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Modulating reproductive activity in stallions: A review☆

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Abstract

Situations in which suppression or stimulation of reproductive activity in stallions has been attempted, or is desired, include resolution of the equine arteritis virus 'shedding' state, induction of testicular descent in inguinal cryptorchids, and the improvement of sperm production capacity and/or semen quality in sub-fertile stallions. However, the most common reason for wanting to modulate reproductive activity in a stallion is to alter the expression of sexual behaviour. In the case of intact stallions used for competitive or recreational purposes, the overt expression of sexual or aggressive behaviour can be distracting for both animal and owner and, in some cases, dangerous to all concerned. By the same token, a breeding stallion that displays little interest in mounting a mare/phantom, or is slow to achieve erection and/or ejaculation, can be extremely frustrating. This paper reviews the major pharmacological agents reported to usefully modify reproductive activity in stallions, and outlines their pros and cons when compared to training, management or surgical alternatives.

Keywords: Stallion; Reproductive activity; Sexual behaviour; Suppression; Stimulation

1. Introduction

With regard to the desired end-effect, reproductive modulation in stallions can be divided broadly into two categories, suppression and stimulation. The most common reason for

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wanting to pharmacologically suppress reproductive activity is to inhibit the expression of sexual or aggressive behaviour in stallions currently used for purposes other than breeding, but for whom a subsequent breeding career is envisaged. It is, however, important to note that not all of the components of sexual behaviour are dependent solely on testicular steroid hormones and it is, therefore, not always possible to rid a male horse of unwanted sexual or aggressive behaviour by surgical castration (Line et al., 1985; Cox, 1986), or by a pharmacological treatment that mimics castration. Other reasons for wanting to suppress reproductive activity in stallions include temporary suppression of testosterone production to help clear equine arteritis virus from the accessory sex glands of 'shedding' stallions (Stout and Colenbrander, 2004), and the suppression of fertility in 'harem' stallions as a means of contraception in feral horse populations that threaten to exceed the carrying capacity of a wildlife park (Turner and Kirkpatrick, 1982).

Pharmacological stimulation of reproductive activity in stallions is predominantly requested for breeding stallions that show little enthusiasm for their work or apparent dysfunction in one of the components of mating ability (McDonnell, 1993). However, because sexual desire and mating performance are complex traits affected in an intricate and highly individual manner by management, psychological, hormonal and physical factors, it is important to establish the background and possible causes of any dysfunction and to determine whether training or correction of an underlying management or health problem are more appropriate than an immediate attempt to treat the presenting symptom. Other situations in which reproductive stimulation has been attempted in stallions include gonadotrophin treatment to induce testicular descent in inguinal cryptorchids, or to improve sperm production and semen quality either in sub-fertile stallions (Amann, 1993) or in normal stallions outside the physiological breeding season (Sieme et al., 2004). The aim of this article is to review the most common reasons for wanting to either suppress or stimulate reproductive activity in stallions, to summarise the products available, and to outline the evidence that the treatment in question is preferable to alternative surgical or management approaches, or to doing nothing.

2. Modulating reproductive activity in stallions: why and how?

2.1. Unwanted expression of reproductive or aggressive behaviour

The expression of sexual behaviour by stallions outside the breeding shed is undesirable because it can adversely affect performance or may endanger the handler, rider or others. Fortunately, most young stallions can be taught not to exhibit sexual behaviour in particular circumstances or in response to specific cues. The potential downside to such 'negative conditioning' is, as will be discussed later, that when the stallion is subsequently asked to mount a mare or phantom, he may be too scared or confused to perform (McDonnell et al., 1985). If training fails to curb unwanted behaviour in an intact colt or stallion, the classical approach is to remove the source of testicular steroids by surgical castration. Of course, this is undesirable if the animal may later be required as a breeding stallion and it entails appreciable surgical risk, particularly in older animals. Moreover, surgical castration is not always successful as a means of preventing sexual or aggressive behaviour in horses (Line

et al., 1985; Cox, 1986). While the failure of castration to rid older, retired breeding stallions of behavioural patterns that they have learned and reinforced over years of repetition is not surprising, Line et al. (1985) reported that 20–30% of stallions gelded before 2 years of age still went on to develop typical stallion-like sexual behaviour and aggression towards other horses, while 5% also became aggressive towards people. It follows that treatments aimed predominantly at inhibiting testicular steroid production may also fail to achieve the desired behavioural suppression in all cases; however, they may be useful non-invasive ways of assessing the likely utility of surgical castration for behavioural control in an older stallion. The major pharmacological options described for the suppression of unwanted sexual or aggressive behaviour in stallions are progestagens (Roberts and Beaver, 1987) and GnRH vaccines (Stout and Colenbrander, 2004).

