Embryo production in South America

Pietro Baruselli\textsuperscript{ab}

\textsuperscript{a}Departament of Animal Reproduction, FMVZ-USP, São Paulo-SP, Brazil
\textsuperscript{b}President of SBTE (Brazilian embryo Transfer Society)
Number of embryos in South America
### Table 1A. Bovine In Vivo Derived Embryo Activity in 2011

<table>
<thead>
<tr>
<th>CONTINENTS</th>
<th>Flashes</th>
<th>Transferrable Embryos</th>
<th>Number of Transferred Embryos</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>FRESH</td>
</tr>
<tr>
<td>AFRICA</td>
<td>1,438</td>
<td>9,401</td>
<td>4,056</td>
</tr>
<tr>
<td>ASIA</td>
<td>15,444</td>
<td>124,362</td>
<td>24,026</td>
</tr>
<tr>
<td>EUROPE</td>
<td>23,480</td>
<td>108,712</td>
<td>41,040</td>
</tr>
<tr>
<td>N. AMERICA</td>
<td>54,837</td>
<td>362,781</td>
<td>109,197</td>
</tr>
<tr>
<td>S. AMERICA</td>
<td>12,174</td>
<td>68,187</td>
<td>36,953</td>
</tr>
<tr>
<td>OCEANIA</td>
<td>10,755</td>
<td>59,419</td>
<td>32,921</td>
</tr>
<tr>
<td>2011 Totals</td>
<td>118,128</td>
<td>732,862</td>
<td>248,193</td>
</tr>
<tr>
<td>2010 Totals</td>
<td>104,651</td>
<td>732,000</td>
<td>243,885</td>
</tr>
<tr>
<td>Per Cent Change</td>
<td>12.88%</td>
<td>0.12%</td>
<td>1.77%</td>
</tr>
</tbody>
</table>
Table 5. Bovine In Vitro Produced Embryos in 2011

<table>
<thead>
<tr>
<th>Continents</th>
<th>Transferrable Embryos</th>
<th>Number of Transferred Embryos</th>
<th>TOTAL &amp; PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FRESH</td>
<td>FROZEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFRICA</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ASIA</td>
<td>62,418</td>
<td>4,086</td>
<td>6,699</td>
</tr>
<tr>
<td>EUROPE (8 countries)</td>
<td>8,034</td>
<td>8,034</td>
<td>3,419</td>
</tr>
<tr>
<td>N. AMERICA</td>
<td>48,474</td>
<td>17,850</td>
<td>2,930</td>
</tr>
<tr>
<td>S. AMERICA</td>
<td>325,349</td>
<td>307,278</td>
<td>15,879</td>
</tr>
<tr>
<td>OCEANIA</td>
<td>9,196</td>
<td>6,679</td>
<td>1,015</td>
</tr>
<tr>
<td>TOTAL</td>
<td>453,471</td>
<td>343,927</td>
<td>29,942</td>
</tr>
<tr>
<td>2010 Totals</td>
<td>450,549</td>
<td>315,715</td>
<td>23,970</td>
</tr>
<tr>
<td>Per Cent Change</td>
<td>0.65%</td>
<td>8.94%</td>
<td>24.91%</td>
</tr>
</tbody>
</table>
IVF Labs in Brazil, Argentina, Colômbia Venezuela

IETS 2012 Statistics and Data Retrieval Committee Report
Number of embryos in Brazil
Brazilian embryos market

Number of embryos

IFV
ET

Year

IVF
ET
Total

1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

350,762
318,118
32,646

Viana, SBTE 2012
Brazilian ET market (2011)

ET “in vivo”

\[ \frac{\text{Nº of ET}}{\text{Embr/SOV}} = \frac{32,646}{5.0} = 6,500 \text{ SOV} \]

ET “in vitro”

\[ \frac{\text{Nº of ET}}{\text{Embr/OPU}*} = \frac{318,118}{5.0} = 63,600 \text{ OPU} \]

* Mean of 15 viable oocyte per OPU with 30% of in vitro embryo production
Beginning of the IVF in Brazil
Establishment of an IVF Program for Zebu Cattle (Bos indicus) in Brazil

Enoch B. de Oliveira, Yeda F. Watanabe, Joaquim M. Garcia
Departamento de Reprodução Animal
FCAVJ-UNESP
14870-000 Jaboticabal, SP, Brazil
Fixed-time embryo transfer
Figure. Pregnancy rate in *Bos indicus* × *Bos taurus* recipients transferred at a fixed-time and treated or not with eCG.

Baruselli et al., 2000 (SBTE)
FTET protocol is easy to perform, reducing labor and animal handling, improving the efficiency and facilitating the use of ET.
IVF market in Brazil (2012)

- ~ 50 private labs
- equipment, materials, recipients (~ 500,000/year)

Collaboration with the Universities and Research Institutes (Embrapa)
Particularities of IVF market in Brazil
IVF embryo production according genetic group (Bos indicus or Bos taurus and crosses)

350,762 embryos/2011

Bos indicus: 84.6%

Bos taurus and crossbreed: 15.4%
Effect of genetic groups on the number of recruited follicle at the beginning of the follicular wave

Beef heifers

Cycling heifers

Nelore
*Bos indicus*

Nelore X Angus
*Bos indicus x Bos taurus*

Angus
*Bos taurus*

Gir
*Bos indicus*

Girolando
*Bos taurus x Bos indicus*

Dairy heifers

Carvalho et al., 2004
Number of follicle at the begging of the follicular wave

- Day 0
- Day 3 a 4
- Day 7 a 9

BE

PGF$_{2\alpha}$

CIDR
Mean (± SEM) number of follicles recruited per wave in *Bos indicus*, *Bos indicus* x *Bos taurus*, and *Bos taurus* heifers treated with 2 mg estradiol benzoate and CIDR insert, Pindamonhangaba, 2003.

