

# CAMEL-ASSISTED SERVICES (CAS): TREATMENT, EDUCATION AND SUPPORT PROGRAMMES

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## ABSTRACT

The increasing presence of camels in domestic settings has facilitated the implementation of camel-assisted services (treatment, education and support programmes) with satisfactory outcomes. However, their specific use for interventions that benefit human physical and psychosocial health requires further empirical investigation. This work reviews the characteristics of camels that make them suitable for these assisted services, such as their tranquil temperament, social character and unique locomotion. These assisted services can promote human and animal welfare and contribute to the sustainable conservation of zoogenetic resources. Nevertheless, more specific studies are needed to evaluate the detailed impact of these assisted services on human and animal health. Additionally, addressing the accessibility challenges is crucial, as costs are often not covered by insurance, making them less affordable.

**Key words:** Animal welfare, animal-assisted service, domestic camel, functional valorisation, human well-being, human-animal interaction

Historically, domestication arose from the human need for efficient food production (Hayden, 2009; Mota-Rojas *et al*, 2021) and as support in warfare (Hediger, 2017). Recently, there has been a rise in breeding animals for therapeutic, educational and recreational purposes through guided human-animal interactions (O'haire *et al*, 2015; Walsh, 2009). These interactions yield benefits across physical, social, emotional and cognitive domains for humans while promoting the psychological health of animals.

The latest 'Five Domains Model' incorporates human-animal interactions into animal welfare assessments, emphasising the need for animals to seek positive interactions with the environment, other non-human animals and humans (Mellor *et al*, 2020). The International Association of Human-Animal Interaction Organisations (IAHAIO) advocates that only domestic animals should participate in assisted services designed for human benefit (Jegatheesan, 2014), as they are more accustomed to human presence, minimising stress-related behaviours that

could compromise both animal welfare and human safety.

The term 'animal-assisted interventions' (AAI) encompasses three categories: animal-assisted therapy (AAT), animal-assisted education (AAE) and animal-assisted activities (AAA). The new framework includes 'animal-assisted services' (AAS) as the overarching term, with subcategories such as 'animal-assisted treatment' (AATx), 'animal-assisted education' (AAE) and 'animal-assisted support programmes' (AASP) (Binder *et al*, 2024).

In AATx, animals participate in goal-directed activities to improve human physical, social, emotional, or cognitive functions, requiring licensed therapists and trained animals. AAE involves structured educational interactions, necessitating educators and child development specialists (Binder *et al*, 2024). AASP aims to enhance quality of life through recreational interactions, requiring activity coordinators and animal welfare professionals (Binder *et al*, 2024; Kruger and Serpell, 2010).

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Common animals in AAS include dogs, cats, birds, horses and small ruminants (Martos-Montes *et al*, 2015). While donkeys and camelids are used in these activities, they are undervalued due to misconceptions about their temperament (González *et al*, 2019) and limited financial support for their inclusion. Health insurance companies and authorities may not be willing to subsidise animal-assisted services that involve camels due to the lack of scientifically proven impacts.

The present review work aims to create a conceptual framework for valorisation programmes for domestic camels (dromedaries or one-humped camels and Bactrian or two-humped camels) in animal-assisted services. This review aligns with the bottom-up approach to integrative validity, as proposed by Chen (2010), which emphasises viability as the key evaluation criterion for determining whether a program is practical, functional and evaluable. Systematic empirical research will enhance camel-assisted services (referred to as CAS from here after), addressing ethical concerns and promoting biological conservation by assigning these animals a new sustainable role (Glenk, 2017; McCune *et al*, 2020). In regions where domestic camels hold socio-cultural significance, their inclusion in therapy or educational programmes may also strengthen connections to local traditions and practices.

