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Agroscope

History Pitching Success Story: *In vitro* Digestibility and Protein Quality Assessment- The example of edible insects

Lotti Egger, Laila Hammer, Raquel Sousa, and Reto Portmann

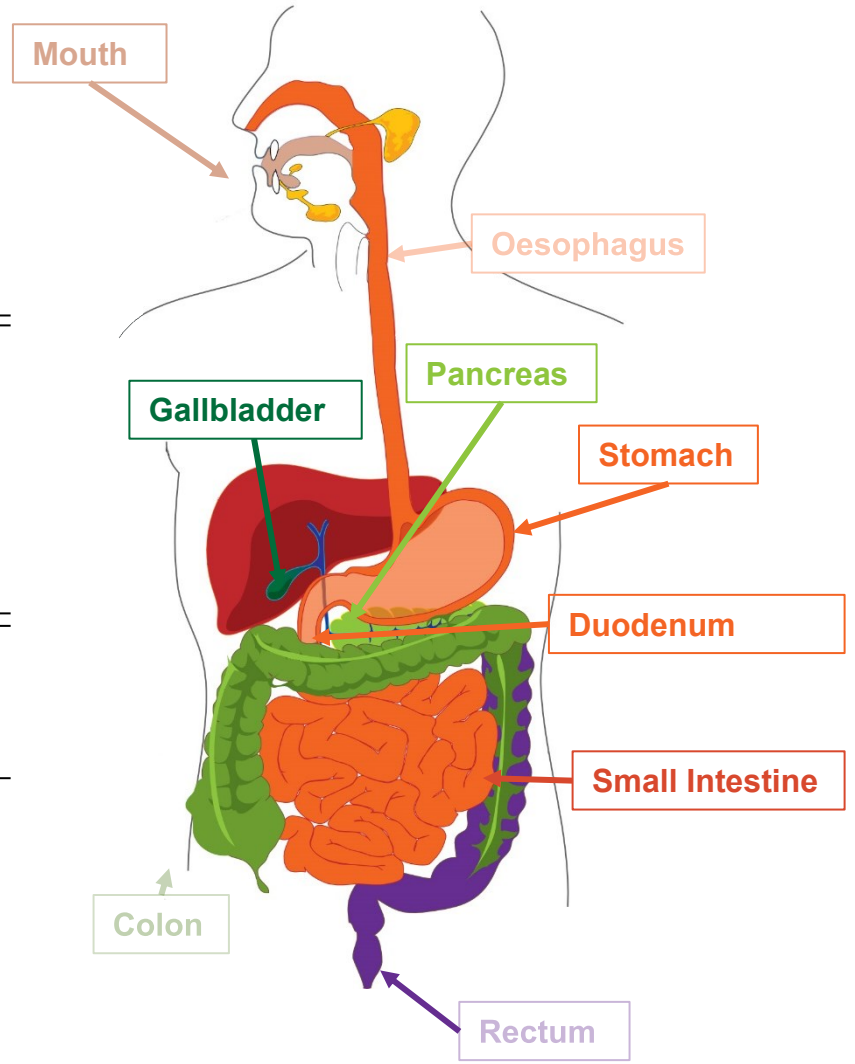
AGRO FOOD innovation forum, History Pitching Success Story
Techno Park, 19th September 2023

