



NACIONĀLAIS  
ATTĪSTĪBAS  
PLĀNS 2020



EIROPAS SAVIENĪBA  
Eiropas Reģionālās  
attīstības fonds

I E G U L D Ī J U M S T A V Ā N Ā K O T N Ē

**Form for the report of evaluation of the scientific quality of interim results of the implementation progresses of the post-doctoral research applications (completed in English)**

Title of the Research Application:	<b>Processing of whey into value added products for food industry and agriculture (PROPIO)</b>	
Number and title of the specific aid objective/measure selection:	1.1.1. Measure 1.1.1.2 “Aid to Post-Doctoral Research” of the Specific Aid Objective “To increase the research and innovative capacity of scientific institutions of Latvia and the ability to attract external financing, investing in human resources and infrastructure”	
Implementer of the Research Application:	Latvia University of Life Sciences and Technologies (LLU)	
Registration number/Taxpayer registration number:	90000041898	
Type of the implementer of the Research Application:	Derived public entity	
Type of the Research Application	Economic activity unrelated research	
Research category	Industrial research	
Field, sub-field of science	2. Engineering and Technology: 2.11. Other engineering and technologies 4. Agricultural, forestry and veterinary sciences: 4.2. Animal and dairy sciences	
Strategic priority or area of smart specialization	Knowledge-intensive bioeconomy	
Classification of the implementer of the research application in accordance with NACE general classification of economic activity:	NACE code	Title of the economic activity
	Code 85.42	Academic higher education
Classification of the research application in accordance with NACE general classification of economic activity:	Codes	Milk processing and cheese production Livestock breeding, milk production
	10.51 01.41	
Research Application identification No.:	1.1.1.2/VIAA/2/18/307	

## 1 SECTION – IMPLEMENTATION DESCRIPTION OF THE RESEARCH APPLICATION

**Summary of research application: objective of the research application, main activities/work packages, duration, total costs and planned results. Progress in achieving the objective of the research application, implementation progress of the main activities and achieved results.**

**The aim of the research application:** development of skills needed for young scientist – postdoctoral researcher, increase of scientific capacity, promotion of research competencies, opening opportunities for career in scientific institutions and cooperation with entrepreneurs.

**Progress towards the objective of the research application:**

As planned, one postdoctoral position in terms of full-time equivalent was created in Latvia University of Life Sciences and Technologies (LLU). Out of the planned EUR 6690.30, EUR 1811.85 of private investments has been attracted. There are two companies cooperating with the research institutions, meeting the number planned. Scientific articles and publications, as well as new technologies that can be commercialized, constitutes 0, as were not planned upon the reporting (see Table 1).

Project duration: 36 months (01.03.2019–28.02.2022); total planned costs: EUR 133806.00, of which EUR 65537.72 were used at the reporting time.

**Scientific goal of the project:** finding solutions for more efficient processing of whey lactose by means of biotechnological methods thus helping to increase the added value of the products made by dairy processing companies, as well as acquisition of new, valuable agricultural and food products.

**Main activities, planned results, progress in implementation of main activities:**

**The aim of the WP1 work package “Fermentation research for obtaining feed acidifiers ”** covers research on the fermentation of whey lactose for production of animal feed additives (acidifiers) emphasizing use of propionic acid bacteria (Prb). Currently, the activities planned for the WP1 work package are implemented as indicated in the research application. The practical part of fermentation studies and screening analyses (laboratory experimental stage) are completed\*. At the time of the report, a simplified technological description of the product production has been developed. The amount of animal feed acidifier required for further research has been produced in the pilot plant of the LLU Faculty of Food Technology (PTF). Scientific and popular science publications must be submitted by March 2021. Studies of the composition and stability of the samples obtained as well as processing of the results (for final technology description (Df)) must be completed by the end of October 2021.