### **Theoretical foundations and previous experiences in CAS**

Over the past three decades, there has been an increasing socio-economic interest in camel breeding and production due to their sustainability in the face of climate change and desertification (Faye, 2020). As the domestic camel population increases, it becomes imperative for caretakers to recognise these animals' behavioural needs to facilitate safe human-animal interactions that promote welfare. In domestic settings where camels are predominantly utilised for interactive experiences, this understanding is particularly essential. While traditional uses of camels in historically significant breeding regions focus on food production and transport, in countries where camel breeding is relatively nascent, such as in Europe and America, the emphasis often shifts towards leisure and fostering individual human-animal bonds.

Camels are group-living animals that display cooperative behaviours crucial for their survival in harsh environments (Brandlová *et al*, 2013). Their social structures and the dynamics within camel herds can strengthen social bonds and improve

group cohesion, even though they engage in fewer close-contact interactions than other social animal species (Ward and Webster, 2016). This proclivity for cooperation underscores their social intelligence, which may enhance their engagement in structured activities and group settings, further highlighting their adaptability to therapeutic contexts where cooperation and focus are pivotal for successful outcomes. Moreover, given their evolutionary history in arid regions, camels have developed physiological adaptations, such as lower metabolic rates and energy requirements (Dittmann *et al*, 2014; Hoter *et al*, 2019; Nelson *et al*, 2015). These traits contribute to their generally calm temperament (Henry *et al*, 2010), which, along with their physical robustness and endurance (Soman and Tinson, 2016), makes them suitable for therapeutic settings where a reassuring presence is vital. Additionally, the minimal presence of natural predators contributes to their non-flight responses (Deel, 2014; Irwin, 2010). In any case, it remains crucial to ensure that these inherent characteristics do not result in overworking the animals.

Variability in camel behaviour and reactivity can arise from factors such as sex, age and phaneroptics. In particular, in leisure-oriented tourism activities, male dromedaries are often seen as more cautious and reactive than females, but castration, training and desensitisation protocols can help develop proactive coping behaviours from a young age (Pastrana *et al*, 2021; Pastrana *et al*, 2024). Furthermore, traits such as coat and eye colour have been reported to influence camel social dynamics and leadership behaviour. These findings are attributed to the pleiotropic effects of genes governing phaneroptical traits on the development and functioning of neural structures. Specifically, dromedaries exhibiting a variable proportion of white fur and significant iris depigmentation or heterochromia tend to be more submissive, potentially impairing their leadership abilities. Conversely, darker, younger and heavier individuals are more inclined to lead group movements (Iglesias Pastrana *et al*, 2021).

Given their social nature, the presence of conspecifics also fosters proactive coping behaviours, which not only facilitates group training but also enhances the comfort of the camels during collective activities (Pastrana *et al*, 2021; Pastrana *et al*, 2024). Understanding the social dynamics, including intraherd social hierarchies, enables handlers and caregivers to strategically utilise group structures in

training sessions and routine management activities. This approach allows for the selection of camels based on dominance or leadership traits, depending on the specific functional objectives (Schulte and Klingel, 1991).

Concerning the human-driven settings in which these animals are reared for various functional purposes, camels produce less noise and odour compared to conventional livestock, thereby enhancing the sensory experience of visitors at camel facilities (Gole and Hamido, 2020). The hypoallergenic nature of camel hair fibres may also reduce allergic reactions among those interacting with them (Fazal-ur-Rehman *et al*, 2024). Moreover, the rising demand for camel milk, particularly among health-seeking consumers, further underscores the appeal of camel-assisted treatments (Gahlot and Adams, 2023).

Based on this theoretical framework, domestic camels are gradually gaining popularity among professional groups dedicated to developing animal-assisted services (Kinoshita and Kaufmann, 2023; Lidfors *et al*, 2023). Larsson and Brothers (2019) conducted a survey that revealed camels have been actively included in animal-assisted services (AAS) in Australia, Austria, Germany and the United States for over ten years. The study involved individuals aged 15 to 24 and focused on educational objectives, therapeutic riding and treatments for emotional and cognitive conditions (autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), depression, separation anxiety, irritability and sadness). Results indicated improvements in overall well-being, attention, prosocial behaviour, physical coordination and self-esteem among human participants. However, there is limited information on the impact of these activities on the camels themselves, highlighting the need for future research to ensure their welfare is adequately assessed.

