UNIVERSITI PUTRA MALAYSIA

EFFECTS OF POSTBIOTIC METABOLITES PRODUCED BY Lactobacillus plantarum AND ACIDIFIER ON WEIGHT AND MEAT QUALITY OF BROILER CHICKENS

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FP 2015 54

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

November 2015

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

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November 2015

Chairman : Professor Loh Teck Chwen, PhD
Faculty : Agriculture

Postbiotic metabolite produced by *Lactobacillus plantarum* is intermediate and final metabolic product of bacteria. There have antibacterial effect from organic acids and bacteriocin. Acidifier known as feed additive to improve performance of broiler chicken. The studies investigate the synergistic effect of combination of postbiotic metabolite produced from *L. plantarum* strains with acidifier on broiler chicken. Three experiments were conducted to achieve the objectives. Experiment I was conducted to select the best combinations by determination of inhibitory activity assessment. Six strains of *Lactobacillus plantarum* (UL4, TL1, RS5, RI11, RG11 and RG14) and 0.1% until 0.5% concentrations of acidifiers (malic acid and citric acid) were used in this study. Seventy six of the postbiotic metabolite and acidifier treatment were produced. The inhibitory activity against *Pediococcus acidilactici, Salmonella enterica, Escherichia coli* and *Listeria monocytogenes* of UL4 combine with 0.5% malic acid, RG14 combine with 0.5% malic acid and TL1 combine with 0.4% citric acid showed higher score than the other treatments. Therefore, these treatments were selected for further studies. Experiment II was carried out to determine the effects of combinations postbiotic metabolite with acidifier on the growth performance, fecal pH, microflora counts, villi height and crypt depth. A total of 150 male Cobb broilers were raised for 42 days. The birds were randomly divided into 5 groups and fed with various treatment diets: (i) basal diet (control); (ii) basal diet supplemented with antibiotic (positive control) (iii) basal diet supplemented with 0.3% of UL4 + 0.5% malic acid (iv) basal diet supplemented with 0.3% of RG14 + 0.5% malic acid and (v) basal diet supplemented with 0.3% of TL1 + 0.4% citric acid. Feeding of combination postbiotic metabolites with acidifier and control group did not showed significant different ($p>0.05$) for growth performance and lactic acid bacteria counts. *Enterobacteriocea* (ENT) count result showed that UL4 + 0.5%MA and RG14+0.5%MA did not showed significant different ($p>0.05$) with positive control. Combination of RG14 + 0.5% MA showed better effect than control group for histopathology of small intestine. The results indicate that, the inclusion combination of postbiotic metabolite and acidifiers have shown potential effect similar to antibiotic diet group for growth performance, faecal pH, and lactic acid bacteria population. Besides that, it also reduced the population of *Enterobacteriaceae* and increase villus height of small intestine. Overall, combination of RG14 + 0.5% malic acid prominently shows improved effect as compared to other

treated diets. Experiment III was carried out to determine the carcass composition and meat quality of chickens fed with combination of postbiotic metabolite with acidifier. This experiment was continued from second experiment. This study was conducted to examine the effects of feeding postbiotic metabolites which produced from *L. plantarum* and acidifier in the diets of broilers chickens on carcass composition and meat quality. Generally, combination UL4 + 0.5% MA and RG14 + 0.5% MA had shown similar effect as control group for carcass weight, meat percentage and meat quality traits. Nevertheless, the supplementation of combination postbiotic metabolites and acidifier significantly reduced ($p<0.05$) abdominal fat and increased ($p<0.05$) percentage of bone. Thus, these findings suggested that postbiotic metabolite produced by locally isolated *L. plantarum* combine with acidifier is potential alternative feed additives in poultry production.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

KESAN PEMBERIAN KOMBINASI POSTBIOTIK METABOLIT DARI STRAIN *Lactobacillus plantarum* DAN PENGASID TERHADAP BERAT DAN KUALITI DAGING AYAM PEDAGING

Oleh

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Postbiotik metabolit yang dihasilkan daripada *Lactobacillus plantarum* merupakan produk pertengahan dan produk akhir ketika metabolisma bakteria. Ia mempunyai kesan yang bermanfaat seperti asid organik dan bakteriosin. Pengasid merupakan makanan tambahan untuk meningkatkan prestasi ayam pedaging. Kajian ini adalah untuk mengkaji kesan kesinambungan diantara kombinasi postbiotik metabolit yang dihasilkan daripada strain *L. plantarum* dengan pengasid terhadap ayam pedaging. Tiga eksperiman dilakukan bagi mencapai objektif ini. Eksperimen I dijalankan bagi memilih kombinasi yang terbaik dengan penentuan penilaian aktiviti perencatan. Enam strain daripada *Lactobacillus plantarum* (UL4, TL1, RS5, RI11, RG11 and RG14) dan 0.1% sehingga 0.5% kepekatan pengasid (asid malik dan asid sitrik) digunakan di dalam kajian ini. Tujuh puluh enam rawatan postbiotik metabolit dan pengasid dihasilkan. Aktiviti perencatan terhadap *Pediococcus acidilactici, Salmonella enterica, Escherichia coli* dan *Listeria monocytogenes* oleh kombinasi UL4 dengan 0.5% asid malik, kombinasi RG14 dengan 0.5% asid malik dan kombinasi TL1 dengan 0.4% asid sitrik menunjukkan jumlah skor tertinggi berbanding rawatan yang lain. Maka, rawatan-rawatan ini dipilih untuk kajian yang seterusnya. Eksperimen II dijalankan untuk menentukan kesan kombinasi postbiotik metabolit dengan pengasid terhadap prestasi pertumbuhan, pH dan bilangan mikroflora tinja, dan ketinggian villus dan kedalaman krip. Sejumlah 150 ayam pedaging jantan baka Cobb dipelihara untuk tempoh 42 hari. Ayam dipilih secara rawak dan dibahagikan kepada 5 kumpulan rawatan makanan seperti berikut; (i) diet asas (kawalan); (ii) diet asas ditambah dengan antibiotik (kawalan positif) (iii) diet asas ditambah dengan 0.3% kombinasi UL4 + 0.5% asid malik (iv) diet asas ditambah dengan 0.3% kombinasi RG14 + 0.5% asid malik dan (v) diet asas ditambah dengan 0.3% kombinasi TL1 + 0.4% asid sitrik. Pemberian makanan kombinasi postbiotik metabolit dengan pengasid dan kumpulan kawalan tidak menunjukkan perbezaan yang ketara ($p>0.05$) untuk prestasi tumbesaran dan bilangan bakteria asid laktik. Keputusan bilangan *Enterobacteriaceae* (ENT) menunjukkan UL4 + 0.5% MA dan RG14 + 0.5% MA tidak menunjukkan perbezaan yang ketara ($p>0.05$) dengan kawalan positif. Kombinasi RG14 + 0.5% MA menunjukkan kesan yang lebih baik daripada kumpulan kawalan untuk histopatologi usus kecil. Keputusan ini menunjukkan bahawa pemberian kombinasi postbiotik metabolit dan pengasid mempunyai kesan potensi yang sama

seperti kumpulan diet antibiotik untuk prestasi tumbesaran, pH tinja dan populasi bacteria asid laktik. Disamping itu, ia juga mengurangkan populasi *Enterobacteriaceae* (ENT) dan meningkatkan ketinggian villus usus kecil. Secara keseluruhannya, kombinasi RG14 + 0.5% MA menunjukkan kesan peningkatan berbanding diet yang lain. Eksperimen III dilakukan bagi penentuan komposisi karkas dan kualiti terhadap daging ayam pedaging yang diberi makan dengan kombinasi postbiotik metabolit dan pengasid. Kajian ini dilakukan berterusan daripada eksperimen kedua. Eksperimen ini dilakukan bagi mengkaji kesan kombinasi postbiotik metabolit yang dihasilkan daripada *L. plantarum* dan pengasid di dalam pemberian makanan ayam pedaging terhadap komposisi karkas dan cirri- cirri kualiti daging. Secara amnya, kombinasi UL4 + 0.5% MA dan RG14 + 0.5% MA menunjukkan kesan yang sama seperti kumpulan kawalan untuk berat karkas, peratus daging dan ciri-ciri kualiti daging. Walaubagaimanapun, penambahan kombinasi postbiotik metabolit dan pengasid menunjukkan pengurangan yang ketara ($p<0.05$) terhadap lemak abdomen dan peningkatan ($p<0.05$) peratus tulang. Oleh itu, penemuan ini, mencadangkan postbiotik metabolit yang dihasilkan dari pengasingan setempat *L. plantarum* dan dikombinasikan dengan pengasid berpotensi sebagai alternatif makanan tambahan di dalam produksi poltri.

ACKNOWLEDGEMENTS

I would like to express my most sincere gratitude and appreciation to my supervisor, Prof. Dr. Loh Teck Chwen for his invaluable guidance, patience and constant encouragement throughout my study. I am also immensely grateful for the advice and support given by the members of my supervisory committee, Prof. Dr. Mohd Hair Bejo and Assoc. Prof. Dr. Awis Qurni Sazili, Assoc. Prof. Dr. Foo Hooi Ling.

Deep appreciation is also extended to School of Graduate studies, Universiti Putra Malaysia for granting Graduate Research Fellowship and providing excellent services and support. Special thanks to lecturers and staff of the Animal Science Department and Veterinary Faculty for their guidance, technical support.

