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**A STUDY OF THE EFFECT OF MILK UPON THE
BACTERIAL FLORA OF THE INTESTINAL TRACT.**

A STUDY OF THE EFFECT OF MILK UPON THE
BACTERIAL FLORA OF THE INTESTINAL TRACT.

THESIS

Submitted to the faculty of the Michigan Agricultural
College in partial fulfillment of the requirements
for the degree of Master of Science.

By

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June 1920

1. The first step in the process of identifying a problem is to define the problem.	
2. The second step is to identify the causes of the problem.	
3. The third step is to identify the effects of the problem.	
4. The fourth step is to identify the stakeholders involved in the problem.	
5. The fifth step is to identify the resources available to solve the problem.	
6. The sixth step is to identify the constraints on the solution.	
7. The seventh step is to identify the potential solutions.	
8. The eighth step is to evaluate the potential solutions.	
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INTRODUCTION

Problems arising in connection with the high death rate among children in the United States have long been a worthy field for investigational and social welfare work.

It has been shown that of the 2,500,000 babies born each year in the United States, something like fourteen per cent or 350,000 die during the first year. This death rate as has been pointed out (35) is over seven times as high as that of the British soldiers engaged in the world war.

This great number of deaths is mainly due to two general causes: (1) neglect due to ignorance and (2) intestinal disorders. The first of these can be undoubtedly largely overcome by the efforts of social workers but the second must be controlled by the pediatrician who must have reliable data at hand in order to develop a rational system of treatment.

While clinical experience has shown the desirability of breast feeding over artificial feeding, definite data is still lacking in respect of the precise effects of artificial milk foods upon the intestinal flora of young children.

1. Introduction

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Tissier (1), Moro (2), Logan (3), Kendall (4), and others found that the organism named by Tissier as Bacillus bifidus communis was predominant in the feces of breast-fed infants, while Bacillus acidophilus was more predominant in the feces of some bottle-fed infants. These two organisms, being able to produce large amounts of acid in the presence of carbohydrates, were considered as fermentative organisms to distinguish them from putrefactive types.

It was thus thought that normal infants had a predominance of fermentative organisms in their feces and that these in turn produced sufficient acid to inhibit the growth of toxin producing organisms, which are believed to be the cause of many intestinal disorders among infants.

Porter, Morris and Myers (5) have recently shown that the above assumption is not altogether true. They found that the fecal flora of normal infants consisted of both fermentative and putrefactive organisms and that neither predominated, but that in the case of infants suffering with intestinal disorders that the putrefactive organisms predominated.

This project was thus undertaken primarily with a view to determine the type of bacterial flora existing in the feces, when various milk diets were

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fed, and secondarily to determine whether the guinea pig could be utilized to advantage in this line of research.

HISTORICAL REVIEW OF LITERATURE

Escherich (6) was perhaps the first investigator to study the fecal flora of both breast and bottle-fed infants. He employed both aerobic and anaerobic culture methods in his investigation and in his list of the commonly encountered bacteria of the intestinal tract, we find some of the most well known organisms completely described.

This investigator noticed that the majority of the bacteria discernible in the freshly passed feces were gram-positive and that his pure cultures derived from feces were for the most part gram-negative.

Schmidt (7), a student of Escherich, claimed that he could bring about this change by growing them in media containing fat. This, however, was disproved by Lehman and Neumann (8) and finally by Escherich (9) who published a paper in which he shows the fallacy of Schmidt's observations.

This problem of these gram staining bacteria

remained unsolved until Tissier (10) and Moro (11) took up the investigation. These investigators used special media and methods and as a result contributed two new organisms to the intestinal flora.

Tissier isolated an anaerobe to which he gave the name Bacillus bifidus communis. Moro's organism was aerobic and was given the name of Bacillus acidophilus because of its ability to grow in relatively large amounts of free acid. Both of these organisms were gram-positive bacilli, morphologically similar to those found in the stools of normal nurslings.

Finkelstein (12) working independently and using different media isolated organisms similar to and probably identical with the organisms isolated by Tissier and Moro.

A controversy then arose as to the relative predominance of B. bifidus and B. acidophilus. Tissier claimed that B. bifidus was the dominant bacillus in normal breast-fed infants and that Moro's organism occurred only in the feces of infants suffering from intestinal disorders and in normal bottle-fed infants.

Moro re-investigated the subject a few years later and found that B. bifidus was the dominant organism of normal breast-fed infants, but that B. acidophilus was also represented in the feces of such

1. Introduction

The purpose of this report is to provide a comprehensive overview of the current state of the market for [Product/Service]. The report will analyze the market's growth, key players, and future prospects. It will also identify the challenges and opportunities facing the market and provide recommendations for stakeholders.

The report is organized as follows:

- 1. Introduction
- 2. Market Overview
- 3. Key Players
- 4. Market Growth
- 5. Challenges and Opportunities
- 6. Recommendations

2. Market Overview

The market for [Product/Service] is a rapidly growing sector, driven by increasing demand for [Product/Service] and the entry of new players. The market is characterized by high competition and a focus on innovation and differentiation.

Key factors influencing the market include:

- Increasing demand for [Product/Service]
- Entry of new players
- High competition
- Focus on innovation and differentiation

3. Key Players

The following table provides a summary of the key players in the market:

Company Name	Market Share (%)	Key Products/Services
Company A	25%	[Product/Service 1], [Product/Service 2]
Company B	18%	[Product/Service 3], [Product/Service 4]
Company C	12%	[Product/Service 5], [Product/Service 6]
Company D	8%	[Product/Service 7], [Product/Service 8]
Company E	5%	[Product/Service 9], [Product/Service 10]

4. Market Growth

The market for [Product/Service] is expected to continue its rapid growth over the next five years, driven by increasing demand and the entry of new players. The market is projected to reach a value of [Value] by [Year].

Key factors driving market growth include:

- Increasing demand for [Product/Service]
- Entry of new players
- Focus on innovation and differentiation

5. Challenges and Opportunities

The market for [Product/Service] faces several challenges and opportunities. The following table provides a summary of the key challenges and opportunities:

Challenge/Opportunity	Description
Challenge 1	High competition
Challenge 2	Focus on innovation and differentiation
Opportunity 1	Increasing demand for [Product/Service]
Opportunity 2	Entry of new players

6. Recommendations

Based on the findings of this report, the following recommendations are provided for stakeholders:

- Focus on innovation and differentiation
- Increase marketing efforts
- Expand into new markets
- Develop new products/services

infants though in fewer numbers.

Moro's view has now been substantiated by the researches of Cahn (13), Rodella (14), Coppolina (15), Jacobson (16), and others and it is definitely established that this view is correct.

Johannesen of Christiania in 1897 was probably the first to use acid broth as a medium for isolating bacteria which can grow in relative large amounts of free acid. About a year later, Bruno Heymann made use of dextrose broth to which acetic acid was added. This medium which is known as Heymann's medium is one of the best that has been used for the isolation of aciduric bacteria (17).

Among the first investigators to study the effect of diet on the types of intestinal flora were Herter and Kendall (18) who found in their experiments on kittens and monkeys that an abrupt change in diet from a dominant protein to a milk and sugar diet is followed by an alteration of physiological conditions in three distinct ways: (1) in the nature of the intestinal flora, (2) in the putrefactive products of feces and urine, (3) in the clinical conditions. These authors suggest that the change in intestinal flora is due to the addition of carbohydrates rather than a diminution in protein.

About the same time that Herter and Kendall did their work, MacNeal, Latzer and Kerr (19) made a study of the fecal bacteria of healthy men.

Noguchi (20) published a paper "Pleomorphism and Pleobiosis of Bacillus Bifidus Communis" in which he draws the conclusion that B. bifidus has an aerobic phase in which it closely resembles B. mesentericus fuscus and that the one source of the organism in the feces of breast-fed infants is the breast of the mother where it occurs as an organism of the skin.

Kendall (17), in 1910 published a paper, "Observation On Aciduric Bacteria" suggesting that there are two types of aciduric organisms: "The true or obligate aciduric bacteria of which B. acidophilus is the best known member; and the facultative aciduric bacteria which may include various organisms".

One year later Kendall (21) published a paper "Activity of Bacteria In Intestinal Tract", in which he concluded that by the feeding of lactose and dextrose the intestinal flora may be temporarily changed from that of toxin producing bacteria to that of fermentative bacteria. However, the after-feeding will be the determining factor as to whether the fermentative flora will remain.

In the researches of Logan (22) on "The In-

testinal Flora of Infants and Children", we find the findings of Moro (2) confirmed; namely, that in the flora of breast-fed infants the aciduric group is predominant and is strictly of the type called B. bifidus and that in the artificially fed infants the place of the B. bifidus is largely taken by the facultative aerobe, B. acidophilus. The cases on both breast and bottle showed a halfway stage between the two types of flora.

Cohendy (23) who fed four patients for an extended period on milk curdled with B. bulgaricus, concluded that this organism became readily established in the intestine and that it persisted there for a considerable time after the subject had ceased taking the fermented milk. This was said to be especially true if a diet was adopted containing suitable carbohydrates for the ingested organism. It is stated that the growth of these bacteria took place in the upper two-thirds of the colon.

In a later paper the same writer shows that intestinal putrefaction as indicated by the excretion of ethereal sulphates in the urine was materially reduced by the addition of sour milk to the diet, and that this reduction may be reasonably attributed to the disinfection of the large intestine, prolonged

after the ingestion of sour milk was discontinued. This may be taken as an indication that the growth of bacteria continued after introduction ceased.

Belonovsky (24) studied the effect of the Bacillus bulgaricus on the intestinal flora of mice. In his experiment several lots of mice were fed on a basic ration of sterilized grain and water and to the ration of two of his lots were added milk cultures of B. bulgaricus. Mice fed on this ration forty-five days showed this organism in the feces fifteen days after the last feeding. With animals fed the culture for four months, it was present for four weeks after the last feeding.

On the other hand, Herter (25) found that in the digestive tract of a monkey killed after feeding for two weeks on milk soured with B. bulgaricus, this organism was abundant in the upper part of the small intestine only. In the lower part of the small intestine and in the large intestine, B. bulgaricus was present in only moderate numbers as compared with other bacteria.

Heinemann and Hefferan (26) found an organism answering to the description of B. bulgaricus in ordinary milk in feces of cows, horses, and man, and in soil, grains, and pickles. They consider that it

• *Staphylococcus aureus* is a Gram-positive, spherical bacterium that is commonly found on the skin and in the nose. It is a leading cause of skin infections, such as abscesses and impetigo, and can also cause more serious infections, such as pneumonia and sepsis.

• *Streptococcus pneumoniae* is a Gram-positive, spherical bacterium that is commonly found in the lungs. It is a leading cause of pneumonia, meningitis, and sepsis.

• *Escherichia coli* is a Gram-negative, rod-shaped bacterium that is commonly found in the intestines. It is a leading cause of food poisoning and can also cause urinary tract infections and sepsis.