Carvalho et al., 2004 (ICAR)
IVF embryo production

*Bos indicus X Bos taurus*

**Studies at controlled conditions:**

Same farm, nutrition, IVF lab, semen, OPU procedure, etc...
**Figure.** Effect of genetical group (Nellore and Holstein) on OPU and IVF production (9 Nellore and 9 Holstein x 6 replicate). São Paulo, 2008.

*Gimenes et al., 2008*
Effect of donor (non-lactating cows) genetic group \([Bos indicus (Gir) and Bos taurus (Holstein)]\) on oocyte recovery rate and quality.

<table>
<thead>
<tr>
<th>Genetic Group</th>
<th>Gir (n = 14)</th>
<th>Holstein (n = 14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Replicates</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Total oocytes</td>
<td>23.4 ± 1.6(^{a})</td>
<td>14.9 ± 0.9(^{b})</td>
</tr>
<tr>
<td>Recovery rate (%)</td>
<td>91.2(^{a}) (2604/2856)</td>
<td>61.1(^{b}) (1633/2673)</td>
</tr>
<tr>
<td><strong>OOCYTE QUALITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>5.3 ± 0.5(^{a})</td>
<td>1.6 ± 0.2(^{b})</td>
</tr>
<tr>
<td>Grade 2</td>
<td>9.8 ± 0.7(^{a})</td>
<td>5.2 ± 0.4(^{b})</td>
</tr>
<tr>
<td>Grade 3</td>
<td>4.8 ± 0.5</td>
<td>4.3 ± 0.4</td>
</tr>
<tr>
<td>Grade 4</td>
<td>0.9 ± 0.2</td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>Apoptosis by TUNEL (%)</td>
<td>16.6(^{b}) (21/117)</td>
<td>40.6(^{a}) (34/82)</td>
</tr>
</tbody>
</table>

\(^{a,b}\)P < 0.05.

Adapted from Sales (2011)
Quantity and quality of follicles in *Bos taurus* and *Bos indicus*.
ET Market in Brazil
IVF embryo production in Brazil according to production system (Beef or Dairy)

350,762 embryos/2011

- **Beef**: 76.3%
- **Dairy**: 23.7%
350,762 embryos/2011

93.3% Fresh

6.7% Frozen

IVF embryo production in Brazil (frozen and fresh transferred embryos)

Viana, SBTE 2012
Figura - Taxa de prenhez de embriões bovinos produzido in vitro frescos ou vitrificados

Nasser et al., 2011 - SBTE
Using sex-sorted sperm in embryo production
Timing of insemination using sex-sorted sperm in embryo production with *Bos indicus* and *Bos taurus* superovulated donors

J.G. Soares a,*, C.M. Martins b, N.A.T. Carvalho c, A.C. Nicacio a, A.L. Abreu-Silva a, Evanil P. Campos Filho d, J.R.S. Torres Júnior a, M.F. Sá Filho e, P.S. Baruselli e,**

a Universidade Estadual do Maranhão (UEMA), São Luís-MA, Brazil
b Fertiliza Consultoria Reprodutiva, Poços de Caldas-MG, Brazil
c APTA, Pôlo Regional do Vale do Ribeira, Registro-SP, Brazil
d Sexing Technologies, Sertãozinho, São Paulo, Brazil
e Department of Animal Reproduction, FMVZ-USP, CEP 05508-000, São Paulo, Brazil
Figure. Number of transferable embryos from superovulated Nelore cows timed inseminated with sex-sorted sperm or non sex-sorted sperm.

Soares et al., 2011 ARS (in press)
Figure - Effect of type of semen (conventional vs. sexed) and timed artificial insemination after LH (12 and 24 vs. 18 and 30) in Holstein heifers (Bos taurus) superstimulated, Poços de Caldas, MG, 2008.

Martins et al., 2008
Efficiency of sex-sorted sperm applied in different biotechnologies

**FTAI**
- 40% TC
- 0.4 conception/dose

**SOV**
- 4 doses
- 4 embryos
- 50% TC
- 0.5 conception/dose

**FIV**
- 100 oócitos/dose
- 30 embriões
- 40% TC
- 12 conception/dose
- 30 %
FTET in Nelore recipient
Sexed semen - 88% female
ET to improve genetic and reproductive efficiency in lactating cows in tropical conditions.
Figure. Conception rates in lactating Holstein cows submitted to AI (n=7501) or embryo transfer (n=2112) throughout the year.

Rodrigues et al. (ICAR 2004)
Fig. 5. Conception rate and pregnancy loss of high-producing repeat breeders (≥ 4 services; gray bars) and non-repeat breeder Holstein cows (black bars) submitted to AI (n = 19,112) or embryo transfer (ET; n = 5,364). There were effects for breeding technique (AI or ET; P = 0.001), animal category (repeat breeder or non-repeat breeder cows; P = 0.001) and their interaction (P = 0.001) on conception rates. Pregnancy loss was not influenced by the breeding technique (P = 0.08) or animal category (P = 0.39), and there was no interaction (P = 0.87).

Adapted from [48].
Brazilian ET market

*Bos taurus* donners

Lactating *Bos taurus* recipients

To improve genetic and reproductive efficiency
Thank you