I am heartily thankful to Banu, Suraya, Tenesa, Hazira, Sharmila, Salwani, Leo, Hanif, Muin, Farid, other friends and staff in UPM who have supported me in various aspects during the completion of this study. Last but not least, this thesis would not have been possible without the love and supports from Mohd Sani Putra, Muhammad Rayyan Putra, my lovely family and in- law.

Praise to Allah for everything

I certify that a Thesis Examination Committee has met on (9 November 2015) to conduct the final examination of Rosyidah Bt Mohd Radzi on her thesis entitled "Effect of Postbiotic Metabolite Produced by *Lactobacillus plantarum* and Acidifier on Weight and Meat Quality of Broiler Chickens" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The committee recommends that the student be awarded the Degree of Master.

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LIST OF ABBREVIATIONS

°C	Degree Celsius
µL	Microliter
a*	Redness
ADG	Average daily gain
AGP	Antibiotic growth promoter
ANOVA	Analysis of variance
ATP	Adenosine triphosphate
AU	Arbitrary unit
b*	Yellowness
BW	Body weight
CFLX	Colorflex
CFS	Cell free supernatant
CFU	Colony forming unit
CL	Cooking loss
cm	Centimeter
CO_2	Carbon Dioxide
d	Day
DFD	Dark-Firm-Dry
DL	Drip loss
ENT	Enterobacteriaceae
FCR	Feed conversion ratio
Fe	Ferum
FI	Feed intake
g	Gram

GIT	Gastrointestinal tract
GLM	General linear model
GRAS	Generally recognize as safe
h	Hour
IB	Infectious bronchitis
IBD	Infectious bursal disease
kcal	Kilocallories
kg	kilogram
L	Liter
L*	Lightness
LAB	Lactic acid bacteria
M	Molar
mg	Milligram
mL	Mililiter
mM	Milimolar
MRS	DE Man, Rogosa and Shape
ND	Newcastle Disease
nm	Nanometer
OD	optical density
ppm	Part per milion
PSE	Pale-Soft-Exudative
rpm	Rounds per minute
SAS	Statistical analysis software
SEM	Standard Error Mean
TA-HD	Texture Analyser High density

USA	United States of America
VFA	Volatile Fatty Acid
VRE	Vancomycin-resistant enterococci
w/v	Weight versus volume
w/w	Weight versus weight
W1	Weight before
W2	Weight after
WG	Weight gain
WHC	Water Holding capacity

CHAPTER I

INTRODUCTION

Antibiotic is widely used as a promoter since a long time ago and is considered as an important feed additive due to their property as growth promoters and in livestock health. However, some issues have arisen with the use of antibiotics as growth promoters that were previously used to treat or prevent diseases. The issues are about antibiotic developing resistance to many pathogenic diseases and also the presence antibiotic residue. It has been shown that faecal *E. coli* isolated from pigs was resistant to antibiotics such as neomycin, oxytetracycline, chloramphenicol and nalidixic acid (Loh *et al.*, 2006; van den Bogaard *et al.*, 2001). Furthermore, the residue of antibiotics is frequently present in the end products of animal production (van den Bogaard *et al*., 2001). This has led many countries to ban the use of antibiotics.

In view of the total ban in the use of antibiotics as growth promoters in livestock and poultry production, many parts of the world are experimenting alternative feed additive that may be used to alleviate the problems associated with the withdrawal of antibiotics from feed. Alternative strategies that had been proposed should have a favourable effect on livestock production, without endangering animal or human health, as well as nature. The level must be controllable, the levels used for the purpose of preventing and treating disease should be different, as well as for medical and veterinary purposes (Butaye *et al*., 2003).

Among the alternatives that has been used are acidifiers. Several organic acids, including citric acid, fumaric acid, formic acid, and propionic acids have a positive influence on growth performance (Partanen and Mroz, 1999). However, the result obtained of acids used in poultry is not consistent (Thompson and Hinton, 1997).

The final or intermediate fermented products produced by *L. plantarum* also known as postbiotic metabolite have natural antibacterial properties. These postbiotic metabolites contains bacteriocin, organic acids and commonly used as food preservatives. Therefore, it has been reported that the postbiotic metabolites can be used as feed additive to replace in-feed antibiotics in the poultry industry (Thanh *et al*., 2009; Loh *et al*., 2009).

Many enquiries are raised due to the use of acidifier and postbiotic metabolite as feed additive in the farm. However, the information about the combination of acidifier and postbiotic metabolites produced by 6 available strains locally isolated *L. plantarum* is still unknown. Furthermore, their ability in against pathogenic bacteria such as *Salmonella* spp., *E.coli*, *Listeria* spp. and *Pediococcus* spp. have not been investigated. Similarly, their impact on growth performance, gut microflora, small intestine morphology, and carcass and meat quality also need to be studied. The 6 strains of postbiotic metabolites were obtained by Foo *et al.* (2001) and patented by the Faculty of Biotechnology and Biomolecular Science, Universiti Putra Malaysia.

The hypothesis of this study were; combination of acidifier and postbiotic metabolite produced by *L.plantarum* strains have inhibitory activity against certain pathogens, which can improve growth performance, reduce intestinal *Enterobacteriaceae* (ENT) and increase intestinal lactic acid bacteria (LAB) population, increase villi height, improve carcass composition and meat quality of broilers. Thus, the objectives of this study were;

i) To quantify the inhibitory activity of acidifier and postbiotic metabolites produced by *Lactobacillus plantarum (L. plantarum)* on *E. coli*, *L. monocytogenes*, *S. enterica* and *P. acidilactici* indicators and selection of the highest inhibitory activity.

ii) To determine the effect of feeding a combination of acidifiers and postbiotic metabolites on growth performance and faecal microbial population, small intestine morphology of broiler chickens.

iii) To evaluate the effect of feeding a combination of acidifiers and postbiotic metabolites on carcass composition and meat quality of broiler chickens.

REFERENCES

Aarestrup, F. M. 2003. Effects of termination of AGP use on antimicrobial resistance in food animals. Working papers for the WHO international review panels evaluation. Document WHO/CDS/CPE/ZFK/2003.1a.World Health Organization, Geneva, Switzerland, 6–11

Abdel-Fattah, S. A., M. H. El-Sanhoury, N. M. El-Mednay and F. Abdel-Azeem 2008. Thyroid activity, some blood constituents, organs morphology and performance of broiler chicks fed supplemental organic acids. International Journal of Poultry Science ;7(3): 215-222.

Abdulrahim, S. M. , M. S. Y. Haddadin, N. H. M. Odetallah, and R. K. Robinson. 1999.Effect of *Lactobacillus acidophilus* and zinc bacitracin as dietary additives for broiler chickens. British Poultry Science 40, 91-94.

Abdulwahab, A., and E. Horniaková. 2010. Some parameters of meat and bone chemical content of broilers fed diets containing *Lactobacillus* species based on dried yogurt. Actauniv.agric. etsilvic. Mendel. Brun. LVIII, No. 2, pp. 13–18

Adil, S., M. T. Banday, G. A. Bhat, M. S. Mir, and ManzoorRehman. 2010. Effect of dietary supplementation of organic acids on performance, intestinal histomorphology, and serum biochemistry of broiler chicken. SAGE-Hindawi Access to Research Veterinary Medicine International Volume 2010.

Adil, S., M. T. Banday, G. A. Bhat and M. S. Mir. 2011. Alternative strategies to antibiotic growth promoters. A review. Online Veterinary Journal: Vol. 6 No. 1, Article 76.

Ahmed, S. T., J. A. Hwang,., J. Hoon, H. S. Mun, and C. J. Yang. 2014. Comparison of single and blend acidifiers as alternative to antibiotics on growth performance, fecal microflora, and humoral immunity in weaned piglets. Asian-Australasian Journal of Animal Sciences, *27*(1), 93–100. http://doi.org/10.5713/ajas.2013.13411

Alexopoulos, C., I. Georgoulakis, A. Tzivara, C. Kyriakis, A. Govaris, and S. Kyriakis. 2004. Field evaluation of the effect of a probiotic-containing *Bacillus licheniformis* and *Bacillus subtilis* spores on the health status, performance, and carcass quality of grower and finisher pigs. Journal of Veterinary Medicine Series A J Vet Med Series A, 306-312.

Al-kassi, A G., and M. AqeelMohssen, 2009. Comparative study between single organic acid effect and synergistic organic acid effect on broiler performance. Pakistan Journal of Nutrition, 8(6), 896–899.

Aly, S., A. T. O. Cheik, H. N. B. Imael, and A. S Traore. 2004. Antimicrobial activities of lactic acid bacteria strains isolated from burkina faso fermented milk. Pakistan Journal of Nutrition, 3, 174–179.

Aly, S., A. T. O. Cheik, H. N. B. Imael, and T. S. Alfred. 2006. Bacteriocins and lactic acid bacteria- a minireview. African Journal of Biotechnology, 5(9), 678–683. http://doi.org/10.5897/AJB05.388

Anderssen, E. L., D. B. Diep, I. F. Nes, V. G. H. Eijsink, and J. Nissen-Meyer. 1998. Antagonistic activity of *Lactobacillus plantarum* C11: Two new two- peptide bacteriocins, plantaricins EF and JK, and the induction factor plantaricin A. Applied and Environmental Microbiology, 64(6), 2269–2272.

Anonymous, 1999. How do mannanoligosaccharides work. Feeding Times (1):7-9.

