EAZA RMG
EAZA Reproductive Management Group

Taxon name: *Canidae*

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We would recommend assessing any contraceptive bout with behavioural and hormone monitoring. For more information on this, please contact contraception@chesterzoo.org

Contraceptive methods:	GnRH agonist (implant)	GnRH agonist (injection)	Progestogen (Oral)	Progestagen (implants)	Progestagen (implant)	Progestagen (injection)	Progestagen (injection)	GnRH vaccine (injection)	Surgical/ Permanent
Contraceptive Product:	Deslorelin acetate	Luprolide acetate	Megestrol acetate	Etonogestrel 68 mg	Levonorgestrel 2x 75mg	Medroxyprogesterone acetate 150 mg/ml	Proligestrone 100mg/ml	GnRH protein conjugate	N/A
Commercial Name:	Suprelorin ®	Lupron®	Ovarid/Megace®	Implanon® Nexplanon®	Jadelle®	Depo-Provera®, Depo-Progevera®, Cenavul®	Delvosteron®, Covinan®	Improvac®	N/A
Product Availbility:	4.7mg ('Suprelorin 6') and 9.4 mg ('Suprelorin 12') widely available through veterinary drug distributors in the EU.	Luprolide acetate licenced for human use.	Manufactured by Virbac, available through veterinary distributors.	Manufactured by Bayer Schering Pharma AG. Available through human drug distributors.	Manufactured by Organon. Available through human drug distributors.	Manufactured by Pfizer. Widely avilable throughout Europe through human drug distributors.	Manufactured by MSD animal Health UK, Intervet Europe. Licensed for use in female dogs, cats, and ferrets; available through veterinary distributors.	Available through veterinary drug distributors.	N/A
Restrictions and/or permit required by Importing Country:	The EAZA RMG recommends: always check with your local licencing authority.	**Data deficient.**	The EAZA RMG recommends: always check with your local licencing authority.	The EAZA RMG recommends: always check with your local licencing authority.	The EAZA RMG recommends: always check with your local licencing authority.	The EAZA RMG recommends: always check with your local licencing authority.	The EAZA RMG recommends: always check with your local licencing authority.	Widely available throughout European countries. The EAZA RMG recommends: always check with your local licencing authority	N/A
Mechanism of action:	GnRH agonist suppresses the reproductive endocrine system, preventing production and secretion of pituitary and gonadotrophic hormones. As an agonist of the GnRH, it initially stimulates the reproductive system -which can result in oestrus and ovulation in females and temporary enhancement of testosterone secretion and spermatogenesis in males - therefore additional contraception is needed during this period in females. Please, see below and refer to Deslorelin datasheet for detailed information.	GnRH agonists suppress the reproductive endocrine system, preventing production of pituitary and gonadal hormones.	Anti-oestrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation. Progestogen contraceptives are associated with progressive uterine growth and degeneration (i.e. endometrial hyperplasia) that can result in infertility, infection, and sometimes uterine neoplasia; mammary tissue stimulation due to long-term progestagen exposure also can result in mammary gland neoplasia.	Anti-oestrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation.	Anti-oestrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation.	Anti-oestrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation. Long-term use of progestagen contraceptives are associated with progressive uterine growth and degeneration (i.e. endometrial hyperplasia) that can result in infertility, infection, and sometimes uterine neoplasia. Mammary tissue stimulation also can result in mammary gland neoplasia.	Anti-oestrogenic activity. Interference with fertilization by thickening cervical mucus, interrupting gamete transport, disruption of implantation, inhibition of LH surge necessary for ovulation. Long-term use of progestagen contraceptives are associated with progressive uterine growth and degeneration (i.e. endometrial hyperplasia) that can result in infertility, infection, and sometimes uterine neoplasia. Mammary tissue stimulation also can result in mammary gland neoplasia.	Production of anti-GnRH antibodies by the immune system, neutralising endogenous GnRH activity. This results in a reduction of FSH and LH production by the anterior pituitary and, ultimately, in a reduction of ovarian follicular development, ovarian steroids and, in males, inhibition of testosterone synthesis and secretion from the testes and spermatogenesis.	**Castration:** surgical removal of the testes. **Vasectomy:** surgical procedure in which the ductus deferens are cut, tied, cauterized, or otherwise interurrupted. Salpingectomy: Fallopian tubes are tied off. **Ovariohysterectomy:** removal of one or both ovaries and the uterus. **Ovariectomy:** removal of both ovaries.
