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Post Weaning Diarrhea in Piglets: from cause to Control

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Abstract

The total pig population in India is 9.06 million, which was reduced to around 12% from the previous livestock census in 2017. The decreasing number of population might be attributed to the loss of interest of farmers or stakeholders due to losses associated with various diseases of pigs and the cost incurred in treatment, vaccination, and management of pigs. Diarrhea in pigs, mainly post-weaning diarrhea (PWD) caused by *E. coli* strains is the major problem for the piggery industry worldwide, including India which leads to huge economic losses to the pig industry. Antimicrobial resistance additionally worsens the situation by increasing the cost in terms of antibiotics and high mortality. The PWD can be prevented and controlled by following biosecurity and hygienic measures at farms and by treating the affected animals. This article provides insight into the basic understanding of the PWD, the cause of this disease and how to prevent and control this disease.

Keywords: PWD, *E. coli*, Pigs

Introduction

Diarrhea in piglets can be neonatal diarrhea and post-weaning diarrhea (PWD). PWD is responsible for high morbidity and mortality where mortality may reach up to 20-30% during acute outbreaks of PWD (Mittal *et al.*, 2018). Many viral, bacterial, and parasitic agents are involved in the cause of neonatal diarrhea such as transmissible gastroenteritis (TGE) virus, swine enteric coronavirus disease (SECD) including porcine epidemic disease virus (PEDV) and swine delta coronavirus (SDCV), rotavirus, *E. coli*, *Salmonella*, *Clostridium perfringens* type C, *Strongyloides ransomi* and *Coccidia*. PWDis multifactorial as it involves interaction between factors such as sow, piglet, environment, ETEC (Enterotoxigenic *E. coli*) or EPEC (Enteropathogenic *E. coli*) bacteria and managemental practices (Hong *et al.*, 2006). In India, the most common cause of morbidity and mortality in piglets is diarrhea (Sinha *et al.*, 2018) and *E. coli* is primarily associated with these diarrheic

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pigs (Begum *et al.*, 2014). Depending upon the severity of the disease, the cost of PWD is estimated to vary from €40 to €314 per sow, equivalent to INR 3200-25250 per sow (Sjolund*et al.*, 2014; Mittal *et al.*, 2018). This is in addition to the heavy losses in piglets due to decreased weight gain, vaccination, cost of treatment, mortality and use of feed supplements (Fairbrother and Gyles, 2012). Due to the exceptionally high proliferacy of the sow, there can be the birth of nearly 10 -14 piglets at a time. The post weaning stage is full of stress for piglets due to sudden changes in the nutrition, management, and internal physiology of the animal itself.PWD in piglets majorly affects piglets 2 weeks post weaning which is characterized by diarrhea, dehydration, retarded growth, and death sometimes.

To control PWD, antibiotics are commonly used in piggeries for prophylactic and therapeutic purposes.The most commonly used antimicrobials to treat affected piglets are amoxycillin/clavulanate, sulphonamides/trimethoprim, colistin, enrofloxacin, apramycin, ceftiofur, neomycin and gentamicin (Fairbrother and Gyles, 2012). Frequent and long-term use of an antibiotic in a specific area may results in the development of resistance in the bacteria to that particular antibiotic and thus failure to treatment (Moon *et al.*, 2007). It thus becomes important to understand that the disease and various control measures available.

Causes of PWD

The main etiology of PWD is strains of *E. coli* such as *ETEC* although sometimes *EPEC* also causes PWD. Besides *E. coli*, other related etiologies of PWD may be as listed in Table 1. The virus or parasite can predispose the piglets to infection of *E. coli*. The etiology mentioned below may not be able to cause diarrhea alone and needs interaction or secondary infection with *E. coli*, especially in PWD.

Table 1. Various causative agents responsible for diarrhea in piglets alongside *E. coli*.

Bacteria	**Viruses**	**Parasites**	**Nutrition**	**Others**
E. coli	Rotavirus	Cryptosporidia	Protein	Sanitation
C. perfringens	Coronavirus	*Ascaris suum*	Fat	Downtime
L. intracellularis	SRRPv	*Trichuris suis*	Starch	Environment
Brachyspira sp	PCV2		Fiber	Density
Salmonella sp			Vitamins	Antibiotics
			Minerals	Drinking water
			Mycotoxins	Feed change
			Ionic imbalance (Na-Cl-K-Ca/P)	

Predisposing factors to PWD

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The gut health in piglets is maintained by the balance of acquired immunity (from colostrum), ongoing protective milk-based antibodies and the mixture of beneficial microflora. But at weaning, many changes take place which predisposes the piglets to diarrhea. Few of such changes are like protective milk antibodies are removed, change from highly digestible milk protein and sugars to solid feed, shrinkage of gut villi, which reduces absorptive surface area and nutrients pass further down to large intestine, stress as a result of competition due to large litter size and change leading to reduced feed intake and gut stasis and challenge of a new environment by microbial exposure (Rhouma *et al.*, 2017).

