
UNIVERSITI PUTRA MALAYSIA

# *A STUDY OF THE IMMUNOLOGICAL STATUS OF NEONATAL CALVES REARED UNDER DIFFERENT FARM MNAGEMENT SYSTEMS, USING THE LENS REFRACTOMETER*

ELIZABETH AK. GREGORY JIMOS

# A STUDY OF THE IMMUNOLOGICAL STATUS OF NEONATAL CALVES REARED UNDER DIFFERENT FARM MANAGEMENT SYSTEMS, USING THE LENS REFRACTOMETER

BY

ELIZABETH AK. GREGORY JIMOS

DOCTOR OF VETERINARY MEDICINE

1989

FACULTY OF VETERINARY MEDICINE

AND ANIMAL SCIENCE

UNIVERSITI PERTANIAN MALAYSIA

List of Contents Page

List of Tables Page

List of Figures

# ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Kedoktoran Veterinar dan Sains Peternakan untuk memenuhi sebahagian daripada keperluan kursus VPD 401 - Projek Perindustrian Ternakan.

SATU KAJIAN STATUS IMMUNOLOGI ANAK LEMBU BARU LAHIR (NEONATE) YANG DI BAWAH PENGURUSAN LADANG YANG BERLAINAN DENGAN REFRACTOMETER LENS.

oleh

ELIZABETH AK. GREGORY JIMOS

1989

Supervisor : DR. FATIMAH ISKANDAR

Satu kajian telah dijalankan ke atas 193 anak lembu dari tiga jenis ladang yang mengamalkan sistem pengurusan ladang yang berbeza. Ladang-ladang tersebut adalah ladang lembu pedaging UPM yang pelihara kebanyakkannya lembu pedaging baka tempatan seperti Kedah-Kelantan (KK) dan ladang lembu tenusu yang pelihara lembu jenis impot seperti kacukan Friesian dan Jersey. Manakala, ladang lembu tenusu penternak kecil memelihara kebanyakkannya lembu baka tempatan seperti Local Indian Dairy (LID). Ladang lembu pedaging UPM mengamalkan sistem pengurusan ladang secara ektensif di mana anak lembu dibiarkan

menyusu ibu sesuka hati sehingga dicerai susu pada umur 7 hingga 8 bulan. Ladang lembu tenusu UPM mengamalkan sistem pengurusan ladang secara separuh intensif di mana anak lembu dipisahkan serta-merta dari ibu selepas lahir dan diletakkan di kandang individu dan diberikan colostrum dan susu dengan botol. Manakala, ladang lembu tenusu penternak kecil kebanyakkannya mengamalkan sistem pengurusan ladang sama ada secara separuh intensif atau ektensif di mana anak lembu dibiarkan menyusu ibu sesuka hati selama 24 hingga 48 jam selepas lahir dan dipisahkan dari ibu buat sementara waktu bila ibu dilepaskan untuk pergi meragut. Selepas balik dari meragut barulah anak lembu dibiarkan menyusu lagi. Anak lembu ini sebaik-baiknya berumur lebih kurang dalam satu minggu. Paras immunoglobulin serum anak lembu dianalisis secara tak langsung melalui pengukuran jumlah konsentrasi protin serum dengan menggunakan refractometer.

Keputusan menunjukkan pada tahun 1984, jumlah konsentrasi protin serum (TSP = 7.01 ± 1.09 gm %) anak lembu pedaging UPM adalah bererti tingginya ($P<0.05$) dari jumlah konsentrasi protin serum (TSP = 5.8 ± 2.07 gm %) anak lembu tenusu UPM, tetapi pada tahun 1988, keputusan tidak menunjukkan adanya perbezaan bererti di antara jumlah konsentrasi protin serum anak lembu pedaging UPM (TSP = 6.35 ± 1.15 gm %) dan anak lembu tenusu UPM (TSP = 7.07 ± 1.79 gm %). Pada tahun 1988, jumlah konsentrasi

Protin serum kedua-dua anak lembu pedaging (TSP = 6.35 ± 1.15 gm %) dan anak lembu tenusu (TSP = 7.07 ± 1.79 gm %) UPM adalah masing-masing bererti tingginya ($P < 0.01$) dan ($P < 0.05$) darijumlah konsentrasi protin serum anak lembu penternak kecil (TSP = 5.08 ± 1.27 gm %).

Ini menunjukkan bahawa jenis sistem pengurusan ladang yang diamalkan terutamanya pengurusan anak lembu selepas lahir seperti jumlah masa bersama ibu, masa pertama sekali mendapat colostrum, cara dan jangkamasa pemberian colostrum mempunyai pengaruh yang tak langsung ke atas jumlah konsentrasi serum protin anak lembu dan seterusnya akan mempengaruhi secara tak langsung paras immunoglobulin serum. Baka lembu yang berlainan, misalnya baka lembu tenusu jenis impot seperti Friesian dan baka lembu tenusu jenis tempatan seperti Local Indian Dairy (LID) juga mempunyai pengaruh ke atas jumlah konsentrasi protin serum anak lembu yang seterusnya mempunyai pengaruh tak langsung ke atas paras immunoglobulin dalam serum..

# ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine and Animal Science in partial requirement of the course VPD 401 - Animal Industry Project.

A STUDY OF THE IMMUNOLOGICAL STATUS OF NEONATAL CALVES REARED UNDER DIFFERENT FARM MANAGEMENT SYSTEMS, USING THE LENS REFRACTOMETER.

by

ELIZABETH AK. GREGORY JIMOS

1989

Supervisor : DR. FATIMAH ISKANDAR

A study was carried out on 193 calves from three cattle farms which practiced different types of farm management system. The farms were the Universiti Pertanian Malaysia (UPM) Beef Farm which reared mainly the local Kedah - Kelantan (KK) beef cattle and UPM Dairy farm which reared mostly the exotic crossbreds dairy cattle such as Friesian and Jersey crosses. The smallholder Dairy Farms reared mostly the local dairy breed of cattle such as Local Indian Dairy (LID). The UPM Beef Farm practiced on extensive type of management system in which the calves were allowed to suckle their

dams at will until they were weaned at 7 to 8 months old. The UPM Dairy Farm practiced a semi - intensive type of management system and the calves were separated immediately from their dams after birth and kept in an individual pen where they were bottle - fed colostrum and milk. The smallholder dairy farms practiced either the semi - intensive or extensive type of management system in which the newly born calves were allowed to suckle their dam at will for 24 to 48 hours after birth after which they were only separated for a while from the dam when the dams were let out to graze. After that they were allowed to suckle their dams again. The calves sampled were preferably within one week of age. The calves serum immunoglobulin levels were analysed indirectly through measurement of total serum protein concentration using the lens refractometer.

The results showed that in 1984 the total serum protein (TSP = 7.01 ± 1.09 gm %) of UPM Beef Calves was significantly higher ($P < 0.05$) than the total serum protein (TSP = 5.8 ± 2.07 gm %) of UPM Dairy calves, but in 1988 there was no significant difference between the total serum protein of the UPM beef calves (TSP = 6.35 ± 1.15 gm %) and the UPM dairy calves (TSP = 7.07 ± 1.70 gm %). In 1988, the total serum protein concentrations of the UPM beef calves (TSP = 6.35 ± 1.15 gm %) and the UPM dairy calves (TSP = 7.07 ± 1.79 gm %) was significantly

higher ($P < 0.01$) and ($P < 0.05$) respectively than the total serum protein of the smallholder dairy calves (TSP = 5.08 ± 1.27 gm %).

This result showed that the type of farm management system practiced particularly the management of calves immediately after birth like the time spent with the dam, time of first feeding of colostrum, method and duration of feeding of colostrum do have an indirect influence on the total serum protein concentration and which in turn would have an indirect influence on the immunoglobulin levels. The different breeds of cattle, example the imported dairy breed like Friesian and the local dairy breed like Local Indian Dairy (LID), also have influence on the total serum protein concentration and which in turn have an indirect influence on the serum immunoglobulin levels in calves.

## INTRODUCTION

The livestock industry in Malaysia, especially the ruminant sector has in the past been rather sluggish in its development. In recent years both the government and private sectors have shown keen interest in dairying. This resulted in a number of smallholder farmers becoming involved in cattle rearing for milk production which could give a fast net return to the farmer's economy as compared to cattle reared for beef production.

Calves are a form of farm product that are not productive but are a form of investment in delayed return. They represent the expansion of a herd as well as a substantial source of income.

It is widely known that the newly born calves are aqammaglobulinaemic and are therefore susceptible to neonatal infections like septicaemia and enteric colibacillosis. Therefore these newborn calves need to be protected. This protection is achieved through passive immunity. Passive immunity is obtained through the ingestion of the cow's first milk (colostrum). It is very important for the calves to drink the colostrum as soon as possible after birth, essentially, within 12 to 24 hours of birth. The colostrum carries the maternal antibodies essential to protect the calf from any infections early in life before it has operated its own active system of immunity. The failure of passive transfer of immunoglobulins from colostrum is recognised as a major cause of loss due to disease in young calves. The type of management

procedures practiced on newborn calves may play a part in influencing the serum immunoglobulin levels of calves (Selman, et. al., 1971). It has also been reported that suckled calves have higher levels of serum immunoglobulin than calves removed from their dams at birth and fed colostrum by bucket (Mc Beath et. al., 1971).

