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Authors : Tim Snijders, Philippe Pinckaers, Luc van Loon
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Annual Project Report 2018

Plantbased Proteins (16NH02)

Table Document description

Report title	Plantbased Proteins
Report type	Annual Project Report
Theme	
Project name	Plantbased Proteins
Project code	16NH02
Year	2018
Authors	Dr. T.Snijders, P.Pinckaers, Prof. Dr. Luc J.C. van Loon
Project leader	Prof. Dr. LJC van Loon
Theme director	Dr. R. Beudeker
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1 Project synopsis

Project title Anabolic properties of plant based proteins						Project No. 16NH02
Project status	<input type="checkbox"/> new	<input type="checkbox"/> OPP	<input type="checkbox"/> FPP	<input checked="" type="checkbox"/> running	<input type="checkbox"/> mid-term review	<input type="checkbox"/> completed
Key objectives						
<ul style="list-style-type: none"> ▪ To assess the anabolic properties of key plant based protein sources and specific protein blends. 						
Main deliverables						
<ul style="list-style-type: none"> ▪ Definition of nitrogen content and amino acid profile of a wide variety of plant based proteins ▪ Assessment of anabolic response to the ingestion of a selection of key plant based proteins, a key reference protein, and their protein blends <i>in vivo</i> in humans. ▪ Deeper understanding of the anabolic properties of plant based proteins <i>in vivo</i> in humans. 						
Approach						
<p>The project consists of three work packages (WP). WP1: in this work package the characteristics of a large number of available animal and plant based proteins will be analyzed for nitrogen content and amino acid profile within the same laboratory. In work package 2 (WP2) we will assess the efficacy of three different plant based proteins (wheat, corn and pea protein), three protein blends (wheat+milk, corn+milk and pea+corn+milk) and one key reference (milk protein) to stimulate muscle protein synthesis following ingestion of a single meal-like amount <i>in vivo</i> in humans. Contemporary stable isotope tracer methodology will be applied, with plasma and muscle biopsy collection to assess post-prandial amino acid flux, muscle protein synthesis <i>in vivo</i> in humans. By comparing the post-prandial amino acid response of the plant based proteins and/or protein blends with the response following the ingestion with the reference protein we will evaluate the differences in protein digestion and amino acid absorption kinetics between different protein sources. In the final work package (WP3), a product based upon wheat protein (Genvie 2.0) will be evaluated for its capacity and compared with chicken-breast filet to increase post-prandial amino acid concentrations and the subsequent post-prandial muscle protein synthetic response to feeding. Contemporary stable isotope tracer methodology will be applied identical to WP2 to assess post-prandial amino acid flux as well as muscle protein synthesis <i>in vivo</i> in humans. The outcomes from this project will provide leads to develop novel concepts and dietary strategies to improve muscle health and function.</p>						
Indication of total project costs		Start date		Estimated end date		
1320 kE		2016		2020		
Main location(s):						
Name Project leader		Name Theme director		Date		
Luc van Loon		Rob Beudeker				

2 Milestones

	Milestone	Status
1	Definition of nitrogen content and amino acid profile of a wide variety of plant based proteins	Realized
	Manuscript entitled "Protein content and amino acid composition of commercially available plant-based protein isolates" by first author Stefan H. M. Gorissen et al. has been published in the journal "Amino Acids"	
	Manuscript can be accessed via: https://www.ncbi.nlm.nih.gov/pubmed/30167963	
2	Assess protein digestion and amino acid absorption of corn, wheat and pea protein versus milk protein based on post-prandial amino acid profile.	Running
	Experimental trails and sample analysis are ongoing.	
3	Proof the efficacy of corn vs wheat vs pea vs milk protein to increase muscle protein synthesis following ingestion of single meallike amount <i>in vivo</i> in humans.	Running
	Experimental trails and sample analysis are ongoing.	
4	Proof the efficacy of single animal (milk) and plant based proteins (corn, wheat and pea) vs specific formulated protein blends to increase muscle protein synthesis following ingestion of a single meallike amount <i>in vivo</i> in humans.	Running
	Experimental trails and sample analysis are ongoing.	
5	Assess protein digestion and amino acid absorption of genvie2.0 vs chicken breast filet based on post-prandial amino acid profile.	Running
	All experimental trails have been completed. Plasma amino acid profiles have been analysed, and data processing and interpretaion is ongoing.	
6	Proof the efficacy of Genvie 2.0 vs chicken breast filet to increase muscle protein synthesis following ingestion of a single meallike amount <i>in vivo</i> in humans.	Running
	All experimental trials have been completed and sample analysis in final stage	

