Recent advancements in scientific management practices for enhancing the productivity of pigs: A review

ABSTRACT

Around the world, pork breeding and production technology has changed widely in recent years. Enhancing pig production and reducing employment, requires a boost and a complete approach to herd management. Among livestock, pig rearing generates high income because pigs have the highest feed conversion ratio among other meat-producing animals, excluding broilers. They produce an average of 10 piglets per farrowing during a shorter gestation period of 114 days. Pig farming gives quick returns, though the marketable weight can be gained within a period of 7 months. There is a good demand for pig products such as bacon, ham, sausages, pork, etc. Pig rearing occurs in backyard systems, on garbage belts, on family-operated farms, and also in large-scale integrated pig industries with strict bio-security measures. The most important way to attain that goal is to maintain animal health and welfare. The health of pigs is also a key aspect of production economics on the farm. To maintain a high health status, pig herds have to reduce their long-term use of drugs to minimise the occurrence of different diseases. The use of devices (microphones, accelerometers, or radio-frequency identification transponders and cameras), vital signs of animals, images, sounds, and movements, etc., allows for early identification of diseases, increases the productivity of breeding, and also improves their welfare. An early warning system on the basis of continuous monitoring of specific parameters (e.g., body temperature) and behavioural parameters can also provide an alternative diagnosis by the veterinarian or the herd manager.

Keywords: pigs, health, welfare, monitoring technologies, herd management

1. INTRODUCTION

The intense indoor confinement system is the predominant method of producing pork in developing nations. Since its inception, the intense indoor manufacturing system has been under fire for potential environmental damage that could jeopardise sustainability in both Asian and European nations (Dawkins, 2017). On the other hand, outdoor production techniques have the ability to address these environmental problems as well as those related to food safety while promoting animal welfare and opening up new business prospects for small, resource-constrained farmers. Outdoor production is an excellent substitute for small farmers' indoor confinement systems because of the relatively low investment cost and possibility for added value (Miao et al., 2004). According to Krogh, Oksbjerg, Ramaekers, et al. (2016), “modern sows typically wean 33–35 piglets per sow per year, while herds with the highest productivity now wean more than 40 piglets per year per sow. This diminishes the vulnerability and growth potential of pigs born from modern sows”.

The sow is put under more metabolic stress throughout pregnancy and lactation as a result of the improvements in reproductive capacity. Females of the modern genotype today grow more quickly and have less fat tissue than their ancestors did. In commercial production, it is usual to find sows at parity 2 and older with fat depth ranging from 12 to 16 mm at farrowing (Thomas et al., 2018). Gilt tenth rib fat depth at farrowing averages 16 mm. The nutritional requirements for gestation and breastfeeding are altered by these changes in body composition and reproductive efficiency.

In the growing-finishing stage, pig breeds are genetically bred to produce lean meat and have excellent feed efficiency, but this also has an impact on the reproductive females' genetics, physiology, productivity, and feed efficiency. “Because traits like adequate body fat and colostrum production, as well as optimal farrowing and lactation performance, are significantly more important for female reproductive pigs than the traditional traits in growing pigs, where the focus is on maximising gain and feed efficiency, feeding the reproductive females is a discipline that differs significantly from that of feeding growing pigs” (Kim et al., 2015). This paper summarises the physiological traits of growing gilts and reproductive sows during gestation, transition, and lactation and updates the state of the art regarding the energy and lysine requirements during these physiological periods.

