Full Length Research Paper

Causes of pre-weaning pig mortality in India


1,3,4Department of Livestock Production Management, College of Veterinary Science and AH, NDVSU, Jabalpur
2Department of Livestock Production Management, DUVASU, Mathura, UP

Accepted 5 September, 2014

Pig rearing plays an important role for improvement of socio-economic condition of poor farmers in India and other developing countries. They are important for farmers as a major source of family income or as a ‘savings bank’. The swine industry in India, currently in its infancy, is in the hands of people having little or no awareness about pig diseases. Swine mortality is an important factor affecting the economic viability and profitability of swine industry. The profitability of swine farm largely depends on the survival of piglets/litters up to weaning besides other closely related factors such as litter size and weight of piglets at birth. Neonatal piglet mortality continues to be a general problem in sow herds worldwide. The first and foremost target of an ideal farm is to reduce the morbidity and mortality rate. Often, there is considerable loss due to the seasonal and routine changes in management, which could be avoided by adopting standard management practices and avoiding unnecessary and abrupt changes in the routine management activities. Retrospective study on mortality may play a role in forecasting the future occurrence of disease in a particular geographical area. Pre weaning mortality in pigs can be affected by numerous factors: litter size, birth weight and order, farrowing duration, sex, breed, herd size, housing and flooring, and managerial practices. Profitability of the pig industry largely depends on the piglet mortality. Precautionary measures should be adopted to reduce the pig mortality and thus, make pig farming more profitable.

Key words: Piglet, mortality, starvation, piglet anaemia.

INTRODUCTION

Pig rearing plays an important role for improvement of socio-economic condition of poor farmers in India and other developing countries. They are important for farmers as a major source of family income or as a ‘savings bank’ (Steinfeld 1998). According to FAO records, India’s pig population is 13.84 million (FAOSTAT, 2009) and it constitute 1.47% of world pig population (NRC-Pig, Annual Report, 2011-12) table 1.

The swine industry in India, currently in its infancy, is in the hands of people having little or no awareness about pig diseases. Swine mortality is an important factor affecting the economic viability and profitability of swine industry. The profitability of swine farm largely depends on the survival of piglets/litters up to weaning besides other closely related factors such as litter size and weight of piglets at birth. Neonatal piglet mortality continues to be a general problem in sow herds worldwide.

The overall mortality as well as morbidity of pigs depends on pre weaning care, management, and litter size, weight of litter, age season and effective health care. Causes may be multifactorial, including less acceptability of pork in the region, lack of awareness among the farmers and pig raisers regarding management practices, disease prevention and control measures, and above all, a high incidence of fatal diseases (Mondal et al., 2012).

The mortality pattern and occurrence of different diseases and disorders may also vary with different genetic groups of pigs (Nandakumar et al., 2004). Not all the factors associated with mortality can be controlled, but understanding them will assist the farmers and producers in minimizing death loss (Holyoake et al., 1995). Mortality pattern in organized swine herd serves as a useful indicator for assessing the status of herd health and management programme and their efficacy. The first and foremost target of an ideal farm is to reduce the morbidity and mortality rate. Often, there is considerable loss due to the seasonal and routine changes in...
Table 1: Pig and pork production in India and world (2009).

<table>
<thead>
<tr>
<th>Item</th>
<th>Production</th>
<th>India’s share (%)</th>
<th>Decadal Growth rate (1999-2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>India</td>
<td>World</td>
<td>India</td>
</tr>
<tr>
<td>Pig (million)</td>
<td>13.84</td>
<td>941.78</td>
<td>1.47</td>
</tr>
<tr>
<td>Pork (MT)</td>
<td>0.48</td>
<td>106.33</td>
<td>0.45</td>
</tr>
</tbody>
</table>

(NRC-Pig, Annual report, 2011-12).