2.1.1. Suppressing sexual behaviour in stallions using progestagens

Until recently, the only practical alternative to castration for the suppression of sexual behaviour in stallions was chronic progestagen administration. It is generally assumed that the major effect of this treatment is to suppress hypothalamic and anterior pituitary secretion of GnRH and LH, respectively, and thereby to inhibit testicular steroid production and sexual behaviour (Brady et al., 1997). However, progestagens also appear to exert a direct 'calming' effect at a higher (CNS) level (Roberts and Beaver, 1987; Perkins, 2004), which presumably explains why progestagens such as altrenogest (Regumate®) are also often effective at curbing unwanted sexual or aggressive behaviour in geldings (McDonnell, 2003). Given how frequently progestagens are used in unruly young stallions in practice, there is surprisingly little published about dose rates, efficacy and side effects. Nevertheless, there is evidence that altrenogest is capable of exerting behavioural control, since Brady et al. (1997) found that treating young (2–4-year old) stallions with 0.088 mg/kg altrenogest daily (double the dose recommended for suppression of oestrus in mares) resulted in an inhibition of both libido and aggressive behaviour. However, because Miller et al. (1997) found no evidence of reduced sexual behaviour in older (>5-year old) stallions treated with 0.044 mg/kg altrenogest for 30 days, it appears either that older stallions are less responsive, for example because the behavioural response has become 'learned', and/or that high circulating concentrations of progestagen are needed for behavioural suppression. A number of long acting progestagen implants or injections have also been reported anecdotally to suppress sexual behaviour in stallions and geldings (including delmadinone acetate; Tardak®; the product commonly used for treating hypersexuality in dogs), with the advantage of less frequent administration; however, effective doses, efficacy and side-effects have not been studied in controlled trials. Moreover, the ability of many of these products to achieve adequate serum concentrations of bioactive progestagen in horses is questionable, since a number (medroxyprogesterone acetate, hydroxyprogesterone hexanoate, megesterol acetate, norgestomet) were unable to maintain pregnancy in mares in the face of prostaglandin $F_{2\alpha}$-induced luteolysis (McKinnon et al., 2000).

The major side effect of progestagen administration is the suppression of spermatogenesis secondary to reduced testicular steroid production (Brady et al., 1997). In older stallions, this is unlikely to be a significant and lasting problem; indeed, Miller et al. (1997) found no reduction in sperm production or quality in mature adult stallions treated with altrenogest for 30 days. However, it is not clear whether long-term administration of progestagens to

peripubertal colts permanently damages spermatogenic capacity. Clearly further studies are necessary to establish which progestagens are most effective for behavioural control, and whether the effects of long-term treatment are fully reversible at the level of spermatogenesis. On a final note of caution, it should be remembered that in many sports, progestagen administration to stallions constitutes a "doping-offence". Moreover, in countries where horses are considered "food-producing" animals there may be further rules that either prohibit the use of progestagens or limit the choice of agents that may be used.

2.1.2. Suppressing reproductive behaviour in stallions by blocking GnRH activity

An alternative way of suppressing reproductive activity in stallions is to block the activity of GnRH at its pituitary receptors. In stallions, this has been attempted using GnRH vaccines, antagonists and large doses of agonists (Stout and Colenbrander, 2004).