• *Salmonella* is a Gram-negative, rod-shaped bacterium that is commonly found in the intestines. It is a leading cause of food poisoning and can also cause urinary tract infections and sepsis.

• *Shigella* is a Gram-negative, rod-shaped bacterium that is commonly found in the intestines. It is a leading cause of shigellosis, a type of bacterial dysentery.

• *Clostridium difficile* is a Gram-positive, rod-shaped bacterium that is commonly found in the intestines. It is a leading cause of antibiotic-associated diarrhea and can also cause sepsis.

• *Legionella* is a Gram-negative, rod-shaped bacterium that is commonly found in water systems. It is a leading cause of Legionnaires' disease, a type of pneumonia.

• *Mycobacterium tuberculosis* is a Gram-positive, rod-shaped bacterium that is commonly found in the lungs. It is a leading cause of tuberculosis, a type of lung disease.

• *Histoplasma capsulatum* is a fungus that is commonly found in the soil. It is a leading cause of histoplasmosis, a type of lung disease.

• *Coccidioides immitis* is a fungus that is commonly found in the soil. It is a leading cause of coccidioidomycosis, a type of lung disease.

• *Cryptosporidium parvum* is a parasite that is commonly found in the intestines. It is a leading cause of cryptosporidiosis, a type of diarrheal illness.

• *Toxoplasma gondii* is a parasite that is commonly found in the intestines. It is a leading cause of toxoplasmosis, a type of parasitic infection.

• *Giardia lamblia* is a parasite that is commonly found in the intestines. It is a leading cause of giardiasis, a type of diarrheal illness.

is normally present in small numbers in the digestive tract and suggested that it may cause pathological conditions under certain circumstances.

In 1915 Rettger (27) published a paper, "The Influence of Milk Feeding on Mortality and Growth, and On the Character of the Intestinal Flora", in which he says "Practically the same results were obtained whether sweet or sour milk was fed and no difference could be observed in the relative value of ordinary sour milk and of the so-called bulgaricus product. Hence, the unique properties of this food exists in the milk as such rather than in any milk acids or milk bacteria that may be present". He also concludes that milk and lactose diet exert a very important influence on the character of the intestinal bacteria, especially in white rats and chickens. Within a few days after the ingestion of milk on lactose, a transformation of the flora takes place, the usual mixed flora giving away to a more simplified flora in which B. acidophilus and B. bifidus are prominent.

According to Rettger's studies the ingestion of large numbers of foreign bacteria does not of itself bring about an elimination or displacement of the common intestinal microorganisms.

1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. If there is a discrepancy, a problem is identified.
2. Once a problem is identified, the next step is to define the problem more precisely. This involves determining the scope of the problem, the resources available, and the constraints that may be affecting the problem.
3. The third step is to analyze the problem. This involves identifying the causes of the problem and determining the relationships between different factors. This step is often done using tools such as fishbone diagrams or flowcharts.
4. The fourth step is to develop a solution. This involves brainstorming ideas and evaluating them against the criteria of feasibility, effectiveness, and cost. The best solution is then selected and implemented.
5. The final step is to evaluate the results of the solution. This involves monitoring the performance of the system over time and comparing it to the desired state. If the problem has been solved, the process ends. If not, the process starts over.
6. The process of problem solving is often iterative. This means that it may take several cycles of identifying, defining, analyzing, developing, and evaluating solutions before a problem is solved.
7. Problem solving is a skill that can be developed through practice. The more problems one solves, the better one becomes at identifying, defining, analyzing, developing, and evaluating solutions.
8. Problem solving is an important part of many professions. It is used in engineering, business, medicine, and many other fields. It is a skill that is essential for success in many careers.
9. Problem solving is a process that can be taught. There are many books and courses that teach the skills of problem solving. These resources can be used to help people learn how to solve problems more effectively.
10. Problem solving is a process that can be improved. There are many ways to improve one's problem solving skills. These include practicing problem solving, seeking feedback, and learning from mistakes.

Sisson (28) found in his work with puppies that the type of organisms occurring at the duodenum, ileum, cecum and rectum are in all instances similar and that one cannot speak of a characteristic local flora occurring in these regions. He also disagrees with previous investigators in that feeding puppies with cow's milk mixed with high percentages of sucrose and lactose does not cause characteristic changes in the intestinal flora at any level.

In direct contrast to Sisson's work is the work of Torrey (29) who found that the intestinal flora is changed by the feeding of carbohydrate diets and that it is not only shown in the feces but may be shown at the different levels of the intestines. Torrey suggests as a reason for Sisson's failure to observe a change in the flora, that the media he used was not suited to the growth of the aciduric type that is found when a high carbohydrate diet is fed.

Porter, Morris and Myers (30) found in their work with infants suffering with intestinal disorders that these disorders were always accompanied by a predominance of putrefactive organisms and that by a change to a high carbohydrate diet that these putrefactive bacteria could be replaced with more of the fermentative bacteria, thus relieving a large amount of the disorder. These investigators also found that

in the feces of a normal infant neither putrefactive nor fermentative bacteria predominated but that they occurred in about equal numbers.

METHOD OF INVESTIGATION

The literature reviewed has not revealed any data or studies of the intestinal flora produced by the feeding of modified and fermented milks (except milk inoculated with B. bulgaricus) often fed to infants.

This investigation was designed to cover the following points: (1) a study of the intestinal flora of infants on various diets, (2) a study of the intestinal flora of guinea pigs fed on various modified milks with particular attention to raw and pasteurized milk.

The samples of feces studied were obtained and handled in the following manner: (1) those from infants were obtained through the courtesy of the Sparrow Hospital, Lansing, Michigan and were collected by means of a copper wire containing a loop in one end; standardized with a No. 2 lath nail. This wire was inserted into a test tube or small bottle through the cotton plug and sterilized before being taken to the hospital. The nurse in attendance at the time

excreta was passed would fill the loop of the wire from a representative portion of the feces and then place the wire and plug in the bottle. The bottle was then taken to the laboratory where proper dilutions were made by addition of sterile saline solution to the bottle containing the specimen. (No effort was made to secure quantitative results).

From the above suspension the following plates were poured:

(1) Endo plates that gave an insight into the type of aerobic bacteria which develop rather characteristically on this media such as B. coli, B. proteus, B. mesentericus and Streptococci.

(2) Liver glucose agar plates + 4 to phenolphthalein, incubated aerobically (31). This media offers a very good means of differentiating the aciduric bacteria. It also has the advantage of suppressing Streptococci and to a large extent B. coli.

(3) Liver glucose blood agar plates + 1 to phenolphthalein, incubated anaerobically for the cultivation of B. bifidus (31).

(4) Liver glucose agar plates + 1 to phenolphthalein, incubated anaerobically for cultivation of such spore bearing bacteria that might not develop on the other media (31).

(5) Litmus lactose agar plates, incubated aerobically for the per cent of acid producers that develop on this medium.

(6) Gelatin plates, incubated aerobically for the per cent of organisms producing liquefaction.

(7) Fermentation tubes of dextrose, lactose, saccharose and litmus milk were also inoculated and the percentage of gas recorded, likewise the physical appearance of the litmus milk, such as reduction and production of red and blue color.

(8) Acetic acid broth having acidities of N/20, N/10 and N/5, respectively were inoculated and incubated for the isolation of aciduric bacteria.

All cultures with the exception of the fermentation tubes were incubated for 72 hours and all but the gelatin plates at 37°C. Fermentation tubes were incubated for 48 hours at 37°C. and gelatin plates were incubated at 20°C. for 72 hours.

Novy's jars and the pyrogalllic acid-caustic soda methods were used in obtaining anaerobic conditions.

(II) Fecal specimens from the guinea pigs were collected in the morning at intervals of every few days. Beaver-board, which had been scrubbed with bichloride of mercury was placed in the cages

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as a false floor for the deposit of the feces. The pigs being closely watched until a deposit was made, when a portion was immediately collected and placed in a test tube containing about 10 cc. of physiological salt solution. After a suspension of the feces had been made, appropriate dilutions were prepared from the suspensions and the same media used as was used in the case of infants feces.

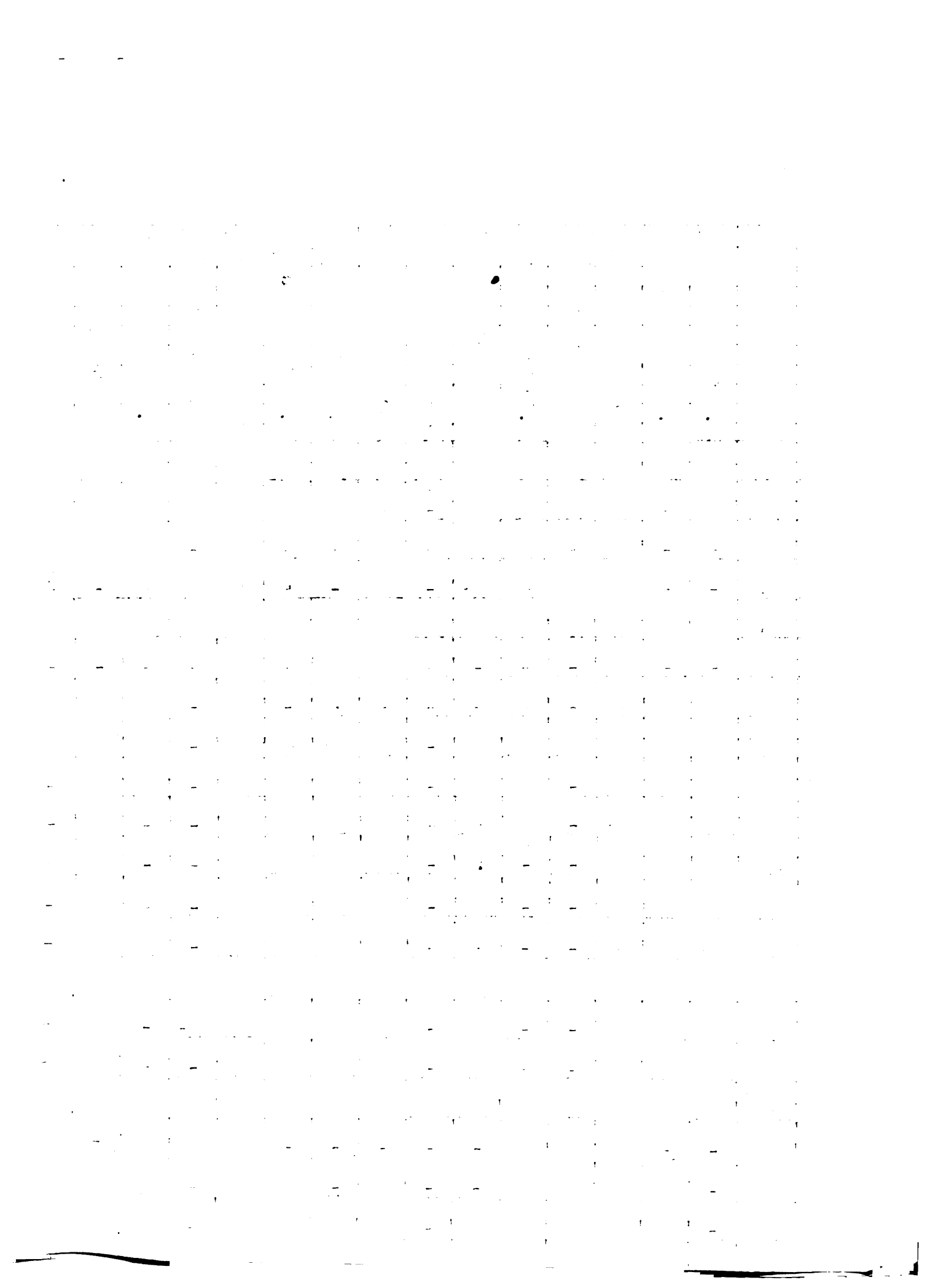
EXPERIMENTAL DATA

(1) Results of Infant Study.