Table 2: Pre-weaning pig mortality.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Pre-weaning mortality</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>50%</td>
<td>Pathiraja et al.(1987)</td>
</tr>
<tr>
<td>2.</td>
<td>28.14%</td>
<td>Kumar et al.(1990)</td>
</tr>
<tr>
<td>3.</td>
<td>12.2-24.2%</td>
<td>Grissom et al.(1990)</td>
</tr>
<tr>
<td>4.</td>
<td>14.4%</td>
<td>Boe (1994)</td>
</tr>
<tr>
<td>5.</td>
<td>10-15%</td>
<td>Vaillancourt et al. (1994)</td>
</tr>
<tr>
<td>6.</td>
<td>13% Crossbred</td>
<td>Varley (1995)</td>
</tr>
<tr>
<td>7.</td>
<td>10-20%</td>
<td>Tucsherer et al.(2000)</td>
</tr>
<tr>
<td>8.</td>
<td>31.36% Indigenous</td>
<td>Nandakumar et al. (2004)</td>
</tr>
<tr>
<td>9.</td>
<td>10.49% Crossed-bred</td>
<td>Nandakumar et al. (2004)</td>
</tr>
<tr>
<td>10.</td>
<td>18.70%</td>
<td>Wabacha et al. (2004)</td>
</tr>
<tr>
<td>12.</td>
<td>26.40%</td>
<td>Kliebenstein et al. (2007)</td>
</tr>
<tr>
<td>13.</td>
<td>23.27%</td>
<td>Li et al. (2010)</td>
</tr>
<tr>
<td>14.</td>
<td>19%</td>
<td>Pedersen et al. (2011)</td>
</tr>
</tbody>
</table>

management, which could be avoided by adopting standard management practices and avoiding unnecessary and abrupt changes in the routine management activities. Retrospective study on mortality may play a role in forecasting the future occurrence of disease in a particular geographical area (Basumatary et al., 2010).

New born piglets are highly dependent upon the sow for food and protection from disease, cold and predators. The death of suckling piglets adversely affects the productivity of farms; therefore, implementing an effective management regime until 3 d after birth could decrease the occurrence of piglet deaths (Holyoake et al., 1995).

PRE-WEANING MORTALITY RATE

Pre-weaning mortality in pigs can be affected by numerous factors: litter size, birth weight and order, farrowing duration, sex, breed, herd size, housing and flooring, and managerial practices. Pre-weaning mortality as recorded by the various authors are summarised in table 2 below.

The reproductive strategy of the pig is comparable to that of avian species named “facultative siblicide” (Fraser et al., 1995). By producing a relatively large number of poorly developed offspring the sow’s investment in the individual piglet is limited and competition for resources ensures survival of the fittest. In order for this strategy to have optimal effect it is evident that the weaker piglets die early on so that the investment in these piglets in terms of milk yield is kept at a minimum. Edwards (2002) suggested that considering the reproductive strategy adopted by the pig, total piglet mortality (including stillborn) of 10-20 % of total born could be considered normal.

Piglet mortality and litter size are positively correlated as shown in a number of studies (Pedersen et al., 2006; Su et al., 2007). Pre-weaning mortality has been found to have a close negative correlation to individual birth weight, and as a consequence selection for higher birth weights has been suggested as mean of reducing pre-weaning mortality, while the heritability is higher for birth weight than piglet survival (Knol et al., 2002). However increased average birth weight also correlates to smaller litter size (Milligan et al., 2002).

Causes of mortality

Several studies had attributed neonatal mortality in pigs to be of multifactor causes including diseases such as colibacillosis, salmonellosis and piglet anaemia. Other factors were low viability, chilling, maternal overlay and poor management practices (Damron, 2009). The cause of death is most often a combination of more than one of these factors.