2. GROWTH PERFORMANCE

In general, outdoor-raised pigs receive more area per pig than those raised in captivity. According to a study, outdoor-raised pigs spent more time walking and playing than indoor-raised pigs did (p 0.05), and although it was statistically insignificant, outdoor-raised pigs stood up more often than they did when they were lying down (Johnson et al., 2001). Pigs raised outside have a longer activity period; therefore, they need more food to gain the same amount of weight as pigs raised indoors. Outdoor-raised barrows exhibited a greater average daily feed intake (ADFI) when fed at will, which led to a reduced gain: feed (G: F) ratio (p 0.01) (Gentry et al., 2004). The same study also examined how the barrows' birth environment affected their ability to grow. The weight increase in outdoor-born pigs was considerably greater at 28, 56, and 112 days after weaning (p 0.05); however, at 140 days and the average daily gain (ADG), the differences were not statistically significant ($p > 0.05$). ADG for pigs raised outdoors versus indoors did not differ much either. On the other hand, pigs raised outdoors weighed more at 140 days after weaning. For gilts raised outdoors, various outcomes were reported (Patton et al., 2008). Gilts with unlimited access to food had increased feed efficiency (FE) and ADG. There may have been a variation in sex and experimental periods, which is why the gilts performed differently than the pigs. At 4 months of age, when their weights ranged from 59 to 71 kg, Patton et al. (2008) randomly assigned the gilts to treatments of either hooping or confinement, whereas the pigs in the trial by Gentry et al. [16] were kept in the study from weaning to 112 days post-weaning. Additionally, the Patton et al. study was carried out in Ames, Iowa, and the latter study was carried out in Lubbock, Texas (Gentry et al., 2004; Patton et al., 2008). The results vary because of the widely different climatic conditions in the two states.

“The growth performance of pigs in outdoor production systems can be significantly impacted by the weather. The performance of finishing pigs in hoop structures and confinement over the summer (June to October) and winter (December to April) seasons in Iowa was examined” by Honeyman and Harmon (2003). The average summer temperature is 20°C higher than the average winter temperature, which is below freezing. No season-housing type interaction was seen whether pigs were housed inside or outdoors for the start and end weights ($p>0.05$); however, outdoor-raised pigs were heavier at marketing and acquired more weight than indoor-raised pigs (p0.05). Additionally, compared to the other pairings, the ADFI for the winter outdoor hoop group was much greater. The same group had the worst FE and the lowest G:F. The summer outdoor hoop group had the highest ADG (p 0.05). The outside pigs grow more slowly in the winter because they use more energy to stay warm than they do in the summer. In France, similar outcomes were discovered (Dourmad et al., 2009). For the feed conversion ratio (FCR), a relationship between confinement vs. outdoor rearing and season (summer vs. winter) was discovered. While the contrary was observed throughout the other seasons, FCR tended to be higher for pigs raised outside during the winter. If the FCR is higher, then more feed must be consumed to attain the same amount of weight. This might be because outdoor-raised pigs need more energy for thermoregulation and physical activity. Because ADG did not observe the relationship between season and rearing conditions, the findings cannot be directly compared to those reported by (Carter et al., 2013).

Pigs raised outdoors showed a greater ADFI and ADG when the two raising methods were contrasted in Belgium, France, and Sweden (Millet et al., 2005 & Olsson et al., 2003). In all three investigations, the pigs raised outdoors had hot carcass weights that were higher relative to their live weights at slaughter, but their lean meat percentage was significantly lower than that of pigs raised in confinement, these findings conflict with what was discovered in the US. According to Patton et al. (2008), outdoor pigs had a significantly higher lean meat percentage when measured as the fat-free lean (FFL) percentage using the National Pork Board% FFL equation. However, outside pigs had a significantly lower average daily gain (ADG) and carcass weight (p0.05) than indoor pigs. Additionally, compared to European pigs raised outdoors, which had higher fat thickness, American pigs raised outdoors had lower measurements of back fat thickness at the 10th and last ribs (Patton et al., 2008). Comparing the outcomes of pigs raised outdoors should take into account the different raising settings. The outdoor pigs were raised in two separate European experiments using an alternative indoor-outdoor arrangement that gave them access to both an inside sawdust bedding space and an outdoor area with a concrete surface. The outdoor pigs were raised in a deep-bedded hoop barn for the American study. The various results could be brought on by the various raising environments.