Anvoh, K. Y. B., A. Z. Bi, and D. Gnakri. 2009. Production and characterization of juice from mucilage of cocoa beans and its transformation into marmalade. Pakistan Journal of Nutrition, 8(2), 129–133. http://doi.org/10.3923/pjn.2009.129.133

AACC, Approved methods of the American Association of Cereal Chemists 2000. St. Paul, Minn. (10th ed.).

Awad, W. A, K. Ghareeb, S. Abdel-Raheem, and J. Böhm. 2009. Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens. Poultry Science, 88(1), 49–56. http://doi.org/10.3382/ps.2008-00244

Barbut, S. 2002. Poultry product processing:an industry Guide. CRC Press. Pg; 31-41

Barnes, E. M. 1958. The effect of antibiotic supplements on the faecal streptococci (Lancefield group D) of poultry.British Veterinary Journal. 114:333–344.

Beuchat, L. R., and D. A. Golden. 1989. Antimicrobials occurring naturally in foods. Food Technology (USA), 43(1), 134–42. Retrieved from http://agris.fao.org/agris-search/search.do?recordID=US8900153

Blanchard, P. J., J. P. F. D'Mello, A. M. C. Macdonald, S. Catton and U. Roser 2001. Minimum inhibition concentrations for propionic acid and organic acid mixtures against storage fungi. World Mycotoxin Forum pp. 62 – 62

Blum, S., D. HallerPfeifer, A., and E. Schiffrin, 2002.Probiotics and immune response. Clinical Reviews in Allergy and Immunology, 287-309.

Boostani, A, A. Ashayerizadeh, H. R. MahmoodianFard and M. Aminafshar. 2013. Growth performance, carcass yield and intestinal microflora populations of

broilers fed diets containing thepax and yogurt. Brazilian Journal of Poultry Science.v.15.n.1:1-6

Brashears, M., A. Amezquita, , D. Jaroni and L. Steve. 2005.Lactic acid bacteria and their uses in animal feeding to improve food safety.Advances in Food and Nutrition Research, 11-31

Buket, E.R., F.K. Onurdağ, B. Demirhan, S. O. Özgacar,B. A. Öktem and U. Abbasoğlu 2013. Screening of quinolone antibiotic residues in chicken meat and beef sold in the markets of Ankara, Turkey; Poultry Science 92: 2212-2215

Buncic, S., S. Fitzgerald, C. M. Bell, and R. G. Hudson. 1995. Individual and combine listericidal effects of sodium lactate, potassium sorbate, nisin and curing salts at refrigeration temperatures. Journal of Food Safety., 15, 247–264.

Butaye, P., L. A. Devriese., and F. Haesebrouck 2003. Antimicrobial growth promoters used in animal; effects of less well-known antibiotics on Gram-positive bacteria. Clinical Microbial Review. 16(2): 175-188.

Byrd, J., B. Hargis, D. Caldwell, R. Bailey, K. Herron, J. McReynolds, R. L. Brewer, R. C. Anderson, K. M. Bischoff, T. R. Callaway and L. F. Kubena. 2001. Effect of lactic acid administration in the drinking water during preslaughter feed withdrawal on *Salmonella* and *Campylobacter* contamination of broilers. Poultry Science. ;80:278-283.

Canibe, N.; S.H. Steien, M. Overland and B.B. Jensen. 2001. Effect of K-diformate in starter diets on acidify, microflora, and the amount of organic acids in the digestive tract of piglets, and on gastric alterations. Journal of Animal Science, Vol. 79, No. 8: 2123– 2133

Canibe, N., E.Virtanen , and B. B. Jensen. 2007. Effect of acid addition to pig liquid feed on its microbial and nutritional characteristics. Livestock Science. 108: 202-205.

Caplice, E., and G.F. Fitzgerald. 1999. Food fermentations: role of microorganisms in food production and preservation. International Journal of Food Microbiology., 50, 131-149

Casadei, G, E. Grilli, and A. Piva. 2009. Pediocin A modulates intestinal microflora metabolism in swine in vitro intestinal fermentations. Journal of Animal Science. 87: 2020-2028.

Caspary, W. F. 1992. Physiology and pathophysiology of intestinal absorption. American Journal of Clinical Nutrition. 55 (Suppl. 1): 299s-308s.

Castanon, J. I. R. 2007. Review: History of the use of antibiotic as growth promoters in european poultry feeds. Poultry Science 86:2466–247; doi:10.3382/ps.2007-00249

Cengiz, O., B. H. Koksal, O. Tatli, O. Sevim, H. Avci, T. Epikmen, and A G. Onol. 2012. Influence of dietary organic acid blend supplementation and interaction with delayed feed access after hatch on broiler growth performance and intestinal health. VeterinarniMedicina, 57(10), 515–528.

Ceslovas, J., J. Vigilijus and S. Almantas. 2005. The effect of probiotic and phytobiotics on meat properties and quality in pigs.Veterinary Zootechnology, 29: 80-84.

Cetinkaya, F., A. Yibara, G.E. Soyutemiza, B. Okutanb, A. Ozcanc, and M.Y. Karacac. 2012. Determination of tetracycline residues in chicken meat by liquid chromatography-tandem mass spectrometry; Food Additives and Contaminants: Part B: Surveillance; 5(1): 45-49

Chah, C. C. , C. W. Carlson, G. Semeniuk, I. S. Palmerand, and C. W. Hesseltine. 1975. Growth-promoting effects of fermented soybeans for broilers. Poultry Science 54:600–609.

Choct, M. 2001. Enzymes supplementation of poultry diets based on viscous cereals in enzymes. Bedford M R and Partridge G G: Farm Animal Nutrition., CABI Publishing, UK. 2001

Choe, D. W., H. L. Foo, T. C. Loh, M. Hair-Bejo and Q. S. Awis. 2013. Inhibitory property of metabolite combinations produced from *Lactobacillus plantarum* strains. Pertanika Journal of Tropical Agriculture Science. 36 (1): 80 – 88

Cicenia, A., A. Scirocco, M. Carabotti, L. Pallotta, M. Marignani, and C. Severi. 2014. Postbiotic activities of lactobacilli-derived factors. Journal of Clinical Gastroenterology.

Cintas, L.M., M.P. Casaus, C. Herranz, I. F. Nes, and P.E. Hernandez. 2001. Review: bacteriocins of lactic acid bacteria. Food Science Technology International: 7: 281-305.

Coast, J., R. Smith, and M. R. Millar. 1996. Superbugs: should antimicrobial resistance be included as a cost in economic evaluation? Health Economics. :217–226.

Cole, D. J., R. M. Beal, and J. R. Luscombe. 1968. The effect on performance and bacterial flora of lactic acid, propionic acid, calcium propionate and calcium acrylate in the drinking water of weaned pigs. Veterinary Record. 83:459-464.

del Río, E., R. Muriente, M. Prieto, C. Alonso-Calleja, and R. Capita. 2007. Effectiveness of trisodium phosphate, acidified sodium chlorite, citric acid, and

peroxyacids against pathogenic bacteria on poultry during refrigerated storage.Journal of Food Protection. 70(9):2063-71

Demeckova, V., C.A. Moran, C. Cavenay, A.C. Campbell, V. Kuri, and P.H. Brook. 2002. The effect of fermentation and/or sanitation of liquid diets on the feeding preferences of newly weaned pigs. In: Lindberg J.E., Ogle B. (eds.): Digestive Physiology of Pigs. CABI Publishing, Wallingford, UK, 291–293.

Denbow, D. M. 2000. Gastrointestinal anatomy and physiology.sturkie's avian physiology, ed. G.C. Witthow, 5th ed. Acedemic Press, California, USA. 299-325.

Denli, M, F. Okan, and K. Celik. 2003. Effect of dietary probiotic, organic acid and antibiotic supplementation to diets on broiler performance and carcass yield. Pakistan Journal of Nutrition.2: 89-91.

Dibner, J.J., and P. Buttin. 2002. Use of organic acids as a modelto study the impact of gut microflora on nutrition and metabolism.The Journal of Applied Poultry Research., 11: 453-463

Dibner, J. J., and J. D. Richards. 2004. The Digestive System: Challenges and Opportunities. The Journal of Applied Poultry Research. 13:86–93

Dibner, J. J., and J. D. Richards. 2005. Antibiotic growth promoters in agriculture: History and mode of action. Poultry.Science. 84:634–643.

Diebold, G. and U. Eidelsburger. 2006. Acidification of diets as a alternative to antibiotic growth promoters. Antimicrobial Growth Promoters, 1st ed., Wageningen Academic Publishers, the Netherlands. 311-328

Dierick, N., and J. Decuypere. 1996. Mode of action of exogenous enzymes in growing pig nutrition. Pig News Information 17:41N-48N.

Dizaji, B. R., A. Zakeri, and A. Golbazfarsad. 2013.Influences of different growth promoters on intestinal morphology of broiler chickens, 3(2), 32–37.

Drider, D., G. Fimland, Y. Héchard, L. McMullen and H. Prévost. 2006. The continuing story of class IIabacteriocins. Microbiology and Molecular Biology Reviews., 70, 564–582.

Dudley, M.A., L.J. Wykes, A. W. Dudley, D. G. Burrin, B.L. Nichols, J. Rosenberger. F. Jahoor, W. C. Heird, and P.J. Reeds. 1998. Parenteral nutrition selectively decrease protein synthesis in the small intestine. American Journal of Physiology Gastrointestinal and Liver Physiology. 274: G131-G137.