The study of the fecal flora of infants was undertaken in order that the writer might test the media to be used as well as familiarize himself with the normal flora of healthy infants.

Table No. I gives the results of the studies made on the fecal flora of infants.

Date
Case
I
10/1
10/1



From the table it will be noticed that Cases I, II, V, and VI were fed from the breast. In these four cases the writer found a strongly gram-positive flora with B. bifidus predominating both in the stained film and the cultures. Other gram-positive organisms present were B. acidophilus, Staphylococcus pyogenes, and B. proteus. In Case I, Staphylococcus pyogenes aureus and Bact. welchii were quite prominent. This case, having a syphilitic history, was troubled to a great extent with constipation, senna and oil being given in order to produce bowel movement.

Case III which received Mellin's Food showed a gram-positive flora composed of B. acidophilus, B. bifidus and Streptococcus lacticus. This case also showed a very high fermentative flora.

Case IV was fed both from the breast and bottle. The latter (hospital formula) consisted of 1 oz. of milk sugar, 2 oz. of top milk, 11 oz. of water, and 1 oz. of lime water dissolved by adding the milk sugar to boiling water after which the top milk and lime water were added and stirred well. This formula was fed at the rate of 1 to 2 oz. every 2 1/2 hours.

The flora in Case IV was very similar to that of Case III except Streptococcus lacticus was

not so much in evidence and the percentage of fermentative organisms was lower.

It will be noticed from the table that the early specimens collected after birth showed little or no growth upon the culture media. This was in every case the meconium and in most cases it was doubtful whether the child had had the breast before motions.

The writer also observed that the three phases of bacterial infection of infants as mentioned by Kendall (4) are quite distinct, that is, (1) a sterile period in which the meconium is practically sterile for about 24 hours, (2) "Period of mixed infection" which occurs about the third day, due probably to the presence of food in the alimentary canal. The organisms found during this period are B. subtilis, B. coli, B. proteus, B. mesentericus, etc. (3) "Period of Transition" in which B. coli diminishes in number but does not entirely disappear; B. bifidus becomes predominant and B. acidophilus also appears.

The media used in identifying the organisms found were as follows: plain agar, dextrose agar, litmus lactose agar, blood agar, gelatin, plain milk, litmus milk, lactose, dextrose saccharose, mannit, and maltose broths in fermentation tubes as well as the special media mentioned on page 12.

(2) Morphological and Cultural
Characteristics of the Aciduric Group

Bacillus bifidus, the dominant organism in the stools of breast-fed infants, morphologically is a long thin rod, frequently slightly curved with tapering ends occurring singly in pairs or groups with the long axis parallel. Typically gram-positive, but under certain conditions may appear as gram-positive granules in otherwise gram-negative rods. Culturally, B. bifidus is an obligate anaerobe, fermentative in character, producing lactic acid but no gas. Grows best on glucose blood agar (Torrey 31) upon which its colonies are visible in 24 hours but more distinctive after 48 hours incubation as globular opaque colonies 1 to 3 mm. in diameter, buff to reddish brown in color.

Bacillus acidophilus is described by Moro (32) and by Finkelstein (33) as a somewhat pleiomorphic bacillus of varying length which may occur singly or in pairs, chain formation not being uncommon in artificial media. The organism forms no spores or capsules and is typical gram-positive, although in old cultures it may appear gram-negative.

B. acidophilus may be isolated direct from suspected material in N/20, N/10 and N/5 acetic acid dextrose broth by a series of transfers. Probably the

the first of these is the fact that the system is not a simple one, but a complex one, in which the various parts are interrelated and interdependent. The second is that the system is not a static one, but a dynamic one, in which the various parts are constantly changing and evolving. The third is that the system is not a closed one, but an open one, in which the various parts are constantly interacting with the environment. The fourth is that the system is not a linear one, but a non-linear one, in which the various parts are constantly interacting with each other in a non-linear fashion. The fifth is that the system is not a deterministic one, but a probabilistic one, in which the various parts are constantly interacting with each other in a probabilistic fashion. The sixth is that the system is not a simple one, but a complex one, in which the various parts are interrelated and interdependent. The seventh is that the system is not a static one, but a dynamic one, in which the various parts are constantly changing and evolving. The eighth is that the system is not a closed one, but an open one, in which the various parts are constantly interacting with the environment. The ninth is that the system is not a linear one, but a non-linear one, in which the various parts are constantly interacting with each other in a non-linear fashion. The tenth is that the system is not a deterministic one, but a probabilistic one, in which the various parts are constantly interacting with each other in a probabilistic fashion.

best solid medium for the growth of this organism is glucose liver agar + 4 to phenolphthalein and containing 0.2 per cent sodium oleate according to the procedure of Torrey (31). Most strains of B. acidophilus form on this medium flat, dingy colonies with a serrated edge, although a few produce a round convex smooth edged colony. This organism like B. bifidus is also fermentative in character but produces no gas.

(3) Result of Experimental Work With Guinea Pigs

The experimental work which follows was conducted with guinea pigs. Pigs were selected of approximately the same age and size and were all fed a basic diet of sterilized bran as a concentrate and carrots which had been peeled and washed in a solution of 1-1000 bichloride of mercury as a succulent food. To this was added the experimental foods.

(4) The Effect of Feeding Raw Skim

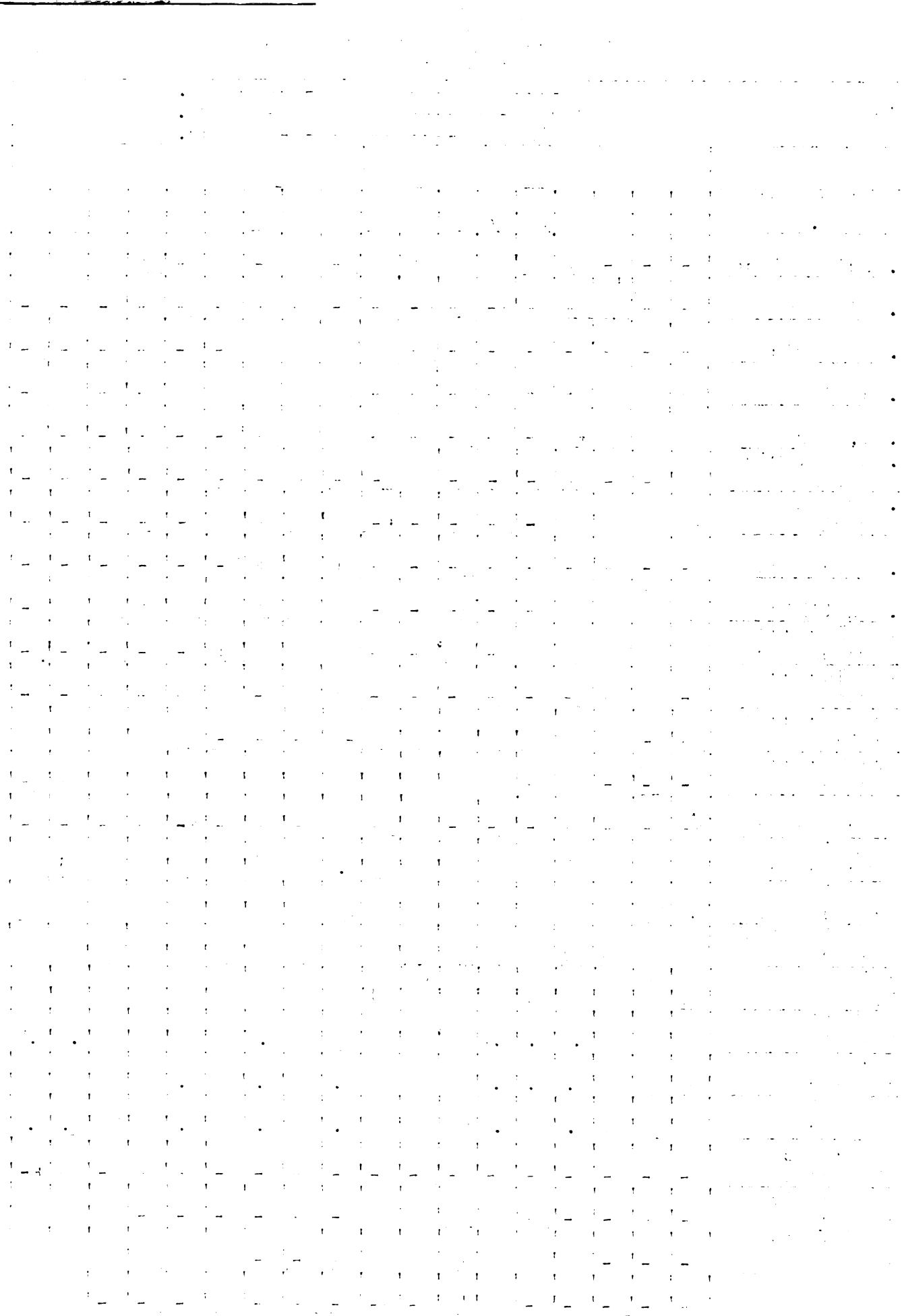
Milk Upon the Intestinal Flora of the Guinea Pig.

Two pigs were fed fresh raw skim milk for a period of 45 days. The fecal flora of these pigs were studied at intervals of every 7 days. The results of these studies are shown in Table II.