Insertion/Placement:	Subcutaneous, in a place where it can be easily detected or located for removal at a later date (e.g. upper inner fore- or hind leg or post-umbilical area); refer to the Suprelorin fact sheet for effective method of implant placement (tunnelisation).	Injectable.	Orally (daily)	Intramuscular or subcutaneous. The EAZA RMG recommends subcutaneous, upper inner arm for visibility (aid for later removal).	Intramuscular or subcutaneous. The EAZA RMG recommends subcutaneous, upper inner arm for visibility (aid for later removal).	Injectable (intramuscular).	Injectable subcutaneously - do not inject intradermally or into subcutaneous fat or scar tissue.	Injectable intramuscular or subcutaneously.	N/A
Females	**Recommended**	**Data deficient**	**CAUTION - see side effect below**	**Not recommended for long term (>2 years / >2 breeding seasons) use**	**Not recommended for long term (>2 years / >2 breeding seasons) use**	**Not recommended for long term (>2 years / >2 breeding seasons) use**	**Not recommended for long term (>2 years / >2 breeding seasons) use**	**Data deficient**	**Ovariectomy/Ovariohysterectomy**
Dose:	**Data deficient.** Dosages and duration of efficacy have not been well established for all canid species. Dosages required have been generally higher than the effective for domestic dogs. For example, one or perhaps two 4.7 mg implant is the standard dose for dogs, but female Mexican wolves weighing 20–25 kg typically require four implants. Dosing for individual species should not be calculated by body weight alone. Please contact the EAZA RMG for dosage recommendations.		2-5 mg/kg daily orally for 7 days before and 7 days after the placement of Suprelorin implants (see GnRH recommendations). As a contraceptive, it should not be used for long-term contraception (>2 years) nor in seasonal breeders for more than 2 consecutive seasons.	N/A	N/A	N/A	N/A	**Data deficient.**	N/A
Latency to effectiveness:	3 weeks average as GnRH agonist initially stimulates gonadotrophin before suppression is achieved - please, refer to the Deslorelin datasheet for detailed information. Additional contraception is needed during this period in order to suppress the initial stimulatory phase (see product data sheet; ~2mg/kg megestrol acetate pills (Ovarid/Megace®) or progestin birth control pills daily 7 days before and 7 days after has been used to suppress initial stimulatory phase. In studies on wild canids, the stimulation phase was not suppressed, and no complications occurred. However, it may be that any complications went unnoticed.		If a progestin is used in canids, treatment should start well BEFORE any signs of prooestrus, since the elevated endogenous oestrogen can exacerbate side effects of the progestin.	N/A	N/A	N/A	N/A	Latency to effectiveness can be up to 6 weeks, so separation of the sexes is recommended if possible.	Immediate.
Oestrous cycles during contraceptive treatment:	Initial oestrus and ovulation (during the first 3 weeks post implantation) may occur before cyclicity is supressed. To supress the initial oestrus and ovulation, the subsequent progesteron production, and the associated deletereous effects of long-term progesterone exposure you **MUST** follow the megestrol acetate protocol described above.			N/A	N/A	N/A	N/A	**Data deficient,** but cycling should be suppressed.	
Use during pregnancy:	**Not recommended.**		**Not recommended.** Progestins should not be used in pregnant animals, since they may suppress natural signals and mechanisms necessary for normal parturition (e.g. uterine contractions). Thus, progestins should only be administered to females CONFIRMED non-pregnant.	N/A	N/A	N/A	N/A	Unknown.	
Use during lactation:	No contraindications once lactation has commenced.			N/A	N/A	N/A	N/A	Unknown.	
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet. Deslorelin acetate seems to delay puberty onset in domestic bitches younger than 6 months; similar effects may be expected in non-domestic canids.			N/A	N/A	N/A	N/A	Unknown.	Ovariectomy and castration may delay epiphyseal closure of the long bones, resulting in taller individuals. Increased risk of rupture of the cranial cruciate ligament. Immaturity of external genitalia (infantile vulva - Increased risk of urinary incontinence and cistitis).
Use in seasonal breeders:	**Data deficient**. Treat at least 1 months or more prior the expected breeding season.		If a progestin is used in canids treatment should start well BEFORE any signs of prooestrus, since the elevated endogenous oestrogen can exacerbate side effects of the progestin.	N/A	N/A	N/A	N/A	**Data deficient,** but if used, vaccination should be done at least 6 weeks prior to the breeding season, before cycling starts.	
Duration:	Duration of efficacy has not been well established. As a guideline, 4.7 mg implants will suppress for a **minimum** of 6 months (typically effective for approximatelly 1 year); 9.4 mg will be effective for a **minimum** of 12 months (typically effective for approximatelly 2 years).			N/A	N/A	N/A	N/A	Unknown for most of species. Antibodies in the domest pig (species marketed for) last approximately 6 months.	Irreversible.

