

## Opis delovnega mesta mladega raziskovalca/ke (*Description of the Young Researcher's position*)

1. Članica UL (*UL member*):

Biotehniška fakulteta, Oddelek za zootehniko  
Biotechnical Faculty, Department of Animal Science

2. Ime, priimek in elektronski naslov mentorja/ice (*Mentor's name, surname and email*):

Andrej Lavrenčič, [andrej.lavrencic@bf.uni-lj.si](mailto:andrej.lavrencic@bf.uni-lj.si)

3. Raziskovalno področje (*Research field*):

4.02 Živalska produkcija in predelava/ 4.02.02 Prehrana živali  
4.02 Animal production / 4.02.02 Animal nutrition

4. Opis delovnega mesta mladega raziskovalca/ke (*Description of the Young Researcher's position*):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce.

*slo:*

Usposabljanje mladega raziskovalca/ke (MR) bo potekalo na Katedri za prehrano Oddelka za zootehniko Biotehniške fakultete Univerze v Ljubljani v okviru programske skupine Prehrana in mikrobna ekologija prebavil (P4-0097).

Področje raziskav bo usklajeno z raziskavami v okviru programske skupine. MR se bo predvsem posvečal/a raziskavam o vplivu prehranskih dopolnil oz. prehranskimi dodatki na osnovi zdravilnih rastlin, zelišč, začimb in rastlinskih izvlečkov na hranilno vrednost krme in krmil za prežvekovalce, njihovem vplivu na okolje, pri čemer bo pozornost posvečal dodatkom, ki zmanjšujejo izločanje toplogrednih plinov (metan) in dušikovih spojin v okolje (amoniak in N<sub>2</sub>O) ter preko tega iskal tiste dodatke, ki vodijo k bolj gospodarni, trajnostni, nizkoogljivi, ekološki in konkurenčni priraji mleka in mesa. Naravni rastlinski dodatki so okoljsko sprejemljivi in jih lahko uporabljamo ne le v intenzivni (konvencionalni), ampak tudi v ekološki oz. biološki reji živali, poleg tega pa so sprejemljivi tudi z vidika porabnikov, ki prednostno izbirajo živila, pri pridelavi katerih se uporabljajo naravni in ne sintetični dodatki. Raziskovanje delovanja dodatkov bomo razdelili na dva sklopa. V prvem sklopu - »ŽIVAL« - bomo ocenili, kakšen vpliv imajo dodatki in z dodatki tretirana krmila na kakovost in izkoriščanje krme ter hranljivih snovi, na procese prebave, na mikrobno razgradnjo in fermentacijo hranljivih snovi v predželodcih prežvekovalcev, na presnovo hranljivih snovi in na zdravje živali ter kako vplivajo na aktivnost mikrobne združbe v prebavnem traktu. V drugem sklopu - »OKOLJE« - bomo preučili vplive dodatkov na obremenjevanje okolja, predvsem na emisije toplogrednih plinov, kot sta metan in ogljikov dioksid, ter izločanje nekaterih okoljsko problematičnih snovi v okolje, kot je npr. amoniak.

Z uporabo (zdravilnih) rastlin (listov, cvetov, sadežev, semen), rastlinskih izvlečkov oz. posameznimi izoliranimi bioaktivnimi snovmi lahko spreminjamo, nadzorujemo in usmerjamo fermentacijo in razgradnjo hranljivih snovi v predželodcih prežvekovalcev. Z uporabo rastlin in njihovih izvlečkov bi želeli doseči, da bi bila prehrana živali naravnana tako, da bi bila čimbolj

okoljsko sprejemljiva. To bi lahko dosegli z:

