Sustainable well-tasting meat products – substituting meat with texturized vegetable proteins

Margit Dall Aaslyng
Danish Technological Institute

DANISH TECHNOLOGICAL INSTITUTE

The meat industry is challenged

The scientific targets set out by this Commission provide guidance for the necessary shift, recommending increased consumption of plant-based foods – including fruits, vegetables, nuts, seeds and whole grains – while in many settings substantially limiting animal source foods.

Summary report of the EAT-Lancet Commision, 2019

Huge reduction in meat-eating 'essential' to avoid climate breakdown

The Guardian

11 Great Reasons To Eat Less Meat (Even If You're Not Ready To Go Vegan)

www.mindbodygreen.dk

Sustainability
Health

Consumer groups

Aim:
To develop generic guidelines for production of meat products containing meat and plant proteins

DANISH TECHNOLOGICAL INSTITUTE

Nutrition in plant-based mince?

Ingredients:
Water, texturized pea protein concentrate (21%), coconut oil, WHEAT gluten, ALMOND, fermented dextrose, colour (beet root), tomato, natural aroma, salt, porcini mushrooms, malt extract (Barley), stabilizer (methyl cellulose). Might contain traces of soy.

Ingredients:
Rehydrated SOY protein/isolate (58%), water, coconut oil, SOY flour, WHEAT gluten, porcini mushrooms, tomato, fermented dextrose, tapioca starch, salt, malt extract (Barley), colour (beet root), natural aroma, maltodextrin, stabilizer (methyl cellulose).

Ingredients or vegetables?
Fat content!
Allergenic ingredients!

Ingredients:
100% beef

Ingredients:
Minced pork

	Energy	Fat	Saturated fatty acids	Carbonhy-drates	Protein	Salt
Per 100 g	*kJ*	*g*	*g*	*g*	*g*	*g*
Plant-based mince, pea	880	11	**7.9**	**9.6**	18	**1.3**
Plant-based mince, soy	814	10	**8**	**6.2**	18	**1.2**
Minced beef	712	10	**4.1**	**0.5**	19	**0.17**
Minced pork	783	12	**4.3**	**0.5**	20	**0.19**

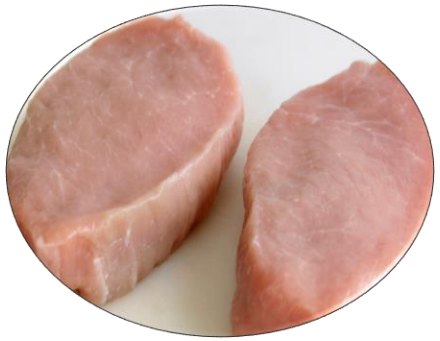
DANISH
TECHNOLOGICAL
INSTITUTE

One solution is to partly replace the meat protein with plant proteins to keep the good eating quality of the meat products in a more sustainable way

