From field to fork: Opportunities and challenges of plant food value chain and plant-derived foods in Norway

Nofima

RISE

Virkemidler for Omstilling av Matsystemet

Framtidens matsystem - hvordan går vi i riktig retning?
Oslo, 29. - 30. oktober 2025

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Virkemidler for omstilling av matsystemet (VOM)

WP3: Verdiskaping og nye muligheter

for plantebasert mat i Norge

Virkemidler for Omstilling av Matsystemet

Task 1: Sensorisk kartlegging av eksisterende produkter og forbrukeraksept

Smakens rolle i å sikre aksept, endrede forbrukerpreferanser og ytelsen til dagens norske plantebaserte produkter.

Task 2: Læring fra utlandet

Identifisere suksessfaktorer og insentiver i vellykkede norske plantebaserte produkter.

Muligheter og utfordringer for norske plantebaserte matprodusenter.

Task 3: Fremtidige plantebaserte muligheter

Muligheter og barrierer for økt innovasjon innen plantebasert mat, basert på norske råvarer.

Fokus på videreforedling av norske grønnsaker.

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Fra norske grønnsaker til bærekraftige ingredienser og produkter

- barrierer og muligheter for økt innovasjon og verdiskaping

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Mat og Helse

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Innovasjon

Virkemidler for Omstilling av Matsystemet

Fortsatt spiser vi langt fra 5 (8) om dagen

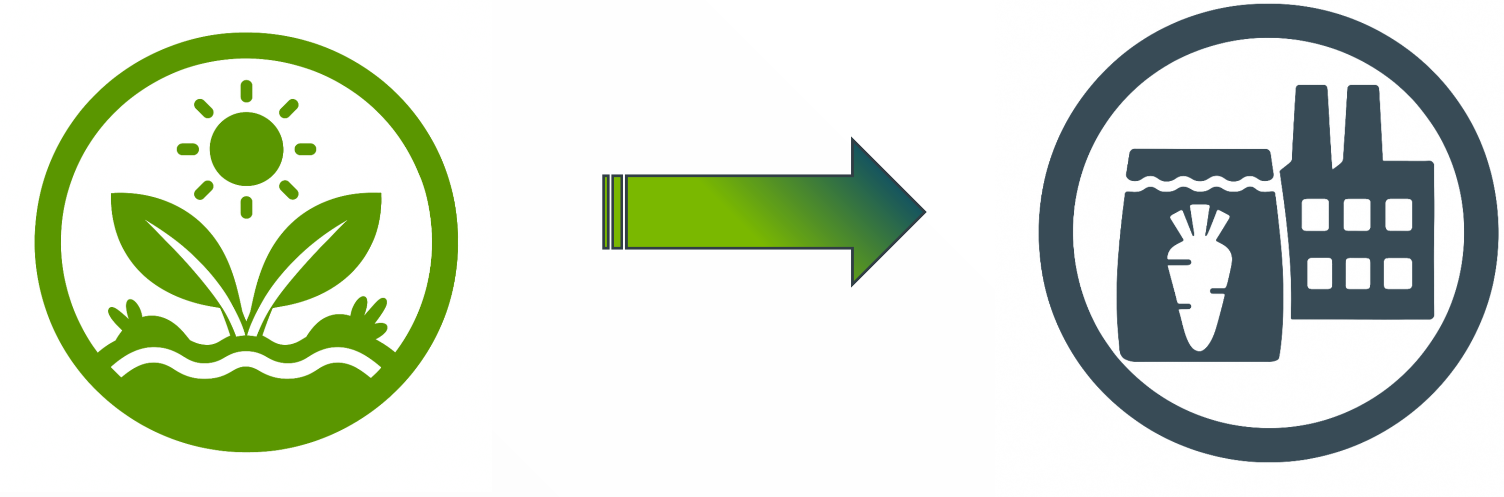
– ***grønnsaker*** *må ta en større plass*

"ikke bare som tilbehør"

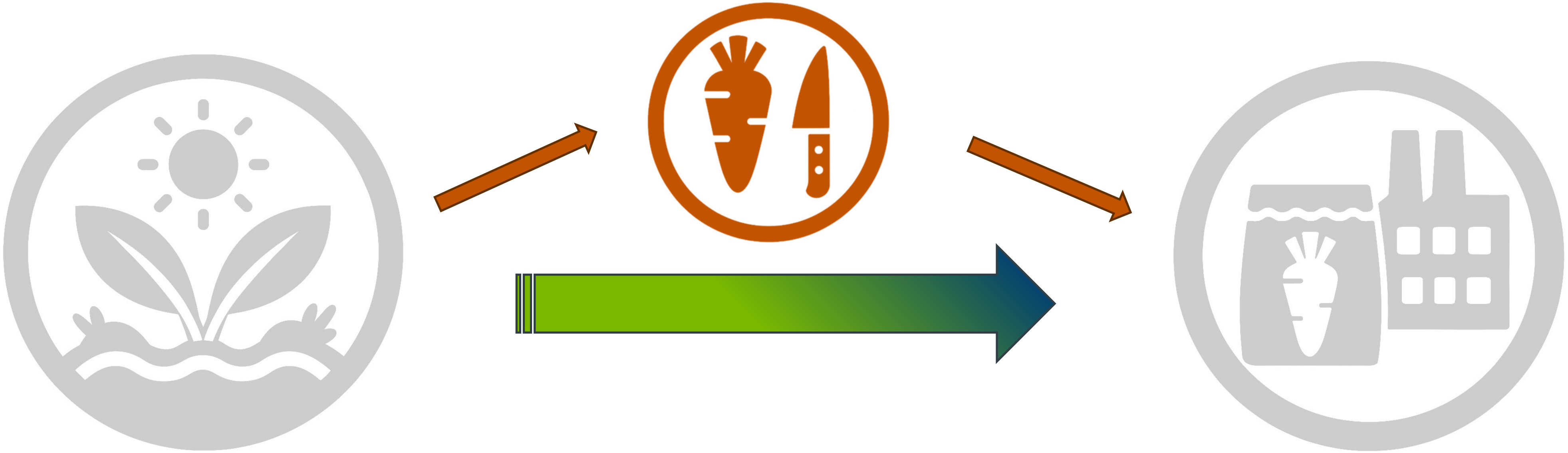
Figur fra: https://www.helsenorge.no/kosthold-og-ernaring/slik-setter-du-sammen-et-sunt-kosthold/

Bakgrunn

- Produktutvikling og innovasjon
- Matprodusenter trenger ulike typer **råvarer og ingredienser** til plantebaserte produkter
- **Norske råvarer og produkter** er ønsket av forbruker



Barrierer



Hypotese:

Aktører som **videreforedler grønnsaker** til ulike **ingredienser** mangler – eller er ikke integrert i verdikjeden

Intervjuer med primærprodusenter

WP3 – Verdiskaping og nye muligheter

- **Spørsmål til** 22 primærprodusenter av grønnsaker
  - Utført av Norsk Landbruksrådgiving i flere regioner i hele Norge 2024
  - En del av en større undersøkelse, der produsenter også ble spurt om videreforedling

– Bearbeider dere produktene deres i dag, eller har dere planer om å gjøre det selv, eller har dere kontakter som kan gjøre dette for dere?

