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THESIS

Breed evolution and development of the Swedish Warmblood Horse

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ABSTRACT

In this literature review of the Swedish Warmblood breed's development, I have summarized findings from different studies, mainly spanning the years from the 1970's until today. The origin and background of the breed, the phenotypical change, and the inheritabilities of the performance of the breed will be discussed. The genetic divergence of the two types of SWB horses will be mentioned. Also, the development of the two main equestrian sports in Sweden, show jumping and dressage, will be mentioned to be able to understand why the breed's development has taken the directions it has.

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1. INTRODUCTION:

1.1 Summary of the very beginning of the Swedish Warmblood breed

The Swedish Warmblood (will be referred as SWB in this document) is one of the oldest breeds of warmblood horses. During the great power era of Sweden, circa 1611-1718, the breed was formed to be an able warhorse on the battle fields for the royal cavalry. The goal was to create a lighter horse that was strong, fast, and agile. The heavier horses used to work the fields and pulling carts at home was not suitable for the use in battles.

Before 1620 there was no such type of horse called 'warm-blooded' or 'cold-blooded', there were just a variable of mix breeds¹. Noble oriental horses that had been won in wars were highly esteemed.

Due to the many wars, and many losses, in the late 1660's there were a huge shortage of capable war horses. The King Karl XI of Sweden gave Rutger von Ascheberg the task of improve the horse breeding for the Swedish army. He was a man that came from a true horse family, was a cavalryman and one of that time's most esteemed hippologists, By 1680 the first breed standard was set.

The King Karl XI imported horses from England, France, Spain, and Germany to improve the size of the small horses that still could be found in Sweden.

The next king Karl XII is famous for his incredible war tactics, where the cavalry shocks were the key component. These impressive battle tactics needed a horse that was fast, agile and had great stamina. The first horses that were used in battles were called '*Klippare*', but these were small and often choose to extend the trot rather than to gallop. The gallop is the preferred gait in performing the cavalry shock. So, the king ordered the breeding for better quality of suitable war horses.

1.2 Strömsholm

Strömsholm castle was established around 1550 by the King Gustav Vasa. In 1620s this became an important royal stud farm to produce good cavalry horses. In the 1870's the stud farm completely moved to Flyinge, but Strömsholm kept around 80 stallions. The army still had their riding- and driving school at the facilities. At the end of the 1950's

¹'FLYINGE- Hippologi från medeltid till nutid', by Dr Ingvar Fredricson.

even the stallions were moved from Strömsholm to Flyinge. By this time the army also started to discontinue the riding-and driving school on the property, due to the decreasing importance of horses in the Swedish army.

1.3 Flyinge

Flyinge was established in 1661, by King Karl X Gustav. In 1747 it became Sweden's state farm for breeding.

1814 Adam Ehrengranat became the head of the stud farm, and during his time the breeding standards really increased. Mr Ehrengranat also created the equestrian riding academy at Flyinge. He is known as the man laying the foundation of the Swedish riding art and biomechanic research on the movement of the horses.

In 1970 the state of Sweden decided to discontinue financing the cavalry for the army. In 1982 the congressional decision to privatize Flyinge was laid down.



Picture 1. The battle of Lund 1676. Painted by Johann Philip Lemke.

1.4 From a versatile cavalry horse to specific sport horse

The Swedish warmblood earlier was a versatile cavalry horse, but in the few last decades the breeders have specialized the breeding. There are breeders for dressage or show jumping horses. The phenotypes of the jumping horse and dressage horse differs. Since 2002 at the stallion performance test, the stallions are selected either for dressage or show jumping.

2. METHODS

In my research I have used books, and material and documents found on the Swedish Warmblood Association's (SWA) website, and different research papers. I have also used articles from websites that are relevant to this topic.

I have studied pictures of horses, both mares and stallions, from performance tests, inspections and competitions spanning the years 1970- 2019.

I also watched videos of competitions from different world cups, Olympic Games, and other professional competitions.

3. THE PAST CENTURY

3.1 The early 1900's

In the early 1900's the breeding shifted from a lighter horse, to breed a heavy, more set horse. The aim was to be able to use the warmblood as an all-round horse. That even could be used on the fields, instead of the draft horses for example the Ardennes horse.² To create this heavier set horse from the available warmblood, Oldenburg stallions were imported from Germany. Later Hanoverian stallions were used.

3.2 The shift from a heavier build to a more gracile horse

At the middle of the 20th century the army stopped using horses and more and more farmers started to use machines in their daily work. This led to the horses to become more of a recreational hobby. The competitions started to get more advanced in show jumping,

² S Dyrendal, 1989

and in dressage the suppleness and grace in the gaits developed. To be able to compete against more agile, flashy, and graceful moving horses, the breeding needed to shift towards a horse with a lighter conformation.

4. THE SWEDISH WARMBLOOD ASSOCIATION

4.1 The foundation of the organisation

The Swedish Warmblood Association is the head organisation of the Swedish Warmblood breed. Henceforward the Swedish Warmblood Association is shortened SWA in this document.

The foundation of the breed started in the 17th century, when the first royal stud farm *Strömsholm*, located close to the royal capital of Sweden, was established in 1620s. The second royal stud farm *Flyinge*, located in the southern part of Sweden, was established in 1661 by the King Karl X Gustav. This remains the headquarters for the Swedish Warmblood Association.

