Effect of Baking, Extruding and Raw Ingredient Selection on Pet Food Sensory and Aromatic Properties

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What's new?

- Petfood Forum 2013:
  Characterization of
  dry dog food category

- Petfood Forum 2014: focus on specific ingredient and processing effects

Objectives

1) determine processing, meat inclusion, and extrusion thermal input level effects on sensory, volatile, and texture properties of pet foods, and

2) to determine associations among sensory and volatile characteristics of baked and extruded pet foods.

Take-home messages

- Descriptive sensory analysis enables detailed characterization of pet food and better understanding of palatability
- Baked pet foods differ from extruded pet foods in aroma, flavor, appearance, and texture characteristics

Layout

- Baked and extruded pet foods: what do we know?
- Typical baked and extruded pet foods
- Materials and Methods
- Results
- Conclusions

Typical baked and extruded pet foods

- Extruded pet foods: mainly everyday diets

- Baked pet foods: mainly treats
- 10 brands manufacture baked everyday diets
- http://www.healthypetcorner.com/content/19-oven-baked-food

Baked and extruded pet foods: what do we know?

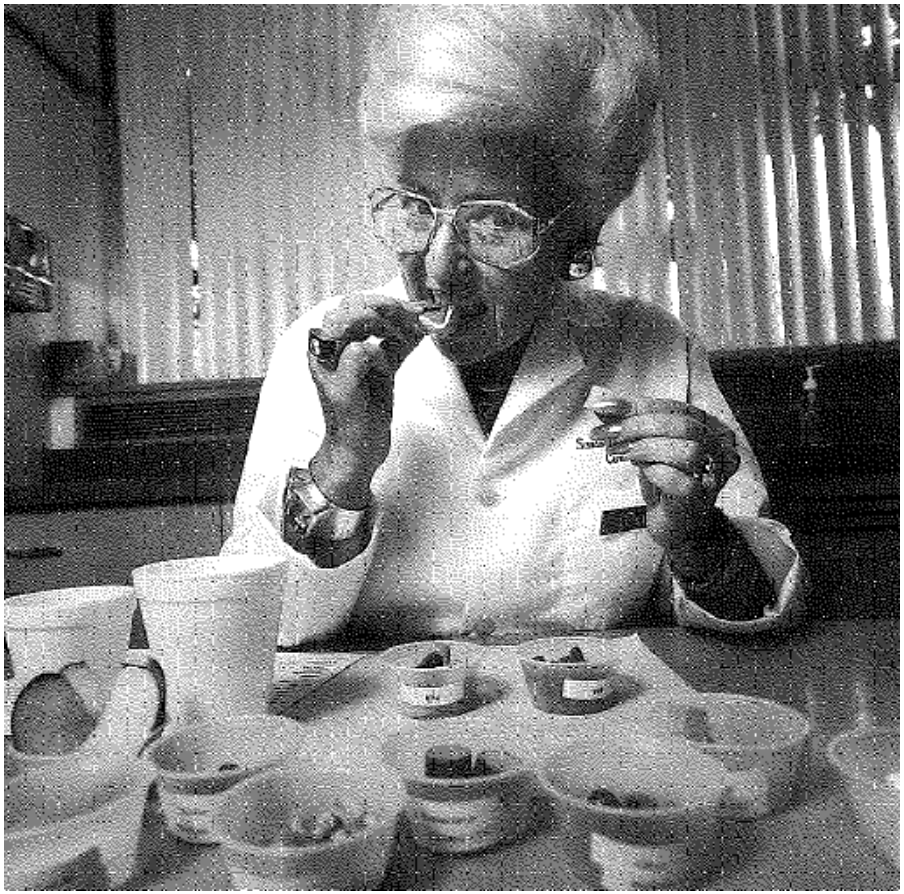
- Processing characteristics
- Extrusion more powerful
- Baking less powerful, leads to different structures (Gibson and Alavi, 2013)
- How do sensory characteristics differ?
- Which one is healthier? More palatable?