Reversibilty:	Considered reversible, but has not been tested in all species. Reversibility has been demonstrated in African wild dogs, maned wolves, arctic foxes, bat-eared foxes, fennec foxes, gray wolves, red wolves, and Mexican wolves. Duration to reversibility is extremely variable. **Removal of implant is recommended to aid reversibility.** Implants should be placed in locations with thinner skin e.g. the umbilicus, base of the ear, inner frontleg (axilla), or inner thigh. The site of implantation should be recorded for future reference.			N/A	N/A	N/A	N/A	Data deficient. **Improvac has not been designed to be reversible,** however reversibility has been demonstrated in some wild animal species when used short term. We do not have any records of reversal in canid species.	Irreversible; procedures should only be carried out with the full apporval and knowledge of the species coordinator.
Effects on behaviour:	Females - anoestrus (similar to those seen with gonadectomy, but reversible).		May cause decreased libido, increased apetite, polyuria/polydipsia.	N/A	N/A	N/A	N/A	Similar to surgical castration for the duration of antibody effect.	Reproductive behaviour supressed aftr castration and ovariectomy.
Effects on sexual physical characteristics:	Similar to gonadectomy. Side effects have been reported in a few bitches and include uterine disease, urinary incontinence and changes in hair coat. Weight gain may be observed.	Some dichromatic species may change colour.	Increase in body weight.	Some signs of oestrus behaviour might occur. Ovulation may also occur even though pregnancy does not ensue.	Some signs of oestrus behaviour might occur. Ovulation may also occur even though pregnancy does not ensue.	See above.	See above.	Similar to surgical castration for the duration of antibody effect.	Weight gain might occur following castrtion and ovariectomy.
Males	**Recommended**	**Data deficient**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**Data deficient**	**Castration/Vasectomy**
Dose:	Usually higher doses are required in males than in females, particularly to mediate testosterone dependent behaviour. **Data deficient.** Please contact the EAZA RMG for dosage recommendations.		N/A	N/A	N/A	N/A	N/A	**Data deficient.**	
Latency to effectiveness:	Testosterone decreases after 3-4 weeks, but sperm can remain viable for longer. Depending on the species there may be fertile sperm present in epididymis/vas deferens for 6-8 weeks post treatment or even longer.		N/A	N/A	N/A	N/A	N/A	Latency to effectiveness can be up to 6 weeks, so separation of the sexes is recommended if possible.	Allow 6-8 weeks post surgery to ensure no viable sperm in ejaculate. Keep sexes appart during this period or keep females contracepted.
Use in prepubertals or juveniles:	**Data deficient** in this group, see product information sheet. Deslorelin acetate seems to delay puberty onset in 4 months-old domestic dogs[5]; similar effects might be expected in non-domestic canids.		N/A	N/A	N/A	N/A	N/A	**Data deficient.**	
Use in seasonal breeders:	**Data deficient.** Should start at least 2 months prior the breeding season. In African wild dogs treatment is recommended 2 months before the expected breeding season in males or females.		N/A	N/A	N/A	N/A	N/A	**Data deficient**. If used, vaccination should be done at least 6 weeks prior to the breeding season, before cycling starts.	
Duration and Reversibility:	Deslorelin is considered reversible and reversibility has been demonstrated in the African wild dog, red wolf and the Mexican wolf. As a guide: 4.7 mg implants will suppress for a minimum of 6 months (typically effective for approximatelly 1 year); 9.4 mg will be effective for a minimum of 12 months (typically effective for approximatelly 2 years). Complete recovery of seminal quality will take at least 8-9 weeks after normalization of testosterone concentrations.		N/A	N/A	N/A	N/A	N/A	Unknown for most species. Improvac is NOT designed to be reversible. There are currently no records of reversal on the database for canids However; anecdotal reports in several species have shown Improvac to be reversible following short-term use.	Irreversible; procedures should only be carried out with the full apporval and knowledge of the species coordinator.