Therefore, the objectives of this Project were :

(a) To analyse and compare the serum immunoglobulin levels of calves, indirectly through the measurement of total serum protein, reared under different types of farm management systems.

(b) To study and analyse the correlation between the immunological status of calves with mortality and disease occurences..

## LITERATURE REVIEW

### Cattle Industry in Malaysia

Osman (1982), reported that the cattle sector of the livestock industry in the country is still in the infant stage of development. He also wrote that the infant stage of this sector required a firm comittment and financial assistance from the Government.

The production of milk and beef are primarily from the dairy and beef smallholders that are located all over the country. The smallholders are an important sector and economic force in Malaysia. It had been estimated that nearly half of these smallholder farms were less than 1.2 ha. while another 20% of the farms were between 1.2 to 2 ha. in size. (Economic Report, 1974). Smallholders in the context of livestock can be viewed as economic units with relatively small heads of cattle (Naziri et. al., 1976). About 90% of the cattle population in Malaysia are kept by the smallholders (Osman Awang, 1976). The majority of these farms are owned by Punjabi and Indian families. Each family kept about 5 to 30 animals. The other remaining cattle production are from the Government Dairy and Beef farms which have more than 100 heads of cattle.

### Importance of Calves

Gedder (1980) stated that calves are not productive animals but are an investment in delayed return. Davis (1962) wrote that a continuous supply of good quality replacement stocks is

essential if efficient production is to be maintained. Well-grown healthy heifers are the most desirable source of these replacements. The management of the herd replacement begins before the calf is born by providing it with a well-fed, healthy dam. To produce a well-grown, healthy heifer for herd replacement, a proper farm management system starting from the calf immediately after birth, housing/pen structure and sanitation, feeding system, prevention and control of diseases and prompt treatment of diseased animals is essential.

Thuraisingham (1969), reported that in the Malaysian Cattle Industry, the calf has not received much attention especially in the smallholding dairy farms and even in the Government Dairy Farms. The main reason was that the interest was in the lactating cows for milk production. As a result there was no defined system of calf management. Attention given to calves was minimal and only for the necessity to have the calves at foot to stimulate milk letdown in cows of zebu breed; the breed commonly kept by the smallholder dairy farmers.

## Importance of Colostrum

Colostrum of domestic animals represent the accumulated secretion of the mammary gland over the last few weeks of pregnancy together with proteins transferred from the blood stream under the influence of estrogen and progesterone (Tizard, 1977). It is rich in immunoglobulin G (IgG) and IgA but also contains some IgM and IgE. The predominant immunoglobulin in colostrum is IgG. All of the IgG, most of the IgM and about half

of the IgA in bovine colostrum are derived from serum (Tizard, 1977).

In serum, IgG predominates. It plays a major role in antibody-mediated defense mechanism. The second highest is IgM which is secreted by intact plasma cells. It is the major immunoglobulin produced in the primary immune response. The IgA is a minor component in animal serum. It is the major immunoglobulin in the external secretions of the body and is of critical importance in protecting the intestinal, respiratory and urogenital tracts, the udder and the eyes against infection (Tizard, 1977).

Many research workers have shown that adequate levels of colostral immunoglobulins in serum are essential for the survival of the newborn calf (et. al., 1974). The immunoglobulins are acquired by ingestion of the dam's colostrum and subsequent absorption from the small intestine. Immunoglobulins are absorbed efficiently from the small intestine during the first 6 to 12 hours after birth and therefore the calf must have access to colostrum early in life (Kruse, 1970; Selman et. al., 1971). From 12 to 24 hours after birth, the efficiency of absorption decreases rapidly. Maximum level of serum immunoglobulin is reached in the calf at 24 to 48 hours after birth (reviewed by Radostits, 1981).

Passive immunity to some infectious agents is transferred from the cow to calf via colostrum. Efficiency of absorption is decreased when ingestion of colostrum is delayed, indicating the

importance of colostrum intake soon after birth. More important is that, the transmigration of pathogenic bacteria can be prevented by colostrum in the intestinal lumen. (Bush, L.J. and Staley, T.E., 1980).

Kruse (1970), estimated that a certain frequency of hypogammaglobulinaemia cannot be avoided under practical farm conditions due to variations in birth weight, immunoglobulin concentration in colostrum, dose of colostrum, age at first feeding and probably too, the genetically determined ability to absorb immunoglobulin.

Immunological status of neonatal calves and its relationship to disease

Regardless of what system is used, the newborn calf should received adequate colostrum, preferably by nursing the dam for the first 24 to 48 hours after birth, to obtain protection against neonatal infections (reviewed by Donald et. al., 1981). Ingestion of colostrum is no guarantee for protection against infections unless the calf had ingested enough colostrum with adequate levels of immunoglobulins at the right time. In addition, having good pen sanitary conditions is also beneficial to reduce risk of contaminations from microbial infections.

Withers (1952), reported that the mortality rate and incidence of disease varied in herds under different management procedures. He found that there was a higher percentages of mortality in dairy calves as compared to beef and dual purpose calves. He said that the lower death rates in beef herds were

due to the more natural condition of rearing calves which included suckling of the dam. The importance of adequate serum immune globulin concentration has been well established (Gay et. al., 1965; Fisher et. al., 1968; McEwan et. al., 1970b). Calves which obtained colostrum by suckling their dams generally attained higher serum immune globulin concentrations than those calves which were bucket-fed or bottle-fed colostrum (Smith, et. al., 1967; Selman et. al., 1970; and Radostits, 1981).

Logan (1974), found that even in a suckler herd some calves received insufficient colostrum and as a consequence were susceptible to colibacillosis. He observed this when he did a quantitative study on serum immunoglobulin levels in suckled calves from birth to 5 weeks.

The correlation between serum protein and immunoglobulin levels in the neonate and susceptibility to infections has been well established (reviewed by Gay et. al., 1965). Since the quantity of immunoglobulin absorbed by the neonatal calf from its dam's colostrum affects its susceptibility to disease, the estimation of serum immunoglobulin in early life is of clinical importance (McEwan et. al., 1970).

The refractometer test is not a direct measure of immunoglobulin (Ig) but it gives a reasonable, rapid assessment of Ig and could be easily used in the field (McBeath, et. al., 1971).

Naylor, et. al., (1977), in their observations when studying

the plasma total protein measurement for prediction of disease and mortality in calves suggested that 6 gm/dl as a cut-off point in the distribution of plasma total protein concentrations. They found that less disease and no deaths occurred above this value. Alternatively, the cut-off point for serum total protein is 5.5 gm/dl. These workers also found that none of the serum total protein, .zinc sulfate turbidity test and concentration of immunoglobulin measured in 32 calves of the 76 calves was superior to the plasma total protein as a prediction of disease or mortality. Calves with serum total protein 5.5 gm/dl had a significantly ($P<0.05$) higher incidence of disease.

Testing of immunological levels

There have been many methods used to measure the levels of immunoglobulin in calf serum or plasma. These methods are the lens refractometer test (Reid and Martinez, 1965); zinc sulfate turbidity test (McEwan, et. al., 1970); single radial immunodiffusion test (McGuire, et. al., 1976); serum electrophoresis and sodium sulphite precipitation test (Pfeifer and McGuire, 1977). The zinc sulfate test and the single radial immunodiffusion are a more specific test for measuring the immunoglobulin, whereas the other tests measure indirectly, the serum or plasma immunoglobulins by measuring the total serum/plasma proteins. The commonly used methods are the lens refractometer test and the zinc sulfate turbidity test.

The serum protein of calves make up 6% to 7% of serum weight. The serum protein constitutes albumin and globulin.

The albumin makes up 55 to 64% of the total serum protein. The globulin fraction makes up 33 to 49.7% of total serum protein. The globulin consists of alpha (11.2 to 17.3%), beta (11.6 to 15.2%) and gamma (10.1 to 17.2%) components (Carpenter, 1965). The bovine serum has 85 to 90% of IgG and less than 10% IgM (Klaus, et. al., 1969). It has been reported (Anon, 1969) that there is a close relationship between the gammaglobulin and total serum protein. Antibody activity is only found in the globulin fraction of blood serum specifically, in the gamma and beta globulin fraction. No antibody activity is found in the albumin or alpha globulin fractions (Herbert, 1974).

## MATERIALS AND METHODS

This study was carried out for a duration of five weeks from November - December, 1988.

### Calves

Calves used in this study were from three different types of farms; the Universiti Pertanian Malaysia (UPM) Dairy and Beef Farms and the smallholder Dairy Farms which were located outside the UPM campus area, within a radius of 10 - 40 km. The calves were mostly within the age of one week but several calves were more than one week but less than one month of age.

### Farm visits

Visits were made to each of the farm and a similar set of

questions (Appendix 1) were asked about the farm management routine, particularly the management of calves immediately after birth, how the calves were fed colostrum, ages of the calves when sampled, dam parity and the farm hygiene, particularly the sanitary condition of the calf pens. The type of calf pen either individual or group pen, elevated or level ground and whether cemented or just soil ground were also noted.

