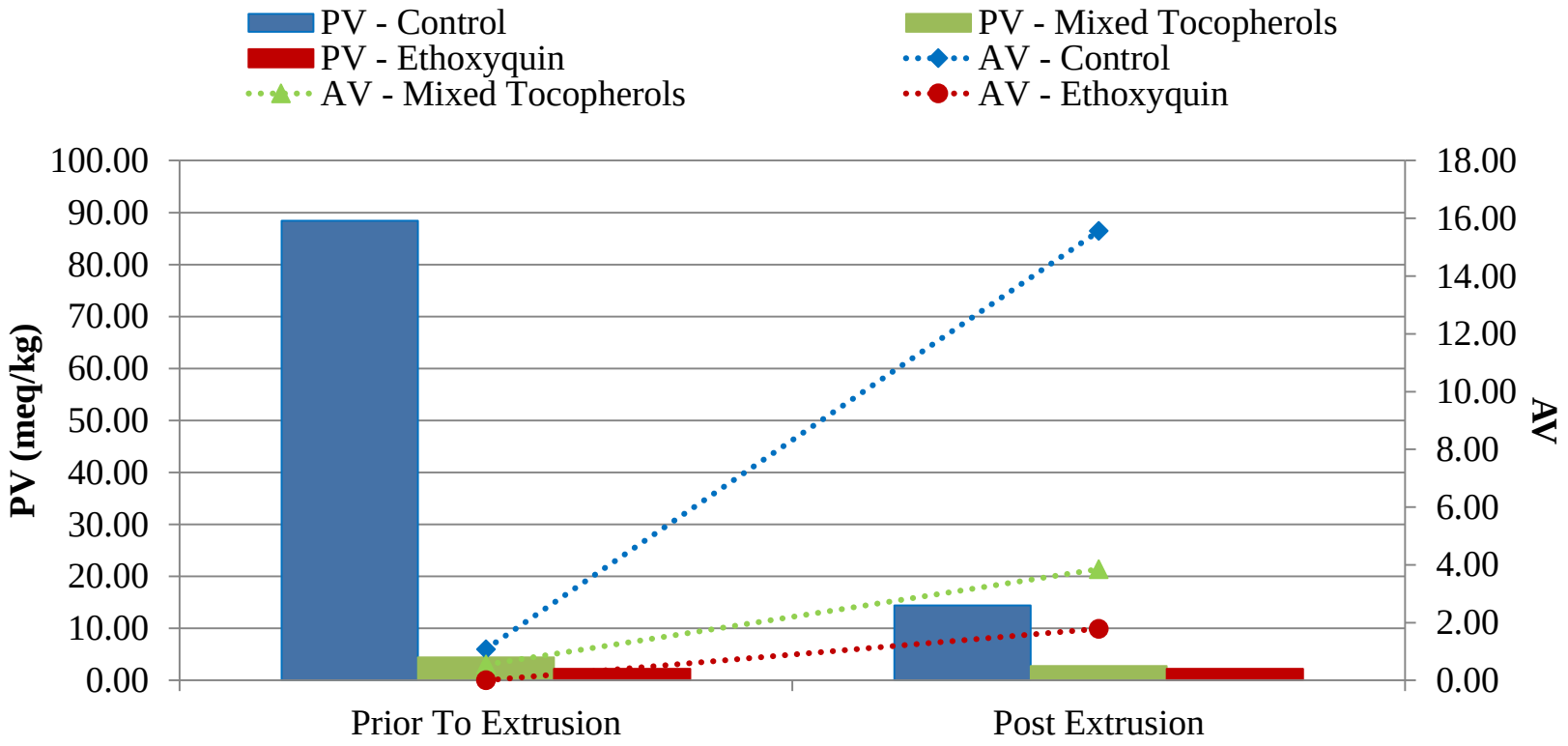
Cat Food Production

Ingredient	Diet, %	Diet %
Chicken By-Product Meal	37.80	-
Meat and Bone Meal	-	51.37
Rice, Brewers	18.92	14.38
Corn	18.92	14.38
Wheat	18.92	14.38
Beet Pulp	4.00	4.00
Potassium Chloride	0.40	0.40
Monosodium Phosphate	-	0.25
Salt	0.25	0.25
Choline Chloride, 60% Dry	0.20	0.20
Vitamin Premix	0.15	0.15
Trace Mineral Premix	0.10	0.10
DL Methionine	0.10	-
Taurine	-	0.05
Ingredient Total	**100.00**	**100.00**