DANISH
TECHNOLOGICAL
INSTITUTE

80’s

CHEAP

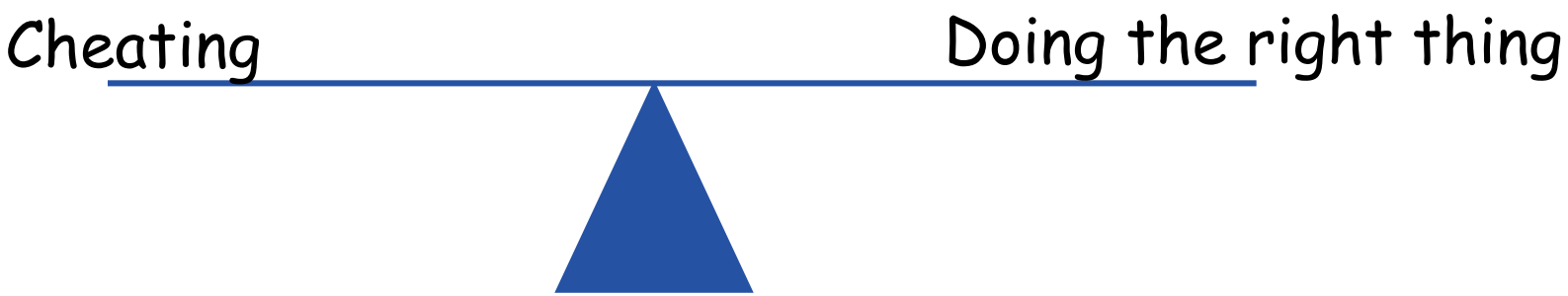


00’s

HIGH MEAT CONTENT

Today

SUSTAINABLE



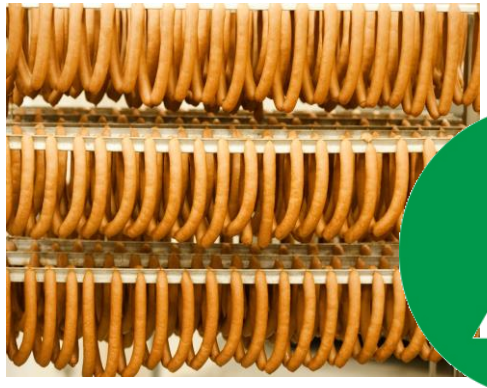
DANISH TECHNOLOGICAL INSTITUTE

Optimizing the texture

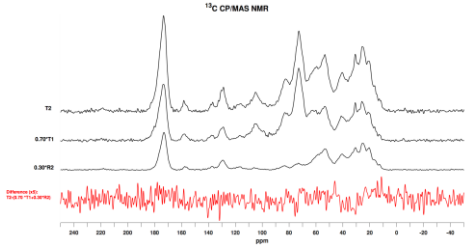
'Home-made' texturized proteins

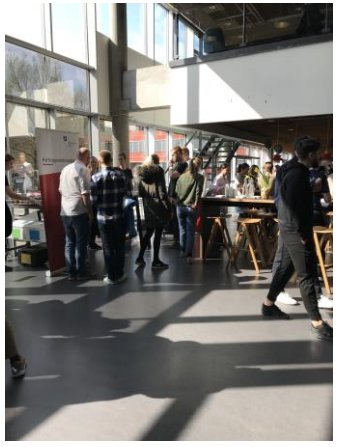
0%, 10%, 30%, 50%
of the meat protein!