2.1.2.1. GnRH vaccines. A GnRH vaccine typically comprises GnRH conjugated to a foreign protein that confers antigenicity, and an adjuvant that enhances antibody formation (Thompson, 2000). The anti-GnRH antibodies that are raised bind to endogenous GnRH within the hypothalamic-pituitary portal vessels and prevent it from binding to receptors on the pituitary gonadotropes, thereby removing the stimulus to gonadotrophin secretion. The resulting loss of gonadal stimulation results in a fall in steroid hormone production and consequent reductions in sexual behaviour and spermatogenesis (Thompson, 2000). Schanbacher and Pratt (1985) were the first to demonstrate the efficacy of GnRH immunization in a stallion when they suppressed testosterone secretion from the abdominal testis of a 3-year-old cryptorchid stallion for 4 months using a series of five immunizations with a LHRH vaccine; they concluded that GnRH vaccination was a useful alternative to surgical castration for suppressing male behaviour in cryptorchids. Subsequently, a handful of small studies have examined the effects of GnRH vaccination on reproductive parameters in normal stallions. Although the efficacy of vaccination depends on the anti-GnRH antibody titer achieved and, therefore, on the exact composition of the vaccine used, the various studies highlight some general patterns in responsiveness. In young stallions, vaccination fairly reliably induces a rise in circulating anti-GnRH antibody titers, followed by reductions in testosterone concentrations and, as a result, in libido and all parameters of sperm production and quality (Dowsett et al., 1991, 1996; Turkstra et al., 2005). In mature stallions, the response to vaccination (anti-GnRH antibody titre) is less reliable and more boosters are often needed to achieve a clinical effect in terms of blood testosterone concentrations and sperm production capacity. In addition, the response is more variable between individuals, and there appears to be a higher incidence of local vaccination reactions than in younger animals, although this may be partly a factor of the larger number of injections used (Malmgren et al., 2001; Stout and Colenbrander, 2004). More significantly, while circulating testosterone concentrations, testicle size, sperm production and sperm quality all drop in mature stallions that respond to vaccination, there are no obvious effects on libido and aggressive behaviour (F. Clément and others, Les Haras Nationaux, unpublished observations). The difference in response to vaccination between young and mature stallions is clearly illustrated by our own studies. Briefly, two injections of a GnRH tandem dimer-ovalbumin conjugate combined with CoVaccine^{TM} adjuvant were sufficient

to induce anti-GnRH antibodies and suppress testosterone production in all of 4 (Turkstra et al., 2005) and 5 (van der Meer et al., 2001) 3–4-year-old Shetland pony stallions for 2–5 months. By contrast, only 4 of 8 retired breeding stallions experienced a fall in testosterone concentrations after two injections of the same vaccine, another two responded moderately after a third vaccination and the remaining two animals failed to respond even after a fourth injection (Malmgren et al., 2001; Clément and others, unpublished observations): in the responders, the four vaccinations allowed suppression of approximately 1 year in duration.

With regard to its efficacy in suppressing sexual behaviour it, therefore, appears that GnRH vaccination may be of more use in young stallions (<4-year old) than in older animals in which it is more difficult to elicit an effective GnRH antibody titre and in which the behavioural patterns may be 'hard-wired'. As with progestagens, the major side effect of using GnRH vaccines for behavioural control is a profound suppression of sperm production. However, data from our studies showed that, even in 2–4-year-old stallions yet to achieve full sexual maturity, spermatogenic capacity had recovered to the level of untreated controls within 4 months after the GnRH antibody titres had declined (Turkstra et al., 2005; K.J. Teerds and others, Utrecht University, unpublished data). Recently, a GnRH vaccine (Equity^{TM} Oestrus Control: CSL Animal Health, Victoria, Australia) was licensed in Australia for the control of oestrus and oestrus-related behaviour in mares, and has apparently found an additional 'off-license' market for the control of sexual behaviour in stallions; it will be interesting to hear in-the-field experiences of its use for behavioural control.

2.1.2.2. GnRH antagonists. GnRH antagonists suppress the release of gonadotrophins by competitively occupying pituitary GnRH receptors. In stallions, GnRH antagonists have been shown to inhibit secretion of LH and testicular steroids (Hinojosa et al., 2001; Fortier et al., 2002). However, as with GnRH vaccines the behavioural response to suppression appears to be age-dependent; whereas a large single dose of antarelix (100 μg/kg) suppressed libido in young stallions (Hinojosa et al., 2001), daily doses of 10 μg/kg antarelix or cetrorelix for 35–37 days did not affect libido in mature adult stallions despite a dramatic fall in circulating testosterone concentrations (Fortier et al., 2002). Moreover, the use of GnRH anatagonists for behavioural control in clinical practice is likely to be prohibited by the extremely high costs of effective doses.