From a delimited perspective of animal welfare, Majchrzak *et al* (2015) found that tourist camel rides positively influenced camel welfare, evidenced by decreased cortisol levels, indicating reduced stress compared to non-participating dromedaries.

### Utilitarian principles in CAS

This section discusses the potential utilitarian fundamentals and functional objectives of CAS to guide health and education professionals, as well as AAS practitioners, in recognising the diverse therapeutic, educational and recreational contributions of camels. It is important to note that no single form of AAS is universally superior for

specific groups; individualised assessments are necessary to determine the appropriateness of assisted services for each person. The effectiveness of AAS is multifactorial and varies based on the specific context of its application. While an activity may focus on a particular objective, it also requires other important participant skills due to the surrounding environment. A thorough analysis and evaluation of each activity can uncover additional requirements, including motor, cognitive, social, communication, emotional regulation and sensory skills.

### Camel-assisted treatment (CATx).

#### *Functional potentialities associated to patients' familiarity with camels*

- A. Novelty:** In regions where camel breeding is still emerging, these animals may be perceived as unique or exotic, capturing the attention of patients more effectively. The distinctive characteristics and size of camels can engage patients' interest, reducing disengagement during therapy and fostering trust. This, in turn, can help improve social interaction skills with unfamiliar elements (Allison and Ramaswamy, 2016; Heidicke, 2021).
- B. Exposure:** The exotic appearance of camels may initially intimidate patients, especially those with anxiety disorders (Firmin *et al*, 2016). However, camel-assisted treatment sessions can provide a controlled setting where patients are gradually exposed to anxiety-inducing stimuli under the guidance of trained therapists. This exposure, combined with emotional regulation techniques, may help patients manage their anxiety. Interestingly, some patients may even experience unexpected relaxation around camels, possibly due to the lack of preconceived negative preconceptions.
- C. Recognition and flexibility:** For individuals familiar with camels, these animals can facilitate better communication, encouraging self-expression and dialogue. Familiarity with camel body language, facial expressions and vocalisations also enhances patients' ability to recognise the emotional states of others, thereby promoting socialisation (Alwahaibi *et al*, 2023; Ramadan *et al*, 2018; VanFleet *et al*, 2015; Volodin *et al*, 2022). Patients also learn to interpret subtle cues such as avoidance behaviours and are encouraged to develop flexible thinking, adapting to changing situations and recognising when to withdraw from uncontrollable circumstances (Kaufmann *et al*, 2019).



**Fig 1.** Illustrative scenes of camel-assisted treatment programmes, showcasing therapeutic interactions between camels and participants (a) A therapeutic session for individuals with functional diversity using wheelchairs, with the camel in sternal recumbency, facilitating accessibility (©Henrik Møller); (b) Two participants brushing a camel in sternal recumbency as part of a sensory and therapeutic interaction (©Malin Larsson); (c) An instructional activity teaching participants how to handle camels, focusing on developing confidence (©Green Chimneys Farm and Wildlife Centre/Sam and Myra Ross Institute).

### ***Functional potentialities associated to camel social behaviour***

**A. Non-demanding socialising:** Camels, while needing social connections, do not always engage in direct interaction unless for specific purposes like reproduction or dominance (Mohammed *et al*, 2020). Their ability to maintain well-being through passive cohabitation (Heidicke, 2021; Kikusui *et al*, 2006) can be advantageous for individuals with ASD, who may struggle with forming social connections and experience distress in isolation. The presence of camels offers a therapeutic opportunity for ASD patients to experience social engagement without pressure, potentially easing feelings of isolation and encouraging gradual interaction (Beetz, 2017).

