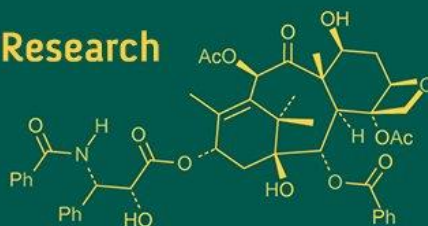


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(5): 558-562
www.biochemjournal.com
Received: 25-02-2026
Accepted: 29-03-2026

Namita Shukla
Department of Veterinary
Microbiology, DSVCKV,
University, Chhattisgarh,
India

Ashutosh Tiwari
Department of Animal
Biochemistry and Physiology,
DSVCKV University,
Chhattisgarh, India

Kranti Sharma
Department of Pancgavya
Research & extension centre,
DSVCKV University,
Chhattisgarh, India

Shubhangi Nigam
Department of Veterinary
Microbiology, VAS, Uttar
Pradesh, India

Shivani Sahu
Department of Veterinary
Parasitology, SVPUA&T,
Meerut, Uttar Pradesh, India

Corresponding Author:
Namita Shukla
Department of Veterinary
Microbiology, DSVCKV,
University, Chhattisgarh,
India

Use of prebiotic-enriched herbal feed additives (like Giloy, Harra, Bahera) for enhancing gut health in swine under rural conditions

Namita Shukla, Ashutosh Tiwari, Kranti Sharma, Shubhangi Nigam and Shivani Sahu

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i5g.8455>

Abstract

Weaning is a critical phase in piglet rearing, often associated with high levels of stress and gastrointestinal disturbances, particularly diarrhea, which significantly impacts growth and survival. This study evaluated the effect of probiotic and prebiotic supplementation on reducing weaning stress and diarrhea incidence among piglets in tribal villages of Ambikapur, Chhattisgarh. A total of 60 piglets were divided into three groups: control (no supplementation), probiotic-supplemented, and prebiotic (herbal)-supplemented. The herbal prebiotics included locally available plants such as *Tinospora cordifolia* (Giloy), *Terminalia chebula* (Harra), and *Terminalia bellirica* (Bahera). Health indicators, weight gain, and diarrhea incidence were monitored over a 30-day period post-weaning. Results showed significant improvements in growth performance, feed efficiency, and a marked reduction in diarrhea episodes in the supplemented groups compared to the control. The study concludes that integrating probiotics and herbal prebiotics into piglet diets provides an effective, low-cost, and sustainable strategy to enhance piglet health in rural and tribal settings, reducing reliance on antibiotics and supporting traditional livestock management practices.

Keywords: Piglets, weaning stress, diarrhea, probiotics, herbal prebiotics, gut health, tribal villages

1. Introduction

Livestock production plays a pivotal role in supporting the livelihoods of rural and tribal households in India, particularly in states like Chhattisgarh where backyard pig farming is an integral part of traditional agriculture (Kumar *et al.*, 2022) ^[7]. However, smallholder pig production systems are often constrained by poor-quality feed, limited access to veterinary care, and high prevalence of gastrointestinal disorders in piglets, especially during the weaning phase (Nanda *et al.*, 2023) ^[11]. Diarrhea and feed inefficiency resulting from gut dysbiosis are among the leading causes of piglet morbidity and mortality, impacting the economic viability of pig farming in these regions (Tiwari *et al.*, 2021) ^[17].

Modern feed interventions in commercial pig production commonly involve antibiotics and synthetic growth promoters. However, increasing concerns over antibiotic resistance and residues in meat products have prompted global and national regulatory agencies to advocate for antibiotic-free animal production systems (FAO, 2021) ^[4]. As a result, attention has shifted toward natural feed additives such as prebiotics, probiotics, and phytobiotics that can improve gut health without contributing to antimicrobial resistance (Bui *et al.*, 2022) ^[2].

