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Original Research Article

Study on microbiology of intestines of swine fed with kitchen waste

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A B S T R A C T

The study included the bacteriological examination of fecal samples of three groups of pigs (T_1, T_2 and T_3) fed three types of diets *viz.*, concentrate mixture, raw kitchen waste and boiled kitchen waste, respectively. The three types of diets were taken to examine bacteriological quality and bacteria (aerobic and anaerobic) present in it. The growth performance of three groups of pigs (T_1, T_2 and T_3) was also studied. A total of 330 samples including 180 fecal samples from three groups of pigs and 150 samples of three types of diet *viz.* concentrate mixture, raw kitchen waste and boiled kitchen waste were collected and processed. In fecal samples, *E. coli* was major organism (81 isolates, 45%) followed by gram positive rods and bacilli (29 isolates, 16.11%) and *Enterococcus* spp. (19 isolates, 10.55%). Besides members of the family Enterobacteriaceae, *Pseudomonas* spp., *Staphylococcus* spp., *Streptococcus* spp. and gram positive rods and bacilli were also isolated.

Keywords

Bacteriological examination; Fecal samples; Kitchen waste; Pigs.

Introduction

Bacterial contamination of food is the most frequent cause of food borne disease. Many bacterial pathogens (*Salmonellae*, some *Shigellae* and some enteropathogenic strains of *Escherichia coli*) are conveyed by foods invade the intestinal mucosa causing true infection. Others like *Vibrio cholerae*, some enteropathogenic *Escherichia coli* release enterotoxins during growth or lysis or during sporulation, like *Clostridium perfringens* in the gut. Other bacteria such as *Clostridium botulinum* and *Staphylococcus aureus*, produce toxins as the food is eaten, cause an intoxication. However, other agents have been found to cause food borne disease such as *Bacillus cereus*, enteropathogenic *Escherichia coli*, *Vibrio parahaemolyticus*, and *Yersinia enterocolitica*.

Keeping all the above facts in view, a research programme on the present topic was taken up with the objectives of studying bacteriological quality of kitchen waste used for feeding pigs, isolation and identification of enteric pathogens from pigs reared on kitchen waste and to

attempt the isolation of anaerobic contaminants of normal pig ration and kitchen waste.

Materials and Methods

Experimental animals

The present study was carried out on 18 weaned pigs of both sexes (age 2 to 2.5 months) maintained at the pig farm of the institute. They were divided randomly into three groups (T_1, T_2 and T_3).Each group comprising of six pigs in such a way that their mean body weight did not differ significantly.

Before the experiment, animals of all the groups were drenched with anthelmintic (fenbendazole @ 5mg /kg body wt.) to eliminate internal parasite.

Housing of animal

All the pigs of one group were kept together in one room made up of cement concrete floor covered with asbestos sheet with attached fenced concrete open running space. Watering trough was provided in each room made of cement concrete. All the rooms and watering troughs were cleaned and washed everyday in the morning.

Experimental diets

Three types of diets were fed to the experimental pigs:

i) Concentrate mixture: Pigs of group T_1 (control group) was fed *ad libitum* standard concentrate mixture. ii) Raw kitchen waste: Pigs of group T_2 was fed *ad lib* raw (uncooked) kitchen waste. iii) Boiled kitchen waste: Pigs of group T_3 was fed *ad lib* boiled (cooked) kitchen waste.

Feeding schedules

Feeding schedule as above was followed for all the groups of pig during whole experimental period of about 3 months, maintained in standard farm conditions in Instructional Pig Farm, RVC. All groups of pig were fed *ad libitum.*

Collection and preparation of kitchen waste

The kitchen waste required for the research work was procured from different hotel and restaurants located at Ranchi, India. Then the kitchen waste was properly mixed. The kitchen waste was boiled in a large pan for about 30 min.

Formulation of ration

A standard concentrate grower ration was prepared as per NRC (1988). The grower ration was fed up to 7^{th} fortnight from the start of the experiment.

Materials for bacteriological examination

Samples used for bacteriological examination during present investigation were collected as follows:

i) Collection of fecal samples

Fecal samples were collected from each of the pig for examination of intestinal microflora on ten regular intervals during the whole experimental period.

ii) Collection of feed samples

During the collection period, a representative sample of feed *viz.* concentrate mixture, raw kitchen waste and boiled kitchen waste, offered was

collected for estimation of bacteriological quality, aerobic and anaerobic bacteria present in it.

Collection of samples

Maintaining all possible aseptic precautions, samples were collected in sterile UV irradiated polythene packets. The samples were brought immediately to the laboratory for bacteriological examination.

Isolation and identification of aerobic bacteria

Different media for cultivation and biochemical characterization of enterobacteria were prepared as per techniques described by Cruickshank *et al.,* (1975).