**B. Calmness:** Camels naturally display a calm demeanor in non-threatening environments, an evolutionary trait linked to energy conservation. This innate calmness, paired with the intriguing nature of camels, makes them suitable candidates

for animal-assisted treatment sessions targeting individuals with ASD or ADHD.

### ***Functional potentialities associated to the camel morphology/size and locomotion***

**A. Sternal recumbency:** When camels lie in sternal recumbency (with their chest and abdomen on the ground), their necks position their heads at a height similar to that of a medium-sized human. This posture reduces the perceived threat of the camel's size and minimises the risk of sudden movements (Niehaus, 2022), making interactions safer, particularly for patients developing social skills and confidence. It also facilitates secure engagement for individuals with physical disabilities, such as wheelchair users (Fig 1).

**B. Humps:** With the animal in sternal recumbency, the hump(s) can serve as an additional support mechanism for improving postural control.

**C. Size:** The substantial size of camels may facilitate nonverbal communication between the patient



**Fig 2.** Representative images of camel-assisted education programmes, depicting educational sessions where camels are integrated as part of the learning process (a) A session on safe camel handling techniques, promoting proper interaction with the animals (©Green Chimneys Farm and Wildlife Centre/Sam and Myra Ross Institute); (b) A group camel handling activity, emphasising the importance of cohesion and coordination (©Doug Baum); (c) An environmental education session using camels as model animals with primary school children (©Ursula Schulz); (d) A specific moment from an environmental education programme, where the instructor explains the unique callosities of camels, highlighting their adaptations (©Carlos Iglesias Pastrana).

and the animal, which could be particularly useful in crafting treatment programmes for narcissistic personality disorder (Abrams, 2013).

**D. Empowerment:** Interacting with and managing a large animal like a camel, under professional guidance, can help boost self-esteem. Patients are given specific tasks and recognised for their bravery, which fosters empowerment (Fig 1) (Granger and Kogan, 2000). These experiences can help socially excluded individuals overcome feelings of marginalisation through meaningful engagement with the animal.

**E. Locomotion:** The camel's unique four-beat gait mirrors natural human pelvic movement, making it beneficial for physiotherapy (Ni, 2020). However, difference between Bactrian and dromedary camels impact therapeutic riding experiences:

a. Dromedary camels offer varying stability depending on seating position, though

there is a lack of studies on optimal saddle configurations.

b. Bactrian camels provide greater stability to the rider due to their two humps. In addition, riding between the humps of a Bactrian camel allows direct contact between the rider and the camel's soft and warm fur, which might have a therapeutic impact. Furthermore, when riding a Bactrian camel, the cranial hump can assist patients in developing visual orientation and offer tactile stimulation to the hands, arms and upper trunk, as well as the caudal hump may provide support and stimulation for the patient's back, promoting improved movement symmetry.

#### *Other indirect avenues*

Although, research in this area is still in its early stages, preliminary findings suggest a potential therapeutic benefit of camel milk for patients with



**Fig 3.** Scenes from camel-assisted support programmes (a) An interaction between an elderly individual and a camel in sternal recumbency, designed to foster emotional connection and provide comfort (©Henrik Møller); (b) Camels during a nursing home visit (©Doug Baum); (c) Camel trekking activity, which offers participants both physical engagement and emotional support, emphasising the therapeutic benefits of outdoor experiences with camels (©Doug Baum).

ASD. According to scores on the Childhood Autism Rating Scale (CARS) and the Social Response Scale (SRS), individuals with ASD who consume camel milk demonstrate significant improvements (Adams, 2013; Adams, 2019; Al-Ayadhi and Elamin, 2013; Al-Ayadhi *et al*, 2015). Further investigation is strongly recommended to enhance understanding of the effects of camel milk on neurological disorders.

