Effect of Medium-Chain Triglycerides on Piglets in Three Farms in Selangor and Penang, Malaysia

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Abstract

The aims of this study were to evaluate effect of medium-chain triglycerides (MCT) between treatment and control groups on growth performance, mortality rate and fecal coliform count in piglets. In addition, the effect of MCT on weaning body weight was evaluated. This study was separated into Phase I and Phase II. In phase I, 18 litters were selected from three farms in Selangor and Penang. Piglets in each litter was equally divided into control group and treatment group where only treatment group piglets were fed twice with 2 ml MCT on Day 1. Body weight was taken on day one, three, five and seven. Phase II involved 12 litters from a farm. The same procedure as in phase I was done, except the body weight was taken on day one, fourteen and twenty eight. MCT treatment group piglets were found to have higher growth performance and lower mortality rate thAn control group piglets. No difference in fecal coliform count was observed between treatment and control group. MCT showed more prominent effect on growth performance during weaning period of the piglets. In conclusion, MCT supplementation had positive effect on the growth performance of piglets as a result of increased body weight and average daily gain. Besides, MCT were able to reduce mortality in piglets in all the farms.

Keywords: medium-chain triglycerides (MCT), average daily gain, body weight gain, fecal coliform count, mortality

Introduction

Pre-weaning piglets are subjected to nutritional and environmental stress, thus resulting in reduced feed intake, low weight gain, diarrhea and death. Pre-weaning mortality varies considerably among production units, ranging from 5 to 39% of piglets born alive (Wieland et al*.,* 1993). In addition, energy insufficiency was identified as one of the major causes of mortality, given that energy reserves at birth are low (Noblet et al*.*, 1997). The neonatal piglets are prone to develop hypoglycemia due to the limited liver glycogen that can supply the energy requirement and the insufficient gluconeogenesis in newborn piglet (Too, 1997). The runt piglets would not be able to compete with others for milk, thus lead to starvation and mortality.

Due to the unique digestive and metabolic properties of medium chain triglycerid (MCT) supplementation, it was claimed as a remedy for this energy insufficiency (Wieland et al., 1993). With medium-chain triglycerides, the piglets become energetic and alert, which enable them to suckle milk more efficiently.

The MCT were also reported to be naturally occurring antimicrobial agents that could be used as growth promoter, preventive and curative treatment to promote health (Dierick et al., 2002). Thus these MCT might have effect on coliform bacteria in pigs such as *Escherichia coli*, which is a common bacterium causing piglet enterotoxigenic colibacillosis in Malaysia. Neonatal piglets are susceptible to enterotoxigenic colibacillosis which would lead to digestive disturbances and gastrointestinal disease. This study was conducted to evaluate effect of MCT on body weight gain, weaning body weight, mortality rate, and fecal coliform count of piglets in MCT treated and control group piglets.

Materials and Methods

Experimental Animals

In phase I experiment, 18 litters were selected from three farms, each farm contributed 6 litters. Eight piglets in a litter were chosen and randomly distributed into two groups, which are the control and treatment groups. This was to reduce bias due to the different sows, the disturbance of maternal antibody and environments. Prior to treatment, all piglets were allowed to suckle colostrum. Daily routine farm activities such as iron supplements, needle teeth removal were undisturbed and equally perform on both the control and treatment groups. Meanwhile, another twelve litters were selected in phase II experiment. Each litter was randomly and equally distributed into control and treatment group. Routine farm activities were as in phase I study.

Treatments

In phase I and phase II study, each piglet in the treatment group were given MCT within 6 hours after farrowing and the second dose after 6 hours whereas the control group were not be given any MCT. Body weight of both groups piglets in phase I were recorded on day 1, 3, 5 and 7, also in phase II where body weight of piglets were recorded on day 1, 14 and 28 with a body weighing scale.

Growth Performance and Mortality Rate

In both phases, cumulative weight of siblings, litter size, sex and mortalities of the piglets were recorded on every visit. In addition, average daily gain, body weight difference and body weight gain in percentage on day 3, 5 and 7 were calculated from the records. The same parameters were also recorded for phase II study on day 1, 14 and 28.

Coliform Plate Count

Eighteen fecal samples were taken randomly for coliform count, which consist of 9 fecal samples respectively from treatment and control group. The count was done by adding 1 g of fecal sample to 9 ml peptone broth, followed by ten-fold serial dilutions with peptone broth. One mililitre aliquots of each dilution were then transferred to their respective petri dishes, to which 15 ml of sterile molten Violet Red Bile Agar (VRBA) was added. The petri dishes were incubated at 35°C for 24 hours before performing bacterial colony counts.

Statistical Analysis

The data was analyzed using independent T test to compare the differences in growth performance of piglets and fecal coliform count due to the effects from the treatment. The statistical test was conducted at 95 % confidence level using SPSS program.

