COMPARISON OF THE PASSIVE PROPHYLACTIC EFFECT OF BOVINE MILK IMMUNOGLOBULIN FED EITHER AS A BOLUS OR CONTINUOUSLY AGAINST DIARRHOEA CAUSED BY *ESCHERICHIA COLI* K88 USING PIGLETS AS MODELS

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ABSTRACT

The overall aim of the study was to determine the passive prophylatic effect of bovine milk immunoglobulin administered orally either as a bolus (once a day) or as continuously (three times a day) against diarrhoea caused by *Escherichia coli* K 88.

As the piglets have gastrointestinal structural and physiological similarities to humans they were assumed to be an appropriate model for the study. The first part of the study was done to evaluate the quantity of undigested immunoglobulin G in the gastrointestinal tract of the piglet. This was conducted in two experiments. One was a pilot study and the other was to estimate the quantity of undigested immunoglobulin G in the gut.

A pilot study was conducted to evaluate the rate of movement and the quantities of digesta that can be collected in the gastrointestinal tract regions at varying time intervals. Ten piglets were randomly divided into five groups of two in each. One from each group was selected, fed with an experimental diet which contained blue colour glass beads and dye and slaughtered at either 1, 5, 9, 16 and 24 hrs after feeding. Digesta was collected from various regions of the gastrointestinal tract. Faeces were collected using ostomy bags from those slaughtered at 9, 16 and 24 hrs only. The dye movement and the glass beads recovered were monitored. The movement of the dye was observed up to the small intestine at 1 hr, the caecum at 5 hrs, the beginning of the colon at 9 hrs, the two third of the colon at 16 hrs, and in the faeces at 24 hrs. Most of the beads were found in the stomach between 1 and 5 hrs, spread throughout the small intestine at 9 hrs, in the caecum at 16 hrs and in the colon at 24 hrs. The results confirmed that a sufficient amount of digesta could be collected from the various regions over a 24 hr period. The data facilitated the planning of the immunoglobulin digestibility trial which is the second part of the experiment.

To measure the IgG digestibility, the piglets were fed on a large dose of an experimental diet (10% of their metabolic body weight $kg^{0.75}$ contain 30% immunoglobulin) and the digesta, faeces and blood were collected. On the slaughter day, a group of five animals were fed on an experimental diet and digesta and blood were collected 1, 5, 9, 16, and 24 hours after feeding. Faeces were collected from those killed at 16 and 24 hours. Blood was analysed for immunoglobulin G for all piglets. Digesta and faeces were

analysed for chromium and immunoglobulin G. There was no evidence of the presence of immunoglobulin G in the blood and faeces. A larger quantity of immunoglobulin G was found in the stomach ($p<0.001$) with a less in the first and second third of the small intestine ($p<0.05$) 24 hours post-prandially. This demonstrated that immunoglobulin G could resist digestion in the gut.

The second part of the study was conducted to compare the effect of feeding bovine immunoglobulin as a bolus versus continuous against *Escherichia coli* K88 diarrhoea. Twenty-four piglets, four-week-old, were randomly allocated to three treatment groups, namely continuous (fed a diet containing 10% immunoglobulins three times a day), control (fed an immunoglobulins free diet), and bolus (fed a 30% immunoglobulins diet in the morning and control diet the other two feeds). On Day 9, 30 minutes before the morning feed, the piglets were inoculated with 1×10^9 cfu *Escherichia coli* by a syringe into their throat, and observed for nine days. On day 17, all piglets were fed on control diet (no Ig) to evaluate if *Escherichia coli* K88 would have any effect on recolonisation and diarrhoea and observed for further three days. Finally they were all treated with antibiotics, Biosol M and Tylan 200. The observations include faecal culture, faecal consistency, the percent of free water content in the faeces, weight and feed intake. Faecal culture was done twice before inoculation, three times during treatment, and once after all were fed on control diet and once after the antibiotics treatment. The free liquid content in the faeces was highest in the control group (37.5%) and lower in the continuous immunoglobulin group (25.0%) and least in the bolus immunoglobulin group (17.5%). Bolus immunoglobulin feeding (11.25%) lessened the severity of diarrhoea (classified by consistency) compared with the control group (26.2%) and continuous group (25.0%). Hence bolus immunoglobulin feeding had a better effect in controlling water loss and the severity of diarrhoea. A higher dosage of immunoglobulin in bolus feeding may also have prevented bacterial shedding. From this study, it can be concluded that feeding immunoglobulin as a bolus could be used as a prophylactic treatment for diarrhoea.

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ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
CCM	Caecum
COL	Colon
Cr	chromium
Cr FD	chromium in freeze dried sample
DICP	Di calcium phosphate
E.coli	Escherichia coli
FD	Freeze dried
Fab	Fragment antigen binding
Fc	Fragment crystalline
Ig	Immunoglobulin
Igs	Immunoglobulins
IgA	Immunoglobulin A
IgD	Immunoglobulin D
IgE	Immunoglobulin E
IgG	Immunoglobulin G
IgG FD	IgG in freeze dried sample
IgM	Immunoglobulin M
IgY	Immunoglobulin Y
IM	Intramuscular
IV	Intravenous
N	Negative
NF	Not fed
NS	No samples
P	Positive
PBS	Phosphate buffer solution
RID	Radial immuno diffusion
SI1	Small intestine 1
SI2	Small intestine 2
SI3	Small intestine 3
SIgA	Secretory immunoglobulin A
SIgGCr	Sample IgG/chromium
SMP	skim milk powder
STM	Stomach
TNBS	Trinitrobenzenesulfonic acid
WGC	Whey globulin concentrate