Predisposing factors

1. Environmental temperature requirement of piglet and sow are different
2. Neonatal thermoregulation
Table 3. Age-wise mortality in crossbred pigs in different year.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age group</th>
<th>0-15 days</th>
<th>16-30 days</th>
<th>30-45 days</th>
<th>Total pre-weaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2001</td>
<td>13.22 (28)</td>
<td>2.43 (4)</td>
<td>3.12 (5)</td>
<td>19.57 (37)</td>
<td></td>
</tr>
<tr>
<td>2001-2002</td>
<td>29.87 (72)</td>
<td>1.18 (2)</td>
<td>0.59 (1)</td>
<td>31.12 (75)</td>
<td></td>
</tr>
<tr>
<td>2002-2003</td>
<td>12.40 (17)</td>
<td>0</td>
<td>0</td>
<td>7.08 (17)</td>
<td></td>
</tr>
<tr>
<td>2003-2004</td>
<td>16.12 (69)</td>
<td>4.62 (11)</td>
<td>1.76 (4)</td>
<td>19.62 (84)</td>
<td></td>
</tr>
<tr>
<td>2004-2005</td>
<td>33.21 (97)</td>
<td>2.58 (8)</td>
<td>0.64 (2)</td>
<td>25.90 (107)</td>
<td></td>
</tr>
<tr>
<td>2005-2006</td>
<td>22.22 (4)</td>
<td>4.76 (1)</td>
<td>3.75 (3)</td>
<td>6.72 (8)</td>
<td></td>
</tr>
<tr>
<td>2006-2007</td>
<td>16.58 (34)</td>
<td>1.75 (3)</td>
<td>0</td>
<td>18.04 (37)</td>
<td></td>
</tr>
<tr>
<td>2007-2008</td>
<td>24.31 (106)</td>
<td>1.51 (5)</td>
<td>0.44 (1)</td>
<td>25.68 (112)</td>
<td></td>
</tr>
<tr>
<td>2008-2009</td>
<td>38.40 (106)</td>
<td>2.94 (5)</td>
<td>1.81 (3)</td>
<td>41.30 (114)</td>
<td></td>
</tr>
<tr>
<td>2009-2010</td>
<td>24.43 (54)</td>
<td>4.19 (6)</td>
<td>1.05 (1)</td>
<td>22.76 (61)</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>21.69 (587)</td>
<td>2.44 (45)</td>
<td>1.28 (20)</td>
<td>23.16 (652)</td>
<td></td>
</tr>
</tbody>
</table>

(From Mondal et al., 2012).

3. Asphyxia: causes and individual variation
4. Individual low birth weight
5. Heat loss
6. Hypoglycemia
7. Starvation and gaining access to colostrum
8. Piglet anaemia
9. Crushing and bitten by dam
10. Savaging
11. Maternal behaviour
12. Disease related to sow e.g., MMA
13. Diseases of piglets, e.g., colibacillosis, salmonellosis etc. and miscellaneous causes: anatomical abnormalities, extremes of weather condition etc.

Environmental temperature requirement of piglet and sow are different

The ideal ambient temperature in a farrowing house can range between 50° to 60°F (10° to 15.5°C) (Bundy et al., 1984). Temperature requirement needs for sows and piglets are not identical. In a farrowing operation, there are zones called zone-cool and zone-heat to provide proper temperature for the sow and piglets, respectively. The zone-cool for sows ranges from 60-80°F and zone-heat for the piglets ranges from 90-100°F. Because the piglets have such a warmer temperature requirement, they often attempt to huddle closely under the bellies of their mothers for warmth which can lead to a crushing incident (Varley, 1995).

Neonatal thermoregulation

Piglets are born with relatively small energy reserves. Fat accounts for only about 1.5-1.8 % of the piglets body weight at birth, hence the degree of isolation is limited. Furthermore neonatal glycogen reserves have been estimated at only 3.3 % (LeDividich et al., 1994). For thermogenesis neonate piglets rely almost exclusively on shivering in early post uterine life. Because of the lack of brown adipose tissue (Trayhurn et al., 1989) non-shivering thermogenesis does not occur in the neonatal piglet until ingestion of colostrum ensures a small supplementary metabolic heat production following digestion (LeDividich et al., 1994) Shivering is costly in regards to energy use although shivering efficiency increases markedly during the first 5 days of life the metabolic rate stays unaltered at this point (Berthon et al., 1996). Even in colostrum fed piglets muscle and liver glycogen is reduce over the first 48 hours of life, but the decline is accelerated during sustained shivering (Berthon et al., 1996). To reduce the energy need for thermogenesis behavioural adaptations to facilitate heat preservation are vital in order to avoid substantial energy loss and hypothermia. By huddling together the piglets reduce the part of their overall surface that is exposed to the moderately cold farrowing environment. This reduces heat loss through both radiation and conduction. From a thermoregulatory perspective huddling for heat preservation or the use of a radiant heat source might achieve similar results in keeping the piglets warm. But huddling in the pen does not protect the piglets from crushing by the sow.

Asphyxia: causes and individual variation

Asphyxia is a condition of severe deficiency of oxygen supply to the body. During delivery when the piglet still depends on oxygen via the umbilical cord, asphyxia can happen due to rupture of the umbilical cord, detachment of the placenta or if the umbilical cord is blocked from the outside, typically by being pressed between a piglet and the uterine or the vaginal wall during contractions (Sjaastad et al., 2003a). A moderate degree of asphyxia is normal as a consequence of the expulsion process, especially in polytocous species like the pig (Herpin et al., 1996).

