

Reduction of *Salmonella typhimurium* in the Caecum of Broiler Offered Rations Containing Banana Peel or Palm Kernel Meal

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Abstract

Oligosaccharides in digestive tract stimulate the growth of some intestine lactobacillus bacteria and reduced phatogenic bacteria. Kernel palm meal (KPC) and banana peel (BP) are high in mannan and fructose based polisaccharides. Limited ferementation of these products may produce olygosaccarides. The objective of this research was to evaluate the effect of the dietary inclusion of fermented palm kernel meal and banana peel on *Salmonella typhimurium* in the caecum of broiler. Experimental diets were: P0= Ration without BP, PKM, Bifidobacterium bifidum (Control); P1= Ration 2.5% BP; P2= Ration 2.5 % PKM; P3= Ration 2.5 % BP + B.bifidum, P4= Ration 2.5 % PKM+ B.bifidum. Ration contained 22% protein and 3050 kcal ME/kg. Experimental diets were allocated in a completely rendomized design with 5 replicates of 5 DOC each. At 14 days old, broiler were infected by *Salmonella typhimurium* and offered experimental diets. Weight gain, final body weight, carcass weight, carcass precentage, feed consumption and conversion, viscerals percentage and total colony of *S.typhimurium* in secum were evaluated. Weight gain, final body weight, carcass weight, carcass precentage, feed consumption and conversion, viscerals percentage of broiler offered ration contained BP, PKM and B. bifidum were not different from those of control. Percentage of liver, proventikulus, and jeujenum of broiler in P1 were smaller ($P<0.05$) than those of control. Total colony of *S.typhimurium* in secum of broiler in P1, P3, and P4 were smaller ($P<0.05$) than those of control. It was conluded that inclusion of benana peel 2.5% in the broiler rations without B.bifidum inhibited *S.typhimurium* growth and increased body weight, weight gain, carcass weight, and improved feed conversion. Addition of B.bifidum into the ration did not improve the usefulness of banana peel as a source of prebiotic.

Keywords: broiler, banan peel, palm kernel, *S. typhimurium*, *B. bifidum*,

Introduction

The presence of gastrointestinal pathogenic bacteria such as *Salmonella typhimurium* results in many problems in broiler farming and products (Ohl & Miller, 2001). *Salmonella typhimurium* is one of the common bacteria reducing nutrient utilization, disturbing some biological functions, growth and increasing mortality of chicks. Maintaining the balances of gastrointestinal micro flora is an important effort. Dietary addition of antibiotic is a common practice in reducing the persence of gastrointestinal pathogenic bacteria. However, the residual antibiotic in animal products is a major concerns, since it results in the resistance of bacteria wihch is harmful for the consumer. Application of prebiotics in poultry ration is an alternative to replace the nutritional fuction of antibiotics.

Dietary addition of mannan and fructose olygosaccharides have been demonstrated to have similar beneficial effects with an antibiotic in maintaining a balance gastrointestinal micro flora and improve productivity in broilers (Kim *et al.*, 2011). Mannan containing polysaccharides from palm kernel meal (PKM) could be used as an alternative to replace antibiotics in preventing the colonization of *Salmonella typhimurium* in poultry (Tafsina *et al.*, 2007). Banana peel is an agricultural by product wich is available from banana processing activity. Controled hidrolisis of PKM and banana peel containing mannan and fructose polysacharides, may produce mannan and fructoce olygosaccharides. The present experiment aimed et evaluating the effect of the dietary inclution of fermented PKM and BP on *Salmonella typhimurium* in the caecum of broiler.

Materials and Methods

The total of 125 day old chick (DOC) of Cobb CP 707 strain were allocated radomly into five dietray treatments in a completely randomised design with 5 replicates of 5 DOC each. Experimental diets were: P0= Ration without BP, PKM, *Bifidobacterium bifidum*; P1= Ration 2,5% BP; P2= Ration 2,5 % PKM; P3= Ration 2,5 % BP + *B. bifidum*, P4= Ration 2,5 % PKM+ *B. bifidum*. Ration contained 22% protein and 3050 kcal ME/kg. Chick in all treatments were offered P0 ration and kept in a collony cage facilitated with two 100 watt of ball lamps as heaters. Banana peel and palm kernel meal used in the experiment were ground and mixed with filtrate obtained from the fermentation of either BP or PKM. The fermentation was conducted for 24 hours accoding to the modified method of Tilley dan Terry (1963). Source of bacteria used in the method was the mixture of bacteria isolates instead of fresh rumen liquor. At 14 days old, broiler in all treatments were infected by *Salmonella typhimurium* and offered experimental diets. Feed and water were given *ad libitum* *S. typhimurium* and *B. bifidum* were administered orally on day 14. *S. typhimurium* was administered at level of 1×10^4 cfu and *B. bifidum* 1×10^5 cfu. Weight

