

Sexual behavior of male pigs

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Abstract

Two major characteristics of males that affect the likelihood of achieving copulation are the sexual motivation and mating competency of the male. The behavior of domestic animals, including their sexual behavior, is dependent upon a complex interaction between the organism's internal and external environment. In male pigs, as in other mammalian species, it is clear that testicular steroids are required to maintain sexual behavior and testosterone plays a critical role. Consistent with studies in other species, it is apparent in male pigs that there is a threshold circulating concentration of androgens and/or estrogens required to maintain sexual behavior and that the level of sexual motivation is unrelated to levels of sex steroids providing these are adequate for normal sexual behavior. Key aspects of the external environment that affect the sexual behavior of the male pig include genetic, seasonal, social, sexual and psychological factors.

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Introduction

Sexual behavior has evolved to ultimately result in the deposition of sufficient viable spermatozoa in the reproductive tract of the female at the optimum time of the estrous cycle to ensure conception. While there is little documented evidence of poor sexual behavior in commercial male pigs (boars), early reports from artificial insemination centers and commercial piggeries indicate that up to 49% of culled boars were unable to copulate or copulate at sufficient frequency (Melrose, 1966), while Rasbech (1969) suggested that about 50% of culled boars were eliminated due to poor semen quality or sexual behavioral problems. This situation may not have changed much today.

Low levels of sexual behavior result from either low sexual motivation or poor mating competency, two major characteristics of males that affect the likelihood of achieving copulation. Sexual motivation, sometimes referred to as libido or sexual

drive, refers to the tendency to copulate. Mating competency, sometimes referred to as mating dexterity, is the ability to copulate, that is the ability to mount, gain an erection, thrust, achieve intromission and ejaculate. Poor mating competency, if not too serious, may be overcome in some situations where matings are supervised and assisted by stockpeople. Under a general model of the control of behavior (Fraser and Broom, 1997), poor mating competency that leads to reduced mating success and consequently less positive feedback on motivation may lead in turn to poor sexual motivation.

Male sexual behavior is obviously necessary to achieve impregnation in natural mating systems. Furthermore, the level of male sexual behavior may affect level of reproductive performance such as the number and timing of offspring produced, which have clear economic implications. The level of sexual behavior of rams and bulls in competitive and uncompetitive natural mating systems will affect numbers of females mated and pregnancy rate (Blockey, 1978; Price et al., 1996). Furthermore, some studies have shown that a high level of sexual behavior in bulls can lead to greater weaning or marketing weights because the offspring are born earlier (Blockey, 1978). In artificial insemination centers, male sexual

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behavior is also obviously important in order to collect semen and to collect semen at the desired frequency.

Patterns of male farm animal sexual behavior

Male sexual behavior is quite varied, although the essential features of intromission, pelvic thrusting and ejaculation are characteristic of the sexual behavior of all male mammals. A number of components of male sexual behavior are common to a number of species such as nosing the perineum, nudging, flehmen, flicking the tongue, striking out the forelimb and low-pitched bleats in sheep and goats (see review by Fraser and Broom, 1997). Other components of male sexual behavior are reasonably specific to an individual species. During courtship, boars will generally utter a short series of characteristics grunts and champ their jaws producing saliva, often while their heads are held in close proximity to that of the female (Signoret, 1970). They may also urinate rhythmically. If the female stands stationary, the boar may vigorously nudge or nose the flanks, sniff the ano-genital region or head of the female and mount her (Signoret, 1970). It is clear that the elements of the boar's courtship are important in stimulating reproductive processes in the female and this is discussed later in this review.

As mentioned earlier, while there is little evidence of poor sexual behavior in commercial boars, some reports suggest that poor sexual behavior is an important reason for culling commercial boars (Melrose, 1966; Rasbech, 1969). However, boars remaining in breeding herds are capable of a great number of copulations before exhaustion occurs. While Hemsworth et al. (1983a) found that most mature boars in a large breeding herd could copulate at least 6 times per week, Fraser and Broom (1997) reported that boars can copulate up to 8 times during a 2–25 h test period. Reports on duration of ejaculation in the boar vary from 3 to 20 min (Signoret, 1970; Fraser and Broom, 1997).