2.1.2.3. High doses of GnRH agonists. In a number of species, chronic high-dose administration of a GnRH agonist induces, after an initial gonadotrophin hypersecretion, pituitary desensitization and decreased gonadotrophin release. However, there are clear species differences in susceptibility to the down-regulatory effects of GnRH agonists, and the available evidence suggests that stallions are fairly resistant to suppression. Moreover, while Boyle et al. (1991) reported that chronic GnRH agonist treatment induced, following a transient stimulation, a clear suppression of gonadotrophin secretion, testicular steroid production and spermatogenesis in mature stallions, libido was not affected. In addition, Brinsko et al. (1998) were unable to demonstrate any suppressive effects of chronic high dose GnRH administration (250 μg every 2 h for 75 days), while Roser and Hughes (1991) and Sieme et al. (2004) reported a contradictory enhancement of gonadotrophin secretion, sperm quality and libido in animals treated chronically with GnRH outside the physiological breeding

season. In short, high doses of GnRH do not appear to be a useful way of suppressing reproductive behaviour in stallions.

2.1.3. Elimination of the equine arteritis virus (EAV) shedder status

Infection of a naïve stallion with EAV is generally either asymptomatic or results in a transient vasculitis, with typical clinical signs including respiratory disease, conjunctivitis and oedema of the head and extremities. In most cases, equine virus arteritis (EVA) is similarly mild in mares; however, in countries or horse-populations where EVA is not endemic, it is considered a serious problem because it can cause abortion in pregnant mares and is occasionally life threatening in foals (Timoney and McCollum, 1997). Although many stallions clear the virus after the acute stage, 30–60% become asymptomatic carriers with the virus localising in the accessory sex glands from where it is shed into the semen during ejaculation (Timoney and McCollum, 1993). Since EAV antibody negative mares can develop an active viral infection after insemination with semen from a shedding stallion (even if that semen has previously been centrifuged, frozen and thawed), shedding stallions are an important reservoir of virus and many countries insist that stallions are proven non-shedders before they can be registered for breeding, and certainly before their semen is approved for export. Although vaccination against EVA should prevent the establishment of the shedder state (Timoney and McCollum, 1997), EVA vaccines are not licensed in all countries. Moreover, while shedder stallions may spontaneously clear the virus from their accessory glands, many continue to shed for a number of years (Timoney and McCollum, 1993), at considerable loss of revenue to their owner. However, it appears that viral persistence in the stallion's accessory sex glands is testosterone-dependent (McCollum et al., 1994), and it has been proposed that suppressing testosterone production for a prolonged period may be a way of resolving the shedder state while preserving breeding potential (Stout and Colenbrander, 2004). In this respect, Fortier et al. (2002) reported that daily treatment with a GnRH antagonist (10 μg/kg cetrorelix or antarelix) for 35–37 days led to a temporary elimination of virus from the semen of all of five treated stallions. And although three subsequently resumed viral secretion, two remained negative. However, because, two of four control stallions also ceased virus shedding during the experimental period, the authors were not able to prove that the resolution in the first group was an effect of treatment. Similarly, while Burger et al. (2004) reported the cessation of EAV shedding by a stallion in which testosterone production was suppressed for 5 months by vaccination against GnRH, it is not possible to exclude the possibility that virus secretion stopped spontaneously. To date, there is thus only preliminary, inconclusive evidence to suggest that GnRH vaccines or antagonists can 'cure' EAV shedding stallions while preserving their reproductive capacity.

2.1.4. Contraception

Although contraception is not an issue in domestic horses, in feral horse populations fertility suppression (or culling) is sometimes required to prevent numbers increasing beyond the carrying capacity of a park. While immunocontraception with a porcine zona pellucida (PZP) vaccine has proven a practical, successful and reversible approach to population control in horses (Kirkpatrick et al., 1992), it is only applicable to mares and a large percentage must be vaccinated if fertility control is to be effective. By contrast, because harem-stallions are few and readily identifiable, male contraception would be a cheaper and easier alter-

native, as long as the harem stallion's fertility could be curtailed without him losing social dominance and his band of mares. In this respect, microencapsulated or silastic-implant androgen (e.g. testosterone propionate) preparations have been shown to significantly reduce the foaling rate (0.07 foals per mare in bands of treated stallions versus 0.37 for controls; Turner and Kirkpatrick, 1982) without altering stallion sexual or dominance behaviour. However, the practicality of the androgen preparations was limited by the need for large doses and frequent administration, often under restraint. In theory, GnRH vaccines might offer an easier to administer alternative to steroid implants; however, their usefulness is currently limited by the lower response rate in mature adult stallions and, in responders, the suppression (without replacement) of endogenous testosterone production may be a disadvantage; in the longer term, a responding stallion may lose his position in the dominance hierarchy and thus his harem, and many more males would then need to be vaccinated to ensure effective population control.

