

Biologically active components of rugosa rose (*Rosa rugosa* Thunb.) as potential modulators of methane emission, fatty acids biohydrogenation, and milk quality in dairy cows

To achieve carbon neutrality by 2050, the research communities have stepped up efforts to identify strategies to reduce greenhouse gas emissions also from the agricultural sector. One of the popular directions is the use of feed components to reduce methane production and modulate the population of microorganisms inhabiting the rumen of ruminants. According to the latest knowledge, among the feed components, chemical blockers of methanogens can be the most promising substances. However, many cattle breeders and finally consumers in Poland and Europe prefer natural solutions, such as plants containing biologically active components. Additionally, biologically active components from selected feed components may have the health-promoting properties of animal products. An example could be the nutritional enrichment of milk with health-promoting polyunsaturated fatty acids, including conjugated linoleic acid. **Therefore, further research is essential to enable the livestock sector to use feed components and additives, including biologically active components combining the reduction of the cost of purchases with an environmentally friendly character.** Rugosa rose (*Rosa rugosa* Thunb.) is a popular plant in Poland with low cultivation requirements. All parts of this plant are used in natural medicine, and the petals and fruits are commonly used to produce jams, teas, and juices. Examples of bioactive substances found in rose hips are not only vitamins (C, A, B₁, and E) but also polyphenols, which are responsible for antioxidant properties. Additionally, rose hips include a high content of unsaturated fatty acids (mainly C18:3 n-3).

The research project will investigate the role and mechanisms of action of rugosa rose fruit pomace (Polska Roza Sp. z o. o., in fresh and ensiled form) rich in polyphenols and unsaturated fatty acids, especially C18:3 n-3, on basic biochemical rumen parameters as well as changes of microorganisms responsible for these processes. Finally, the methane emission scale will be determined, and the level of C18 PUFA biohydrogenation will be analyzed based on the FA profile in the rumen and milk. In addition, the oxidation-reduction potential of milk and its basic nutrients will be examined, as well as the hormonal profile, antioxidant parameters and basic blood parameters in dairy cows. **It is assumed that the rugosa rose fruit pomace can be a by-product available in Poland and Europe on a worth-the-attention scale and may be a valuable component of the diet for dairy cows, reducing methane emissions and positively influencing the antioxidant profile and the content of long-chain fatty acids in milk.**

This project includes *in vitro* and *in vivo* experiments that will comprehensively cover the topic of using rose hip pomace in the fresh and ensiled form in dairy cows' nutrition. The influence of this by-product from the local production of juices on the parameters described above will be analyzed, but also the importance of individual bioactive substances (polyphenols and C18:3 n3 acid extracted from rose hip pomace) and the interactions between them will be evaluated. **The project includes the use of modern research procedures, such as** studies of the fatty acids profile, gene expression in milk somatic cells, the oxidation-reduction potential of milk, and the studies of quantitative and qualitative changes in the population of rumen bacteria using next-generation sequencing (NGS).

It is expected that polyphenols and unsaturated fatty acids (C18:3 n- 3) from rugosa rose fruit pomace (*Rosa rugosa* Thunb.) as natural components of dairy cow's diet will have a beneficial effect on the rumen microflora population and thus improve fermentation and reduce methane emission. Finally, the active compounds of the rugosa rose promote milk's quality and nutritional value by increasing the level of unsaturated fatty acids and compounds with antioxidant properties.