The first studbook was established in 1874. The association '*Avelsföreningen för Svenska Varmblodiga Hästen*', translated to 'The Breeding Organisation of The Swedish Warmblood Horse'. Today the organisation is called Swedish Warmblood Association and was established in 1928.

4.2 Breeding goals

According to SWA the breeding goals are as followed: '*A noble, correct and sound warmblood horse, that through its rideability, performance-oriented temperament, excellent gaits and/or jumping ability is internationally competitive.*'

4.3 Vision

The SWA's vision is that '*SWB shall be synonymous with quality, the production of a high-quality warmblood horse and should also be tied to the horse's success in sport. Swedish Warmblood breeding shall be one of the top programs worldwide, producing high quality horses for riding purposes.*'

Sustainable breeding of the SWB has led to the production of good quality sport horses. The foals and young horses are kept on pastures with variable terrain, with the freedom to roam at all gaits. This will lead to healthy individuals. According to Swedish law, all horses have to have access to a paddock for at least eight hours each day. The paddock needs to be big enough for the horse to be able to perform all gaits.

4.4 Mission

SWA's mission is that *'We will work towards the SWB being viewed as one of the top riding – and sport horse breeds in the world.'*

5. SWA'S BREED STANDARD OF THE SWB HORSE

5.1 Exterior

A warm-blooded horse that is built to naturally carry itself in the correct frame under a rider, and with ease perform the work asked of it. It should be light, well proportioned, preferably with a high rise with a long top line, have a beautiful expressional head, well-placed and well-developed neck, sloping shoulder, and slightly sloping croup, with a strong back with a correct saddle place. It should have correct extremities, with hooves of good quality. Desired height of stallions is between 165-172 cm at the withers, and the mares' desired height is 164-170 cm.

5.2 Dressage

The SWB-horse should move in an uphill manner with harmony, ease, elasticity, rhythm and schwing, with a good hind limb push and self-carriage in all gaits. The horse shall be beautiful to watch, have a natural capacity for collection and lengthening, be willing to work and have a good rideability, be sensitive and fast to react to the aids of the rider, and be relaxed.

5.3 Show jumping

The SWB-horse shall be sensible regarding the fences, have the willingness to jump, have a big capacity and good sense of judgement of the fences. It shall have a good fore-and-

hind limb technique with a good back action in the jump. It shall have a high rideability and have a well-balanced and easy to regulate canter. The show jumper shall have a power to its jump, be elastic, react fast, be brave and in the same time be cautious.

5.4 Cross country

The cross country SWB-horse shall have the combined breed standards of the dressage- and show jumping horses. It shall additionally be brave, durable, and have a ground covering, yet easy to regulate canter. It shall be out of a lighter type of horse.

5.5 Health and sustainability

The soundness of the horse is defined as durability. The SWB-horse shall be a durable horse that are free from defects that can be inherited, or that might affect the horse's versatility or wellbeing in a negative manner. The SWB-horse shall also have a good fertility and shall be developed early.

5.6 Temperament

The SWB-horse shall be easy to handle, be relaxed, willing to work and have a good temper. The horse should also be characterized by being brave, have a will to cooperate and be responsive.

All the above-mentioned combined breed standards shall be strived for, in the pursuit to internationally be able to compete in the different sport disciplines. It shall also be suitable for riders at lower levels and in variable activities.

5.7 Head, neck and withers

The head should be expressive, and the neck should be well set, with well-developed withers. Horses should have a strong, moderately long back with a slightly sloping croup. The height span is 150-180 cm, with the desirable height of 163-170 centimeter.

5.8 Colour and age

Brown, chestnut, black and white are the most common colours. Around the age of four to five years the horses are considered to have reached their adult height. The life span can reach up to 30 years, although it is very rare today due to different circumstances.

Common causes that lead to early culling of the SWB horses are belonging to problems of the locomotion apparatus.

6. GENETIC DIVERGENCE

6.1 Genetics of the specialized breeding

Due to the specialized breeding, into either dressage or show jumping, there has been a genetic divergence in the SWB. According to Ablondi et al (2019) the two subpopulations of SWB horses were moderately differentiated on average. Their study also revealed that on eleven chromosomes, there was more differentiation. In their study they found that the chromosomal regions had signatures of positive selection for show jumping, and what they refer to as non-show jumping performance. According to their study the show jumping horses had genes that primarily are related to the endogenous reward system, neuromuscular control and coordination, and also for the excitatory synaptic plasticity.

In what they called ‘non-showjumping horses’ they found genes that are related to the joint-laxity, collagen build-up and muscle function. Their suggestion of this finding was that there are several genes that are involved in the expression of the gaits of the performance horse. In their study they found that, there are chromosomal regions that are noncoding elements for the genetic expression, leading to additional variability in the phenotypes in horses. Pictured is the winners of the stallion performance test 2022 in respective class. The phenotypical difference is evident.



Picture 2. Zino 1467, the winner of the stallion performance test 2022, show jumping. OLD by Zinedream, out of Bali by Acobat II – Turban Rose (SF) – Cantus. Bred in Germany by Sabine Toll, owner Lövsta Stuteri AB. Photo: Pernilla Hägg.



Picture 3. Serious 1457, winner of the stallion performance test 2022, dressage. HANN by Secret, out of Fleur d'Amour by Fürst Romancier – Weltmeyer – Lauries Crusador XX. Bred in Germany by H and H Bonhorst, owner Lövsta Stuteri AB.) Photo: Roland Thunholm.