Table II
Showing Results of Feeding Fresh Raw Skim Milk Upon Fecal Flora of the
Guinea Pig

	Bran----- 35 gr.																	
Diet	Carrots-----100 gr.																	
	Raw Milk-----100 cc.																	
Case																		
	I										II							
Feeding period in days.	B	1	3	7	10	14	24	31	45	B	1	3	7	10	17	24	31	45
B. acidophilus	-	-	+	-	+	+	+	+	+	-	-	-	+	-	+	-	+	+
B. bifidus	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	+	+	+
B. bulgaricus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. coli	++	++	++	+	+	+	-	+	+	++	++	+	+	+	+	-	-	+
B. l. aerogenes	+	+	+	+	-	-	-	-	-	+	+	+	+	+	-	-	-	-
B. mesentericus vulgatus	+	+	+	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-
B. proteus vulgaris	++	++	+	+	+	-	+	+	+	+	+	+	+	+	-	-	-	-
B. pyocyaneus	-	+	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-
B. subtilis	++	++	+	+	+	+	+	+	+	++	++	++	+	+	+	+	+	-
Staphylococcus pyogenes aureus	++	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+
Staphylococcus pyogenes albus	-	-	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-
Streptococcus lacticus	-	-	+	-	+	+	+	+	+	-	-	+	+	+	+	+	+	+
Streptococcus pyogenes	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Other bacteria	+	+	-	-	+	+	-	-	-	+	+	-	-	+	+	-	-	-
% Gas in dextrose broth	30	35	30	10	10	5	0	5	5	25	20	20	5	T	0	0	5	5
% Gas in lactose broth	25	25	23	7	5	T	0	T	5	18	15	15	5	0	0	0	T	T
% Gas in Saccha- rose broth	10	10	8	T	T	0	0	0	0	15	10	10	T	0	0	0	0	0
Action on Litmus milk	SA	A	A	P	P	P	AC	AC	AC	AC	AC	AC	AP	AP	AC	AC	AC	AC
% Gelatin liquefiers	23	21	16	14	3	11	49	3	15	3	6	30	26	33	3	0	0	0
% Acid producers	4	3	2	11	6	16	69	2	33	30	32	21	5	23	19	5	7	22
% Alkaline and Inert	73	76	82	74	1	72	7	5	52	67	62	48	5	51	47	2	90	77
N/5 Acetic acid broth	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	+	+
N/10 Acetic acid broth	-	-	-	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+
N/20 Acetic acid broth	-	-	-	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+
Yeasts	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	+	+

* High percentage of liquefiers due to *Staphylococcus aureus*



The Symbols used in the tables are listed below.

++ = Very numerous

+ = Many

+- = Few .

- = None found

SA = Slightly acid

P = Peptonized

T = Trace

A = Acid

C = Coagulation

B.ME = B. Edematis maligni

SF = Spore former

B = Before receiving milk

BW = Bact. welchii

MT = Micrococcus tetragenus

HD = Hemolytic diplococcus

Dip = Diplococci

G+B = Gram-positive bacilli

A brief study of Table II will first reveal that the feeding of raw milk to these pigs resulted in a change of flora within three days; second that the new flora consisted largely of organisms which are capable of decomposing carbohydrates rather than those which attack and break down proteins. It will likewise be observed that while bacteria which are able to ferment carbohydrates were present in the greater number, that they were not gas producers, and that the gas producers originally present were greatly diminished.

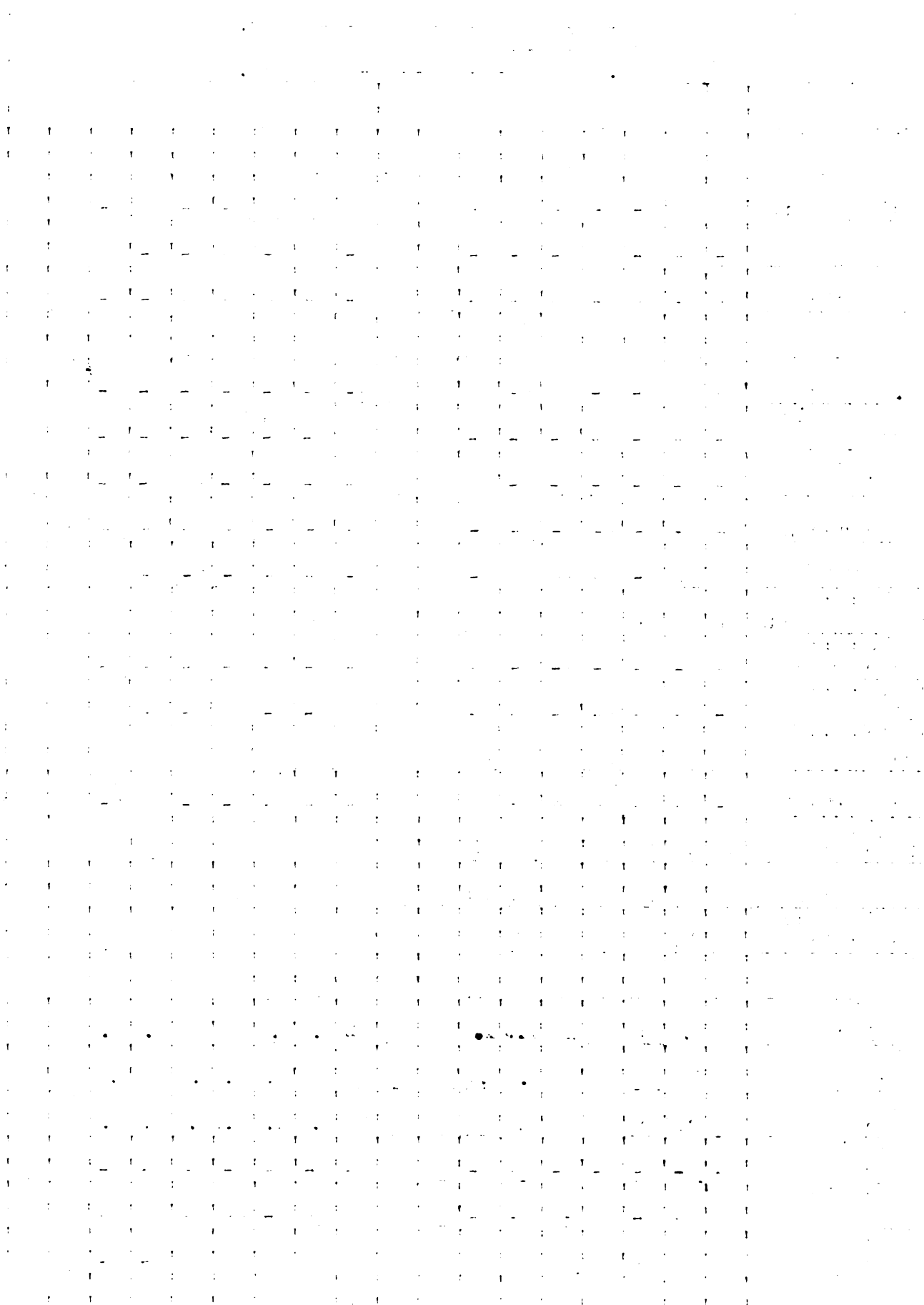
The number of organisms capable of liquefying gelatin decreased in Case I from 23% to 6%, while those in Case II decreased from 30% to 2.1%. Those capable of fermenting carbohydrates during the same period increased in Case I from 4% to 32%, and in Case II from 21.5% to 36%, thus showing some individual variations.

The per cent of fermentative bacteria shown in the table and in the tables which are to follow were determined by adding together the percentages of those which developed as acid colonies on litmus lactose agar and those belonging to the aciduric group, as shown on the special glucose liver agar used.

(5) Effect of Feeding Pasteurized
Milk Upon the Intestinal Flora of the Guinea Pig

As was previously mentioned in this paper, these pigs were fed raw skim milk for a period of 45 days. They were then transferred to milk which had been pasteurized at 145°F. for 30 minutes and cooled to approximately 50°F.

The results obtained from the study of the fecal flora from pasteurized skim milk is shown in Table No. III.



From Table No. III it will be observed that when pasteurized milk was fed, the per cent of fermentative organisms decidedly decreased and particularly true was this of the Streptococcus lacticus group. It will likewise be observed that the putrefactive organisms increased slightly upon this diet. This possibly may have been due to the fact that the Streptococcus lacticus group was greatly decreased during pasteurization while the putrefactive group, which is more resistant, (many of them being spore formers) was not decreased to such an extent, thus making it easier for them to gain a foothold.

(6) Effect of Feeding Sterilized Milk
Inoculated With Streptococcus lacticus
Upon the Intestinal Flora of the Guinea Pig.

As a direct contrast to feeding pasteurized milk in which the Streptococcus lacticus group is greatly decreased. Sterilized skim milk which was freshly inoculated with a pure culture of Streptococcus lacticus was fed for a period of 45 days to another group of pigs. The results of which are recorded in Table IV.

Table V.

Showing Results of Feeding Streptococcus lacticus in Milk Upon the Fecal Flora of the Guinea Pig

Diet	Bran-----	35 gr.
	Carrots-----	100 gr.
	Milk + Strept. lact.----	100 cc.

Case	VII						VIII					
Feeding period in days	B' 3 '10'			Died of 'pneumonia'			B' 3 '10' 17 '24 '31 '45'					
<i>B. acidophilus</i>	-	+	-				-	-	+	+	+	
<i>B. bifidus</i>	-	-	-				-	-	+	-	-	
<i>B. bulgaricus</i>	-	-	-				-	-	-	-	-	
<i>B. coli</i>	++	+	+-				++	++	+	+-	+-	
<i>B. l. aerogenes</i>		+	+-	-			+-	+-	+-	+	-	
<i>B. mesentericus vulgatus</i>	+-	-	-				-	-	-	+-	-	
<i>B. proteus vulgaris</i>	+	+	+-				+	+	+	+-	+-	
<i>B. pyocyaneus</i>	-	-	-				+-	+-	+-	-	-	
<i>B. subtilis</i>	+	+	-				+	+	+	-	-	
<i>Staphylococcus pyogenes aureus</i>	+	+	+				+	+	+	+	+-	
<i>Staphylococcus pyogenes albus</i>	+-	-	-				-	-	+-	-	-	
<i>Streptococcus lacticus</i>	-	+-	-				-	+-	+	++	++	
<i>Streptococcus pyogenes</i>	+	+	+				+	+	+	+	+-	
Other bacteria	SF	SF	-				SF	SF	SF	SF	SF	
% Gas in Dextrose broth	30	20	10				20	50	25	15	5	
% Gas in Lactose broth	25	20	5				20	40	15	10	T	
% Gas in Saccharose broth	10	10	T				12	25	12	5	0	
Action on litmus milk	AP	AC	AC				AP	AP	AC	AC	AC	
% Gelatin liquefiers	46	42	13.9				50	26	20	15	10	
% Acid producers	48	8	27.8				15	25	3.3	45	50	
% Alkaline and inert	42	50	41.7				35	37	65.8	40	40	
N/5 Acetic acid broth	-	-	-				-	-	-	+-	+-	
N/10 Acetic acid broth	-	+-	+-				+-	+-	+	+	++	
N/20 Acetic acid broth	+-	+	+				+	+	++	++	++	
Yeast	-	-	-				-	-	-	-	-	

plates broken on this date

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. The text outlines various methods for organizing and storing data, suggesting that digital tools can be highly effective for this purpose.