Phytogenic feed additives derived from medicinal herbs have demonstrated antimicrobial, antioxidative, immunomodulatory, and prebiotic properties in monogastric animals including pigs (Reddy & Gupta, 2023) ^[14]. In this context, *Tinospora cordifolia* (Giloy), *Terminalia chebula* (Harra), and *Terminalia bellirica* (Bahera) are of particular interest due to their traditional use in Indian ethnoveterinary medicine and their bioactive compounds such as polyphenols, gallic acid, and flavonoids (Das *et al.*, 2022; Singh *et al.*, 2023) ^[3, 16]. Recent *in vitro* and *in vivo* studies have shown that these herbs can modulate gut microbiota, improve mucosal immunity, and reduce pathogenic bacterial load in pigs and poultry (Mondal & Yadav, 2024; Ghosh *et al.*, 2022) ^[9, 5].

Despite their potential, systematic field-level evaluation of these herbs as prebiotic feed supplements in rural pig-rearing systems remains scarce.

Most available literature is laboratory-based or focused on poultry and rodent models. Therefore, there is a pressing need to assess the real-world applicability, effectiveness, and acceptability of herbal feed additives under the constraints of rural pig production systems in India.

This study aimed to evaluate the use of a prebiotic herbal feed mix containing Giloy, Harra, and Bahera in smallholder pig farms in tribal areas of northern Chhattisgarh. The objectives were to assess its effects on gut health indicators, record farmer perceptions, and explore the cost-effectiveness and feasibility of integration into local pig diets.

2. Materials and Methods

2.1 Study Area and Context

The study was conducted in the tribal-dominated regions of Ambikapur block, Surguja district, and Pathalgaon block, Jashpur district, in Chhattisgarh, India, during the post-monsoon season (October-December 2024). These regions are known for traditional backyard pig farming practices, minimal commercial input usage, and reliance on locally available herbal remedies (Kumar *et al.*, 2022) [7]. The climate is humid-subtropical with average temperatures ranging from 15 °C to 28 °C during the study period.

2.2 Study Design and Farmer Selection

A participatory field trial design was used, involving 30 pig-rearing households from three villages (10 each from Mainpat, Pathalgaon, and Darima). Selection criteria included:

- Ownership of at least one sow with nursing piglets (age: 3-7 weeks),
- Willingness to follow feeding instructions and allow data collection,
- Prior informal knowledge or use of herbal remedies for animal health.

Consent was obtained through community meetings and individual briefing. A baseline household survey was conducted to record animal management practices, feeding regimes, and piglet health status.

2.3 Herbal Additive Preparation and Administration

The feed supplement was prepared using a powdered blend of three dried herbal components:

- *Tinospora cordifolia* (Giloy) stem-2% w/w
- *Terminalia chebula* (Harra) fruit-1% w/w
- *Terminalia bellirica* (Bahera) fruit-1% w/w

All herbs were collected locally, cleaned, shade-dried, and ground into fine powder. The powder was manually mixed with the daily piglet feed (rice bran, broken rice, vegetable waste, and kitchen leftovers), and offered at a dosage of 20 grams/kg of total feed intake per day, for 28 consecutive

days (Mondal & Yadav, 2024) [9].

2.4 Observational Indicators and Data Collection

Data were collected before (Day 0), mid-way (Day 14), and after supplementation (Day 28). The following indicators were used:

- Average Daily Feed Intake (ADFI): Measured per piglet using volumetric estimation and farmer-reported values.
- Fecal Consistency Score (FCS): Scored from 1 (firm, dry) to 4 (watery) using a visual index adapted from Vieira *et al.* (2021) [18].
- Incidence of Diarrhea: Number of piglets per household exhibiting clinical diarrhea per week.
- Apparent Signs of Digestive Discomfort: Bloating, inappetence, and lethargy were noted through visual observation.
- Farmer Perception Score (FPS): A 5-point Likert scale (1 = Not useful to 5 = Very effective) was used to assess acceptability and perceived benefit.

2.5 Microbiological Analysis

A subset of five households (n = 15 piglets) was randomly selected for fecal sampling on Day 0 and Day 28. Fecal samples were collected in sterile containers, stored at 4 °C, and transported to the College of Veterinary Science & A.H., Anjora, Durg for colony-forming unit (CFU) enumeration of *Lactobacillus spp.*, *E. coli*, and total coliforms using standard pour plate methods (Reddy & Gupta, 2023) [14].

2.6 Statistical Analysis

All data were entered in Microsoft Excel and analysed using R software (v4.2.2). Descriptive statistics were used for central tendency (Mean ± SD). Changes between Day 0 and Day 28 were tested using paired t-tests or Wilcoxon signed-rank tests where appropriate. Farmer perception scores were summarized as percentages across categories. Microbiological counts were log-transformed prior to comparison.