Additionally, conditions related to pregnancy and parturition of the sow such as litter size, parity, and postpartum dysgalactia syndrome also predispose the piglets to PWD (Hong *et al.*, 2006). As maternal antibodies cannot be transported from the mother through the impermeable placenta in sow, therefore newborn piglets acquire maternal immunoglobulin from colostrum during the first 24–48 h of life (Lalles *et al.*, 2007). The post-weaning period is a critical phase in the pig's life due to immatureintestinal immune system,and sow milk removal which deprives piglets of nutritive intake of the IgA present in this milk, contributes to increased susceptibility of pigs to PWD (Heo*et al.*, 2013).

Mode of transmission

Post-weaning diarrhea may result from the mixing of pigs carrying the *E. coli* strainwith animals at weaning, which are already susceptible to infection. Infection is also transmitted directly from older, affected or recovered pigs by feco-oral route. Asan organism survives well in the environment, so intra-farm spread can occur indirectly by contact with contaminated pan, furniture, instruments, and clothing. The other diarrheal agents as described (**Table 1**) can also be transmitted in similar ways. Introduction to the new farm is usually by means of carrier pigs, but can also occur by clothing, vehicles and footwear which are contaminated with infected faeces (Fairbrother and Gyles, 2012).

Treatment options

The PWD infections can be treated with antibacterial/antibiotics and supportive treatment for diarrhoea and dehydration. Asa majority of infections in PWD are due to *E. coli*, bacterial isolation, antimicrobial sensitivity testing (AST) should be done before starting with any random antibiotics. The use of antibiotics without AST would only lead to resistance of these bacteria to such antibiotics and thus mortality and economic losses to

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farmers (Mittal *et al.*, 2018).Asa supportive treatment, antidiarrheal powder/liquid, anti-inflammatory drugs and probiotic/synbiotics (for recovery) can provide relief as seen in clinal cases reported.

Preventive measures

The stocking density reduction should be considered to decrease the occurrence of PWD as well as other diseases in pigs as high density contributes to more transmission, stress, and inefficient management (Gardner *et al.,* 2002). The management strategies around weaning should be in such a way that avoid any kind of stress for pigs. The measures include preventing the spread of infection by treatment or segregation, by providing the pigs with good thermal comfort, giving them adapted feed and allowing access to feed for all piglets (Rhouma *et al.,* 2017). Some feeds such as soybeans in weaned piglet feed should be avoided as it favors the occurrence of PWD (Dreau *et al.*, 1994).

Control measures

Once occurred PWD can be controlled either by antibiotics or by various other alternatives to antibiotics. As irresponsible use of antibiotics creates antibiotic resistance bacteria and makes treatment difficult, other alternatives to antibiotics should be used. List and benefits of these alternatives and other remarks such as their use, disadvantages are also mentioned for better understanding (Table 2).

Other alternatives such as plasma dried spray and specific egg yolk antibodies are also there but they are still not available in the market and their efficacy is not well known. Additionally, in India, most of pig rearing is limited to small scale and rural household settings, which limits the use of such advanced and costly alternatives.

Conclusion

Despite the progress that has been observed in modern pig farms during the last decade to prevent infectious diseases and improve global animal health, PWD remains a problem that causes significant economic losses in pig production. Antibiotics have contributed significantly to reduce the economic losses caused by infectious diseases and particularly PWD in swine. However, increasing bacterial resistance leading to therapeutic failures on farms as well as the greater vigilance of consumers regarding antimicrobial residues, have resulted in more intensive research and a large number of clinical trials for the development of alternatives to antimicrobials. Until then responsible use of antibiotics, good

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management practices at piggery farms, use of feed supplements can reduce the incidence of PWD and thus save on the cost incurred in antibiotic treatment and mortality.

Feed Additive/Strategy	Benefits	Other Remarks
Zinc Oxide	Inhibition of bacterial adhesion to the intestinalmucosa, stimulates growth rate, maintain intestinal mucosal integrity and modulates immune functions	High levels of increased PWD and bacteria can develop resistance to it
Organic acids	Decreases pH in the stomach, improves growth performance and reduces PWD	Can be easily provided in feed or water
Prebiotics, probiotics and synbiotics	Improves intestinal health, improves growth performance, reduces diarrhea, and prevent attachment of pathogenic bacteria to the intestinal mucosa	Various brand name are available in the market but are costly
Bacteriophages	Reduces *E. coli* mucosal adhesion, maintains intestinal mucosal integrity, and decrease diarrhea	Narrow spectrum of activity, development of bacterial resistance, high cost, non-availability in a rural market
Antimicrobial peptides (AMPs)	Improves growth performance, decreasesdiarrhea, and enhance immune function	Non-availability in market

Table 2. Feed additives or strategies to control PWD other than antibiotics (Rhouma *et al.* 2017).

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