**The aim of the WP2 work package “Animals – the study of acidifying preruminant calves’ feed”** covers testing of the efficiency of the products obtained (feed additives) on the growth and health indicators of calves. Currently, the activities planned are being implemented and based on the research plan are completed partially. Preliminary feeding trials have been carried out; the main experiment is started and it has been planned that it will be completed by the end of November 2020. Publications must be completed and submitted by November 2021 (planned end of the activity).

**The aim of the WP3 work package “Antimicrobial activity studies *in vitro*”** is related to the study of antimicrobial properties of the products derived from fermentation. In line with the work plan, practical activities in this activity will be performed later (from January 2021), but they have already been started in parallel with WP1, when the approbation of analytical methods was started. The practical part must be completed by the end of September 2021. The planned end of the activity is February 2022 when analysis of results must be completed and publications must be submitted.

## 2 SECTION – SCIENTIFIC QUALITY

**2.1. Clarity of objectives of the research application:** is the implementation process of the research application aimed at achieving the objectives and results planned in the application

### **Description of progress towards implementing key actions (see Table 2).**

**Within the WP1 work package**, fermentation research for obtaining feed acidifiers was performed at LLU PTF and cooperation partner institution – Institute of Microbiology and Biotechnology of the University of Latvia (LU MBI). One merchant was involved as well – Joint Stock Company "Smiltenes Piens" which introduces researcher with the whey processing and provides raw materials for research (investment in-kind). Currently, milestones 1.1–1.4 are reached:

Milestones 1.1–1.3: seven strains of Prb were purchased and used in research; growth rate in different environments and conditions were studied; acidity changes were compared; main laboratory experiments of fermentation research and practical part of screening analyzes have been completed; cultivation parameters optimum for the development of technology used in the production of feed acidifiers was set for the next WP2. A simplified technological description of the product (scheme D) has been developed, however it will be specified when summarizing all research results. In-depth composition research still continues. At the end of the project, final technological description (Df) as well as recommendations for manufacturers will be developed and submitted. It was concluded that in order to refine the final technological description Df further, it would be desirable to study effects of agitation speed on several strains of Prb bacteria in more detail (by the end of January 2022 to gain the additional knowledge needed to develop a Df by February 2022).

Milestone 1.4: whey fermentation for the next work package has been completed – 650 L of animal feed acidifier was produced in LLU PTF pilot plant.

Milestone 1.5: studies started on the stability of the product and its ingredients storage.

The presentation of the results at the conference (C1) was fulfilled partially, as summary was submitted and accepted for the *Foodbalt 2020* conference in Estonia, but the results were not disseminated because due to the Covid-19 threat conference was postponed to May of the next year.

In line with the time schedule, the following planned results have yet to be achieved in the remaining part of the project (not planned at the time of the report): preparation of P1 scientific publication on fermentation studies and A1 – article or other information in a popular scientific publication, mass media, etc.; d – three diagrams showing results of the product stability studies and final technological description (Df).

**In the WP2 work package**, research on the feeding of acidifiers to animals are started at the dairy farm owned by the cooperation partner – LLU research farm SIA "Vecauce"; the partner provides study with preruminant calves, necessary feed, etc. materials (in-kind contribution). Also measuring equipment and other materials (energy, veterinary costs, bedding, water, etc.) are available for the study. Several qualified employees are funded from the project to perform specific tasks of the activity. According to the time schedule, milestones 2.1–2.2 were reached (preparing trials and pilot experiment with 1–75 days-old dairy heifers). The main experiment is currently underway. Other activities: a seminar "Improving reproducibility and the 3Rs of animal experiments, from planning to publication" was attended in 2019 (the notation "X" in the time schedule). The following results are still to be achieved within rest of the project: P2 – scientific article; C2 – presentation of results at conference; A2 – article in press or popular scientific journal; Z – activity for public involvement.