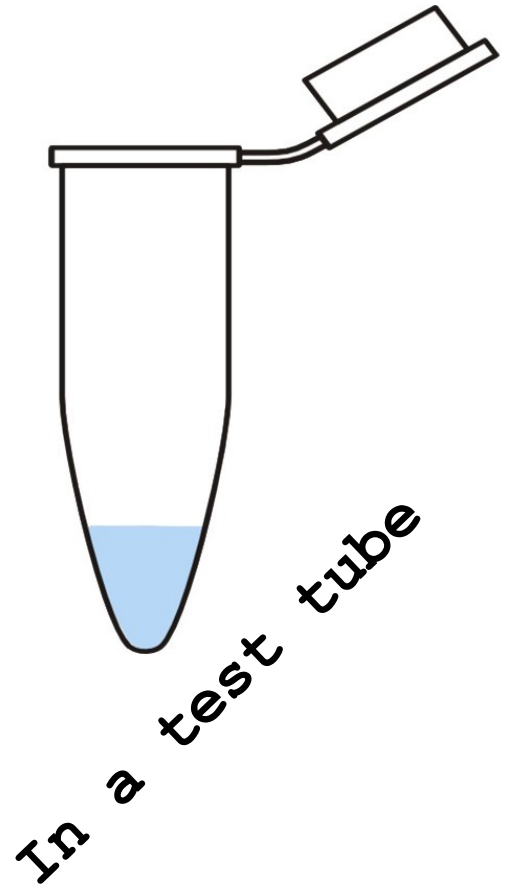
Starting point 2011: The Human digestion – in a test tube

Oral phase:

Stomach:

Intestinal Phase:

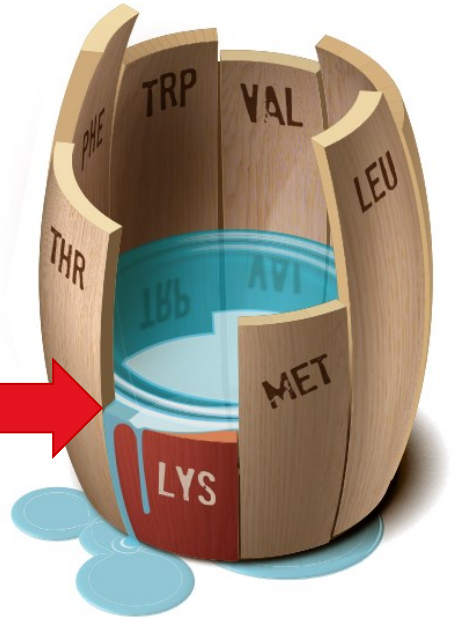




Our goals for the use of *in vitro* digestion

Protein declaration in EU is based on quantity, but…

Limiting essential amino acid



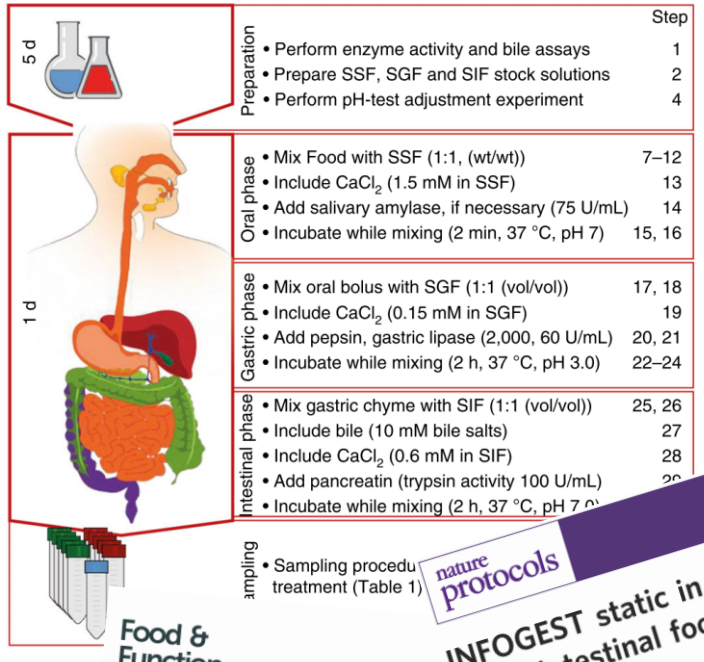
LYS = Lysin / **MET** = Methionin
ILE = Isoleucin / **LEU** = Leucin / **PHE** = Phenylalanin
THR = Threonin / **TRP** = Tryptophan / **VAL** = Valin