3. DIETARY AND PHYSIOLOGICAL ASPECTS

3.1 Before onset of puberty

"When thinking about nutrition and care for developing gilts, it is vital to take into account factors like age and live weight at the start of puberty, longevity, and lifetime reproductive output. Due to pigs' genetic selection for lean meat and excellent feed efficiency, this has favoured rapid growth of muscular tissues during the growing and finishing periods. With limited fat retention, growing gilts present a nutritional problem. To avoid having too much muscle mass and not enough body fat, the diet of growing gilts should aim for enhanced fat retention at the price of protein retention, as opposed to the nutrition of growing or finishing pigs". [63] Because reproductive females need more feed to meet their maintenance energy needs (0.440 MJ ME/kg 0.75; Dourmad et al., 2008), having too much muscle mass costs money. When gilts are mated at 170 kg at their first service instead of 140 kg, their daily maintenance energy needs increase by around 0.2 kg per day throughout their lifespan, which reduces their feed efficiency. As litter size is clearly favoured by breeding at a higher weight (0.4 additional total born piglets for every 10 kg extra; Bruun et al., 2022), delaying gilt breeding to a greater age or weight has additional effects beyond maintenance needs (Bruun et al., 2020). For example, it is associated with lower breeding success when they are related later for their second parity. Furthermore, due to locomotor issues, gilts mated at a high live weight will probably have a shorter lifespan.

“Increased body fatness is needed for reproductive females, as opposed to growing or finishing pigs, because it may be beneficial for the start of puberty and future reproductive production” (J. S. Kim et al., 2015; Knecht et al., 2020; Maes et al., 2004). To maximise the sow's lifelong reproductive potential, the goal with modern slim genotype gilts should be to guarantee appropriate backfat thickness at an ideal age and weight. Regarding the age, weight, and backfat thickness of gilts at first service, various guidelines exist. A breeding age of 220-230 days, a weight of 130–140 kg, and a backfat thickness of 18–20 mm were suggested by Close and Cole (2000). Rozeboom (2015) recommended a target weight range of 135–150 kg with less emphasis on age and backfat thickness. The current recommendation for the first service in Denmark is between 140 and 160 kg of live weight and 13 to 15 mm of backfat thickness, which should be obtained at an age of 220 to 240 days. The latter advice is applicable to contemporary hyperprolific sows in order to guarantee substantial litter size in the first parity without sacrificing sow longevity and feed efficiency.

3.2 During Gestation period

“Because nutrients are primarily used by the sow body (for maintenance) and maternal growth, and only a small amount of nutrients are used for reproduction, pregnant sows are physiologically similar to growing or finishing pigs during early and midgestation” (Sola-Oriol & Gasa, 2017). “Pregnant gilts and sows devote a significant amount of energy and amino acids (AA) to foetal growth, placenta growth, conceptual fluids and membranes, and mammary growth in the final third of gestation” (National Research Council, 2012; Noblet et al., 1990). “This gradually changes as gestation progresses. Mammary growth becomes significant as parturition approaches and the snow begins to manufacture colostral proteins, which will be covered in more detail in the section for transition sows” (Feyera & Theil, 2017). As is the case with growing gilts, the nutrition of gestating gilts and sows in early and mid-pregnancy should not aim to maximise the maternal growth of the reproductive females but rather merely attempt to keep the body weight at a fairly low level in order to avoid excessive muscle mass because it is linked to extra feed needed for maintenance, lower feed efficiency, and a shorter lifespan.