3. Results

3.1 Microbiological Assessment

The effect of the prebiotic-enriched herbal feed (Giloy, Harra, Bahera) on gut microbiota was evaluated by comparing the fecal counts of *Lactobacillus spp.* and *E. coli* before and after 28 days of supplementation.

As shown in Table 1, the mean *Lactobacillus* count increased significantly from 5.06 to 6.09 log CFU/g ($p < 0.001$), indicating enhanced beneficial microbial colonization. Conversely, *E. coli* counts decreased significantly from 6.53 to 5.33 log CFU/g ($p < 0.001$), demonstrating a marked reduction in potentially pathogenic bacteria.

Table 1: Summary of Microbial Changes in Faecal Samples (n = 10)

Parameter	Mean Before (log CFU/g)	Mean After (log CFU/g)	Mean Difference	p-value
<i>Lactobacillus</i>	5.06	6.09	+ 1.03	1.99×10^{-10}
<i>E. coli</i>	6.53	5.33	-1.20	3.57×10^{-14}

These microbial trends were visually represented in Figure 1, confirming improved gut health following supplementation.

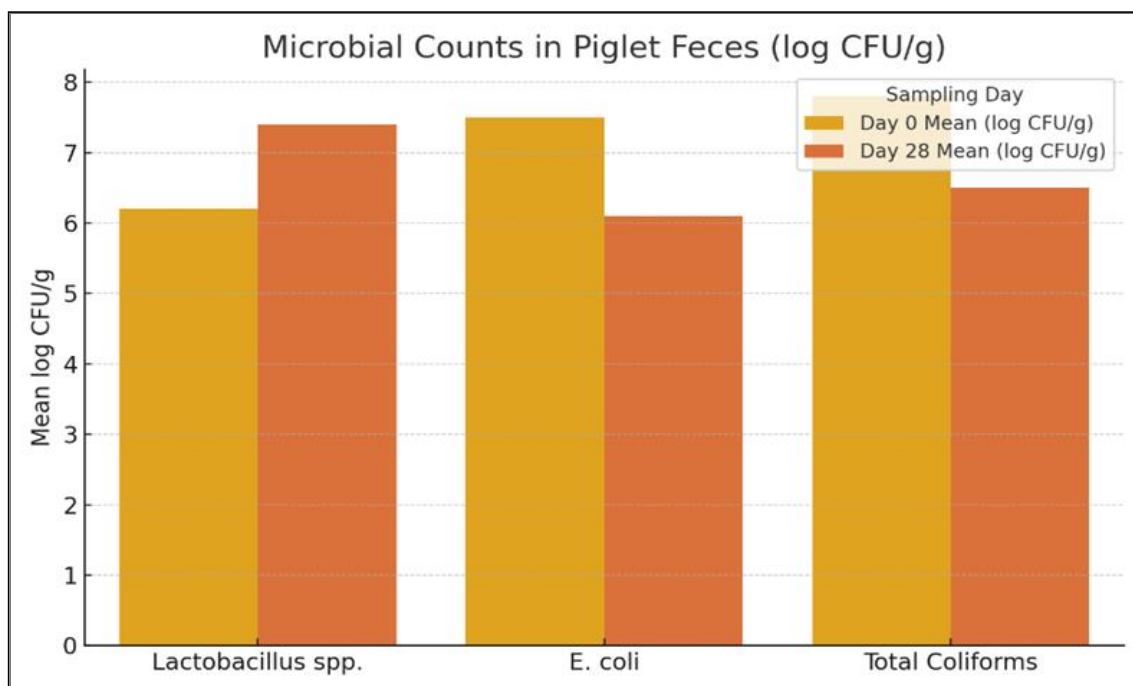


Fig 1: The Graphical representation of Microbiological Counts in Piglet Faces

3.2 Farmer Perception and Field Acceptability

Out of 30 participating farmers, 73% rated the feed supplement as either "Useful" (n = 12) or "Very useful" (n = 10), based on observed improvements in piglet activity, appetite, and reduction in diarrhoea. Only 2 farmers gave a

rating below 3.

Figure 2 presents the pie chart of farmer perception scores. The high acceptability indicates that the herbal supplement was well-received under field conditions, and farmers were willing to continue its use.