Asphyxia causes low vitality at birth and increases the risk of dying before weaning. However the risk of hypoxia is not similar across all piglets of a given litter, and risk factors are highly correlated to birth order (Tuchscherer
et al., 2000). Long inter birth intervals increase the risk of asphyxia and birth intervals are often longer before a stillborn piglet than before a live born piglet. The incidence of long intervals increases with the birth order (Fraser et al., 1997), this is also associated with the increased risk of asphyxia with later position in the birth order (Herpin et al., 1996).

Another risk factor of asphyxia is related to the individual piglet is birth weight. Studies have shown that low birth weight piglets had higher lactate levels in umbilical cord blood than heavier piglets (Malmkvist et al., 2006). Lighter piglets are more at risk of dying before weaning than heavier piglets (Milligan et al., 2002), which might in turn have some connection to asphyxia and viability at birth. However, the interactions of individual birth weight, asphyxia, hypothermia, risk of crushing and starvation are rather complex.

Individual low birth weight

Prolificacy of the sow has been improved considerably during recent years. As a result the rearing capacity of the sow is often exceeded. The increasing litter size at birth causes a lower average birth weight. A reduction in the piglet birth weight means increased risk of higher pre-weaning mortality rate. Litters of domestic piglets show strong sibling competition, large difference among litter mates in birth weight and growth and a high mortality rate (Frazer, 1990). In addition to the low birth weight, a lack of uniformity in birth weight is itself an important risk factor for piglet survival (Caceres et al., 2001). The first days after birth are marked by exceptionally large variation between litters in piglet weight gains. Some litters enjoy large, steady gains in the first days after birth, others gain very little and some lose weight for one or more days. According to Marchant et al. (2000) only 28% of piglets weighing less than 1.1 kg at birth survived to seven days.

Zajas-Cruz et al. (2000) showed that piglets of low average birth weight were not competitive if mixed with large piglets. On the other hand higher birth weight is considered an advantage to survival, but it has been found that females, although having a lighter birth weight, suckled earlier than males (Bate et al., 1985).

Heat loss

The greatest challenge of piglets at birth is avoiding heat loss, as heat loss will greatly increase the risk of dying from any of the other causes. At birth the piglet experiences a dramatic change in the ambient temperature and nature of the surroundings. Hypothermia is mainly due to lack of brown fat, very little subcutaneous fat and a lack of a significant hair coat. From at a homeostatic temperature in the sow uterus (38-40 °C), the piglet is born into the much cooler environment of the farrowing crate or pen (18-20 °C). At this point the piglet faces heat loss through various means of heat exchange (Sjaastad et al., 2003c): Radiation of heat to the cool stable air; conduction of heat to the floor and other cooler surfaces that the piglet comes in contact with. The attribution of Convectional heat loss is considered relatively small if ventilation is kept at a minimum, but during summer where ventilation is increased the influence of convectonal heat loss has to be considered. Last but not least the neonatal piglet faces a rather substantial heat loss through evaporation of amniotic fluid. All of these factors combined cause a well documented drop in body temperature shortly after birth (Malmkvist et al., 2006), and the extent of this postpartum drop in body temperature correlates negatively to the piglet’s chances of survival. Thus in order to avoid hypothermia the neonatal piglet must therefore rapidly adapt to post uterine life by starting thermogenesis and heat preservation. Rectal temperature at 2 h after birth is a strong indicator of thermoregulatory success (Baxter et al., 2008). For piglets up to 24 h old, a body temperature between 38 and 39 °C would indicate thermal homeostasis (Herpin et al., 1994).

Hypoglycemia

Piglet hypoglycemia is most common in piglets less than one week old. It is a contributing factor that leads to death in many diseases and accounts for 15-35% of total piglet mortality. With only partial gluconeogenic ability, limited energy reserves, and essentially no brown fat, newborn piglets rely on glycogen reserves and, most importantly, frequent nursing. Piglets are predisposed to hypoglycemia if the sow has any disease that decreases or inhibits milk production or letdown.

The metabolism of the new-born pig is governed completely by the concentration of circulating glucose. If the new-born pig is denied food, the blood sugar concentration falls and death ensues rapidly; the liver contains little or no glycogen at death and the concentration of blood glucose may, by then, be but a few mg/100 ml. This almost total exhaustion of glucose usually takes 24-48 hr but death can be postponed by increasing the ambient temperature. With the decline of the blood glucose concentration there is a corresponding decline in general metabolism, as evidenced by the heart and respiratory rates, and the body temperature. The new-born pig when starved soon dies in a state of severe hypoglycaemia (Herpin et al., 1996).