7. GENETIC IMPROVEMENT

7.1 Genetic inheritability

Until the mid-1980's, there had basically not been any genetic progress in the SWB's traits. By 1986 the BLUP value was put into use, and the development of the breed could start. The show jumping horses were the first to improve fast. The heritability for show jumping is higher than for dressage, allowing for a faster improvement in the show jumping horses. The improvement was depending on the selection of good stallions, both Swedish and imported stallions.

The dressage horses reach advanced levels of competition later in life, compared to the show jumping horse, and the heritabilities for dressage are lower compared to the jumping horses. With this kept in mind, the young horse field tests, performed when the horse is three- and four years old, are important for the breeding values of the stallion, mare, the individual itself, but also for close relatives.

There also was an improvement in the stallion performance test. The quality testing of the young horses had been used since 1973, where the young horses had been evaluated based on their conformation and traits in show jumping or dressage.

According to a study by Ablondi et al (2019), they found that there are genes that are associated with behavior, physical abilities and the fertility. In their study they found signatures in genomic regions that contains genes that regulates the function of the nervous system, the muscle contractions, and the development of those. Their study concluded that the selection of the performance of the horse are connected to the genomic regions. The study revealed that the effect of the selected breeding of horses has shaped the genome of the Swedish Warmblood as a breed which can compete as a modern sport horse.

8. HEALTH GENETICS

8.1 Health inheritability

To be able to live a long life, the health of the horse is very important. The soundness of the horse is essential for the aspect of the animal welfare, and for the usage of the horse. The most common injuries that halts training and competition of the horse, or leading to culling of the horse, are belonging to the musculoskeletal apparatus. Even though the health is of great importance, the heritability traits have not been estimated earlier.

In a study performed by Jönsson et al (2013), the heritability of palpatory orthopedic health ($h^2= 0.12$) and the shape and quality of the hoof ($h^2= 0.10$) was investigated. According to their study the highest heritability belonged to the clinical signs of palpatory orthopedic health, were synovial effusions, with a heritability of 0.14. Their study also showed that the heritabilities of medical health and problems of the locomotion apparatus were low, 0.02 and 0.04 respectively. In their findings they could see that there were differences between the progeny groups. Hence there is a possibility to improve the inheritance of these traits trough selection in the breeding. The inherited predispositions for osteochondrosis, bone spavin, and navicular disease can also influence the further health of the horse.

In the breeding goal of the SWB, the health and soundness of the horses are considered, and is a health trait that should be a part of the genetic evaluation before breeding.

Demonstrated in the table below is the estimated breeding value. We can see the improvement in the traits of orthopedic- and hoof health over the years. The table is borrowed from the study ‘Genetic analysis of clinical findings at health examinations of young Swedish Warmblood riding horses’ by Jönsson et al.

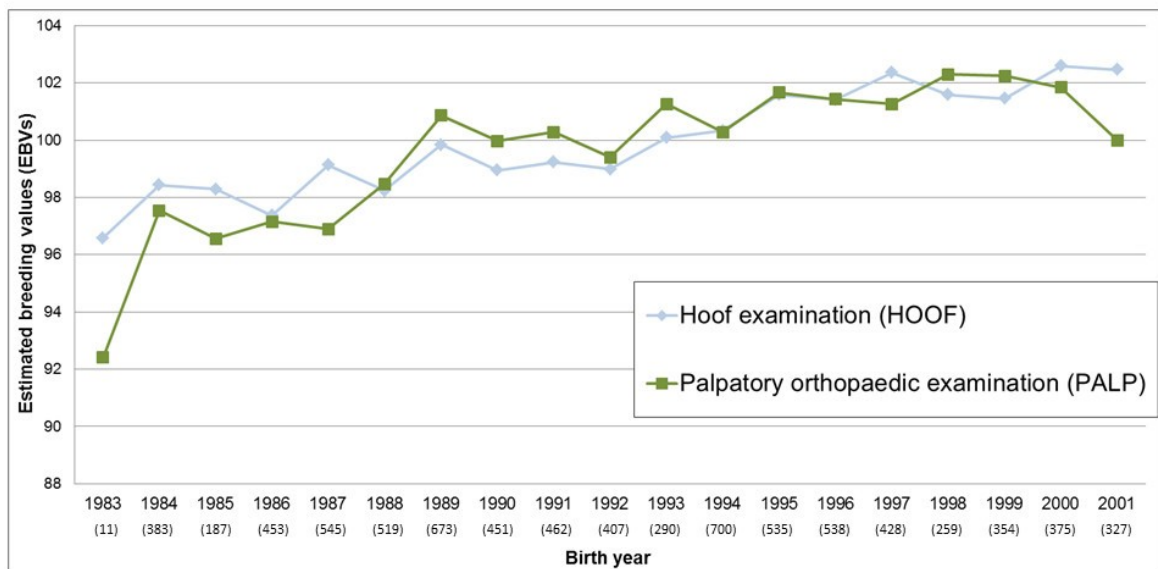


Table 1. Table borrowed from ‘Genetic analysis of clinical findings at health examinations of young Swedish Warmblood riding horses’ by Jönsson et al. Genetic trend of palpatory orthopaedic health (PALP) and hoof findings (HOOF) in examined horses born in 1983–2001. Estimates are presented on a scale of 100 as mean, where all examined horses ($N = 8,238$) constitute the reference population. Number of examined horses each birth year is presented within brackets.