gain, final body weight, carcass weight, carcass percentage, feed consumption and conversion, viscerals percentage and caecal *Salmonella typhimurium* were observed. Feed consumption and body weight were determined weekly. Caecal *Salmonella typhimurium* was observed on day 28.

Results and Discussion

Live Weight and Carcass

Mean of final live weight, carcass weight and carcass percentage of of broiler infected *S. typhimurium* and offered different rations with or without *B. bifidum* were presented in Table 1. Mean of final and carcass weight of broiler was the highest when BP was included in the diet. However further inclusion of *B. bifidum* in a ration containing BP reduced the final weight of the broiler. Mean of carcass percentage were not affected by dietary treatments. The result indicated that feeding broiler with a ration containing BP for 14 days reduced the negative effect of *S. typhimurium* infection in broiler. The result suggested that the fermented BP contained active

Table 1. Mean of Final Live Weight, Carcas Weight and Carcas Percentage of Broiler offered Ration Containing BP or PKM on 28 days

	Dietary Treatments				
	P0	P1	P2	P3	P4
Final live weight, g	871 ^{AB} ± 49	943 ^B ± 67	858 ^{AB} ± 42	812 ^A ± 68	843 ^{AB} ± 60
Carcass weight, g	527 ^{AB} ± 49	584 ^B ± 45	516 ^{AB} ± 39	493 ^A ± 51	525 ^{AB} ± 34
Carcass percentage, %	60.39 ± 2.42	61.77 ± 0.65	60.10 ± 1.41	60.73 ± 1.95	62.31 ± 0.79

Note: Means with different superscript differ significantly (P<0.05); P0= Control; P= Ration 2.5% BP; P2= Ration 2.5% PKM; P3= P1 + *B. bifidum*; P4= P2 + *B. bifidum*.

Table 2. Mean of Feed Consumption, Daily Gain and Feed Conversion Ratio of Broiler offered Ration Containing BP or PKM on 28 days

	Dietary Treatments				
	P0	P1	P2	P3	P4
Consumption (g/bird)	1190 ±101	1166 ±40	1233 ±80	1167 ±145	1165 ±51
Weight Gain (g/bird)	739 ±43	765 ±53	750 ±56	721 ±90	709 ±35
FCR (consumption/ADG)	1.61 ±0.11	1.53 ±0.06	1.65 ±0.06	1.63 ±0.15	1.65 ±0.12

Note: P0= Control; P= Ration 2.5% BP; P2= Ration 2.5% PKM; P3= P1 + *B. bifidum*; P4= P2 + *B. bifidum*.

substances such as fructose oligosaccharides, but the oligosaccharides from fermented BP did not support the growth of *B. bifidum*.

Feed Consumption, Weight Gain and Feed Conversion Ratio

Mean of feed consumption, weight gain (WG) and feed conversion ratio (FCR) were presented in Tabel 2. Mean of total feed intake, weight gain and feed conversion of broiler infected *S. Typhimurium* and offered different rations with or without *B. bifidum* varied from 1164-1233 g per bird, 708-764.97 g per bird and 1.53-1.63, respectively. There were no significant different ($P < 0.05$) in total feed intake, weight gain and feed conversion among treatments. Inclusion of BP without *B. bifidum* tended to increase weight gain and improved feed conversion. The result indicated that inclusion of BP, KPM and *B. bifidum* in broiler infected by *S. typhimurium* was not effective. However, the improvement of the fermentation method of BP and PKM and the increase in inclusion level of fermented product may improve the response of broiler.

Wiryawan *et al.* (2005) reported that supplementation of FOS at level of 2.5% from garlic increased weight gain of infected *S. typhimurium* bird. The present result indicated that BP and PKM suppressed the negative effect of *S. typhimurium* on growth but the level could not optimize nutrient metabolism to create the better weight gain and feed conversion ratio.

