

# Fermented rapeseed meal in the diet of growing pigs

Domżał-Kędzia M.<sup>1</sup>, Czech A.<sup>2</sup>, Nowakowicz-Dębek B.<sup>3</sup>, Łukasiewicz M.<sup>1,4</sup>, Wlazło Ł.<sup>3</sup>, Lewińska A.<sup>5</sup>

<sup>1</sup> Department of Biotransformation, Faculty of Biotechnology, University of Wrocław, F. Joliot-Curie 14A, 50-383 Wrocław, Poland, [marta.domzal@uwr.edu.pl](mailto:marta.domzal@uwr.edu.pl)

<sup>2</sup> Department of Biochemistry and Toxicology, Faculty of Animal Sciences and Bioeconomy, University of Life Sciences in Lublin, 12 Akademicka Street, 20-950 Lublin, Poland, [anna.czech@up.lublin.pl](mailto:anna.czech@up.lublin.pl)

<sup>3</sup> Department of Animal Hygiene and Environmental Hazards, Faculty of Animal Sciences and Bioeconomy, University of Life Sciences in Lublin, 13 Akademicka Street, 20-950 Lublin, Poland, [lukasz.wlazlo@up.lublin.pl](mailto:lukasz.wlazlo@up.lublin.pl); [bozena.nowakowicz@up.lublin.pl](mailto:bozena.nowakowicz@up.lublin.pl)

<sup>4</sup> InventionBio, Jakóba Hechlińskiego 4, 85-825 Bydgoszcz, Poland, [marcin.lukaszewicz@inventionbio.pl](mailto:marcin.lukaszewicz@inventionbio.pl)

<sup>5</sup> Faculty of Chemistry, University of Wrocław, Joliot-Curie 14, 50-383 Wrocław, Poland [agnieszka.lewinska@chem.uni.wroc.pl](mailto:agnieszka.lewinska@chem.uni.wroc.pl)

Key words: solid-state fermentation, rapeseed meal, *Bacillus*, animal fodder  
Presenting author email: [marta.domzal@uwr.edu.pl](mailto:marta.domzal@uwr.edu.pl)

## Introduction

Rapeseed meal (RM) is a feed material obtained after pressing oil from rapeseeds, subjected to continuous extraction with organic solvents, containing 2–4% fat. In monogastric animals, substances contained in rapeseed meal (e.g. glucosinolates, phytates, or dietary fibre) can limit the utilization of nutrients or exert harmful effects on the animals. The content of these substances can be reduced through fermentation. The nutritional benefits of the modifications of nutrients in fermented rapeseed meal (FRM) are reflected in improved growth performance of pigs (Czech et al. 2021) as well as favourable changes in their faecal microbiota, and thus a reduced frequency of diarrhoea and death (Grela et al., 2019). Moreover, emissions of ammonia and other nutrients are reduced by more than 20% (Czech et al., 2022 - under preparation) (Fig. 1).