**In the WP3 work package**, in parallel with other activities, preparations for *in vitro* antimicrobial activity studies of fermentation products (approbation of microbiological methods) was started (earlier than planned). During the rest of the project, the following results were achieved: P3 – scientific article; A3 – article in a press or popular scientific journal (or publication for general public in mass media); C/S3 – presentation of results at a conference or symposium; Z – activity for public involvement.

**Changes made:**

1) Changes due to the global spread of COVID-19:

(1a) Foreign mobility restrictions due to the COVID-19:

COVID-19 makes the situation worldwide change rapidly, so travelling is restricted, and no long-term projections can be made. Currently, mobility took place for 24 days (total planned duration: 180–186 calendar days). Due to the spread of COVID-19, conference attendance (part of the mobility planned for 2020) has been postponed to May 2021.

The achievement of the objectives will not be affected if implemented during the second half of the project and the remaining part of the mobility is divided into several parts. The remaining mobility (location, duration, activities) will be implemented based on the epidemiological situation in the world.

(1b) Participation in public involvement activities is planned in a more flexible way, allowing for deviations from the time schedule; activities in which to participate would be selected taking into account the epidemiological situation in the world and Latvia.

2) Other changes (changes in foreign mobility before COVID-19): in May and November 2019 planned mobility was not implemented because the initial mobility planning was imprecise (it was planned too early). It was decided to carry out mobility at a later stage when more experience is gained from our own research and samples for further research are obtained. Mobility was started in January 2020 and lasted for 24 days allowing to the postdoctoral researcher starting the first exchange of experience and improvement of language and scientific writing skills (see Section 3.1).

**Conclusions:** The mid-term progress of the research application meets the objectives set (see Table 1). According to the description of the progress of the main actions mentioned above it can be stated that:

1) the activities performed during the implementation of the research application comply with the provisions of Clause 3 of the Cabinet Regulation 1.1.1.2 for the purpose of the measure “Support for post-doctoral research” and how they will contribute to 1.1.1.2 in achieving the objective of the measure “Support for Postdoctoral Research”;

2) the activities performed during the implementation of the research application correspond to the field of RIS3 smart specialization – knowledge-intensive bioeconomy;

3) the activities performed during the implementation of the research application comply with the scientific objective defined in Annex 4 “Scientific proposal” and contribute to the achievement of this objective and the planned results.

Table 1

Outcome indicators <i>(in accordance with Table 1.6.1 of the research application)</i>								
No.	Title of indicator	Initial value		Planned value				Unit
		year	value	year	intermediate value	year	final value	
1.	Number of created post-doctoral researcher posts expressed as full-time equivalent	2019	1	2020	1	2023	1	Number
2.	Number of scientific articles and publications	2019	0	2020	0	2022	3	Number
2.1.	Number of articles in the Web of Science / Scopus	2019	0	2020	0	2022	1	Number
2.2.	Including with a citation index of 50% of the industry average	2019	0	2020	0	2022	2	Number
3.	Number of new products and technologies that can be commercialized	2019	0	2020	0	2022	1	Number
4.	Attracted private investments	2019	0	2020	1811,85	2022	6690,30	EUR
5.	The number of enterprises, which co-operate with research institutions	2019	1	2020	2	2022	2	Number

**2.2. Correspondence of the methodology of the research application for achievement of the objective and results of the application:** whether methodology used in the research application is appropriate for achievement of the goal and end results of the research application

The methodology used in the research application is appropriate to achieve the aim and final results of the application, but there are some changes:

**WP1 activity:**

1.1 In order to choose the tactics for the production of animal feed additives on a larger scale in the conditions of a laboratory pilot-plant, fermentation studies have been carried out on a sufficient scale and a simplified technological description of the product has been developed (Scheme D). However, it was concluded that in order to develop the final technological description (Df) more precisely, it would be desirable that additional research should be carried out for understanding more in-depth the effect of the mixing rate on the activity of different Prb bacterial strains. If resources are sufficient, such research should be carried out by the end of January 2022 (possibly also in the framework of foreign mobility).