Elliott, S. D., and E. M. Barnes. 1959. Changes in serological type and antibiotic resistance on Lancefield group D streptococci in chickens receiving dietary chlortetracycline. Journal of General Microbiology. 20:426–433.

Eswaranandam, S., N. S. Hettiarachchy, and M. G. Johnson. 2004. Antimicrobial activity of citric, lactic, malic, or tartaric acids and nisin-incorporated soy protein film against *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella gaminara*. Journal of Food Science, 69(3), FMS79–FMS84. http://doi.org/10.1111/j.1365-2621.2004.tb13375.x

Etani, E., M. Agai, S. Tsujihata, T. Tsukamoto and M. ohta. 1998. Antbacterial action of vineger against food-born pathogenic bacteria including *Escherichia coli* 0157:H7. Journal of Food Protection,61(8):953-959.

Ewing, W. N., and D. J. A. Cole. 1994. The living gut: an introduction to microorganisms.packington, UK. Context Publications.:10-74.

Fallah, R., and H. Rezaei. 2013. Effect of dietary prebiotic and acidifier supplementation on the growth performance, carcass characteristics and serum biochemical parameters of broilers. Journal of Cell and Animal Biology Vol. 7(2), pp. 21-24

Fan, Y; J. Croom, V. Christensen, B. Black, A. Bird, L. Daniel, B. McBride and E. Eisen. 1997. Jejunal glucose uptake and oxygen consumption in turkey poults selected for rapid growth. Poultry Science., 76: 1738-1745.

Felis, G. E., and F. Dellaglio. 2007. Taxonomy of lactobacilli and bifidobacteria.Current issues in intestinal microbiology, 8(2), 44.

Fleming, R. 2008. Nutritional factors affecting poultry bone health. Proceedings of the Nutrition Society.177-183.doi:10.1017/S0029665108007015

Fletcher, D. L. 2002. Poultry meat quality. World's Poultry Science Journal, 58:131-145

Foo, H. L., Y.Z. Lim, and G. Rusul. 2001. Isolation of bacteriocin-producing lactic acid bacteria from Malaysian fermented food, Tapai. In preceeding of the 11th World Congress on Food Science and Technology, Seoul, Korea.Pp 185.

Foo, H. L. , T. C. Loh, Y. S. Lim, M. H. S, C. N. Kufli, and . F. L. Law . 2003a. Effects of fermented fruits on growth performance, shedding of enterobacteriaceae and lactic acid bacteria and plasma cholesterol in rats. Pakistan Journal of Nutrition, 2(4), 228–233. http://doi.org/10.3923/pjn.2003.228.233

Foo, H. L, T. C. Loh, F. L. Law, Y. Z. Lim, C. N. Kufli, G. Rusul. 2003b. Effects of feeding *Lactobacillus plantarum* I-UL4 isolated from Malaysian Tempeh on growth performance, faecal flora and lactic acid bacteria and plasma cholesterol

concentrations in postweaning rats. Journal Food Science Biotechnology 12: 403-408.

Foo, H. L., T. C. Loh, P. W. Lai, Y. Z. Lim, C. N. Kufli and G. Rusul. 2003c. Effects of Adding Lactobacillus plantarumI-UL4 Metabolites in Drinking Water of Rats, Pakistan Journal of Nutrition 2 (5): 283-288

Foo, H. L., Y. S. Lim, T. C. Loh, N. M. Saleh, A. R. Raha, and G. Rusul. 2005. Cahracterization produced of bacteriocin produced by *Lactobacillus plantarum* I-UL4 isolated from Malaysian fermented tapioca, Tapai Ubi. Proceeding of 4th NIZO Dairy Conference, Papendal, Netherland, p 33.

Fouad, A. M., and H. K. El-Senousey. 2014. Nutritional factors affecting abdominal fat deposition: A review. Asian Australas Journal Animal Science V.27.n.7: 1057-1068

Fukunaga, T. M, Y. Sasaki, T. Araki, T. Okamoto, T. Yasuoka, Tsujikawa, Y. Fujiyama and T. Bamba. 2003. Effects of the soluble fibre pectin on intestinal cell proliferation, fecal short chain fatty acid production and microbial population. Digestion; 67: 42-49.

Gabriel, I., M. Lessire, S. Mallet and J. F. Guillot. 2006. Microflora of the digestive tract: critical factors and consequences for poultry. World's Poultry Science Journal, 63, 03:499-511. http://dx.doi.org/10.1017/S0043933906001115

Gaggia, F. , P. Mattarelli and B: Biavati. 2010. Probiotics and prebiotics in animal feeding for safe food production.International Journal Food Microbiology,141:S15–S28.

Galfi, P., and J. Bokori. 1990. Feeding trial in pigs with a diet containing sodium n-butyrate.Acta. Vet. Hung., 38: 3-17.

Garcia, V., P. Catala-Gregori, F. Hernandez, M. D. Megias and J. Madrid. 2007. Effect of formic acid and plant extracts on growth, nutrient digestibility, intestine mucosa morphology, and meat yield of broilers. Journal of Applied Poultry Research;16: 555–562.

Gauthier, R. 2002. The mode of action of acidifiers and the interest they generate in the growing finishing phase. In: Current Developments in Pig Production, French Association of Swine Practitioners, Maisons-Alfort, France p. 16,.

Gebre B. A. 2012. Qualitative screening of antibiotic residues and identification of antibiotic resistant salmonella from raw and ready to eat meat in Thailand; International Journal of Advanced Life Sciences; 5(1): 51-64

Ghishan F. K. , and P. R. Kiela. 2011. From probiotics to therapeutics: another step forward?. Journal Clinical Invest. 2011;121:2149–2152.

González-Fandos, E. and B. Herrera. 2013. Efficacy of malic acid against *Listeria monocytogenes* attached to poultry skin during refrigerated storage. Poultry Science 92 :1936–1941 http://dx.doi.org/ 10.3382/ps.2012-02968

Greko, C. 2001. Safety aspects on non-use of antimicrobials as growth promoters. Gut Environment of Pigs. A. Piva, K. E. Bach Knudsen and J. E. Lindberg, ed. Nottingham University Press, Nottingham, UK. 219–230

Gunal, M., G. Yayli, O. Kaya, N. Karahan, and O. Sulak. 2006. The effects of antibiotic growth promoter, probiotic or organic acid supplementation on performance, intestinal microflora and tissue of broilers. International Journal of Poultry Science, 5(2), 149–155. http://doi.org/10.3923/ijps.2006.149.155

Guo, G., Y. Liu, W. Fan, J. Han, Y. Hou, Y. Yin, H. Zhu, B. Ding, J. Shi, J. Lu, H. Wang, J Chao and Y. Qu. 2008. Effects of Achyranthes Bidentata polysaccharide on growth performance, immunological, adrenal, and somatotropic responses of weaned pigs challenged with *Escherichia coli* lipopolysaccharide. Asian-Austria Journal of Animal Science 21:1189–1195

Hair-Bejo, M. 1990. Gastrointestinal response to copper excess: studies on copper (and zinc) loaded rats. PhD thesis, Department of Veterinary Pathology, University of Liverpool, United Kingdom.

Hammes, W.P. and R. F. Vogel. 1995. The genus lactobacillus. in: the genera of lactic acid bacteria, vol. 2, pp. 19–54. Edited by B.J.B. Wood and W.H. Holzapfel. Blackie Academic & Professional (UK).

Harvey, R. B., R. C. Anderson, K. J. Genovese, T. R. Callaway, and D. J. Nisbet. 2005. Use of competitive exclusion to control enterotoxigenic strains of *E. coli* in weaned pigs. Journal Animal Science 83 (E.Suppl.): E44-E47.

Hernandez, F., V. Garcia, J. Madrid, J. Orengo, P. Catala, and M. D. Megias. 2006. Effect of formic acid on performance, digestibility, intestinal histomorphology and plasma metabolite levels of broiler chickens. British Poultry Science.47(1): 50-56.

Hinton, M. and A.H. Linton. 1988. Control of *Salmonella* infections in broiler chickens by the acid treatment of their feed. The Veterinary Record , 123 , 416 -421.

Holzapfel, W. H., P. Haberer, J. Snel, U. Schillinger, T. Huisin and J. H. J. Veld. 1998. Overview of gut flora and probiotics.International Journal Food Microbiology.41:85–101.

Honikel, K.O. 1998. Reference methods for the assessment of physical characteristics of meat. Meat Science 49:447-457.

Honikel, K.O. and R. Hamm. 1994. Measurement of water-holding capacity and juiciness. In: Advances in Meat Research. Vol. 9. Quality Attributes and Their Measurement in Meat, Poultry and Fish Products (ed. A.M. Pearson and T.R. Dutson). Blackie Academic and Professional. London, UK. Pp. 125-161.

Honikel, K.O., C. J. Kim, R. Hamm and P. Roncales. 1986. Sarcomere shortening and their influence on drip loss. Meat Science 16, 267–282

Hossain, M. E., G. M. Kim, S. K. Lee, and C. J. Yang. 2012. Growth performance, meat yield, oxidative stability, and fatty acid composition of meat from broilers fed diets supplemented with a medicinal plant and probiotics.Asian-Australasian Journal of Animal Sciences, 25(8), 1159.

Hudha, M. N., M. S. Ali, M. A. A. Azad, M. M. Hossain, M. Tanjim, S. C. Bormon, and A. K. Paul. 2010. Effect of acetic acid on growth and meat yield in broilers. International Journal of Bioresearch, 1, 31-35.

