Commentary

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Selenium is an Essential Component of Various Enzymes and Proteins

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Description

The study aimed to assess the suitability of yellow mealworms raised on local agricultural by-products as a potential feed for both monogastric and ruminant animals. Mealworms were cultivated on Oat-Based (OB) and Wheat-Based (WB) by-products and their nutritional characteristics and digestibility were examined, mimicking the digestive systems of both types of animals. Additionally, the gut microbiome of mealworm larvae was investigated. Larvae fed on WB showed higher levels of crude fat and most minerals compared to those fed OB, reflecting the nutritional composition of the substrates.

Livestock feed

Larvae and pupae exhibited similar nutritional profiles, with lower levels of crude fiber, crude protein and total amino acids and higher levels of crude fat, total fatty acids and gross energy compared to adults. The total essential and non-essential amino acid contents in larvae and pupae resembled those found in commercial Soybean Meal (SBM). Protein digestibility of larvae and pupae were similar to SBM and significantly higher than those of adults for both monogastrics and ruminants. Understanding the nutritional value of mealworms at different developmental stages when fed agricultural by-products and how feeding influences the larval gut microbiome offers a novel approach to utilizing mealworms as a sustainable alternative feed source in the future.

As the global population expands rapidly, ensuring food security has become a pressing concern worldwide. The livestock industry plays a crucial role in agricultural food production, providing 15% of total food energy and 31% of dietary protein globally. With an increase in calorie consumption and a shift towards animal-based diets globally, there is an anticipated rise in the demand for livestock-based products, especially in low and middle-income nations. Meeting this increased demand for livestock products necessitates the identification and utilization of alternative animal feed resources to establish a sustainable livestock sector. In recent years, various insect species have emerged as promising alternatives and more sustainable feed ingredients for livestock due to their ability to convert waste or by-products into biomass rich in protein and other essential nutrients.

Mechanisms in livestock

Several studies have affirmed the crucial importance of nutrient detection in livestock, both in controlled laboratory settings and in real-world scenarios. Most of the mechanisms for sensing nutrients like amino acids, fats and carbohydrates are similar across various farmed animals such as pigs. Amino acids like methionine, leucine, arginine, among others, have been shown to trigger the mTOR pathway in cell cultures from different animals including quails, cows and pigs. Additionally, certain amino acids, particularly branched-chain ones, can activate the mTORC1 pathway in lactating cows and piglets. Fatty acids, particularly long-chain ones, stimulate the release of certain hormones in pig intestines, while linoleic acid seems to affect specific protein levels in the muscle of broiler chickens. The PI3K-PKB-mTOR pathway has also been linked to infections caused by certain viruses in pigs. Supplementing the diet with Leucine could mitigate the decline in mucin production in the intestines of young pigs affected by a certain type of virus. Furthermore, deficiencies in mTOR activity have been associated with intestinal issues during weaning in piglets. Glutamate supplementation has been shown to improve signaling related to mTOR, reduce inflammation and alleviate intestinal damage in young pigs subjected to bacterial challenges. Moreover, activators of mTOR, including certain amino acids, have been found to promote muscle growth in young pigs.

In pigs, the intestine plays a crucial role in communicating the body's nutritional status to the brain and regulating feeding behavior. Artificial sweeteners, commonly added to piglet diets to mitigate post-weaning digestive problems and stimulate growth, are now thought to work by enhancing certain activities in the intestines related to glucose absorption. Taste receptors and nutrient sensors in the intestines also contribute significantly to food intake and appetite control in chickens.

Selenium (Se), an essential nutrient for both human and animal health, is involved in various bodily functions including antioxidant defense, immune response and metabolism. The importance of dietary selenium, in organic and inorganic forms, has been extensively studied in domestic animals. Various feeding strategies have been devised to increase selenium levels in animal products, addressing deficiencies and potentially offering therapeutic benefits against diseases associated with free radicals. However, further research is urgently needed to determine the optimal selenium supplementation in feed, long-

term effects of selenium use in animal nutrition, the transformation of metallic selenium nanoparticles in living organisms and the impact of selenium nanoparticles on feed industry workers and the environment. This review primarily focuses on the absorption and metabolism of selenium and its antioxidant properties, exploring its applications in animal health and highlighting unresolved issues that warrant further investigation. The aim is to provide a theoretical framework for improving the quality of animal products and developing technologies for enhancing nutritional value using selenium.