**Within the WP2 activity,** in order to ensure scientific quality in calf feeding experiments, qualified employees of the Faculties of Agriculture and Veterinary Medicine of the LLU are involved, performing certain duties to investigate animal weight gain, feed intake, diarrhea frequency and blood biochemical parameters of calves aged 1–90d.

During the planning and pre-testing activities, consultation with experts allowed making adjustments to the grouping

- In the pilot-experiment (3x4 animals) and
- In main study instead of the two groups planned, three groups – one control and two experimental groups consisting of ten animals (heifers) each – were formed to study the effect of acidification performed by different milk feeding methods:

1) Control group fed with warm milk (35 °C) without added acidifier (restricted feeding);

2) 1st Experimental group – limited feeding with gentle milk acidification to reach milk pH 4.6–5.2 and reduce milk temperature (20–25 °C);

3) 2d Experimental group – unrestricted milk feeding (*ad libitum*) with stronger acidification to reach pH 4.2–4.6. Acidified milk is prepared once a day and fed in unlimited amounts.

The total duration of the experiment was increased by feeding the acidifier until about 75d of age instead of the planned 60d, so that at the end of the milk period the live weight of the calf had reached 110 kg. The planned follow-up period is up to 90 d of age.

**2.3. Result clarity and scientific quality of the research application:** whether achieved research results are clear and unmistakable; scientific quality is appropriate, taking into account the scientific value, level of novelty of the achieved results

Scientific quality of results can be reached by using an appropriate methodology in the development of experimental design and correctly processing of the obtained data. The experiments are organized in such a way that the results obtained are scientifically reliable:

- 1) in fermentation and other studies in laboratory, the number of replicates is  $\geq 3$ ;
- 2) in animal studies, the number of animals in a group is 10, which is due to the fact that the birth, live weight and health indicators of the animals are less homogeneous and there is a higher risk that an animal may fall out of the group;
- 3) the number of replicates for analyzes is  $\geq 3$ .

#### Novelty

Research with propionic acid bacteria is an innovative research direction at LLU and LU speaking about the last 30 years in Latvia. Regarding animal nutrition aspect of this project, the use of animal feed acidifiers containing organic acids is a well-known practice; however, the use of fermented whey or its by-products is a promising and innovative way enriching the product with other valuable antimicrobial compounds and nutrients. Research is topical and relevant, as one of the priorities at the European Union level is to promote the research for use of natural remedies to strengthen the animal's internal ecosystem, as well as to reduce the antimicrobial resistance (AMR) caused problems to both – humans and animals.

#### Acquired technology rights

No commercialization of the product is planned during the implementation period of the application. It could be implemented during the post-monitoring period, for example in the form of a license agreement. During the implementation period of the application, a technological description will be developed, which can be used for concluding a license agreement. It is not intended to obtain a patent.

### 3 SECTION - SOCIO-ECONOMIC INFLUENCE

#### **3.1. Social and economic influence of the achieved results of the research applications:**

whether results of the research application have promoted development of the post-doctoral researcher, implementer of the research application, cooperation partner, scientific or economic sector, RIS3 objectives, society

#### **Impact on the development of science or economy, RIS3 goals and society**

First of all, it should be noted that one of the most valuable benefits of this project is cooperation between Latvian scientific institutions (LLU, LU MBI and SIA "Vecauce"), which expands the experience of all involved partners. In such a way the implemented project promotes cross-sectoral cooperation and development of scientific areas of food science, biotechnology and agriculture (livestock breeding and dairy sector), therefore it contributes to one of the RIS3 directions – development in areas with high growth potential and strong horizontal impact. The bioeconomical strategy also stipulates that it is important to rationalize the use of food by-products. The project will provide an experience that can be used by milk processors for more efficient production, acquisition of new products or products with higher added value. Manufacture of products that are local and cheaper compared to imported ones, and produced with environmentally friendly methods can contribute not only to specific businesses, but also to the development of local economy and promotion of global sustainability. Also society has to gain a deep understanding of sustainable bioeconomic supply and its opportunities. By popularizing the importance of research in the community (public informing activities see in the section 3.2.) it is expected to have a strong horizontal impact for the broad public.