9. FIELD TESTING OF THE YOUNG HORSES

9.1 Field testing of the young horses

For the breeders, owners, and trainers there are two types of one-day-field-tests of the ridden SWB horses. The tests act as a good indicator of the quality of the horse. At the tests the conformation, the quality of the different gaits and the jumping ability are appraised.

In 1973 the field testing of the four-year old SWB, called Riding Horse Quality test, was introduced. At the quality test, five-year-old mares that have had a foal at the age of four, are welcome to attend. And in 1999 the test for the three-year olds, the Young Horse Test, was introduced. Each year around one third of the four-year-old SWB horse population attend the quality test. It would be desirable to have a higher attendance rate. The field-tests are providing information for the genetic evaluation of the breeding and adding estimated breeding values to the stallions and mares. The tests also act as an indicator for the general quality and talent of the young horses in their respective field of sport.

For the breeders of SWB foals, there is a foal inspection every fall. The foals are evaluated on their exterior and gaits. The show jumping- and- dressage foals are evaluated in their respective class.

9.2 Heritabilities seen at the young horse tests

In a study made by Viklund et al (2008), the heritabilities for the conformation traits were moderate to high, with a value of $h^2 = 0.24$ to 0.58 . The correctness of the extremities were considered to be 0.08 .

The heritability for gaits were also moderate to high, with a value of 0.37 to 0.58

The show jumping heritability traits varied between 0.17 and 0.33 . The genetic correlation in traits was estimated to 0.82 to 0.99 . The test results of the three-year-olds are not included in the genetic evaluation for the breeding values for SWB, but the results of the four-year-olds are considered. It would be favourable to also include the three-year-olds results into the evaluation.

10. STALLIONS

10.1 Approval of stallions

All stallions that are approved in the breeding of SWB shall; have passed the evaluation and appraisal at the stallion performance test, either in Sweden or in another country, or have excellent merits from competitions.

10.2 The stallion performance test

In 1977 the stallion performance test was established. At the performance test, the stallion's exterior and abilities are examined. There are judges and test riders to scrutinize the stallion to be able to secure a breeding value. The qualities showed at the performance test has been proved to have a high inheritability to future generations. This has been a good influence in the development in the breed. Since 2002 the performance test is divided into a show jumping category and one dressage category, which has opened for a more specific breeding possibility.

There are relatively few SWB stallions being tested at the stallion performance test each year. The majority of the stallions being tested are imported from other countries and stud books. For the SWB, it would be desirable to be able to test more SWB stallions. One reason for the low Swedish born SWB stallion participation is, that most breeders in Sweden keeps only one or two brood mares. There is a logistic problem to be able to keep a colt, and to raise him into a stallion at home. There are many young colts that will never be screened as a stallion prospect.

10.3 Health record of the stallion

To be eligible for the stallion performance test, the stallion needs to have undergone health investigations. The stifle joints and tarsal joints are examined for osteochondrosis and bone spavin. The x-rays need to be without any remarks upon investigation. The stallion must have undergone a video-endoscopic investigation of the larynx and be without any remarks. The endoscopic video and the x-ray results are to be sent to the SWA's veterinarians for evaluation.

All stallions need to be DNA tested to see if there is the gene coding for Warmblood Fragile Foal Syndrome, a deadly inheritable disease. The stallion can still be used for breeding even if he is tested positive for WFFS.

10.4 Correlation of the stallion performance test and inheritability of traits

Studies has shown that the traits examined at the performance test have medium high to high heritability, and strong correlations to the breeding goals set by the SWA. The goal being a horse that can compete and be placed in the top sport competitions.

11. MARES

11.1 Mare's breed classifying

Since 2013 mares are no longer in the stud book, but they are divided into their own quality classes. What class a mare belongs to is depending on their results in competitions and young-horse inspections. These classes are divided into the classes: *, ** and ***. A mare can further receive the breeding letter 'A' or 'Elite', which depends on their offspring's individual results. The BLUP index is also determining what class the mare is belonging to.

12. BEST LINEAR UNBIASED PREDICTION

12.1 BLUP

BLUP is the method used for the breed index. For the value one horse get is calculated based on all the horse's relatives result. The most important are the close relatives and the individual's own result. The result is a combination of the points given at the inspections, the sex of the horse and the year of birth. When all the factors are considered, all horses will get an index that can be used to compare with other horses.

When selecting a horse for breeding, the estimated breeding value (EBV) from the BLUP model, results in a faster genetic improvement, compared to phenotypic merits.³ This is due to an increase in the accuracy.

³ Árnason et al. 2000.

Today, the selection of young SWB breeding stock is mainly based on phenotypic merits. Olsson et al. (2008) estimated the accuracy at selection of stallions to 0.60 for show jumping and 0.41 for dressage based on phenotypic evaluations at the stallion performance test. Olsson et al. proposed that a BLUP evaluation using the information gathered at the stallion performance test, the young horse tests, and competitions could improve the accuracy at the selection of stallions after performance testing.

13. SHOW JUMPING

13.1 The origin of show jumping

Hunting performed on horseback is considered to be the very foundation that led to the sport that show jumping is today. The military evolved the sport further.

The competition form of show jumping has advanced, from the single high jump and one wide jump, in the beginning of the 1900s. The fences were often made to look like brick walls, big logs could be used, and the poles of the obstacles could be made out of metal. The high jump was of sloping rails with brush. From the 1970's the fences progressively have become higher, and the poles have become lighter.

