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Program and Extended Abstracts

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An update on Bactrian camel reproduction

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Introduction

Bactrian camel population in Iran is threaten with extinction; although, it is assumed that this species has been domesticated on the eastern border of the Caspian sea around 2500 B.C. and from there it was migrated to several countries worldwide (8). Present manuscript will summarize our recent findings on controlling follicle wave cycle and applying reproductive technologies in Bactrian camel.

Semen collection and processing

Semen was collected using a modified bovine artificial vagina (1). The inner surface of the AV liner was covered with a thin layer of sterile petroleum jelly. Semen was collected after she-camel was physically restrained in sternal recumbency (7). Viscosity, as the major constraint in the processing of camel semen (1), was reduced using a simple mechanical approach (7).

Semen biophysical and biochemical characteristics

The color of Bactrian camel semen was milky (7). The volume of the ejaculates averaged 8.2±0.7 ml (1.2-26 ml; Table 1; 7). The average osmolality of Bactrian camel semen was 318.2±1.9 mOsm/kg H₂O (300 to 348 mOsm/kg H₂O; Table 1; 7). The pH of the seminal plasma was found to be slightly alkaline (7.4±0.1; 7.1-7.9; Table 1, 7). The concentration of spermatozoa was 417 ± 24.9 x 10⁶/ml (Table 1; 7).
Table 1. Characteristics of Bactrian camel semen

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>Mean±SEM</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of Collection (min)</td>
<td>63</td>
<td>5.3±0.3</td>
<td>2.5</td>
<td>11</td>
</tr>
<tr>
<td>Volume (ml)</td>
<td>75</td>
<td>8.2±0.7</td>
<td>1.2</td>
<td>26</td>
</tr>
<tr>
<td>Osmolality (mOsm/kg H₂O)</td>
<td>53</td>
<td>318.2±1.9</td>
<td>300</td>
<td>348</td>
</tr>
<tr>
<td>PH</td>
<td>44</td>
<td>7.4±0.1</td>
<td>7.1</td>
<td>7.9</td>
</tr>
<tr>
<td>Concentration (X 10⁶/ml)</td>
<td>52</td>
<td>417±24.9</td>
<td>133</td>
<td>945</td>
</tr>
</tbody>
</table>


Semen preservation

We were able to innovate an extender named SHOTOR diluent (SHOTOR means camel in persian language) for preservation of Bactrian camel semen (10). SHOTOR diluent consists of tris, 214.6 mM; citric acid, 64.2 mM; glucose, 66.6 mM, and fructose, 49.9 mM; with the osmolality of 330 mOsm/kg and pH of 6.9 (10).

Figure 1. The effect of four semen extenders: SHOTOR diluent, Green buffer, lactose and sucrose on the progressive forward motility of Bactrian camel spermatozoa maintained at 4°C. abValues with different superscripts indicate significant difference over the time within experimental groups (P<0.05). ABValues with different superscripts indicate significant difference at any particular time among experimental groups [P<0.05; Niasari-Naslaji, et al. (2006). Cryobiology, 53: 12-21].
Lactose and sucrose have been used for preservation of camel semen (3, 13). Our data indicated that lactose and sucrose are not suitable extenders for preserving Bactrian camel semen (10). Recently, we have compared 4 extenders including: lactose, sucrose, Green buffer and SHOTOR diluent for the short-term preservation of camel semen (10). As far as progressive motility of sperm concerns, after 4 hr incubation at 4 ºC, SHOTOR diluent was superior to lactose and sucrose extenders. It was also superior to Green buffer extender after 12 hrs incubation at 4 ºC (Figure 1).

Semen cryopreservation in the Bactrian camel is feasible when it is extended in SHOTOR diluent, cooled within 1 hr to 4 ºC, and glycerol was added, at the final concentration of 6% (9). Post-thaw progressive forward motility of spermatozoa was greater in SHOTOR (29.9%) diluent compared to IMV buffers (4.2%; P<0.05; Figure 2).

Figure 2. Comparing post-thaw progressive forward motility of Bactrian camel spermatozoa extended in SHOTOR diluent and IMV buffers. abValues with different superscripts indicate difference over the time within experimental groups (P < 0.05). AABValues with different superscripts indicate difference (P < 0.05) at any particular time between groups (Niasari-Naslaji, et al., Cryobiology 2006, 53: 12-21).

Follicle wave cycle

Camelids have follicle wave cycle rather than estrous cycle throughout breeding season. In Dromedary camel, the mature phase is 7.6 days, during which, the diameter of follicle reaches 13-17 mm in diameter (12). In Bactrian camel, the follicle mature phase is about 10 days during which the size of mature follicle reaches 13-19.7 mm in diameter (unpublished data). The inter-wave interval was about 19 days (unpublished) which could be reduced to 11.7±1.11 (9-14) days after induction of ovulation (11).
Control of ovulation

Ovulation can be induced by a single injection of GnRH analogues (Buserelin: 20 µgr, i.v.; 11; Alarelin: 25 µgr, i.m.; 6), hCG (1000-2000 i.u., i.m.; 2) or natural LH (Lutropin-v; 25 mg, i.v.; 6; LH; 300 i.u., i.m.; 2) in Bactrian camel.

Control of follicle wave cycle

Prostaglandin can not be used in camel due to the lack of functional CL during reproductive cycles. In addition, the beneficial application of progestogens is controversial in camel (4, 5, 11). However, two injections of GnRH, 14 days apart, made a tight synchrony of follicle wave emergence in Bactrian camel (11).

Interspecies embryo transfer

More recently we were able to transfer successfully Bactrian camel embryo to Dromedary camel. Accordingly, we achieved the first Bactrian camel calves born from Dromedary camels (unpublished data).

Conclusion

In conclusion, development of semen processing and preservation in association with controlling follicle wave cycle will assist us to extend AI network, as a valuable tool for breeding management and enhancing production of camel throughout the world. Interspecies embryo transfer provides a crucial approach to preserve endangered species of camels from the threat of extinction and also to introduce new species of camels to other country without introducing live animals.

Acknowledgments

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References