### Camel-assisted education (CAE)

- A. Meeting strangers and self-reflection:** Preparing for camel interactions involves familiarising oneself with the animal through activities like trekking and grooming. Participants learn to bond with the camel by securely fitting gear and interacting through gentle touch and verbal cues (Fig 2). Emphasising calmness and empathy fosters self-reflection and encourages kindness towards others (Altschiller, 2011; Heidicke, 2021).
- B. Trust in strangers (humans and animals):** For many, interacting with a camel may be a first-time

experience, requiring trust in the camel handler's guidelines and the animals themselves to ensure a safe interaction (Fig 2) (Altschiller, 2011; Heidicke, 2021).

- C. Listening and following instructions:** Given their size and strength, camels can pose risks if not handled correctly. Camel handlers need to emphasise safety protocols, making it crucial for visitors to pay attention to grasp the safety instructions (Fig 2) (Altschiller, 2011; Heidicke, 2021).
- D. Responsibility and self-efficacy:** Engaging in tasks such as grooming, cleaning and feeding camels may help participants develop a sense of responsibility and empathy (Altschiller, 2011).
- E. Group work:** Camelback riding is typically done in groups to prevent undesirable reactions in camels due to anxiety from being separated from their conspecifics. Additionally, camels are accustomed to walking in a caravan (Riemer and Förster, 2021).

This reinforces the importance of group cohesion for safety and enhances the overall experience (Fig 2) (Altschiller, 2011).

**F. Environmental and cultural education (Heidicke, 2021; Irwin, 2010; Khan et al, 2003):** Camels can serve as effective models for environmental education in several ways (Fig 2):

- a. **Environmental adaptations:** Teaching about camels' adaptations to arid environments, including water conservation and heat tolerance.
- b. **Habitat conservation:** Raising awareness about conserving the ecosystems where camels thrive.
- c. **Sustainability:** Promoting sustainable resource use for communities that rely on camels for transportation and food.
- d. **Local culture and traditions:** Exploring the socio-cultural significance of camels in communities, as well as their historical roles, such as their importance on the Silk Road.

### Camel-assisted support programmes (CASP)

Animal-assisted support programmes extend beyond entertainment, aiming to improve the physical and emotional well-being of participants in various settings:

- A. **Guided visits:** Offering camel-guided visits to geriatric homes, hospitals, or prisons may introduce a multisensory experience that breaks the monotony of long-term stays. The presence of camels stimulates socialisation, encourages gentle physical activity and evokes positive emotions, improving overall well-being (Fig 3).
- B. **Camel trekking tours:** Camel trekking tours, set in rural environments, allow participants to reconnect with nature and unwind from daily routines. The calming, rhythmic motion of riding a camel further promotes relaxation (Fig 3).

### Ethics and safety of CAS

The implementation of CAS requires careful consideration of ethics and safety, ensuring proper management of both human participants and camels. CAS must adhere to established standards, set clear objectives and well-defined measurable outcomes in areas such as health, well-being, or education, be subject to regular oversight and be conducted by professionals with proper training.

Key points include:

#### 1. Ethical considerations:

- a. Activities must be conducted in a respectful and non-exploitative manner, ensuring the

welfare of camels and informed consent from participants. Camels should be viewed as co-therapists/co-workers and the human-camel relationship should be based on mutual respect (Clark *et al*, 2020).

- b. Handlers must be trained to recognise signs of stress and body language in camels, ensuring ethical and appropriate handling practices. Understanding signs of stress and body language in camels is further crucial to determine when an animal may need to be temporarily removed from a session or retired altogether (Brelsford *et al*, 2020; Murthy *et al*, 2015; Ng and Fine, 2019).
- c. Camel handlers must have AAS-specific training, including handling best practices, zoonosis prevention and professional conduct. Additionally, access to continuing education and maintaining recognised handling credentials are crucial to ensure that handlers stay updated on best practices and standards, fostering a safer and more effective environment for all participants (Kerulo *et al*, 2020; Linder *et al*, 2017; Stewart, 2014; Stewart *et al*, 2013).
- d. Animal-assisted service teams and facilities should be submitted to thorough and regular evaluations to assess their competences to remain in these activities (Binfet and Hartwig, 2019; Kerulo *et al*, 2020; Murthy *et al*, 2015; Serpell *et al*, 2020).