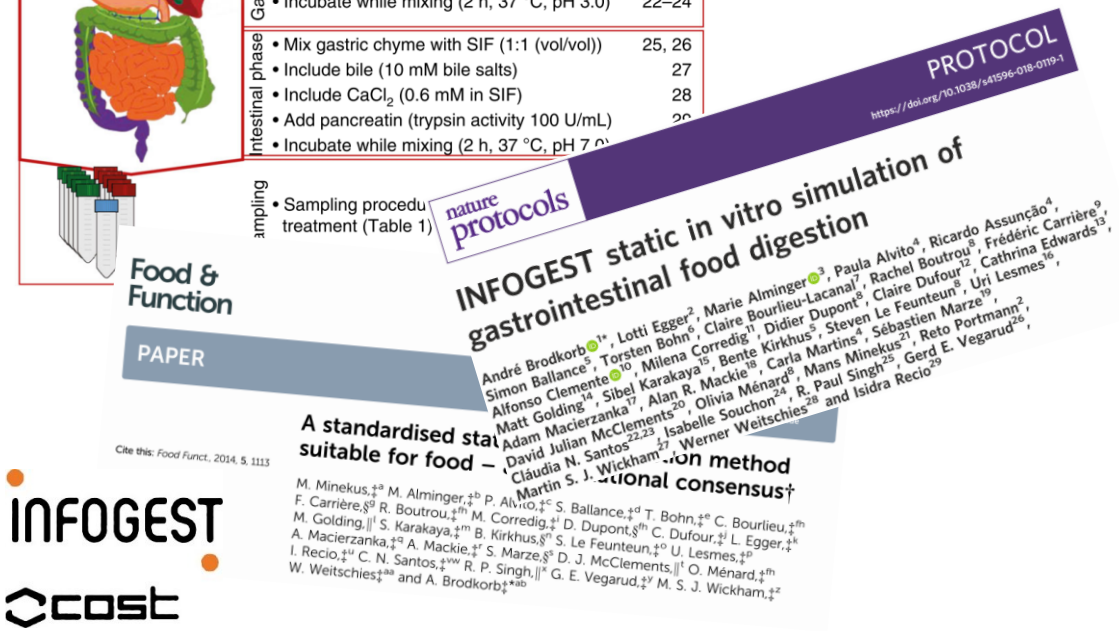
www.sge-ssn.ch/protein-2022.

…protein sources are compared based on quality (DIAAS, FAO 2013)

2014-2019: INFOGEST - International harmonized protocol

In vitro digestion protocol





Minekus, M. et al. (2014), A standardised static in vitro digestion method suitable for food – an international consensus, Food Funct.
Brodkorb, Egger, Recio et al. (2019). INFOGEST static in vitro simulation of gastrointestinal food digestion, Nature Protocols

