



PPP Project Annual Report 2018

The PPP-projects that have been established under the direction of the top sectors must submit an annual report on their technical and financial progress. This format is to be used for reporting the technical progress. A separate format ('PPP final report') is available for PPP-projects that have been completed in 2018.

The annual reports will be published in full on the websites of the TKIs/top sector, excluding the blocks 'Approval coordinator/consortium' and 'Planning and progress' . Please ensure that no confidential matters are left in the remaining blocks.

The PPP Project Annual Reports must be submitted by 15 February 2019 to Hans van der Kolk

Algemene gegevens	
PPS-nummer	AF-15269
Titel	Sustainable Future Proteins Focus on nutritional and health-promoting quality
Thema	Healthy and Safe
Uitvoerende kennisinstelling(en)	<i>WFBR; UU-UIPS</i>
Projectleider onderzoek (naam + emailadres)	Prof. Dr. Harry J. Wichers harry.wichers@wur.nl
Penvoerder (namens private partijen)	Dr. Jeroen BergenHenegouwen jeroen.vanbergen@danone.com
Contactpersoon overheid	Marjan van Creij
Werkelijke startdatum	1 April 2016
Werkelijke einddatum	31 March 2020

General information	
PPP number	AF-15269
Title	Sustainable Future Proteins Focus on nutritional and health-promoting quality
Theme	Healthy and Safe
Executive knowledge institution(s)	WFBR; UU-UIPS
Research project leader (name + e-mail address)	Prof. Dr. Harry J. Wichers harry.wichers@wur.nl
Coordinator (on behalf of private parties)	Dr. Jeroen BergenHenegouwen jeroen.vanbergen@danone.com
Government contact person	
Total project size (k€)	3 007
Address project website	https://topsectoragrifood.nl/project/future-proteins/ https://sharepoint.wur.nl/sites/futureproteins/SitePages/Home.aspx
Start date	1 April 2016
End date	31 March 2020

Approval coordinator/consortium

The annual report should be discussed with the coordinator/the consortium. The TKIs appreciate being informed of possible feedback on the annual report.

The coordinator has assessed the annual report on behalf of the consortium:	<input checked="" type="checkbox"/> approved <input type="checkbox"/> rejected
Possible feedback on the annual report:	

Short content description/aim PPS

What is going on and how is this project involved?

What will be delivered by the project and what is the effect of this?

Due to (globally) increasing demands for protein for inclusion into the human diet, alternative sources for such proteins, from maximally sustainable sources, need to be identified. This project aims at studying nutritional properties of proteins from sustainable sources. Therefore, a toolbox will be developed to assess the digestibility of proteins, to evaluate how well a given (mixture of) protein(s) is able to meet human amino acid requirements, and which spectrum of biologically active peptides is formed during digestion, with an emphasis on effects on gastro-intestinal health.

Planning and progress (if there are changes to the project plan, please explain)

Is the PPP going according to plan?	Yes
Have there been changes in the consortium/project partners?	Not since the consortium has been expanded with Cargill, Lesaffre and Pepsico in 2017.
Is there a delay and/or deferred delivery date?	No
Are there any substantive bottlenecks?	No
Are there any deviations from the projected budget?	No

Results in 2018/ so far

Give a short description of the high-lights and (most important) project deliverable in 2018 / so far and their target group

WP1: in vitro digestion

Based on *in vitro*-digestion measurements, and a number of *in vitro* bioactivity assays (gut barrier (see also WP2), ACE-inhibition, RAGE-binding, short-chain fatty acid production), a statistical analysis was performed to select samples for inclusion into the intervention trial that was envisaged for WP3. Also, out of 14 total protein-test samples, 7 were eligible on arguments 'food-grade'-ness and sufficient availability (ca. 35 kg).