3.3 Lactating sows

“Complex regulation balances the sow's ability to produce milk with the need for milk from piglets. The 30% increase in litter growth that occurred when six glands were alternately suckled by two groups of six piglets at intervals of 30 minutes demonstrated the importance of the piglets' need for milk in determining milk production” (Auldist et al., 2000). “At the same time, the sow's ability to produce milk may also put a cap on the amount of milk produced. In fact, sow-raised piglets typically develop at a rate of 250 g/day, whereas artificially reared piglets may grow at a rate of over 400 g/day during the first 23 days of postnatal life” (Boyd et al., 1995). “This equilibrium between piglet need and sow milk production capacity is greatly influenced by the management of mammary gland growth during lactation” (Krogh et al., 2021). In fact, there is a two-thirds reduction in mammary gland weight within a week of weaning (Ford et al., 2003), a 100% increase in the total amount of mammary gland DNA during the first three weeks of lactation (S. W. Kim et al., 1999), and a positive correlation between mammary gland weight and piglet growth (S. W. Kim et al., 2000). This control is influenced by a wide range of elements, including local and systemic hormone levels, blood-borne nutrition delivery, cell proliferation and apoptosis, and the ability to suck piglets to extract milk from the glands (Krogh et al., 2021). As a result, when feeding modern nursing sows, the amount of milk production is a crucial aspect to take into account. For pigs, the availability of energy and Lys are regarded as the first and second most important nutritional components, respectively. These requirements must be satisfied for optimal performance while minimising the loss of body reserves and maximising feed efficiency. Understanding the nutritional linkages between feed intake, mobilisation of body reserves, and milk production when feeding lactating sows is crucial in this situation.

4. FEED AND ENERGY INTAKES

4.1 Before onset of puberty

Crude protein (CP), lysine (Lys), and energy are all concurrently increased with an increase in the daily feed intake of a single meal in the same proportion. Even when feed intake is raised at a fixed daily intake of CP and Lys (Thingnes et al., 2015), it is related to the greater average daily gain (ADG) of growing gilts (Klaaborg et al., 2019; Klindt et al., 1999; Strathe et al., 2019). These studies showed that the primary constraint on the growth of gilts is the energy supply. No matter whether the diet contained low, intermediate, or high dietary CP and Lys concentrations, changing the feeding strategy from restricted feeding (maximum 2.52 kg/day) to semi-ad libitum (i.e., feeding close to ad libitum but the feed is provided in meals to avoid spillage; here max 3.27 kg/day) in gilts from 47 kg for the following 12 weeks increased the final body weight by 16 kg. During the course of the 12 weeks, gilts fed the lowest feed supply added an average of 3.7mm of backfat, whereas gilts fed semi-ad libitum added an average of 5.9mm. Dietary CP and Lys levels had no impact on either of these average gains. After 11 weeks of treatment, gilts with a mean beginning weight of 62 kg gained 8 kg more live weight and 0.6 mm more backfat thickness when the maximum feed limit was increased from 2.9 to 3.25 kg/day to a diet containing 12.2% CP and 5.6 g SID Lys/kg (Klaaborg et al., 2019). In contrast to limited feeding utilising intermediate CP levels, Van Vliet et al. (2016) showed that "ad libitum feeding with either low or high CP diets increased body fat content as well as backfat thickness at first service. The findings show that diets low in CP and Lys provided ad libitum are preferable because they favour body fat accumulation at the expense of protein accretion".

Due to their slimmer genotypes, these feeding regimens offer chances to guarantee enough backfat thickness at first service without gaining too much weight. The finding that leptin, a hormone that controls appetite, is produced in adipose tissue serves as yet another justification for first-service attention being given to the body fat pool. Leptin influences the neuroendocrine axis, upregulating gonadotropin-releasing hormone secretion by the hypothalamus. This in turn impacts the release of luteinizing hormone, which is a modulator of the commencement of the first estrus, according to a review by Barb et al. (2008). Furthermore, estradiol levels appear to influence leptin secretion in the latter stages of the rearing period (Qian et al., 1999), with estradiol influencing leptin responsiveness around the time of the first estrus (Barb et al., 2005). Genetic advancements that have produced slimmer gilts may limit the reproductive advantages of leptin, as stated by Barb et al. (2008). Because reaching a suitable body fat pool at a mature age (or weight) may have a negative impact on sow longevity, dietary manipulation of development to favour storage of back during the raising stage is of great interest.