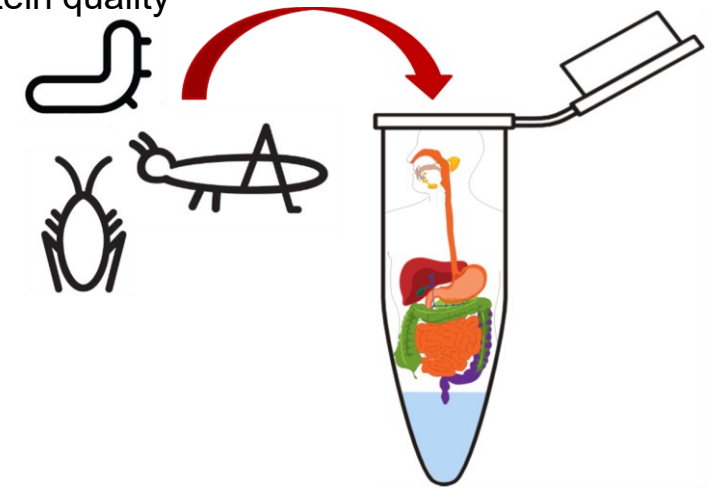
Project submission 2019

swiss FOOD RESEARCH

Call 2019 – July 10, 2019 – Project 1906

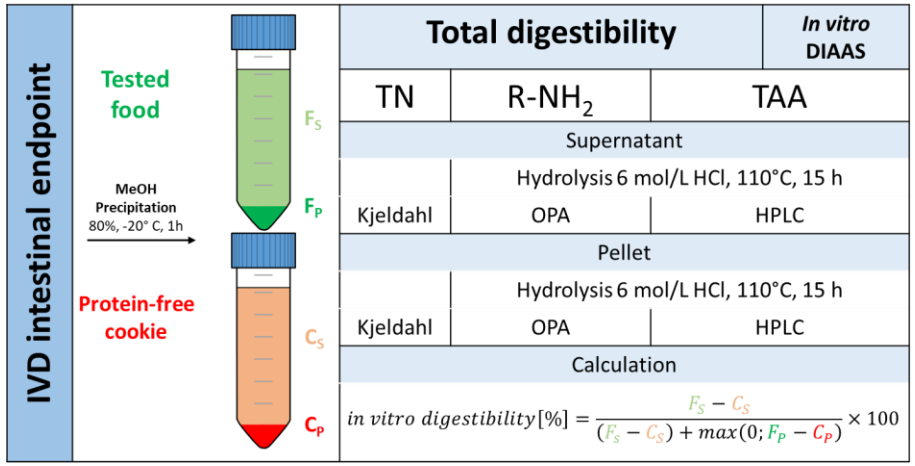
Protein quality of edible insects
Charlotte Egger and Reto Portmann, Agroscope
Philipp Egli, Insekterei GmbH