Of these 7, only those that most closely matched with anticipated read-outs of the intervention were included in the statistical analysis. On this basis, corn protein and bovine plasma (BP) were selected to be included in the intervention trial, with whey protein (WPC) as benchmark. For the trial, samples with 'extreme' performance were selected, to maximise the chances of possibly detectable difference in the trial set-up. A graphical impression of how statistical selection took place is depicted in figure 1:

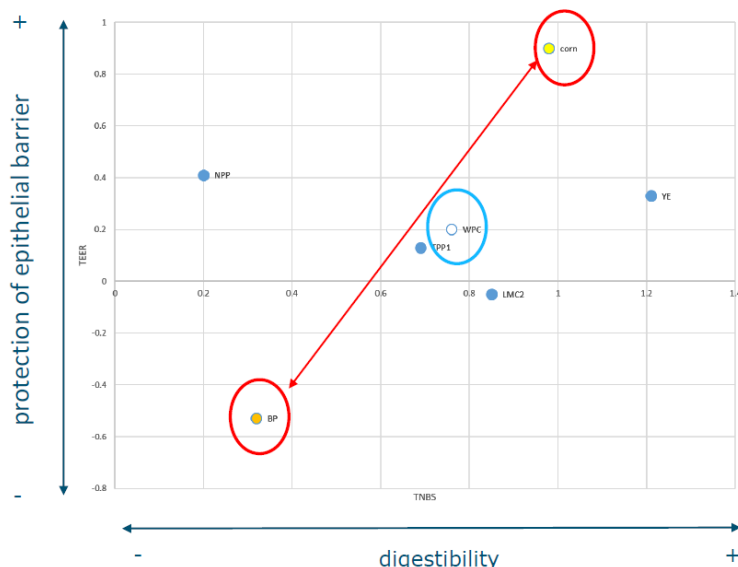


Figure 1. Digestibility (TNBS) and barrier-protective properties (TEER) of digesta of a number of proteins that could potentially be included in the human intervention.

WP2: Immune read-outs

For the development of a gut-on-a-chip (GoaC) model, the bioengineered intestinal tubules composed of hollow fibre membranes covered with Caco-2 cells, nears completion. Applying shear stress via incubation on a rocking incubator leads to more pronounced villi and induction of not only epithelial-like cells, but also of goblet cells, Paneth cells, intestinal stem cells, and entero-endocrine cells. Challenges with de-oxynivalenol, Toxin-A (from *Clostridium*) and acetylsalicylic acid have been validated.

In the near future, the work is being extended with the use of organoid-like cell types as seed. The development of *in vitro* immune read-outs has been hampered strongly by the presence of pyrogens (particularly LPS) in the majority of the industrial protein samples. Pyrogens have such a strong immune stimulatory effect that it is practically impossible to distinguish the milder effects of food components: something like trying to distinguish a torch light next to the sun. This issue likely has been solved by applying co-cultures where the immune cells are shielded by a layer of Caco-2 cells.

WP3: Human intervention

After selecting the samples that were to be included in the human trial, an METC-protocol has been written and approved.

In November and December of 2018, the actual intervention has taken place. Currently, samples that were collected (blood, saliva, urine, faeces) are being analysed for relevant parameters, and interpreted. The results will be available in the course of 2019.

Trial details can be found on <https://clinicaltrials.gov/ct2/show/NCT03744221>.

Number of delivered products in 2018 / so far (in an appendix, please provide the titles and/or description of the products or a link to the products on public websites)			
Academic articles	Reports	Articles in journals	Introductions/workshops
Nutrients. 2018 Mar 7;10(3). pii: E322. doi: 10.3390/nu10030322			

Appendix: Names of the products or a link to the products on a public website

Jochems PGM, Garssen J, van Keulen AM, Masereeuw R, Jeurink PV. Evaluating Human Intestinal Cell Lines for Studying Dietary Protein Absorption. Nutrients. 2018 Mar 7;10(3).

<https://topsectoragrifood.nl/project/future-proteins/>

<https://www.wur.nl/nl/Onderzoek-Resultaten/Topsectoren/show/AF-15269-Future-Proteins-Nutritional-quality-and-bio-functional-activity-after-digestion.htm>