± 10 min smoke



Fat < 10%
Salt < 2%

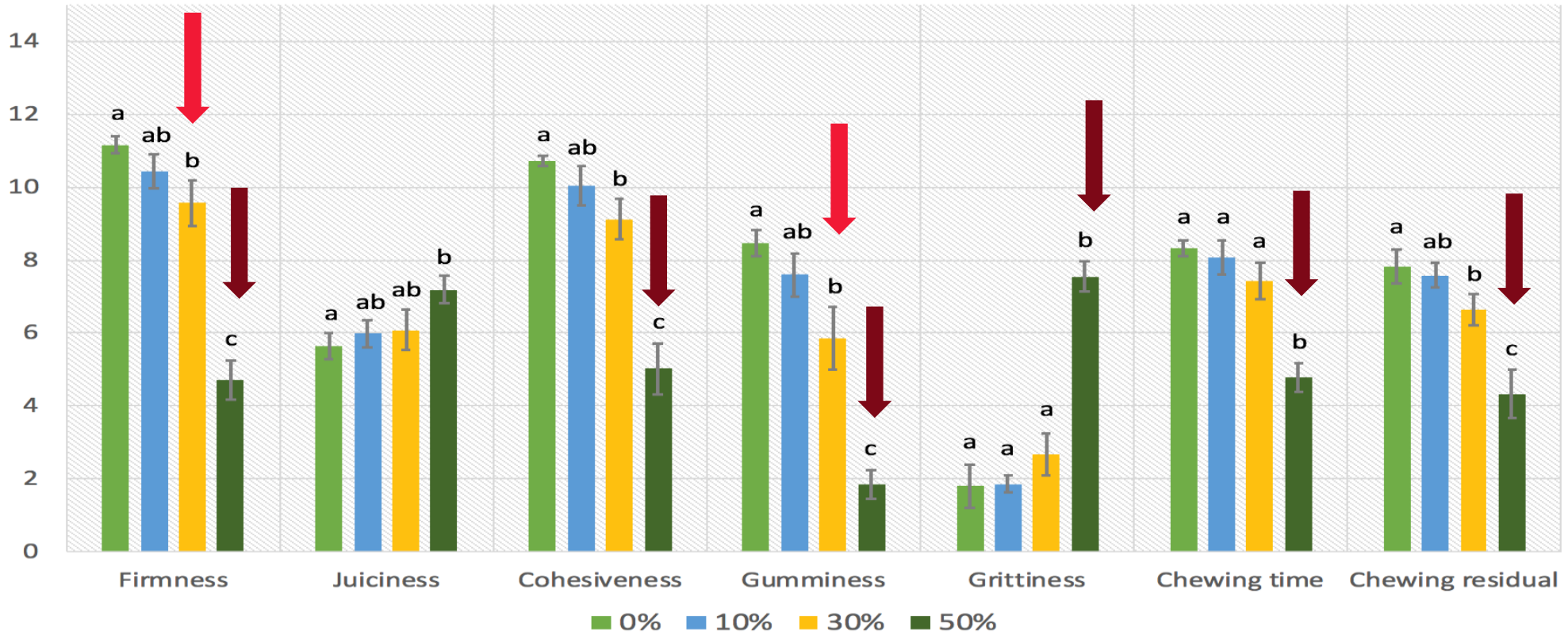




DANISH TECHNOLOGICAL INSTITUTE

10% : No significant difference changes
30% : Slightly decreased firmness and gumminess, increased grittiness, especially in pea-potato
50% : Large significant difference changes in all texture attributes

