



Effects of two different management systems on hormonal, behavioral, and semen quality in male dromedary camels

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Abstract

Effects of two different management systems on male dromedary camel hormones, behaviors, and semen parameters were documented. Camels ($n=6$) were tested under two management systems: (i) housed in single boxes with 1-h freedom (H23); (ii) exposed to females for 17 h (from 3.30 p.m. to 8.30 a.m.) and then housed (ConExF). Blood was collected every morning; camel behavior was recorded twice a day: (i) from 7:00 to 8:00 a.m. to determine the short effects; (ii) from 2:00 to 3:00 p.m. to determine the long effects. Each camel underwent a female parade and semen collection thrice a week; sexual behavior, libido, and semen parameters were assessed. Testosterone and cortisol concentrations were higher in ConExF than H23. Compared to the H23 group, ConExF group spent more time walking, standing tripods, and looking outside their pen/box but they spent less time eating, ruminating, resting, standing, and showing stereotypical behaviors. In the morning, ConExF group spent more time walking, ruminating, and showing typical sexual behaviors compared to themselves during afternoon time and the H23 group. However, in the afternoon time, ConExF camels put more time their heads outside the box through the window and showed higher frequencies of stereotypies, probably due to a higher level of frustration. While the sexual behavioral score was higher and ejaculates showed a higher fraction of milky white and white-colored semen in ConExF than H23 group, their libido was similar. Overall, 17 h of exposure led to an increase in testosterone and cortisol levels, enhancing sexual behavior and semen color, but leading to frustration.

Keywords Hormones · Behaviors · Semen parameters · Female stimulation · Dromedary camel

Introduction

The camel population is growing and more intensive camel farms are opening. In intensive farming, camels are often kept in individual boxes with limited opportunities for social contact and other natural behaviors (Fatnassi et al. 2014b; Padalino et al. 2014). However, this management system

may lead to sufferance, affecting camel welfare (Padalino et al. 2014; Menchetti et al. 2021). Since welfare is linked with production and reproduction, correct management is crucial for male camels used for artificial insemination. To date, research has focused on the strategies to improve housing conditions of males to enhance their reproductive performance and safeguard their welfare. For instance, increasing space allowance (Hansen and Berthelsen 2000), appropriate diet quality (Thorne et al. 2005), and more opportunity for social contact with conspecifics of the same or different gender (Sondergaard et al. 2011) have been proposed as useful and applicable practices to improve animal welfare. The opportunity for social interaction may be considered an environmental enrichment.

The benefits of social contact of male camels with females on hormones, behavior, and welfare have been reported. In dromedary camels, the daily exposure of male camels to females for 30 min led to an increase in hormonal levels (testosterone and cortisol), frequency of typical rutting behavior, enhancing their welfare status (Padalino et al. 2014). In the

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