Results and Discussion

Weight Gain

In phase I, MCT group had higher mean body weight, ADG and percentage body weight gain (Figure 1). MCT can be utilized as a fuel by the newborn piglet and are able to spare critical fuels, glycogen and protein that stored in the piglets prior to birth (Benevenga et al., 1989). The animals supplemented with MCT in diet showed a higher mucosal mass and protein content and increased villus length and crypt depth in the proximal part of the small intestine (Galluser et al., 1993). It is also reported that the MCT might enhance calcium and amino acid uptake and also have the positive effect of intracellular protein synthesis (Galluser et al., 1993). These effects of MCT will finally contribute to better growth performance of piglets in MCT treatment group.

Limited significant difference was detected within the seven day period trial, so another study was being conducted to monitor the growth rate from day one until weaning (28th day). In phase II of the study, the growth performance showed prominent improvement on 14th till 28th day (Figure 2). This was further supported by (Dierick et al., 2002) where the MCT produced the most pronounced daily growth rate in the first two weeks after weaning at twenty one days, where the MCT produced up to 30% better growth performance over the soybean oil as a control.

Mortality Rate

Overall, there were more mortality in the control group, sixteen control group piglets and six MCT group piglets died. Mortality of piglets in the control group were mainly due to failure to consume milk with other piglets leading to poor body weight, starvation, death or crushed by sows. Meanwhile, treatment group piglets died of diarrhea or crushed by sows. The mortality rate in control group was higher than treatment group which were 11.6 and 4.1% respectively. This can be due to improved energy status of treatment group by orally dosing MCT where MCT was reported to be an energy source with high digestibility and oxidation rates (Lee and Chiang, 1994).

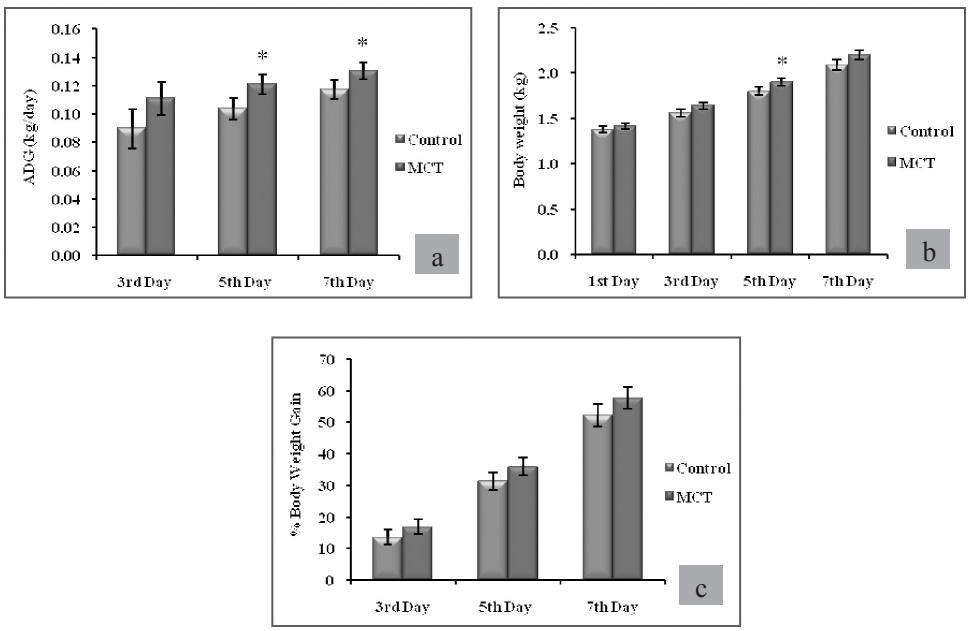

Figure 1. Combined result of three farms in Phase I. (a) Body weight of piglets. The MCT group had higher body weight than control group and was significantly higher on fifth day. (b) Average daily gain of piglets. MCT group had higher ADG than control group and was statistically significant on fifth and seventh day. (c) Percentage of body weight gain compared to first day. MCT had higher percentage than control group. Error bar indicates standard error of mean. Error bar indicates standard error of mean. Bar with * on the top is significantly different in values ($p<0.05$).