13.2 The show jumping horse in the last century

There were no defined exterior of the show jumping horse. It was not uncommon to use horses that were mix bred, and commonly there could be a draft horse mix. The horse's main feature was that they should be able to jump high and to be brave. The horses needed to be strong with strong hind limbs that ensured a lot of power. The horses' mentality, until the second half of last century, was brave and they did not get worried if they knocked, or crashed into, a fence. Often times the horses jumped better after an error made at the warmup. Even backyard horses could compete higher levels. The rider did not have to be very athletic to be able to reach the top.

13.3 Show jumping in the modern time

Nowadays the courses are very technical that requires a lot of precision from the rider and the horse alike. The jumps are high and wide, but the height of the fences is not considered

the main issue. The course covers a long distance, and with a tight time allowance. The course is designed to show good horsemanship, good riding skills, and a cautious horse that wants to clear the course by not touching the poles, knocking them over. The poles are very light and can easily fall out of their holder. The horses need to be very careful. To be able to reach the very top in the modern sport even the rider needs to be physically fit as an athlete.

The quality of the footing of the courses has increased since the beginning of the sport. The ground should be able to offer a good grip, while absorb the shocks from the landings.

13.4 The modern show jumping horse

To be able to clear the jumps, the horse needs to be agile and very careful. The horse needs to possess athletic qualities such as; a well-balanced, good rhythmical canter, and have the capability to, with ease, shorten or lengthen the strides, and have a strong push from the ground. Over the fence the horse needs to be able to quickly pull up its hooves. A quality that a top sport horse needs to possess is scope. Scope refers to the ability a horse has to jump, and clear, a fence with ease. A horse that can jump a fence with little effort and great power is highly desired.

13.5 World ranking of SWB in show jumping

The SWB studbook is ranked, according to World Breeding Federation for Sport Horses July 2022, on the 12th place of the world breeding. The best SWB horse on the world ranking is Independent, born 2011, by Diamant de Revel x Careful, competed by Andreas Schou⁴ (DEN). The equipage is placed on FEI's ranking list as the 45th best in the world⁵.

⁴ October 2022.

⁵ October 2022.



Picture 6. Independent. Photo by: Małgorzata Sieradzan.

14. DRESSAGE

14.1 Dressage in the past

In the past, when horses were trained to be used during battle, having an obedient and well-trained horse, that was strong and had great stamina, was crucial in the battle. Horses were taught movements that could be used to strike an enemy down. During peace time, the social elite trained horses to perform different acrobatic acts and proud movements, to show the status of the rider. An example of this is the capriole, often showed by the Spanish Riding School. During the 1700's and 1800's riding was considered to be an art form, or science. Dressage was called 'horse science' because the riding followed scientific rules and principles.⁶

The first time equestrian sports were a part of the Olympic Games, was in 1912 in Stockholm, Sweden. At the first games the dressage level was equivalent to today's third or fourth level dressage. Meaning that the flying changes and half passes being the most difficult movements. In 1928 they introduced lead changes into the programme. In 1932 they had added canter pirouettes, piaffe and passage.

⁶ E. Lekander, M. Hammarberg.

In the first few Olympic Games it was all military officers competing. By 1936, the first civilians were allowed to compete in dressage in the Olympic Games.

14.2 Dressage horses in the last century

The SWB horse was mainly considered to be a dressage horse. In the last century the dressage horse, still for quite a time, had the appearance of a cavalry horse, which was a horse that should be versatile, and strong. The most advanced dressage movements are requiring a strong horse that is relaxed and agile. The wide leg stance of the horses in the 1970's- 1990's helped the horses to keep a stable balance and gave the impression of 'having one leg placed in each corner of the body'. Overall, the body of the horses had more mass than found in the horses today. The gaits were not as extravagant as seen today. The shoulders of the horses were more sloping, and not as angled as we can see in today's dressage horses.

14.3 World ranking of the SWB in dressage

According to World Breeding Federation of Sport Horses the SWB breeder Verbena Dressage AB is placed 5th on the world ranking for the breeding of Touch Down 1338, by Quarterback x Sack, now gelded, competed by Patrik Kittel (SWE)⁷. The equipage is placed 8th in the world on FEI's ranking list⁸.

⁷ To this date October 2022.

⁸ September 2022.



Picture 7. Touch Down 1338. Born in 2012. Dressage. He has got 45 registered offspring as of October 2022. There are still frozen semen available for use. Photo by: Verbena AB.

15. OWN STUDIES

15.1 Average wither height

The sustainability of the horse is linked to the exterior and its size. There has been research done that prove that both very big and very small horses have reduced sustainability, compared to average sized horses.⁹