Subsequent visits were made to each of the farm to check on the calves and the clinical history of each sampled calf was noted, that is whether scouring had occurred, if treatment took place and the subsequent fate of the calf. The subsequent visit to the UPM Beef and Dairy Farms were made at least twice a week. Whereas, that to the smallholders were made only once, that is, about a month after the first visit.

Serum sample

There were two group of serum samples analyzed in this study. They were serum samples collected during the study period (Nov-Dec, 1988) and stored serum samples kept in a freezer at - 20 $^{o}$C, which were collected between march to August, 1984.

Blood samples were collected from calves through venepuncture of the external jugular vein using venoject needles (Terumo + Corporation, Tokyo, Japan) into a 10 ml plain evacuated tubes (Terumo + Corporation, Tokyo, Japan). The first collection of the blood sample from a calf was taken at the first visit to

the farm. A second blood sample was collected if necessary, two weeks after disease signs were observed from affected calves in the study group. The blood samples were allowed to clot at room temperature for at least one hour and the sera separated by centrifugation at 3,000 - 5,000 rpm for at least 20 to 30 minutes. The sera was then pipetted into a plastic tube, was labelled with the calf's number and date of sampling. These tubes were kept in a freezer at -20°C until used.

Methods of measuring immunoglobulins

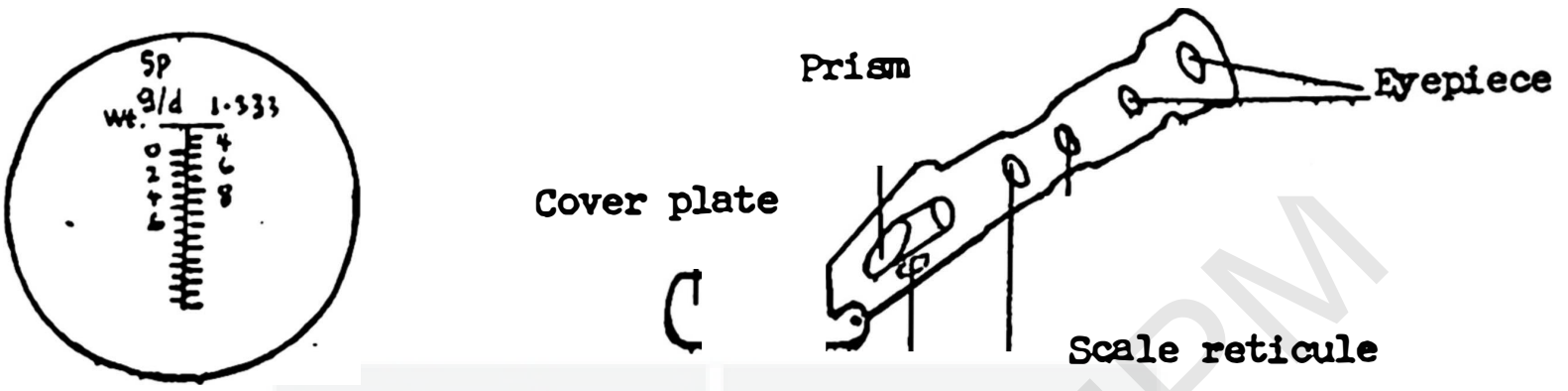
a) Refractometer Test (All samples collected were read)

The refractometer test measures indirectly the immunoglobulin fractions in the blood serum or plasma by measuring its refractive index. The refractive index of serum or plasma is determined by its concentration which in turn depends particularly upon the protein concentration. The protein forms the major component of the blood serum or plasma and the immunoglobulin fractions make up only approximately one-third of the total protein (McBeath, et. al., 1971).

Prior to serum protein measurements the readings were checked by placing a few drops of deionised distilled water on the face of the prism, closing the cover plate and focusing the scale (Fig. 1). If it waas correct, the boundary line created by water would fall on the weight line. If not, the boundary line was adjusted to coincide

with the weight line by turning a screw.

Figure 1 : Lens Refractometer




The cover plate and prism face were then wiped dry with soft tissue paper. A few drops of the serum sample were applied to the prism's face and then the serum protein scales were read (McBeath, et. al., 1971).

b) Determination of serum globulin

Only 30% of the collected serum samples were analysed for serum globulin. These samples were selected randomly from each group of samples which were grouped according to their range of total serum protein value which were determined by the refractometer test.

The serum albumin was determined by performing the Bromocresol Green Test using a commercial test kit (Roche® reagent) which contained Bromocresol green, sodium hydroxide, acetic acid and Brij 35.

The principle of this test is that when the albumin in

the serum is mixed with Bromocresol green, the Bromocresol green will change colour.

The absorbance readings of the albumin in the serum was taken using the spectrophotometer at wavelength of 578 nm. Before it was used, the reading had to be zeroed by using a blank containing the reagent (Roche reagent). A 'test' tube containing a mixture of 4 ml reagent plus 0.01 ml serum was mixed thoroughly and straight away the reading was taken. The albumin value for each serum sample was obtained by multiplying with a factor 10.9. The total serum protein value by lens refractometer minus the serum albumin value will give the globulin fraction of the serum protein.

Farm Records

Farm records from the UPM Beef and Dairy Farms were also analysed to determine the mortality percentages, causes of death and also the parity of the dams.

Statistical analysis

Statistical analysis using student 't' test was used to test for significance difference.

RESULTS

Three different types of farm which were different in terms of their farm management practices, particularly those involving the calves starting immediately after birth were discussed here.

The three farms were the UPM Beef and Dairy and smallholders dairy farms. More attention were given to the type of farm management, feeding and feeds of the animals, housing and sanitary conditions of the farm particularly the sanitary conditions and structure of the calf pens.

## THE FARMS

### a) The UPM Dairy Farm

This is the university's dairy farm which was first established in 1976 and is located on an area of 97.13 hectares (240 acres) within the university campus. The unit practiced a semi-intensive system of management. At present there are about 256 heads of cattle. The animals reared were mainly crossbreds. They were crossbreds of Friesian-Local Indian Dairy (LID), Jersey-LID, Friesian-Sahiwal and Australian Milking Zebu (AMZ)-Jersey. Besides these, there were a few purebred LID animals.

### b) The UPM Beef Farm

The UPM Beef Farm is situated on an areaa of 140 hectares and is located adjacent to the Dairy Farm. An extensive system of management is practiced. The beef breeds reared are mostly the purebred local Kedah-Kelantan (KK) and few crossebreed like the Hereford - Jersey, Brahman-Hereford, LID-KK and LID-Hereford.

c) Smallholders' Dairy Farms

The smallholders Dairy Farms were mainly owned by Punjabi and Indian families. They reared up to 40 heads (5 - 40 heads) of cattle. They practiced a semi-intensive system of management. The farms were located within 10 to 40 km from UPM. These animals were reared either as their main or just as a side occupation to supplement the family's income by the sale of milk as well as meat. Nine of the 10 smallholders' Dairy Farms visited during the study had similar types of management routine, particularly the management of calves immediately after birth until weaning time.

Management of calves immediately after birth

a) UPM Dairy Calves

The calves were immediately separated from their dams after birth. They were then put in a wooden individual calf pen. They were kept here until they were weaned off at 90 days of age. Colostrum was milked immediately from the dam after parturition and fed immediately to the calves. The calves were bottle-fed colostrum twice daily, that is, in the morning for 5 to 10 minutes and again in the afternoon for more than 10 minutes. The colostrum was fed for a period of 3 to 4 days. On the fourth or fifth day the calves were started on cow's milk or a mixture of cow's milk and milk replacer in the same way as it was given colostrum.

b) UPM Beef Calves

The calves in the beef farm were allowed to be with the dam until they were weaned at the age of 8 to 9 months. There was no proper housing for the beef calves. The calves were kept together with their dams in an open paddock near the farm building and cattle yard where supervision can be done easily. During the 8 months the dam were kept in the paddock with their calves, rotational grazing was practiced. This was carried out to avoid overgrazing of one section of the paddock as well as over contamination of the paddock with parasite eggs excreted in the feces of affected adults.

c) Smallholder Dairy Calves

Each of the farm visited reared their own calves until they were weaned off and after which they were either selected as replacement for the existing herd or sold off. The calf management practices of these farms were similar to one another, in that the calves were allowed to suckle their dams for at least 24 to 48 hours after calving. After this period, they were either grouped in calf pen, each pen housing 5 to 10 calves or they were just tied to one corner of the cattle shed. The calves were then only allowed to suckle their dams twice daily once between 7.00 a.m. to 8.00 a.m. and again between 3.00 to 4.00 p.m., that is, at milking time. Calves were allowed to suckle for about 5 to

10 minutes before milking the dam to help in milk letdown and further 10 to 30 minutes after milking.

## The Farm Systems

### (1) Feeding System

#### a) UPM Dairy Calves

Feeding of calves were done twice daily. Newly born calves were bottle-fed with colostrum at 10% bodyweight total feed per day for a period of about 3 to 4 days. Refer to Table 1 for the feeding schedule of calves up to 90 days of age at UPM, Dairy Farm. The concentrates given were a mixture of 70% palm kernel cake (PKC), 20% maize and 10% soyabean. They were given either in the form of pellets or the crushed form which were then mixed with milk before they were offered to the calves.

