

Original Research Article

Lactoferrin Effect on Piglets in Terms of Body Weight and Number of Bacteria

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Abstract: One way to increase body weight and protect pigs from disease is Lactoferrin. Lactoferrin is a protein that can bind and transfer Fe^{3+} ions and have a bacteriostatic effect. So this research needs to be done to determine the effect of Lactoferrin in terms of body weight and the number of bacteria in pigs. The study was conducted at a pig farm in the Bangli area, Bali, Indonesia, the sample used 20 piglets given oral lactoferrin, and their anal swabs were taken. The piglets will be given Lactoferrin every day for 7 days and are weighed first, the first 10 piglets as control are not given Lactoferrin (K), the next 10 piglets are given Lactoferrin (P) at a dose of 2 ml per piglet/day then on the 7th day the anal swab was taken and the piglets were weighed again, then the number of bacteria (Total Plate Count) was calculated. The results showed that there was a weight gain of 1.24 Kg/week in piglets given Lactoferrin (P), compared to control piglets (K) which only showed a weight gain of 0.85 Kg/week, and a decrease in the number of bacteria in the treated piglets (P), which shows the number of TPC of 1.109×10^7 CFU compared to piglets that are not given Lactoferrin (K) which shows the number of TPC of 3.6183×10^8 . The Lactoferrin effect on weight has no significant difference ($P > 0.05$) but in TPC the Lactoferrin has a significant effect to reduce the TPC ($P < 0.05$).

Keywords: Bacteria, Body Weight, Lactoferrin, Piglets, Pigs, Total Plate Count.

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INTRODUCTION

Pigs are very famous livestock in Bali, almost all elements of society use pigs as a means of ceremonies and food. However, not all pigs produced by breeders can meet the quality desired by the community, where sometimes the weight achieved is not following the time and cost of maintenance, besides that the disease in pigs is also more and more complex. Bacterial infections also often make pig production in Bali not optimal. Several bacterial diseases can infect pigs such as *Colibacillosis*, *Streptococcosis*, and *Septicaemia Epizootica* (SE). Susceptibility to this disease varies greatly depending on the age of the pig [1].

One way that is thought to be able to increase body weight and protect pigs from disease is the administration of Lactoferrin. Lactoferrin (or Lactotransferrin) is a protein that can bind and transfer Fe^{3+} ions and is present in high amounts in milk and colostrum. This protein was first isolated from cow's

milk in 1939 by Sorensen and Sorensen [2]. Lactoferrin has strong bacteriostatic (anti-bacterial) activity due to its ability to bind metal ions vital to living things, such as iron. Bacteria can die due to a lack of iron ions to grow [3]. However, it is not known with certainty the effect of giving lactoferrin to pigs at a certain dose and it is also not known how Lactoferrin can suppress infection of harmful bacteria, so this research needs to be done to determine the effect of Lactoferrin in terms of body weight and the number of bacteria in pigs.

MATERIALS AND METHODS

Samples

The sample used 20 piglets given oral lactoferrin and their anal swabs were taken, the piglets have the same age at 28 days old, given the same feed and water.

Lactoferrin Preparation

Lactoferrin was obtained from *Escherichia coli* bacteria that were DNA-modified with a *Bovine*

Lactoferrin Seed plasmid, and was cultured in the laboratory, to produce more lactoferrin. After the Lactoferrin was produced, the Lactoferrin was added NaCl and *Terrific Broth Media* to make it easier to store and give to the piglets.

Research Procedure

Piglets that will be given lactoferrin every day for 7 days are weighed first to determine the initial weight, the first 10 piglets as control are not given lactoferrin (K), the next 10 piglets are given lactoferrin (P) at a dose of 2 ml per piglet/day later. After 7 days the anal swab was taken and weighed to determine the final weight. Then the results of the swab were brought to the laboratory using Stuart transport media and the number of bacteria was counted using the Total Plate Count (TPC) calculation method.

Data Analysis

Data will be descriptively presented and the difference of Lactoferrin effect in body weight and

Total Plate Count was analyzed by using T-Test. Statistical analysis was performed using IBM SPSS statistics 20 for Windows.

RESULT

Weight Gain of Control (K) and Treatment (P) Pigs

The average weight gain of control piglets (K) for 7 days (Table 1) increased by 0.85 Kg on average, with the highest number in K8 piglets with 1.4 Kg, for 7 days and the lowest was in K9 piglets with an increase of 0.1 kg for 7 days. While the weight gain of piglets given Lactoferrin (P) every day for 7 days (Table 2) averaged at 1.24 Kg, the highest increase was in P3, P8, and P10 piglets with 1.6 Kg each, for 7 days and the lowest there is in P1 piglets where there is no weight gain at all for 7 days probably due to diarrhea in the piglets it was very thin and the conversion of feed into meat is not optimal. The statistical analysis shows that Lactoferrin has no significant effect ($P>0.05$) on weight gain in all samples.