A) 0-50% pea protein



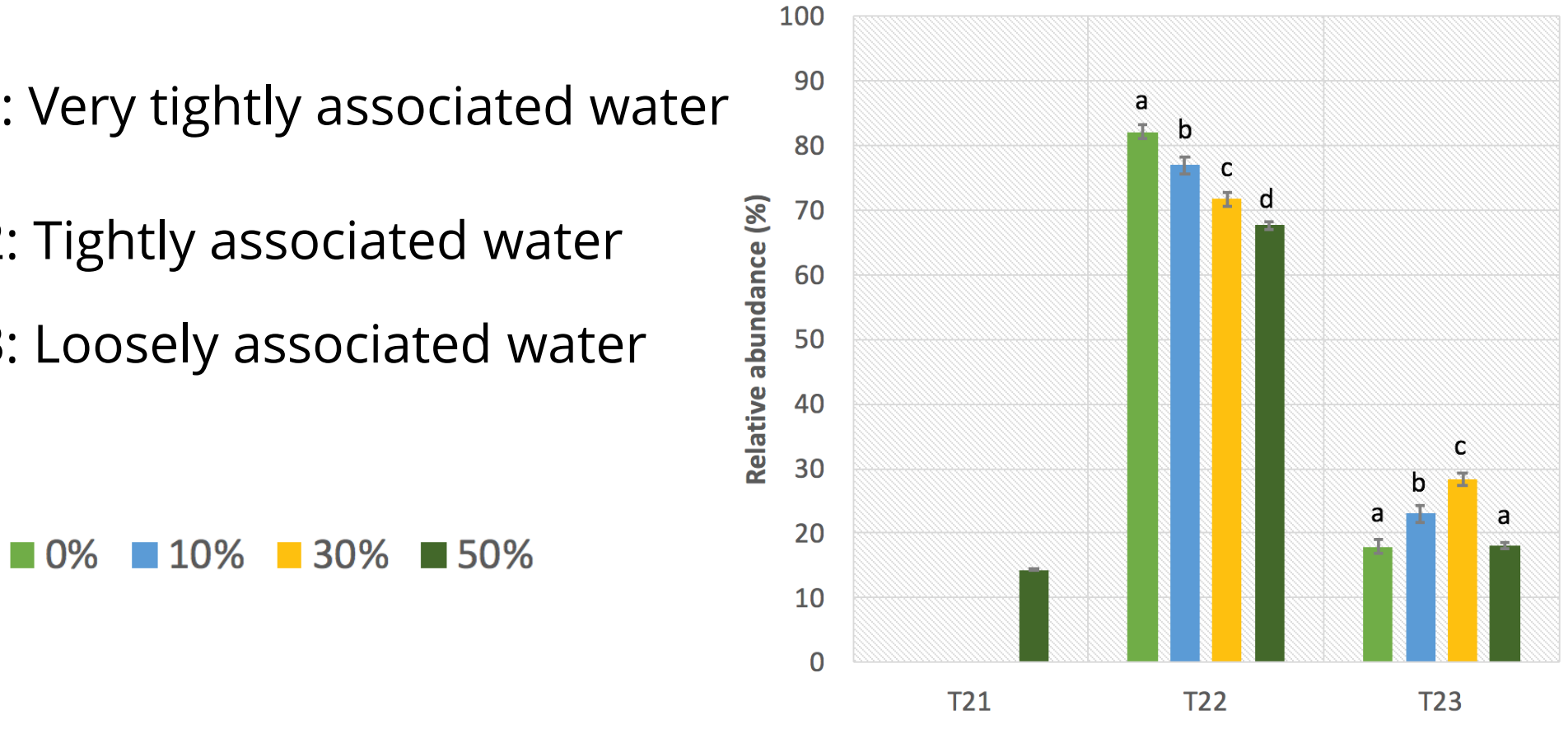
DANISH TECHNOLOGICAL INSTITUTE

LF-NMR assessing how tight the water is bound in the product

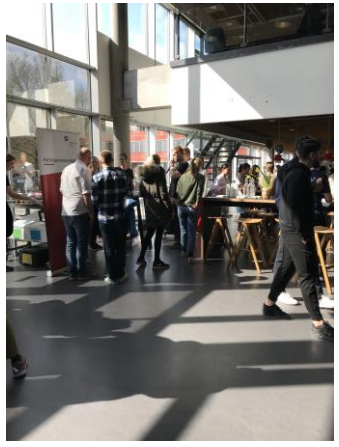
T21: Very tightly associated water

T22: Tightly associated water

T23: Loosely associated water

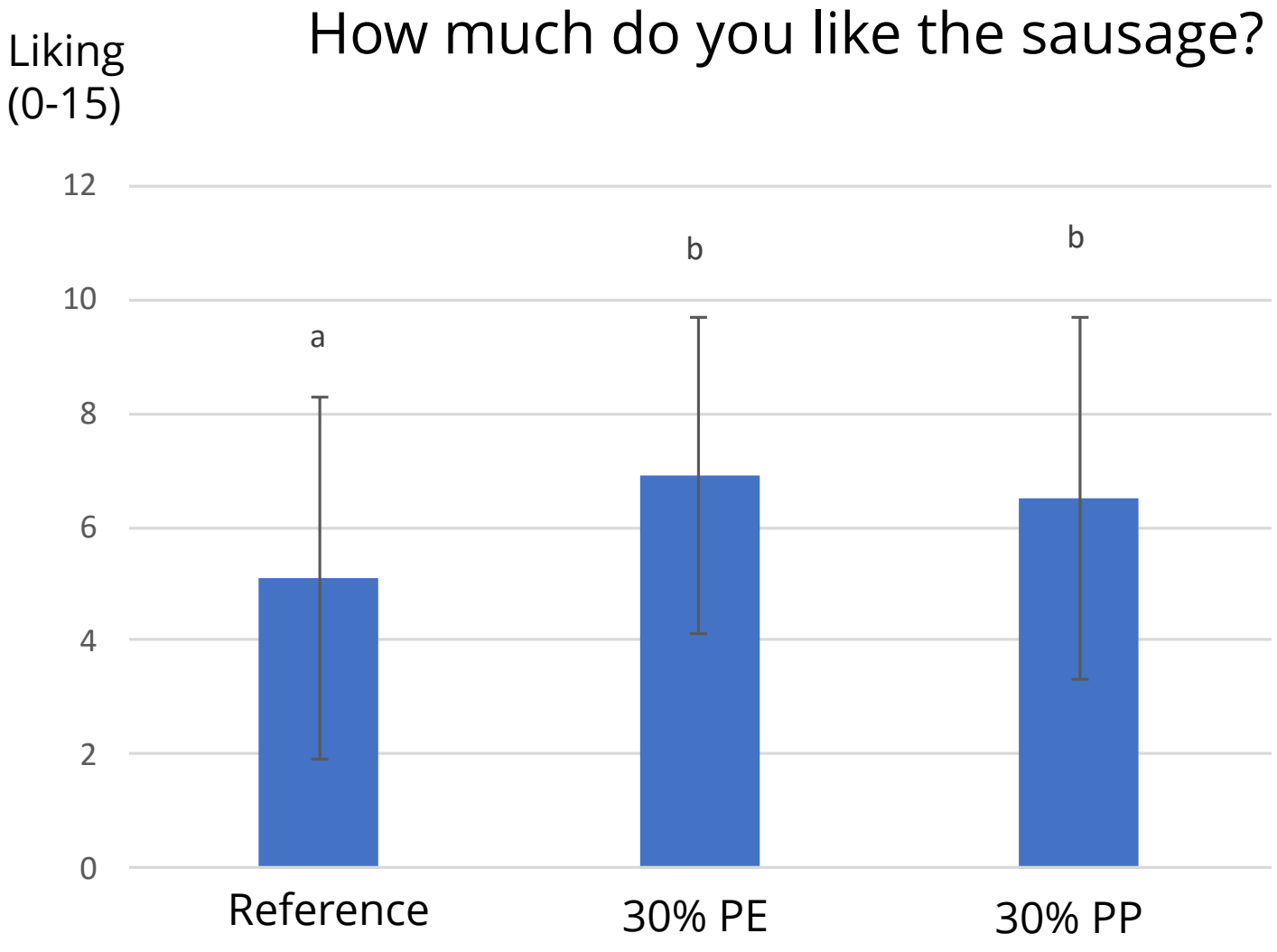


DANISH TECHNOLOGICAL INSTITUTE



N=42

Age 14-70 years, main part between 30 and 59 years



Can we optimize the quality further by changing the process?

30%, commercial texturized pea protein

1 (reference)

Minced meat

↓ ← Wet texturized pea protein — 2 (previous recipe)

Salt, water, spices

↓ ← Wet texturized pea protein — 3 (new recipe)

4 (like 3, but smoked fat)