Table 1 : Calf Feeding Schedule at the UPM Dairy Unit.

| Age (days) | Amount of Feed Given | | | |
|---|---|---|---|---|
| | Liquid Feed | | Concentrate | Grass |
| | Source | % bwt/day | gm/day | ad libitum |
| 1 - 4 | Colostrum | 10 | | No |
| 5 - 30 | Fresh Milk | 10 | 150 | Yes |
| 31 - 60 | Milk Replacer | 10 | 150 - 300 | Yes |
| 61 - 70 | Milk Replacer | 7.5 | 350 | Yes |
| 71 - 80 | Milk Replacer | 5.0 | ↓ | Yes |
| 81 - 90 | Milk Replacer | 2.5 | 700 | Yes |

The amount of concentrates given was increased as the calves grew older.

b) UPM Beef Calves

As mentioned earlier, the beef calves were kept with the dams from the time of birth until weaning at the age of about 8 months in the nearby paddocks. In this type of system, each calf had the advantage of suckling its dam at any time, that is, largely influenced by its instinct. The calves also ate anything that were offered to the dam, for example, concentrates. At the same time they had the chance to graze at an early age as they were exposed to the grass immediately after birth.

c) Smallholders Dairy Calves

Table 2 shows that in all the ten farms visited, the calves were allowed to suckle colostrum and milk. The calves were allowed to suckle the colostrum for a period of up to 4 days. During the first day of life the calves were left with their dam in the hope that the calves would suckle enough colostrum. Most of the farmers realised how important the colostrum was to the calves' health and future performance. During the second day the calves were separated for a while from the dam when the dams were let out to graze. The unique observation in the smallholders' dairy farms was that the calves were allowed to suckle their dam for about 5 to 10 minutes before the actual milking process. This was done to stimulate milk letdown through the suckling reflex. Most of the farmers allowed the calves to suckle their dams for milk up to 7 months of age, that is two months before the dams were ready to calve down again. Feed supplements were also offered to the calves to acclimatize them to solid diet. Feed supplements offered were cut grasses, soyabean waste, rice bran, wheat bran, palm kernel cake, palm oil sludge and brewers grain. The ages of calves when the feed supplements were offered varied between the farms. These feed supplements together with water supply were given ad Libitum.

Table 2 : The calf feeding procedures of the UPM Dairy and the 10 smallholder Dairy Farms.

| Feeding Procedures | UPM Dairy | Smallholder Dairy No. of Farms |
|---|---|---|
| **A) COLOSTRUM** | | |
| 1) Methods of feeding - suckled | | 10 |
| - bucket/bottle-fed | | |
| 2) Frequency and duration of feeding | | |
| a) Whole day with dam (1st. 2 days) | | 10 |
| b) 2x/day (i) morning: 5-10 mins. | ✓ | 9 |
| : >10 mins. | | 1 |
| (ii) afternoon: 10-15 mins. | ✓ | 2 |
| : >15 mins. | | 8 |
| 3) Total length of feeding : 1 to 2 days | | 4 |
| : 3 to 4 days | ✓ | 6 |
| **B) MILK** | | |
| 1) Methods of feeding - suckled | | 10 |
| - bucket/bottle-fed | ✓ | 0 |
| 2) Frequency and duration of feeding | | |
| 2x/day (i) morning: 5-10 mins. | ✓ | 9 |
| : >10 mins. | | 1 |
| (ii) afternoon: >10-15 mins. | ✓ | 2 |
| : >15 mins. | | 8 |
| **C) FEED SUPPLEMENTS** | | |
| 1) Types - cut grasses + bread | | 5 |
| - cut grasses + soyabean waste + rice bran | | 2 |
| - grazing or cut grasses only | | 2 |
| - cut grasses + PKC | ✓ | 1 |
| 2) Age when given | | |
| (i) < 1 week | | 4 |
| (ii) ≥ 1 week | | 5 |
| (iii) > 1 month | ✓ | 1 |

B) Housing System

a) UPM Dairy Farm

As mentioned earlier, newly born calves in this farm were separated from their dams immediately after birth. They were then put in a wooden individual pen measuring approximately about 0.8 m x 1.45 m or 1.16 $m^2$ for a period of 90 days. The pens were located next to each other with a distance of 64.0 cm between two rows of calf pens (Table 3) A drain was located about 61 cm to 91 cm on one side of the pens. The calf pens were arranged in such a way that the front of one pen is facing the back of the other pen. The space allocated for the feed and water trough was approximately 80 cm x 30 cm. The feeding troughs were made of wood and measured about 23 cm width x 14 cm height x 36 cm lenght. A 2 litre pail was used as a water trough.

Table 3 : Description of the calf pen in the UPM Dairy and in the smallholders dairy farms.

| CALF PEN FACTORS | | UPM Dairy | Smallholder Dairy No. of Farms |
|---|---|---|---|
| 1) a) Individual Pens | | ✓ | |
| b) Group Pen | (i) ≤ 5 calf/pen | | 5 |
| | (ii) > 5-10 calf/pen | - | 2 |
| 2) Level ground flooring | (a) concrete floor | | 5 |
| | (b) wooden floor | | 1 |
| | (c) trampled ground | | |
| 3) Elevated flooring | (a) slatted | ✓ | 1 |
| | (b) non-slatted | | |
| | (c) base | Concrete | Soil |
| 4) Pen size ($m^2$) (Group pen) | (a) 10-20 $m^2$ (mean 14.67 $m^2$) | | 3 |
| | (b) 20-30 $m^2$ (mean 24.88 $m^2$) | | 4 |
| 5) Space per calf ($m^2$) | (a) 1.0-2.0 $m^2$ (mean 1.47 $m^2$) | ✓ (1.16 $m^2$) | 3 |
| | (b) 2.0-3.0 $m^2$ (mean 2.94 $m^2$) | | |
| 6) Distance from cowpen | (a) attached/adjacent | ✓ | 4 |
| | (b) different building | | 3 |
| 7) Pen floor | | | |
| (a) gap size between slats : 2.54 - 5.08 cm | | ✓ | 1(3.81 cm) |
| (b) Slats size | (i) 1 cm x 2 cm | ✓ | |
| | (ii) 1 cm x 4 cm | | 1 |
| (c) Height of pen floor from the ground | (i) 25.0 - 33.0 cm | | 1(30 cm) |
| | (ii) 34.0 - 43.0 cm | ✓ | - |

b) UPM Beef Farm

In this farm, there were no calf pens as the newly born calves were kept together with their dams in an open paddock nearby the yard until they were ready to wean off at 8 months of age. The only shelter from rain, wind and sunlight were provided by the trees that were found in the fields.

c) Smallholders' Dairy Farm

Seven of the ten farms visited had calf pens built especially for the newly born calves and those below 6 months. The remaining 30% farms do not have proper calf pens. They only tied their calves to poles/posts found in the cattle shed. The calves were tied to the milking shed and brought to their dams only during feeding time. Most of the pens built in the seven farms were group pens which can house up to 10 animals (Table 3). The farms which had no proper calf pens had their calves housed together with adult animals or were just tied to one section of the milking area in the cattle shed.

DISEASE CONTROL PROGRAM

Table 4 shows the various disease control program.

a) Vaccination

The UPM Beef and Dairy Farms had a similar

vaccination program. Brucellosis vaccine is only given to female calves once at 6 months of age. Heamorrhagic septicaemia vaccine was given at 6 months of age and a booster dose was given 6 months later. The first dose of the Foot and Mouth (FMD) vaccine was given at 3 months of age and a booster dose every 6 months, there on.

There is no proper vaccination program in all the smallholder farms visited. The animals that may have been vaccinated are those animals that had been loaned to the farmers by the Government which had been vaccinated first before they were distributed out to the farmers. Some of the farmers have no knowledge of their animals vacination status.

Table 4 : Disease Control Program

| Program | UPM Beef | UPM Dairy | SH Dairy |
|---|---|---|---|
| 1) Vaccination Program | | | |
| a) Brucellosis | + | + | |
| b) Haemorrhagic Septicemia | + | + | |
| c) Foot and Mouth Disease (FMD) | + | + | |
| 2) Medication Program | | | |
| a) Deworming | + | + | + |
| b) Deticking | + | + | |
| 3) Sanitation Program | | | |
| a) Cleaning of pen | + | + | |

b) Calf Pen Sanitation Program

UPM Dairy Farm

Table 5 shows the frequency of pen cleaning and methods of disposal of feces. The pens were cleaned only in the morning, after feeding. They were washed by flushing the pen floor with a hose and using water pumped from a pond. The washing was carried out with the calf still in the pen. The faeces was washed-off into a drain close to the calf pen. No disinfectant was used during the cleaning of the pens.

UPM Beef Farm

No sanitary procedures practiced as there were no calf pens.

Smallholders' Dairy Farms

Table 5 shows the frequency of pen cleaning and methods of disposal of faeces. The farms that practiced once daily cleaning were those farms which cleaned the calf pens only when they appeared soiled with calf faeces. Those that practiced twice daily cleaning, did the cleaning after the morning and afternoon feeding of calves. The farm that practiced once a week cleaning of calf pens were those farms that had group calf pens. These pens had floors that were elevated either over soiled ground or concrete floor. The pen floors were covered with cut grass as bedding material. The faeces was disposed off by being scooping out with a spade and heaped in one area of the farm.