- **Dybdeintervjuer**
  - Liten og medium store produsenter av både frilands- og veksthusgrønnsaker
  - Utført av Nofima februar 2024
  - Disse intervjuene hadde som mål å identifisere <u>barrierer og utfordringer som hindrer økt salg av norske grønnsaker til bruk i prosesserte plantebaserte produkter</u>.

Hovedutfordringer

Resultater fra intervjuer om videreforedling

Primærprodusenter (bønder):

- Fokus på dyrking, lite videreforedling
- Overproduksjon og svinn ved høy etterspørsel
- Svinn under lagring + utfordringer med utsortering (lagring, transport etc)
- Høy risiko og kostnader ved investering i ny infrastruktur

Primærprodusenter som også videreforedler:

- Liten kapasitet utover egen produksjon
- Sesongbaserte, gårdsproduksjoner og utsalg lokalt
- Konkurranse med import, pris
- Pakkerier og grossister videreforedler i noen grad, men i liten grad «halvfabrikata»

Matindustri:

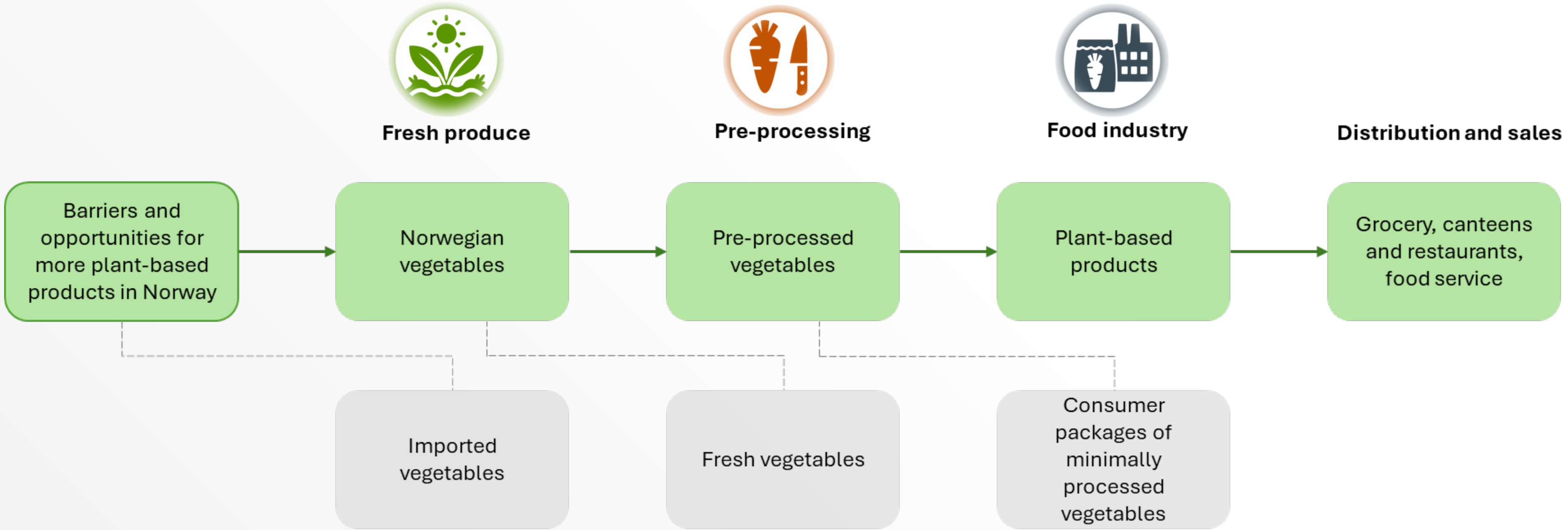
- Ønsker store volum, jevn tilgang av ingredienser / halvfabrikata
- Bruker lite grønnsaker direkte fra norske bønder
- Ofte import (halvfabrikata ingredienser)

Foto: Grethe Borge @Nofima

Hovedutfordringer - oppsummert

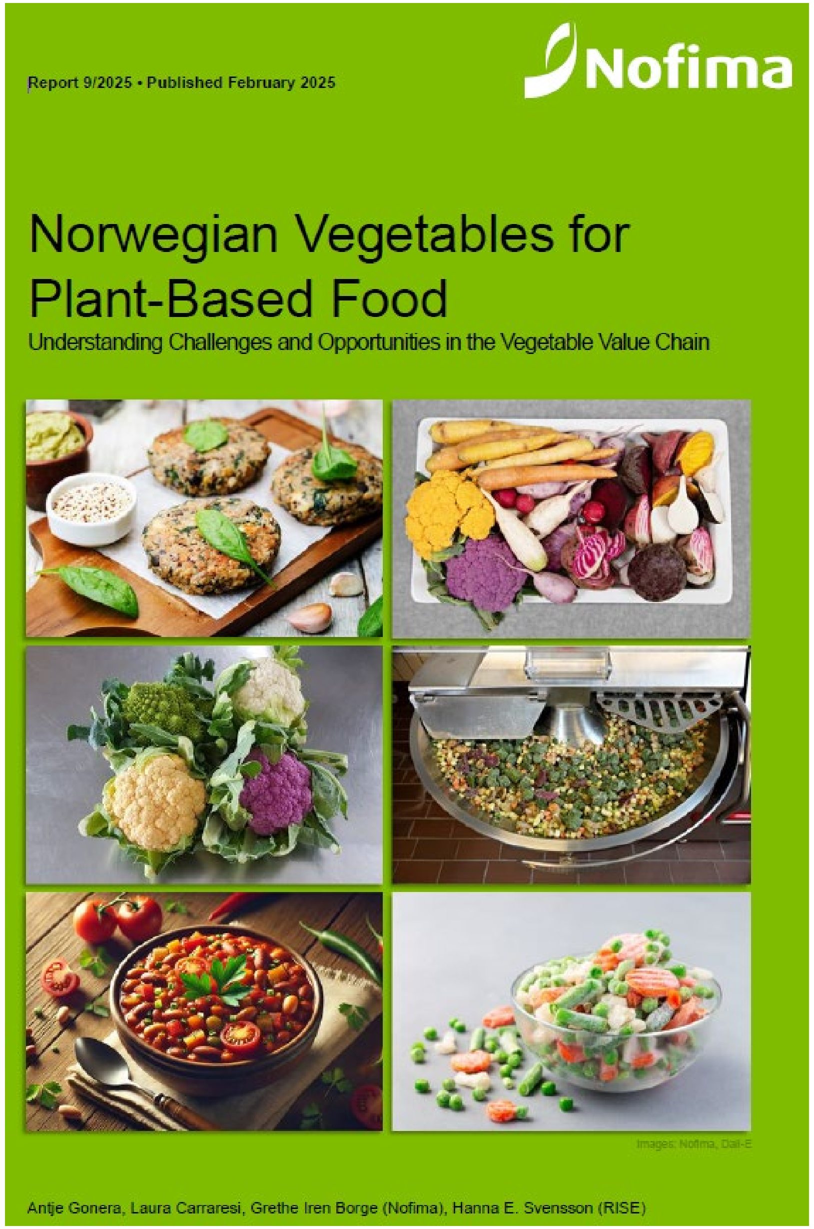
– Resultater fra intervjuer om videreforedling av norske grønnsaker (til ingredienser)

