

1 Executive Summary

This report gives an overview of the status of NextGenProteins at the end of the second year (24M). The report is based on the contributions given by various partners at the 2nd Annual Meeting which was held online during 2nd and 3rd of November 2021. For further details on the status of the project we refer to the attached presentations given at the meeting as well as the Technical report submitted at 18M.

Both days at the 2nd Annual meeting were dedicated to presentations on the status of individual work-packages (WP1-WP9). A specific presentation was held on “Responsible Research and Innovation” (RRI) during the first meeting day. Further, a session was held with all participants to discuss and strengthen dissemination and the exploitation of outcomes from NextGenProteins.

Status of NextGenProteins. Overall, it can be stated that NextGenProteins is on a good track in reaching all the specific objectives that we set out to achieve, 24 months ago. All milestones for the period (M13-M24) were reached on time, but two deliverables (D2.1 and D5.1) were delayed by one month due to Covid-19 related issues. The pandemic has, however, not affected the work in NextGenProteins to any large degree. No issues have come up that could not be handled within the Consortium or any major issues that affect the implementation of the DoA. The work is progressing as planned and the project partners are moving forward to fulfil the project objectives and the overall aim of optimising the production of three alternative proteins – microalgae, single cell and insect protein - and verify their use in various feed and food applications, in order to meet customers’ needs and ensure consumer acceptance.

Status of work in individual Work-packages. Work in all WPs has been initiated.

WP1 has delivered reports on the EU regulatory landscape for production and use of alternative proteins in both food and feed. Progress is ongoing on task 1.2 “Policy contribution” with interviews with appropriate national and international authorities. A webinar will be held in collaboration with the “sister” projects, SusinChain, ProFuture and Smartprotein in December 2021 on “Safety & regulations for novel protein sources”. Work on pre-market approval (task 1.3) for the three alternative proteins (Single Cell Proteins (SCP), Microalgae proteins and insect proteins) is in a preparatory stage.

In *WP2* work is ongoing on “Alternative protein production” (task 2.2) and “Process and Post-process optimisation” (task 2.3). Arbiom has supplied, during period 12-24M, over 480 kg of a single cell product to other partners for trial work and plans to deliver over 2.850 kg more for mainly field trials before end of M36. VAXA has supplied about 900 g of green and blue Spirulina for testing in other WPs. MUTATEC has supplied over 440 kg of insect meal for trial work in WPs 3 and 4. MUTATEC plans to supply additional 6.200 kg for lab scale and field trials before the end of M36. Covid-19 slowed down MUTATEC’s production and scaling up of their operations, but the new plant will be ready soon. Some improvements of the functional

properties of the alternative protein products have been achieved e.g. in cricket biomass and SCP by post-process optimisation. VAXA has developed two new products, Green UltraSpirulina and Blue UltraSpirulina. The products have superior sensory quality and nutritional composition.

In *WP3*, work is ongoing in “Ready meals” (task 3.1), “Bakery products (task 3.2), “Imitation meat” (task 3.3) and “Functional food supplements” (task 3.4). Addition of Spirulina in different ready meals, to a level of 12% protein kcal/total kcal, such as broccoli gratin, potato gratin and vegetable cakes gave a hint or even noticeable microalgae flavour which needs to be masked in further trials. Broccoli gratin with 0.1% and 0.5% torula gave promising results and breaded vegetarian cakes with torula as well. However, torula (SPC) additions for ready meals were cut short as there are regulation restrictions for their use in the premises of Grimur Kokkur. Similarly, torula addition to bakery products had to be stopped and we are waiting for EFSA’s opinion on whether torula is a novel food or not. Cricket flour added up to 5% to crisp bread was well tolerated and an addition of 3% Spirulina to crisp bread as well. Spirulina affects the colour and flavour of bakery products at 1% addition and it is difficult to mask the impact. The pigments from the Blue and Green spirulina are unfortunately heat sensitive and the colour changes on baking. Trials with SCP addition in imitation meat revealed that different maskers are needed to address both yeast odour and flavour that the SCP imparts. Further trials are ongoing but due to the uncertainty of the regulatory status of SCP, extrusion and sensory evaluation work will be limited. Trials are ongoing with the addition of Spirulina, SCP and cricket powder as functional food supplements for elderly people e.g. in pea, fish, chicken and bread purees. Cricket powder and gelled bread, as well as yeast powder and chicken are promising products.