Table 5 : Frequency of pen cleaning and methods of faecal disposal

| Types of calf pens | No. of smallholder farms | | |
|---|---|---|---|
| | Group Pen | Housed with adults | UPM Dairy |
| A. Frequency of Cleaning | | | |
| 1) Daily a) 1x/day | 2 | | |
| b) 2x/day | 3 | | |
| 2) Weekly a) 1x/week | 3 | | |
| b) 2-3x/week | | | |
| B. Methods of faecal disposal | | | |
| a) Wash off | 4 | 2 | ✓ |
| b) Scoop out | 4 | - | |

HUMAN FACTORS

Personnel looking after calves

a) UPM Dairy Farm

One personnel was allocated to look and take care of the calves. He did all the work from feeding to cleaning of the pens.

b) UPM Beef Farm

No special personnel were allocated to look after the calves as they were always with the dam.

c) Smallholder Dairy Farms

In the smallholder farms, different members of the family took care of the calves. There were no special attention given to the calves. Attention was only given when the calves were allowed to suckle the dam before milking to stimulate milk letdown.

ANIMAL FACTORS

a) Immunological Status of Calves

Table 6 shows the distribution of calves from the three types of farms (the UPM Beef and Dairy and the smallholders' Dairy Farms) according to their range of Total Serum Protein readings taken by the lens refractometer.

In the year 1984, about 60 of the 98 UPM Beef Calves sampled had total serum protein (T.S.P.) between 6.1 and 8.0 gm% while in 1988, 16 of the 34 beef calves sampled had T.S.P. between 4.1 and 8.0 gm%. In 1984, about 9 of the 18 UPM dairy calves sampled were distributed between 4.1 and 6.0 gm%. While in 1988, 4 of the 10 UPM Dairy Calves were distributed between 6.1 and 8.0 gm% T.S.P.

For the smallholders, 17 of the 33 calves sampled in 1988 had T.S.P. between 4.1 and 6.0 gm%.

Table 6 : Distribution of calves according to their Total Serum Protein Values.

| Types of farms | UPM Beef (1984) | | UPM Beef (1988) | | UPM Dairy (1984) | | UPM Dairy (1988) | | SH Dairy (1988) | |
|---|---|---|---|---|---|---|---|---|---|---|
| T.S.P. (gm%) | No. of Calves | % | No. of Calves | % | No. of Calves | % | No. of Calves | % | No. of Calves | |
| 2.0 - 4.0 | 0 | 0 | 1 | 3.0 | 3 | 16.7 | 0 | 0 | 4 | 12.1 |
| 4.1 - 6.0 | 29 | 28.6 | 16 | 47.1 | 9 | 50.0 | 3 | 30.0 | 17 | 51.5 |
| 6.1 - 8.0 | 60 | 61.2 | 16 | 47.1 | 5 | 27.8 | 4 | 40.0 | 12 | 36.4 |
| 8.1 - 10.0 | 9 | 9.1 | 1 | 2.95 | 1 | 5.6 | 3 | 30.0 | 0 | 0 |
| Total No. of Calves | 98 | | 34 | | 18 | | 10 | | 33 | |

Note : All sera were taken from calves within 48 hours of life for both UPM beef calves and dairy calves.

Table 7, shows the mean ± S.D. of the total serum protein, albumin and globulin level in calves. The total serum protein concentration of the UPM Beef Calves in 1984 was significantly ($p<0.05$) higher than the total serum protein concentration of UPM Beef Calves in 1988.

The total serum protein concentration of UPM Beef Calves in 1984 was also significantly higher ($p<0.05$) than the total serum protein concentration of UPM Dairy Calves in 1984. In 1988, there was no significant difference between the total serum protein concentration of the UPM Beed and UPM Dairy Calves. For the UPM Dairy Calves, there was no significant difference between the total serum protein concentration of calves in 1984 and 1988. Both the total serum protein concentration of the UPM Beef and Dairy Calves in 1988 was significantly higher ($p<0.05$) than the total serum protein concentration of the Smallholders' Dairy Calves in 1988.

Table 7 : Serum Protein of Calves

| No. of Calves | 36 | | 12 | | 9 | | 3 | | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Types of Calves | UPM Beef (1984) | | UPM Beef (1988) | | UPM Dairy (1984) | | UPM Dairy (1988) | | SH Dairy (1988) | |
| Serum Proteins | Mean | ± S.D. | Mean | ± S.D. | Mean | ± S.D. | Mean | ± S.D. | Mean | ± S.D. |
| 1) Total serum protein (gm%) (TSP) | 7.01 | 1.09 | 6.35 | 1.15 | 5.8 | 2.07 | 7.07 | 1.79 | 5.08 | 1.27 |
| 2) Serum Albumin (gm%) | 1.16 | 0.36 | 1.33 | 0.28 | 1.01 | 0.39 | 1.00 | 0.03 | 1.19 | 0.34 |
| 3) Serum globulin (gm%) (TSP - Albumin) | 5.85 | 1.16 | 5.02 | 1.30 | 4.79 | 2.06 | 6.07 | 1.78 | 3.89 | 1.08 |
| 4) Albumin Globulin (A:G) | 0.23 | 0.11 | 0.29 | 0.14 | 0.29 | 0.12 | 0.18 | 0.06 | 0.31 | 0.09 |

Figure 2, shows the relationship between the total serum protein and serum globulin by linear regression.

b) Parity of dams

Table 8, shows the distribution of dams according to their parity number.

From this table, there seems to be no definite relationship between the parity number of dams with the total serum protein of calves from both the UPM Beef and Dairy Farms in the years 1984 as well as 1988.

Fig. 2 · Relationship between total serum protein and serum globulin of UPM Beef calves (A), UPM Dairy calves (B) and Smallholder Dairy calves (C) by linear regression.

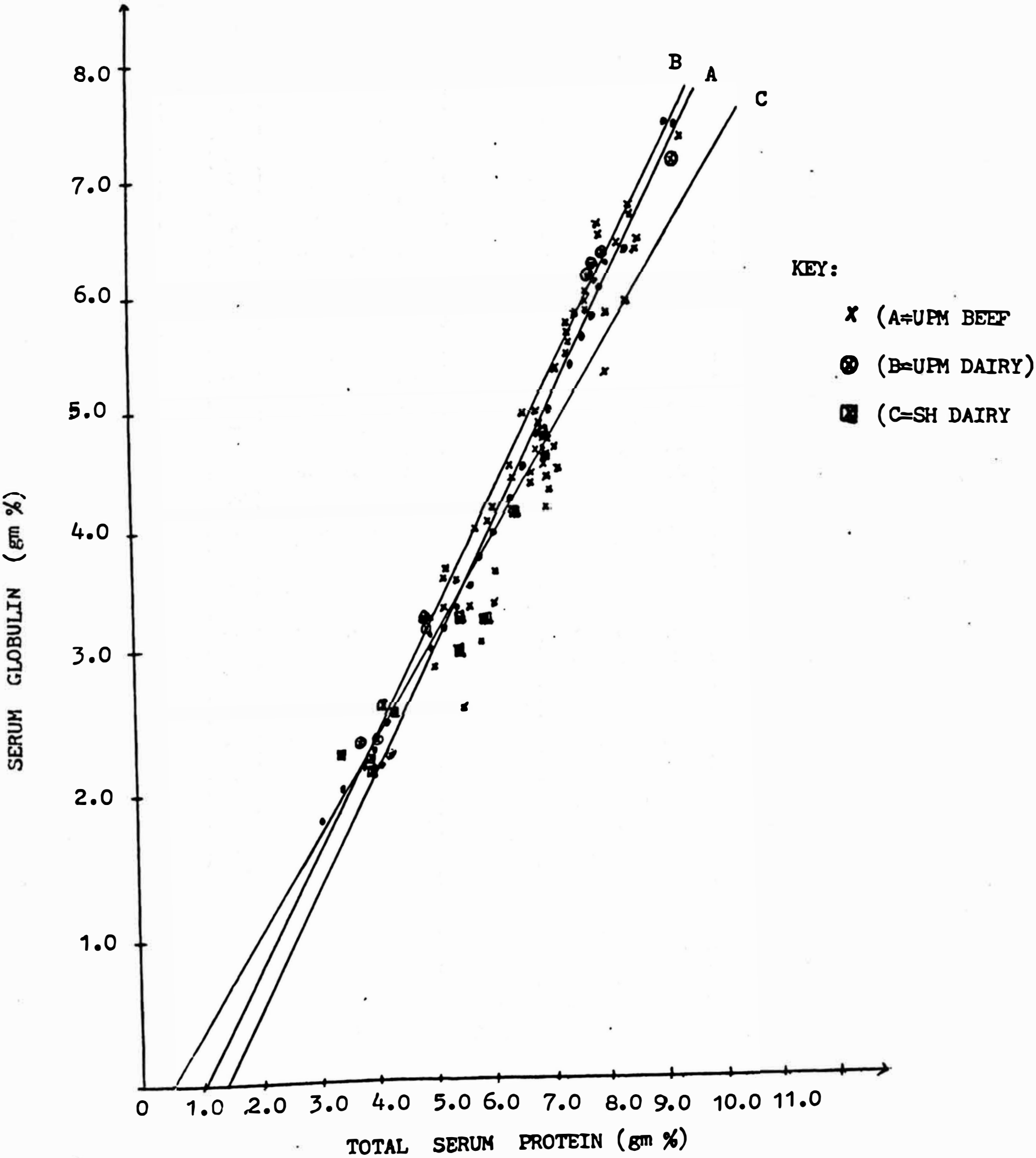


Table 8 : Parity number of cows in the UPM Beef and Dairy Farms for the year 1984 and 1988.

