

**Review: A systematic review on the use and effects of postbiotics on the general health, gut health, and performance of sows and piglets.**

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Journal: *animal*

**Table S1.** Boolean search string used for the bibliographic search of articles examining the effects of postbiotic supplementation on gut health indicators in pigs.

Database	Research strings
PubMed and Scopus	( postbiotic OR "heat treated product" OR "tyndallized probiotic" OR "inactivated probiotic" OR "fermentation product" OR "yeast derived product" OR "treated yeast" OR "bacterial lysate" OR exopolysaccharide OR "teichoic acid" OR peptidoglycan OR "cell-free supernatant" ) AND ( swine OR pig OR piglet OR sow OR litter OR offspring ) AND ( gestating OR lactating OR suckling OR weaning OR post-weaning ) NOT probiotic
Google Scholar	("postbiotic" OR "heat treated product" OR "tyndallized probiotic" OR "inactivated probiotic" OR "fermentation product" OR "yeast derived product" OR "treated yeast" OR "bacterial lysate") ("exopolysaccharide" OR "teichoic acid" OR peptidoglycan OR "cell free supernatant") (swine OR pig OR piglet OR sow OR litter OR offspring) (gestating OR lactating OR suckling OR weaning OR "post weaning") -probiotic
Web of Science	(TS=(postbiotic) OR TI=(Heat treated product OR tyndallized probiotic OR Inactivated probiotic OR Fermentation product OR Yeast derived product OR Treated yeast OR Bacterial lysate OR Exopolysaccharide OR Teichoic acid OR Peptidoglycan OR Cell – free supernatant) AND TI=(swine OR Pig OR piglet OR sow OR litter OR offspring) AND TI=(gestating OR lactating OR suckling OR weaning OR post-weaning) NOT TI=(probiotic))

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**Table S2.** Gut health parameters analysed in the articles examining postbiotic supplementation and its effects on gut health indicators in pigs included in the review.

Gut health pillars				
Epithelial barrier and digestion	Immunomodulation	Oxidative stress homeostasis	Microbiota balance	Performance and health
Apparent Total Tract Digestibility	Immunoglobulin	Catalase	α-diversity	Average Daily Gain
Cells Proliferation	Aspartate Aminotransferase	Glutathione Peroxidase	Beneficial bacteria	Antibiotic injection
Claudin	Blood Urea Nitrogen	Malondialdehyde	Harmful bacteria	Average Daily Feed Intake
Crypt Depth	Creatine Phosphokinase	Superoxide Dismutase	Short-Chain Fatty Acids	Backfat thickness
Digestive enzymes	Interferon	Total Antioxidant Activity		Body Condition Score
Faecal score	Interleukin			Body weight
Occludin	Mammalian Target Of Rapamycin			Born Alive
Transporters	Neutrophil			Feed Conversion Ratio
Villous Area	Nuclear Factor Kappa-Light-Chain-Enhancer Of Activated B Cells			Feed Intake
Villous Height	Plasma Urea Nitrogen			Feed To Gain Ratio
Villous Width	Platelet			Gain To Feed Ratio
Villus To Crypt Ratio	Toll-Like Receptor			Mortality
Zonula Occludens-1	Transforming Growth Factor Beta			Number of weaned pigs
	Tumour Necrosis Factor			Stillborn
	White Blood Cell			Total Born
				Wean to oestrus

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**Table S3.** Complete list of articles related to postbiotic supplementation and its effects on gut health indicators in pigs included in the review.