Before and After Pet Food Processing Oxidized BMBM



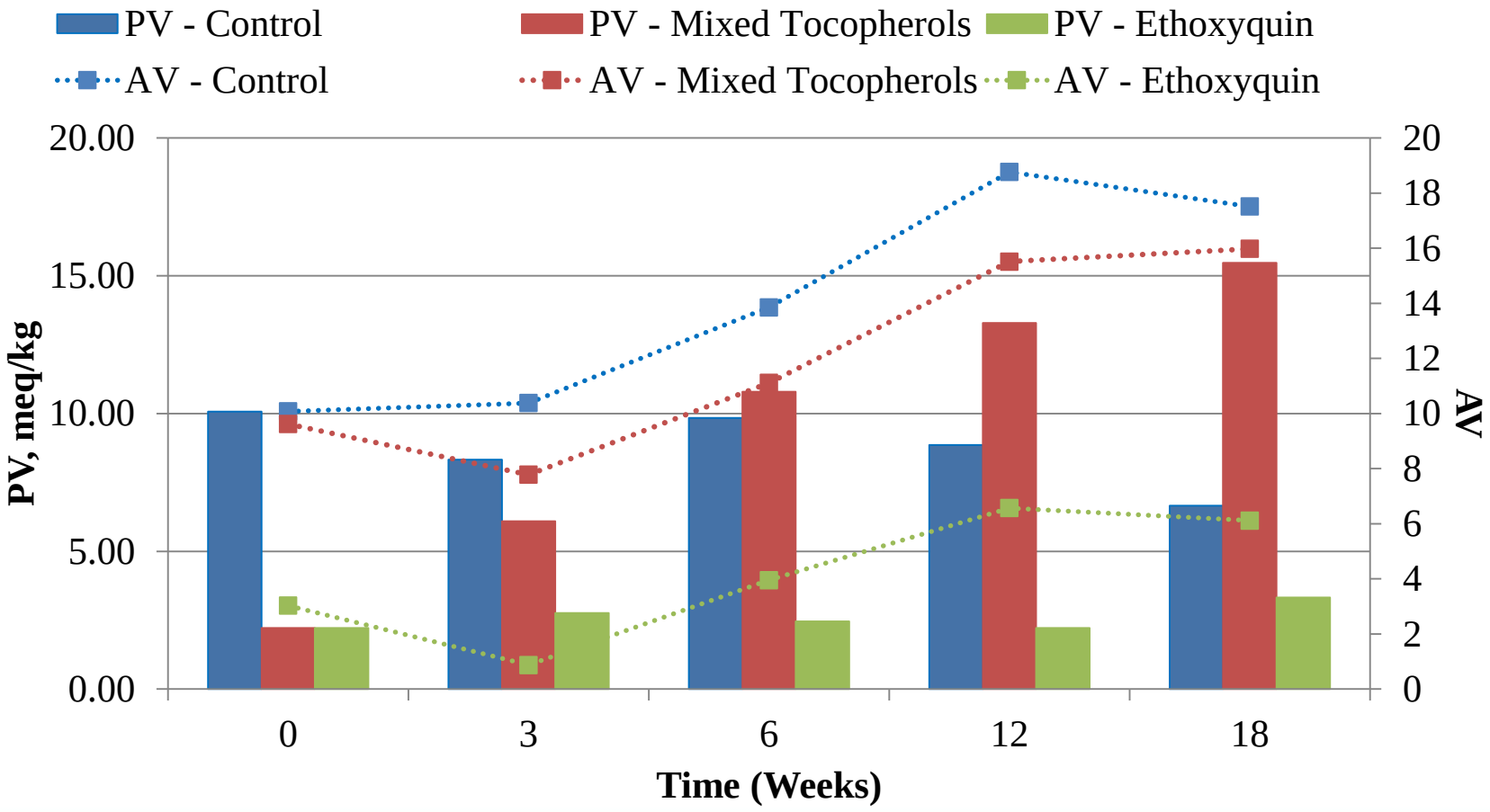
Before and After Pet Food Processing Oxidized CBPM