3. Stimulating reproductive function in stallions: why and how?

3.1. Stimulating sexual behaviour

Apparently low sexual motivation/libido or poor mating ability are among the more common reproductive complaints in the breeding stallion. In fact, the root cause of the problem often has more to do with previous experience, current health, handling or management than a specific reproductive dysfunction. It is, therefore, generally accepted that pharmacological manipulation to stimulate libido or aspects of mating ability is a last resort to be attempted only when clinical examination, careful observation of management and handling practices, and patient attempts to train and encourage the stallion have not been successful (McDonnell, 1993). In many cases where "stimulation" of sexual behaviour is the stated requirement, the actual desired effect could more correctly be classified as a relief from psychological obstacles to sexual desire or performance, where these are themselves often the result of previous bad experiences and/or 'negative conditioning' to prevent the expression of sexual behaviour during a competitive career (McDonnell et al., 1985). Indeed, for 'slow-starting' young stallions, sympathetic handling, patience and an experienced oestrous mare are usually all that are required to overcome initial inhibitions. Similarly, when treatments to reduce anxiety (0.05 mg/kg diazepam slow i.v. 5 min prior to breeding) or to temporarily boost libido (50 μg GnRH s.c. 2 and 1 h prior to breeding) are considered necessary in a novice stallion, they are usually required on only a limited number of occasions (mostly once), because ejaculation is a powerful reinforcing stimulus (McDonnell, 2003). Although the GnRH treatment regime aims to temporarily increase circulating testosterone concentrations, use of exogenous testosterone to boost libido is not recommended because too a high a dose risks suppressing spermatogenesis and stimulating aggressive behaviour (circulating testosterone concentrations should be maintained at <4 ng/ml; McDonnell, 1993).

The reason for poor libido or failure to achieve erection or ejaculation in an experienced breeding stallion is often even more complicated and it is, therefore, essential to fully investigate the background, management factors and/or disease processes that may have contributed to the problem. Common factors include unsympathetic handling, overuse,

illness or pain (often musculoskeletal) or, in the case of a stallion used for artificial insemination, an inadequately prepared artificial vagina (e.g. not hot enough, too little pressure). In a small selection of stallions, poor libido may truly be secondary to low circulating androgen concentrations. However, because LH and testosterone secretion show a diurnal pattern, it is recommended that blood samples be collected over the course of at least 8 h, starting in the morning, if an androgen insufficiency is to be confirmed (Nett, 1993). If proven, low androgen production could be a symptom of the 'bachelor stallion effect' described by McDonnell and Murray (1995); that is, a socially mediated suppression in testosterone production and reproductive function in subordinate stallions within a group. Therefore, reducing contact with other stallions and increasing contact with mares might allow recovery of testosterone production and sexual behaviour. While androgen insufficiency has also been hypothesised to arise from insufficiency in hypothalamic GnRH release (hypogonadotrophic-hypogonadism) that, in some cases, can be remedied by chronic pulsatile administration of GnRH (Amann, 1993), this remains an area of contention (e.g. Blue et al., 1991). In addition, care is needed with long-term GnRH administration to avoid suppressing spermatogenesis (Boyle et al., 1991). Nevertheless, chronic GnRH treatment has been reported to improve libido in stallions outside the physiological breeding season (Sieme et al., 2004), by enhancing the seasonally depressed LH and testosterone concentrations (Roser and Hughes, 1991).