Sensory Evaluation

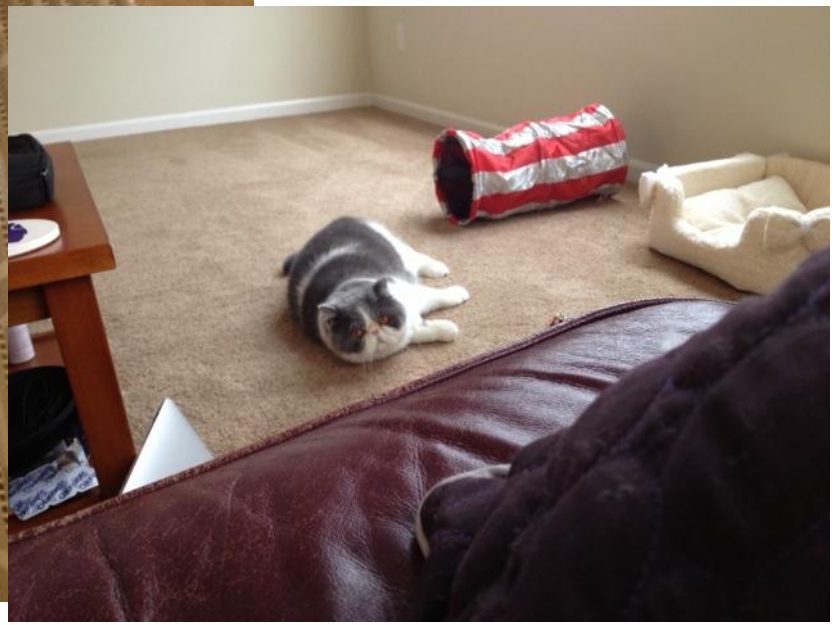
- Use our senses (sight, smell, touch, taste, hearing) to evaluate product properties such as appearance, aroma, flavor, texture

Why?

- Schiff, 2006



Because taste and flavor matter!



Current situation

- Few publications have dealt with human sensory analysis:
- Koppel, 2014
- Koppel et al., 2013
- Di Donfrancesco et al., 2012
- Pickering, 2009 a,b
- Lin et al., 1998

- Ingredient and processing effects:

Gibson and Alavi, 2013; Felix et al., 2012; Kumar et al., 2011; Carciofi et al., 2009

Preferences and palatability of dog food

- Dogs prefer beef – pork – chicken – lamb – horsemeat;
- Cooked over raw meat;
- Warm over cold meat;
- Canned over dry food;
- Pet dogs have more variability in flavor preferences than kennel dogs;
- Sensory studies that compare dry food textures were not found.

Houpt and Smith, 1981; Smith et al., 1983.

Materials and Methods

- Samples
- Ingredients

Ingredients, %	0% Fresh Meat	20% Fresh Meat
MD Frozen Chicken	0.00	20.00
Chicken By-Product Meal	20.94	10.91
Chicken Fat	5.32	2.34

- Other ingredients: rice, corn, wheat, beet pulp, corn gluten meal
- Minor ingredients: calcium carbonate, potassium chloride, sodium chloride, dicalcium phosphate, choline chloride, antioxidants, vitamins, minerals

Materials and Methods

Baked

- Mixing
- Molding
- Baking 11 min, 220 °C
- Drying 5h, 50 °C

- 2 baked samples

Extruded

- Extrusion
- Low mechanical ratio
- Medium
- High
- Drying 2x10 min 220 °C
- Cooling 10 min

- 6 extruded samples

Materials and Methods

- Descriptive sensory analysis
- 5 highly trained panelists
- Select vocabulary: appearance, texture, aroma, & flavor
- Attribute intensity measured on a scale from 0 to 15 with 0.5 increments
- Evaluate the samples in triplicate
- Apple slices, unsalted crackers, purified water, and toothbrushes for palate cleansing