Hormonal and neural control of male sexual behavior

The hormonal and neural control of sexual behavior of males and females have been most studied in laboratory species, particularly the rat. Research from the 1940s to the 1960s on rats, guinea pigs and other laboratory species clearly demonstrated the critical role of the gonadal hormone testosterone on male sexual behavior. Testosterone is necessary to elicit sexual behavior: castration diminished sexual behavior with the extent dependent on age and/or sexual experience at the time of castration (Beach, 1967; Beach and Holz-Tucker, 1949; Grunt and Young, 1953; Larsson, 1966; Rosenblatt and Aronson, 1958a,b). Research also indicates that a threshold concentration of testosterone is required to elicit sexual behavior and above this threshold, the concentration of the hormone is ineffectual in increasing copulatory behavior. For example, increasing the dose of testosterone above the maintenance concentration, that is the amount required to restore the level of sexual behavior to its pre-castration level, failed to increase the level of sexual behavior of the castrate above the pre-castration level of the

fowl (McCollum et al., 1971), the guinea pig (Grunt and Young, 1952, 1953), the quail (Cunningham et al., 1977), the rat (Larsson, 1966) and the mouse (McGill and Tucker, 1964). In addition to maintaining sexual behavior, androgens stimulate the latter stages of spermatogenesis and prolong the life span of epididymal sperm (Ortavant et al., 1977).

In male pigs, as in other mammalian species, it is clear that testicular steroids are required to maintain sexual behavior and testosterone plays a critical role. For example, sexual behavior was decreased 30–60 days following castration in adult sexually experienced boars (Levis and Ford, 1989) and treatment with testosterone restored sexual behavior in castrated adult boars (Joshi and Raeside, 1973; Levis and Ford, 1989; Polanco et al., 1982) and in boars actively immunized against gonadotropin releasing hormone (GnRH) (Esbenshade and Johnson, 1987). Testosterone could act directly, or after metabolism to dihydrotestosterone, via androgen receptors and/or after conversion to estradiol via estrogen receptors to maintain sexual behavior. Conversion of testosterone to dihydrotestosterone does not account totally for the androgenic stimulation of sexual behavior in boars because treatment with dihydrotestosterone failed to restore sexual behavior in adult boars castrated prepubertally (Parrott and Booth, 1984) or postpubertally (Levis and Ford, 1989). Treatment of immature castrated boars with estradiol initiated but did not sustain sexual behavior whereas treatment with a combination of dihydrotestosterone and estradiol resulted in the full compliment of sexual behavior (Parrott and Booth, 1984). Furthermore, whereas treatment with testosterone restored and maintained sexual behavior in adult boars that had been castrated, treatment with estradiol was successful in initially restoring many components of sexual behavior but was unable to sustain sexual behavior (Levis and Ford, 1989). It has been suggested that the maintenance of sexual behavior in the adult boar requires a combination of estrogen and androgen (Levis and Ford, 1989) but further research is required to systematically delineate the precise roles of androgens and estrogens in the development, initiation and maintenance of sexual behavior in boars.

Consistent with studies in other species, in male pigs it is apparent that there is a threshold circulating concentration of androgens and/or estrogens required to maintain sexual behavior and that the level of sexual motivation is unrelated to levels of sex steroids providing these are adequate for normal sexual behavior. While housing in isolation of female pigs markedly reduces the sexual behavior of mature boars, isolation from females did not consistently affect the integrated value of plasma testosterone concentration of these isolated boars over a 12-h period (Hemsworth et al., 1981). Furthermore, there clearly needs to be a substantial and chronic reduction in testicular steroid secretion before sexual behavior is adversely affected in boars. Male pigs treated with a GnRH agonist to suppress the reproductive axis and reduce circulating concentrations of testosterone and estradiol continued to mount an artificial sow and most indicators of sexual behavior were unaffected although the number of false mounts, that is mounts that did not lead to ejaculation, was greater in the GnRH agonist treated boars (Estienne et al., 2004). Based on the studies with

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