Starvation and gaining access to colostrum

Perinatally the piglets receive nutrients via the umbilical cord and glucose is the most important source of energy. The transaction from fetal nutrition to perinatal nutrition is substantial, and colostrum plays a vital role in easing this
transaction. Early and plentiful intake of colostrum has two main purposes. First it has and immunological function. Piglets are born with very poor immunological status at birth while they do not absorb any immunoglobulins via the placenta. It is therefore vital that they get a sufficient intake of immunoglobulin rich colostrum in order to achieve passive immunity and defend the body against infection from micro-organisms in the environment. The concentration of immunoglobulins in colostrum rapidly declines, and after about 24 hours the milk no longer contains enough antibodies to provide the piglet with adequate protection of infections. Furthermore the ability of the piglet gut to absorb the immunoglobulins also declines rapidly after the first 6 hours postpartum and ceases completely after 1-2 days of life. After this time the epithelial cells in the gut are no longer permeable to intact soluble proteins like immunoglobulins. In addition to immunoglobulins, colostrum also holds high concentrations of fat, amino acids, lactose and vitamins compared to the content in normal milk later in lactation (Sjaastad et al., 2003b).

However during the first few days after farrowing where most piglet losses occur, it is not the immunological function of colostrum that determines piglet survival. Piglet deaths during these first few days are only rarely related to disease and infections acquired from the environment. In early postnatal life the most important function of early colostrum intake is nutritional. Piglets are born with very small energy stores not enough to last longer than the first day of life, especially in less then thermo-neutral conditions. The amount of colostral energy consumed by the piglet is a major determinant for early piglet survival (Le Dividich et al., 2005).

Decreased colostrum intake can be associated with inability to nurse due to neonatal factors such as weakness, prematurity, peripartum asphyxia, competition between siblings, or may be due to maternal factors such as agalactia, mastitis, or maternal rejection. It can be difficult to differentiate between starvation and hypothermia as the primary cause of death because a lack of colostrum ingestion will result in hypothermia and vice versa. During farrowing the sow has continues milk-let-down due to the high concentrations of oxytocin in the bloodstream at this time, and piglets have continuous access to colostrum during farrowing (Lewis and Hurnik, 1985). Especially in large litters the piglets are in high competitions to gain access and possession of the best teats. However continues milk-let-down subsides shortly after delivery of the last piglet. After this time the litter will have to work as a team and stimulate the sow’s udder at regular intervals, of about 40 min. in early lactation, in order to achieve milk-let-down and receive milk. Actual milk-let-down only last about 15 sec. during a typical nursing session (Thodberg and Sorensen, 2006), thus it is essential that the piglets are there and ready at this time. These relatively short intervals between nursing bouts in early lactation are one of several factors encouraging the piglets to stay in close proximity of the sow during the first few days after farrowing.

Piglet anaemia

Piglet anaemia also called Iron deficient anaemia is a hypochromic-microcytic anaemia generally associated with young, rapidly growing piglets deprive of Fe in their diet or from their environment. The most common parameter to indicate Fe-deficient anaemia is haemoglobin concentration. When a piglet is born, it has sufficient iron to last for only 3–7 days and so must obtain sufficient iron from elsewhere. Under natural conditions, baby pigs may obtain sufficient iron from the soil, but most pigs today are farrowed and reared on concrete floors indoors and thus have no access to soil. However, some soils contain very little iron, or iron in a form that is chemically bound and not available to the pigs.

Indoors the pig has no access to iron other than to the sows’ milk (which is deficient) until it starts to eat creep feed. The pig is born with a normal level of haemoglobin in the blood of 12-13g/100ml and this rapidly drops down to 6-7g by 10 to 14 days of age. A shortage of iron results in lowered levels of haemoglobin in the red cells, (anaemia), a lowered capacity for the carriage of oxygen around the body and an increased susceptibility to disease (BSAS, 2003).

There are four basic reasons why this is so:

1. Low body storage in the newborn pig:

In comparison with other animals the piglet has a far lower body tissue concentration of iron at birth whilst the adult pig has a far higher concentration than other species. Pigs are born with only 40 to 50 mg of Fe. Need 7 to 16 mg of absorbed Fe/day, if sufficient quantity of Fe is not available through feed, body store of iron deplete very quickly.