- 1) Zmanjšanjem produkcije metana in na splošno tudi drugih fermentacijskih plinov, kar ima za posledico boljše izkoriščanje energije in hranljivih snovi obroka.
- 2) Povečanjem mikrobne sinteze beljakovin oz. zmanjšanjem razgradljivost kakovostnih beljakovin v predželodcih prežvekovalcev, s čimer bi zmanjšali odvisnost prežvekovalcev od dragega nakupa beljakovinskih krmil ter tako zagotovili boljše pokrivanje potreb živali z beljakovinami in/ali
- 3) Povečanjem sinteze hlapnih maščobnih kislin (HMK) pri fermentaciji ogljikovih hidratov v vampu, s čimer bi zagotovili boljšo oskrbo živali z energijo. Želeli bi namreč najti dodatke, ki ne samo povečajo sintezo HMK, ampak tudi spremenijo razmerja med posameznimi HMK, predvsem med očetno in propanojsko kislino. S spreminjanjem mikrobne fermentacije v smer večje sinteze HMK, predvsem propanojske kisline, bi dosegli boljšo oskrbo živali z glukozo (glukoneogeneza) in zaradi tega tudi:
  - 1) manjšo možnost pretirane izgube telesne kondicije (lipolize telesnih rezerv) in pojava ketoze pri molznicah, boljšo plodnost molznic, s tem pa tudi manjše število izločenih živali in povečano dolgoživost molznic
  - 2) boljše priraste pri pitovnih živalih, saj je znano, da propionska kislina deluje anabolno in povečuje nalaganje telesnih beljakovin.

V prvem delu raziskave bomo preučevali, kako različni rastlinski dodatki, v različnih koncentracijah in z različnimi načini tretiranja vplivajo na *in vitro* razgradljivost, prebavljivost in fermentabilnost krme in obrokov, ter kakšni so končni produkti fermentacije, predvsem kako vplivajo na tvorbo in sproščanje metana, drugih toplogrednih plinov in hlapnih maščobnih kislin. V drugem delu raziskave bomo najbolj obetavne rastlinske dodatke (vrste, količine in načine tretiranja) uporabili tudi v poskusu/poskusih na pitovnih prežvekovalcih, kjer bi poleg vplivov dodatkov na zauživanje obroka, priraste in konverzijo krme preverjali tudi, kako ti dodatki vplivajo na parametre krvi, kot so npr. vsebnosti glukoze, beta-hidroksibutirata, nezaestrenih maščobnih kislin in sečnine ter na določene jetrne encime, kot so npr. gama-glutamyl transferaza (GGT), aspartat aminotransferaza (AST) in alanin aminotransferaza (ALT) in na oksidativni stres z meritvami vsebnosti malondialdehida (MDA), antioksidativne kapacitete (ACL in ACW) .... S pomočjo analize izdihanega zraka živali, bi lahko ugotavljali, ali dodatki učinkovito zmanjšujejo količine in koncentracije nezaželenih plinov tudi *in vivo*, predvsem toplogrednih plinov (ogljikov dioksid in metan) in amoniaka. Ob ugodnih rezultatih teh dveh delov raziskav bi lahko delo razširili tudi na molznice, kjer bi preučevali vplive dodatkov na mlečnost in sestavo mleka, ter podobno kot s pitanci na parametre krvi, jetrne encime, na oksidativni stres živali in izločanje plinov v izdihanem zraku.

Metode dela:

- kabinetne raziskave
- eksperimentalne raziskave:
  - o v laboratoriju: uporaba *in vitro* tehnik, izvajanje kemijskih analiz in fizikalnih meritev v vzorcih, pridobljenih v *in vivo* in *in vitro* raziskavah
  - o na živalih: izvajanje prehranskih poskusov (pod vodstvom)

Kandidat za MR mora obvladati angleški jezik.

*eng:*

The young researcher will be trained at Chair for Nutrition of the Animal Science Department of the Biotechnical Faculty of the University of Ljubljana within the framework of the research programme Nutrition and microbial ecology of the gastrointestinal tract (P4-0097).