2. The second section focuses on the role of communication in project management. It argues that clear and consistent communication is the foundation of any successful team effort. The author provides several practical tips for improving communication, such as holding regular meetings and using collaborative platforms. It also stresses the importance of active listening and being open to feedback.

3. The third part of the document addresses the challenges of time management. It acknowledges that everyone faces time constraints and offers strategies to help prioritize tasks and avoid procrastination. The text suggests creating a detailed schedule and breaking down large projects into smaller, manageable steps. It also encourages the use of time-blocking techniques to ensure that important tasks receive the necessary attention.

4. The fourth section discusses the importance of continuous learning and professional development. It notes that the field is constantly evolving, and staying up-to-date with the latest trends and technologies is crucial for success. The author recommends attending workshops, conferences, and taking courses to expand one's knowledge and skills. It also encourages a mindset of lifelong learning and being open to new ideas.

5. The final part of the document provides a summary of the key points discussed and offers some concluding thoughts. It reiterates the importance of the topics covered and encourages readers to apply the advice provided. The text ends with a call to action, urging readers to take the first step towards implementing the strategies discussed.

Table No. IV shows a decided increase in the Streptococcus lacticus group and also in the number of B. acidophilus present. However, in Case III it does not show the reduction of putrefactive organisms that might be expected, while in Case IV, the results are decisive.

As Bact. welchii persisted quite consistently in the feces of Case III and as that case did not respond to the feeding of Streptococcus lacticus as did Case IV. It was decided to try the experiment on two more pigs which had a very high percentage of putrefactive organisms to commence with. The results as shown in Table No. V correspond quite closely with Case IV in Table No. IV. Therefore, it may be said that the flora of the milk consumed has a temporary effect on the fecal flora of the guinea pig.

(7) The Effect of Feeding Sterilized Skim Milk Inoculated With Bacillus bulgaricus Upon the Intestinal Flora of the Guinea Pig.

As many pediatricists find that feeding milk inoculated with Bacillus bulgaricus to infants and children suffering with intestinal disorders is beneficial and in that there have been many recent attempts to establish this organism in the intestinal tract without success, it was deemed advisable to feed

the organism to guinea pigs and study its effect on the intestinal flora.

Sterilized milk which had been inoculated with a pure culture of B. bulgaricus was fed for a period of 90 days, after which the B. bulgaricus was discontinued. Upon being discontinued, specimens were collected every day to determine how long after feeding the organism could be isolated from the feces when suitable food, such as plain milk was fed to the subject.

The flora resulting from feeding milk inoculated with Bacillus bulgaricus is shown in Table No. VI.

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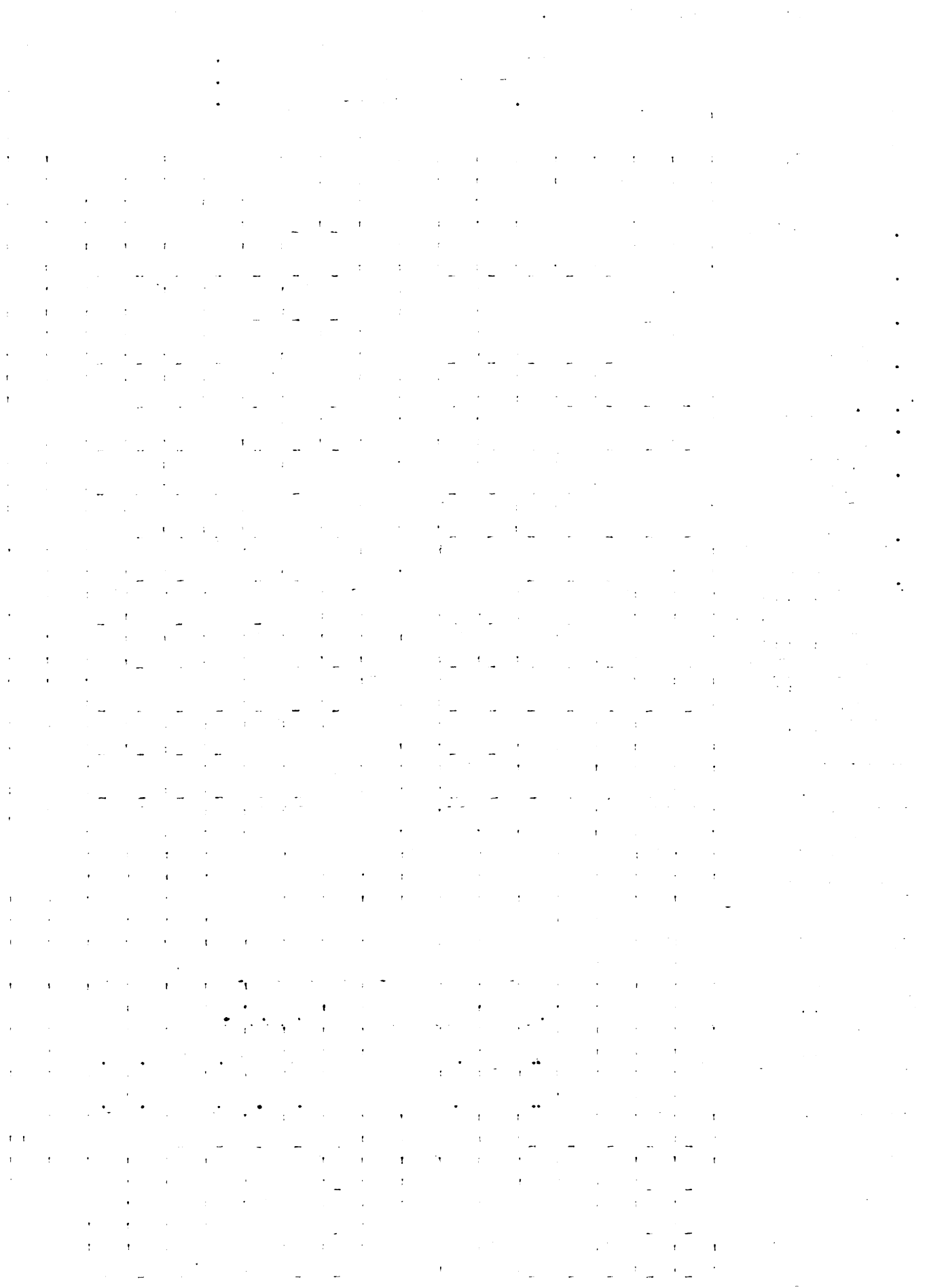
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Table VI

Showing Results of Feeding *B. bulgaricus* in Milk Upon Fecal Flora of Guinea Pig

Diet	Bran-----35 gr. Carrots-----100 gr. Milk + <i>B. bulgaricus</i> -----100 cc.													
Case	V							VI						
Feeding period in days	B	3	10	17	24	31	45	B	3	10	17	24	31	45
<i>B. acidophilus</i>	-	+	++	++	++	+	+	-	-	+	++	++	++	++
<i>B. bifidus</i>	-	-	+	-	+	-	+	-	-	+	-	+	-	+
<i>B. bulgaricus</i>	-	-	+	+	++	++	++	-	-	+	+	++	++	++
<i>B. coli</i>	++	+	+	-	+	-	-	++	+	+	-	-	-	-
<i>B. l. aerogenes</i>	+-	+-	-	-	-	-	-	+-	+-	-	-	-	-	-
<i>B. mesentericus vulgatus</i>	-	-	-	-	-	-	-	+-	-	-	-	-	-	-
<i>B. proteus vulgaris</i>	+	+	+	-	+	-	-	+	+	+	-	-	-	-
<i>B. pyocyaneus</i>	+-	+-	-	+	+-	-	-	+-	+	+	+-	+-	-	-
<i>B. subtilis</i>	+	+	-	-	-	-	-	+	+	-	-	-	-	-
<i>Staphylococcus pyogenes aureus</i>	+	+	+	+	+-	+-	-	+	+	+	+-	+-	+-	+-
<i>Staphylococcus pyogenes albus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Streptococcus lacticus</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-
<i>Streptococcus pyogenes</i>	++	+	+	+	+	+-	+-	++	+	+	+-	+-	+-	+-
	SF	SF						SF	SF				MT	
Other bacteria	+	+	-	-	-	-	-	+	+	-	-	-	-	+
% Gas in Dextrose broth	20	20	5	5	T	T	T	20	15	5	0	0	0	0
% Gas in Lactose broth	18	15	T	T	0	0	0	20	10	T	0	0	0	0
% Gas in Saccharose broth	10	10	T	T	5	10	10	10	5	5	5	5	5	5
Action on litmus milk	AP	AP	AC	AC	AC	AC	AC	AP	AC	AC	AC	AC	AC	AC
% Gelatin liquefaction	24	21	6	5	43	0	0	44	12.5	11.2	14	3	8	0
% Acid producers	14	16	40	44	56	155	53.8	11	25	27	41	34	49	77.6
% Alkaline and inert	62	63	54	51	49.6	45	46.2	45	64.5	61.8	55.6	43	32.4	30.6
N/5 Acetic acid broth	-	-	+	+	+	+	+	-	-	+	+	+	+	+
N/10 Acetic acid broth	-	-	+	+	+	++	++	-	+	+	+	+	++	++
N/20 Acetic acid broth	+-	+-	++	++	++	++	++	+-	++	++	++	++	++	++
Yeast	-	-	-	-	-	+	+	-	-	+	-	-	-	-



While the organism was being fed to the milk, the writer was able to isolate them from the feces in large numbers. The writer is aware that the above is contrary to the results of Rettger, who fed the organism to chickens.

In the past, there has been considerable controversy as to the differentiation between B. bulgaricus and B. acidophilus, which may have resulted in B. bulgaricus not being found in the feces of chickens.

The writer has found that while the growth of B. bulgaricus is very similar to B. acidophilus on liver glucose agar as used, the colonies can be readily picked because they are much thicker and have a more thread-like edge. The writer further believes that B. bulgaricus can be readily distinguished from B. acidophilus by its lack of ability to ferment maltose (34).

The presence of B. bulgaricus in the feces of Case V continued for a period of 17 days after ingestion of the organism. In Case VI, it was continued in the feces for a period of only 13 days, thus showing that it could not be permanently established in the intestinal tract of the guinea pig which corresponds with the investigations of Herter, Kendall, Rahe, Rettger, Torrey and others.

• Die 1. Phase ist die Entstehung der ersten Zellen aus unorganischen Substanzen.
• Die 2. Phase ist die Entstehung der ersten Lebewesen aus organischen Substanzen.
• Die 3. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.
• Die 4. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.

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• Die 5. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.
- Die 6. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.
• Die 7. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.
- Die 8. Phase ist die Entstehung der ersten komplexen Lebewesen aus organischen Substanzen.