4.2 During the Gestation period

The majority of our knowledge is derived from research focusing on reproductive output like litter size at delivery and piglet birth weight; therefore, there is a dearth of information on the effects of feeding regimens on the performance and energy use of pregnant sows. The sows give top priority to allocating nutrients to their offspring and use their bodies as a buffer of nutrients in the event that the feeding method or food composition is insufficient; therefore, these attributes do not fully reflect the effects of inappropriate feeding. A Danish study compared a traditional feeding strategy (low supply in early and midgestation [2.1 kg/day], followed by a higher supply in late gestation [3.3 kg/day]; Nielsen and Danielsen, 1983) with a simplified feeding strategy (2.4 kg/day throughout gestation). This study was conducted starting on Day 84 of pregnancy. Compared to the conventional feeding method (10.9 liveborn), the streamlined strategy resulted in a smaller litter size at birth (10.2 liveborn). It is important to emphasise that low-prolificity sows were used in the study.

“The effects of two different feeding levels given to gestating gilts (2.4 and 3.3 kg/day) and three different feeding levels given to multiparous gestating sows (2.4, 3.3, and 4.2 kg/day) during the last third of gestation were tested in a follow-up study with hyperprolific gestating gilts and sows fed a common gestation diet (containing 13.32 MJ ME/kg) (Srensen, 2012). The mean birth weight of piglets only slightly increased in response to a higher feed supply in sows (1.34, 1.36, and 1.37 kg/liveborn piglet, respectively, for 2.4, 3.3, and 4.2 kg feed/day; p 0.05). No zootechnical variables (e.g., backfat, live weight, weight gain) or indicators of alterations in body composition were reported for the gilts or sows”. [63]

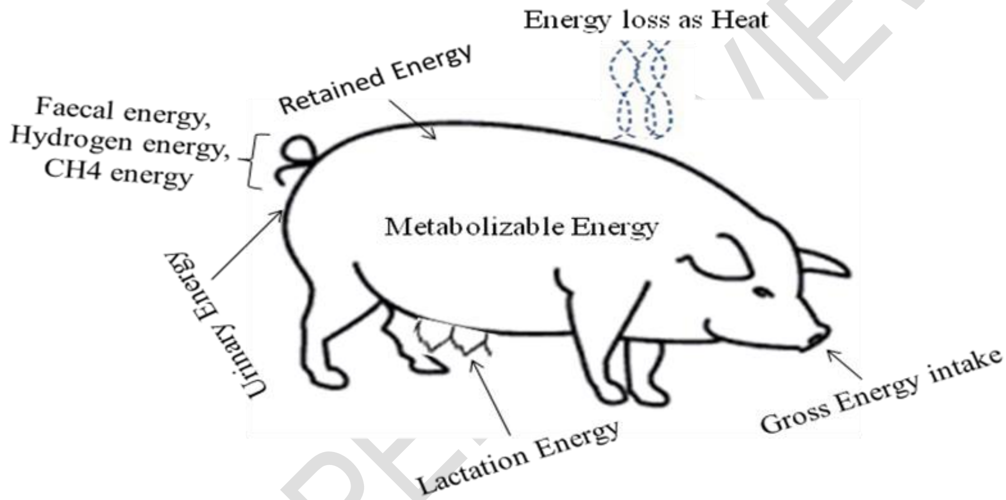

Fig. 1. An illustration of a pig‘s energy flow.

(Adapted from Jørgensen et al., 2011)

When gilts were fed 2.4 and 3.3 kg/day, the equivalent values in their progeny were mean birth weights of 1.23 and 1.25 kg/liveborn piglet. Because 2.4 kg/day is insufficient to meet the energy demand in late gestation, these results highlight how gilts and sows use their own bodies to buffer deficient food supplies (Noblet et al., 1990). It should be noted that both studies used sows that were created for the duration of gestation. Now that sows cannot be crated for the duration of pregnancy, it is customary to feed pregnant sows more food (0.3–0.5 kg/day) to compensate for their increased energy needs (Noblet et al., 1993). Noblet et al., (1990) stated that although sows' energy needs rise as their pregnancies go on, there isn't enough evidence to conclusively prove that feeding gestating sows during different phases of their development leads to more (re)productive responses.