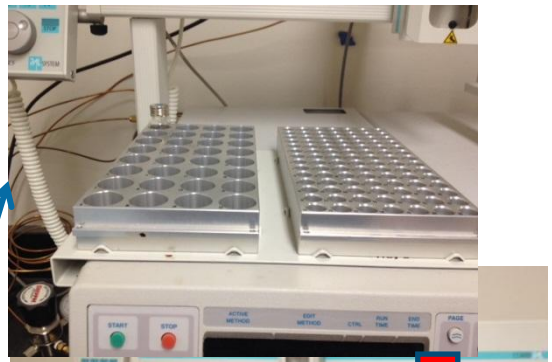
Materials and Methods

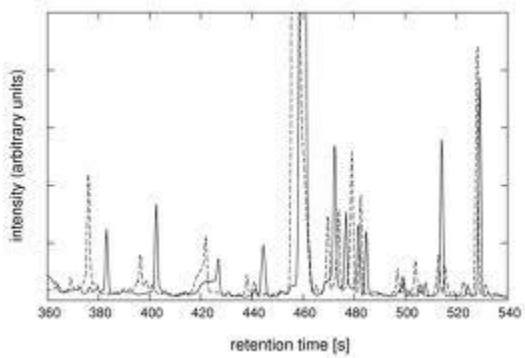
- Example evaluation

- Sourness
- 0; 0.5; 1; 1.5;……14.5;15.0
- Hardness
- 0; 0.5; 1; 1.5;……14.5;15.0
- …

Materials and Methods

- Volatile aromatics using GC-MS SPME





Materials and Methods

- Summary of consumer reviews online
- Amazon reviews on baked and extruded dog foods
- Used Wordle to create word clouds (www.wordle.net)

Materials and Methods

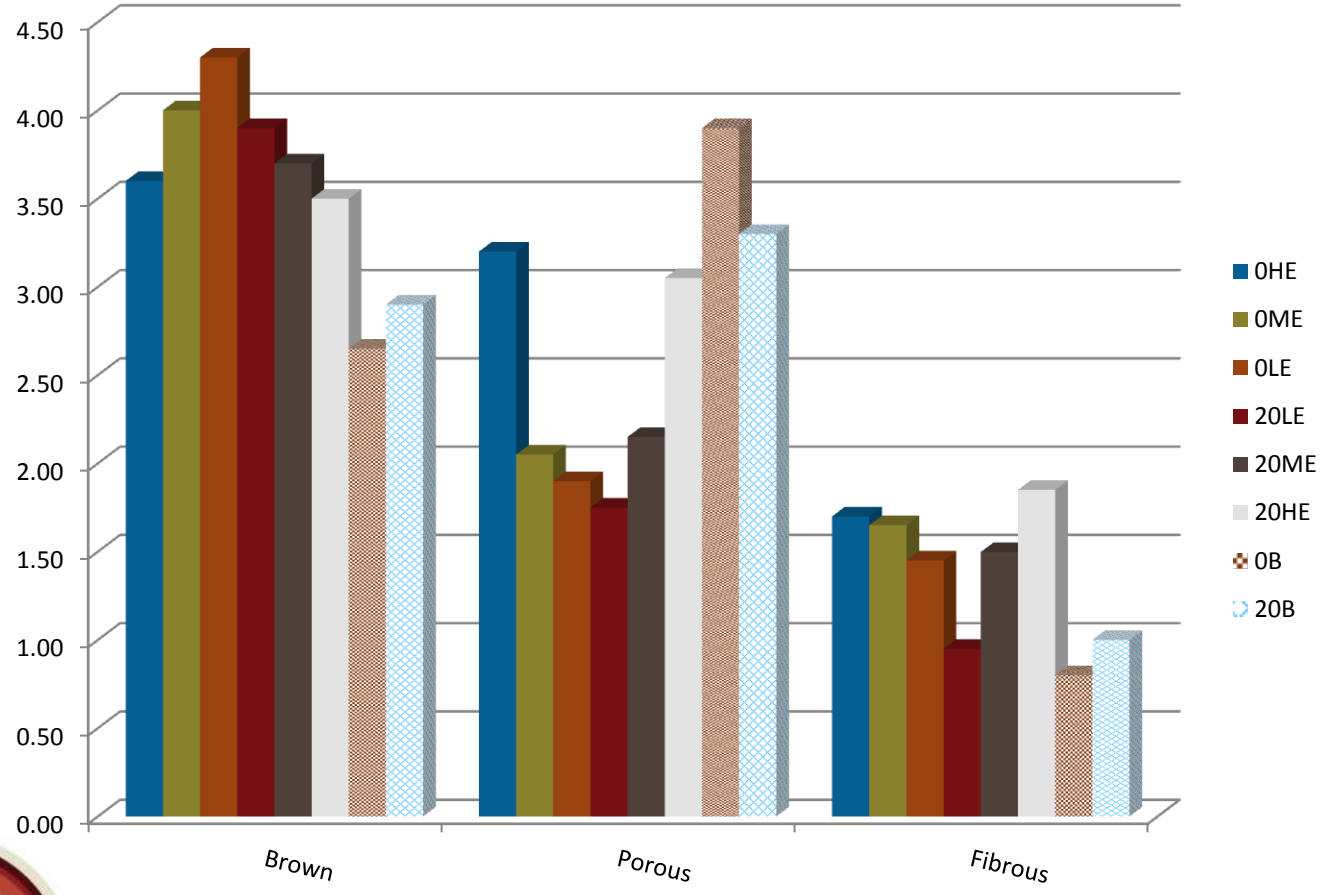
- Data analysis
- SAS Proc Glimmix ($p<0.05$) to determine significant ingredient and processing effects
- Unscrambler PLSR mapping to associate sensory and volatile information