Table 1: Weight Comparison of Control Piglets (K) On Days 1 and 7

Sample No.	Day-1 (Kg)	Day-7 (Kg)	Average Gain (Kg)
K1	5.9	6.6	0.7
K2	6.1	6.7	0.6
K3	6.2	7	0.8
K4	6	6.6	0.6
K5	5.5	6.4	0.9
K6	4.5	5.6	1.1
K7	5.2	6.4	1.2
K8	5	6.4	1.4
K9	3.5	3.6	0.1
K10	4.5	5.6	1.1
Average	5.24	6.09	0.85

Table 2: Weight Comparison of Treatment Piglets (P) On Day 1 and Day 7

Sample No.	Day-1 (Kg)	Day-7 (Kg)	Average Gain (Kg)
P1	5.2	5.2	0
P2	7.2	8.6	1.4
P3	7.4	9	1.6
P4	6.1	7.5	1.4
P5	7.8	9.2	1.4
P6	7.1	8.6	1.5
P7	5.7	6.3	0.6
P8	8	9.6	1.6
P9	6.5	7.8	1.3
P10	6.6	8.2	1.6
Average	6.76	8.00	1.24

Total Plate Count (TPC) of Control (K) and Treatment (P) Piglets

The number of bacteria found (Total Plate Count) in control piglets (K) was 3.6183×10^8 CFU (Table 3), with the highest TPC in K2 piglets with 8.9×10^8 CFU and the lowest in K10 piglets with 1.09×10^7 CFU. While in treatment piglets (P) the number of TPC was $1,109 \times 10^7$ CFU (Table 4), with the highest TPC in P8 piglets with 7.5×10^6 CFU and the lowest in P4

piglets with 6.8×10^5 CFU. The statistical analysis showed that Lactoferrin has a significant effect on reducing TPC ($P<0.05$).

Table 3: Total Plate Count in Control Piglets (K)

No.	TPC (CFU)
K1	6×10^7
K2	8.9×10^8
K3	8.6×10^8

No.	TPC (CFU)
K4	3.1×10^8
K5	7.5×10^8
K6	1.26×10^8
K7	4.8×10^8
K8	1.4×10^7
K9	1.17×10^8
K10	1.09×10^7
Average	3.6183×10^8

Table 4: Total Plate Count in Treatment Piglets (K)

No.	TPC (CFU)
P1	5.1×10^6
P2	5.4×10^6
P3	1.32×10^6
P4	6.8×10^5
P5	3.4×10^6
P6	2.6×10^6
P7	1.92×10^7
P8	7.5×10^6
P9	5.9×10^7
P10	6.7×10^6
Average	1.109×10^7

DISCUSSION

The course of growth after birth in all species of mammals including pigs is generally almost the same, where growth usually starts slowly then progresses rapidly, and finally returns slowly when the pig undergoes body packaging [4]. This pattern produces a sigmoid (S-shaped) growth curve. The general bodyweight growth period is 680 grams/pig/day [5]. While the results of the weekly average weight gain of control (K) and treatment (P) piglets in this study were still 0.85 Kg/week or 0.12 Kg per day (120 grams) per piglet for Control (K) and 1.24 Kg/week or 0.18 Kg (180 grams) per piglet for treated piglets (P), this result is still below the general standard of data [5] while according to research [6] data on weight gain of pigs per week ranged from 1.15 Kg in the first week, 1.44 Kg in the second week, 1.20 Kg in the third week, and 0.92 Kg in the fourth week. So that the weekly weight gain of the control (K) and treatment (P) piglets obtained is more suitable with the study [6] because the age of the pigs used is almost the same at 28 days (4 weeks) during the post-weaning phase, in control pigs (K) 0.85 Kg/week and treatment pigs (P) 1.24 Kg/week compared to an average of 0.92 Kg/week. By giving lactoferrin to treatment pigs (P) the above results were obtained from the study [6] with a positive difference of +0.32 Kg, compared to control pigs (K) who were not given lactoferrin, the weight achieved was still below the results of the study [6] with a negative difference of -0.07 Kg. The weaning weight of piglets is the stage of growth of animals or mammals when they no longer depend on their mother's milk and begin to consume solid and liquid rations [7]. Weaning weight depends on birth weight because the condition of the piglet is strongly influenced by prenatal growth [8]. Weaning

weight is very much determined, among others, by sex, bodyweight of the parent, age of the parent, condition when the cattle were born, and the ability of the mother to breastfeed her child, the quantity and quality of the ration, and the environmental temperature [9].

The Total Plate Count (TPC) is a number that indicates the number of colonies of aerobic mesophilic bacteria found per gram or milliliter of the test sample [10]. Bacterial phylotypes mainly belonging to the group of fermenting microbes commonly found in anaerobic digestion ecosystems in the gastrointestinal tract of pigs are low GC Gram-positive bacteria (*Eubacterium*, *Clostridium*, *Bacillus-Lactobacillus-Streptococcus*) and Bacteroides [11]. Many diseases can be transmitted by these bacteria through feces, so it is hoped that reducing the infection of bacterial diseases transmitted by the above bacteria can be done by giving lactoferrin. Based on the chemical function of the protein, there are two possible physiological functions of lactoferrin, as a source of iron for infants/children and a potential antimicrobial factor in the milk ducts and the gastrointestinal tracts of infants/children [12-14]. In cattle, according to [15, 16], stated that lactoferrin is a multi-functional protein such as helping the absorption of iron in the intestine, intestinal cell growth, protecting from microbial attacks that cause infection, and as an immune system. Lactoferrin is a milk protein that has broad-spectrum antimicrobial properties and when used as a supplement it can reduce the presence of *E. coli* in the intestines of calves and reduce diarrheal attacks. This is following the results of this study, where there was a significant decrease in the number of bacteria (TPC) in pigs given lactoferrin (P), compared to control pigs (K).

CONCLUSION

There was an increase in body weight of 1.24 Kg/week in pigs given Lactoferrin (P), compared to control piglets (K) which only showed a weight gain of 0.85 Kg/week, but no significant effect ($P > 0.05$) from Lactoferrin in all samples. TPC number decrease in treated piglets (P) which showed the number of TPC was 1.109×10^7 CFU compared to piglets that were not given lactoferrin (K) which showed a TPC number of 3.6183×10^8 , the Lactoferrin has a significant effect for decreasing the TPC ($P < 0.05$).

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