Table No. VI further shows that B. bulgaricus milk increased the fermentative flora to a greater extent than did the milk alone as shown in Table No. II. This might seem to suggest that the organism itself exerted an influence upon the flora. To determine whether this was or was not the case, the following experiment was conducted.

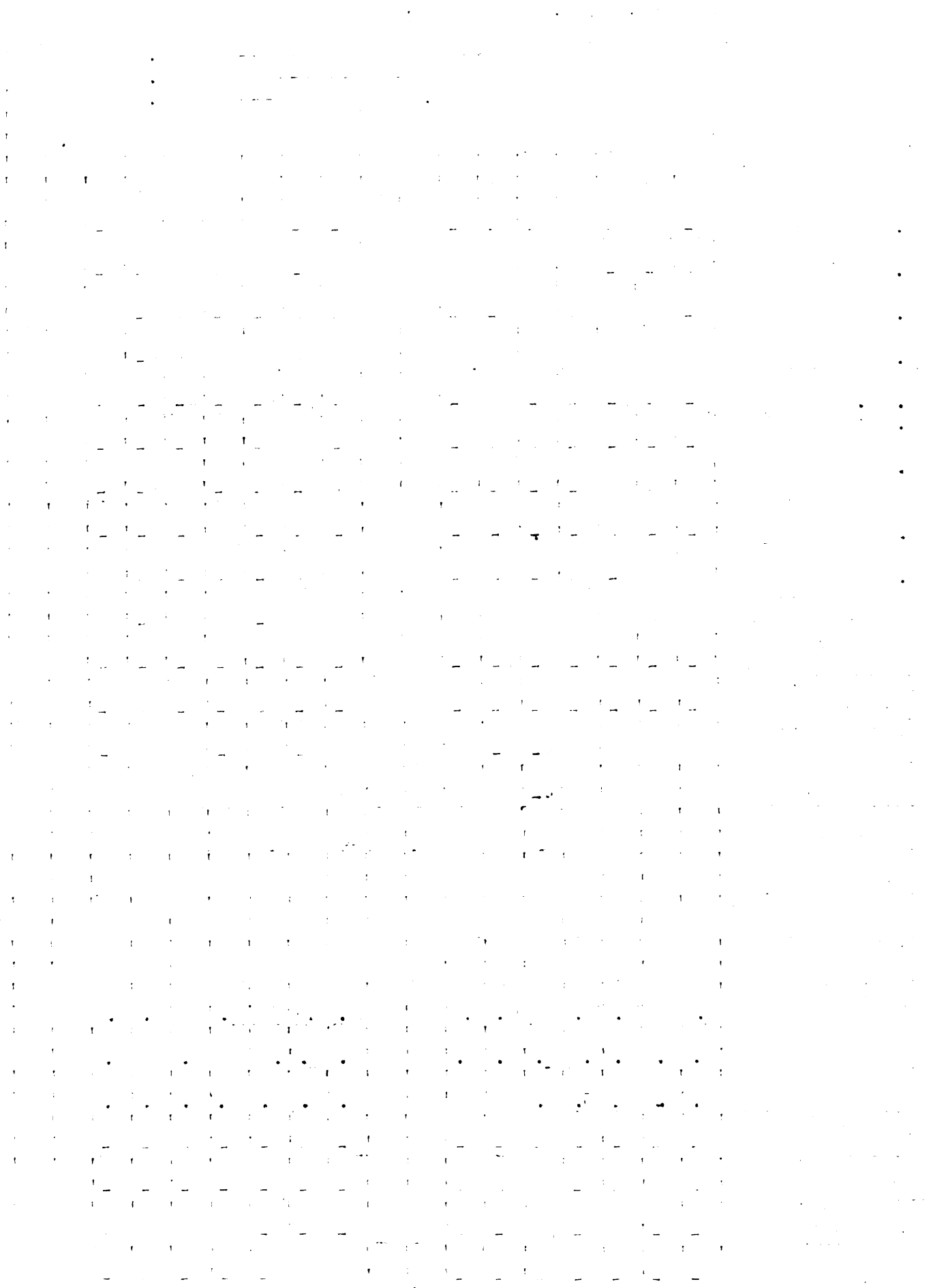
(8) Effect of Feeding Sterile Water Inoculated With B. bulgaricus on the Intestinal Flora of Guinea Pig.

Bacillus bulgaricus was cultured on liver glucose agar, washed off in sterile water and fed to Cases XI and XII for a period of 45 days. The flora produced by this diet did not show any appreciable difference or change from the normal flora of the pigs. In just one instance was the writer able to isolate B. bulgaricus from the feces which suggests that the organism dies off in the intestinal tract when no suitable carbohydrate is fed. Table No. VII shows the results of the feeding of B. bulgaricus in water.

of the Guinea Pig

Diet

Case	XI	XII
Feeding period in days	B' 3'10'17'24'31'45'	B' 3'10'17'24'31'45'
<i>B. acidophilus</i>	- - - - -	- - - - -
<i>B. bifidus</i>	- - - - -	- - - - -
<i>B. bulgaricus</i>	- - - - + - -	- - - - -
<i>B. coli</i>	+ + + + +	+ + + + - +
<i>B. l. aerogenes</i>	+ - + - - - + -	+ - + - - - -
<i>B. mesentericus vulgatus</i>	- - - - -	+ - - - -
<i>B. proteus vulgaris</i>	+ + + - + - + -	+ + - + - + -
<i>B. pyocyaneus</i>	- + - - + - -	- - - - -
<i>B. subtilis</i>	+ + - - - -	+ + - - - -
<i>Staphylococcus pyogenes aureus</i>	+ + + + +	+ + + - + +
<i>Staphylococcus pyogenes albus</i>	- + - - - + - -	- - - + - + - -
<i>Streptococcus lacticus</i>	- - - - -	- - - - -
<i>Streptococcus pyogenes</i>	+ + + + - + -	+ + - + - + -
Other bacteria	SF SF SF SF SF SF SF	SF SF SF SF SF
% Gas in Dextrose broth	'30'20'20'10'20'20'10'	'35'30'20'20'10' T'10'
% Gas in Lactose broth	'25'20'10'10'10'10' 5'	'20'20'10' T' 5' 0' T'
% Gas in Sacch- arose broth	'15'10' 4' T' T'10' T'	'15'10'10' T' T' 0' T'
Action on litmus milk	'AP'AP'AP'AC'AC'AC'AC'	'AP'AP'AP'AC'AC'AC'AC'
% Gelatin liquefiers	79.4'21'77.5'119'13'10.7'8.9'	75.5'73'23'121' 9'128'7.3'
% Acid producers	11.3'9.9'122'26'76.4'143'131'	76.7'112.9'17'75.1'21'79.6'
% Alkaline and inert	'69.3'69.1'70.8'157'6'75'78'	'67.8'71.5'62.3'70.9'76.9'66.2'73.1'
N/5 Acetic acid broth	- - - - -	- - - - -
N/10 Acetic acid broth	- - - - -	- - - - + - + -
N/20 Acetic acid broth	+ - + - + - + - + -	- + - + - + + +
Yeast	- - - - -	- - - - -



(9) Effect of Feeding Milk Plus Lactose

Upon the Intestinal Flora of the Guinea Pig.

It having been definitely determined by the investigations of Kendall (17), Terrey (31), Rettger (27), and Porter, Morris, and Meyers (5) that the addition of lactose to any diet would change the flora from a putrefactive to a fermentative type. This experiment was added as a control or check on the other experiments conducted. The results are shown in Table No. VIII and correspond with the findings of the investigators mentioned above. The aciduric group consisting of B. bifidus and B. acidophilus predominating and almost completely crowding out all other forms.

•

(10) Effect of Feeding Borden's Eagle Brand, Condensed Milk, Horlick's Malted Milk and Mellin's Food on the Intestinal Flora of the Guinea Pig.

These kinds of milk mentioned above being used in a great many instances as food for infants and especially so among the pediatricists of Lansing; it was considered of sufficient importance to determine the typical fecal flora resulting from their feeding.

The guinea pigs used in these experiments were first fed upon formulas recommended by the respective manufacturers for infants of one month of age and gradually increased until they were receiving the formulas recommended for infants of twelve months of age.

The type of flora and the relative numbers of the different organisms are shown in Tables No. IX, X, and XI respectively.

1. The first step in the process of creating a new product is to identify a market need.

2. The second step is to develop a concept that addresses the market need.

3. The third step is to create a prototype of the product.

4. The fourth step is to conduct market research to determine if there is a demand for the product.

5. The fifth step is to develop a business plan for the product.

6. The sixth step is to secure funding for the product.

7. The seventh step is to manufacture the product.

8. The eighth step is to distribute the product.

9. The ninth step is to monitor the product's performance in the market.

10. The tenth step is to make adjustments to the product as needed.

11. The eleventh step is to continue to develop new products.

12. The twelfth step is to maintain a strong relationship with customers.

13. The thirteenth step is to stay up-to-date on industry trends.

14. The fourteenth step is to be flexible and adaptable.

15. The fifteenth step is to be persistent.

16. The sixteenth step is to be innovative.

17. The seventeenth step is to be a team player.

18. The eighteenth step is to be a good listener.

19. The nineteenth step is to be a good communicator.

20. The twentieth step is to be a good leader.

21. The twenty-first step is to be a good manager.

22. The twenty-second step is to be a good negotiator.

23. The twenty-third step is to be a good problem solver.

24. The twenty-fourth step is to be a good decision maker.

25. The twenty-fifth step is to be a good team player.

26. The twenty-sixth step is to be a good listener.

27. The twenty-seventh step is to be a good communicator.

28. The twenty-eighth step is to be a good leader.

29. The twenty-ninth step is to be a good manager.

30. The thirtieth step is to be a good negotiator.

Table IX

Showing Results of Feeding Borden's Eagle Brand Condensed Milk Upon
the Fecal Flora of the Guinea Pig

[illegible]