Results: Descriptive Analysis

- Most attributes evaluated in the weak range (0-5 on a scale from 0-15)

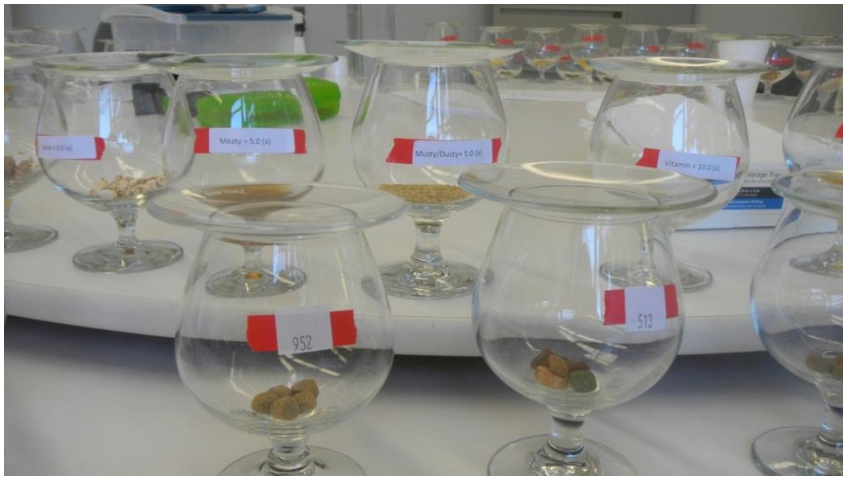
- No meat flavor detected in any of the samples

Results: Descriptive Analysis Appearance



Results: Descriptive Analysis

- Aroma
- Evaluated: Barnyard, brothy, toasted, brown, grain, vitamin, stale, meaty, musty, oxidized oil, cardboard, liver, and fish attributes