- ❑ Begrenset kapasitet og høy risiko hemmer verdiskaping
- ❑ Strukturelle og markedsmessige barrierer hindrer vekst



Muligheter og anbefalinger

– for økt innovasjon og vekst innen plantebasert mat



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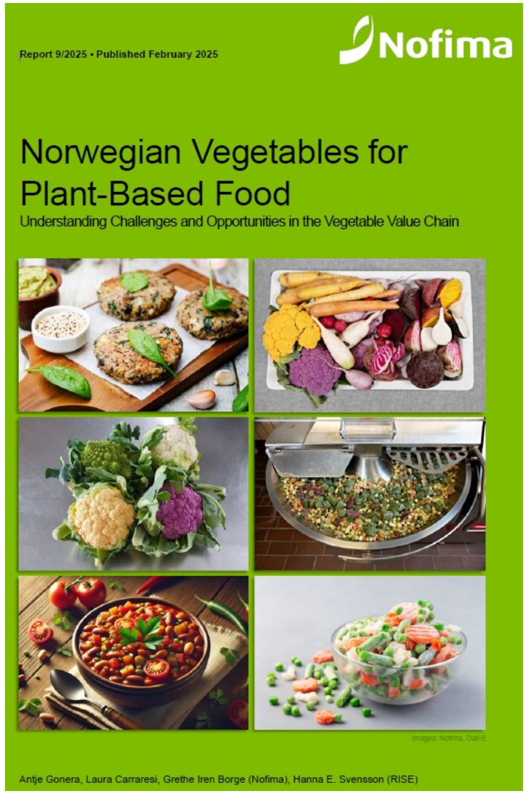
Muligheter og anbefalinger

– for økt innovasjon og vekst innen plantebasert mat

1. **Øke pre-prosessering og videreforedling av grønnsaker i Norge**
   Flere norske aktører som kan videreforedle grønnsaker av ulik kvalitet inkl. overskudd/sidestrømmer.
2. **Øke etterspørselen** av bearbeidede grønnsaker gjennom utvikling av flere smakfulle produkter.
3. **Insentiver til produsenter** for økt bruk/salg av overskudd og svinn til mat i stedet for dyrefór/kompost.
4. **Strategiske investeringer og innovasjon** i prosessering, distribusjon og forbrukerkommunikasjon.

Øke videreforedling av grønnsaker for økt norskandel i plantebasert mat



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Opportunities and challenges of plant food value chain in Norway and abroad


Laura Carraresi


Antje Gonera


Grethe Iren Borge


Hanna E. Svensson

The plant-based food segment

- On the market for several years, but **not exploding**
- **Weak and incremental innovation** only on behalf of large companies
- No big changes in extant business models
- Food system is **traditional**
- **Opposition** from the industry
- Support from **small consumer clusters**
- Developed by **small-scale firms**, struggling with entry barriers

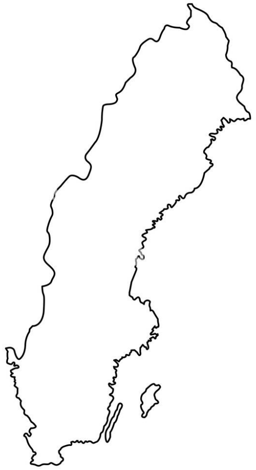
Learning from abroad

- Exploring the **plant-based food market** outside Norway
- 10 small-scale plant-based agri-food firms located in **Northern Europe** (Germany, Sweden, Denmark) have been selected
- Several types of products: meat replacers, tempeh, dairy alternatives grain mix, vegan food, plan-based texturized proteins









Challenges and possible solutions for the SMEs in the plant-based food sector

1. Insufficient knowledge on product development

1. How do they solve it?:

- Research institutions (SMEs)
- Local network and chefs
- Testing
- Niche segment releases

2. Tough competition and hard market conditions

2. How do they solve it?:

- Mutually beneficial alliances with other, often competing firms
- **Why?**: Expand network, create exposure, and share facilities (mEs)
- **Why?**: Create a common front (SMEs)

3. Consumer habits

3. How do they solve it?:

- Familiar flavors and textures
- Imitate and replicate (SMEs)
- Mimic (mEs)

4. Established business norms

4. How do they solve it?:

- Value chain overview
- Local ingredients
- Open communication and encouraging stakeholders
- Good work environment

Young and micro-sized companies struggling with **access to capital, missing knowledge and raw material availability**

More mature and medium-sized companies struggling with **expanding to wider consumer segments**

Plant-based food in Norway

- Exploring the opportunities and challenges in scaling up production of **plant-based food** in Norway
- 11 Norwegian companies
- Fresh fruit and vegetable importer and pre-processing of legumes, large- and small-scale traditional food producers, retail, food service.

Challenges related to plant-based Norwegian raw materials across the value chain

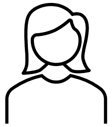
Food pre-processing **Food Production**

- ✓Complicated production chain, **missing capacity to refine ingredients** from the farmers to the food industry
- ✓**High risk investing in new technology**
- ✓**Teaching** the consumers how to **use and handle new raw materials.**
- ✓**Meet the demands from the retail distribution chain** on shelf-life
- ✓Make **new products work in the existing production lines**.

Food Service & Retail

- ✓Good **sensory** profile **throughout shelf life.**
- ✓The **consumers require new innovation**
- ✓**Difficult to get shelf space** unless you have a strong brand.

Consumer



- ✓**Consumers** who tested the first plant-based products may have **been scared away and do not want to try again**
- ✓Meat stands strong and **it is a threshold for many to try plant-based**.
- ✓Concerns about meat analogue products considered as **ultra processed**.
- ✓Consumers talk about sustainability but don't act accordingly.