The project has made also a valuable **contribution to further growth of the postdoctoral researcher and the increase of his scientific capacity:**

1. Literature studies and the first experiments encouraged more in-depth studies of various issues in the field of microbiology and biotechnology, therefore in the autumn months of the 2019 the postdoctoral student supplemented his knowledge at the University of Latvia by participating in autumn semester lectures and practical courses of microbiology. This is one of the science disciplines where new discoveries and methods are constantly emerging, so it was worth to return to the high school bench. Cooperation with the scientists of the LU MBI is also very valuable, allowing learning various modern work and analysis methods.

2. In order to prepare for animal nutrition research, the postdoctoral researcher attended the seminar "Improving reproducibility and the 3Rs of animal experiments, from planning to publication", in Latvia, Riga (November, 2019)

3. Several international scientific conferences were attended in Latvia, Jelgava, where experience was gained on issues of fermentation, whey utilization, bioeconomy, sustainable use of resources: "Foodbalt 2019"; "Bioeconomy and Rural Development 2019"; "Research for Rural Development 2019" (May, 2019).

4. The training seminar for researchers "Writing Research Papers and Good Practices in Scholarly Publishing" organized by VIAA was valuable for the development of research skills (May, 2019).

5. In January 2020, during the mobility to Estonia the postdoctoral researcher attended the language courses "Improv.English" and "Academic Writing in English" at the Tallinn University, improving both speaking and writing skills in English. During the mobility, she visited the Tallinn Food and Fermentation Technology Research Center for presenting the research project and discussing cooperation opportunities.



### 3.2. Achievements in dissemination of the results of the research application and in knowledge or technology transfer measures

<i>Public information measures implemented in the project</i>			
<b>Type of the measure</b>	<b>Description of the measure</b>	<b>Implementation period</b>	<b>Number</b>
<b>Information plate</b>	Plate at the beneficiary's premises	All research application implementation time	1 plate
<b>Information plate</b>	Plate at partners premises	During the cooperation period	3 plates
<b>Information on the Internet</b>	Publications as regular information updates about project progress on the LLU website ( <a href="http://www.llu.lv">www.llu.lv</a> ).	All research application implementation time (once every 3 months)	6 publications
<b>Participation in public involvement activities</b>	Events "European Scientists' Night 2019" and "RigaFood 2019"	2019	2 events
<b>Informing other researchers and academic staff</b>	Informing the Science Council of the LLU about scientific performance of the project	2019-2020 (once every six months)	2 presentations
	Presentation of the project topicality and goals for teachers of various Latvian educational institutions (courses organized by the Central Union of Latvian milk manufacturers for teachers of professional institutions (technical schools, colleges)) (venue LLU PTF)	2019	1 presentation
	Presentation about the project topicality and goals during a visit to the Tallinn Food and Fermentation Technology Research Center	2020	1 presentation
	Presentation of project objectives and results of WP2 pilot study to the Board of Directors of Latvian Agricultural Scientific Institutions, SIA "Vecauce", LLU teaching staff and industry specialists	2020	1 presentation
<b>Exchange of experience</b>	In 2019, several international scientific conferences were attended in Latvia, Jelgava, where experience was gained on issues of fermentation, whey utilization, bioeconomy, sustainable use of resources: "Foodbalt 2019"; "Bioeconomy and Rural Development 2019"; "Research for Rural Development 2019"	May, 2019	3 events

**4 SECTION – IMPLEMENTATION QUALITY**

**4. Implementation quality of the research application:** efficiency of the used resources, implementation progress of performed activities and quality of management system

When assessing the quality of the implementation of a research application, various aspects have been considered:

1. The division of roles and responsibilities of the collaborating partners, the contribution to the achievement of the objectives and results of the research application is excellent. The partners provide significant support in the implementation of the project (see the detailed description in section 2.1 of the report). Also the contribution of the 3 volunteers involved in animal and fermentation studies is a great support for the implementation of the project.

