General data

PPP number	**AF-16505**
Title	**The Biology behind perceivable consumer benefits, Glucose (M)apping**
Theme	**Health and Nutrition**
Executing research organisation(s)	**Maastricht University, Wageningen University, Radboud University, Leiden University**
Project leader research (name + email address)	**Prof dr Ellen Blaak** **e.blaak@maastrichtuniversity.nl**
Coordinator (on behalf of private parties)	**Dr Rob Beudeker, theme director TIFN**
Contact person of government	
Total project budget (k€)	**4.693kE**
Project website address	
Starting date	**May 1 2017**
Final date	**May 1 2022**

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	☐ **approved** ☐ 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?
Overall objective
The overall aim of the project is (1) to obtain insight in metabolic and lifestyle determinants of blood glucose homeostasis, as well as and mental and physical performance and well-being and (2) to study how acute and chronic dietary and physical activity intervention alters these parameters in metabolically distinct subgroups. Based on that multiscale tissue dynamics and mathematical models on diet and lifestyle in relation to blood glucose homeostasis as well mental performance and well-being will be developed and validated.

Overview deliverables and results

	Deliverables	Status
1	Creation of classifier using machine learning approaches on characteristics of an individual that can predict to what extent that individual will respond favourably, in terms of insulin resistance, to a diet with a particular macronutrient composition	Finished
	Summary: Based on the classifier combining hypothesis based and machine learning approach for characteristics of individuals from four unique large European dietary/lifestyle interventions, participants will be divided into two metabolically different groups. The division will be based on tissue-specific	

	insulin resistance, whether subjects are more pronounced muscle insulin resistant (MIR) or more pronounced liver insulin resistant (LIR).	
2	Definition of the two diets for the intervention study and assign individuals to two subgroups for the intervention study planned in WP2 (PERSON-study)	Finished
	Summary (exact diet composition finalized): The optimal diet for MIR is a moderate fat content which is high in mono-unsaturated fatty acids (HMUFA, virgin olive oil) with a macronutrient breakdown of 38 E% from fat (20% MUFA, 10% PUFA, 8% SFA), 48 E% from CHO (<15en% mono- and disaccharides), and 14 E% from protein (35-40% plant protein). The optimal diet for LIR is low in fat, high in protein (LFHP) with a macronutrient breakdown of <28 E% from fat (10% MUFA, 10% PUFA, 8% SFA), 48 E% from CHO (<15en% mono- and disaccharides), and 24 E% from protein (35-40% plant protein), and an additional supplement of 6g of soluble fiber per day. Also, with both diets, low fat, high protein products as well as the supplement are provided by industrial partners. Participants will be randomized into one of the following intervention groups: • Group MIR-1 receiving the HMUFA diet optimal for MIR (optimal diet) • Group MIR-2 receiving the LFHP diet optimal for LIR (suboptimal diet) • Group LIR-1 receiving the LFHP diet optimal for LIR (optimal diet) • Group LIR-2 receiving the HMUFA diet optimal for MIR (suboptimal diet)	
3	METC-approval for PERSON-study	Finished
	Summary: The protocol for the PERSON-study has been approved on 18 April 2018. 1st amendment approved on 8 August 2018, 2nd amendment approved on 9 January 2019. 3rd amendment approved 15 July 2019.	
4	Predicting individual improvements in glucose metabolism in response to a diet with a particular macronutrient composition: A re-analysis of existing large scale cohorts (WP 3.1)	Finished
	Summary: Create and validate classifiers to predict response of an individual in terms of insulin resistance to a diet with a particular macronutrient composition using existing data. In general, the classifier shows low predictive power for all tested outcomes: HOMA-IR, Disposition index, hepatic and peripheral insulin sensitivity, muscle insulin sensitivity index (MISI), hepatic insulin resistance (HIRI), weight, BMI. For that reason, we designed a hypothesis-based classifier based on analyses in the DIOGENES study, available mechanistic data and literature	
5	Study execution	Ongoing
	Summary: Continue with subject recruitment, retention and completion of the PERSON study at UM and WUR until 120 participants have completed the study at each center.	
6	Design a proof of the concept intervention study for models developed.	Ongoing
	Summary: Determine yet unaccounted (by the model) factors influencing glycemic responses to meals by machine learning models. Use machine learning methods to determine physiological factors explaining inter-individual differences in consumer perceivable benefits (mental and physical performance and well-being).	
7	Perform a proof of the concept intervention study for models developed.	Planned
	Summary: Test personalized model in relation to short term changes in blood glucose homeostasis and related perceived benefits in the Person study.	

Number of delivered products in 2019 (give titles and/or description of products, or a link to the products on the project website, or other public websites).
Scientific presentations
- TiFN retreat, Beekse Bergen, Netherlands, 11 September 2019, poster by Kelly Jardon - Research institute visit; Institute of Nutraceuticals and Functional Foods, Quebec, Canada, 21 October 2019; oral presentation and poster by Anouk Gijbels

- Personalized Nutrition Conference, Wageningen Netherlands, 8 Oct 2019; poster by Inez Trouwborst
- University visit; McGill University, Montreal, Canada, 24 October 2019; oral presentation by Anouk Gijbels
- University visit; University of Guelph, Guelph, Canada, 1 November 2019; oral presentation by Anouk Gijbels
- NUTRIM symposium, Maastricht, Netherlands, 27 November 2019; poster by Kelly Jardon

"Computational modelling, hybrid approach"
- MaCSBio Science day, Maastricht, 21-06-2019
  Title: Hybrid modeling approaches to study complex metabolic traits
- TiFN Retreat, Beekse Bergen, 11-09-2019
  Title: Characterizing postprandial glucose responses in individuals using a computational modelling approach
- ByteMAL, Aachen, 24-09-2019
  Title: Characterizing postprandial glucose responses in individuals using a computational modelling approach

Other outputs
- Seminar at Danone Utrecht, TiFN 16NH04 Seminar, Perceivable benefits, 17 January 2019

Scientific papers
Trouwborst I[1], Bowser SM[1], Goossens GH[1], Blaak EE[1]. Ectopic Fat Accumulation in Distinct Insulin Resistant Phenotypes; Targets for Personalized Nutritional Interventions, Frontiers Nutrition 2018