Huff-Lonergan, E. 2009. Fresh meat water-holding capacity. Improving The Sensory and Nutritional Quality of Fresh Meat, 147-160.

Hunter, R.S. and R. Harold. 1987. The measurement of appearance. 2nd ed. Wiley, New York.

Hussein M. A. and S. Khalil. 2013 . Screening of some antibiotics and anabolic steroids residues in broiler fillet marketed in El-Sharkia Governorate. Life Science Journal; 10(1)

Huyghebaert, G., R. Ducatelle, and F. van Immerseel. 2011. Review: An update on alternatives to antimicrobial growth promoters for broilers. The Veterinary Journal 187:182–188

Impey, C. S., G. C. Mead, , and S. M. George. 1982. Competitive exclusion of *Salmonella*s from the chick caecum using a defined mixture of bacterial isolates from the caecal microflora of an adult bird. The Journal of Hygiene, 89(3), 479–490. http://doi.org/10.1017/S0022172400071047

Irshad, A., G. Kandeepan, S. Kumar, A. Ashish Kumar, M. R. Vishnuraj, and V. Shukla. 2013. Factors influencing carcass composition of livestock: a review. Journal of Animal Production Advances. 3(5):177-186. doi:10.5455/japa.20130531093231

Jack, R. W., J. R. Tagg, and B. Ray. 1995. Bacteriocins of Gram positive bacteria. Microbiology Revision. 59: 171-200.

Jarquin, R., G. Nava, A. Wolfenden, A. Donoghue, I. Hanning, S.Higgins, and B. Hargis. 2007. The evaluation of organic acids and probiotic cultures to reduce

Salmonella enteriditis horizontal transmission and crop infection in broiler chickens. International Journal of Poultry Science. 6:182–186.

Jin, L. Z. , Y.W. Ho, N. Abdullah, and S. Jalaludin. 1998 Effects of adherent *Lactobacillus* cultures on growth, weight of organs and intestinal microflora and volatile fatty acids in broilers. Poultry Science,77:1259-1265

Jukes, T. H. , E. L. R. Stokstad, R. R. Taylor, T. J. Combs, H. M. Edwards and G. B. Meadows. 1950. Growth promoting effect of aureomycin on pigs. Arch. Biochemestry. 26:324–330

Kabir, S. M. L. 2009. Effect of probiotic on broiler meat quality. African Journal of Biotechnology,8(15): 3623-3627

Kalavathy, R., N. Abdullah, S. Jalaludin, and Y. W. Ho. 2003. Effects of *Lactobacillus* cultures on growth performance, abdominal fat deposition, serum lipids and weight of organs of broiler chickens. British Poultry Science 44:139-144.

Kandler, O., and N. Weiss. 1986. Regular, nonsporing Gram-positive rods, P. H. A. Sneath, N. S. Mair, M. E. Sharpe, and J. G. Holt (ed.), Bergey's manual of systematic bacteriology, vol. 2. Williams and Wilkins, Baltimore, MD. p. 1208–1234

Kim, I. B., P. R. Ferket, W. J. Powers, H. H. Stein and T. A. T. G. van Kempen. 2004. Effects of different dietary acidifier sources of calcium and phosphorus on ammonia, methane and odorant emission from growing-finishing pigs. Asian-Australian Journal Animal Science 17(8):1131-1138.

Kim, Y. Y., D. Y. Kil, H. K. Oh, and I. K. Han. 2005. Acidifiers as an alternative material to antibiotics in animal feed. Asian-Australian Journal Animal Science. 18(7): 1048-1060

Kirchgessner, M. and F. X. Roth, 1990. Nutritive effect of calcium formate in combinateion with free acids in the feeding of piglets.Agribiological Research 43, No. 1, pp. 53– 64

Kirk, C. K. 2000. Comparative avian nutrition.2nd ed. CABI Publishing, CAB International, Wallingford, UK.25-26

Kocher, A. 2006. Interfacing gut health and nutrition: The use of dietary prebiotics and probiotics to maximise growth performance in pigs and poultry. Pages 289–310 in Antimicrobial Growth Promoters: Where DoWeGoFrom Here? D. Barug, J. de Long, A. K. Kies, and M. W. A. Verstegen, ed. Wageningen Acad. Publ., Wageningen, the Netherlands.

Kossah, R., C. Nsabimana, J. X. Zhao, H. Q. Chen, F. W. Tian, H. Zhang and W. Chen, 2009. Comparative study on the chemical composition of Syrian sumac (*Rhus*

coriaria L.) and Chinese sumac (*Rhus typhina* L.) fruits. Pakistan Journal Nutrition, 8: 1570-1574.

Kral, M., M. Angelovicova, E. Alfaig, and M. Walczycka. 2013. Meat quality of broiler chickens fed diets with bacillus subtilis and malic acid additives. Animal Science and Biotechnologies,46 (2).

Kralik, G., I. Djurkin, Z. Kralik, Z. Skrtic and Z. Radisic. 2014. Quality indicators of broiler breast meat in relation to colour. Animal Science Papers and Reports Institute of Genetics and Animal Breeding, Jastrzębiec, Poland vol. 32 no. 2, 173-178

Kyriakis, S. C., V. K. Tsiloyiannis, J. Vlemmas, K. Sarris, A. C. Tsinas, C. Alexopoulos, and L. Jansegers. 1999. The effect of probiotic LSP 122 on the control of post-weaning diarrhea syndrome of piglets. Research in Veterinary Science.67:223–228.10607501

Lambert, R. J., and M. Stratford**.** 1999. Weak-acid preservatives: modelling microbial inhibition and response. Journal Applied Microbiology 86**:**157-164

Le Blay G, H. M. Blottiere, L. Ferrier, E. C. LeFoll, J. P. Bonnet, Galmiche and C. Cherbut 2000. Short-chain fatty acids induce cytoskeletal and extracellular protein modification associated with modulation of proliferation on primary culture of rat intestinal smooth muscle cells. Digestive Disease Science 45: 1623-1630.

Lee , Y. A. 2002. Purification and characterization of bacteriocin produced by *Lactococcus lactis* subsp. lactis RW18 isolated from steamed fish (Rastrelliger sp.), MSc Thesis, Faculty of Food Science and Biotechnology, Universiti Putra Malaysia, Malaysia.

Liem, A. 2009. Dietary factor influencing Ca and P utilization by broiler chickens. PhD. Diss.University Georgia. Athens.

Lim, Y. S., H. L. Foo, A. R. Raha, T. C. Loh, M. H. Bejo, and R. A. GulamRusul. 2006. The probiotic characteristics of *Lactobacillus plantarum* strains isolated from local foods. Proceeding of the 28th Symposium of Malaysian Society for Microbiology, Melaka, Malaysia 88-89.

Liu, D., 2006. Identification, subtyping and virulence determination of *Listeria monocytogenes* an important foodborne pathogen. Journal Medical Microbiology, 55: 645-659.

Liu, S. N., Y. Han and Z.-J. Zhou. 2011. Lactic acid bacteria in traditional fermented chinese foods, Food Research International, Vol. 44, No. 3, , pp. 643-651. http://dx.doi.org/10.1016/j.foodres.2010.12.034

Liu, X., H. Yan, L. Lv, Q. Xu, C. Yin, K. Zhang, and J. Hu. 2012. Growth performance and meat quality of broiler chickens supplemented with *Bacillus licheniformis* in drinking water. Asian-Australasian Journal of Animal Sciences, 25(5), 682–689. doi:10.5713/ajas.2011.11334

Loddi M. M, V. M. B. Maraes, I.S. O. Nakaghi, F. Tucci, M. I. Hannas and J. A. Ariki. 2004 . Mannan-oligosaccharide and organic acids on performance and intestinal morphometric characteristics of broiler chickens. In: Proceedings of the 20th Annual Symposium on Computational Geometry. Brooklyn, NY, USA. 45.

Loh T. C. , H. L. Foo, K. L. Lee, Y. Z. Lim, C. N. Kufli. 2003a. Effects of fermented fruits on growth performance, shedding of Enterobacteriaceae and lactic acid bacteria counts and interrelationships and plasma cholesterol concentration in rats. Journal of Animal and Feed Sciences, 12 (3), 1656-1660.

Loh, T. C. , H. L. Foo, S. H. Tan, Y. M. Goh, M. H. Shukriyah, and C. N. Kufli. 2003b. Effects of fermented products on performance, faecal pH, *Enterobacteriaceae* and lactic acid bacteria counts and interrelationships, and plasma cholesterol concentration in rats. Journal of Animal and Feed Sciences, 12(3), 633–644.

Loh, T. C. , H. C. Lim, A. B. Bahaman and H. L. Foo. 2006. Prevalence of antimicrobial-resistant Escherichia coli infections in diarroeic piglets. Journal of Veterinary Malaysia. 18:17-20.

Loh, T. C., M. R. Rosyidah, N.T. Thanh, Y. K. Chang, and P. C. Kok. 2007a. Effects of feeding organic and inorganic acid blends on growth performance and nutrient digestibility in young broiler chickens. Jurnal Veterinar Malaysia, 19 (1). pp. 17-20.

Loh, T.C., F. L. Law, H. L. Foo, Y. M. Goh, I. Zulkifli. 2007b. Effets of feeding a fermented products on egg production, faecal microflora and faecal pH in laying hens.Journal of Animal and Feed Sciences, 16, 452-462.