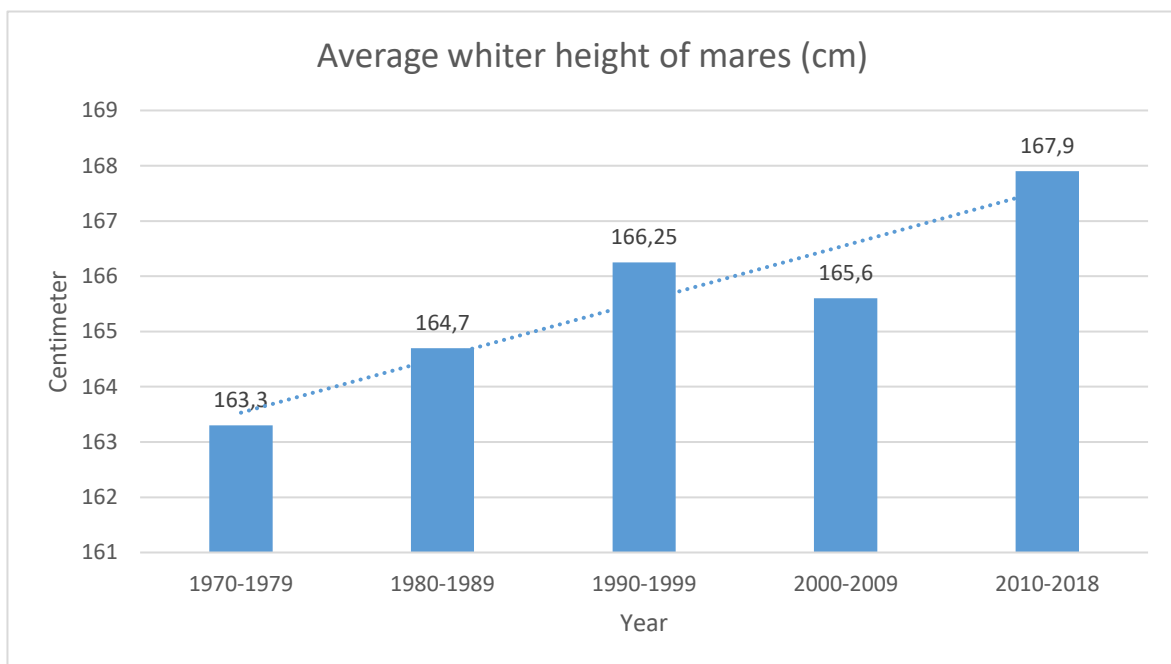
According to the SWA the index calculation for the year of 2021 the average wither height for mares were 165 cm, and for stallions or geldings the height was calculated to be 167 cm. In my research for the change in the wither height, in both sexes, I sought after to see if there has been any increase of the height over the years.

⁹ Article by Emma Thorén Hellsten and Åsa Gelinder Viklund for SWA.

For the data collected in the mares, I have used the winning mares at the mare inspection each year since 1970-2018. All together the data received is from 68 individuals. In the stallions I have used two approved stallions each year that they were born, from 1970 until 2014. I have selected the stallions based on the top 350 best BLUP values in respective category, one for dressage and one for show jumping. Over each decade there are data collected of 20 stallions. The collected data is received from 90 stallions.

The uncompleted decade is hence the age of the mares and stallions haven't reached the mature age for attending any breed inspection nor haven't been able to compete yet. This leading to the fact that the data is subject to change.

What I found from my studies of the wither height, is that the mares have increased from on average 163,3cm in the 1970's to 167,9cm in 2018. This is an increase of +4,6cm. The following graphs show the average wither height and the comparison of the shortest and tallest mares per decade at the mare inspection. Each decade the shortest result has been increasing from 156cm to 163cm. A difference of +7cm.



Tabel 2. The average whiter height of the mares at the mare inspection, per decade.

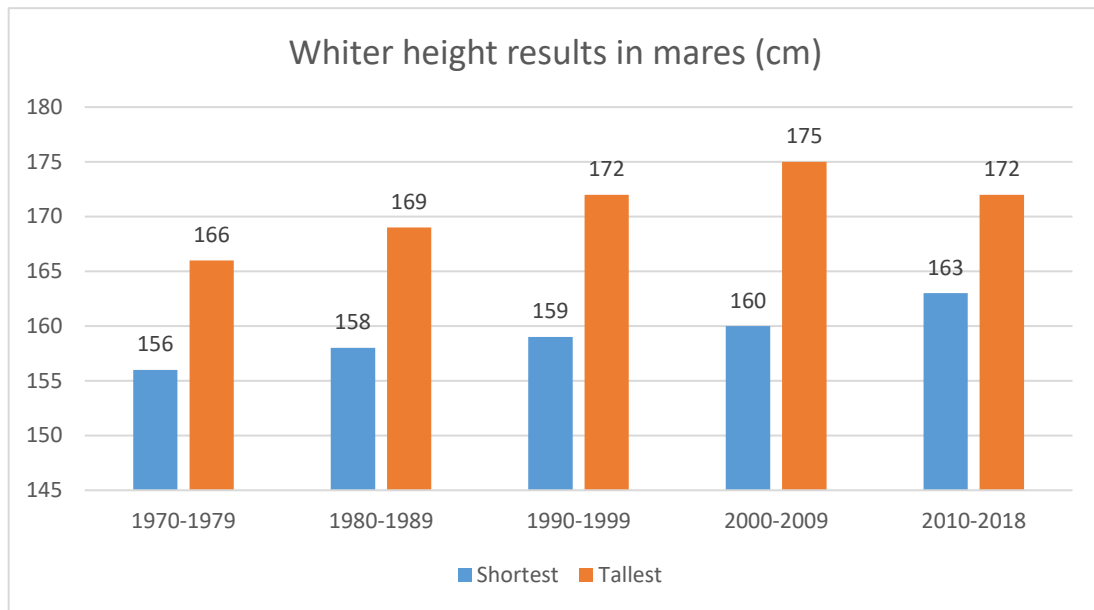


Table 3. The shortest and tallest mares at the mare inspection each decade.