The main research area will be integrated with the current research activities of the research programme. The young researcher will study the effects of feed supplements/feed additives

deriving from medicinal plants, herbs, spices and plant extracts on the nutritive value of feeds for ruminants, their effect on the environment, particularly on those additives which decrease the release of greenhouse gasses (GHG) (methane) and N-compounds to the environment (ammonia and N<sub>2</sub>O) and through them seek for those additives, which lead to more economic, sustainable, low carbon, ecologic and competitive milk and meat production. Natural plant additives are environmentally acceptable and can be used in intensive (conventional) and also in biological and ecological animal rearing systems. They are also accepted by consumers, who predominantly chose the food, which is produced with the use of natural but not synthetic additives. Research efforts will be divided into two parts. In the first part – “ANIMAL” – we will estimate the effects of plant feed additives on the feed quality and conversion of feed and nutrients, on digestive processes, microbial degradation and fermentation of nutrients in ruminant forestomachs, metabolism of nutrients and animal health and how they affect the activities of the microbial community in the gastrointestinal tract. In the second part -” ENVIRONMENT” - we will study the environmental load by using natural plant additives, particularly on the emissions of GHG such as methane and carbon dioxide, and emissions of some environmentally non desired substances such as ammonia.

With the use of (medicinal) plants (leaves, flowers, fruits and seeds), plant extracts or isolated bioactive substances we can change, control and direct the fermentation and degradability of nutrients in ruminant forestomachs. With the use of medicinal plants and their extracts, we want to achieve that animal nutrition is as much as possible environmentally acceptable. This could be achieved by:

- Reducing the methane release but also other fermentation gasses, which improve the utilisation of energy and nutrients from the diet.
- Increase the synthesis of a microbial protein or decrease the high-quality proteins in ruminant forestomachs, which will decrease the dependence of ruminants on the purchase of expensive protein feeds and assure better coverage of animal requirements regarding the protein and/or
- Increase of short-chain fatty acid (SCFA) synthesis during the fermentation of carbohydrates in the rumen, which will assure better coverage regarding the energy. We want also to find the additives, which could, besides the increase of SCFA, also change the proportions between individual SCFA, particularly between acetic and propionic acid. Changing the microbial fermentation towards the greater SCFA synthesis, particularly toward propionic acid, we can achieve also greater glucose synthesis (gluconeogenesis) and because of this also:
  - a) Lower probability of excessive body condition losses (lipolysis of body reserves) and occurrence of ketosis in dairy animals, better reproduction and also decreased number of culled animals together with increased longevity
  - b) Increased daily gains in fattening animals. It is well known that propionic acid is anabolic and increases the accumulation of body proteins.

In the first part of the research we will investigate how the different additives in different concentrations and treatments affect the *in vitro* degradability, digestibility and fermentability of feeds and diets and which are the end products of fermentation, particularly how these additives affect the synthesis and release of methane, other GHGs and SCFAs. In the second part of the research, we will add the most promising plant additives (species, concentrations and treatments) to the diets of fattening animals, where we want to determine the effects of additives on dry matter intake, daily gains and feed conversion, and also how these supplements affect the blood parameters such as glucose, beta-hydroxybutyrate (BHBA), non-esterified fatty acid (NEFA) and urea contents and on specific liver enzymes such as gamma-glutamyltransferase (GGT), Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) and ob parameters of oxidative stress with measurements of malondialdehyde (MDA), and antioxidative capacity (ACL and ACW)... With the analysis of animal breath, we could also determine if additives

efficiently decrease the concentrations of unwanted gasses *in vivo*, especially GHGs (carbon dioxide and methane) and ammonia. If these results will be promising that we could expand the research also on dairy animals, where the analyses will be oriented not only toward blood parameters, liver enzymes, oxidative stress and composition of animal breath, but also toward milk production and milk composition.

Research methods:

- desk research
- experimental research
  - o laboratory research: use of *in vitro* techniques, chemical analyses, physical measurements in samples, obtained in *in vivo* and *in vitro* trials
  - o animal trials: carrying-out nutrition experiments (under supervision)

The candidate for young researcher has to be proficient in English.