Loh, T. C., F. L. Law, Y. M. Goh, H. L. Foo, and I. Zulkifli. 2009. Effects of feeding fermented fish on egg cholesterol content in hens. Animal Science Journal, 80(1), 27–33. http://doi.org/10.1111/j.1740-0929.2008.00591.x

Loh, T. C., N. T. Thanh, H. L. Foo, M. Hair-Bejo, and B. K. Azhar. 2010. Feeding of different levels of metabolite combinations produced by *Lactobacillus plantarum* on growth performance, fecal microflora, volatile fatty acids and villi height in broilers. Animal Science Journal, 81(2), 205–214. http://doi.org/10.1111/j.1740-0929.2009.00701.x

Loh, T. C., N. T. Thanh, H. L. Foo, and M. H. Bejo. 2013. Effects of feeding metabolite combination from Lactobacillus plantarum on plasma and breast

meat lipids in broiler chickens.Brazilion Journal of Poultri Science.v.15n.4: 307-316.

Loh, T. C., D.W. Choe, , H. L. Foo, A. Q. Sazili and M. H. Bejo 2014. Effects of feeding different postbiotic metabolite combinations produced by *Lactobacillus plantarum* strains on egg quality and production performance, faecal parameters and plasma cholesterol in laying hens. BMC Veterinary Research, 10: 149. http://doi.org/10.1186/1746-6148-10-149.

Lokman, I. H., A. B. Z. Zuki, Y. M. Goh, A. Q. Sazili and M. M. Noordin. 2011. Carcass compositions in three different breeds of chicken and their correlation with growth performance.Pertanika Journal. Tropical Agriculture Science 34 (2): 247–252

Lopez-Pedrosa, J. M., M. I. Fernadez, A. Rios, and A. Gil.1998. Severe malnutrition alters lipid composition and fatty acid profile of small intestine in newborn piglets. Journal of Nutrition. 128: 224-233.

Luckstadt, C., N. Şenköylü, H. Akyürek, and A. Aĝma. 2004. Acidifier – A modern alternative for anti-biotic free feeding in livestock production, with special focus on broiler production. VeterinarijaIrZootechnika, 27(49).

Mahan, D.C.; E. A. Newton and K. R. Cera. 1996. Effect of supplemental sodium phosphate or hydrochloric acid in starter diets containing dried whey. Journal of Animal Science 74, No. 6, pp. 1217 –1222, ISSN 0021-8812.

Makras, L., and L. De Vuyst. 2006. The in vitro inhibition of Gram-negative pathogenic bacteria by bifidobacteria is caused by the production of organic acids. International Dairy Journal, 16(9), 1049–1057. http://doi.org/10.1016/j.idairyj.2005.09.006

Maribo, H., E. V. Olsen, P. Barton-Gade, A. J. Moller, and A. Karlsson. 1998. Effect of early post-mortem cooling on temperature, pH fall, and meat quality in pigs. Meat Sci. 50:115-129.

Marteau, P.,and F. Shanahan. 2003. Basic aspects and pharmacology of probiotics: An overview of pharmacokinetics, mechanisms of action and side effect. Best Practice and Research in Clinical Gastroenterology, 17: 725-740.

Mathew, A. G., A. L. Sutton, A. Scheidt, D. M. Bforsyth, J. A. Patterson and D. T. Kelly 1991. Effect of a propionic acid containing feed additives on performance and intestinal microbial fermentation of ten weanling pig.Inproceding of V th International symposium ondigestive physiology in pigs. Wageningen, Netherlands, Eaap Publication,No.54:464-469

Mehaffey, J. M., S. P. Pradhan, J. F Meullenet, J. L. Emmert, S. R. McKee and C.M. Owens 2006. Meat quality evaluation of minimally aged broiler breast fillets from five commercial genetic strains. Poultry Science. 85: 902-908.

Menconi, A., V.A. Kutappan, X. Hernandez-Velasco, T. Urbano, F. Matte, S. Layton, G. Kallapura, J. Latorre, B. E. Morales, O. Prado, J. L. Vicente, J. Barton, R. L. , M. AndreattiFilho Lovato, B. M. Hargis and G. Tellez. 2014. Evaluation of a commercially available organic acid product on body weightloss, carcass yield, and meat quality during preslaughter feed withdrawalin broiler chickens: A poultry welfare and economic perspective. Poultry Science 93:448–455.http://dx.doi.org/ 10.3382/ps.2013-03444

Meredith M. 2003. New probiotic feed supplement for swine. United States Patent. USA, 6, 524–574.

Miles, R.D., G.D. Butcher, P.R. Henry, and R.C. Littell. 2006. Effect of antibiotic growth promoters on broiler performance, intestinal growth parameters and quantitative morphology.Poultry Science 85: 476-485.

Miller, B.F. 1987. Acidified poultry diets and their implications for poultry industry. In: Biotechnology in the feed industry. Alltech Technical Publications, Kentuky, pp: 199-209.

Moghadam, M. S., H. L. Foo, T. C. Leow, R. A. Rahim, and T. C. Loh. 2010. Novel bacteriocinogenic *Lactobacillus plantarum* strains and their differentiation by sequence analysis of 16S rDNA, 16S-23S and 23S-5S intergenic spacer regions and randomly amplified polymorphic DNA analysis. Food Technology and Biotechnology, 48(4), 476–483.

Mohan B, R. Kadirvel, A. Natarajan, and M. Bhaskaran. 1996. Effect of probiotic supplementation on growth, nitrogen utilization and serum cholesterol in broilers. British Poultry Science 37:395-401

Moharrery, A. and M. Mahzonieh. 2005. Effect of malic acid on visceral characteristics and coliform counts in small intestine in the broiler and layer chickens. International Journal of Poultry Science.4 (10): 761-764.

Mollendorff, J. W., S. D. Todorov, and L. M. T. Dicks. 2006. Comparison of bacteriocins produced by lactic-acid bacteria isolated from boza, a cereal-based fermented beverage from the Balkan Peninsula. Current Microbiology. 53: 209-216.http://doi.org/10.1007/s00284-006-0075-9

Moore, P. R., A. Evenson, T. D. Luckey, E. McCoy, E. A. Elvehjem, and E. B. Hart. 1946. Use of sulphasuccidine, streptothricin and streptomycin in nutrition studies with the chick. J. Biol. Chem. 165:437–441.

Moreira J., A. A. Mendes, E. A. Garcia, R. G. Garcia, I. C. L. Almeida, and J. C. G. Almeida Jr. 2001. Efeito do uso do probióticosobre o desempenho e rendimento de carcaçaemfrangos de corte. Anais da 38a Reunião Annual da Sociedade Brasileira de Zootecnia. Piracicaba: SBZ., 852-854

Nahar, K., S.M Ullah and N. Islam, 2011. Osmotic adjustment and quality response of five tomato cultivars (lycopersiconesculentum mill) following water deficit stress under subtropical climate. Asian Journal of Plant Sciences, 10: 153-157. http://scialert.net/abstract/?doi=ajps.2011.153.157

Netherwood, T, H. J. Gilbert, D. S. Parker, A. G. O'Donnell. 1999. Probiotics shown to change bacterial community structure in the avian gastrointestinal tract. Applied Environment Microbiology. ; 65:5134–5138.

Nikaido, H. 2003. Molecular basis of bacterial outer membrane permeability revisited. microbiology and molecular biology Reviews. http://doi.org/10.1128/MMBR.67.4.593-656.2003

Nikaido, H. 1996. Outer Membrane. In: *Escherichia coli* and *Salmonella typhimurium*: cellular and molecular biology, Neidhardt, F.C. (Ed.). American Society of Microbiology Press, Washington, DC., USA.29-47.

Nisha, A. R. 2008. Review; Antibiotic residue-A global health hazard. Veterinary World, 1(12); 375-377.

Ogunwole O.A. , O. A. Abu, and I. A. Adepoju. 2011. Performance and carcass characteristics of broiler finishers fed acidifier based diets.Pakistan Journal of Nutrition 10(7): 631-636.

Ouwehand A.C. 1998. In vitro inhibition of adhesion of *Escherichia coli*.PhD Thesis, Goteborg University, Sweden.

Over, K. F., N. Hettiarachchy, M. G. Johnson, and B. Davis. 2009. Effect of organic acids and plant extracts on *Escherichia coli* O157:H7, *Listeria monocytogenes*, and *Salmonella Typhimurium* in broth culture model and chicken meat systems. Journal Food Science 74:M515-521.

Overland, M., T. Granli, N. P. Kjos, O. Fjetland, S. H. Steien and M. Stokstad. 2000. Effect of dietary formates on growth performance, carcass traits, sensory quality, intestinal microflora, and stomach alterations in growing-finishing pigs. Journal Animal Science 78:1875-1884.

Oyetayo V.O., F. C. Adetuyi, and F. A. Akinyosoye. 2003. Safety and protective effect of *Lactobacillus acidophilus* and *Lactobacillus casei* used as probiotic agent in vivo. African Journal of Biotechnology. 2, 448-452.

Pallauf, J. and J. Huter 1993.Studies on the influence of calcium formate on growth, digestibility of crude nutrients, nitrogen balance and calcium retention in weaned piglets. Animal Feed Science and Technology, Vol. 43, No. 1-2. 65-76

Panesar, P. S. 2011. Fermented dairy products: starter cultures and potential nutritional benefits, Food and Nutrition Sciences, Vol. 2, No. 1, 47-51. http://dx.doi.org/10.4236/fns.2011.21006

Papatsiros, V. and C. Billinis. 2012. The prophylactic use of acidifiers as antibacterial agents in swine. In: Antimicrobial Agents, Bobbarala, V. (Ed.), Chapter 14. 295-310.