Title	Strain-derived postbiotic	Pig category	DOI	Database	Reference
Selection of Fermentation Supernatant from Probiotic Strains Exhibiting Intestinal Epithelial Barrier Protective Ability and Evaluation of Their Effects on Colitis Mouse and Weaned Piglet Models	<i>Lactobacillus reuteri</i>	Post weaning	10.3390/nu16081138	PubMed	Abrehome et al., 2024
Gastrointestinal dynamics, immune response, and nutrient digestibility of weanling pigs fed diets supplemented with enzymatically treated yeast	<i>Saccharomyces cerevisiae</i>	Post weaning	10.1093/jas/skac377	Google Scholar	Alagbe et al., 2022
Influence of a whole yeast product ( <i>Pichia guilliermondii</i> ) fed throughout gestation and lactation on performance and immune parameters of the sow and litter	<i>Pichia guilliermondii</i>	Gestation/lactation	10.1093/jas/skz060	Google Scholar	Bass et al., 2019
Probiotics: viable and inactivated cells on the performance, microflora and blood parameters of piglets	<i>Lactobacillus plantarum</i>	Suckling	10.1590/S1519-99402015000200013	Google Scholar	Busanello et al., 2015
Microbial Mechanistic Insight into the Role of Yeast-Derived Postbiotics in Improving Sow Reproductive Performance in Late Gestation and Lactation Sows	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.3390/ani14010162	PubMed	Chang et al., 2024
The Effects of Dietary Supplementation of <i>Saccharomyces cerevisiae</i> Fermentation Product During Late Pregnancy and Lactation on Sow Productivity, Colostrum and Milk Composition, and Antioxidant Status of Sows in a Subtropical Climate	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.3389/fvets.2020.00071	PubMed	Chen et al., 2020
Growth performance, immune status, gastrointestinal tract ecology, and function in nursery pigs fed enzymatically treated yeast without or with pharmacological levels of zinc	<i>Saccharomyces cerevisiae</i>	Post weaning	10.1093/jas/skac094	Google Scholar	Christensen et al., 2022
Efficacy of <i>Saccharomyces</i> yeast postbiotics on cell turnover, immune responses, and oxidative stress in the jejunal mucosa of young pigs	<i>Saccharomyces cerevisiae</i>	Post weaning	10.1038/s41598-024-70399-2	PubMed	Duarte e Kim 2024
Effects of dietary <i>Lactobacillus</i> postbiotics and bacitracin on the modulation of mucosa-associated microbiota and pattern recognition receptors affecting immunocompetence of jejunal	<i>Lactobacillus fermentum</i> and <i>Lactobacillus delbrueckii</i>	Post weaning	10.1186/s40104-024-01098-1	Google Scholar	Duarte et al., 2024

mucosa in pigs challenged with enterotoxigenic F18+ Escherichia coli					
Investigation of the Efficacy of a Postbiotic Yeast Cell Wall-Based Blend on Newly-Weaned Pigs under a Dietary Challenge of Multiple Mycotoxins with Emphasis on Deoxynivalenol	<i>Saccharomyces cerevisiae</i>	Post weaning	10.3390/toxins12080504	Google Scholar	Holanda et al., 2020
Effects of dietary inactivated probiotics on growth performance and immune responses of weaned pigs	<i>Lactobacillus rhamnosus</i>	Post weaning	10.5187/jast.2021.e44	PubMed	Kang et al., 2021
Saccharomyces yeast postbiotics supplemented in feeds for sows and growing pigs for its impact on growth performance of offspring and growing pigs in commercial farm environments	<i>Saccharomyces cerevisiae</i>	Gestation/lactation/weaning/growing	10.5713/ab.23.0467	PubMed	Kim e Duarte 2024
Effects of Yeast Culture Supplementation to Gestation and Lactation Diets on Growth of Nursing Piglets	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.5713/ajas.2008.70438	Google Scholar	Kim et al., 2008
Lactobacillus reuteri I5007 Modulates Intestinal Host Defense Peptide Expression in the Model of IPEC-J2 Cells and Neonatal Piglets	<i>Lactobacillus reuteri</i>	Suckling	10.3390/nu9060559	Google Scholar	Liu et al., 2017
Effect of yeast culture supplementation in sows during late gestation and lactation on growth performance, antioxidant properties, and intestinal microorganisms of offspring weaned piglets	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.3389/fmicb.2022.1105888	Google Scholar	Liu et al., 2023
Histopathological and ultrastructural findings induced by heat-inactivated Lactobacillus plantarum and the culture supernatant on the intestinal mucosa of piglets: an ex vivo approach	<i>Lactobacillus plantarum</i>	Post weaning	10.1590/1678-4162-10216	Google Scholar	Maidana et al., 2019
Heat-Killed Lactobacillus acidophilus Promotes Growth by Modulating the Gut Microbiota Composition and Fecal Metabolites of Piglets	<i>Lactobacillus acidophilus</i>	Post weaning	10.3390/ani14172528	Scopus	Miao et al., 2024
Use of Saccharomyces cerevisiae fermentation product on growth performance and microbiota of weaned pigs during Salmonella infection	<i>Saccharomyces cerevisiae</i>	Post weaning	10.2527/jas.2009-2728	PubMed	Price et al., 2010
Postbiotic heat-killed lactobacilli modulates on body weight associated with gut microbiota in a pig model	<i>Ligilactobacillus salivarius</i>	Growing	10.1186/s13568-022-01424-8	Web of Science	Ryu et al., 2022
Modulation of the acute phase response following a lipopolysaccharide challenge in pigs supplemented with an all-natural Saccharomyces cerevisiae fermentation product	<i>Saccharomyces cerevisiae</i>	Post weaning	10.1016/j.livsci.2017.11.022	Google Scholar	Burdick Sanchez et al., 2018
Supplementation of a Lactobacillus acidophilus fermentation product can attenuate the acute phase response following a lipopolysaccharide challenge in weaned pigs	<i>Lactobacillus acidophilus</i>	Post weaning	10.1017/S1751731118001222	PubMed	Sanchez et al., 2019
Effects of Dietary Supplementation With Enterococcus faecium and Clostridium butyricum, Either Alone or in Combination, on Growth and Fecal Microbiota Composition of Post-weaning Pigs at a Commercial Farm	<i>Enterococcus faecium</i>	Post weaning	10.3389/fvets.2019.00026	Google Scholar	Sato et al., 2019
The Administration of Inactivated and Stabilized Whole-Cells of Saccharomyces cerevisiae to Gestating Sows Improves Lactation Efficiency and Post-Weaning Antimicrobial Use	<i>Saccharomyces cerevisiae</i>	Gestation	10.3390/vetsci10090576	Google Scholar	Scollo et al., 2023
Effects of supplementing Saccharomyces cerevisiae fermentation product in sow diets on performance of sows and nursing piglets	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.2527/jas.2010-3642	PubMed	Shen et al., 2011
Effects of oral administration of heat-killed Enterococcus faecium strain NHRD IHARA in post-weaning piglets	<i>Enterococcus faecium</i>	Post weaning	10.1111/asj.12163	PubMed	Sukegawa et al., 2014