Digestibility of insect proteins as indicator for protein quality

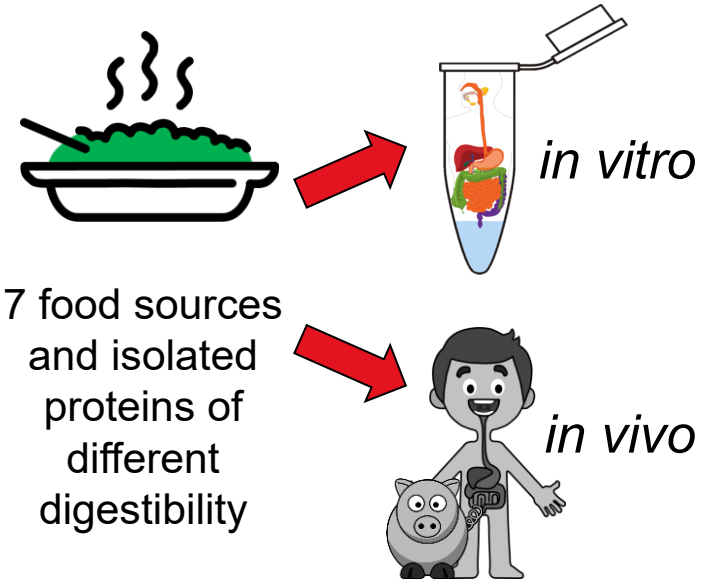


2022: *In vitro* digestibility and DIAAS workflow: validation

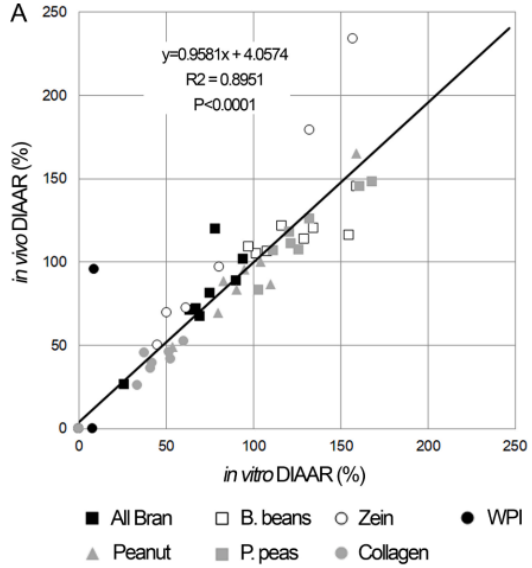
Workflow development



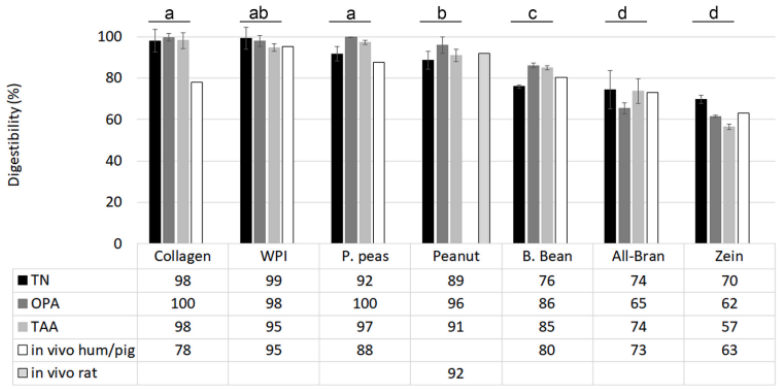
Validation *in vivo* / *in vitro*



Correlation: 0.96

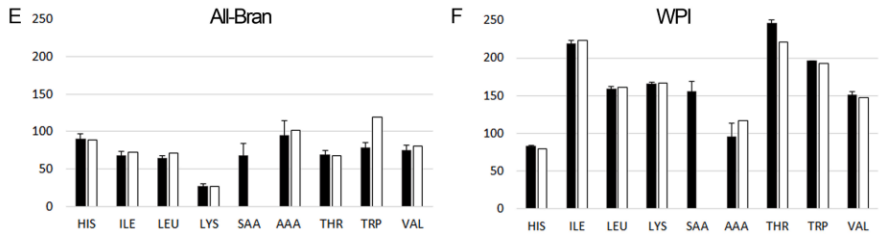


digestibility



	Collagen	WPI	P. peas	Peanut	B. Bean	All-Bran	Zein
TN	98	99	92	89	76	74	70
OPA	100	98	100	96	86	65	62
TAA	98	95	97	91	85	74	57
in vivo hum/pig	78	95	88		80	73	63
in vivo rat				92			

DIAAS



Food Chemistry 404 (2023) 134720

Contents lists available at ScienceDirect

Food Chemistry

journal homepage: www.elsevier.com/locate/foodchem

In vitro digestibility of dietary proteins and *in vitro* DIAAS analytical workflow based on the INFOGEST static protocol and its validation with *in vivo* data

Raquel Sousa [a,b], Isidra Recio [b], Dominique Heimo [c], Sébastien Dubois [c], Paul J. Moughan [d], Suzanne M. Hodgkinson [d], Reto Portmann [a,1], Lotti Egger [a,*,1]

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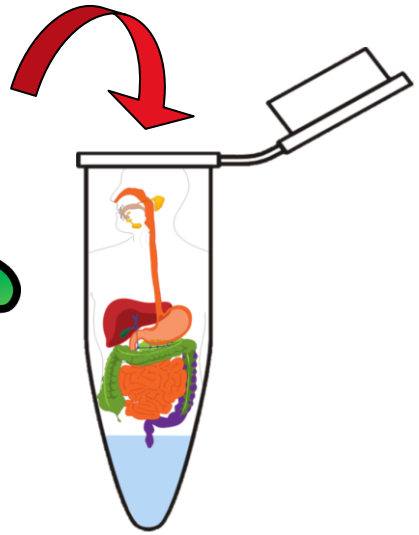
2023: *In vitro* digestibility and DIAAS of mealworm and cricket in comparison to chicken meat