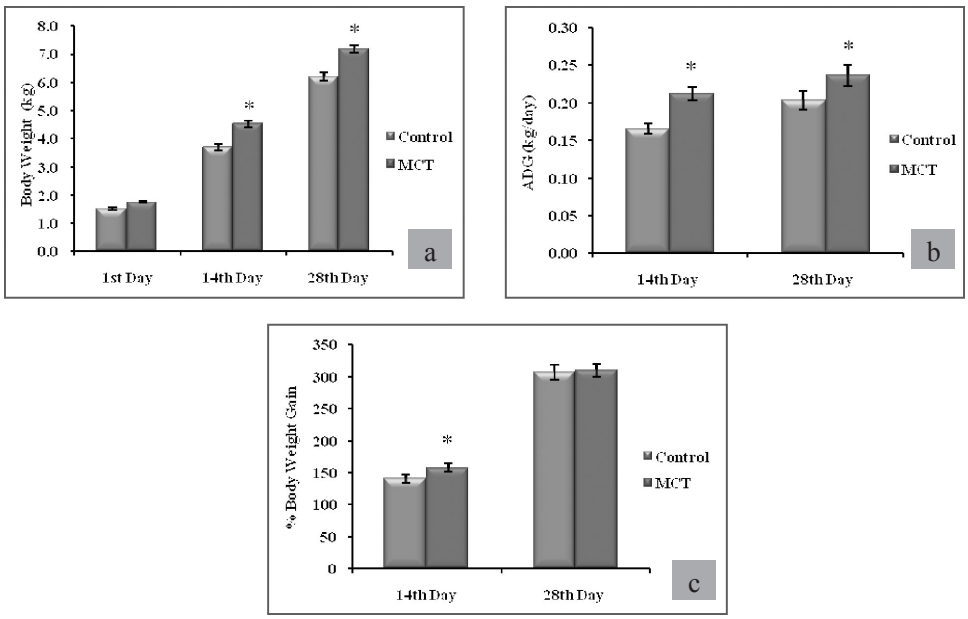

Figure 2. Results for Phase II. (a) Body weight of piglets. The MCT group had higher body weight and was statistically significant on the 14th and 28th day. (b) Average daily gain of piglets. The MCT group had higher ADG and was statistically significant on 14th and 28th day. (c) Percentage of body weight gain of piglets compared to the first day. The MCT group was higher than control group and statistically significant on 14th day. Error bar indicates standard error of mean. Bar with * on the top is significantly different in values ($p<0.05$).

Fecal Coliform Count

There were no significant differences ($p>0.05$) in fecal coliform count between MCT treatment group and the control piglets. MCT treated piglets were observed to have lower fecal coliform count (Figure 3). The findings are inconsistence with a previous experiment of MCFA efficacy against colibacillosis, which indicated that MCFA are able to inhibit bacterial growth in vitro (Gallois et al., 2008). Although no significant difference in fecal coliform count, but the farmers had mentioned that MCT treated piglets had less diarrhea problem as compared to control group piglets. This findings could be supported by a previous research which had proved that pathogenic bacteria including *Pseudomonas spp.*, *Campylobacter spp.*, *Vibrio cholera*, *Salmonella typhimurium*, *Shigella sonnei*, *Hemophilus influenza*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Streptococcus agalactiae*, *Helicobacter pylori* and enterotoxigenic *E.coli* could be inactivated by MCFA or their monoglycerides (Petschow et al., 1998), where the MCT have suppression effect on bacterial load in gut and thus reducing the diarrhea problem in piglets. Although MCT was hypothesized to be able to suppress growth of fecal coliform in gut, but the advantage was not noticed in this research, as this could be due to samples size was too small. In addition, the piglet might not completely consume the MCT given to them which may also lead to failure of MCT to suppress the coliform

growth in the gut. Stressful condition and sample contamination during fecal sample collection also may be the factors that lead to this observation.

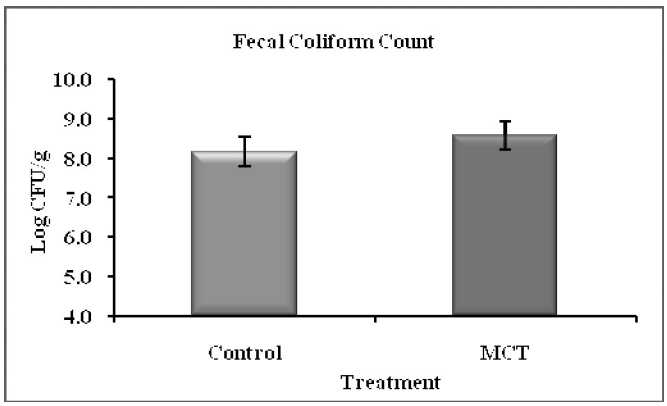

Figure 4. Fecal coliform count of piglets from farm X, farm Y and farm Z. MCT group had higher fecal coliform count than the control group. Error bar indicates standard error of mean.

Conclusion

Medium Chain Triglyceride supplementation in piglets showed higher growth performance than the untreated piglets as shown by the higher body weight, average daily gain and percentage of body weight gain. The MCT showed more prominent effect during weaning age of piglets. Less mortality was observed in MCT treated piglets as compared to control group piglets. No difference in fecal coliform count was observed between the MCT treated piglets and the untreated piglets. In conclusion, MCT is a good supplement for piglets due to its growth benefit.

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