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Alga and insect meal and their effect on monogastric animal meat quality

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Objectives

Replace soy as the main monogastric dietary protein source

- Identify alternative protein sources to be de-centrally & sustainably produced
  - Spirulina (*Arthrospira platensis;* **SP**) &
  - black soldier fly larvae (*Hermatia illucens;* **HI**)
- Assess the meat quality of pigs and broilers

Materials & Methods

Meat quality assessed by zootechnical, physico-chemical and sensory parameters

- Feeding trials from 50% to 100% soy (**C**) substitution with balanced amino acids
- Live & carcass weight, lean colour, lipid oxidation, fatty acid profile & water holding capacity monitored
- Sensory profiling of meat samples by trained sensory panel

Results

Pork (n=47)

- Moderate zootechnical and physico-chemical changes:
  - **HI** results in heavier carcasses than SP
  - **HI** leads to lower cooking loss
  - **HI** animals have higher pH after slaughter
- alternative products associated with stronger odour
  - **HI** products are juicier
  - **SP** products are slightly astringent
- alternative protein sources change fatty acid profile

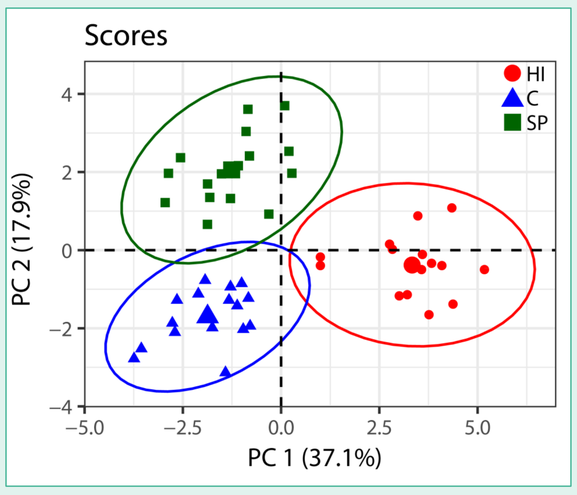

Fig 1: PCA containing ANOVA identified significant parameters

Table 1: Treatment group estimated marginal means (s.e.) for statistically significant physico-chemical and sensory parameters

	Carcass weight (kg)	Cooking loss (%)	pH (45min pm)	Overall odour (scale 1-100)	Juiciness (scale 1-100)	Astringency (scale 1-100)	SFA (%)	MUFA (%)	PUFA (%)
C	95.08^{ab} (1.17)	32.4^{a} (0.30)	6.08^{b} (0.05)	62.3^{b} (3.2)	20.5^{b} (4.3)	24.6^{b} (6.5)	39.75^{a} (0.45)	44.53^{a} (0.452)	15.72^{c} (0.35)
HI	97.99^{a} (1.21)	31.4^{b} (0.30)	6.21^{a} (0.05)	66.0^{a} (3.2)	25.6^{a} (4.3)	28.1^{ab} (6.5)	39.33^{ab} (0.42)	39.33^{c} (0.42)	21.87^{a} (0.32)
SP	93.11^{b} (1.17)	32.3^{a} (0.30)	6.00^{b} (0.05)	66.3^{a} (3.2)	21.4^{b} (4.3)	31.1^{a} (6.5)	38.43^{b} (0.40)	41.78^{b} (0.40)	19.79^{b} (0.31)

Broiler Chicken (n=36)

- Zootechnical and physico-chemical changes:
  - **HI** increased carcass and thigh weights
  - **HI** decreased pH 24hr pm
  - **SP** intensifies meat colour
- Improved eating quality (n=8):
  - **SP** decreased off-odour 'animal'
  - **SP** increased umami and chicken flavour
  - **HI** decreased adhesiveness
- HI increased saturated fat content (n=10)

Table 2: Treatment group colour estimated marginal means (s.e.) (L* = lightness; a* = redness; b* = yellowness)

	Substitution rate	L*	a*	b*
C	50%	56.92^{a} (0.45)	1.79^{b} (0.23)	13.14^{b} (0.25)
HI	50%	57.87^{a} (0.45)	1.95^{b} (0.23)	14.45^{a} (0.25)
SP	50%	57.35^{a} (0.45)	3.81^{a} (0.23)	15.11^{a} (0.25)
C	100%	58.44^{a} (0.51)	0.22^{b} (0.15)	10.95^{c} (0.32)
HI	100%	59.66^{a} (0.52)	0.54^{b} (0.16)	12.24^{b} (0.33)
SP	100%	53.03^{b} (0.51)	7.28^{a} (0.16)	19.32^{a} (0.33)

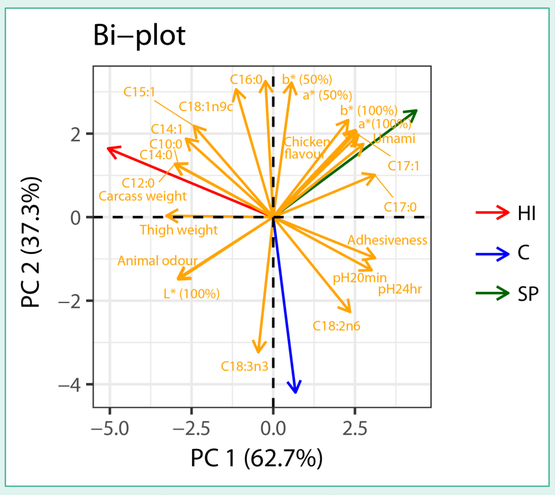

Fig 2: PCA of ANOVA significant parameters

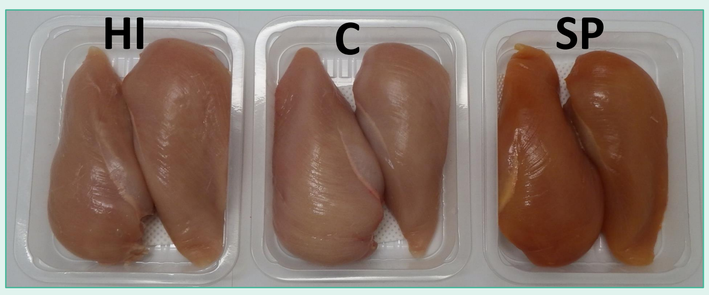

Fig 3: Treatment group colour differences with 100% soy substitution

Summary

- With amino acid supplementation, spirulina and *Hermetia illucens* larvae present themselves as soy protein substitutes
- Pork quality remained relevantly unaffected by protein source, with the exception of an altered fatty acid composition
- Broiler chicken meat exhibited improved sensory characteristics; however the intense colour from SP could be of concern

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Niedersächsisches Ministerium für Wissenschaft und Kultur

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