4.3 Lactating sows

“The greatest priority for lactating sows is milk production, and sows are capable of mobilising significant amounts of body reserves to support milk production while making up for a deficiency in dietary nutrient intake” (King & Dunkin, 1986). “Greater litter size and litter gain boost feed intake” (Eissen et al., 2000). However, lactating sows frequently require more energy and Lys than they consume for milk production and maintenance (Feyera &

Theil, 2017), and this is especially true of today's hyper-prolific sows. As a result, the amount of energy that must be drawn from body reserves depends on the disparity between the amount of dietary nutrition consumed and the nutrients needed for maintenance and milk production. The best feed composition and a high feed intake capacity are therefore essential factors, particularly for high-prolific and high-performing sows. Other factors besides milk supply that affect feed consumption include feed composition, body condition, parity, ambient temperature, and genotype (Eissen et al., 2000).

It is clear that the energy and Lys intakes fall short of meeting the demand for both underperforming and high-performing sows. Energy and Lys outputs are 40–50% higher in the best-performing sows than they are in the worst-performing sows. Energy and Lys intake rise as performance level does as well, but the difference between high- and low-performing sows is only about 20%. The average feed intake throughout the lactation period may exceed 8 kg/day and reach 11 kg/day at peak lactation, despite the fact that, as was previously mentioned, it depends on a number of parameters (Thingnes et al., 2012). According to a recent Danish study (Strathe, Bruun, & Hansen, 2017), sows with a high milk output were distinguished by having both a high feed intake and a high body mobilisation. As a result, when feeding lactating sows, achieving high feed intake seems to be the main goal, but we don't fully understand how to encourage milk production around farrowing. Although sows may increase body mobilisation to compensate for low feed intake, low feed (and energy) availability inhibits milk production, as shown by decreased piglet gain and increased sow body weight loss during lactation in response to low energy availability. When a sow loses more than 10% of its body weight and has a daily energy deficit of more than 15 MJ, milk production looks to be affected.

This is consistent with research by Clowes et al. (2003) that discovered that piglet performance was impaired when mobilisation of body protein at parturition exceeded 10% of the body pools. The correlations between energy balance and the contents of fat, lactose, and protein in milk show that mobilisation of body reserves affects milk composition in addition to the overall output of milk. In conclusion, factors that are closely associated with each other include food intake, milk yield and composition, and the mobilisation of bodily reserves. The correlations discussed above show how important it is to maintain sow productivity to maximise feed intake. Lactating sows must generate the least quantity of milk from body reserves and the most amount of milk directly from the diet in order to have good feed efficiency (Pedersen et al., 2016; Theil et al., 2020).

5. LYSINE INTAKE

5.1 Before onset of puberty

It is usual practice to flush gilts prior to their first mating, which causes more eggs to be laid (Flowers et al., 1989), increasing the size of the subsequent litter (Bruun et al., 2021). According to Bruun et al. (2021), who found “a tendency for an interaction between backfat thickness and parity, the effect of flushing may rely on the energy status and backfat of the gilt”. “This suggests that thinner gilts were more susceptible to flushing when mated in their second heat. In general, it is thought that flushing is most successful in young, lean sows and gilts, as proven for first and third parity sows” (Kirkwoord & Thacker, 1989). However, the effect of flushing multiparous sows on the quantity of eggs being discharged appears not to have gotten much scientific attention.

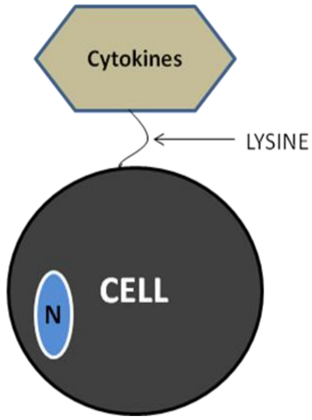

Fig. 2. Lysine's mechanism of action

(Adapted from Datta et al., 2001)

The growth rate of gilts will be slower if the daily supply of CP and Lys is reduced (Cia et al., 1998; Gill, 2006). Cia et al. (1998) discovered enhanced backfat accumulation and a marked drop in ADG when a diet was diluted to attain a lower Lys to calorie ratio at a fixed feed consumption. The ADG may be effectively reduced by limiting the amount of Lys consumed each day (Cline et al., 2000); preferably, this should be done in conjunction with a higher calorie intake. According to Meer et al. (2017), behavioural abnormalities such as ear and tail biting have been linked to low CP (and Lys). Because growing gilts will likely strive to increase their feed consumption in order to fulfil their daily dietary demands and growth potential, it may be necessary to provide diets that are extremely low in CP and Lys along with higher feeding levels.