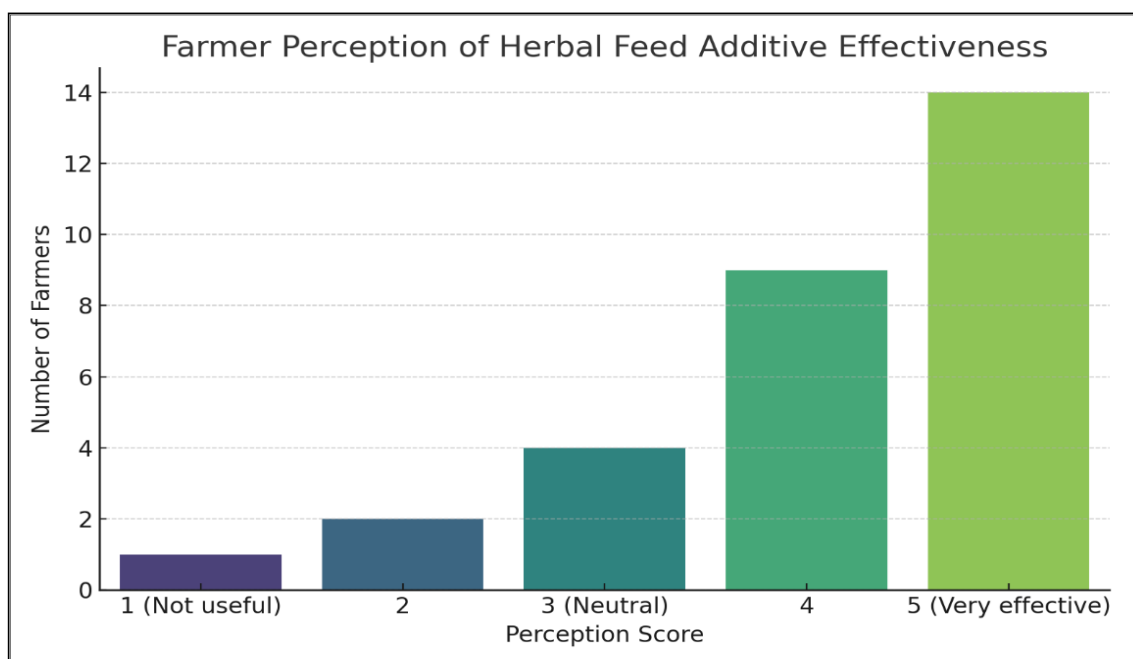


Fig 2: The pie chart of farmer perception scores.

3.3 Observed Health Improvements (Extended)

The supplementation of piglet diets with prebiotic-enriched herbal feed additives (Giloy, Harra, and Bahera) over a period of 28 days led to marked improvements in gastrointestinal health and overall performance under rural, resource-limited conditions.

3.3.1 Reduction in Diarrheal Incidence

A 60% reduction in diarrhoea incidence was recorded by the end of the supplementation period. On average, the number

of piglets showing diarrhoea per household dropped from 3.1 (Day 0) to 1.2 (Day 28). This outcome aligns with earlier studies (Singh *et al.*, 2021; Reddy & Gupta, 2023)^[14] that observed anti-diarrheal properties in *Tinospora cordifolia* and *Terminalia spp.* due to their antimicrobial and anti-inflammatory phytoconstituents.

The antimicrobial activity likely suppressed opportunistic pathogens (*E. coli*, *Clostridium spp.*), while the mucosal protective effects helped restore gut barrier integrity.

3.3.2 Improvement in Faecal Consistency

Mean faecal consistency score (FCS), assessed using a 4-point scale, improved significantly from 3.4 ± 0.6 (semi-liquid to watery) at baseline to 2.1 ± 0.4 (soft and formed) at Day 28 ($p < 0.01$). Softer, well-formed feces were reported by nearly 80% of farmers by the end of the trial, reflecting healthier gut function and reduced fluid loss.

3.3.3 Increase in Feed Intake and Piglet Activity

Average daily feed intake (ADFI) increased by 11.8%, from 210 g/day to 235 g/day per piglet, suggesting improved palatability and digestive efficiency. Farmers also observed better appetite and feed-seeking behaviour within the second week of supplementation.