| Year | Parity Number | UPM Beef | | | UPM Dairy | | |
|---|---|---|---|---|---|---|---|
| | | No. of cows (%) | TSP (gm%) | Globulin (gm%) | No. of cows (%) | TSP (gm%) | Globulin (gm%) |
| 1984 | 1 | 14 | 6.8 | 5.4 | 3 | 6.2 | 4.9 |
| | 2 - 4 | 20 | 7.2 | 6.1 | 5 | 6.0 | 4.9 |
| | 5 | 2 | 7.6 | 6.6 | 1 | 4.0 | 2.9 |
| Total no. of dam (calves) | | 36 | | | 9 | | |
| 1988 | 1 | 5 | 6.4 | 5.2 | | | |
| | 2 - 4 | 5 | 6.2 | 4.9 | 2 | 6.6 | 5.6 |
| | 5 | 2 | 6.6 | 5.3 | 1 | 8.0 | 7.02 |
| Total no. of dam (calves) | | 12 | | | 3 | | |

c) Disease status of calves

UPM Dairy Farm

The UPM Dairy Farm has had exposure to a number of disease problems. The calves were most commonly affected with navel-ill, calf scour, pneumonia, endoparasitism and coccidiosis (Table 10). Most of the calves, especially those below one month old that suffered from these diseases will eventually die due to either dehydration, septicamia or due to respiratory failure. Table 9 shows the annual mortality percentages of one-month old calves.

UPM Beef Farm

The beef calves like the dairy calves were already exposed to several diseases like calf scour, endoparasitism, navel-ill and pneumonia. Surprisingly, the common cause of death in the beef calves was starvation due to deprivation of colostrum or milk. Table 10 shows the common causes of death in calves up to one month of age at the UPM Beef and Dairy Farms.

Table 9 : Annual mortality percentages of one month old calves in the UPM Beef and Dairy Units.

| Year | UPM Beef | | | UPM Dairy | | |
|---|---|---|---|---|---|---|
| | Total No. of calves born | No. of Calves died | Mortality % | Total No. of calves born | No. of Calves died | Mortality % |
| 1983 | 183 | 11 | 6.0 | 82 | 6 | 7.3 |
| *1984 | 217 | 5 | 2.3 | 81 | 3 | 3.7 |
| 1985 | 204 | 8 | 3.9 | 69 | 5 | 7.3 |
| 1986 | 166 | 4 | 2.4 | 79 | 4 | 5.1 |
| 1987 | 212 | 3 | 1.4 | 63 | 5 | 4.9 |
| *1988 | 200 | 2 | 1.0 | 60 | 4 | 6.7 |

* The year when the calves' serum sample were taken.

Table 10 : Common causes of mortality in calves up to 1 month of age.

| Causes of Death | Year | UPM Beef | | | | UPM Dairy | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0-7days | 8-14days | 15-30days | Total (%) | 0-7days | 8-14days | 15-30days | Tota (%) |
| ) Diarrhoea & Dehydration | 1983 | - | 1 | 5 | 6(55) | - | - | 3 | 3(50 |
| | 1984 | - | 1 | 2 | 3(60) | - | - | 1 | 1(1 |
| | 1985 | 2 | - | 3 | 5(62) | - | - | 1 | 1(20 |
| | 1986 | - | - | - | - | - | - | 1 | 1(25 |
| | 1987 | - | 1 | - | 1(33) | 1 | - | 2 | 3(60 |
| | 1988 | 1 | - | 1 | 2(100) | - | 1 | - | 1(33 |
| Respiratory Disease | 1983 | - | - | - | - | 1 | - | - | 1(1 |
| | 1985 | - | - | 1 | 1(13) | 1 | - | 1 | 2(40 |
| | 1986 | 1 | - | - | 1(25) | - | - | 1 | 1(25 |
| | 1987 | - | 1 | - | 1(33) | 1 | - | - | 1(20 |
| | 1988 | - | - | - | - | - | - | 1 | 1(33 |
| Deprived of Colostrum/Milk | 1983 | 1 | - | 1 | 2(18) | - | - | - | - |
| | 1984 | 1 | 1 | - | 2(40) | - | - | - | - |
| | 1988 | - | - | - | - | 1 | - | - | 1(33 |
| Still Birth | 1983 | 1 | - | - | 1(9) | 2 | - | - | 2(33 |
| | 1986 | - | - | - | - | 1 | - | - | 1(25 |
| | 1988 | - | - | - | - | 1 | - | - | 1(33 |
| Septicemia | 1984 | - | - | - | - | 1 | - | - | 1(1 |
| | 1985 | - | - | - | - | 1 | - | - | 1(20 |
| | 1986 | - | - | - | - | - | - | 1 | 1(25 |
| | 1988 | - | - | - | - | - | - | 1 | 1(33 |
| - | | | | | | | | | |
| Others | 1984 | - | - | - | - | 1 | - | - | 1(1 |
| Heart Problem | 1987 | - | - | - | - | - | - | 1 | 1(20 |
| Babesiosis | 1986 | - | 1 | - | 1(25) | - | - | - | - |
| Mycotic Rumenitis | 1985 | - | - | - | - | - | - | 1 | 1(20 |
| Unknown | 1983 | - | - | 2 | 2(18) | - | - | - | - |
| | 1985 | 2 | - | - | 2(25) | - | - | - | - |
| | 1987 | - | - | 1 | 1(33) | - | - | - | - |
| Total | 6yrs | 9 | 6 | 16 | 31 | 12 | 1 | 15 | 28 |

Note: 1) Those years that are missing, no death recorded.
2) Refer to Table 9 for the number of calves died in each year.

Smallholder Dairy Farms

The common diseases encountered and the percentage mortality could not be determined as there were no proper records kept.

Of the ten farms visited, two had problems of navel-ill. In both of these farms, the calf pens were observed to be always wet with urine and faeces of calves as the farms clean the calf pens only when they got very dirty.

Another farm had a calf that had a slightly severe skin disease. Microbiological examination revealed it to be caused by a fungus, Trichophyton schenkii.

d) The second objective of this study was to study the relationship between the calf total serum protein level and mortality and disease occurence.

Unfortunately, of all the 193 calves sampled both in 1984 and 1988 from the 3 types of farms, the three calves that died were recorded only from the UPM beef farm in 1984.

The beef calves that died showed a total serum protein of 5.7 gm% at one day of age and 6.5 gm% at 2 days of age. Both of these total serum protein means were lower than the means of total serum protein (T.S.P. = 7.01 $\pm$ 1.09 gm%) of beef calves recorded in 1984 (Table 11).

Table 11: Details on sampled UPM beef calves in 1984 which died.

| Identification of calves | Total serum protein (gm%) Age at sampling 1 days | 2 days | Age at death(days) | Clinical Disease | Etiology |
|---|---|---|---|---|---|
| 4143 | 4.0 | 7.0 | 12 | weak, thin and dehydrated | starvation |
| 4154 | 7.4 | 6.8 | 53 | diarrhoea | endoparasitism |
| 4225 | 5.6 | 5.6 | 47 | diarrhoea | endoparasitism |

# DISCUSSION

Proper care and management of calves when they were still very young, starting from the day of birth would greatly influence the calves' future health status and growth performances. The types of farm management practiced, especially management of newly born calves right after birth would greatly influence the amount and time of ingestion of colostrum. This would indirectly influence the amount of colostrum absorbed from the gut into the systemic circulation to provide protection against neonatal infection. It was reported that the serum immunoglobulin levels of calves were influenced by their management in early life (Selman, et. al., 1971).

Colostrum contains immunoglobulin (IgG, IgM, IgA and IgE) and it is very important to ensure that newly born calves that are agammaglobulinaemic to ingest adequate colostrum to acquire passive immunity against neonatal infections. The importance of colostral immunoglobulin for the survival of the neonatal calf has been established (Fisher et. al., 1968 and McEwan et. al., 1970).

The results (Table 7) obtained from this study showed that the total serum protein concentration (TSP = 7.01 ± 1.09 gm %) of UPM beef calves sampled in 1984 which were

allowed to suckled their dams at will was significantly higher ($P < 0.05$) than the total serum protein concentration (TSP = 5.8 ± 2.07 gm %) of UPM dairy calves sampled in 1984 which were bottle - fed colostrum and milk. But in 1988, there was no significance difference in the total serum protein concentration of the UPM beef and dairy calves. The results obtained for the two years (1984 and 1988) were different and thus were not consistent with the result obtained elsewhere by McBeath et. al., (1971) who reported that the total serum protein of suckled beef calves was significantly higher than the dairy calves which were bottle-fed colostrum. The total serum protein concentration (TSP = 5.08 ± 1.27 gm %) of the smallholder dairy calves was significantly lower ($P < 0.05$) than the total serum protein concentration of the UPM beef and dairy calves, in 1988.

However, the total serum protein concentration of the three types of calves were still within the cut-off point of 5.5 gm% (Naylor et. al., 1977) of serum total protein of calves.