2. The adequacy of finances and resources is satisfactory. However due to the fact that all the 3 work stages of the research, especially, WP1 and WP2, as well as the planned mobility of the 6 month total duration, are resource intensive; it must be acknowledged that in the next phase of the project the funding required for a more complete process and excellent product research e.g. for the analyses of obtained samples is less than we would like. Additional care will be taken to find funding for in-depth studies that require relatively large resources (e.g. analysis of B group vitamins in fermentation samples).

3. The progress of the implementation of the performed activities is adequate; there are some changes that at the moment have not significantly affected the achievement of research results (see the changes made described in section 2.1 of the application report, including changes related to mobility and training). Regarding the implementation of mobility, due to the constraints created by Covid-19, it is difficult to make further predictions about the implementation of the remaining mobility (~ 5 months). In the worst case, it would be worth that the remaining time of foreign mobility, if not implemented, would be replaced by equivalent activities in Latvia (exchange of experience, conferences, trainings, researches useful for the project taking place in other scientific institutions, etc.).

**Table 2. Implementation progress of the performed activities of the research application\*:** progress of activities, completed tasks, performed deliverables, achieved milestones, time of completion and verification method

No.	Activity (work package) of the research application in accordance with the work plan specified in Section 1.5 of the research application and Annex No. 4/Research proposal”, Section 3.1*	Progress description of the work package	Achieved result	Result in numerical value		Involved partners (if applicable)	Information on what still needs to be done to implement the research application
				Result achieved at the interim moment of scientific quality	Plans for interim period of the research application		
1.	<p><b>WP1 – fermentation research for obtaining feed acidifiers</b></p> <p>1.1 Seven propionic acid bacteria (PrB) test strains chosen for screening; screening parameters (growth speed, propionic acid production) set;</p> <p>1.2. First experiments finished on fermentation optimal media and technology parameter development studies for liquid feed acidifiers;</p> <p>1.3. Process optimized against at least 2 parameters (initial lactose concentration and stirring speed);</p> <p>1.4. Whey-PrB fermentation started for next work package (technological description – D);</p>	<p>The planned activities in the work package (WP1) are in the process of execution and partially completed as planned in the research application. The main stage of fermentation research laboratory experiments and the practical part of screening analyzes have been completed (milestones 1.1.-1.3.); analyzes are still ongoing for in-depth composition research. At present, a simplified technological description of product extraction has been developed (Scheme D). The required amount of animal feed acidifier was produced in the LLU PTF pilot plant for further research.</p> <p>Submission of publications must be completed by March 2021.</p> <p>Studies on the composition and stability of the obtained</p>	<p>Milestones 1.1-1.4 have been fulfilled, as well as the following actions have been performed:</p> <p>1) studies of scientific literature, for example, extraction, composition and processing of whey in milk production enterprises, milk microbiology; propionic acid bacteria, production of propionic acid;</p> <p>2) meeting with the cooperation partner JSC "Smiltenes Piens" to get acquainted with the current whey processing technologies;</p> <p>3) milestones 1.1-1.3 are implemented: seven strains of PrB were purchased and used in the research; studied growth rate in different environments; compared propionic acid etc. substances production, pH and sugar analyzes performed. The optimal cultivation parameters for the development of technology for the production of feed acidifiers have been studied. Pasteurization and sterilization studies of fermentation raw</p>	<p>Scientific publication (P1) - 0</p> <p>Popular scientific publication (A1 *) - 0</p> <p>Conference (C1 **) - 0</p> <p>Simplified product description (D) - 1</p> <p>Diagrams (d) - 0</p> <p>Final technological description (Df) - 0</p> <p>Public involvement measures (Z) - 1</p> <p>Mobility (E, T) - 24 days</p>	<p>Scientific publication (P1) - 0</p> <p>Popular scientific publication (A1 *) - 0</p> <p>Conference (C1 **) - 1</p> <p>Simplified product description (D) - 1</p> <p>Diagrams (d) - 0</p> <p>Final technological description (Df) - 0</p> <p>Public involvement measures (Z) - 1</p> <p>Mobility (E, T) - 60 days</p>	<p>1) JSC "Smiltenes Piens";</p> <p>2) LU MBI;</p> <p>3) SIA "VECAUCE"</p>	<p><u>Publications</u> (P1) and (A1 *) are in preparation stage and will be submitted by March 2021.</p> <p><u>Conference</u> (C1 **) was postponed to May 2021</p> <p><u>To develop:</u> 3 diagrams (d) and 1 final technological description (Df)</p> <p><u>Mobility</u> ***</p>