For the stallions I have collected data of the stallions according to their respective sport category. Generally, the show jumpers have been taller than the dressage horses. In the 1990's the dressage stallions wither height was taller than the show jumpers. The wither height has been relatively stable. In the show jumpers, the difference between the 2010's and 1970's are just +0,2 cm. The trend in the dressage stallions, shows that the wither height has increased from the 1970's. Already by the 1980's the wither height had increased +2,7 cm.

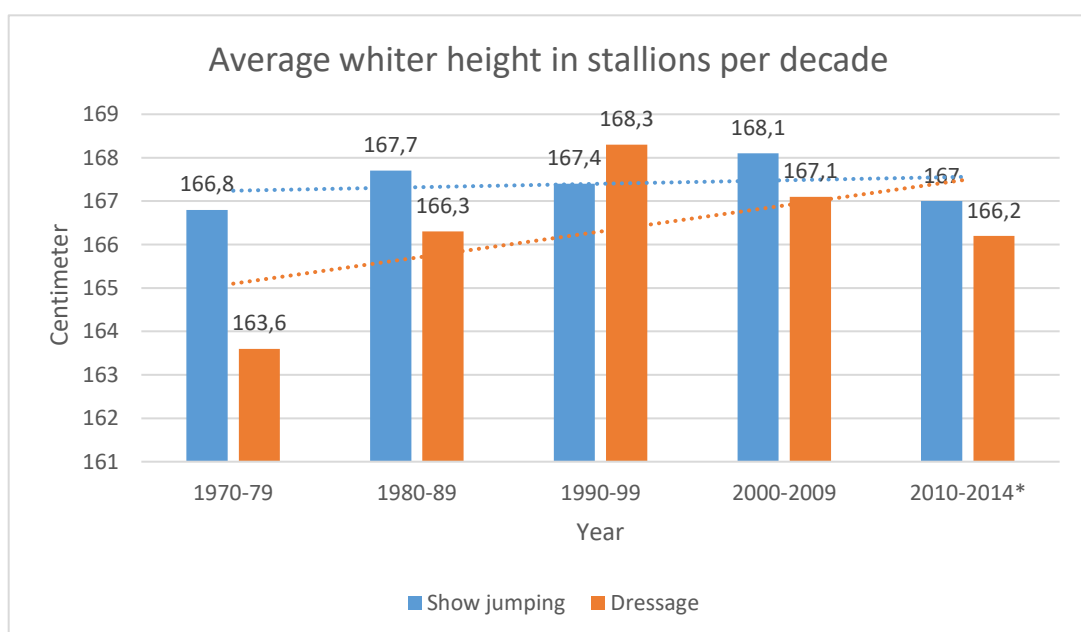


Table 4. Average wither height in stallions per decade. *= not a complete decade, hence subject to change.

16. PICTURE STUDY

16.1 Picture sources

I have studied pictures of the different horses over time, I have used the website of SWA; www.swb.org to find the names of random horses over the different decades. I found pictures of the horses online, and also in books. Until 1980 the breeding of dressage horses and show jumping horses were running parallel, but later the breeding became specialized. Which today has led to, as previously mentioned, two subtypes of the SWB horse.

16.2 Evaluation

Based on the pictures I studied, there has been a progressive change of the exterior and the phenotype of the SWB horses. The natural posture of the horses seen today are of a proud, uphill appearance. The neck is positioned at a high level. The front of the horses gives the appearance of being lighter, compared to before. And the forelimbs, in especially dressage horses, have been successively getting longer.

The development of the breed is pictured in on the graph below, where the breeding index has been increasing in a rapid pace the last 20-30 years. Behind this trend is the strict selective breeding to increase the quality of the breed.