The difference in result of the total serum protein concentration of the same type of calves between the two years could be due to several reasons;

a) Breed factors

In 1984, the breeds of cattle reared were the local Kedah - Kelantan (KK) and the crossbred like the Hereford - Brahman, Hereford - Jersey, LID - KK and Hereford - LID but in 1988, the beef breed of cattle reared were majority of the local Kedah - Kelantan. This could be the reason why the mean total serum protein of beef calves in 1988 were lower than in 1984.

b) Management factors

There could also be some differences or changes in the farm management within the four year period (1984 to 1988) either an increase or decrease in the standard of farm management particularly the management of newborn calves, feeds and feeding of dams as well as the calves. The type and quantity of feeds given to the dams in gestation period would have effects on the quantity and quality of colostrum produced. Although diet has not been demonstrated to have any effect on the concentration of gammaglobulin in colostrum, it does have a marked influence by increasing the yield of colostrum.

Eventhough the total serum protein of UPM beef calves was significantly higher than the total serum protein of UPM dairy calves taken in 1984, but in 1988

there was no significant difference between the total serum protein of UPM beef and dairy calves. There was no significant difference in the total serum protein of beef and dairy calves in 1988 eventhough grossly, the total serum protein of UPM dairy calves was higher than the beef calves in 1988. The reason maybe because the number (n) used for statistical analysis was too small to show any statistical significancy of the difference between the two means of the total serum protein concentrations.

The results also shows that the UPM dairy calves had total serum protein concentration (TSP = 7.06 ± 1.79 gm %) sampled in 1988 which was bottle - fed colostrum was significantly higher ($P < 0.05$) than the total serum protein concentration of smallholder dairy calves which were allowed to suckle their dams for colostrum most of the day for the first two days of birth. The calves were only temporarily separated from the dams when the dams were let out to graze in the morning. Several factors could be the cause to the total serum protein concentration of the smallholder dairy calves being significantly lower ($P < 0.05$) than the total serum protein concentration of UPM dairy calves. These factors maybe as follows:

a) There was little attention and no defined management system given to the newly born calves to make

sure that they suckled enough colostrum. Attention were only given to the newborn calves because of the necessity to have them at foot to stimulate milk letdown in dams (Thuraisingham, 1969). As mentioned earlier, eventhough the UPM dairy calves were immediately separated from their dams after birth and kept in individual calf pen, at the same time they were immediately bottle - fed colostrum. These calves were monitored closely to ensure that they ingested enough colostrum for the first 24 hours of life.

b) Breed of dairy cattle involved could also be one of the reason why the total serum protein of the UPM dairy calves was higher than the smallholder dairy calves. The breed of dairy cattle in the UPM dairy farm were the exotic crossbreds (Friesian crosses) whereas for the smallholder dairy farms the predominant breed reared were the pure Local Indian Dairy (LID) and their crosses. The use of exotic breeds of dairy cattle as well as good nutrition and management of cows at the UPM Dairy Farm, may contribute to the higher total serum protein concentration.

c) The smallholder dairy calves, eventhough allowed to suckle their dams for about 5 to 10 minutes before the cow was milked and then again for 15 to 30 minutes after milking, their total serum protein still remained lower

than those of the UPM dairy calves. The reason could be because the time for the calves to suckle their dams is shorter and they may not get anough colostrum before the cow is milked down. Eventhough they were allowed to suckle their dams after milking, the milk left in the udder may not be enough for the calf.

From the result of the present immunological studies indirectly through the total serum protein concentration, it could be said that the type of farm management procedures practiced in the farm especially concerning the management of calf after birth, time and method of colostrum feeding and time spend with the dam after birth do influenced the total serum protein of the calves. Time and methods of colostrum feeding influence the total serum protein of claves in terms of the amount of colostrum ingested and subsequently the amount of colostral immunoglobulin absorbed from the small intestine.

The refractometer test is not a direct measurement of immunoglobulin (Ig) but it gives a reasonable, rapid assessment of serum Ig and could be easily used in the field (reviewed by McBeath et. al., 1971).

The second objective of this project paper was to study the relationship between the immunological concentrations (indirectly through the total serum protein by the lens refractometer) of calves with disease and mortality occurrence. In this study, only three calves which were sampled from the UPM Beef in 1984 was reported to have died (Table 11). It was observed that the mean of total serum protein of these calves were generally lower than the overall means of total serum protein of 98 calves sampled in 1984 in the UPM beef farm. The causes of death were mostly due to severe diarrhoea and dehydration which could be due to heavy worm burden which is one of the most common problem in the farm. From analysis of the farm records, the common causes of death in one month old calves in the UPM beef farm were starvation and diarrhoea. Endoparasitism was the common cause of diarrhoea in this beef farm.

The commom causes of death in one month old calves in the UPM dairy farm were navel - ill, calf scour, pneumonia and endoparasitism. The high incidence of navel - ill in the UPM dairy farm could be due to mismanagement. When the dairy cleaning was done in the morning, the pens were hosed down with water with the calf still in the pen. This resulted in the central part of abdomen to be always wet, thus greatly predisposing the navel to infections.

# CONCLUSION

It is concluded that from the result of the study, although the total serum protein concentration (TSP = 7.01 ± 1.9 gm %) of UPM beef calves was significantly higher ($P < 0.05$) than the UPM dairy calves (TSP = 5.8 ± 2.07 gm %) sampled in 1984, but there was no significant difference between the total serum protein concentration of the UPM beef calves (TSP = 6.35 ± 1.79 gm %) sampled in 1988. The total serum protein concentration of both the UPM beef (TSP = 6.35 ± 1.15 gm %) and dairy (TSP = 7.07 ± 1.79 gm %) calves was significantly higher ($P < 0.01$) and ($P < 0.05$) respectively than the total serum protein concentration of the smallholder dairy calves (TSP = 5.08 ± 1.27 gm %). It was also concluded that the type of farm management, particularly the calf management immediately after birth like the time spent with dams, time of first feeding of colostrum, method and duration of colostrum feeding do have an indirect influence on the serum immnoglobulin levels (indirectly through measurement of the total serum protein concentration) of calves. The different types of cattle breed, for example the imported dairy breed of cattle like (Friesian) also do have influence on the total serum protein concentration and which in turn have an indirect influence on the serum immunoglobulin levels of calves.

# RECOMMENDATIONS

(1) Further study should be done on the amount of immunoglobulin present in the colostrum in accordance with the amount of immunoglobulin present in calves serum that had ingested colostrum.

(2) Through farm records, at present the percentage of calf mortality that are within one month old in both the Beef and Dairy of UPM was below 10% but it may be further reduced by:

a) Practicing a higher standard of hygiene in the UPM Dairy Farm.

b) Cleaning the calf pens twice daily and disinfecting at least once a week or before reuse.

c) Provide at least a shelter for the newly born beef calves that are kept in the open paddock.

(3) To smallholder farmers, to give more attention and make sure that the newly born calves suckled enough colostrum from their dams especially during the first 24 to 48 hours of life.

# REFERENCES


1. Bush , L.J. and Staley, T.E. (1980). Absorption of colostral Immunoglobulins in newborn calves. J. Dairy Sc., 63: 672 - 680.

2. Carpenter, P.L. (1965). Immunology and Serology, 2nd ed. W.B. Saunders Company, Philadelphia + London. pp. 80 - 108.

3. Davis, R.f. (1962). Modern Dairy Cattle management. Prentice, Hall Incooperation. pp. 100 - 113.

4. Gay, G.C., Anderson, N., Fisher, E.W. and McEwan, A.D. (1965). Vet. Rec., 77:148.

5. Herbert, W.J. (1974). Vet. Immunology. Blackwell Scientific Publication, Oxford, Edinburg and Melbourne.

6. Klaus, G.G.B., Bennett, A. and Jones, E.W. (1969). A Quantitative Study of the Transfer of Colostral Immunoglobulins to the Newborn Calf in: Immunology, 16: 293 - 299.

7. Kruse, V. (1970). Yield of Colostrum and Immunoglobulin in Cattle At The First Milking After Parturition. Anim. Prod., 12: 619 - 626.

8. Logan, E.F., Stenhouse, A., Omrod, D.J. and Penhale, W.J. (1974). The Role of Colostral Immunoglobulin in Internal Immunity to Enteric Colibacillosis in the Calf. Res. Vet. Sc., 17: 290 - 301.

9. McEwan, A.D., Fisher, E.W. and Selman, I.E. (1970). Res. Vet. Sc., 11: 239.

10. McBeath, D.E., Penhale, W.J. and Logan, E.F. (1971). An examination of the influence of the Husbandry on the plasma immunoglobulin level of the newborn calf, using a Rapid Refractometer Test for Assessing mmunoglobulin Content. Vet. Rec., 88: 266 - 270.

11. McGuire, T.C., Pfeiffer, N.E., Weikel, J.M. and Bartsch, C. (1976). Failure of Colostral Immunoglobulin Transfer in Calves Dying From Infectious Disease. J. Amer. Vet. Med. Ass., 169: 713.

12. Naylor, J.M., Kronfeld, D.S., Bech - Nielsen, S. and Bartholomew, R.C. (1977). Plasma Total Protein Measurement For Prediction of Disease and Mortality in Calves. JAVMA. 171: 635 - 638.