#### 2. Safety considerations:

- a. The physical, mental and emotional safety of human participants, especially those in vulnerable situations, must be ensured through clear communication (e.g., information about the nature of the activities, potential risks and expectations) and personalised activities (American Veterinary Medical Association, 2024).
- b. The safety of camels is equally important. To provide camels with adequate training, routine care and rest periods, camels should be closely and routinely monitored for signs of stress or discomfort (Benaissa and Iglesias Pastrana, 2024; Hamad *et al*, 2022), ensuring that they are not placed in situations that could cause them undue stress or harm and guaranteeing that equipment like saddles or harnesses fits properly.

- c. Facilities should be well-designed and maintained, adhering to animal welfare regulations and public safety guidelines and accommodating participants' needs (e.g., ramps, wide doorways and adaptable equipment for individuals with various disabilities) (American Veterinary Medical Association, 2024).
- d. Involvement of veterinarians in the planning and maintenance of CAS programmes is crucial for ensuring adequate hygienic maintenance to minimise the risk of exposure to zoonotic pathogenic agents and prevent the dissemination of diseases (Boyle *et al*, 2019).

Actually, one of the primary challenges in maintaining a high level of animal care in CAS may be the availability of veterinarians with specialised knowledge about camels, particularly in new 'camel countries' (i.e., the nations where camels have been recently introduced and are contributing to the diversification of the livestock industry, especially in Western regions), where such expertise is often limited. Veterinarians involved in CAS programmes must not only possess general animal health knowledge but also be well-versed in camel-specific management strategies, including environmental adaptations. This is especially relevant when designing CAS programmes in areas with climate conditions that differ significantly from the camels' native habitats. Environmental factors such as temperature and humidity levels have a substantial impact on camel's thermal comfort. Inadequate housing systems can exacerbate health risks, further emphasising the importance of veterinary expertise and proper facility design to meet camels' specific climatic requirements (Faraz *et al*, 2024).

### 3. Recommendations for selection and training of camels participating in CAS:

- a. Camels selected to participate as co-therapists or co-workers in CAS with different groups and functional objectives should be adult, ideally socially mature and carefully selected based on their temperament, health status, physical constitution and ability to adapt to different environments (Fredrickson-MacNamara *et al*, 2006; Linder *et al*, 2017; Murthy *et al*, 2015; Winkle *et al*, 2020).
- b. For animals with partially unknown life histories, such as camels acquired from circuses, thorough ethological evaluation is crucial to determine their suitability for

AAS. Previous and unknown events in the animal's life could condition the occurrence of unwanted/altered reactions to stimuli. This evaluation should assess the camel's behaviour towards humans, reactions to sounds and movements, interactions with other camels and responses to commands, as well as signs of stress and escape behaviours. Additionally, it is essential for animal handlers to receive proper training and supervision to ensure safe and responsible interactions, with a solid understanding of camel behaviour and welfare to anticipate and mitigate potential hazards during activities.

- c. An ethical training approach should combine both positive and negative reinforcement to enhance camels' adaptability and behaviour. For positive reinforcement, it is crucial to strike a balance by using food rewards judiciously and intermittently, while also incorporating other forms of positive reinforcement, such as verbal praise or tactile rewards, to maintain motivation without creating dependency solely on food. In the case of negative reinforcement (e.g., utilisation of a lead rope and apply gentle tension to guide the camel, promptly releasing pressure as soon as the camel begins to move), its ethical use is essential to ensure the safety of the camels and humans involved. To gain a further, comprehensive understanding of the fundamental principles for managing and training camelids, we can refer to a dedicated methodology known as CAMELIDynamics (Bennett, 2022).