Opportunities related to plant-based Norwegian raw materials across the value chain

Primary production

- ✓ **Bridge the gap between primary production and food processing** (dialogue and power balance)
- ✓ Stimulate **more cultivation for food production** rather than feed. Support of initiatives for Norwegian grown crops (i.e. peas, faba beans).

Food pre-processing / **Food Production**

- ✓ Increase **pre-processing facilites**
- ✓ Strengthen the **link between farmers and producers** to scale up primary production and processing
- ✓ **Shelf-life** improvement
- ✓ Develop **tasteful products**

Food Service & Retail

- ✓ Good **sensory** profile **throughout shelf life.**
- ✓ **Showcase** vegetables and plant-based products so they become the default choices.
- ✓ **Origin labels** to promote Norwegian raw materials.

Consumer

- ✓ **Increase consumer knowledge** about **how to use and prepare** vegetables and legumes.
- ✓ Convenient **product formats** that are easy to prepare
- ✓ **Targeted communication**

Is the grass greener on the other side? Bridging the sensory gap of plant-based alternatives

Paula Varela
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Professor, NMBU
Sensory & Consumer Sciences

Perceptual barriers to the green shift

Unfamiliarity,
lack of
knowledge

Habits,
tradition

Taste,
texture

LACK OF
TRUST

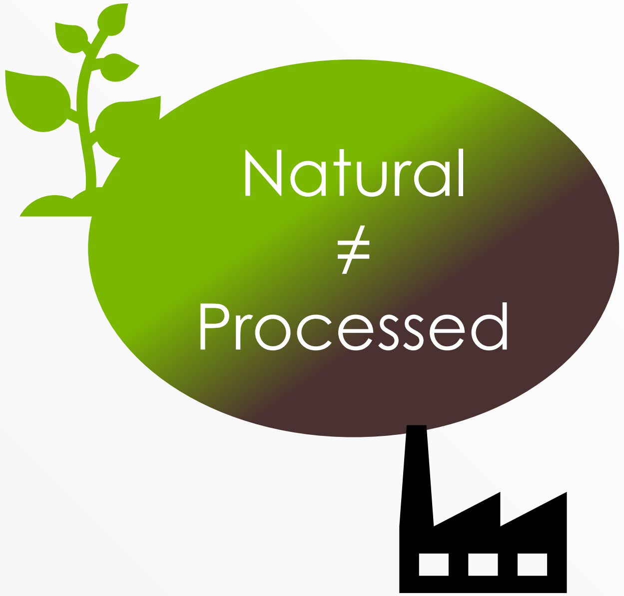
ELSEVIER

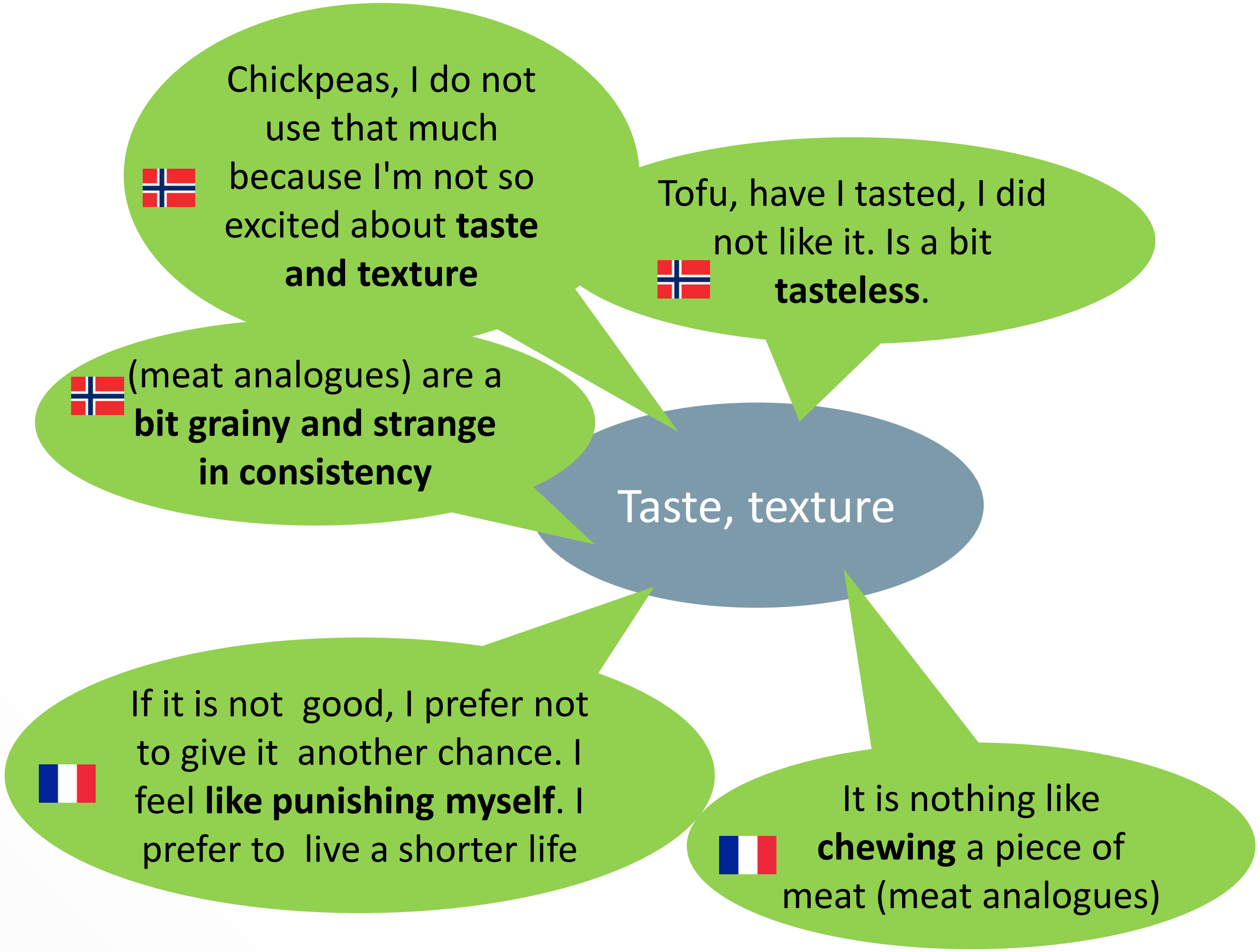
Appetite

Volume 169, 1 February 2022, 105793

Meat replacer? No thanks! The clash between naturalness and processing: An explorative study of the perception of plant-based foods

Paula Varela [a], Gaëlle Arvisenet [b], Antje Gonera [a], Kristine S. Myhrer [a], Viridiana Fifi [b], Dominique Valentin [b]





Virkemidler for Omstilling av Matsystemet

Bridging the sensory gap

Five **quantitative descriptive analyses (QDA)** smell, taste, and texture

Trained sensory panel (n=10)

Each sensory map included an **animal standard product**.

