Introduction

• Warmbloods used extensively
  – Sport & pleasure riding
  – Strong need for good conformation & healthy constitution
• Warmblood population large & genetically diverse
  – Low risks of inbreeding if matings well planned
• Exchange of genetic material increasing within Europe

Introduction cont...

• Little known about how European countries manage inherited disorders in breeding plans
• Such information would allow spread of knowledge
  – Improve health & welfare of horses
  – Strengthen trading ties between countries

Aims

1. Review 11 skeletal disorders with known/suspected heritabilities
2. Determine strategies employed by European countries/breeding associations to manage inherited disorders in warmblood sport horse breeds

Review - Genetic Disorders

• Genetic disorders
  – Defects in structure/function caused by negative mutation (Trommershausen-Smith, 1980)
  – Can be purely genetic (single/many genes) or combination of genes & environment
    • Congenital or developmental
• Horse breeding
  – Advantages: well-kept studbooks, many progeny & new molecular techniques
  – Disadvantages: long gestation, single births, changes in ownership & delayed/no symptoms

Review - Skeletal Disorders

• Abnormal bone & cartilage growths
  – Musculoskeletal problems localised in lower limb
  – Culling of Swedish warmbloods (Wallin et al., 2000)
  – Loss of training in Hanoverians (Stock & Distl, 2005)
  – Great variation in how disorders are defined, diagnosed & graded
    • Standardisation desired
• Many skeletal/conformational deviations not lethal but predispose to injuries
  – Varies between breeds & sport types
  – Treatment/correction
Review – Bench knees

- Genetic implications
  - ↑ weight on medial splint bone & interosseous ligaments
  - Associated with racing injuries in TB horses
  - Every 10% ↑ in offset ratio = ↑ risk of swelling & problems in front fetlock (McIlwraith et al., 2001; Anderson et al., 2001)
  - Prevalence of 60% in SW horses (McIlwraith et al., 1996)
  - $h^2$ not yet estimated

Axial deviation of carpal bones laterally

Review – Calf knees

- Genetic implications
  - Conformation of young TB changes as they mature from back at the knee to slightly over at the knee
  - Strains carpal bone ligaments & ↑ compression on dorsal surface of carpus
  - Highly undesirable in racing & associated with ↑ risk in carpal chip fractures & carpitis (Marks, 2000; Stashak, 2002; Dolvik & Klemetsdal, 1994)
  - High $h^2$ estimated in Norwegian cold-blooded trotters (0.42) (Dolvik & Klemetsdal, 1999)

Backward deviation of the carpal bones

Review – Weak pasterns

- Genetic implications
  - Predispose to injuries of suspensory ligaments, sesamoid bones & superficial flexor tendons
  - Potential causes of carpal chip fractures
  - Long pasterns ↑ odds of forelimb fractures (McIlwraith et al., 2002)
  - Prevalence of sloping pasterns: 35.2% in Norwegian cold-blooded trotters & low $h^2$ of 0.09 (Dolvik & Klemetsdal, 1999)

Correct Long sloping pastern

Review – Toe-in/Toe-out

- Genetic implications
  - Neonatal foals usually toed out but as mature, inward rotation
  - Predispose to ringbone & sidebone
  - Toe out horses “wing” (swing hooves in arc) inwards
  - Mild-to-moderate toe in found in 50% elite SW horses (McIlwraith et al., 2001)
  - Toe out: more prevalent in Norwegian cold-blooded trotters (44 fore & 68% hind) & $h^2$ between 0.04 – 0.11 (Dolvik & Klemetsdal, 1999)

Materials & Methods

November 2008 – online survey sent to 37 breeding organisations in 29 European countries

- Collection & recording of disorders in stallions, young horses, mares & foals
  - When & where?
  - By whom?
  - Summarizing & evaluating records
  - Monitoring of fertility in stallions

- Management of 29 disorders in breeding stallions
  - Disorder screened for?
  - Consideration in breeding?
  - Not considered at all
  - Only when severe
  - Can be compensated with good performance
  - Stallion excluded from breeding

Results & Discussion

- Replies from 11 countries
  - 38% reply rate
- Breeding associations play major roles (stallions & young horses)
- Formulating restrictions
- Record keeping
- Summary & evaluation of records

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<thead>
<tr>
<th>Country</th>
<th>Association</th>
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<td>Switzerland</td>
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Stallions & young horses

• Stallions — Recordings usually occur at compulsory stallion events
• Young horses — Recordings usually occur at young horse events or prior to sale
• Few countries record disorders during private veterinary visits

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<tr>
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Foals & mares

• Owner/breeder usually responsible for reporting disorders of foals
• Missing information from foals not attending YH events
  — Involve vets in collecting records
• Recording of disorders in mares more difficult
  — Higher numbers & dispersed
  — Selection on mares & stallions may be required for disorders with high h²

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Stallion fertility

• Denmark & Norway: semen test
  — Motile & healthy sperm
• Finland, Norway, Sweden: statistics
  — Foaling & pregnancy rate
  — Rates <40-50% considered low
• Important which method used
  — Statistics alone do not represent true fertility of stallion
  — Although good fertility economically important, may not be clearly represented in all breeding plans

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Record evaluation

• 5 countries evaluated records
  — BA & Veterinary Faculty (VF) of University
• 4 of the countries published information
  — Not specified what format information was published in
• Collection & evaluation of records
  — Use available information on disorders to assist BAs and breeders in selecting stallions
  — Option to create central database of disorders at national level

Breeding stallions

• Screening of breeding stallions
  — Skeletal & joint the most (e.g. OC/OCD, bone spavin, over-/underbite & conformational deviations)
  • May reflect lameness as major problem in warmblood sport horse
  — Muscular the least (e.g. Rhabdomyolysis)
  • May be group of emerging disorders
  • Polysaccharide Storage Myopathy (PSSM) correlated with cases of exertional rhabdomyolysis
  • PSSM found in 50% of muscle biopsies from warmblood horses with neuromuscular symptoms
  • h² of exertional rhabdomyolysis estimated at 0.4
    — In TB horses with an autosomal dominant inheritance suggested

• Consideration in breeding stallions
  — Great variation between countries to what level disorders were considered
  — Degenerative joint, reproductive & respiratory disorders mostly resulted in exclusion
  — Conformational deviations = all considered to the same level within countries
  • Race horse studies show some deviations are more detrimental than others
  • Research which conformation is mostly likely to lead to injury, depending on use
Summary

• Many conformational deviations not lethal but do predispose to injuries
  – Varies between breeds and sport types
  – Treatment/correction possible but ultimately should they breed?
  – Variation in how disorders are defined, diagnosed & graded
• Breeding associations play major roles in selection, management & recording
  – Vets & researchers smaller roles
• Recording of disorders
  – Mostly at young horse/stallion events thus not representative of whole population

Summary cont...

• Screening in breeding stallions
  – Skeletal & joint the most
  – Muscular the least
• Consideration in breeding stallions
  – Great variation between countries
  – Degenerative joint, reproductive & respiratory = exclusion
  – Conformational deviations = consensus within countries
• Fertility of stallions
  – Does not seem to be of high priority in most breeding plans

Conclusions

• Consensus desired within & between countries
  – Diagnose & grade disorders in standardised way
  – Research into relationship between conformation & performance of riding horses
• Inclusion of all interested parties in recording, collection & evaluation of disorder data
  – Obtain frequencies & heritabilities
• Information collected
  – Evaluated within breeding associations for stallion approval
  – Published, allowing breeders to more efficiently match stallions to mares

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