

OBJECTIVES



- 1) Bibliographic review and **synthesis** of the main aspects related to **cryptorchidism** in horses.
- 2) Summary of the **main diagnostic techniques** and analysis of new **techniques based on the activity of the anti-Müllerian hormone** as a biomarker for the diagnosis of cryptorchidism in equines.
- 3) **Comparison** based on concrete studies among the main **diagnostic techniques**.

INTRODUCTION



Types of retention

- Inguinal
 - temporary
 - permanent
- Abdominal
 - complete
 - incomplete
- Unilateral/Bilateral

Incidence

- Prevalence in foals 2-8%
- Unilateral cryptorchids > bilateral cryptorchids

CRYPTORCHIDISM

Causes and genetics

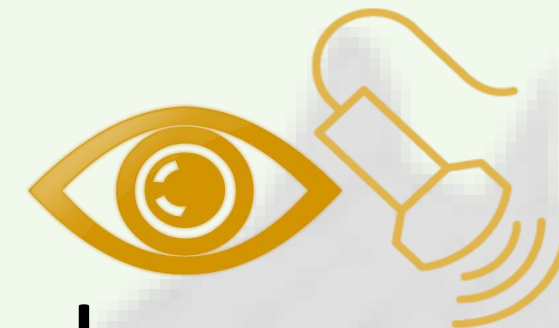
- Multifactorial
- Failure in **TESTICULAR DESCENT**
- Regulated by different genes
Over-representation in some breeds

Consequences

- Ethology: nervousness, aggressiveness, stallion like behaviour
- Reproductive: infertility

DIAGNOSTIC METHODS

HISTORY, PALPATION & ULTRASONOGRAPHY



- **Rig** → entire male horse with stallion like behavior and no signs of external testicles. // **False rig** → gelding male horse with stallion like behavior and no signs of external testicles.
- At **1 to 2 years of age**, a stallion should receive an **examination** of inguinal and scrotal areas. If the testes are not present, rectal examination should be performed.
- **Ultrasonography** (transrectal or transcutaneous): **cryptorchid testis** → smaller, higher degree of echogenicity and difficult to see the central vein.