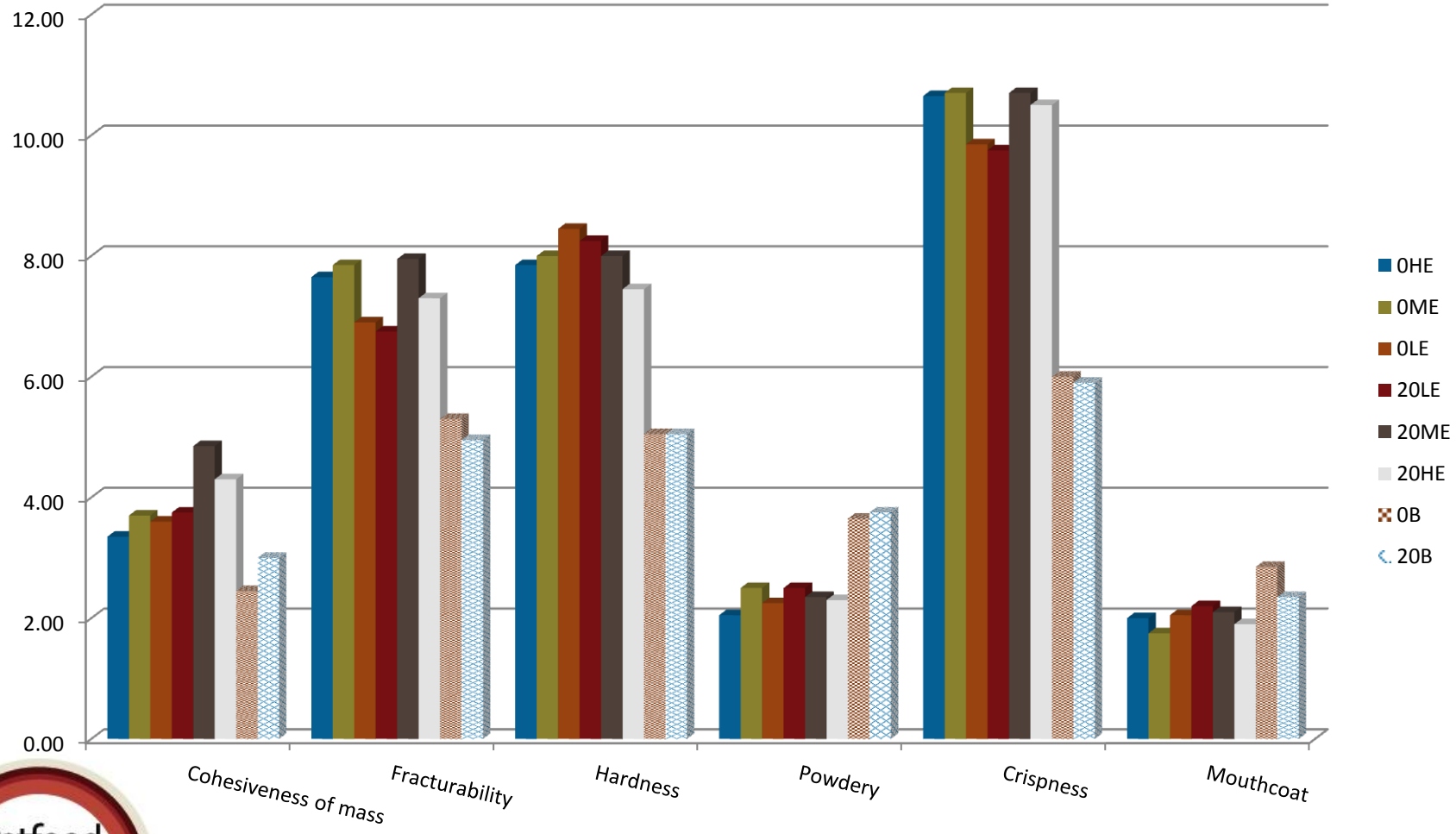


Results: Descriptive Analysis

- Flavor
- Evaluated: Barnyard, brothy, toasted, brown, grain, vitamin, stale, meaty, musty, oxidized oil, cardboard, liver, and fish attributes
- Sour, salty, sweet, and bitter taste and aftertaste and metallic aftertaste attributes

- Main flavor attributes are barnyard, grainy, stale, sour, salty, bitter, and oxidized oil.

Results: Descriptive Analysis, texture



Results: Descriptive Analysis

- Meat effect on flavor and taste
- Pet foods manufactured with fresh meat tended to be less bitter but higher in fish flavor than samples manufactured without fresh meat