	<p>1.5. Monitoring finished on storage stability of product and its' components in different conditions (3 diagrams obtained); development of final technological description (Df) (useful for possible license agreement in post-monitoring period) started.</p>	<p>samples (diagrams d), as well as a summary of the results for the development of the technology must be completed by the end of October 2021 (milestone 1.5.).</p> <p>It was concluded that in order to further refine the final technological description Df, it would be desirable to further investigate, as far as possible, the impact of mixing rates on different strains of Prb bacteria, to be completed by the end of January 2022 to prepare by February 2022.</p>	<p>materials at different temperatures have also been performed;</p> <p>4) mobility with partners at the LU MBI – for the acquisition and application of analytical methods;</p> <p>5) a simplified technological description of the product has been developed at the time of the report (Scheme D); 650 L animal feed acidifier was produced in LLU PTF pilot plant;</p> <p>6) a summary of the publication has been submitted and accepted for the conference “Foodbalt 2020” in Estonia;</p> <p>7) according to the milestone 1.5 studies on the storage stability of the product and its ingredients have been initiated.</p>				
2.	<p><b>WP2 – Animals – the study of acidifying calves' feed</b></p> <p>2.1. Preparation started;</p> <p>2.2. Feeding of acidifiers to calves (1st experiment going on);</p> <p>2.3. Feeding of acidifiers to calves (2nd experiment going on);</p> <p>2.4. Post-monitoring and data collection period (at least 1 month).</p>	<p>The planned activities in the work package (WP2) are in the process of execution and are carried out in accordance with the research application. Preparing trials and pilot experiment have been carried out; the main experiment is going on. Submission of publications must be completed by November 2021 (planned completion of the activity).</p>	<p>Research has been started at the cooperation partner SIA "Vecauce". According to the time schedule milestones 2.1.-2.2. have been fulfilled (pre-trials and pilot experiment1). The main experiment (3x10 animals) was launched in August 2020 and is currently underway (see description in the section 2.2 of the report).</p> <p>Literature studies and discussions with specialists in the field on animal nutrition issues continue. The seminar was attended sooner than planned (marked as "X" in the schedule).</p>	<p>Scientific publication (P2) - 0</p> <p>Popular scientific publication (A2 *) - 0</p> <p>Conference (C2 **) - 0</p> <p>Seminar (X) - 1</p> <p>Public involvement measures (Z) - 0</p> <p>Mobility (E, T) - 0 days</p>	<p>Scientific publication (P2) - 0</p> <p>Popular scientific publication (A2 *) - 0</p> <p>Conference (C2 **) - 0</p> <p>Seminar (X) - 0</p> <p>Public involvement measures (Z) - 0</p> <p>Mobility (E, T) - 0 days</p>	<p>11) JSC "Smiltenes Piens";</p> <p>2) SIA "VECAUCE"</p>	<p><u>Publications</u> (P2) and (A2 *) must be submitted by November 2021.</p> <p><u>The conference</u> (C2 **) must be attended by August 2021</p> <p><u>Public involvement measures</u> (Z) - 1</p> <p><u>Mobility</u> ***</p>