ANTI-MÜLLERIAN HORMONE CONCENTRATIONS

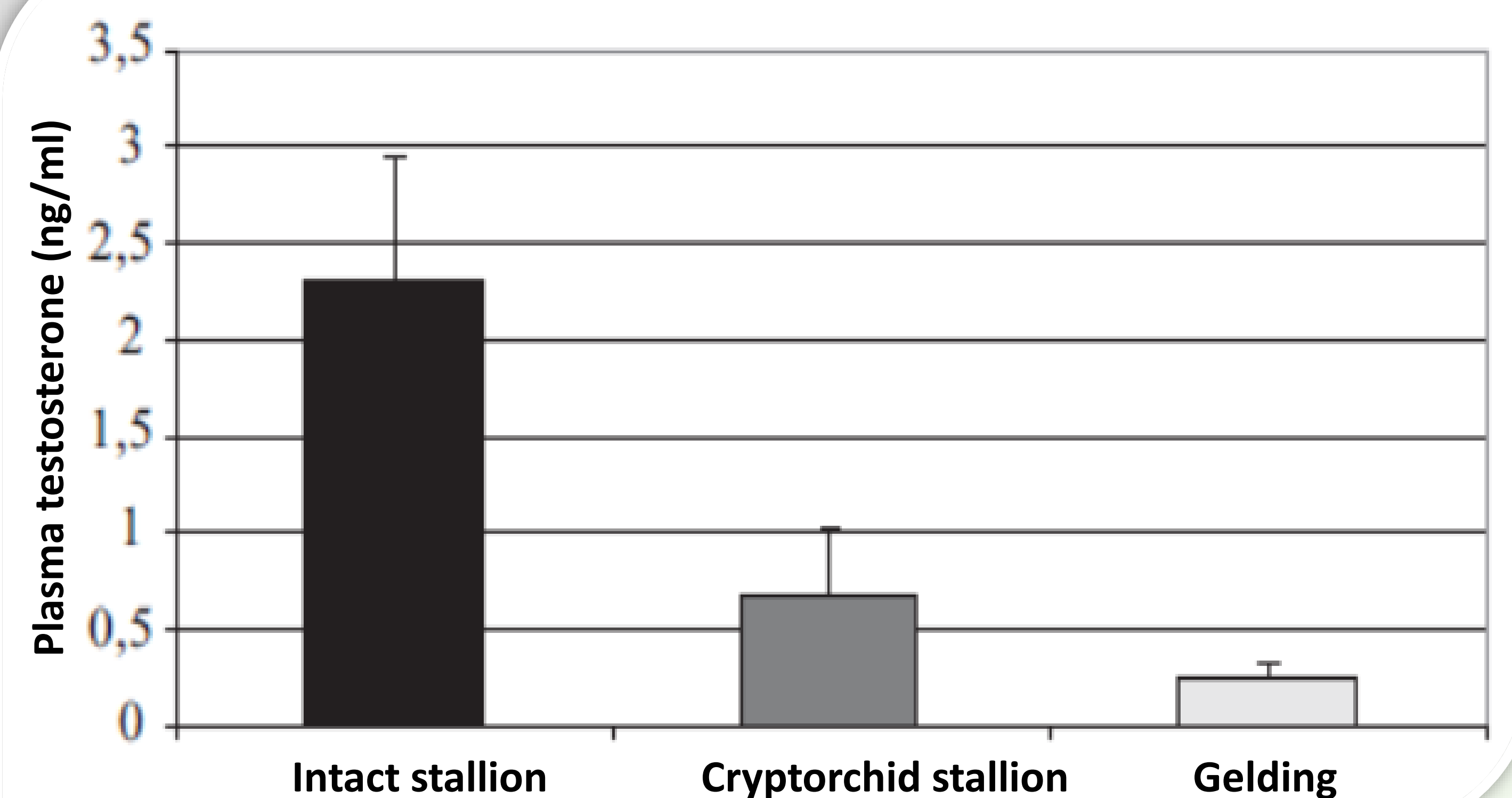


- Functions of AMH: **sexual differentiation** during foetal live and **inhibition of Leydig cells** (quiescent state of testis) in foals.
- AMH secreted only by Sertoli cells → **specific marker of testicular tissue**.
- Cryptorchid stallion > intact stallion > gelding.

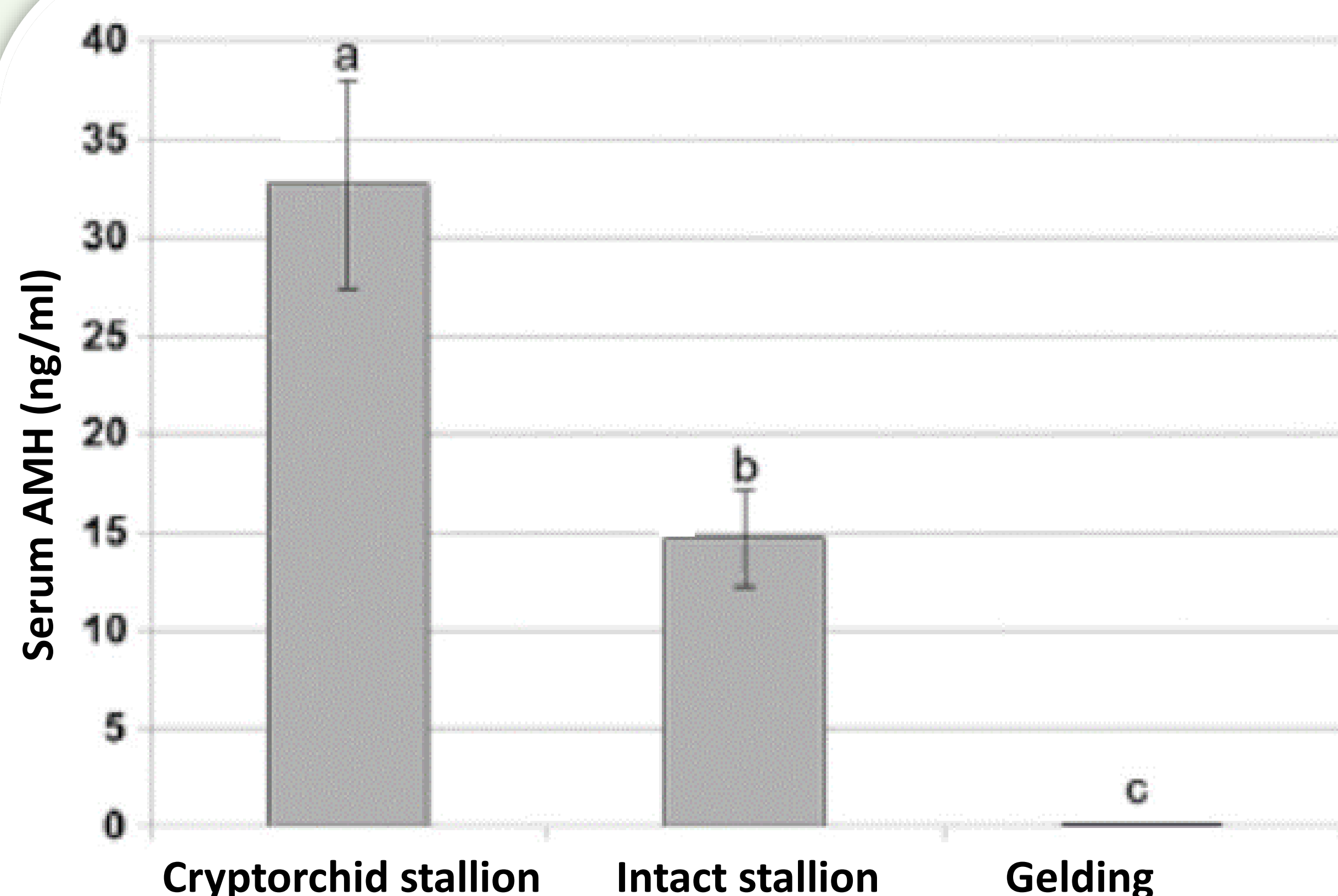
BASAL TESTOSTERONE CONCENTRATIONS



- Sources of **variability**: season, age and secretion of testosterone by adrenal glands.
- Cox et al. 1986, (n=1720) → 14%
 - **hCG stimulating test** → 6,7%
 } not clear result
- Intact stallion > cryptorchid stallion > gelding.