Five plant-based categories from the Norwegian market:

- Burgers (22 products)
- Milk analogues (28 products)
- Mince-meat analogues (12 products)
- Sausages (7 products)
- Chicken-bits analogues (3 products)

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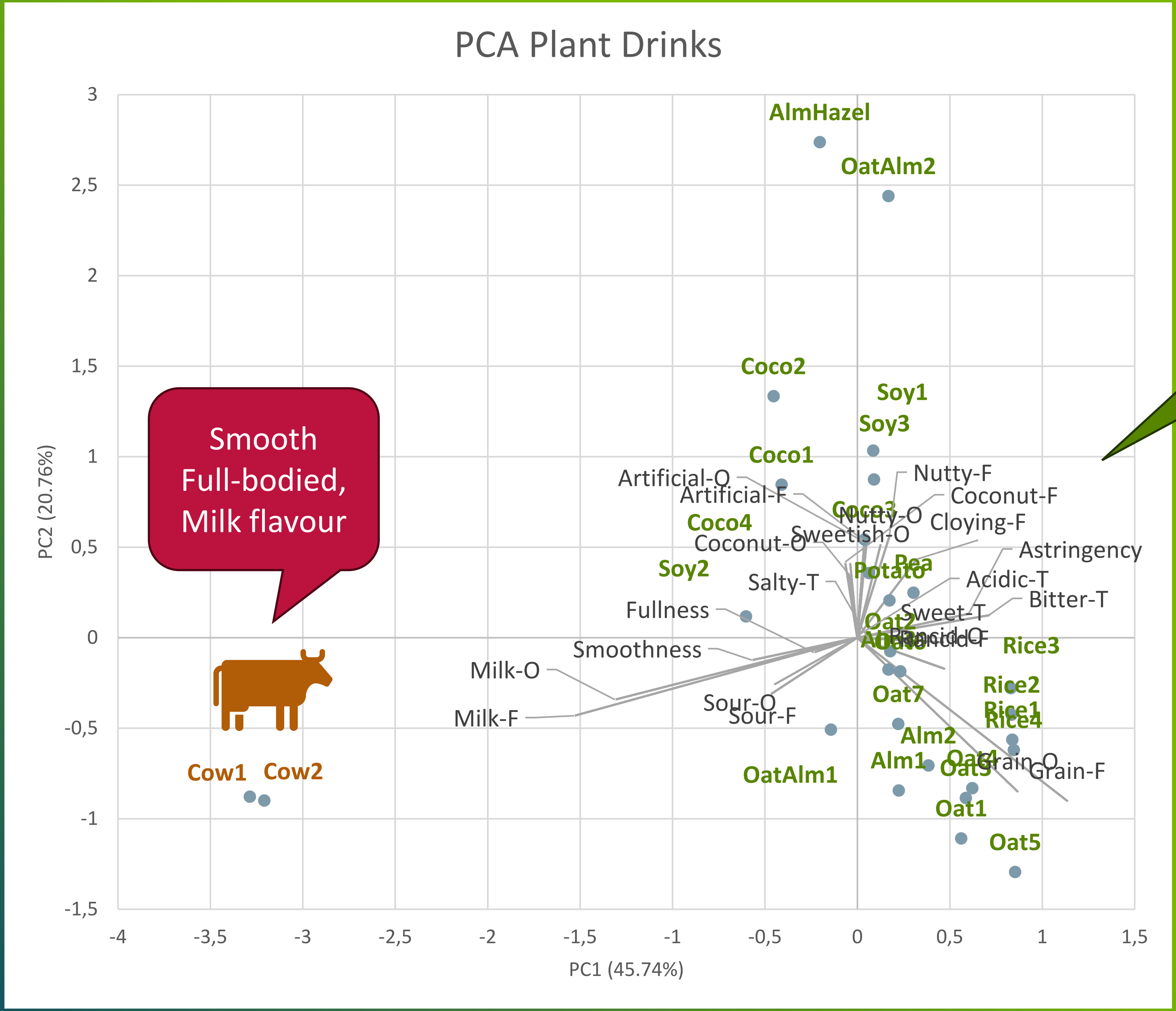
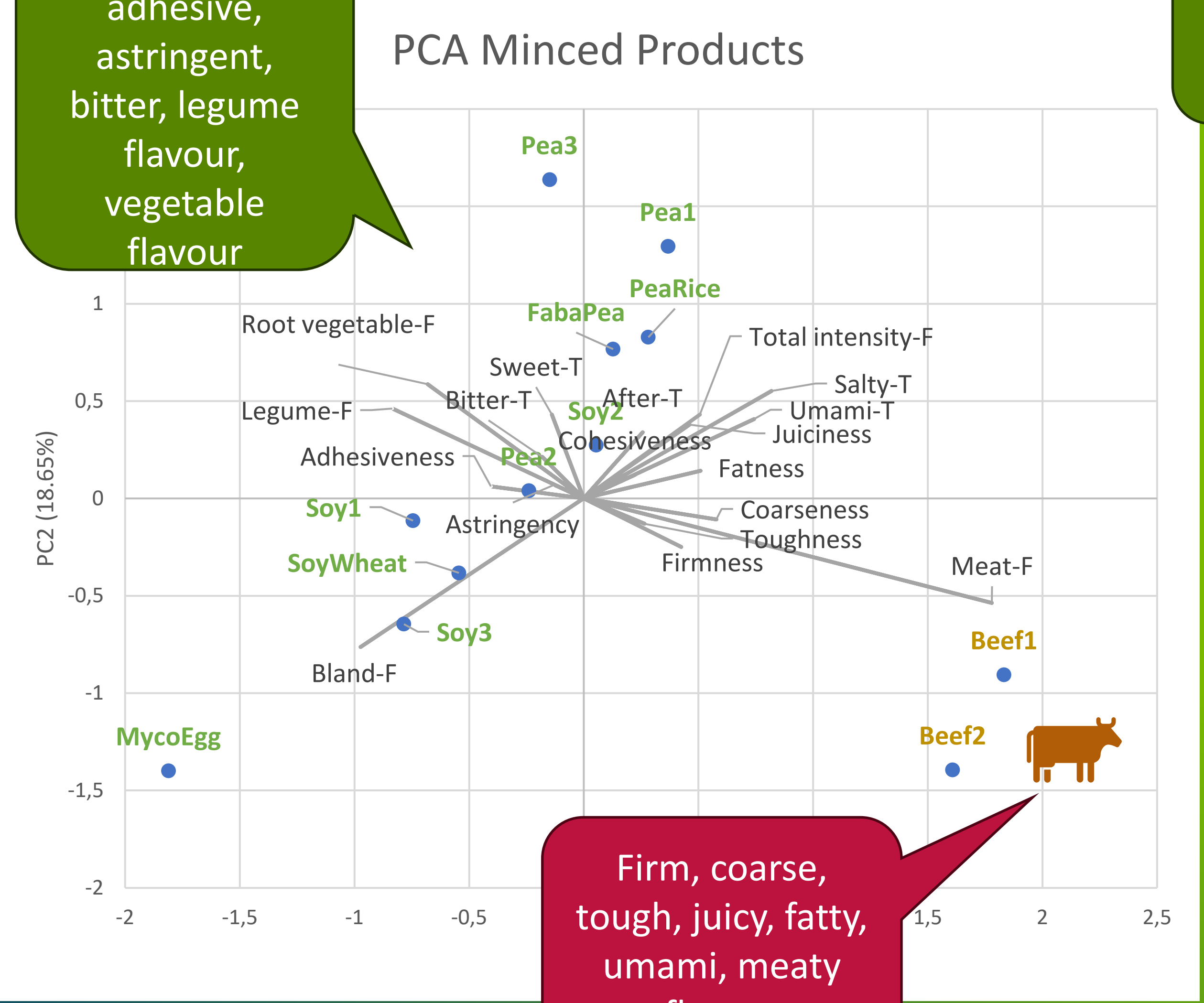