3.2. Improving semen production or quality

A treatment that improved semen production, quality and/or fertility in sub-fertile or, indeed, normal stallions would be a best seller. But while many treatments and supplements have been claimed anecdotally to improve one or all of these parameters, few have been conclusively proven to work in more than a handful of specific cases (Amann, 1993). Indeed, with the possible exception of GnRH administration (50 μg buserelin i.m. twice daily) during the winter (Sieme et al., 2004) when endogenous LH and testosterone production are lower than during the physiological breeding season (Roser and Hughes, 1991), there is little evidence that it is possible to improve semen quality in fertile or sub-fertile stallions unless the problem is related to a specific deficiency, previous medication or disease; and then treatment would be aimed primarily at resolving the underlying problem and allowing spermatogenesis to recover naturally. While there are anecdotal reports of presumed hypogonadotrophic-hypogonadic sub-fertile stallions that respond to chronic pulsatile GnRH administration by increasing testosterone levels and semen quality (Amann, 1993), such stallions are likely to be rare. Indeed, Blue et al. (1991) were unable to improve semen quality in nine sub-fertile stallions to which they administered GnRH in pulses of 10 μg s.c. every 2 h for 20 weeks. In addition, Roser and Hughes (1992) reported that five sub-fertile stallions that they subjected to GnRH challenge responded with an increase in LH production similar to that in fertile stallions, except that it was not accompanied by the expected rise in circulating testosterone concentrations; the subfertile animals also had abnormally high basal gonadotrophin levels. As a result, these authors suggested that subfertility in these stallions was more likely to be associated with impaired ability of the Leydig cells to produce androgens in response to LH, or to the release of biologically inactive gonadotrophins from the pituitary, than with impaired endogenous GnRH production.

In short, although GnRH and hCG challenge tests may help to identify an endocrine basis to sub-fertility (Nett, 1993), there is currently too little known about the various endocrine, paracrine and autocrine regulators of spermatogenesis in the stallion (but see Roser, 2001) to be sure that long-term treatment with gonadotrophins will do more good than harm.

3.3. Inducing descent of inguinally retained testes

Most cryptorchid colts are castrated bilaterally because the retained testicle produces steroid hormones and stimulates stallion-like behaviour, but does not produce sperm. Moreover, although a unilaterally cryptorchid stallion will often produce sufficient sperm from his scrotal testicle for normal fertility, studbooks will not accept them for registration because there may be a hereditary component to cryptorchidism (Cox, 1999). It can therefore be argued that it is unethical to induce testicular descent in a unilaterally cryptorchid stallion if this involves surgical intervention (Cox, 1993). However, in prepubertal boys, gonadotrophins (e.g. GnRH, hCG, human menopausal gonadotrophin) have been used to stimulate the early onset of spermatogenesis and testicular growth in the hope of facilitating descent of an inguinally retained testicle; response rates are reported to be around 15% (Bertelloni et al., 2001). In stallions, there are also anecdotal reports of the use of hCG or GnRH treatment to induce descent of an inguinally retained testicle. If this is to be attempted, it should not be delayed until long after puberty because the spermatogenic capacity of the retained testicle will be permanently damaged by the high temperature of the inguinum, and the testicle may remain small, soft and spermatogenically inactive even after descent. Treatments that have been suggested to help induce testicular descent in young colts (<2-year old) include 500 μg GnRH daily for up to 3 weeks or 2500 IU hCG twice a week for up to 6 weeks (Ptaszynska, 2002). However, it is not known how often testicular descent is successful, and whether the testicle subsequently achieves normal spermatogenic function; indeed, a degree of the initial increase in size is probably a result of oedema due to increased capillary permeability rather than normal growth (Cox, 1999). Furthermore, since no controlled studies have been performed, one cannot be certain that descent would not have occurred without gonadotrophin treatment. Pawlak and Tischner (2001) have at least reported that administering 2000 IU hCG three times a week for 16 weeks to 5–7-month old normal pony stallions did not induce any pathological changes or damage sperm production; they noted only a transient rise in testosterone production and an earlier onset of sexual behaviour than in control animals.

4. Conclusions

Sexual behaviour problems are common in equine practice and, because the underlying mechanisms are poorly understood, they are often challenging to resolve. The suppression of unwanted sexual behaviour in intact stallions can be attempted using GnRH vaccines or progestagens (e.g. altrenogest), but resolution appears to be more likely in young animals (<5-year old). In difficult cases, progestagens may have an advantage because they exert an extra calming effect at the level of the CNS. Enhancement of sexual activity is even more prone to pitfalls. Essentially there are no verified treatments for improving semen quality

or fertility, except possibly the chronic administration of GnRH outside the physiological breeding season; even then, care is needed to avoid contradictory suppression of sperm production. Treatments are available to reduce anxiety or to temporarily boost libido in stallions that are slow to show sexual interest, but pharmacological stimulation to resolve sexual behaviour problems with a less obvious origin is generally considered a last resort and initiated only when the resolution of underlying physical and managemental problems, and gentle retraining, have failed to offer a satisfactory solution.

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