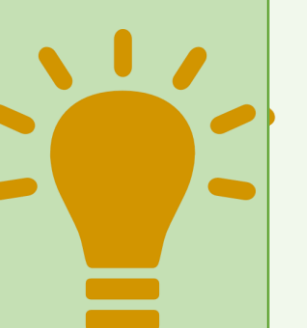


Basal plasma level of testosterone in cryptorchid stallions (n=32), intact stallions (n=15), and geldings (n=15). Raš et al. 2010.



Mean serum AMH concentration in cryptorchid stallions (n=41), intact stallions (n=15), and geldings (n=41). Claes, Barry A. Ball, et al. 2013.

CONCLUSIONS



- **Cryptorchidism** is a relatively **frequent** condition in **equines** with a **multifactorial origin** and a **genetic basis**.
- The **diagnosis** can be very **simple** or very **complex** and may require the **combination of diagnostic techniques**.
- The use of **basal testosterone** concentrations for the cryptorchidism diagnosis generates **inconclusive results** and may require the use of additional techniques.
- The **anti-Müllerian hormone** is a good **biomarker** for the presence of **testicular tissue** and may be useful in the endocrine diagnosis of cryptorchidism in equines.
- In veterinary medicine, **more research is needed** into the diagnosis of cryptorchidism by the anti-Müllerian hormone.

REFERENCES

- Almeida J, Conley AJ, Mathewson L, Ball BA. 2012. Expression of anti-Müllerian hormone, cyclin-dependent kinase inhibitor (CDKN1B), androgen receptor, and connexin 43 in equine testes during puberty.
- Ary M, Ee ML, Aitica P, Onahoe KD, Ilverman EL, Ononobu T, Asegawa H, Ukihiro Y, Ichai M, Ustaofan LG, et al. 1997. Measurements of serum Müllerian inhibiting substance in the evaluation of children with nonpalpable gonads.
- Bauer PK. 2006. Disrupted sex differentiation and feminization of man and domestic animals.
- Boss WTK. 1989. Comparison of hormonal methods for diagnosis of cryptorchidism in horses.
- Carlson CL. 2011. Blackwell's Five-Minute Veterinary Consult: Clinical Companion: Equine Theriogenology.
- Claes A, Ball BA, Almeida J, Corbin CJ, Conley AJ. 2013. Serum anti-Müllerian hormone concentrations in stallions: Developmental changes, seasonal variation, and differences between intact stallions, cryptorchid stallions, and geldings.
- Claes A, Ball BA, Corbin CJ, Conley AJ. 2013. Age and season affect serum testosterone concentrations in cryptorchid stallions.
- Claes A, Ball BA, Corbin CJ, Conley AJ. 2014. Anti-Müllerian hormone as a diagnostic marker for equine cryptorchidism in three cases with equivocal testosterone concentrations.
- Davies Meredith MCG. 2005. Fisiología de la reproducción de los équidos, cría y manejo de la yeguada.
- Derek C. K. Nicola H, John E. M. 2004. Equine neonatology. Medicine and surgery.
- Edwards JF. 2008. Pathologic conditions of the stallion reproductive tract.
- Ghosh S, Arnold C, Wade C, Leeb T, Dist O, Chowdhury BP, Varner DD, Raudkepp T. 2016. AKR1C genes as candidate loci for equine cryptorchidism.
- Mahmud MA, On JI, Shih SA, Umar MA, Bello A, Dammigero A, Mahmud MA. 2015. Cryptorchidism in Mammals-A Review.
- Mc Kinnon AO, Voss JL. 2005. Equine reproduction.
- Nef S, Parada LP. 2000. Hormones in male sexual development.
- Rai A, Rajeev A, Raj-Norjika M, Janowski TE. 2010. Clinical, hormonal and ultrasonograph approaches to diagnosing cryptorchidism in horses.
- Sampson JC, Ploock JF, McKinnon AO. 2007. Current therapy in equine reproduction.
- Schalmberg MA, Farley JA, Marcus M, Lavery S. 2006. Use of transabdominal ultrasonography to determine the location of cryptorchid testes in the horse.
- Silberstein P, Rashed F, Zwaan I, Leymarie P. 1984. Androstenedione and testosterone biosynthesis by the adrenal cortex of the horse.