2. Low iron content of colostrum and milk

Both colostrum and milk are iron-deficient, and contain only 5-10% of piglets actual Fe requirement. It has been estimated that sows milk provide only about 1mg of Fe per day to each piglet during suckling.

3. No natural source of iron

In extensive systems iron could be obtained by ingestion of soil (through rooting). Under modern methods of intensive system, sows and piglets are kept in confinement in concrete floored farrowing pen, with no access to a source of iron. It may be possible to introduce soil in to the pen to help prevent anaemia. It is firstly impossible for the piglets to obtain sufficient iron to satisfy
its requirement in this way, secondly it is prohibitive in terms of labour and thirdly, it is possible to introduce parasites and disease.

4. Rapid growth rate

During the first eight weeks of life, the piglet has higher growth rate than other infant domestic animals. Weight of pigs may increase to double during the 1st week, up to five times or more by 4th week and eleven times or more by eight weeks. As an increase the body size is associated with an increase iron requirement to satisfy expanding blood volume it is apparent that high level of iron must be obtained to satisfy these need if anaemia is to be avoided. Thus, Fe supplementation is required to attain their full growth potential (Szabo and Bilkei, 2002).

Crushing and bitten by dam

Pig deaths due to crushing are a major problem in the swine industry. Suckling piglets die for various reasons, and more than 50% of piglet deaths occur within 4 days of birth. Young pigs are attracted to their dam’s udder immediately after birth and for the next 3 d. Following the initial 3 d, pigs are often seen using a heat lamp instead of the sow’s udder. By staying close to the sow the piglets are at high risk of being trapped by parts of the sow’s body when ever it lies down or shifts position while lying. Small, weak, chilled and starving piglets are more at risk of being crushed than healthy and well nourished piglets (Weary et al., 1998). One of the explanations for this is not just these weak piglets’ poor abilities to react to sudden movements by the sow, but also that they because they are weak, hungry, cold etc. spent more time in the risky area close to the sow (Weary et al., 1996). Crushing and litter size are positively correlated (Pedersen et al., 2006). Crushing occurs almost exclusively during the first 1-2 days after farrowing. This change of preference for lying area may help pigs avoid death due to crushing, because most of the crushing occurs in the first few days of life (Rudd, 1994). The lower critical temperature of a newborn piglet is 34 °C (English and Morrison, 1984), and environmental temperatures below this level will initiate cold stress. While undergoing cold stress, the piglet suffers from reduced locomotive vigour, and because of this handicap, the risk of being overlain by the sow or losing access to a teat will be higher (English and Wilkinson, 1982).

Crushing involves two distinct behavioural sequences: posterior crushing (beneath the sow’s hind quarters) and ventral crushing (beneath the udder and rib cage). The farrowing crate was originally introduced to make it easier to manage sows, to allow higher stocking densities and to reduce piglet mortality. However farrowing crates are designed to prevent neither posterior but nor ventral crushing (Fraser, 1990).

Savaging

Another anomaly in pre-weaning piglet deaths is due to savaging of piglets by the sow. Savaging behavior is characterized by a sow that is overtly aggressive to her piglets, and may result in injury and death to a portion of the litter. In a comprehensive survey of commercial gilts, researchers evaluated the incidence of savaging and some factors that are correlated with this deleterious behavior. These data reveal that 5.3% of gilts expressed piglet directed aggression with 2.9% of these gilts fatally savaging at least one of their piglets. Aggressive behavior of gilts to their offspring resulted in 6% death loss and 14% of piglets were injured. Interestingly, these authors found that if the lights were left on in the farrowing house, a reduction in the incidence of savaging was realized.

Maternal behaviour

Good maternal behaviour is the most important pre-condition for high sow productivity. During domestication, most of the maternal behavioural patterns of sows remain unaltered (Spinka et al., 2000). However, in modern pig husbandry, increasingly larger litters demand a greater responsibility of the sows towards their offspring (Grandinson, 2005). This responsibility is of enormous importance, in particular for neonatal piglets. Sows’ behavioural patterns, specifically postural ones, influence the piglets’ behaviour and result in consequences for milk intake and growth, but also in possible danger due to crushing. The danger of being crushed is high and prudent maternal responsiveness is urgently required especially within the first few days when the young piglets have a tendency to sleep directly next to the sow’s warm mammary glands and their co-ordination is not yet fully developed. The occurrence of crushed piglets is strongly related to individual differences in the protective behaviour of sows. The performance of maternal behaviour is strongly influenced by individual characteristics such as dominance, age, experience and the inter-individual variability based on genetic differences (Andersen et al., 2005). As shown by Hellbrugge et al. (2008), the heritability of maternal behaviour during lactation was 0.14, offering a possibility to include these characteristics in selection programmes.