Smoked fat → Fat, water

↓

Casings

↓ 10 min ↓ 20 min smoke

More gritty and less juicy than no. 2

Slight decrease in pea flavour

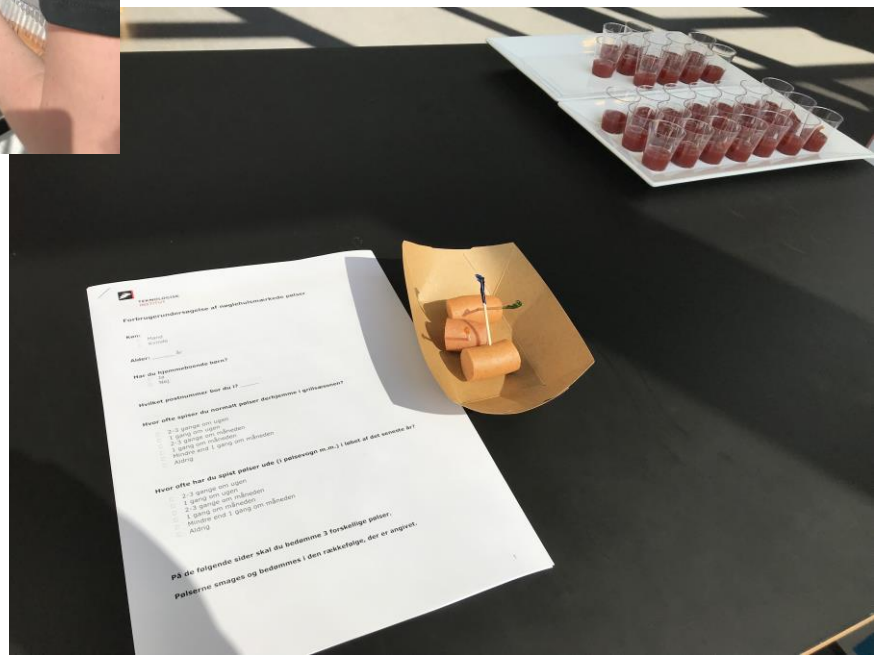
Preliminary results

DANISH TECHNOLOGICAL INSTITUTE

N=172, University College

Reference and Sausage 2 with and without information

In the sausage you are going to taste, a part of the meat is substituted with plant proteins – it is sustainable, and the sausage is of the same good quality as always



Liking	Male	Female
No information	5.7^{A}	4.9^{bB}
Information	5.6	5.8^{a}

DANISH TECHNOLOGICAL INSTITUTE

How to make the optimal process for pepperoni with pea protein

Two processes:

1) Dry texturized pea protein

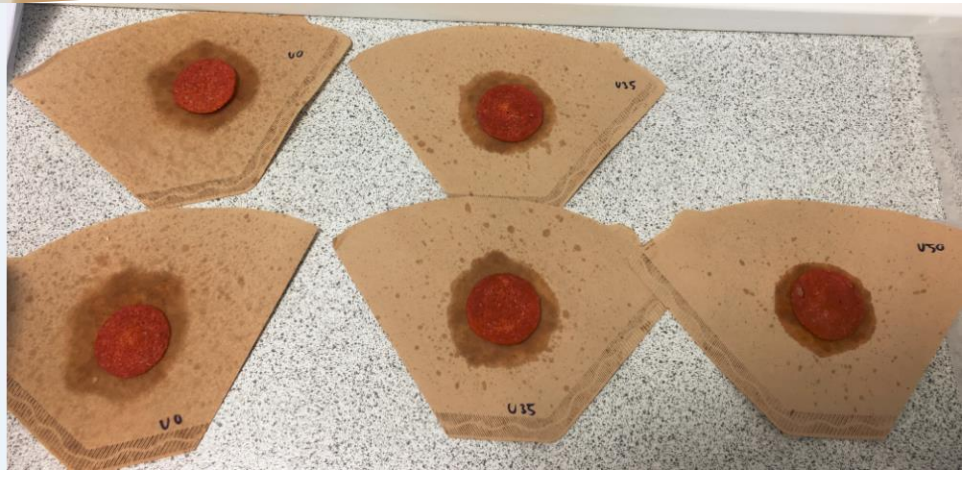
2) Texturized pea protein + water

35% and 50% pea protein

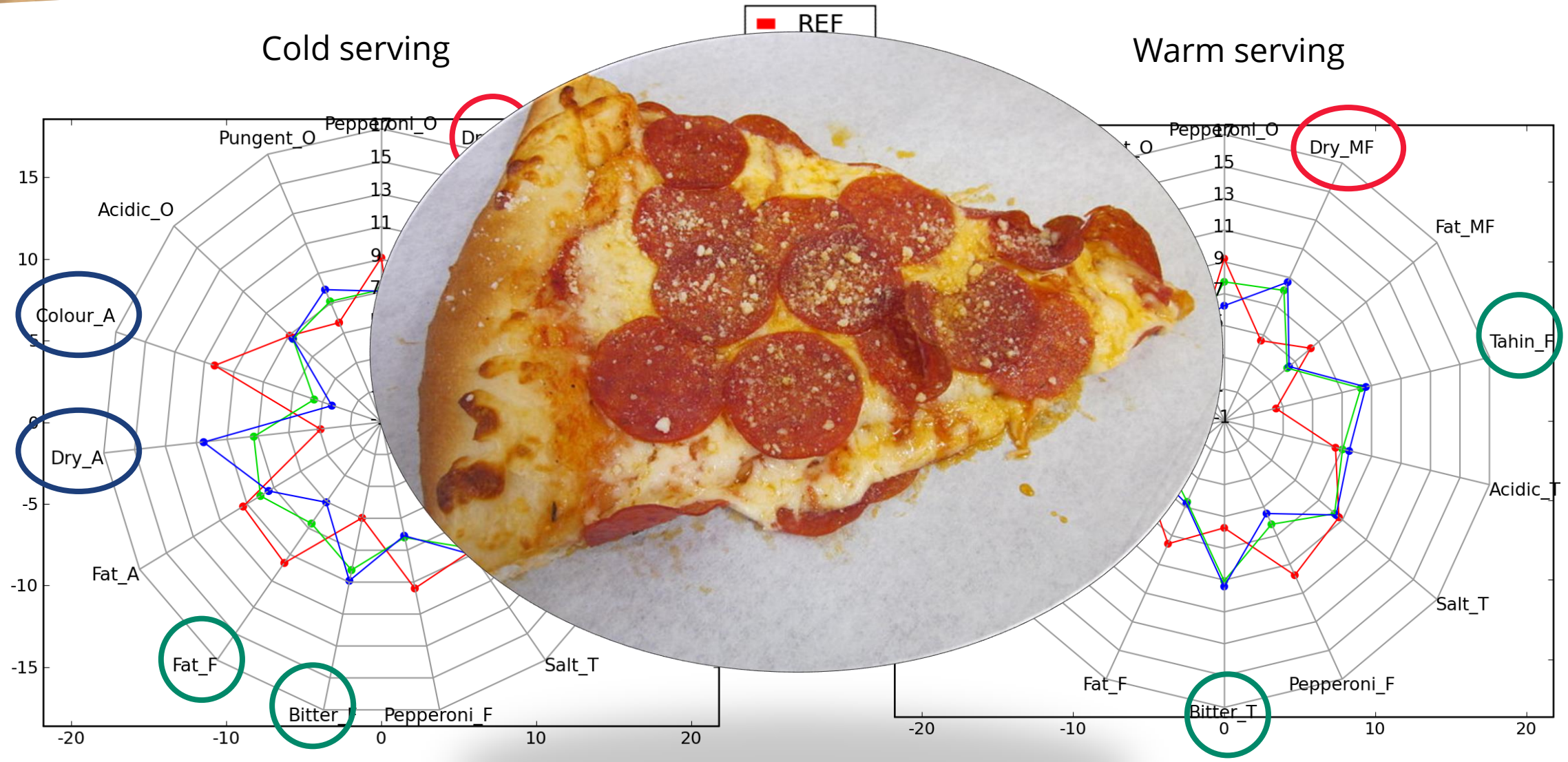
Ref 1 **1:35% pea protein** **1:20% pea protein** **2:20% pea protein** **Ref 2**