Park, Y. K., M. M. Monaco, and S. M. Donovan. 1998. Delivery of total parenteral nutrition (TPN) via unbilical catheterization: development of a piglet model to investigate therapies to improve gastrointestinal structure and enzyme activity during TPN. Biology Neonate. 73: 295-305.

Partanen, K.H., and Z. Mroz. 1999.Organic acids for performance enhancement in pig diets. Nutrition Research reviews, 12: 1-30.

Pascual, M., M. Huges, J. I. Badiola, J. M. Monfort, and M. Gariga. 1999. *L. salivarius* CTC2197 prevents *Salmonella enteritidis* colonization in chickens. Applied Environment Microbiology. 65 (11): 4981-4986.

Patterson, J. A., and K. M. Burkholder. 2003.Application of prebiotics and probiotics in poultry production. Poultry Science. 82:627–631.

Paul, S.K., G. Halder, M. K. Mondal, and G. Samanta 2007. Effect of organic acid salt on the performance and gut health of broiler chickens. Journal of Poultry Science. 44(4): 389-395.

Pelicano, E.R.L., P. A. Souza, H. B. A. Souza, A. Oba, E. A. Norkus, L. M. Kodawara and T. M. A. Lima. 2003. Effect of different probiotics on broiler carcass and meat quality. Brazilian Journal of Poultry Science. V.5.n.3: 207-214.

Pelicano, E. R. T. , P. A. Saouza, H. B. A. Souza, M. M. Figuetredo, and S. R. Carvalho. 2005. Intestinal mucosa development in broiler. Brazilian Journal Poultry Science, Brasileira, Revista Science, 7(4), 221–229.

Pelicia, K., A. A. M. Mendes, E. S. P .B. Saldanha, C. C. Pizzolante, S. E. Takahashi, R. G. Garcia, C. L. A. Paz, and R. R. Quintero. 2004. Utilização de promotores biológicosparafrangos de cortetipo colonial.Revista Brasileira de CiênciaAvícola (supl 6): 21.

Podolsky, D. K. 1993. Regulation of intestinal epithelial proliferation: a few answer, many question. Animal Journal Physiology 264: 179-186.

Quadros, A. R. B. , C. Kiefer, N. L. C. Ribeiro, and L. A. Zink. 2001. Característicasqualitativas da carne de suínosalimentados com rações contend ounãoprobióticos. In:XXXVIIIReuniãoAnual da SBZ, Piracicaba. Anais. Piracicaba, 2001;794-795.

Rathnayaka, R. 2013. Antibacterial effect of malic acid against *Listeria monocytogenes*, *Salmonella enteritidis* and *Escherichia coli* in mango, pineapple and papaya juices. American Journal of Food Technology. 74-82. http://scialert.net/abstract/?doi=ajft.2013.74.82

Reid,G. 2001. Probiotics agent to protect the urogenital tract against infection. American Journal Clinical Nutrition 73: 437S-443S.

Richards, J. D., J. Gong, and C. E. M. Delange. 2005. The gastrointestinal microbial and its role in monogastric nutrition and health with an emphasis on pigs; current understanding possible modulations and New technologies studies.Canadian Journal of Animal Science.85: 421-435.

Ricke, S. C. 2003. Perspectives on the use of organic acids and short chain fatty acids as antimicrobials.Poultry Science 82:632–639.

Rinttila, T. and J. Apajalahti. 2013. Intestinal microbiota and metabolites-Implications for broiler chicken health and performance. Journal of Applied Poultry Research. 22:647–658 http://dx.doi.org/ 10.3382/japr.2013-00742

Ritz, C. W., R. M. Hulet, B. B. Self, and D. M. Denbow 1995.Growth and intestinal morphology of male turkeys as influenced by dietary supllementation of amylase and xylanase.Poultry Science 74: 1329-1334.

Roe, A. J., D. McLaggan, I. Davidson, C. O'Byrne and I. R. Booth. 1998. Perturbation of anion balance during inhibition of growth of *Escherichia coli* by weak acids. Journal Bacteriology 180, 767–772.

Romans, J. R., K. W. Jones, W. J. Costello, C. W. Carlson, and P. T. Ziegler. 1985. The meat we eat. 12th ed. Danville, IL; The Interstate Printers and Publishers, Inc.

Ross, R. P., S. Morgan, C. Hill 2002. Preservation and fermentation: past, present and future. International Journal Food Microbiology. 79: 3-16.

Rosyidah, M. R., T. C. Loh, H. L. Foo, X. F. Cheng, and M. H. Bejo. 2011. Effect of feeding metabolites and acidifier on growth performance, faecal characteristics and microflora in broiler chickens. Journal of Animal and Veterinary Advances. http://doi.org/10.3923/javaa.2011.2758.2764

Roth, F. X. and M. Kirchgessner 1998. Organic acids as feed additives for young pigs: nutritional and gastrointestinal effects. Journal of Animal and Feed Sciences7:25-33.

Roy, P., A. S. Dhillon, L. H. Lauermen, D. M. Schaberg, D. Bandli, and S. Johnson. 2002. Results of *Salmonella* isolation from poultry products, poultry, poultry environment, and other characteristics. Avian Disease. 46: 17-24.

Russell, J. B., and F. Diez-Gonzalez. 1998. The effects of fermentation acids on bacterial growth. Advances in Microbial Physiology, 39, 205–234. http://doi.org/10.1016/S0065-2911(08)60017-X

Sakata, T., M. Adachi, M. Hashida, N. Sato, and T. Kojima. 1995. Effect of n-butyric acid on epithelial cell proliferation of pig colonic mucosa in short-term culture. Dtsch. Tierarztl. Wschr.102:163–164.

Saleh, A. A., K. Hayashi, D. Ijiri and A. Ohtsuka. 2014. Beneficial effects of *Aspergillus awamori* in broiler nutrition. World's Poultry Science Journal, Vol. 70, : 857-864

Samana, M., and P.Biswas. 1995. Effect of feeding probiotics and lactic acid in the performance of broilers. In. Journal of Poultry Science 30:145-147.

Samanya, M., and K. E. Yamauchi. 2002. Histological alterations of intestinal villi in chicken fed dried Bacillus SubtilisvarNatto. Comparative Biochemistry and Physiology 133: 95-104.

Samappito, S., and L. Butkhup. 2008. An analysis on organic acids contents in ripe fruits of fifteen Mao Luang (Antidesmabunius) cultivars, harvested from dipterocarp forest of Phupan Valley in Northeast Thailand. Pakistan Journal of Biological Sciences, 11(7), 974–981. http://doi.org/10.3923/pjbs.2008.974.981

Samik, K. P., H. Gobinda, K. M. Manas and S. Gautam. 2007. Effect of organic acid salt on the Performance and Gut Health of Broiler Chicken. Journal of Poultry Science 44, 389–395.

Sanz, M., C. J. Lopez-Bote, D. Menoyo, and J. M. Bautista. 2000. Abdominal fat deposition and fatty acid synthesis are lower and β-oxidation is higher in broiler chickens fed diets containing unsaturated rather than saturated fat. Journal of Nutrition. 130: 3034-3037.

Sebastian S., L. E. Phillip, V. Fellner, and E. S. Idzian. 1996. Comparative assessment of bacterial inoculation and propionic acid treatment of aerobic stability and microbial population of ensiled high moisture ear corn. Journal of Animal Science 74: 447–56 http://jas.fass.org/cgi/reprint/74/2/447

Sen S., S. L. Ingale, Y. W. Kim, J. S. Kim, K. H. Kim, J. D. Lohakarea, E. K. Kim, H. S. Kim, M. H. Ryu, I. K. Kwon, and B. J. Chae. 2012. Effect of supplementation of *Bacillus subtilis* LS 1-2 to broiler diets on growth performance, nutrient

retention, caecal microbiology and small intestinal morphology. Research in Veterinary Science 93, 264–268.

Senkoylu N., H. E. Samli, M. Kanter and A. Agma. 2007.Influence of a combination of formic and propionic acids added to wheat- and barley-based diets on the performance and gut histomorphology of broiler chickens. Acta Veterinaria Hungarica 55(4) : 479-90.

Seo, S., D. Jung, X. Wang, D. Seo, M. Lee, B. Lee, and C.Choi. 2013. Combined effect of lactic acid bacteria and citric acid on *Escherichia coli* O157:H7 and *Salmonella Typhimurium.* Food Science and Biotechnology, 1171-1174. http://doi.org/10.1007/s10068-013-0199-1

Shah, N. P. 2001. Functional foods from probiotics and prebiotics. Food Technology., 55: 46-53.

Sharma, R., B. S. Sanodiya, D. Bagrodia, M. Pandey, A. Sharma and P. S. Bisen. 2012. Efficacy and potential of lactic acid bacteria modulating human health. International Journal of Pharma and Bio Sciences, Vol. 3, No. 4, pp. 935-948.

Shirzadeh E. and M. Kazemi. 2011. Effect of malic acid and calcium treatments on quality characteristics of apple fruits during storage. American Journal of Plant Physiology, 6: 176-182. http://scialert.net/abstract/?doi=ajpp.2011.176.182

Sholeva Z., S. Stefanova, and V. Chipeva. 1998. Screening of antimicrobial activities among Bulgarian lactobacilli strains. Journal of Culture Collections 2, 15-20.