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3 Conclusions

WP 1 Dietary protein characteristics: This work package has been completed. The manuscript entitled “Protein content and amino acid composition of commercially available plant-based protein isolates” by first author Stefan H. M. Gorissen et al. has been published in the journal “Amino Acids”. The manuscript can be accessed via:

<https://www.ncbi.nlm.nih.gov/pubmed/30167963>

WP 2A Anabolic response to plant based protein ingestion: Trials for this work package are running, and are expected to be finished in Q1 2019. Due to the large sample size, analysis of blood and muscle tissue samples has already started in order to prevent delays at the end of the project.

WP 2B Anabolic response to protein blends: In parallel to work package 2A, trials for work package 2B are ongoing, and are expected to be finished in Q1 2019. Due to the large sample size, analysis of blood and muscle tissue samples has already started in order to prevent delays at the end of the project.

WP 3 Anabolic response to plant based versus animal based products: All experimental trials have been performed and 24 healthy, lean males have been tested. Plasma analysis have been completed and muscle tissue analysis are in the final stage.

Based on the current progress, the overall target to complete the project by September 2019 is still achievable.

Annex 1 Activity planning 2019

Description of activities	Milestones	Deliverables
-Work package 1	<ul style="list-style-type: none"> • Work package completed 	
-Work package 2	<ul style="list-style-type: none"> • Finalizing experimental testing and data collection • Finalizing analysis biological sample • Completion Analysis of data • Writing & submitting manuscript 	<ul style="list-style-type: none"> • Assess the efficacy of three different plant based proteins (wheat, corn and pea protein), three protein blends (wheat+milk, corn+milk and pea+corn+milk) and one key reference (milk protein) to stimulate muscle protein synthesis following ingestion of a single meallike amount <i>in vivo</i> in humans. • Identify the differences in protein digestion and amino acid absorption kinetics between different protein sources (plant vs animal vs protein blend)
-Work package 3	<ul style="list-style-type: none"> • Finalizing of Analysis biological samples • Completion Analysis of data • Publishing manuscript 	<ul style="list-style-type: none"> • Assess the efficacy of Genvie 2.0 vs chicken breast filet to enhance muscle protein synthesis following the ingestion of a meallike amount of protein <i>in vivo</i> in humans. • Determine the plasma amino acid profile following the ingestion of Genvie 2.0 vs chicken breast filet.

Annex 2 List of publications, patents and other outputs

Publications

Scientific papers in peer-reviewed journals

Gorissen SHM, Crombag JJR, Senden JMG, Waterval WAH, Bierau J, Verdijk LB, van Loon LJC. *Protein content and amino acid composition of commercially available plant-based protein isolates*. *Amino Acids*. 2018 Dec;50(12):1685-1695. doi: 10.1007/s00726-018-2640-5. Epub 2018 Aug 30.

Invited lectures

Tim Snijders

- *Protein nutrition: comparing plant and animal based proteins for a better health*. Bridge2Food – WEBINAR. November 2017.
- *Protein nutrition: comparing plant and animal based proteins for a better health*. Bridge2Food – 10th protein summit, Reims, France. September 2017.
- *Anabolic properties of plant based protein*. Bridge2Food – healthy aging summit, Noordwijkerhout, the Netherlands. June 2017.

Philippe

- *Anabolic properties of plant based proteins*. Foodvalley Summit Sports & Nutrition – Ede, The Netherlands, October 2018

Other outputs

NA



PPP annual report 2018

PPPs which have started under the direction of the top-sectors need to deliver an annual report regarding their research and financial progress. For reporting on research progress this format has to be applied. A separate format 'PPP final report' is available for PPPs that have finalized in 2018. **Annual reports are entirely published on the TKI/topsector website(s). Please prevent the incorporation of confidential matter in the report.**

PPP annual reports have to be submitted - pooled for each research organisation - before 1 March 2019 to the TKIs at info@tkitu.nl, or at info@tki-agrifood.nl. For Wageningen Research the delivery of reports occurs centrally.