Effects of Dietary Supplementation with <i>Lactobacillus reuteri</i> Postbiotics on Growth Performance, Intestinal Flora Structure and Plasma Metabolome of Weaned Piglets	<i>Lactobacillus reuteri postbiotics</i>	Post weaning	10.3390/ ani15020204	PubMed	Sun et al., 2025
Effects of Heat-Killed <i>Lactobacillus plantarum</i> L-137 Supplementation on Growth Performance, Blood Profiles, Intestinal Morphology, and Immune Gene Expression in Pigs	<i>Lactobacillus plantarum</i>	Post weaning	10.3390/vetsci10020087	Google Scholar	Tartrakoon et al., 2023
Feeding a whole-cell inactivated <i>Pichia guilliermondii</i> yeast to gestating and lactating sows in a commercial production system	<i>Pichia guilliermondii</i>	Gestation/lactation	10.1093/tas/txac160	PubMed	Thayer et al., 2023
Evaluation of the heat-killed and dried cell preparation of <i>Enterococcus faecalis</i> against villous atrophy in early-weaned mice and pigs	<i>Enterococcus faecalis</i>	Post weaning	10.1111/j.1740-0929.2010.00829.x	Google Scholar	Tsukahara et al., 2011
Evaluation of a <i>Lactococcus lactis</i> -based dried fermentation product administered through drinking water on nursery pig growth performance, fecal <i>Escherichia coli</i> virulence genes and pathotypes, antibiotic usage, and mortality	<i>Lactococcus lactis</i>	Post weaning	10.1093/tas/txad093	PubMed	Warner et al., 2023
Postbiotic effects of <i>Lactobacillus fermentum</i> on intestinal health, mucosa-associated microbiota, and growth efficiency of nursery pigs challenged with F18+ <i>Escherichia coli</i>	<i>Lactobacillus fermentum and Lactobacillus delbrueckii</i>	Post weaning	10.1093/jas/skac210	Google Scholar	Xu et al., 2022
Effects of yeast-derived postbiotic supplementation in late gestation and lactation diets on performance, milk quality, and immune function in lactating sows	<i>Saccharomyces cerevisiae</i>	Gestation/lactation	10.1093/jas/skad201	PubMed	Xu et al., 2023
Postbiotics from <i>Pichia kudriavzevii</i> promote intestinal health performance through regulation of <i>Limosilactobacillus reuteri</i> in weaned piglets	<i>Pichia kudriavzevii</i>	Post weaning	10.1039/d2fo03695a	Google Scholar	Zhang et al., 2023

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