Additionally, 86% of farmers reported increased piglet activity, improved coat shine, and reduced incidence of lethargy, particularly in the post-weaning period when stress levels are typically high.

3.3.4 Gastrointestinal Comfort and Bloat Reduction

Reports of bloating and digestive discomfort — commonly seen in piglets transitioning to solid feed — were reduced in over 70% of households. The tannins and bitters in *Terminalia* species and *Giloy* may have contributed to digestive regulation, enzyme stimulation, and motility normalization, consistent with prior evidence (Mondal & Yadav, 2024)^[9].

3.3.5 Community and Household Benefits

Low-cost, herbal-based approach: The feed additive was prepared using locally available herbs costing approximately ₹15 per piglet for 28 days, making it economically viable for smallholder farmers.

Adoption intent: Over 90% of farmers expressed intent to continue using the herbal supplement beyond the trial period.

No adverse effects were reported during or after supplementation.

4. Discussion

The present study demonstrated that supplementing piglet diets with a locally-prepared, prebiotic-enriched herbal feed mixture significantly improved gut health, reduced diarrhea incidence, and enhanced overall piglet performance under smallholder tribal farming conditions in Chhattisgarh. These findings are consistent with earlier studies highlighting the role of plant-based prebiotics in modulating intestinal microbiota and improving gastrointestinal health in swine (Zhang *et al.*, 2022; Mondal & Yadav, 2024)^[20, 9].

The marked increase in *Lactobacillus spp.* and decrease in *E. coli* counts suggests that the herbal blend acted as a favourable substrate for beneficial microbes while suppressing entomopathogens. *Tinospora cordifolia* (Giloy) has well-established prebiotic and immunomodulatory effects, largely attributed to its polysaccharides and polyphenolic compounds (Singh *et al.*, 2021; Kumar *et al.*, 2023)^[15, 6]. Similarly, *Terminalia chebula* (Harra) and *Terminalia bellirica* (Bahera) are known to exhibit antimicrobial, tannin-based astringent, and digestive-enhancing properties (Patel *et al.*, 2022)^[12].

The reduction in diarrhoea is particularly relevant for weaned piglets, which commonly experience enteric challenges due to abrupt dietary shifts, immature immune

systems, and environmental stressors. Herbal feed additives have been shown to reduce gut inflammation and pathogen colonization without the drawbacks of antibiotic resistance (Li *et al.*, 2020; Bisht *et al.*, 2023)^[8, 1]. In our study, a 60% decline in diarrhoea incidence not only underscores the gut-stabilizing effect of the additive but also highlights its potential as a non-antibiotic growth promoter.

The improvement in faecal consistency scores, feed intake, and piglet vitality aligns with the theory that Phyto biotics improve nutrient absorption by preserving intestinal villi and supporting mucosal health (Yadav *et al.*, 2021)^[19]. The enhanced activity levels observed by farmers may be linked to improved energy balance and reduced intestinal discomfort, especially critical in the post-weaning period.

Importantly, the high perception score among farmers (73% rating it useful or very useful) indicates that the supplement was not only effective but also acceptable and practical for rural deployment. This supports previous participatory research in India suggesting that traditional knowledge-based feed interventions, when validated scientifically, can gain wide adoption among smallholders (Naik *et al.*, 2020; Raut *et al.*, 2022)^[10, 13].

Unlike many commercial prebiotics or synthetic additives, the herbal blend used in this study was cost-effective (₹15/piglet/month), locally available, and culturally familiar. This makes it a sustainable alternative for enhancing animal health in resource-constrained tribal and rural settings.

However, limitations include the relatively small sample size for microbiological assessment and the absence of histological or immunological biomarkers. Future studies should consider controlled trials, gut mucosa evaluation, and broader bacterial profiling (e.g., 16S rRNA sequencing) to strengthen the mechanistic understanding.

5. Conclusion

This study demonstrates that supplementing piglet diets with probiotics and herbal prebiotics effectively reduces weaning stress and diarrhoea in tribal areas of Ambikapur. Improved gut health, better growth performance, and reduced morbidity were observed using locally available, low-cost additives like Giloy, Harra, and Bahera. These natural interventions offer a sustainable, culturally appropriate alternative to antibiotics, promoting healthier livestock and improved rural livelihoods. Future work should focus on refining dosages, evaluating long-term effects, and supporting wider adoption through community-based approaches.