5.2 During Gestation period

A number of studies have been carried out to quantify nitrogen retention using nitrogen balance in order to understand the Lys demand of pregnant sows. Because more Lys is continually required for reproductive reasons, the Lys demand rises as gestation proceeds (Sola-Oriol & Gasa, 2017). According to a recent study, optimal Lys utilisation efficiency was attained in pregnant gilts with 7.2, 9.1, and 13.5 g SID lysine/day in early, mid, and late gestation, respectively (Ramirez-Camba et al., 2020). Additionally, they discovered that for early, mid, and late gestation, respectively, 8.5, 10.5, and 20.9 g of SID lysine per day resulted in the greatest Lys retention. The overall effectiveness of SID Lys used for retention in pregnant gilts was shown to be highest in early gestation (0.65), lowest in mid-gestation (0.38), and intermediate in late gestation (0.52). This shift most likely reflects the fact that pregnant gilts continue to prioritise maternal gain in the early stages of pregnancy, which decreases as gestation develops, while Lys retention increases in the latter stages of pregnancy, resulting in higher Lys efficiency. Due to increasing mammary and foetal growth in late gestation, Shi et al. (2016) observed SID Lys needs of 14 g/day from days 0 to 80 of gestation and 21 g/day from day 81 of gestation until farrowing. It should be noted that Samuel et al. (2012) reported total Lys rather than SID Lys, and their study was focused on multiparous sows fed semisynthetic diets. They found slightly lower needs of 9.4 g/day in early gestation and 17.4 g/day in late gestation. While Dourmad and Etienne (2002) reported a Lys requirement of 10.5 g SID/day and Woerman and Speer (1976) reported an average Lys requirement of 7.5 g/day (total lysine) over the duration of gestation, no information on the gestational stage was provided in this study. The SID Lys requirement is probably no more than 8–10 g/day in early gestation and 18–24 g/day in late gestation, although this merits investigation in hyperprolific sows. As was previously indicated, it should be emphasised that while sows have higher lysine requirements as gestation progresses, there is a lack of evidence that feeding gestating sows throughout a phase boosts (re)productive responses.