Mean of Percentage of Visceral Organ

Mean of percentage visceral organ is presented in Tabel 3. Inclusion of BP, KPM and *B. bifidum* in diet of broiler from 14 to 28 day old, had significant effect on their percentage of liver, gizzard and proventriculus. Percentage of liver, gizzard and proventriculus of broiler offered diet P1 had the lowest values. The result indicated that BP inclusion in the diet reduced the negative effect of *S. typhimurium* infection in broiler. Ferket *et al.* (2002) reported that infection of *S. typhimurium* could swell liver organ. Therefore dietary inclusion of 2.5% BP (P1) stimulated the balance growth of intestinal micro flora and suppressed *S. typhimurium* growth. Reduction of *S. typhimurium* growth may maintain the normal condition and function of liver and digestive tract.

Total Colonies of Salmonella typhimurium

Data of total number of *S. typhimurium* colonies was shown in Table 4. Mannan and fructose oligosaccharides produced short chain fatty acids and lactic acid (Bantora & Ditya, 2012). These organic acids have antimicrobial property to inhibit pathogenic bacteria. The data indicated that the most effective treatment to reduce *S. typhimurium* colonies was P1 and P4 with total number of *S. typhimurium* colonies was 1.58×10^3 and 2.4×10^3 , respectively.

Table 3. Mean of the Percentage of Visceral Organ to Live Weight (LW) of Broiler offered Ration Containing BP or PKM on 28 days

Visceral Organ (% LW)	Dietary Treatment				
	P0	P1	P2	P3	P4
Liver	3.17±0.62 ^b	2.46±0.18 ^a	2.97±0.45 ^{ab}	2.73±0.13 ^{ab}	2.80±0.24 ^{ab}
Gizzard	2.47±0.32 ^{ab}	2.15±0.18 ^a	2.30±0.18 ^{ab}	2.57±0.35 ^b	2.33±0.18 ^{ab}
Proventriculus	0.73±0.20 ^b	0.57±0.07 ^a	0.66±0.07 ^{ab}	0.67±0.11 ^{ab}	0.70±0.11 ^b
Lymph	0.12±0.04	0.11±0.04	0.14±0.04	0.12±0.04	0.09±0.04
Heart	0.52±0.04	0.50±0.03	0.57±0.06	0.54±0.06	0.57±0.08
Bile	0.15±0.20	0.11±0.04	0.10±0.05	0.13±0.04	0.10±0.06
Kidney	0.79±0.11	0.89±0.14	0.82±0.14	0.83±0.08	0.88±0.12
Pancreas	0.44±0.12	0.41±0.04	0.42±0.06	0.39±0.05	0.44±0.06

Note: Means with different superscript differ significantly ($P<0.05$); P0= Control; P= Ration 2.5% BP; P2= Ration 2.5% PKM; P3= P1 + *B. bifidum*; P4= P2 + *B. bifidum*.

Table 4. Number of *S. typhimurium* collonies in Cecum of Broiler offered Ration Containing BP or PKM on 28 days

Parameter	Treatment				
	P0	P1	P2	P3	P4
Number of colonies (cfu)	155 x 10 ³	1.58 x 10 ³	160 x 10 ³	10 x 10 ³	2.4 x 10 ³

Note: P0= Control; P= Ration 2.5% BP; P2= Ration 2.5% PKM; P3= P1 + *B. bifidum*; P4= P2 + *B. bifidum*.

Data showed that BP inclusion in a broiler diet stumulated the growth of *B. bifidum* and therefore reduced caecal *S. typhimurium* colonies. Dietary inclusion of PKM had no effect on *S typhimurium* growth in the caecum. However, inclusion of *B. bifidum* in the diet containing PKM reduced caecal *S. typhimurium* colonies. The result indicated that inclusion of either BP or PKM facilitated the growth of *B. bifidum* as probioticand.

Conclusions

Dietary inclusion of 2.5% fermented banana peel was effective to reduce colonization of *S. typhimurium*. Dietary inclusion of both banana peel and palm kernel meal stimulated the growth of *Bifidobacterium bifidum* suppressing *S.*

typhimurium growth in broiler. Therefore banan peel and palm kernel meal were potential sources of oligosaccharides.

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