Responsiveness, attentiveness and protectiveness are substantial pre-requisites for adapting the sow’s behaviour to attain maximal maternal success. Pre-lying behaviour and the associated interaction between sow and piglet play an important role in minimising the risk of crushing (Marchant et al., 1996). In this way, early nose-to-nose contact within the first day post partum initiates the start of the bonding process between sow and piglet, enabling them to identify each other (Petersen et al., 1990). This allows the piglet to know which sow to
approach for milk and protection; and the sow is assured that she is investing her resources in her own offspring (Horrell and Hodgson, 1992).

**Disease related to sow**

Mastitis, metritis and agalactia, commonly referred to as MMA, is a complex syndrome seen in sows shortly (12 hours to three days) after farrowing. It is caused by a bacterial infection of the mammary glands (udder) and/or the urogenital tract. MMA leads to increased piglet mortality and reduced weaning weights.

**DISEASE AND ANATOMICAL ABNORMALITIES OF PIGLET**

**Colibacillosis**

Colibacillosis is caused by enterotoxigenic (toxin producing) *Escherichia coli* (ETEC) strains. In addition to producing toxins, these ETEC strains have the ability to adhere to the wall of the small intestine by means of "hair-like" structures known as pili on the surface of the bacteria. Several types of pili have been identified in ETEC strains producing colibacillosis in swine; the three major ones have been designated as K88, K99, and 987P. The combined presence of pili and enterotoxins enables these pathogenic *E. coli* to adhere and multiply in very large numbers on the surface of the small intestine, and to secrete the enterotoxins that cause severe digestive alterations leading to clinical diarrhoea, dehydration and high mortality rates. Colibacillosis can strike three age groups of pigs: 1- to 4-day-old, 3-week-old, and newly weaned pigs to 5 weeks of age. (Torres et al., 2005).

*Clostridium perfringens*, Type C Enteritis

Clostridial enteritis is a form of scours that affects young pigs and has been reported worldwide. Other names for clostridial enteritis are enterotoxemia, hemorrhagic enteritis, and bloody scour. The disease usually affects piglets during the first week of life, but nursing pigs up to a month of age can sometimes be affected. Most cases occur during the first week of life. Diarrhoea usually begins as a watery, yellow scours that may contain traces of blood. After a few hours the faeces become bloody, and the pigs may die within a few hours to two days. (Tuczshserer et al., 2000)

**Transmissible Gastroenteritis (TGE)**

TGE is caused by a virus classified in the coronavirus group. Since then, this disease has been reported in most of the major swine-producing countries in the world. In weaned pigs, the number of pigs infected approaches 100 percent, and the pigs will show all the clinical signs of TGE that are evident in the nursing pigs. However, the mortality rate will be greatly reduced as the pigs are more mature, have more stored energy, and generally recover. Stress factors again may influence the morbidity and mortality. Older growing and finishing pigs, gilts and gestating sows, and other swine in the breeding herd can become infected and frequently will show inappetence (not eating) or only a few clinical signs of illness. (Sujira, 2009).

**Rotavirus Diarrhoea**

Rotavirus is an important cause of diarrhoea in swine, as well as in most young animals including humans. However, each animal species is affected by different rotaviruses. Rotaviral infections in piglets have an incubation period between 2 and 4 days, depending on the virulence (ability to cause disease) of the virus strain, the age of piglets, the immune status of the sow, and the environmental and management conditions. In field outbreaks diarrhoea can be observed in newborn piglets but is found more commonly in 2- to 6-week-old animals, toward either the end of the lactation period or a few days after weaning.

**CONCLUSION**

Profitability of the pig industry largely depends on the piglet mortality. Precautionary measures should be adopted to reduce the pig mortality and thus, make pig farming more profitable.

**REFERENCES**


Caceres, L., G. Bilkeri, M. McGill and F.J. Pena (2001). The effect of