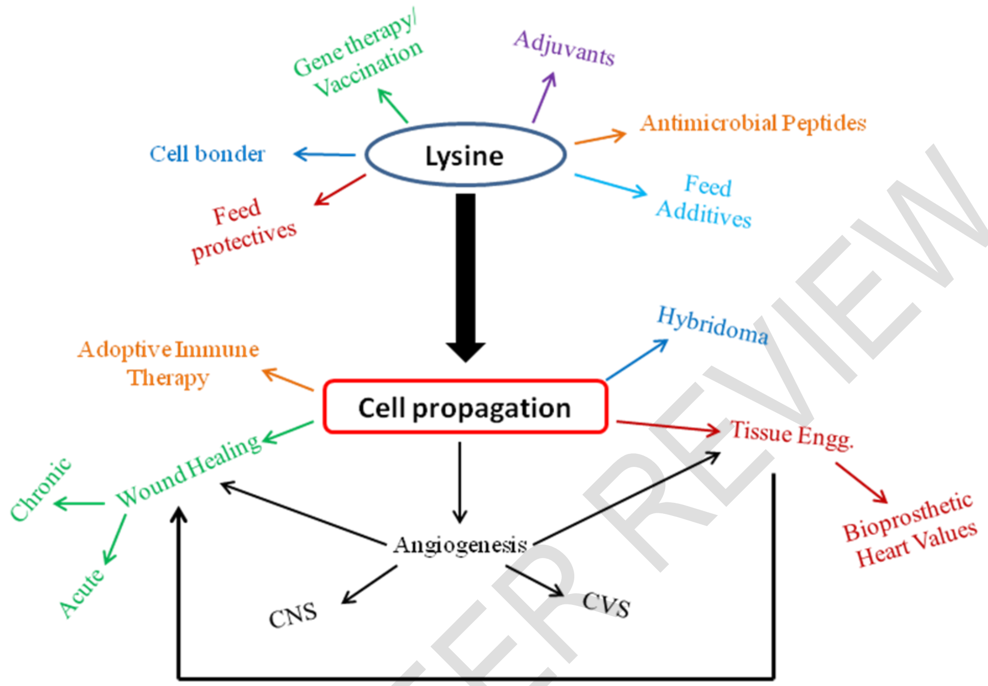

Fig. 3. Schematic diagram of biological functions of Lysine
(Adapted from Datta et al., 2001)

5.3 Lactating sows

Production of milk depends heavily on the availability of necessary AA and protein. The dietary needs of essential AA or protein have been the focus of studies utilising high-prolific lactating sows (Hojgaard, Bruun, & Theil, 2019a, 2019b; Hojgaard, Bruun, Strathe, et al., 2019; Strathe, Bruun, Geertsen, et al., 2017). These studies demonstrate that sows' milk production diminishes if they are given insufficient dietary Lys on a daily basis, as seen by reduced litter growth. A daily Lys feed above 55 g SID Lys had no impact on piglet or litter growth at the level of performance that was seen (about 13 weaned piglets and a 3 kg daily litter increase). From the same experiments, it was predicted that dietary Lys was utilised for milk synthesis with efficiencies of 82% when intake and requirements were equal and 50% when intake exceeded requirements for maintenance and output in milk. Hojgaard, Bruun, and Theil (2019b) observed that hyperprolific sows were able to use dietary SID Lys with an efficiency as high as 88%.

This demonstrates the significance of modifying feed composition in order to maximise productivity and feed efficiency concurrently, taking into account observed feed intake levels and milk production capacity of sows. This is complicated by the wide variations in intake and needs between people and herds, but it's an essential part of maximising the feeding of lactating sows. Currently, sow lactation diets are created without considering the production level based on a suggested feeding curve and an optimal AA profile (Hojgaard, Bruun, &

Theil, 2019a). It would be able to maximise sow performance and feed efficiency while lowering the quantity of feed used per kilogramme of piglet produced by include herd-specific data like as feed intake and litter gain, or even simpler criteria like the size of the nursing litter.

6. Troubleshooting/future suggestion

Research is required to comprehend the significance of gilts' body fat pools in relation to their potential reproductive output and to examine food composition and feeding methods that encourage fat retention. Instead of concentrating on sow weight change and litter size after parturition, research should examine changes in maternal retention of fat and protein, foetal growth, and mammary growth during pregnancy. This is because sows place a high priority on their offspring. On a whole animal level, quantifying the retention of fat and protein does not indicate whether nutrients are used for production or reproduction. To offset the genetic drive for protein retention, feeding practises for developing gilts and multiparous sows during early and midgestation should attempt to reduce maternal growth and protein retention and favour fat retention. Because the transition and lactation periods have a significant impact on litter size and weight at weaning, as well as total sow productivity, it is important to better understand nutrition during these times. To reduce food input and maximise nutrient utilisation for productive and reproductive outputs, clarifications of feed efficiency for growing gilts and sows during gestation, transition, and lactation are also required. These methods help reduce the harm that pig production does to the environment in terms of contamination of the air and water.

7. Conclusion

In conclusion, the lactating sow has proven to be remarkably resilient in the face of both dietary difficulties and significant increases in output. Meeting the nutrient needs of high-producing sows still involves several practical considerations. Lysine and energy requirements must be addressed with increased milk supply to prevent excessive bodily tissue catabolism.

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