Enumeration of bacteriological quality of concentrate mixture, raw kitchen waste and boiled kitchen waste

Processing of samples

7 gm of sample was taken and triturated aseptically in a sterile mortar and pestle with 63 ml of 0.1 per cent sterile peptone water media to obtain 1 in 10 dilutions. Further ten fold dilutions up to 10^8 dilutions were made in the same media from this initial dilution. These dilutions provided the source for estimation of total bacterial count in concentrate mixture, raw kitchen waste and boiled kitchen waste.

Total Viable Count (TVC)

TVC was determined according to the procedure recommended by American Public Health Association (1976). The inoculated plates were incubated at 37°C for 24 h. The plates showing 30-300 colonies of bacteria were selected for counting.

For quantitative enumeration, plates were introduced in duplicate with desired dilution and the number of bacteria per gram of sample was calculated by multiplying the number of colonies (mean) with its dilution factor.

Results and Discussion

The experimental study was undertaken on 18 pigs of either sex with apparently good health status. These were categorized into three groups- Group T_1 (fed with concentrate mixture), Group T_2 (fed with raw kitchen waste) and Group T_3 (fed with boiled kitchen waste), each group comprising of 6 pigs.

A total of 330 samples consisting of feces of pigs (180 samples) and different diets fed to pigs (150 samples) were examined for isolation of bacteria. The study on the incidence of gastrointestinal microflora in pigs was carried out by examining 180 fecal samples (60 samples each from three groups of pig). The different diets comprising of concentrate mixture, raw kitchen waste and boiled kitchen waste. From each diet, 50 samples were taken**.**

Isolation and Identification of intestinal microflora

Altogether 144 (80.00%) samples, out of 180 fecal samples, were positive for bacterial isolation. The fecal samples positive for bacterial isolation from T_1, T_2 and T_3 groups of pig were 50, 53 and 41, respectively.

The percentage of isolations was highest from fecal samples of T_2 groups of Pig (88.33%) followed by T_1 groups of pig

Table.1 Fecal samples of different groups of pig showing bacterial isolation

Group of pigs	Number of pigs	Total number of samples	Total number of positive	Percentage of positive
T_1	6	60	50	83.33
T_2	6	60	53	88.33
T_3	6	60	41	68.33
Total	18	180	144	80.00

(83.33%) and it were lowest from fecal samples of T_3 groups of pig (68.33%).

Out of 180 fecal samples, 102 (56.66%) samples were positive for single isolation of bacteria and 42 (23.33%) samples were positive for mixed isolation of bacteria. From 60 fecal samples of T_1 groups of pig 38, (63.33%) were positive for single isolation and 12 (20%) were positive for mixed isolation. In 60 fecal samples of T_2 groups, 34 (56.66%) were positive for single isolation and 19 (31.66%) were positive for mixed isolation. Out of 60 fecal samples of T_3 groups, 30 (50%) samples were positive for single isolation and 11 (18.33%) were positive for mixed isolation.

Different bacterial isolates of enteropathogenic bacteria were obtained from fecal samples of different groups of T and D pig. Total 208 bacterial isolates were obtained from 180 fecal samples.

Numerous studies show that the major bacterial groups isolated from the pig intestine are *Streptococcus, Lactobacillus, Prevotella, Selenomona, Mitsuokella, Megasphera, Clostridia, Eubacteria, Bacteroides, Fusobacteria, Acidodaminococci,* and the *Enterobacteria* (Moore *et al.*, 1987; Jensen 2001).

Pirie and Harrigan (1962) found heat treatments caused a reduction of over 99.9% in the numbers of *Clostridium welchii* added to the meat mix. Twenty of these above isolates were identifiable for their genus on the basis of the cultural, morphology, staining and biochemical characters although the surface colony from ten culture plates were evident and suggestive for belonging to *Clostridium* species. Strong *et al.,* (1962) found the incidence of *Clostridium perfringens* was 4.1% in 610 food samples. Komnenov *et al.,* (1981) reported *Clostridium perfringens* from 64% of the 86 feed samples (concentrates and mixes). Secasin (1983) isolated *Clostridium perfringens* from 185 (28.8%) of 642 fodder and feed samples examined. The concentration ranged from 10^2 to 2.3×10^3.

The highest percentage of prevalence of bacteria was found in fecal samples of pigs of group T_2, which were fed raw kitchen waste. Anaerobic contaminants were isolated mostly from raw kitchen waste than concentrate mixture. From boiled kitchen waste anaerobic contaminants were not isolated. Cooking or boiling of kitchen waste reduces the bacterial count, less viable count in boiled kitchen waste suggesting the lowering effect of cooking on viable count of bacteria.

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