13. Naziri B. Mohd. Nordin, Mansor B. Daud and Noridah Bt. Abd. Rahman 91976). Smallholders in Malaysia in: Symposium on Smallholder Livestock Production and Development. Edited by C. Devendra and S. Thamuraram. Ministry of Agriculture Malaysia. pp. 3 - 28.

14. Osman Din (1982). Strategies for Resource Development of Animal Production in Malaysia in: Animal Production in the tropics. Edited by M.R. Jainudeen and A.R. Omar. Penerbit Universiti Pertanian Malaysia Serdang, Selangor. pp. 115 - 118.

15. Oyeniyi, O.O., and Hunter, A.G. (1978). Colostrum constituents including immunoglobulins in the first three milkings post partum. J. Dairy Sc. 61: 44.

16. Pfeiffer, N.E., McGuire, T.C., Bendel, R.B. and Weikel, J.M. (1977). Quantification of Bovine Immunoglobulins Comparison of Single Radial Immunodiffusion, Zinc Sulfate Turbidity, Serum Electrophoresis and Refractometer Methods. Am. J. Vet. Res., 30: 693 - 698.

17. Pfeiffer, N.E. and McGuire, T.C. (1977). A sodium sulphite Precipitation Test for Assessment of Colostral Immunoglobulin Transfer to Calves. JAVMA, 170: 809 - 811.

18. Radostits, O.M. (1981). In Howard: Current Vet. Theraphy: Food and Animal Practice.

19. Reid, J.F. and Martinez, a.A. (1975). A modified refractometer method as a practical aid to the epidemiological investigation of disease in the neonaral ruminant. Vet. Rec., 96: 177 - 179.

20. Selman, I.E., McEwan, A.D. and Fisher, E.W. (1970). J. Comp. path., 80: 41.

21. Selman, I.E., Fisher, E.W. and McEwan, A.D. (1971). Immune Globulin Concentration of Newborn Dairy Heifer Calves: A Farm Survey. Vet. Rec., 88: 460 - 464.

22. Smith, H.W., O'Neil, J.A. and Simmonds, E.J. (1967). Vet. Rec., 80: 73; 664.

23. Thuraisingham, S. (1969). Proposals for Larger Scale Dairy Development, Ministry of Agriculture and Co-operatives, Kuala Lumpur.

24. Tizard, I.R. (1977). An Introduction to Veterinary Immunology. W.B. Saunders Company, Philadelphia, London, Tokyo. pp. 32 - 50; 155 - 165.

25. Withers, F.W. (1952). British Vet. J. 108: 315 - 382.

Appendix 1

Title : A Survey Of Calf Immune Status Reared Under Different Management System

NO.: _____

Name: _____ Date : _____ Main occupation: _____

Address: _____ Side occupation: _____

Species: Cattle Breed: _____

Type: Beef_____ Dairy: _____

Herd Size: _____

No. of animal relating to age:

| | Female | Male |
|---|---|---|
| 1 wk | _____ | _____ |
| 1 wk-1 mth | _____ | _____ |
| 1 mth-6 mths | _____ | _____ |
| 6 mths-1 yr | _____ | _____ |
| 1 yr (Adult) | _____ | _____ |

Calf Pen

1) Elevated:

a) Flooring design:

i) slatted _____ concrete____

ii) non-slated _____ or soil base ____

2) Level ground:

b) Flooring material: i) concrete ____

ii) wooden _____

iii) trampled soil ____

Pen types:

1) Individual _____

2) Group pen: 5 calf/pen _____

5-10 calf/pen _____

10 calf/pen _____

Frequency of cleaning and disinfecting:

1) Daily i) 1x/day _____

ii) 2x/day _____

2) Weekly i) 2x/week _____

ii) 3-4x/week _____

i) 4x/week

Labour (Looking after calf)

a) Hired: Sex _____ Number

Age: 15 _____

15-20 _____

20 _____

b) Family members:

i) Farmer_____ ii) Wife _____

iii) Children: 10 _____

10-15 _____

15-20 _____

Turn looking after calf

a) same personnel _____

b) alternatively/different _____

Feeling/attitude of worker(s) toward calf _____

_____

Pen size:

Height: _____ Width: _____

Length: _____

Distance from cow pen:

a) mixed with adults _____

b) separated pen: i) attached ____

ii) different building ____

Feces disposal:

a) wash off _____

b) scoop out _____

c) do nothing _____

Ventilation: Good___ Moderate___ Poor

Pen Condition: Good___ Moderate___ Poor

FEEDING

DAM: a) concentrate and type _____ b) Grazing:

i) Pasture _____

ii) roadside _____

c) Homemix _____

d) Other special management during drying period prior to calving _____

_____

ALF: Time spend with the dam after birth:

a) Immediately separated _____

b) few hours to 24 hours _____

c) until weaning time _____

| | colostrum | milk |
|---|---|---|
| I) Methods of feeding | | |
| a) suckled | | |
| b) bottled/pailed | | |
| 2) Duration per feeding | | |
| 3) Total length of feeding | | |
| 4) Amount given | | |
| 5) Frequency of feeding | | |
| 6) Time of day | | |
| 7) Temperature | | |

Time allowed to suckle milk:

a) before milking _____

b) after milking _____

c) anytime _____

Type of milk:

a) cow's milk _____

b) milk replacer _____

c) mixture _____

i) Ratio:

cow's milk _____ milk to replacer

Other feeds/supplements given and when given:

I) _____

2) _____

Appendix 2

FARM NO:_____ DATE :_____

A) CALF

Breed:_____ I.D:_____

Sex:_____ Birthweight:_____kg

Date of birth:_____

Date of serum sampling:_____

Age at sampling:_____

B) DAM

Breed:_____ I.D:_____

Age:_____

Parity:_____

Vaccination status:_____

Health status:

Health status during pregnancy:

Appendix 3 Table 12 : Distribution of calves according to their serum prote

| Types of calves | | | UPM Beef (1984) | | UPM Beef (1988) | | UPM Dairy (1984) | | UPM Dariy (1988) | | SH Dairy (1988) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serum Protein | Total No. calves | Overall Means | No. of calves | Mean | No. of calves | Mean | No. of calves | Mean | No. of calves | Mean | No. of calves | Mean |
| TSP (gm%) | | | | | | | | | | | | |
| 2.0 - 4.0 | 7 | 3.71 | 0 | 0 | 0 | 0 | 3 | 3.9 | 0 | 0 | 4 | 3.55 |
| 4.1 - 6.0 | 67 | 5.34 | 29 | 6.99 | 19 | 5.58 | 9 | 5.16 | 3 | 5.13 | 17 | 5.29 |
| 6.1 - 8.0 | 103 | 7.19 | 60 | 7.33 | 21 | 7.03 | 5 | 7.80 | 5 | 7.02 | 12 | 6.65 |
| 8.1 -10.0 | 13 | 8.72 | 9 | 8.69 | 1 | 8.60 | 1 | 9.40 | 2 | 8.60 | 0 | 0.00 |
| Serum Albumin (gm%) | | | | | | | | | | | | |
| 0.50-1.00 | 23 | 0.83 | 13 | 0.84 | 2 | 0.96 | 2 | 0.89 | 2 | 0.99 | 3 | 0.79 |
| 1.01-1.50 | 38 | 1.20 | 17 | 1.18 | 7 | 1.28 | 7 | 1.03 | 1 | 1.04 | 7 | 1.21 |
| 1.51-2.00 | 9 | 1.69 | 4 | 1.70 | 3 | 1.68 | 0 | 0.00 | 0 | 0.00 | 2 | 1.71 |
| 2.01-2.50 | 2 | 2.03 | 2 | 2.03 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Serum Globulin (gm%) | | | | | | | | | | | | |
| 1.50-3.00 | 7 | 2.71 | 0 | 0.00 | 1 | 2.54 | 3 | 2.90 | 0 | 0.00 | 3 | 2.57 |
| 3.10-4.50 | 18 | 3.96 | 6 | 4.19 | 3 | 4.08 | 3 | 3.77 | 1 | 4.01 | 5 | 3.70 |
| 4.60-6.00 | 23 | 5.23 | 13 | 5.23 | 6 | 5.29 | 0 | 0.00 | 0 | 0.00 | 4 | 5.14 |
| 6.10->7.5 | 24 | 6.96 | 17 | 6.89 | 2 | 6.88 | 3 | 7.33 | 2 | 7.09 | 0 | 0.00 |
| Alb.:Glob.(A/G) | | | | | | | | | | | | |
| 0.05 - 0.20 | 28 | 0.15 | 19 | 0.15 | 3 | 0.16 | 3 | 0.15 | 2 | 0.15 | 1 | 0.17 |
| 0.21 - 0.35 | 33 | 0.27 | 15 | 0.26 | 7 | 0.28 | 3 | 0.28 | 1 | 0.25 | 7 | 0.27 |
| 0.36 - 0.50 | 8 | 0.42 | 1 | 0.40 | 0 | 0.0 | 3 | 0.43 | 0 | 0 | 4 | 0.42 |
| 0 51 - 0 65 | 3 | 0 54 | 1 | 0.54 | 2 | 0.56 | 0 | 0 | 0 | 0 | 0 | 0 |