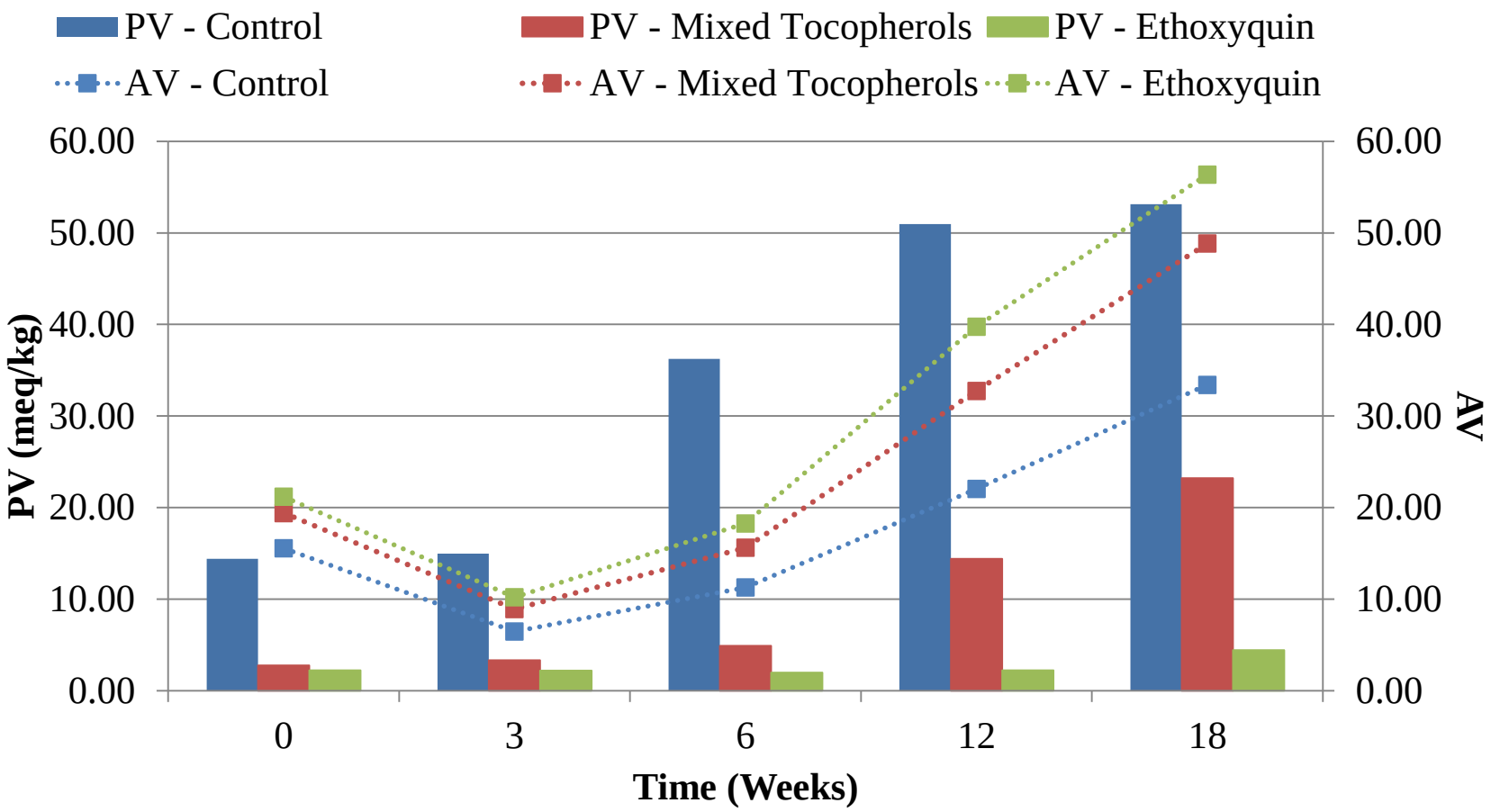
Shelf Life

- 3 kg of pet food/treatment in Ziploc bags
- Accelerated: 40°C; 70% RH
- Ambient: 22°C; 45% RH (ongoing)

Accelerated Shelf Life of Pet Food Produced with Oxidized BMBM (40°C; 70% RH)



Accelerated Shelf Life of Pet Food Produced with Oxidized CBPM (40°C; 70% RH)



Protein in pet foods and nutrition

- Proteins are a point of differentiation in pet foods, a cause for lawsuits, and a major cost factor.
- Higher levels of protein and novel sources are prominent feature in promotions
- Proper selection of proteins can substitute for starches as structure forming elements in pet foods and treats
- Composition and amount of heat processing can affect the nutritional quality of animal based proteins
- Oxidation of animal protein meals may not influence chemical measures of shelf-life profoundly

Questions?