35% 2 was not finished when the photo was taken

DANISH
TECHNOLOGICAL
INSTITUTE



DANISH
TECHNOLOGICAL
INSTITUTE

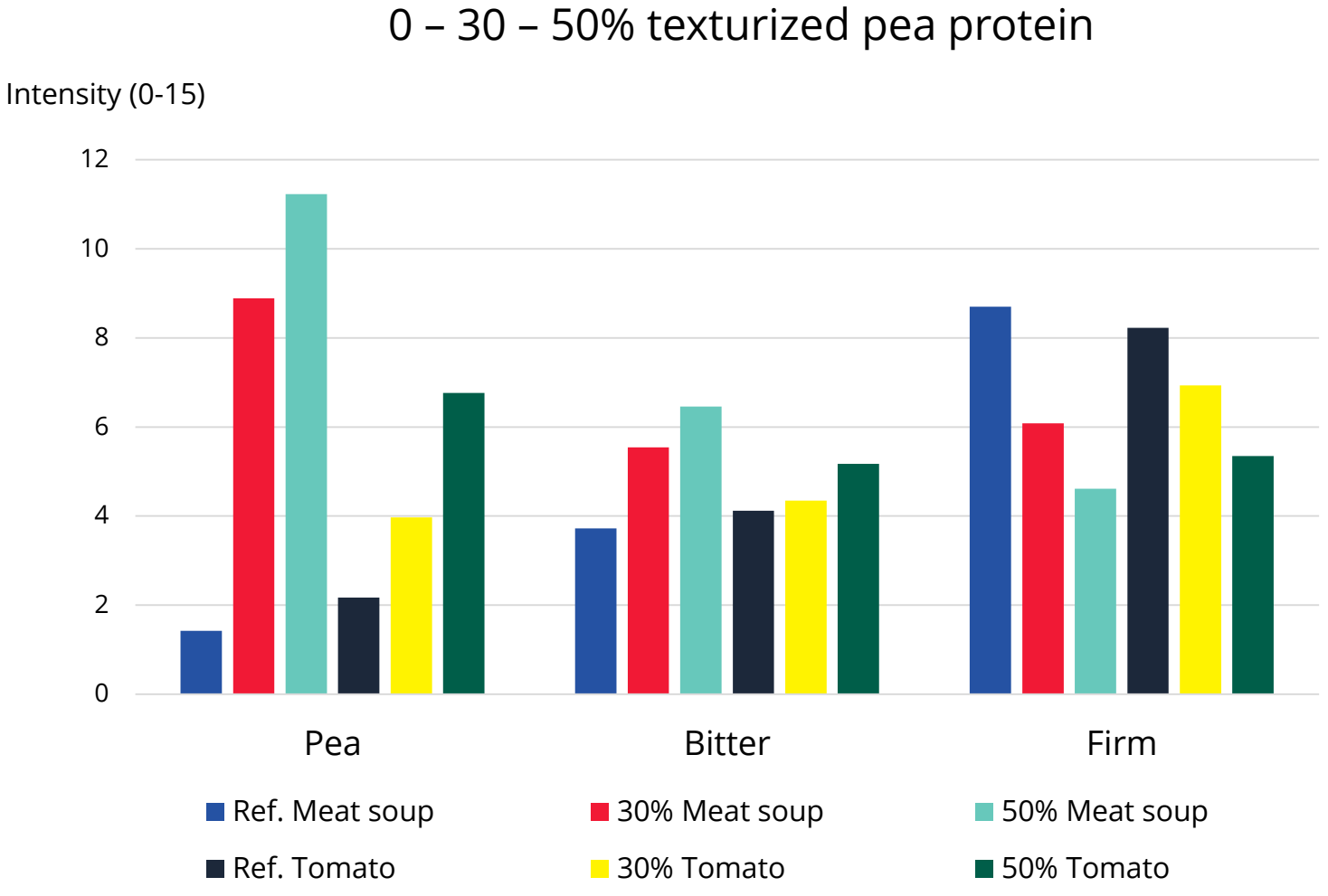


DANISH TECHNOLOGICAL INSTITUTE

Can the pea flavour and the bitter taste be masked?

No – we could not mask anything

DANISH TECHNOLOGICAL INSTITUTE



DANISH TECHNOLOGICAL INSTITUTE

Conclusion

Can we substitute meat protein with texturized plant protein to get well-tasting sustainable meat products?

Addition of texturized pea protein to meat products is possible up to 30%

50% will compromise the eating quality – but can be acceptable in meat balls for tomato soups

Texture is the most challenging attribute

Taste (bitterness) and flavour (pea or tahin) can be masked or partly masked using smoke and serving in a meal

Sustainability still needs to be investigated

Other texturized plant proteins need to be investigated

DANISH TECHNOLOGICAL INSTITUTE

Thank you to

AM nutrition and KMC for protein
Nisco for texturized protein

The Pig Levy Fund for grant

Troels

Louise

Ursula

Mille

Sofie

Linea

Jens

Jonna

Camilla

Astrid

Lotte

Chemical laboratorium

Jesper

Simone

Sensory laboratorium