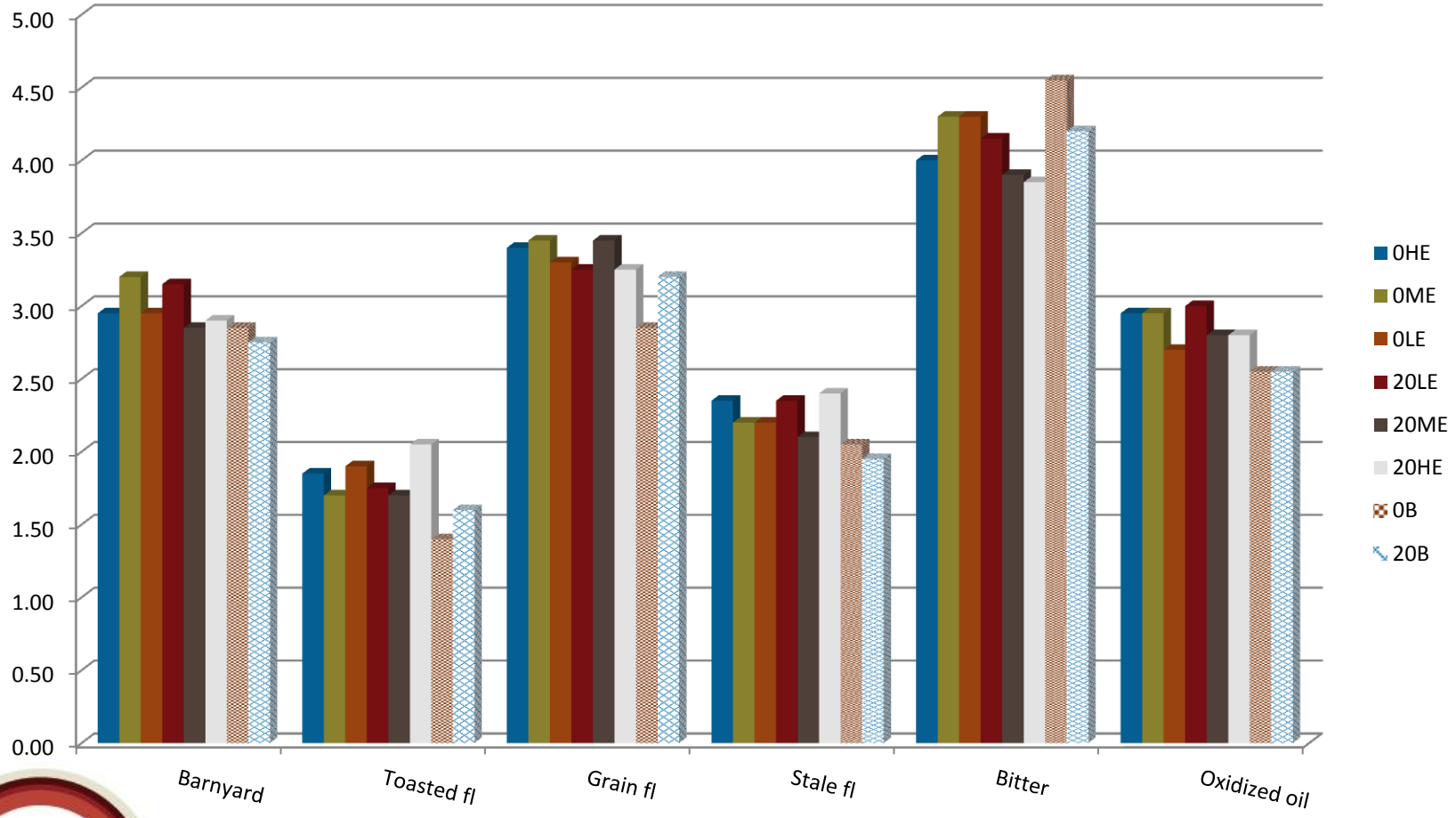
Results: Descriptive Analysis

- Thermal ratio effect
- Higher thermal input tended to decrease brown color intensity and increase porous, grainy, and fibrous appearance
- Musty flavor was more pronounced in pet food samples manufactured at lower thermal input

Results: Descriptive Analysis

- Cooking effect
- Baked pet food samples resulted in a more porous appearance and were lower in brown color intensity
- Baked pet foods were found to be lower in almost all flavor attributes than extruded samples
- Baked samples were lower in cohesiveness of mass, hardness, and initial crispness, but more intense in powdery and mouthcoat attributes