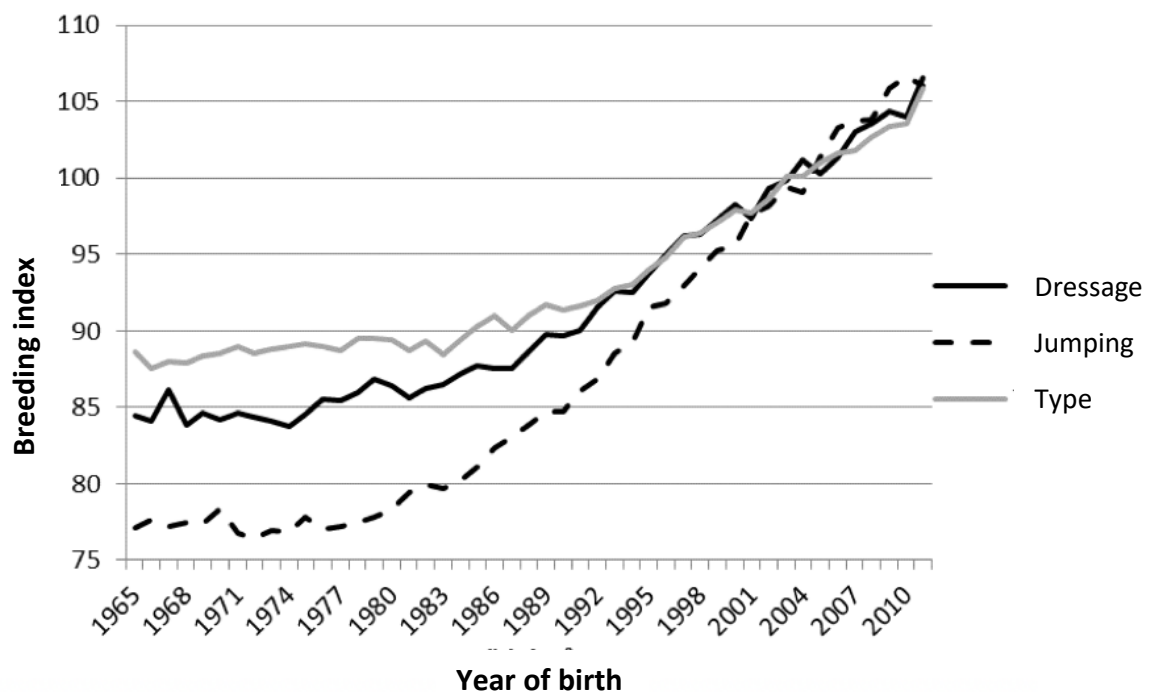


Table 4. Breed development, where the genetic trend is represented. (Graph borrowed from the Swedish Warmblood Association.)

16.3 Picture study of the dressage horses

Based on the pictures I have studied of horses during the 1970s-1990s, there has been a shift from a horse with a heavier body, to a more gracile horse. The position of the neck varied between being level placed to a higher placement. The stallions had thick and shorter necks compared to today's horses. Some stallions were more level framed, with shorter forearms than what one would expect of a horse today, leading to an appearance of being front heavy. To be able to support the front limbs action for stretching forward to be able to show off expressive gaits, with a self-carriage, this exterior needed to be changed. To be able to perform well in the dressage competition, as the movement and gait requirements advanced, the exterior of the SWB horse needed to change. The shoulders angle needed to change, to improve the leg movements.

The back and loin were longer than seen today. The croup was generally not well sloped. By the end of the 1990's the forearms of the horses had become longer, making the appearance of being built in an uphill manner more prominent. The sloping of the croup is becoming more evident. The back and loin is getting shorter, but still longer than seen in today's SWB dressage horses. I would say that the horses still had some mass, and not yet had become as gracile as seen today. Pictured is two horses, born in different decades, to display the difference in the phenotypical appearance.

By the 2000's the appearance of being built in an uphill manner had become common and seen in most of the dressage stallions. The back and loin is shorter, and the angle of the croup is well defined. The body mass had changed, and the more gracile look had developed, with the legs being long and slender. The shoulders are slightly more angled today, allowing the movements of the front limbs to become more expressive and agile. The distance between the forelimbs has become narrower.

The sloping croup, and the short back makes it easier for the horse to carry its weight on the hind limbs. This allows the horse to be able to perform the more advanced dressage tasks asked of it.

The exterior change has improved the rideability of the horses. The horses are born with the correct exterior, making it easier for the horse to perform the work asked of it. This is a contributing factor for the earlier start in more advanced levels of competitions.



Picture 9. Flying Amiral 764, 1985-2003. 162 cm, dressage. Amiral has 840 registered offspring.



Picture 8. Ironman H, born 2013, 169 cm, dressage. 200 registered offspring, October 2022. Now gelded.

16.4 Picture study of the show jumping horse

As the difficulty of the sport has increased, the horse's exterior has changed. In the 1970 until the 1990's, the horses were quite massive. Their canter was somewhat ground bound, and not as airy, and powerful as seen today. Today's show jumpers are gracile, with long, slim limbs. The canter is powerful and easy to regulate the length of the strides. The action of the hind limbs over the fence are quick and precise. The back and the core of the show jumper is longer compared to the dressage horse. This is a trait that is desired, together with a well-balanced and easy to regulate canter, to be able to stretch the horse in the combinations on the course.



Picture 10. Robin Z. Born 1983-2008, show jumping. Robin Z has 1409 registered offspring in SWB. He competed in the 1996 Olympic Games in Atlanta, USA. His most known offspring are Butterfly Flip and Mynta, two mares that also have competed in the Olympic Games for Sweden.



Picture 11. Isadora SN, mare, born 2016. Winner of the three-year-old performance test in show jumping 2019. She has a BLUP index of 152 for show jumping.

17. CONCLUSION

17.1 Own conclusions

The development of the breed, with all the collected data and studies made, shows that the progress has come a long way, but still requires more time to achieve the set breed goal of today. There are still room for improvement of the breed. I would assume that there is dynamics to the breed goal that are ever changing, in the same pace as the sports are further increasing their levels of difficulty. Thus, the studies of the breeding process are needed to be continued.

The top stud books in dressage are still the KWPN, OLDBG, and WESTF. And in show jumping we find the BWP, SF, and KWPN. All of which inspires, and influence the breeding of the SWB. There are many stallions of mentioned studbooks, used for the breeding of Swedish horses.

Desirable would be for a greater part of the SWB population to take part in the test for foals, young horses, and get more stallions to attend at the stallion performance test. This would aid in the estimated breeding value of sires and mares, and get a larger pool of native born sires to choose from for breeding.

But, if the breeding is only oriented on getting excellent sport horses for the top sport, what will be offered for the amateur riders, and riding schools? Top sport horses are high in blood, reactive and sensitive. The amateur riders don't necessarily need a horse of the best calibre. A horse that is friendly, durable, not too hot, and not too sensitive and reactive, is desirable.

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