Contraception of African elephants using porcine zona pellucida vaccine

HJ Bertschinger, AK Delsink, JF Kirkpatrick, D Grobler, JJ van Altena, A Human, R Slotow, B Page
Preliminary work in KNP
1995-2000

• Basic research to show that it could work in 1995
• Followed by two filed trials 1996-2000
• Proved that elephants can be successfully contracepted with the zona pellucida vaccine with an efficacy of 60 % and 80 % respectively
Trials on smaller populations in private reserves

- Makalali – flagship - started in 2000
  - 23 cows and project of Audrey Delsink
- Mabula – started in 2002 - 4 cows
- Shambala – 4 cows
- Phinda – 19 cows
- Thaba Tholo – 8 cows

Few more in the pipeline and interest growing

2004
Makalali project

- Darting carried out from the ground in 2000-2002
- Darting from the chopper in 2003-2004
  - Flying time required was 30 min
- 100% fertility control achieved in 10 cows that have passed the 53-month intercalving interval
- Chopper darting far less disruptive to herds – settled down after 1-2 days
Makalali - Behavioural changes?

- No anomalies with regard to nursing time, nursing behaviour and calf proximity
- No change in the cows’ social hierarchy
- Since January 2003, total of 15 heats observed in 10 cows (2003 = 9; 2004 = 6) and 4 mating episodes
- Normal musth episodes observed – highest frequency in dominant bull
- No harassment or separating off of cows or calves observed
So how does the porcine zona pellucida vaccine work?

- Vaccination of an animal
- Antibody response
- Antibodies prevent fertilisation and cause temporary infertility
- Big advantages are:
  - Remote delivery
  - Reversibility which is essential
Vaccine

- Pigs’ ovaries from abattoirs
- Minced
- Filtered
- Just zP capsules left
- Add adjuvant = vaccine
- Produce 1,500 doses/annum
- Can increase to 10,000 or more
- Approval to produce vaccine by MCC for elephant contraception projects
Mating and deposition of sperm
How do we vaccinate the elephant cows?

• **Method of vaccination**
  - Use drop-out darts – no immobilisation!
  - Dart from the ground – easier to ID cows
  - Dart from a helicopter – very quick

• **Primary vaccination**
  • 1st booster after 3-6 weeks
  • 2nd booster after another 3-6 weeks

• **Annual vaccination maintains infertility**
Vaccination with drop-out dart
Age and state model used to simulate dynamics

- Initial population of 1000 individuals
  - equal sex ratio 1 – 15 years (50 m, 50 f 0-1 y; 50 m, 50 f 1-3 y; 50 m, 50 f 3-5 y; 50 m, 50 f 5-10 y; 50 m, 50 f 10-15 y and 325 fem 15-55, 125 male 15-25)
- Calving interval of 4 years
- Simulated 9 scenarios but showing one only:
  - 2.5% mortality rate and 0%, 60 % and 80% contraception efficacy
- mortality 2.5%
- calving interval 4 years
- conception rate of 1, 0.4 and 0.2
- $r$ is 6.0, 4.0 and 2.4
## Basic cost of primary vaccination for 375 cows in Year 1

<table>
<thead>
<tr>
<th>Item / Procedure</th>
<th>Number</th>
<th>Cost Rands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Darts</td>
<td>400</td>
<td>28 600</td>
</tr>
<tr>
<td>Vaccine</td>
<td>400</td>
<td>60 000</td>
</tr>
<tr>
<td>Helicopter</td>
<td>20 h</td>
<td>56 000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>144 600</strong></td>
</tr>
</tbody>
</table>

No professional fees included
### Vaccination costs for population of 1 000 (initial 375 cows) for 10 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Number cows</th>
<th>Rands</th>
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<tbody>
<tr>
<td></td>
<td>Primary</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>375</td>
<td>213 622</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Booster</td>
<td>375</td>
</tr>
<tr>
<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Booster</td>
<td>375</td>
</tr>
<tr>
<td></td>
<td>213 622</td>
<td>(or 144 600)</td>
</tr>
<tr>
<td>2</td>
<td>375 + 24</td>
<td>153 854</td>
</tr>
<tr>
<td>3</td>
<td>399 + 24</td>
<td>163 109</td>
</tr>
<tr>
<td>4</td>
<td>423 + 14</td>
<td>168 506</td>
</tr>
<tr>
<td>5</td>
<td>437 + 14</td>
<td>173 906</td>
</tr>
<tr>
<td>6</td>
<td>451 + 18</td>
<td>180 846</td>
</tr>
<tr>
<td>7</td>
<td>469 + 22</td>
<td>189 330</td>
</tr>
<tr>
<td>8</td>
<td>491 + 21</td>
<td>197 427</td>
</tr>
<tr>
<td>9</td>
<td>512 + 21</td>
<td>205 525</td>
</tr>
<tr>
<td>10</td>
<td>533 + 21</td>
<td>213 622</td>
</tr>
</tbody>
</table>
pZP Immunocontraception of elephants conclusions

- It works
- Safe during pregnancy and no negative effect on calf raising
- No side effects other than occasional lumps
- Reversible
- Other than increased heat incidence, no behavioural side effects
- Administration is remote – does not require immobilisation
- Why not try it in botanically sensitive areas of KNP!
New one-shot vaccine

- Now successful in wild horses
- Means that during year one only primary vaccination is required
- Will be testing the vaccine in elephants early next year
  - Compare the effect on antibody titres
Acknowledgements

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CatchCo

Amarula elephant research program

KNP