General data	
PPP number	AF-16504
Title	Anabolic properties of plant based proteins
Theme	Gezond en Veilig
Executing research organisation(s)	Universiteit Maastricht, Wageningen Universiteit
Project leader research (name + email address)	Luc van Loon l.vanloon@maastrichtuniversity.nl
Coordinator (on behalf of private parties)	Chair Project Council: Kathy Greaves
Contact person of government	
Total project budget (k€)	
Project website address	
Starting date	1st April 2017
Final date	1st September 2019

Approval coordinator/consortium

The annual report has to be discussed with the coordinator/consortium. The TKI(s) like to be informed regarding potential comments on the annual report.

The annual report is by the coordinator on behalf of the consortium	<input type="checkbox"/> approved <input type="checkbox"/> not approved
Potential comments regarding the final report	

Brief description content/aim PPP

What is the matter and what does the project contribute?

What does the project deliver and what are the effects of its delivery?

Brief description

Our muscles are composed out of proteins. These proteins in turn are built from small building blocks called amino acids. By consuming a sufficient amount of protein in our daily diet, we can assure that there are enough amino acids available for promoting the synthesis of muscle proteins. This availability of amino acids is important for keeping our muscles healthy, for recovery after exercise, and for maintenance of our muscle mass and force in order to perform activities of daily living. The type of protein consumed also plays an important role herein, although it is mostly

unknown to which extent proteins from plant based origin can stimulate the synthesis of muscle proteins.

What is the matter?

On a worldwide scale, more than half of our daily protein intake originates from plant based sources such as grain products, soy etc. Furthermore, plant based proteins are the most important sources of protein in developing countries. Currently it is known that different protein sources can have different effects on the synthesis of our muscle tissue, in which it is generally assumed that plant based proteins have less potential to stimulate muscle growth in comparison to animal based proteins such as milk, meat and eggs. Although, to date a lot is still unknown regarding the actual extent to which plant based proteins can stimulate muscle growth.

What does the project contribute?

The aim of this project is to determine to which extent plant based protein consumption can stimulate the synthesis of muscle tissue (also known as muscle protein synthesis) in comparison to an animal-based protein. This is being investigated by determining how fast the muscle proteins can be synthesized after protein consumption.

What does the project deliver?

The researchers expect that this project will lead to a better understanding of how plant based proteins can contribute to the maintenance and synthesis of or muscles. Thereby, this project aims to determine whether plant based proteins differ herein from animal-based proteins.

What are the effects?

Worldwide 1 billion people suffer from a protein deficiency, thereby, in the upcoming 30 years the world population will grow to ~9.6 billion. The increasing world population also demands an increase in protein production. However, this protein production cannot only be maintained by proteins from animal sources (milk, meat, eggs). Therefore, it is of importance to develop new strategies for sustainable protein production, in order to maintain the healthy, functional muscles.

Results 2018

Give a brief description of the high-lights in 2018.

In 2018 we published the first article for this project entitled: "Protein content and amino acid composition of commercially available plant-based protein isolates". This manuscript can serve to identify the anabolic potential of various protein sources or specific protein blends based on their amino acid composition.

Number of delivered products in 2018 (give titles and/or description of products, or a link to the products on the project website, or other public websites).

Scientific articles	Reports	Articles professional in journals	Lectures/workshops
1			

Titles/descriptions of prominent products in 2018 (max. 5) and their targets groups

Gorissen SHM, Crombag JJR, Senden JMG, Waterval WAH, Bierau J, Verdijk LB, van Loon LJC. *Protein content and amino acid composition of commercially available plant-based protein isolates*. Amino Acids. 2018 Dec;50(12):1685-1695. doi: 10.1007/s00726-018-2640-5. Epub 2018 Aug 30. <https://www.ncbi.nlm.nih.gov/pubmed/30167963>

Annex: Titles of deliverables or a link to products on the project website or other public websites