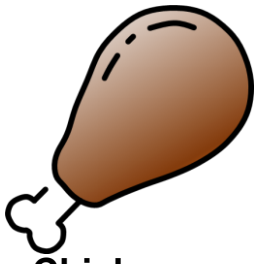
Edible insects

Mealworm

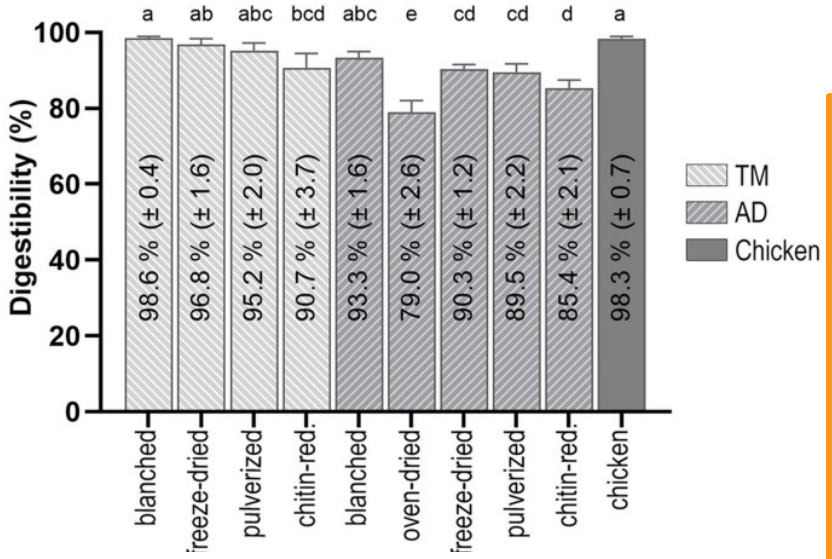
Cricket

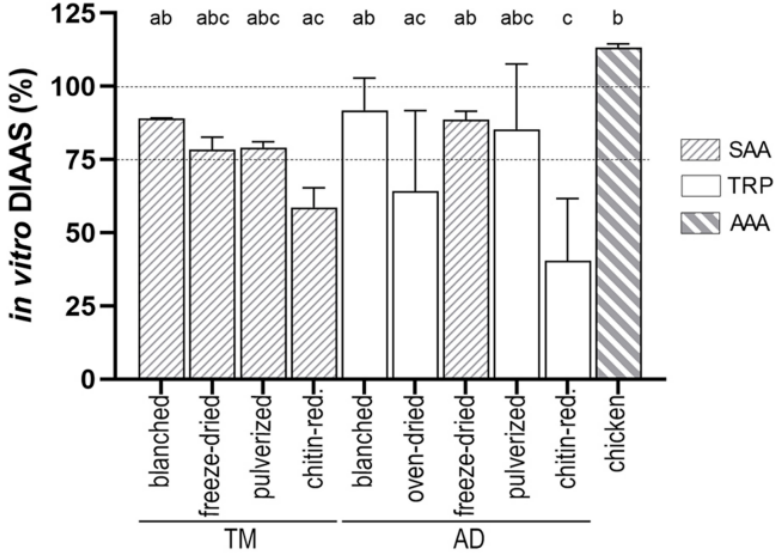


Control food



Chicken meat





ORIGINAL RESEARCH article

Front. Nutr., 03 July 2023
Sec. Nutrition and Food Science Technology
Volume 10 - 2023 |
https://doi.org/10.3389/fnut.2023.1150581

This article is part of the Research Topic
Food of the Future: Insects
View all 5 Articles >

Mealworm larvae (*Tenebrio molitor*) and crickets (*Acheta domesticus*) show high total protein *in vitro* digestibility and can provide good-to-excellent protein quality as determined by *in vitro* DIAAS