Astringent, nutty, cloying, grainy, drying, rough, thin, grain flavour, bitter, artificial

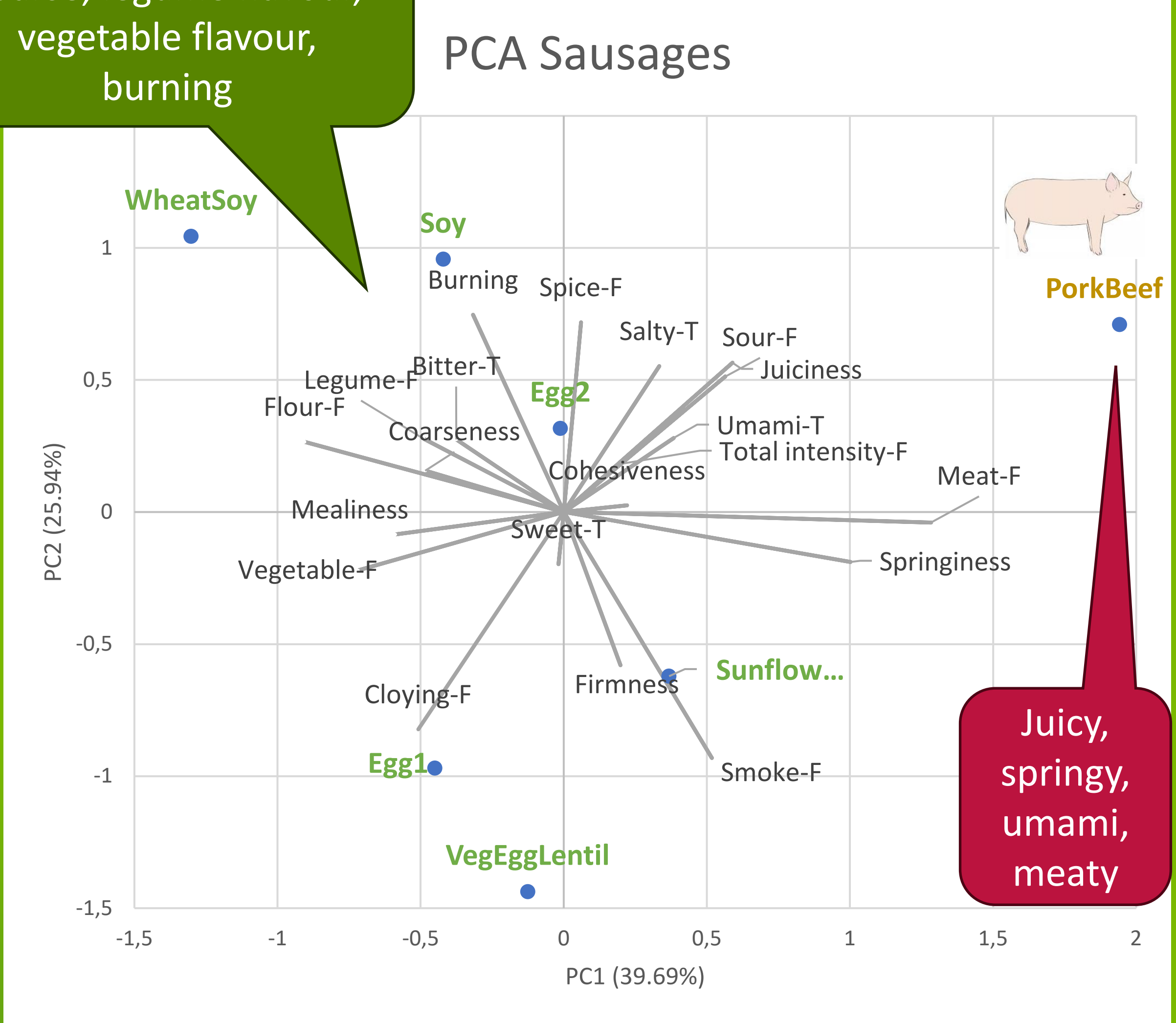
P Varela @ Nofima

Cohesive, adhesive, astringent, bitter, legume flavour, vegetable flavour



Firm, coarse, tough, juicy, fatty, umami, meaty flavour

Mealy, floury, cohesive, coarse, legume flavour, vegetable flavour, burning



Juicy, springy, umami, meaty

P Varela @ Nofima

Virkemidler for Omstilling av Matsystemet

