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 Hertfordshire AL4 8AN, UK
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A review of current indicators of welfare in captive elephants (*Loxodonta africana* and *Elephas maximus*)

E Williams^{*†}, *CL Chadwick*[‡], *L Yon*[§] and *L Asher*[#]

[†] School of Animal Rural and Environmental Sciences, Nottingham Trent University, Brackenhurst Campus, Southwell, Nottinghamshire NG25 0QF, UK

[‡] Ecosystems and Environment Research Centre, School of Environment and Life Sciences, University of Salford, The Crescent, Greater Manchester M5 4WT, UK

[§] School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington Campus, Loughborough, Leicestershire LE12 5RD, UK

[#] Centre for Behaviour and Evolution, Institute of Neuroscience, Newcastle University, Framlington Place, Newcastle NE2 4HH, UK

* Contact for correspondence and requests for reprints: ellen.williams@ntu.ac.uk

Abstract

Concerns over elephant welfare in UK zoos have implications for their future in captivity. To monitor improvements made to elephant welfare in UK zoos, non-invasive, valid and reliable indicators of welfare are needed. Using a rapid review strategy and critical appraisal tool, we aimed to appraise evidence from peer-reviewed literature on potential welfare indicators for captive elephants. Scopus, Web of Knowledge and Ovid were searched in January 2014 using terms relevant to captive elephants and welfare assessment. Inclusion and exclusion criteria were applied and remaining articles were critically appraised against a specially designed welfare indicator appraisal tool. Thirty-seven unique indicators of welfare were extracted from 30 peer-reviewed papers which met the inclusion criteria. Behavioural measures of welfare ($n = 21$) were more common than either physical ($n = 11$) or physiological ($n = 5$) measures. Stereotypies were the most frequently used behavioural measure, glucocorticoids were the most frequently used physiological measure and body condition scores were the most frequently used physical measure. There was most support for the following indicators of improved welfare state: reduced stereotypies, reduced glucocorticoids and improved body condition scores. Additional measures which require further validation but had strong associations with the most supported measures, and thus have potential use in welfare assessment, were: increased lying rest and positive social interactions. Further validation of the described measures is needed, but this information forms a crucial part of the knowledge required to efficiently monitor and improve the welfare of elephants in captivity.

Keywords: animal behaviour, animal welfare, captivity, elephant, welfare assessment, welfare indicators