Table X

Showing Results of Feeding Horlick's Malted Milk Upon Fecal Flora of Guinea Pigs

	Bran-----35 gr.												Carrots-----100 gr.												Horlick's Malted Milk----100 cc.												
Diet																																					
Case	VII												VIII																								
Feeding period in days	B	2	9	16	23	30							B	2	9	16	23	30																			
B. acidophilus	-	+	-	+	+	+	+						+	-	+	+	+	+	+																		
B. bifidus	-	-	+	-	+	-	+	0					-	-	+	+	-	-	-																		
B. bulgaricus	-	-	-	-	-	-	-						-	-	-	-	-	-	-																		
B. coli	+	+	-	+	-	+	-	+	-	+	-		+	+	-	-	+	-	+	-	+	-															
B. l. aerogenes	+	-	-	-	-	-	-						+	-	+	-	-	-	-																		
B. mesentericus vulgatus	-	-	-	-	-	-	-						-	-	-	-	-	-	-																		
B. proteus vulgaris	+	+	-	-	-	-	-						+	-	+	-	-	-	-																		
B. pyocyaneus	+	-	-	-	-	-	-						+	-	-	-	+	-	+	-																	
B. subtilis	+	-	-	-	-	-	-						+	-	-	-	-	-	-																		
Staphylococcus pyogenes aureus	+	+	-	+	-	+	-	+	-				+	-	+	-	+	-	+	-																	
Staphylococcus pyogenes albus	+	-	-	-	-	-	-						-	-	-	-	-	-	-																		
Streptococcus lacticus	-	+	+	+	+	+	+						+	+	+	+	+	+	+																		
Streptococcus pyogenes	+	+	-	+	-	+	-	+	-				+	+	-	+	-	+	-	+																	
Other bacteria	SF	+	-	-	-	-	-						SF	SF	HD	+	+	-	+	-																	
% Gas in Dextrose broth	20	8	10	5	%	T	T						10	10	T	10	10	5																			
% Gas in Lactose broth	10	T	5	T	0	0	0						5	T	0	5	T	0																			
% Gas in Sacch- arose broth	10	T	T	0	0	0	0						5	T	0	T	T	0																			
Action on litmus milk	AP	AC	AC	AC	AC	AC	AC						AP	AC	AC	AC	AC	AC																			
% Gelatin liquefiers	13.2	5.6	13	3.1	2.9	3.3							11.3	1.4	3	1.5	2	.5																			
% Acid producers	8.3	25	40	80	62	261							29.1	42.2	39	45	44	30																			
% Alkaline and inert	78.5	79.4	58.7	16.9	34.9	35.7							59.6	56.4	58.1	53.5	54	69.5																			
N/5 Acetic acid broth	-	-	-	-	-	+	-						-	-	-	+	+	+	-																		
N/10 Acetic acid broth	-	+	-	+	+	+	+						-	-	+	+	+	+																			
N/20 Acetic acid broth	+	-	+	+	+	+	+						+	-	+	+	+	+	+																		
Yeasts	-	-	-	-	-	-	-						-	-	-	-	-	-	-																		

Table XI

Showing Results of Feeding Mellin's Food Upon the Fecal Flora of the Guinea Pig

Diet	Bran-----35 gr.													
	Carrots-----100 gr.													
	Mellin's Food-----100 cc.													
Case	IX							X						
Feeding period in days	B	3	10	17	24	31		B	3	10	17	24	31	
<i>B. acidophilus</i>	+	-	+	+	+	+	+	+	+	+	+	+	+	+
<i>B. bifidus</i>	-	-	+	+	+	+	+	+	+	+	+	+	+	+
<i>B. bulgaricus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>B. coli</i>	++	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>B. l. aerogenes</i>	+	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>B. mesentericus vulgatus</i>	+	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>B. proteus vulgaris</i>	+	-	+	-	-	-	-	+	-	-	-	-	-	-
<i>B. pyocyaneus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>B. subtilis</i>	+	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Staphylococcus pyogenes aureus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Staphylococcus pyogenes albus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Streptococcus lacticus</i>	-	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Streptococcus pyogenes</i>	+	-	+	-	+	-	+	+	-	+	-	+	-	+
Other bacteria	SF			Dip	Dip	Dip		G+B						
% Gas in Dextrose broth	20	30	20	5	T	T		10	5	T	5	T	T	
% Gas in Lactose broth	10	20	10	T	0	0		5	0	0	T	0	0	
% Gas in Saccharose broth	10	5	T	T	0	0		T	0	0	0	0	0	
Action on litmus milk	AP	AC	AC	AC	AG	AC		AP	AP	AC	AC	AG	AC	
% Gelatin liquefiers	3.7	4.1	1.7	.5	0	0		2.1	7	1.9	+	+	+	
% Acid producers	11.9	15.7	30	30	53	67		10	30	37	46	55	56	
% Alkaline and inert	84.4	80.2	68.3	69.5	52	33		87.9	63	61.1	53	44	45	
N/5 Acetic acid broth	-	-	-	-	-	+		-	-	-	+	+	+	
N/10 Acetic acid broth	+	-	+	-	+	+		+	-	+	+	+	+	
N/20 Acetic acid broth	+	+	+	+	+	+		+	+	+	+	+	+	
Yeasts	+	-	+	+	+	-		-	-	-	-	-	-	

• _____ _____

• _____ _____

• _____ _____

From the foregoing tables it will be observed that the flora produced by the various milk diets are very similar, all of them coming under the fermentative type and, to a large extent, consisting of B. acidophilus and Streptococcus lacticus.

Since these kinds of milk all contain a large percentage of carbohydrates particularly maltose, the results obtained with Horlick's Malted Milk and Mellin's Food correlate with the previous work done by various investigators with this particular sugar.

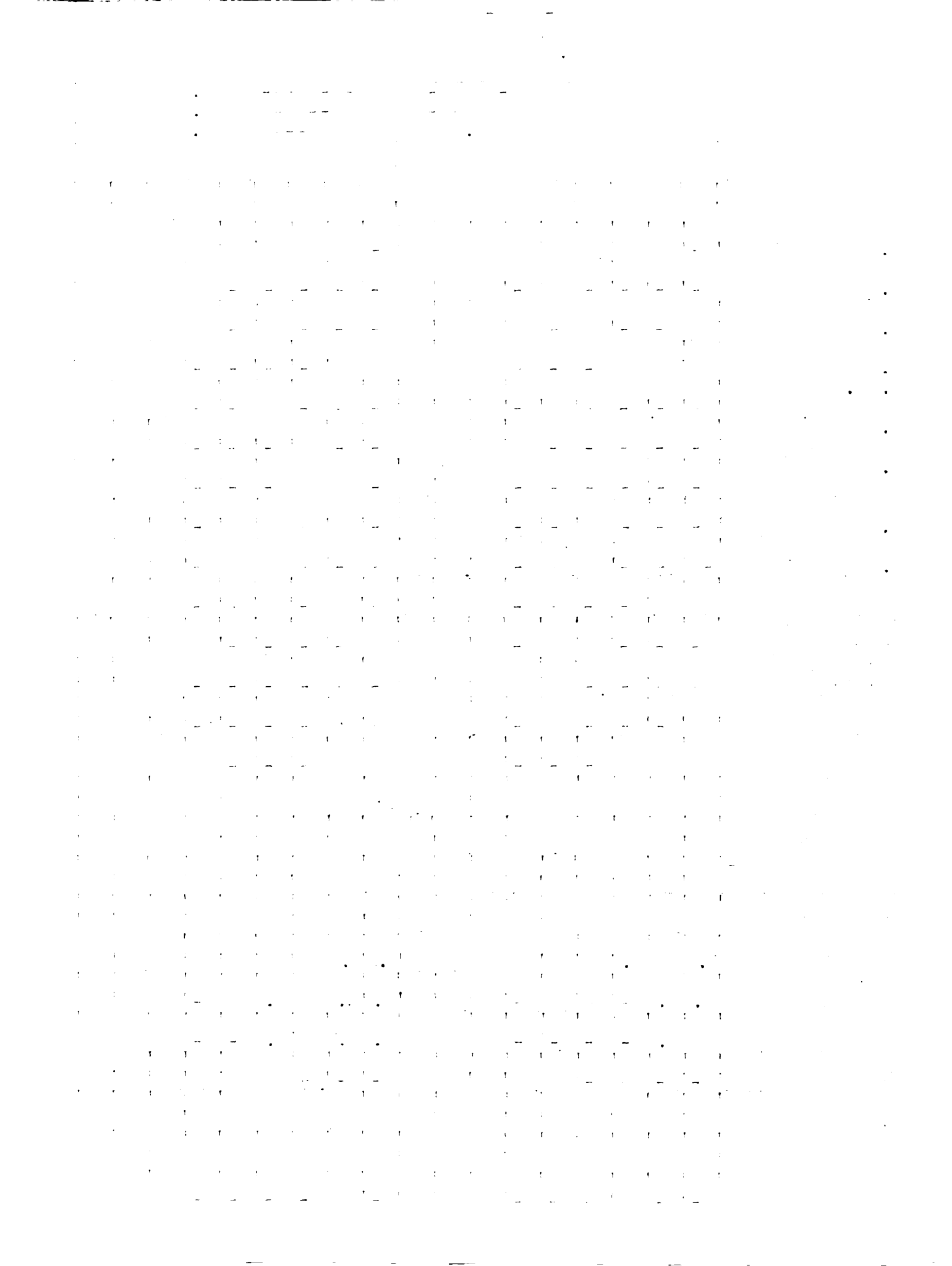
(11) The Effect of Feeding Sterilized
Milk Inoculated With Bacillus acidophilus
Upon the Intestinal Flora of the Guinea Pig

The intestinal tract being the natural habitat of B. acidophilus, the writer considered it of interest to determine if it could be established in the intestinal tract of the guinea pig, which animal was found to contain few if any of this organism in the intestinal tract. Therefore, milk which had been sterilized was inoculated with a pure culture of B. acidophilus and fed to Cases XI and XII for a period of 45 days, during which time B. acidophilus became the predominant organism of the feces.

Table XII

Showing Results of Feeding B. Acidophilus Upon the Fecal Flora of Guinea Pig

Diet	Bran-----35 gr. Carrots-----100 gr. Milk + B. acidophilus----100 cc.													
Case	XI							XII						
Feeding period in days	B	3	'10	'17	'24	'31		B	3	'10	'17	'24	'31	
B. acidophilus	-	++	++	++	++	++		-	++	++	++	++	++	
B. bifidus	-	-	+	-	+	+	o	-	-	-	+	-	-	
B. bulgaricus	-	-	-	-	-	-		-	-	-	-	-	-	
B. coli	++	+	+	+	+	+		++	++	+	+	+	+	
B. l. aerogenes	+	-	+	-	-	-		+	-	+	-	-	-	
B. mesentericus vulgatus	-	-	-	-	-	-		+	-	-	+	-	-	
B. proteus vulgaris	+	-	+	-	-	-		+	-	+	+	-	-	
B. pyocyaneus	-	-	-	-	-	-		-	-	-	-	-	-	
B. subtilis	-	-	-	-	-	-		-	-	-	-	-	-	
Staphylococcus pyogenes aureus	+	+	+	+	+	+		+	+	+	+	+	+	
Staphylococcus pyogenes albus	+	-	-	-	-	-		-	+	-	-	-	-	
Streptococcus lacticus	-	-	-	+	+	+		-	-	-	+	+	+	
Streptococcus pyogenes	+	+	+	+	+	+		+	+	+	+	+	+	
Other bacteria	+	+	+	-	-	-		+	+	-	-	-	-	
% Gas in Dextrose broth	'20	'10	'10	T	T	T		'15	'15	'10	T	T	5	
% Gas in Lactose broth	'10	T	T	O	O	O		5	'10	5	O	O	O	
% Gas in Saccharose broth	'10	T	O	O	O	O		T	'10	T	O	O	O	
Action on litmus milk	'AP	'AC	'AC	'AC	'AC	'AC		'AP	'AC	'AP	'AC	'AC	'AC	
% Gelatin liquefiers	'9.3	8.0	'9.	O	O	O		7.9	3.9	'10	O	O	O	
% Acid producers	12.7	43.8	-	-	-	-		17.2	32.2	'20	'27.5	13	-	
% Alkaline and inert	'78	48.2	-	-	-	-		'74	95.7	'170	'2.5	-	-	
N/5 Acetic acid broth	-	+	+	+	+	+		-	+	+	+	+	+	
N/10 Acetic acid broth	+	+	+	+	+	+		+	+	+	+	+	+	
N/20 Acetic acid broth	++	++	++	++	++	++		+	+	++	++	++	++	
Yeasts	-	-	-	-	-	-		-	+	-	-	-	-	



After the 45 day period sterilized milk was fed without being inoculated with B. acidophilus. However, B. acidophilus remained the predominating organism during the next 45 days that the milk was fed. Subsequent to this, milk was also discontinued as a part of the diet and B. acidophilus almost immediately commenced to diminish until the 31st day was reached, at which time the writer failed to find them in the feces of the guinea pigs.