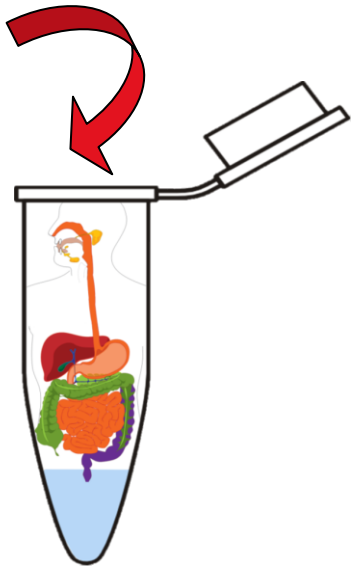
Laila Hammer[1,2,3] Diego Moretti[2] Lychou Abbühl-Eng[1] Pabiraa Kandiah[1]
Nikolin Hilaj[4] Reto Portmann[1*] Lotti Egger[1*]

swiss FOOD RESEARCH

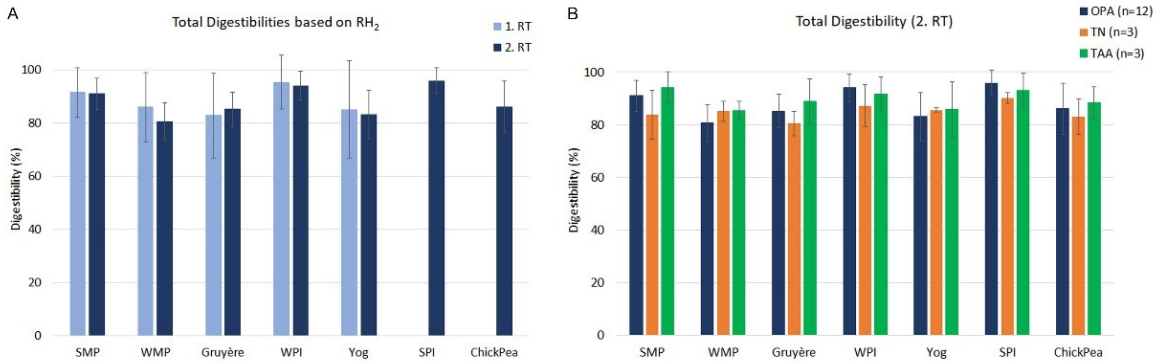
In collaboration with FFHS

2020 – 2025? - Standardization of method whithin IDF and ISO

In vitro digestion of
5 Dairy products:
skim milk powder, whole milk powder, whey protein isolate, yoghurt, cheese
and 2 Plant-based products:
soy protein isolate, chick pea



digestibility



repeatability

			SMP	WMP	Gru	WPI	Yog	SPI	ChickPea
2nd RT		Average	91.0	80.6	85.2	94.0	83.1	95.9	86.1
	N		11	11	11	12	11	12	10
	SD	6.9	6.0	7.1	6.4	5.4	9.2	4.8	9.7
	SEM	2.1	1.8	2.1	1.9	1.5	2.8	1.4	3.1
	s_r	8.6	9.5	11.7	10.3	6.2	7.7	4.7	10.1
	s_{rRel}	9.9	10.4	14.5	12.1	6.6	9.3	4.9	11.7
	r (sr*2.8)	24.1	26.5	32.7	28.9	17.3	21.6	13.1	28.3

ISO #####2023(E)
IDF ###:2023(E)

ISO/TC 34/SC 5
Date: 2023-09-07
Secretariat : NEN

Milk and milk products - *In vitro* digestion protocol for the analysis of protein digestibility and *in vitro* digestible indispensable amino acid score (DIAAS)

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Summary

A validated and standardized *in vitro* workflow for protein digestibility and protein quality assessment (DIAAS)

→ Helps as screening tool in the development of new products

→ Is needed to compare protein quality of traditional and novel sources

→ Can be used to support product claims for protein sources

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Thank you for your attention

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