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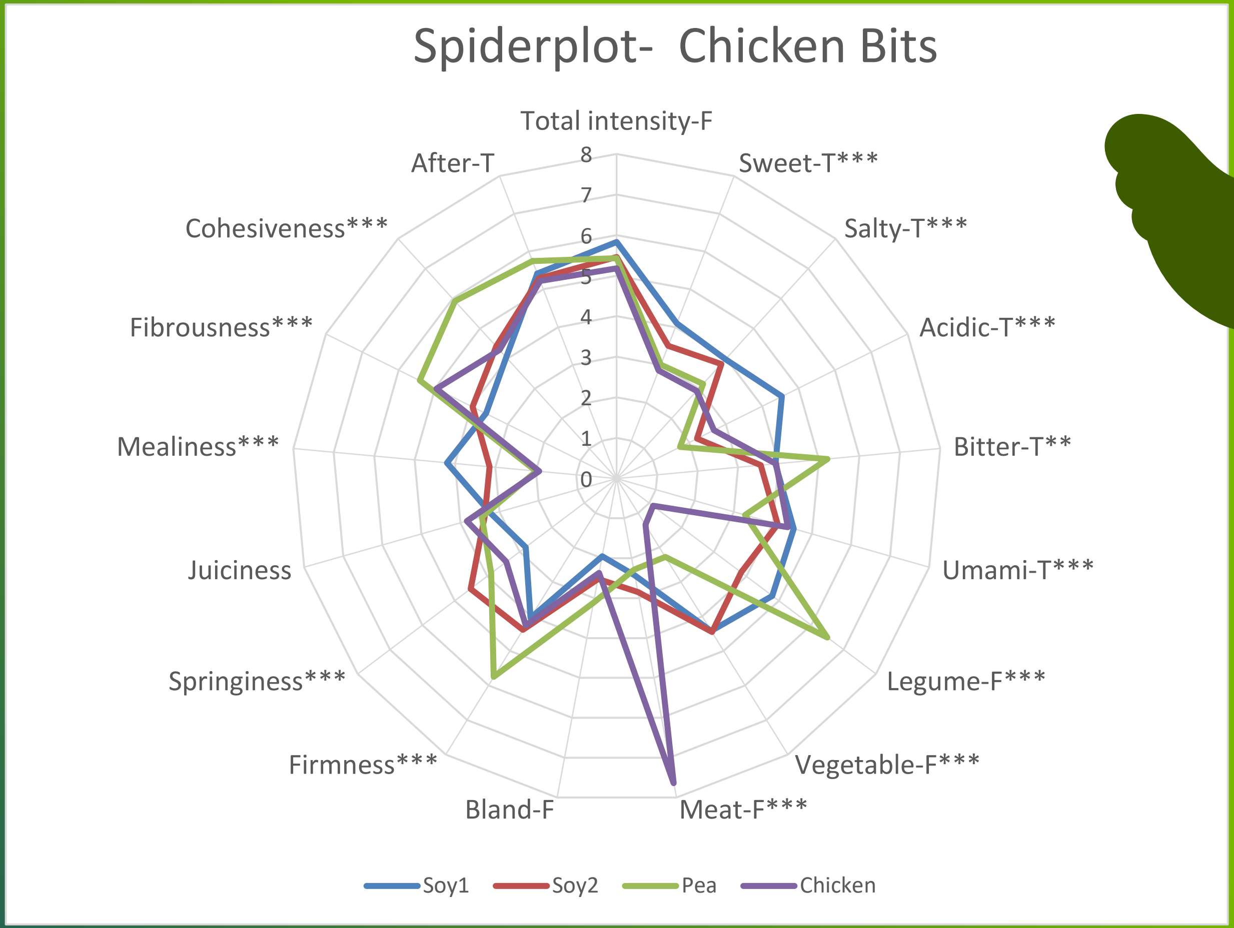
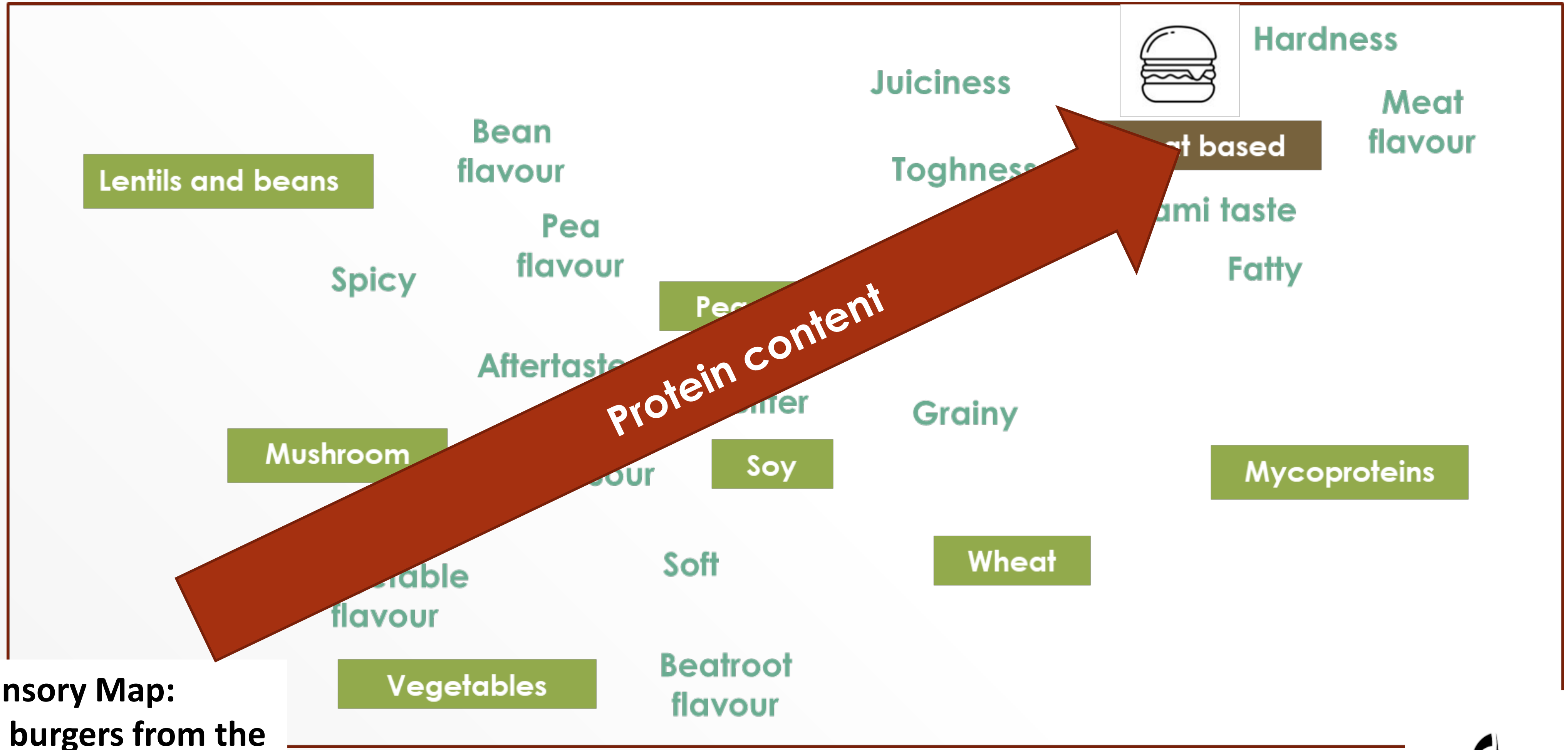

Spiderplot- Chicken Bits
Total intensity-F
Sweet-T***
Salty-T***
Acidic-T***
Bitter-T**
Umami-T***
Legume-F***
Vegetable-F***
Meat-F***
Bland-F
Firmness***
Springiness***
Juiciness
Mealiness***
Fibrousness***
Cohesiveness***
After-T
0
1
2
3
4
5
6
7
8
Soy1
Soy2
Pea
Chicken


«Tastes like chicken!»