3.	<p><b>WP3 – Antimicrobial activity studies <i>in vitro</i></b></p> <p>3.1. Research methodology development, cultivation conditions and controlled growth experiments of 6 microorganism species in 96 well format done.</p> <p>3.2. Antimicrobial effects of propionic acid against 3 microorganisms done.</p>	<p>According to the work plan, the practical activities in this work package are planned later - from January 2021, but they have started earlier (approbation of analytical methods). The practical part must be completed by the end of September 2021. The planned end of the activity is February 2022, when the publications must be submitted.</p>	<p>Studies of the scientific literature on antimicrobial compounds and methods for determining efficacy are being continued.</p> <p>Preparations for this stage of work and approbation of analytical methods have started.</p>	<p>Scientific publication (P3) - 0</p> <p>Popular scientific publication (A3 *) - 0</p> <p>Symposium or conference (S / C3 **) - 0</p> <p>Public involvement measures (Z) - 0</p> <p>Mobility (E, T) - 0 days</p>	<p>Scientific publication (P3) - 0</p> <p>Popular scientific publication (A3 *) - 0</p> <p>Symposium or conference (S / C3 **) - 0</p> <p>Public involvement measures (Z) - 0</p> <p>Mobility (E, T) - 0 days</p>	LU MBI	<p><u>Publications (P3) and (A3 *)</u> must be submitted for publication by February 2022.</p> <p><u>The symposium or conference (S / C3 **)</u> must be attended by January 2022.</p> <p><u>Public involvement measures (Z)</u> - 1</p> <p><u>Mobility</u> ***</p>
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### **Explanations:**

\* Article or other information in a popular scientific publication, in the media, etc.

\*\* Scientific conferences have been assigned a serial number to make it easier to identify the progress made (no number was assigned in the timetable when the project was submitted). Also can be conference-like events (C), for example, a symposium (S).

\*\*\* Foreign mobility – the total planned duration of mobility is 6 months or 180-186 calendar days; it is intended for research and exchange of experience (E) or skills development / training (T). Foreign mobility may not be thematically linked to the duration of a particular work package. By the middle of the project, 24 days of mobility had been carried out (see section 3.1, as well as section 2.1 “Changes made”). The planned mobility to Estonia in 2020 (more precisely, conference Foodbalt 2020, planned as a part of mobility) was postponed to 2021 due to the declaration of a state of emergency as a result of the Covid-19 pandemic. The remaining foreign mobility will be implemented in the second half of the project, divided into several parts.

Budget summary of the research application not related to economic activity:							
Code	Title of the cost item	Application of unit costs (applicable or not applicable*)	Quantity		Unit	Costs of the research application	
			Envisaged in research application	Interim		Envisaged in research application	Interim
1.	Remuneration costs for the implementation personnel of the research application (post-doctoral researcher's gross salary + employer's compulsory social insurance contributions)	Not applicable	36	18	"2843,85"	91 625,82	45 980,93
2.	Implementation costs of the research application (Research costs)	Applicable	36	18	800	28 800,00	14 400,00
3.	Administration and infrastructure maintenance costs of the research application	Applicable			185.83/ shall not exceed 5% from the total eligible costs of the research application	6689,88	3344,94
4.	Investment in kind (shall not exceed 5% from the eligible costs of the research application)	(If applicable)				6690,30	1811,85
4.1.	Fixed assets (tangible assets)						
4.2.	Assigned materials (tangible assets)		16 278	4958	kg	6690,30	1811,85
4.3.	Professional activities related to research within the framework of the research application						
	<b>Total</b>					<b>133 806,00</b>	<b>65 537,72</b>