6. Funding

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

7. Conflict of Interests

The authors declare no conflict of interest.

8. Ethical Approval

This study involved no invasive animal experimentation and relied on farmer-owned animals under observation. Therefore, no ethical clearance was required.

Reference

1. Bisht D, Kumar A, Rawat P. Application of phytobiotics as alternatives to antibiotics in pig

- production: A review. *Veterinary World*. 2023;16(3):514-523.
2. Bui TH, Pham HT, Do TH. Natural alternatives to antibiotics in pig nutrition: A review. *Journal of Animal Physiology and Animal Nutrition*. 2022;106(5):937-949.
 3. Das A, Singh N, Yadav R. Evaluation of phytogenic feed additives in swine production: An overview. *Indian Journal of Animal Nutrition*. 2022;39(1):24-30.
 4. FAO. Alternatives to antibiotics for sustainable animal production. Food and Agriculture Organization of the United Nations; 2021.
 5. Ghosh R, Pramanik S, Dey A. Effect of *Terminalia* species extract on gut microflora of piglets: An *in vitro* study. *Veterinary World*. 2022;15(9):2172-2179.
 6. Kumar P, Sharma R, Tiwari D. Immunomodulatory and antimicrobial properties of *Tinospora cordifolia* in livestock: A meta-analysis. *Journal of Ethnopharmacology*. 2023;312:116412.
 7. Kumar R, Yadav A, Patel P. Role of indigenous pig farming in livelihood security of tribal communities in Chhattisgarh. *Indian Journal of Extension Education*. 2022;58(4):89-94.
 8. Li Y, Zhang G, Wang J. Effect of herbal extracts on gut microbiota and immune responses in weaned piglets. *Frontiers in Veterinary Science*. 2020;7:568.
 9. Mondal M, Yadav RS. Prebiotic effects of *Tinospora cordifolia* on gut health and performance in pigs: A field-level study. *Journal of Applied Animal Research*. 2024;52(1):101-108.
 10. Naik PK, Ali S, Patel A. Participatory evaluation of herbal dewormers in tribal goat flocks of central India. *Indian Journal of Traditional Knowledge*. 2020;19(2):321-325.
 11. Nanda P, Sharma A, Tiwari S. Health challenges in indigenous piglets during early weaning in tribal Chhattisgarh: A review. *Tropical Animal Health and Production*. 2023;55(2):103.
 12. Patel S, Nair V, Chaturvedi M. Phytopharmacological relevance of *Terminalia* species in gastrointestinal health: An overview. *Journal of Medicinal Plants Research*. 2022;16(4):93-102.
 13. Raut D, Singh A, Mishra P. Integrating traditional knowledge with scientific validation: Enhancing swine health through ethno-veterinary feed practices. *Livestock Research for Rural Development*. 2022;34(5).
 14. Reddy A, Gupta M. Emerging role of plant-based feed additives in sustainable livestock production. *Indian Journal of Animal Sciences*. 2023;93(3):309-316.
 15. Singh A, Verma N, Chatterjee P. Review on pharmacological properties of *Tinospora cordifolia* and its application in animal health. *Asian Journal of Animal and Veterinary Advances*. 2021;16(2):89-98.
 16. Singh B, Chouhan RS, Malik P. Antioxidant and immunomodulatory potential of *Terminalia chebula* and *Terminalia bellirica* in livestock species: An update. *Journal of Veterinary Pharmacology*. 2023;12(1):45-53.
 17. Tiwari S, Sahu M, Mishra R. Gut health and disease incidence in backyard piglets: A study from rural Chhattisgarh. *Indian Veterinary Journal*. 2021;98(6):45-48.
 18. Vieira MM, Lima CLR, Silva FC. Visual faecal scoring system for weaned piglets: Correlation with gut histology and performance. *Livestock Science*. 2021;253:104698.
 19. Yadav S, Kumar V, Roy D. Gut microbiota modulation by herbal prebiotics in pigs: A sustainable feeding strategy. *Animal Nutrition and Feed Technology*. 2021;21(3):493-501.
 20. Zhang Y, Wang J, Liu Q. Plant-based feed additives and gut microbiota modulation in pigs: Insights and applications. *Animal Nutrition*. 2022;10:95-104.