Skinner J. T., A. L. Izat and P. W. Waldrop 1991. Research note: fumaric acid enhances performance of broiler chickens. Poultry Science 70, 1444-1447.

Starr, M. P., and D. M. Reynolds. 1951. Streptomycin resistance of coliform bacteria from turkeys fed streptomycin. in Proceedings of the 51st General Meeting, Society of American Bacteriology, Chicago, IL. Pages 15–34

Statistical Analysis Software (SAS).1998. SAS® User's Guide: Statistic. SAS Institute Inc., North Carolina, USA.

Steele, J. J. Broadbent and J. Kok. 2013. Perspective on the contribution of lactic acid bacteria to cheese flavor development, Current Opinion in Biotechnology, Vol. 24, No. 2, pp. 135-141. http://dx.doi.org/10.1016/j.copbio.2012.12.001

Stender, H., K. Oliveira, S. Rigby, F. Bargoot and J. Coull, 2001. Rapid detection, identification and enumeration of *Escherichia coli* by fluorescence in situ hybridization using an array scanner. Journal Microbiology Methods, 45: 31-39.

Summers, J. D. and S. Lesson. 1979. Comprise of poultry meat as affected by nutritional factors. Poultry Science, 58:536-542.

Sun, X., A. McElroy, K. E. Webb, A.E. Sefton, and C. Novak. 2005. Broiler performance and intestinal alterations when fed drug-free diets. Poultry Science, 84(8), 1294–1302.

Swann, M. M. 1969. Report of joint committee on the use of antibiotics in animal husbandary and veterinary medicine. HMSO, London.

Swiatkiewicz, S. and A. A. Wlosek. 2012. Bone quality characteristics and performance in broiler chickens fed diets supplemented with organic acids.Czech Journal Animal Science, 57, (4): 193–205

Thanh, N. T., T. C. Loh, H. L. Foo, M. Hair-Bejo, and B. K. Azhar. 2009. Effects of feeding metabolite combinations produced by *Lactobacillus plantarum* on growth performance, faecal microbial population, small intestine villus height and faecal volatile fatty acids in broilers. British Poultry Science, 50(3), 298–306. http://doi.org/10.1080/00071660902873947

Thanh, N. T, T. C. Loh, H. L. Foo, M. H. Bejo and B. K. Azhar. 2010. Inhibitory activity of metabolites produced by *Lactobacillus plantarum* isolated from Malaysian fermented food. International Journal of Probiotics and Prebiotics. 5: 37-44.

Thomson J. L., and M. Hinton. 1997. Antibacterial activity of formic and propionic acids in the diet of hens on salmonellas in the crop.British Poultry Science. 38: 59–65.

Thu, D. T. N. 2006. Meat quality: understanding of meat tenderness and influence of fat content on meat flavor. Science and Technology Development, Vol 9, No.12.

Thu, T. V., L. T. Chwen, H. L. Foo, Y. Halimatun and M. H. Bejo. 2010.Effects of metabolite combinations produced by *Lactobacillus plantarum* on plasma cholesterol and fatty acids in piglets. American Journal of Animal and Veterinary Sciences, 5(4), 233–236. http://doi.org/10.3844/ajavsp.2010.233.236

Thu , T. V., T. C. Loh, H. L. Foo, Y. Halimatun and M. H. Bejo. 2011a .Effects of liquid metabolites combinations produced by *Lactobacillus plantarum* on growth performance, faeces charecteristics, intestinal morphology and diarrhea incidence in postweaning piglets.Tropical Animal Health and Production,43(1).69-75

Thu T. V, H. L. Foo, T. C. Loh and M. H. Bejo. 2011b . Inhibitory activity and organic acid concentrations of metabolite combinations produced by various strains of *Lactobacillus plantarum*. African Journal of Biotechnology, 10(8):1359–1363.

Tougan, P. U., Dahouda, C. F. A. Salifou, S. G. A. Ahounou, T. Marc, Kpodekon, G. A Mensah, AndréThewis, and I. Y. A. Karim. 2013. Conversion of chicken muscle

to meat and factors affecting chicken meat quality: a review.International Journal of Agronomy and Agricultural Research (IJAAR).(online) http://www.innspub.net. Vol. 3, No. 8, p. 1-20

Tsilingiri, K, T. Barbosa, and G. Penna. 2012.Probiotic and postbiotic activity in health and disease: comparison on a novel polarised ex-vivo organ culture model. Gut.61: 1007–1015.

Tuomola, E. M., A. C. Ouwehand and S. J. Salminen. 1999.The effect of probiotic bacteria on the adhesion of pathogens to human intestinal mucus. FEMS Immunology and Medical Microbiology, 26: 137-142.

van den Bogaard, A. E. N. London, C. Driessen, and E. E. Stobberingh. 2001. Antibiotic resistance of faecal *E.coli* in poultry, poultry farmers and poultry slaughterers. Journal of Antimicrobial Chemotherapy. 47: 763-771.

van der Wielen, P. W., S. Biesterveld, S. Notermans, H. Hofstra, B. A. P. Urlings, and F. van Knapen. 2000. Role of volatile fatty acids in development of the cecalmicroflora in broiler chickens during growth. Apply Environment Microbiology. 66:2536–2540.

van Immerseel, F., J. De Buck, G. Meulemans, F. Pasmans, P. Velge, E. Bottreau, F. Haesebrouck and R. Ducatelle. 2003. Invasion of Salmonella Enteritidis in avian intestinal epithelial cells in vitro is influenced by short-chain fatty acids. International Journal of Food Microbiology, 85, 237-248.

Vargas Jr., J. G., R. S. Toledo, L. F. T. Albino, H. S. Rostango, J. E. Oliveira, and D.C.O. Carvalho. 2002. Características de carcaça de frango de corte,submetidos a Racoes Contendo probióticos , prebióticos e antibióticos . XXXIX Reunion Anual da SBZ

Vicente, J., S. Higgins, L. Bielke, G. Tellez, and D. Donoghue. 2007. Effect of probiotic culture candidates on Salmonella prevalence in commercial turkey houses. Journal of Applied Poultry Research.16:471–476.

Vispo C, and W. H. Karasov. 1997. Interaction of avian gut microbes and their host: An exclusive symbiosis. In: Mackie RJ, White BA, Issacson RE, editors. Gastrointestinal Microbiology 1.Gastrointestinal Microbes and Host Interactions. Chapman and Hall; New York, USA:. pp. 116–155

Vogt, H., S. Matthes and S. Harnisch, 1981. Der einflussorganischer suaren auf die leistungen von broilern und legehennen. Archiv fur Geflugelkunde, 45: 221-232.

Waite, J. G., D. M. Jones, and A. E. Yousef. 2009. The Isolation and Identification of spoilage micro-organisms using food-based media combined with rDNA

sequencing: ranch dressing as a model food. Food Microbiology., 26(3), 235-239.

Walter, J. 2008. Minireviews; Ecological Role of Lactobacilli in the Gastrointestinal Tract: Implications for Fundamental and Biomedical Research. Applied and Environmental Microbiology, Vol. 74, No. 16, 4985–4996.

Wang, J. P., J. H. Lee , J. S. Yoo , J. H. Cho , H. J. Kim , and I. H. Kim. 2010. Effects of phenyllactic acid on growth performance, intestinal microbiota, relative organ weight, blood characteristics, and meat quality of broiler chicks. Poultry Science 89:1549-1555 doi:10.3382/ps.2009-00235

Wierup, M. 2001. The Swedish experience of the 1986 year ban of antimicrobial growth promoters, with special reference to animal health, disease prevention, productivity, and usage of antimicrobials. Microbology Drug Resististant 7:183–190.

Wolfenden, A., C. Pixley, J. L. Vicente, L. Avina, B. M. Hargis, and G. Tellez. 2007. Effect of organic acids during feed withdrawal on mortality, shrinkage and carcass condemnation during transportation to the processing plant.International Journal of Poultry Science. 6:497–500.

Xu, Z. R., C. H. Hu, M. S. Xia, X. A. Zhan, and M. Q. Wang. 2003.Effects of dietary fructooligosaccharide on digestive enzyme activities, intestinal microflora and morphology of male broilers. Poultry Science 82, 1030–1036.

Yang, Y., P. A. Iji, and M. Choct. 2009. Dietary modulation of gut microflora in broiler chickens: a review of the role of six kinds of alternatives to in-feed antibiotics. World Poultry Science Journal.Volume No 65.97-114.

Yason, C. V., B. A. Summers and K. A. Schat. 1987. Pathogenesis of rotavirus infection in various age groups of chickens and turkeys: pathology. American Journal of Veterinary Research.6:927-938

Yeaman, M. R., and N. Y. Yount. 2003. Mechanisms of antimicrobial peptide action and resistance.Pharmacological Reviews, 27-55. http://doi.org/10.1124/pr.55.1.2

Zijlstra, R. T., K. Y. Whang, R. A. Easter and J. Odle 1996. Effect of feeding milk replacer to early-weaned pigs on growth, body composition, and small intestinal morphology, compared with suckled littermates. Journal Animal Science 74:2948-2959.

Zijlstra, R. T., S. M. Donovon, J. Odle, H. B. Gelberg, B. W. Petschow, and H.R. Gaskins. 1997. Protein-energy malnutrition delays small intestine recovery in neonatal pigs infected with rotavirus. Journal Nutrition 127: 1118-1127.