Results: Descriptive Analysis, cooking effect



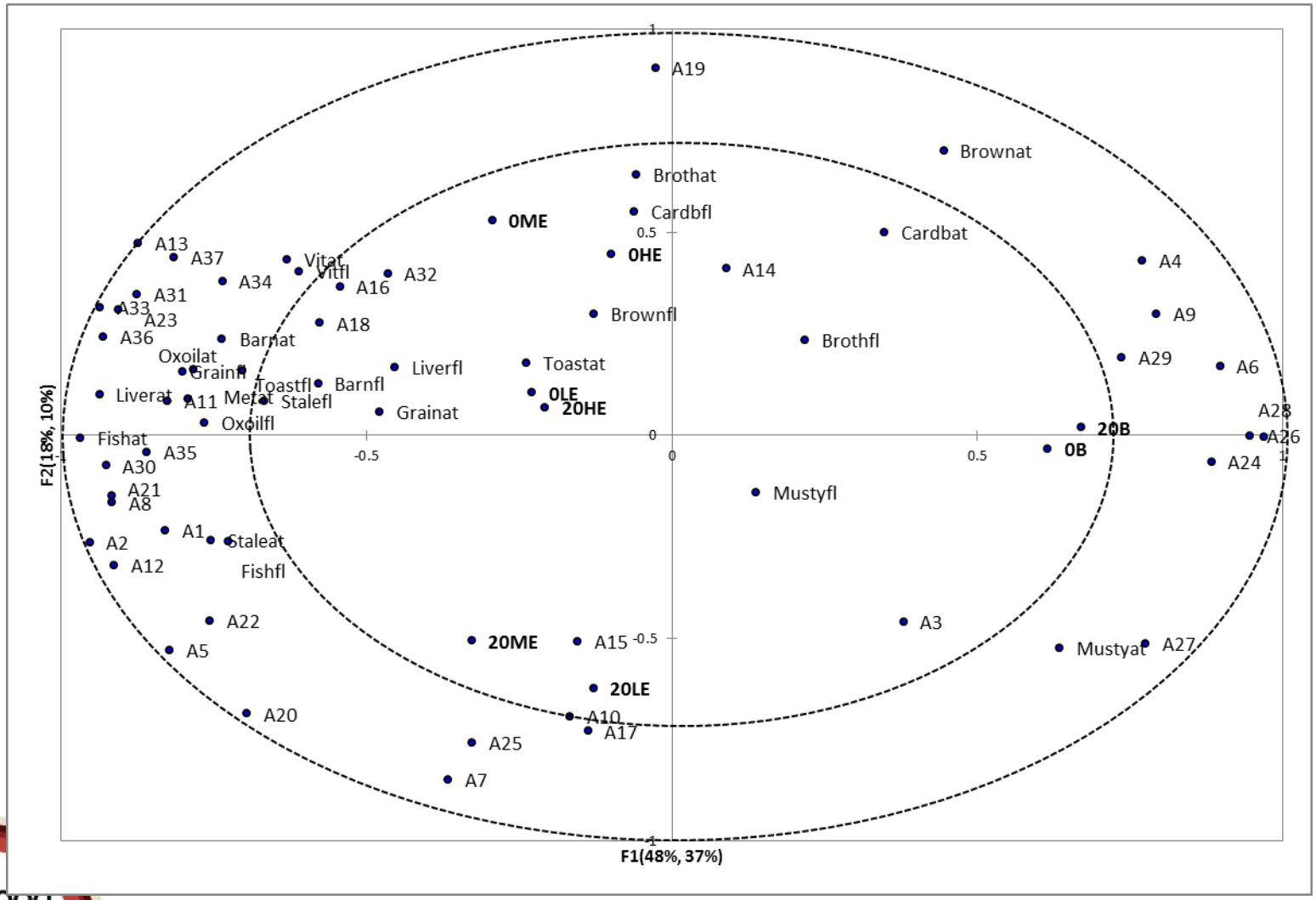
Results: Volatiles

- Volatiles
- 37 volatile compounds were found in the pet food samples
- Total concentration of volatiles was higher in the extruded samples (85-148 µg/kg) when compared to the baked samples (52-58 µg/kg)
- Meat-added samples seemed more aromatic

Results: Volatiles

- Volatiles
- 2-decen-1-ol, 2-ethyl-2-hexenal, 3-octen-2-one, 2-butylfuran and 1-R-α-pinene were present in extruded samples, but were not detected in baked foods
- methylpyrazine, methyl octanoate, and 3-hydroxytoluene were present in baked foods, but were not detected in extruded samples

Results: Flavor and Volatiles



Results: Consumer reviews

Petfood Forum

VATT GLOBAL MEDIA

Results: Consumer reviews

Conclusions

- Clear difference in baked and extruded foods texture properties
- Extruded products are more aromatic
- Consumers seem to switch from extruded to baked in case of digestibility issues

Next steps?

- Ingredient effect on sensory properties
- Palatability associations with sensory characteristics
- Animal food selection behavior

Acknowledgements

- Dr. Greg Aldrich
- Dr. Sajid Alavi
- Michael Gibson
- Brizio Di Donfrancesco
- Dr. Edgar Chambers IV

Thank you!

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