Bridging the sensory gap



Sensory Map:
22 veggi burgers from the Norwegian market

Myhrer, Grini, Gonera & Varela, 2021

Nofima

P1.112, EUROSENSE 2022, TURKU, FINLAND

Nofima
Norwegian Institute of Food, Fisheries and Aquaculture Research

Faux or the next best? Taste, texture, nutrition, and consumer acceptance of veggie burgers vs. the real thing

S. Nersten, K. Myhrer, I.S. Grini, M.E. Pedersen, A. Gonera, P. Varela
Nofima, Norwegian Institute of Food, Fisheries and Aquaculture Research, N-1433 Ås, Norway
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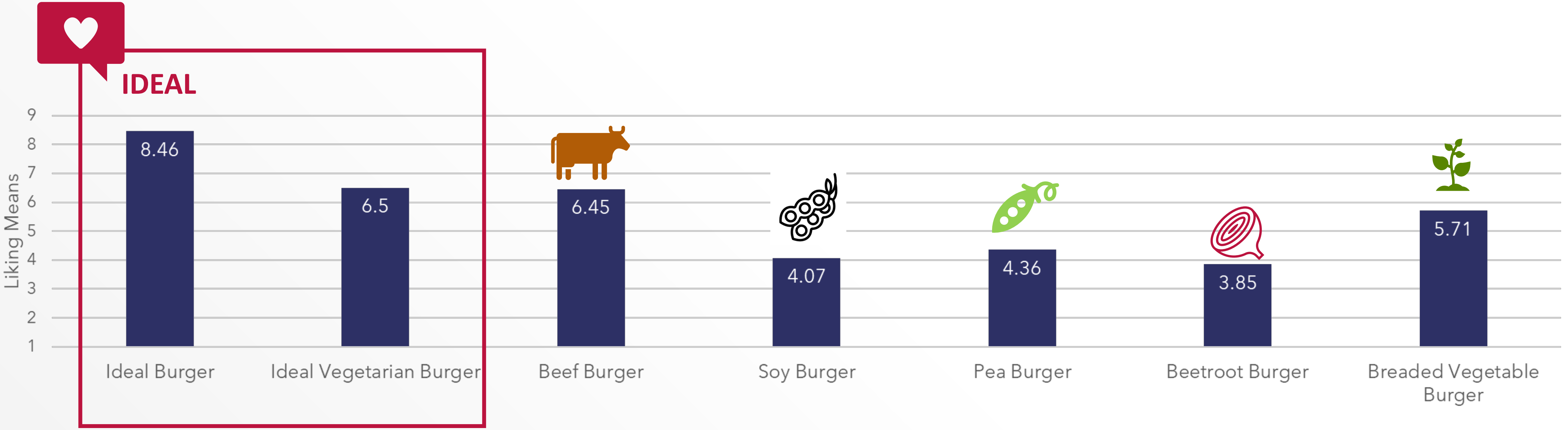
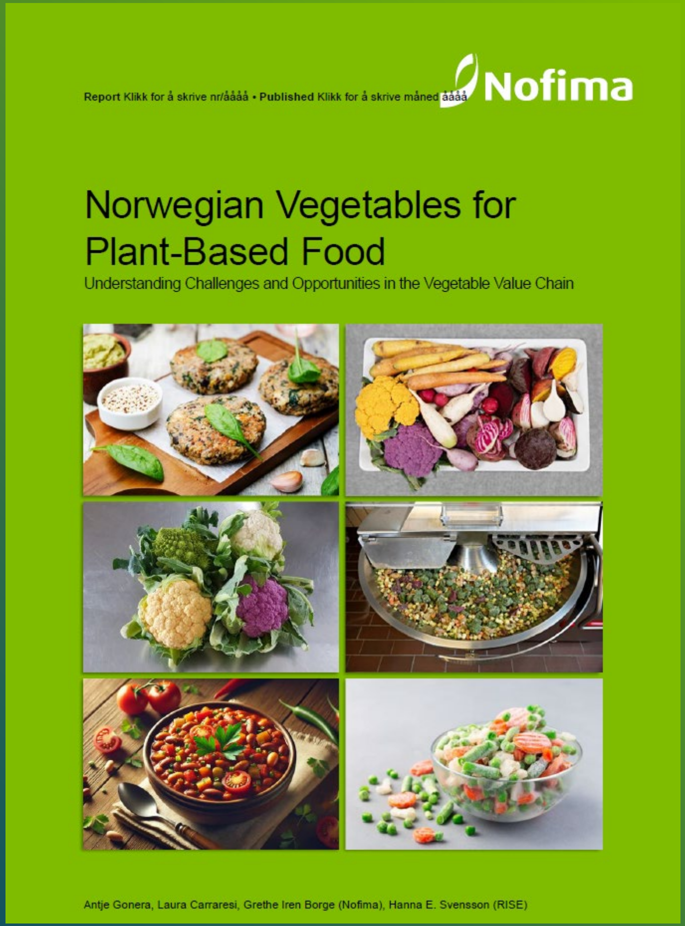
Consumer test

- n = 119 (50 % women, mean age = 31, non-vegetarians)
- 4 vegetarian burgers (soy, pea, beetroot, breaded vegetable) + 1 beef burger
- Ideal burger + Ideal vegetarian burger
- Liking - scale 1-9 (1 = dislike very much, 9 = like very much)
- Check-all-that-apply (CATA) - sensory and non-sensory attributes



CONCLUSIONS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Norwegian Vegetables for Plant-Based Food

Understanding Challenges and Opportunities in the Vegetable Value Chain

Antje Gonera, Laura Carraresi, Grethe Iren Borge (Nofima), Hanna E. Svensson (RISE)

Sensory takeaway

Notable sensory differences in taste and texture across all categories of plant-based products and their animal-based counterparts, hindering consumer acceptance.

Food processors challenges & opportunities

☹ Investment risks in new equipment and technology for a small and unpredictable market

☹ Continuous evaluation of better raw materials and new suppliers

☺ Strengthen the link between farmers and producers

Primary producers' challenges & opportunities

☹ Structural and market barriers are preventing growth of processed ingredients and products

☺ Increase processing of vegetables to raise the share of Norwegian ingredients in plant-based foods