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

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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 Commission, 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
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:
100% beef

Ingredients: Minced pork

Ingredients or vegetables?
Fat content!
Allergenic ingredients!

<table>
<thead>
<tr>
<th></th>
<th>Energy (kJ)</th>
<th>Fat (g)</th>
<th>Saturated fatty acids (g)</th>
<th>Carbonhydrates (g)</th>
<th>Protein (g)</th>
<th>Salt (g)</th>
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<tr>
<td>Per 100 g</td>
<td></td>
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<tr>
<td>Plant-based mince, pea</td>
<td>880</td>
<td>11</td>
<td>7.9</td>
<td>9.6</td>
<td>18</td>
<td>1.3</td>
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<tr>
<td>Plant-based mince, soy</td>
<td>814</td>
<td>10</td>
<td>8</td>
<td>6.2</td>
<td>18</td>
<td>1.2</td>
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<tr>
<td>Minced beef</td>
<td>712</td>
<td>10</td>
<td>4.1</td>
<td>0.5</td>
<td>19</td>
<td>0.17</td>
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<tr>
<td>Minced pork</td>
<td>783</td>
<td>12</td>
<td>4.3</td>
<td>0.5</td>
<td>20</td>
<td>0.19</td>
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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.
80’s
CHEAP

00’s
HIGH MEAT CONTENT

Today
SUSTAINABLE

Cheating

Doing the right thing
Optimizing the texture

‘Home-made’ texturized proteins

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

± 10 min smoke

Fat < 10%
Salt < 2%
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
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
Liking (0-15)  How much do you like the sausage?

Reference  30% PE  30% PP

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

Minced meat

Salt, water, spices

Fat, water

Casings

1 (reference)

Wet texturized pea protein

2 (previous recipe)

Wet texturized pea protein

3 (new recipe)

Smoked fat

4 (like 3, but smoked fat)

Preliminary results

10 min smoke

20 min smoke

More gritty and less juicy than no. 2

Slight decrease in pea flavour

30%, commercial texturized pea protein

Wet texturized pea protein

Wet texturized pea protein
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.

<table>
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<tr>
<th>liking</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td>No information</td>
<td>$5.7^A$</td>
<td>$4.9^{bB}$</td>
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<tr>
<td>Information</td>
<td>5.6</td>
<td>5.8$^a$</td>
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</table>
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
Can the pea flavour and the bitter taste be masked?

No – we could not mask anything
0 – 30 – 50% texturized pea protein

Intensity (0-15)

Pea
- Ref. Meat soup
- 30% Meat soup
- 50% Meat soup
- Ref. Tomato
- 30% Tomato
- 50% Tomato

Bitter
- Ref. Meat soup
- 30% Meat soup
- 50% Meat soup
- Ref. Tomato
- 30% Tomato
- 50% Tomato

Firm
- Ref. Meat soup
- 30% Meat soup
- 50% Meat soup
- Ref. Tomato
- 30% Tomato
- 50% Tomato
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
Thank you to The Pig Levy Fund for grant

AM nutrition and KMC for protein
Nisco for texturized protein

The Pig Levy Fund for grant

Mille
Sofie
Linea
Astrid
Lotte
Jesper
Simone

Ursula
Troels
Louise
Jens
Jonna
Camilla

Chemical laboratorium
Sensory laboratorium