### **Evaluation of CAS**

Programme evaluation involves investigating the outcomes of AAS to assess their merit, value, or success in producing desired changes (Ballesteros, 2001). Key evaluation concepts include efficacy, effectiveness and efficiency (Echeburúa and Corral, 2001; González, 2019; Seligman, 1995). Additionally, important points to consider are utility, viability, addressing social needs and precision (Chen, 2010).

Before evaluating CAS, a thorough need assessment is essential to identify the target population, understand their specific challenges and determine how CAS can effectively address these needs. A systematic approach to CAS evaluation includes the following steps:



1. Programme design and implementation: Begin with a detailed assessment of the programme's design and implementation. This includes evaluating the selection and training of camels, the structure of the CAS, the qualifications of facilitators and adherence to established ethical standards and best practices.
2. Outcome measurement: Employ a variety of outcome measures across physical, psychological and social domains to gauge the impact of CAS. This includes changes in emotional regulation, social interactions, physical functioning and overall quality of life. Utilising standardised assessment tools for both quantitative and qualitative records ensures a comprehensive understanding of programme outcomes. Additionally, measuring the well-being and behavioural changes of camels provides a holistic view of the programme's impact.
3. Data analysis and interpretation: Rigorous analysis of data is crucial for drawing meaningful conclusions. Both quantitative and qualitative statistical analysis (Pandey *et al*, 2024) offers a comprehensive understanding of AAS effects, guiding future programme refinements and research directions.
4. Participant feedback: Gathering participant feedback is integral to the evaluation process. Surveys, interviews and focus groups can yield valuable insights into perceptions of programme efficacy, satisfaction and areas for improvement. Feedback from camel handlers, clients, parents, family members, teachers and school administrators can provide a broader perspective on the programme's effectiveness and operational challenges.
5. Long-term follow-up: Evaluating the sustainability of outcomes over time is critical for assessing the lasting impact of CAS. Long-term follow-up enables tracking of participants' progress beyond the CAS period, identifying potential challenges or relapses. Incorporating long-term monitoring of both participants and camels ensures sustained benefits from the service and allows for timely addressing of any emerging issues.

The calm demeanor and social intelligence of camels suggests that these animals can create a supportive and calming environment for human participants in AAS. Their ability to work as a team in challenging conditions further highlights their adaptability to therapeutic settings, where cooperation and attentiveness are vital for achieving

successful outcomes.

Potential benefits from camel-assisted services (CAS) include various advantages for human patients and the camels themselves. For human patients, physical benefits may involve improved balance, muscle strength, coordination, postural control, increased range of motion and stimulated sensory integration. Psychosocial benefits can lead to better socialisation, enhanced self-esteem, self-confidence, self-discipline and self-efficacy, along with improved cognitive abilities (attention and concentration) and reduced anxiety and stress. Educationally, participants can develop camel-handling skills applicable in other contexts and gain knowledge of animal care, environmental stewardship and cultural sciences.

For camels, involvement in CAS may enhance their physical health through increased activity, provide mental and emotional enrichment to combat boredom and reduce stress and ensure they receive dedicated attention and care from their trainers and caregivers, promoting their overall well-being.

While CAS is an emerging field, there is a pressing need for further scientific research to validate their long-term efficacy, effectiveness, efficiency and sustainability.

Animal, camel and human health professionals, alongside education specialists, are uniquely positioned to contribute to CAS initiatives. Expertise of those delivering community services and supporting the scientific evaluation and documentation of both the benefits and potential risks associated with CAS is crucial.

### **Authors' contribution**

Carlos Iglesias Pastrana conceived the study design and led the project. All authors contributed equally to the critical review and revision of the manuscript.

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