In *WP4* work is ongoing in “Feed formulation and processing” (task 4.1), “Dose-response and field trials, terrestrial (task 4.2) and aquatic animals” (task 4.3) and in “Health, welfare and physiological indicators of animals in dose response trials” (task 4.4). Different feeds containing the alternative proteins have been prepared and their physico-chemical parameters are being determined. The results indicate that high inclusion rates (10-15%) of microalgae meal should not be recommended for broiler chickens. Low levels of microalgae meals from 15-29 days to slaughter gave similar growth performance in chickens as soybean-based diet. The microalgae led to greater pigmentation of shank, breast meat and in yolk. Dose response trials on sea-bream indicate that black soldier larvae meal can replace 5, 10 and 15% of fish meal without compromising growth and feed utilisation. Further, inclusion of the black soldier larvae meal up to 15% did not compromise the technological and oxidative state of the fillets. SCP meal (from Arbiom) can replace 5% of the fish meal without compromising growth and feed utilisation. 7.5% inclusion level seemed to give the best growth performance and 10% inclusion led to a slowdown in growth performance for sea-bream. Dose-response and field trials on salmon fed with feed containing different levels of the alternative proteins are ongoing.

In *WP 5* results on consumer aspects (subtask 5.1.1) in selective European countries revealed that they had mostly positive or neutral attitudes towards the NextGen alternative proteins; their production and application in food. As the products are both unfamiliar and a novelty, a

large share of the consumers did not know what to think or say. Whether the consumers will choose the NextGenProtein products or not, will depend on the sensory quality of products as well as their conviction about personal benefits such as wholesomeness, transparency and how much they trust the food value chain. Interviews with stakeholder (subtask 5.1.2) revealed that many of them have positive expectations towards the proteins, but at the same time they were concerned with potential risks during their production and use. Many stakeholders did not know the products or how to react to them. A major concern of stakeholders was that consumers would not accept the new protein ingredients. It can be concluded that there is business potential in all the NextGen Proteins, but possibly the business will not be in mainstream applications. Niche market segments may be a better option at least in the short run. Boosting of consumer trust and acceptance will be of high importance. Price of products may also be a concern for some applications.

In *WP6* deliverable D6.1 has been submitted as a preliminary sustainability and process analysis. Work is ongoing in “LCA modelling” (task 6.2). The first LCI models have been prepared and interaction processes have been set up to the appropriate LCA databases. The LCA models for the three protein types are being iterated. Economic system analysis is ongoing and relevant data has been collected from all partners. Further, the circular economy potential is being evaluated and the best design approach.

In *WP7* the main work has been in implementing the RRI framework both internally and externally. Further, in engaging with stakeholders both within the food and feed sectors, policy makers and consumers. The platform for communication and dissemination has been improved and extended. The exploitation plan was updated at the end of September 2021 (M24) and has been submitted as a deliverable (D7.4). The data management plan was updated in M18 and uploaded as a revised deliverable, D7.6.

In *WP8* work is ongoing on all tasks (tasks 8.1-8.4). The beneficiaries have requested two amendments, the first one was completed and accepted by the Commission on the 24th March 2021. Another amendment has been requested, due to budget transfers from Fazer to Rise and others. Additionally, Fazer bageri is not needed as a linked third party, and a subsidiary of Harryda, Peas of Heaven, will take over their responsibilities and activities in the project. Further, KPMG has taken over Circular. At the end of 18M the partners in the consortium had claimed about 20% of the total expected cost, or €1.832.724. Work has been initiated in all WPs and approximately 28% of the overall effort was claimed at 18M.

In the interactive workshop on dissemination and exploitation the main exploitable outcomes from NextGenProteins were presented as the microalgae protein, SCP, insect protein and technology to produce the proteins. The main challenges in commercial exploitation have been identified as legislative, technological, market opportunities and consumer aspects and concerns. Other aspects of exploitation were discussed, that is for policy and policy making as well as for the general good of society.