DISCUSSION

From the experimental work done, the writer has shown that the fecal flora of the guinea pig may be influenced by diet. However, he does not believe that they meet the requirements of an experimental animal for this kind of work, because (1) their stools do not resemble closely enough those of the human, (2) they do not consume their food quickly nor cleanly, thereby making it difficult to keep sterile food from becoming contaminated, (3) it is difficult to obtain uncontaminated stools, (4) they are hard to maintain on a monotonous diet.

The data presented also suggest that it might be well to inoculate pasteurized milk with a pure culture of lactic acid bacteria before being

1. 在 1949 年以前，中国是一个半殖民地半封建国家，政治、经济、文化各方面都受到外国势力的控制。在政治上，中国没有真正的主权，外国势力在中国享有特权。在经济上，中国是一个落后的农业国家，工业基础薄弱，主要经济命脉掌握在外国资本家手中。在文化上，中国受到西方文化的冲击，传统文化受到挑战。

2. 1949 年 10 月 1 日，中华人民共和国成立，标志着中国历史的一个重大转折点。从此，中国结束了半殖民地半封建的历史，成为一个独立自主的国家。在政治上，中国建立了人民民主专政的社会主义制度。在经济上，中国开始进行社会主义改造，逐步建立起社会主义经济体系。在文化上，中国大力发展社会主义文化，弘扬民族优秀传统文化。

3. 新中国成立后，中国在国际舞台上日益发挥重要作用。中国奉行独立自主的和平外交政策，反对霸权主义和强权政治。中国积极参与国际事务，为世界和平与发展作出了重要贡献。

4. 在 1978 年以前，中国实行的是计划经济体制。这种体制在建国初期对恢复国民经济和进行社会主义建设起到了一定的作用。但是，随着时代的发展，计划经济体制的弊端日益显现，经济活力不足，人民生活水平提高缓慢。

5. 1978 年 12 月，中国共产党十一届三中全会召开，作出了改革开放的重大决策。从此，中国进入了改革开放和社会主义现代化建设的新时期。在政治上，中国坚持四项基本原则，不断完善社会主义民主政治。在经济上，中国实行改革开放，逐步建立起社会主义市场经济体制，经济实现了高速增长。在文化上，中国实行百花齐放、百家争鸣的方针，文化事业蓬勃发展。

6. 改革开放以来，中国取得了举世瞩目的成就。中国经济总量跃居世界第二，人民生活水平显著提高，国际地位日益提升。中国积极参与全球治理，推动构建人类命运共同体。

7. 当前，中国正处于实现中华民族伟大复兴的关键时期。我们要坚持中国特色社会主义道路，全面深化改革，扩大开放，推动高质量发展，为实现中华民族伟大复兴的中国梦而努力奋斗。

consumed as has been proposed in a recent patent (36).

If for any reason it should not prove desirable to inoculate pasteurized milk with some lactic acid bacteria, the writer would suggest that cow's milk, particularly in the summer and in case of intestinal disorders among children, be modified by the addition of lactose. Human milk contains almost four times as much lactose as protein. Cow's milk contains not quite twice as much lactose as protein and produces a putrefactive flora more commonly than does human milk. It has been repeatedly shown that when lactose is fed a fermentative type of flora results, which closely resembles that of breast-fed infants.

By the addition of lactose to cow's milk as mentioned above, such milk would be made to resemble more closely that of the human, thereby reducing the chances of successful invasion in children of putrefactive bacteria which tend to be inhibited in fermentative surroundings.

Aside from the possible therapeutic value of fermented milks there seems to be no question but that they are nutritious and refreshing and that their use should be encouraged among adults because of their food value.

- Diebstahl = Diebstahl ist ein Verbrechen, das die unrechtmäßige Aneignahme fremder Sachen durch heimliches Entführen und Wegnehmen umfasst.

Diebstahl ist eine Straftat, die in der Strafgesetzbuch (StGB) geregelt ist. Er ist eine Verletzung des Eigentums, die durch das Wegnehmen von Sachen begangen wird.

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SUMMARY

The writer's experiments in feeding different diets to guinea pigs may be briefly summarized as follows:

(1) The feeding of fresh raw skim milk alters the fecal flora from a putrefactive to a fermentative type.

(2) The feeding of pasteurized milk, however, does not produce this change to as great an extent as does raw milk.

(3) Milk inoculated with a pure culture of Bacillus bulgaricus results in a highly fermentative flora and shows B. bulgaricus in large numbers during the period in which fed but immediately disappears when suitable carbohydrate food such as milk is withdrawn from the diet.

(4) The addition of 5% lactose to the milk fed, produces a flora very similar to that of breast-fed infants, B. bifidus and B. acidophilus predominating.

(5) Feeding pure cultures of Bacillus bulgaricus in water produces no change.

(6) Feeding of Borden's Eagle Brand Condensed Milk, Horlick's Malted Milk and Mellin's Food all produce fermentative flora.

(7) B. acidophilus predominated in large numbers in the feces of the pigs fed milk containing B. acidophilus and it remained dominant as long as suitable food, such as milk, was furnished in the diet. However, upon discontinuing food suitable for the growth of B. acidophilus, it was supplanted by putrefactive organisms.

CONCLUSIONS

The work presented in this paper has necessarily been limited but from the data obtained the following conclusions may be drawn:-

(1) The normal intestinal flora of the guinea pig, which is composed of a relatively high percentage of putrefactive organisms, may be changed temporarily to a more fermentative type of flora by the feeding of milk inoculated with lactic acid bacteria or by the addition of lactose to the diet. The writer also found that the feeding of Borden's Condensed Milk, Horlick's Malted Milk and Mellin's Food brought about a similar result.

(2) The length of time in which the fermentative flora, brought about by the feeding of milk inoculated with lactic acid bacteria, will persist after ingestion of the bacteria depends upon the type

of food consumed thereafter.

(3) Guinea pigs do not meet the requirements of an experimental animal for this kind of work.

ACKNOWLEDGMENT

The writer wishes to acknowledge his indebtedness to Mr. L. H. Cooleage, Dr. Ward Giltner, and Mr. G. L. A. Ruehle for suggestions and assistance received during this investigation.

1. The first part of the paper discusses the importance of the study of the history of the United States. It is argued that the study of the history of the United States is essential for a full understanding of the country and its people. The paper then discusses the importance of the study of the history of the United States in the context of the current political and social climate.

2. The second part of the paper discusses the importance of the study of the history of the United States in the context of the current political and social climate. It is argued that the study of the history of the United States is essential for a full understanding of the country and its people. The paper then discusses the importance of the study of the history of the United States in the context of the current political and social climate.

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• The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers want and need. Once a need is identified, the next step is to develop a concept for a product that meets that need. This is often done through brainstorming and sketching. The third step is to create a prototype, which is a small-scale model of the product. This allows the designer to test the product and make any necessary adjustments. The fourth step is to create a detailed design, which includes specifications for the materials, components, and assembly. The final step is to manufacture the product, which involves sourcing materials, purchasing components, and assembling the product. Once the product is manufactured, it is then distributed to the market.

• The process of creating a new product is a complex one that involves many steps. It starts with identifying a market need, followed by developing a concept, creating a prototype, creating a detailed design, and finally manufacturing the product. Each step is crucial to the success of the product, and the designer must carefully consider each step to ensure that the final product meets the needs of the market.

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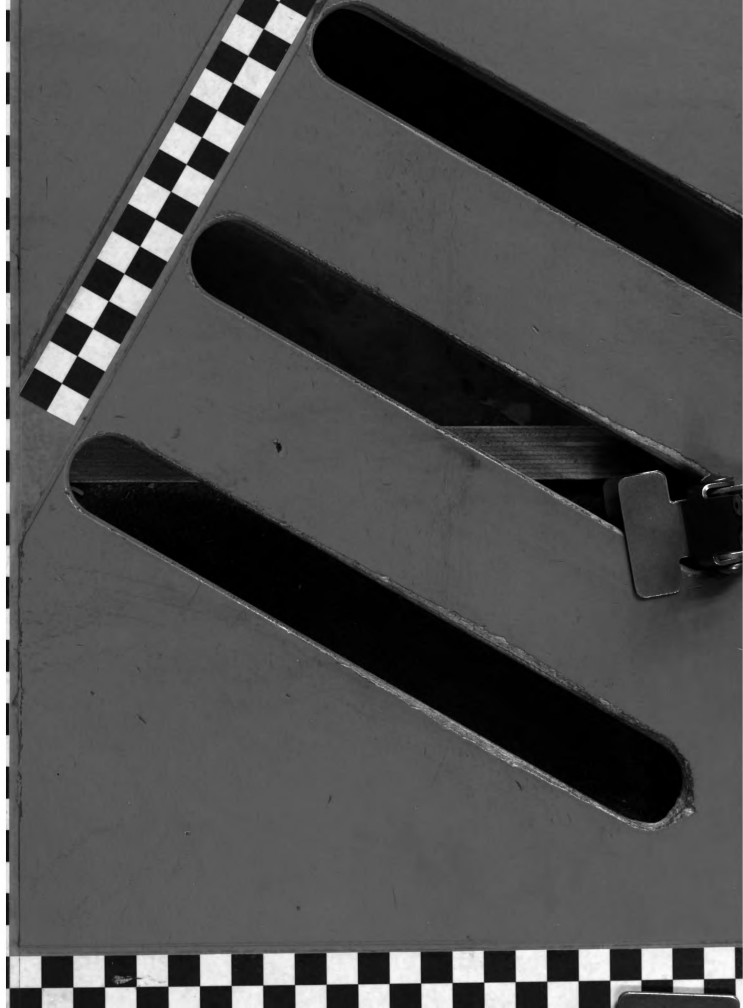
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