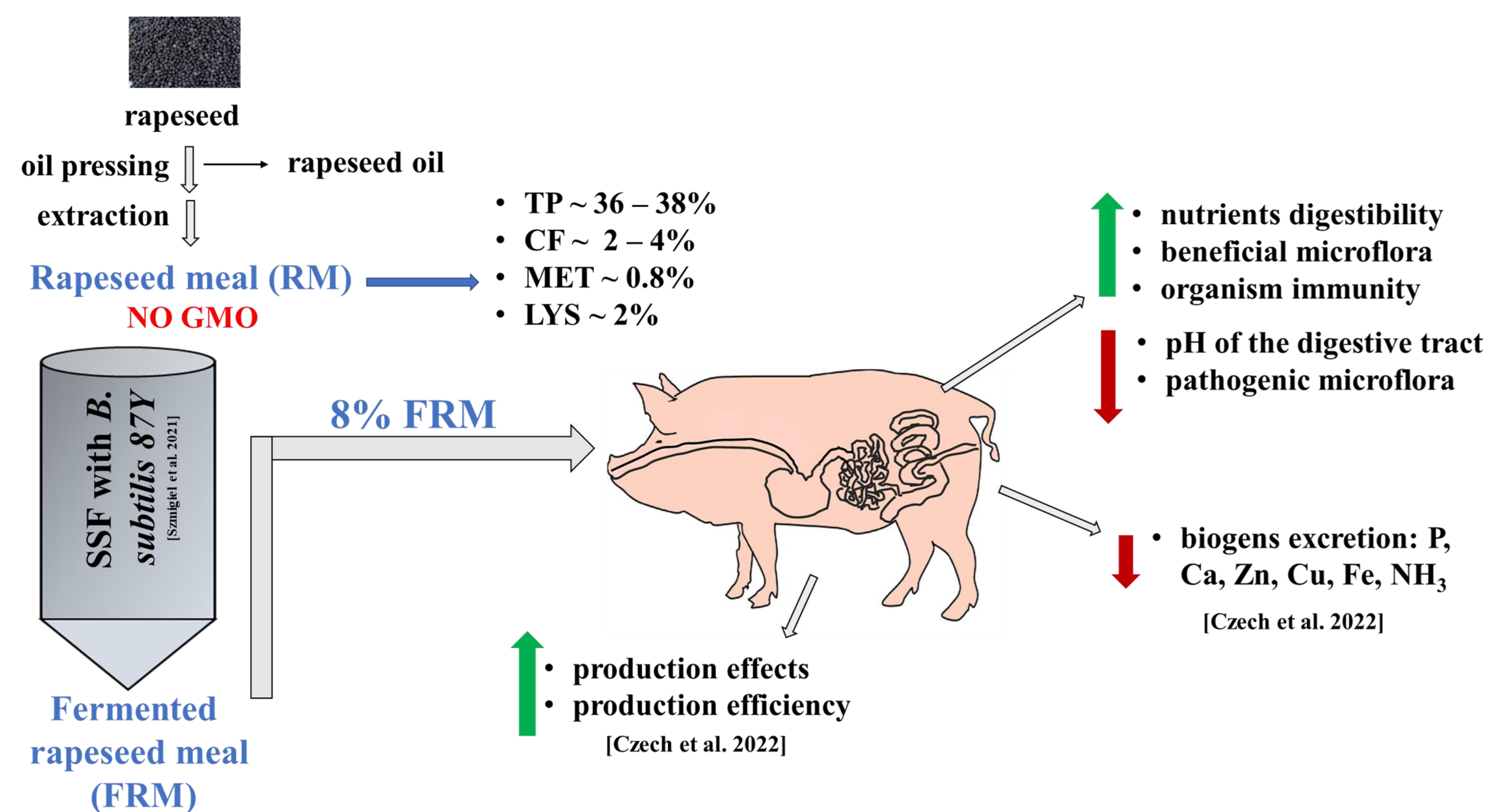


Fig.1. The role of fermented rapeseed meal in the diet of piglets.

To increase the nutritional value of FRM, many microbial species such as *Aspergillus oryzae* (Kim et al., 2007), lactic acid bacteria (Cho et al., 2007), and *Bacillus subtilis* (Kiers et al., 2003) have been used independently for the fermentation process (Yuan et al., 2017). Our own studies on mink (Wlazło et al., 2021b), rabbits (Wlazło et al., 2021a), and poultry (Czech et al., 2022 – under preparation) suggest that the *B. subtilis* 87Y strain used for rapeseed fermentation is an interesting probiotic. It enriches the product and helps to maintain homeostasis and prevent dysbiosis, thereby improving production outcomes. The study aimed to analyse the effect of the use of 8% FRM in diets for piglets on characteristics of the gastrointestinal tract, modulation of the small intestine microbiota, and immune and antioxidant status.

## Materials & Methods

The study was conducted according to the guidelines of the Declaration of Helsinki. The experimental procedure was approved by the Local Ethics Committee on Animal Experimentation of the University of Life Sciences in Lublin, Poland (approval no. 50/2018, of 1st April 2018), Poland. The study was conducted on 28-day-old weaned pigs. In the control group (C), soybean meal (SBM) was the main source of dietary protein. In the diet of the remaining groups, FRA and FR, SBM was partially replaced with 8% FRM. In the FR diet, in contrast to FRA, the following additives were not included: enzyme additives, pro-, and prebiotics, organic acids, and zinc oxide. After final weighing (~35 kg), blood samples from the jugular vein of 6 piglets from each group (one medium-weight boar per pen, 18 pigs in total) were collected for analysis. Then the animals were euthanized and the digestive tract and its contents were collected for analysis. Liver samples were also taken from each animal to test for the content of redox indicators.

## Results & Discussion

Table 1. Microbiological composition of the contents of the small intestine and immunoglobulins in the blood of weaners.

Parameter	C	FRA	FR
Total aerobic bacteria	$7.3 \times 10^4$	$1.2 \times 10^6$	$1.6 \times 10^5$
Total <i>Clostridium perfringens</i>	$1.9 \times 10^3$	$1.2 \times 10^3$	$1.5 \times 10^3$
Total <i>Lactobacillus</i>	$5.7 \times 10^6$	$1.6 \times 10^7$	$3.2 \times 10^7$
<i>Escherichia coli</i>	$4.5 \times 10^4$	$3.3 \times 10^4$	$4.1 \times 10^4$
<i>Salmonella</i>	ng	ng	ng
<b>Immunological parameters</b>			
IgG; mg ml <sup>-1</sup>	17.90	25.55	17.50
IgA; mg ml <sup>-1</sup>	3.34	5.87	3.42
IgM; mg ml <sup>-1</sup>	0.708	1.02	0.304
IL6; pg ml <sup>-1</sup>	116.2	105.1	117.2

The inclusion of 8% FRM with *B. subtilis* 87Y strain in the diet of piglets together with feed additives (phytase, peptidases, xylanases, probiotics, *Saccharomyces cerevisiae*, organic acids, and zinc in the amount of 150 ppm) has a positive effect on gastrointestinal function. FRM also helps to stabilize the sensitive intestinal mucosa, influences the diversity and functions of the bacterial microbiota (increasing numbers of *Lactobacillus*), inhibits the growth of some pathogens, and strengthens the immune response against infections (increasing levels of IgG, IgA, and IgM). By lowering the pH in the digestive tract, increases the influence of beneficial intestinal microbes and volatile fatty acids on *Enterobacteriaceae* and probably on *Salmonella* spp. Feeding piglets a diet with FRM without the addition of feed additives or ZnO in the amount of 150 ppm did not improve immune parameters.

## Conclusions

The use of fermented rapeseed meal in the diet of piglets may help to maintain their health and thus increase productivity. This means of sustainable animal production also reduces the impact of farms on the environment.