Effects on behaviour:	Testosterone related aggression is likely to decrease. Data deficient in this group, see product information sheet. Territorial behaviour of males may be affected.		N/A	N/A	N/A	N/A	N/A	Similar to surgical castration, but for the duration of antibody effect. Decreases male aggression due to down regulation of testosterone synthesis.	Normal male and female behaviour with vasectomy and salpingectomy, respectively. Loss or reduction of testosterone mediated behaviour with castration.
Effects on sexual physical characteristics:	Similar to gonadectomy, but reversible. Feminisation of males, decreased testicular size. Body size may also decrease.		N/A	N/A	N/A	N/A	N/A	Similar to surgical castration but short-acting (for the duration of antibody effect).	No loss of secondary sex characteristics with vasectomy and salpingectomy. Feminisation of males with castration.
General:									
Side effects:	Pseudopregancy, endometrial hyperplasia and pyometra may be associated with the use of GnRH agonists as a result of high progesterone levels should ovulation occur during the stimulation phase. A more recently developed Suprelorin® (deslorelin-acetate) protocol using Ovarid® (megestrol acetate) to prevent the initial stimulation phase, followed by implant removal when reversal is desired, may be a safer contraceptive option. Depo-Provera® cannot be used to suppress the stimulation phase as it disrupts downregulation with Suprelorin.		Risk of pseudopregancy, endometrial hyperplasia and pyometra increases with exposure to prolonged circulating progestagens.	Risk of pseudopregancy, endometrial hyperplasia and pyometra increases with exposure to prolonged circulating progestagens.	Risk of pseudopregancy, endometrial hyperplasia and pyometra increases with exposure to prolonged circulating progestagens.	Risk of pseudopregancy, endometrial hyperplasia and pyometra increases with exposure to prolonged circulating progestagens.	Risk of pseudopregancy, endometrial hyperplasia and pyometra increases with exposure to prolonged circulating progestagens.	Occasional swelling at the vaccination site - vaccination site abscess may occur. The EAZA RMG recommends always reading the manufacturer's data sheet.	Orchidectomy: prostatic neoplasia, osteosarcoma, haemangiosarcoma, Increased risk of cranial cruciate ligament rupture and weight gain have been observed in domestic canids after - might therefore also occur in other canids.
Warnings:	Causes initial gonadal stimulation that MUST be suppressed (see above); correct administration is essential - see product information sheet.							It should be handled with extreme care to avoid handler accidents. The EAZA RMG recommends always reading the manufacturer's data sheet.	Vasectomising the male will not prevent potential adverse effects to females from prolonged, cyclic exposure to endogenous steroids associated with the obligate hormonal pseudopregnancy that follows ovulation in canids. The risk of pseudopregnancy and pyometra increases with age and over time in females that experience exposure to progesterone during repeated non-conceptive cycles. Risks of developing pathologies are s{ecies specific and dependent on the length of the luteal cycle and the number of oestrus cycles a female goes through. We would **strongly discourage** tubal ligation in canidae due to the associated risk of developing uterine pathology.

Reporting Requirements: In order to increase our knowledge of the efficacy of contraception methods in the Canidae family it is recommended that all individuals on contraception be reported to the EAZA RMG

References:

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7) Agnew, MK, Asa, CS, Franklin, AD, McDonald, MM, & Cowl, VB. (2021). Deslorelin (Suprelorin®) use in North American and European Zoos and Aquariums: taxonomic scope, dosing, and efficacy. *Journal of Zoo and Wildlife Medicine* , 52(2), 427-436.

8) Asa, C.S. & Porton, I.J. (eds.) (2005) Wildlife Contraception: Issues, Methods, and Applications. The Johns Hopkins University press: Baltimore.