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One welfare: Linking poverty, equid ownership and equid welfare in the brick kilns of India**

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Abstract

The brick kilns in India are associated with extremely low pay, poor working conditions and a lack of regulation. Equids, however, may provide a route out of poverty by enabling workers to access a higher income. The relatively higher financial returns from healthy equids could also motivate welfare improvements. We used a mixed-methods approach including livelihoods questionnaires, semi-structured interviews and welfare assessments to investigate the links between poverty, equid ownership and equid welfare in the brick kilns of Ahmedabad, India. Whilst equid owners earned more than non-owners during the kiln season, the opposite trend was found for these workers for work conducted outside of the kilns during the off-season. Equid ownership was, however, strongly influenced by social factors and, within certain communities, equid ownership may be the only viable escape from extreme poverty. In terms of welfare, equid behaviour was better for owners with better financial security, likely due to the availability of resources. Equid health improved with longevity of ownership, suggesting that owners who view working with their equids as a long-term partnership are more likely to ensure their equids are kept in good health. For stakeholders aiming to improve both human health and equid welfare, a 'one welfare' approach which values the intrinsic connections between poverty and both equid ownership and equid welfare could greatly increase success.

Keywords: *animal welfare,* Equus asinus*, human livelihoods, poverty, sustainable development goals, working equids*

Introduction

Donkeys (*Equus asinus*), mules (*E asinus* × *E caballus*) and horses (*E caballus*) have long supported human livelihoods, performing an array of heavy labour tasks such as traction work on smallholder farmland (Fernando *et al* 2004; Hassan *et al* 2013), the transport of goods and vital supplies (Arriaga-Jordán *et al* 2005) and human transportation for both necessity and tourism (Ali *et al* 2014; Rayner *et al* 2020). Current data suggest that there are approximately 112 million equids globally, although this is likely to be an underestimate (Food and Agriculture Organisation [FAO] 2019; Norris *et al* 2021). Approximately 43% of equids can be found in Asia, with an estimated 380,000 working in the Indian brick kilns (Mitra & Valette 2017). While estimates vary, around 200 to 250 billion bricks are produced in over 100,000 Indian brick kilns per year (Lalchandani & Maithel 2013; Mitra & Valette 2017).

Brick-making is seasonal work and, as such, employs seasonal, often migrant, workers for a few months of the year (John 2014). Workers usually live on-site during the kiln season, residing in basic, temporary housing which often lacks facilities such as clean water and sanitation facilities (Roy & Kunduri 2018). Workers are responsible for a specific part of the brick-making process, from preparing materials and moulding raw bricks, transporting them to or from the kiln, stacking within the kiln, and managing the firing process, all of which require heavy manual labour during extremely long working hours (Gupta 2003; Ercelawn & Nauman 2004). All parts of the process are carried out by hand, although equids are commonly employed by brick transporters to move bricks to and from kiln sites. Donkeys, mules and horses all carry out this work in India, with mules and horses usually pulling carts, and donkeys tending to carry packs where vehicle use is prohibited by costs, space or difficult terrain (Mitra & Valette 2017).

The United Nations (UN) Sustainable Development Goals (SDGs) aim to "end poverty in all its forms everywhere" and "reduce inequalities." Despite having cut global poverty rates by 27% from 2005/6 to 2015/6, (Oxford Poverty and Human Development Initiative 2018), the distribution of economic benefit has been somewhat unequal across sectors of society (Sankar 2020). As part of the informal sector, the brick kiln

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industry, in particular, is characterised by low wages, lack of social protection and poor regulation (Croitoru & Sarraf 2012). Brick kiln workers commonly originate from marginalised communities, often do not own land and frequently lack a formal education, rendering them particularly vulnerable to financial instability (Fernando *et al* 2004; John 2014). Despite equid owners often being perceived as having a low status in society (Bough 2010), they are not always the "poorest of the poor" (Fernando *et al* 2004). In communities in Tanzania and Ethiopia, for example, donkey-owning families are reportedly wealthier than non equid-owning families (Smith 2004; Hassan *et al* 2011). Indeed, equid ownership may provide a route out of poverty for some by increasing the productivity of manual work which would otherwise be conducted by people (Smith 2004). Whilst equids play a vital role in the brick kilns, there is little information on the financial status of their owners, specifically. In Afghanistan, brick transporters are less vulnerable to debt bondage than brick moulders due to the capital from their equids and carts, placing them above brick moulders in terms of hierarchy (Samuel Hall Consulting 2011), whilst the opposite trend is reported elsewhere (Mitra & Valette 2017).

The kiln environment creates a variety of welfare issues for working equids; extreme temperatures coupled with a heavy workload can lead to heat stress (Ali *et al* 2015), while inadequate working equipment can cause severe lesions (Burn *et al* 2010a; Ali *et al* 2015). However, with an estimated 79% of workers in the informal sector in India continuing to live in poverty after finding employment (NCEUS 2008), kiln workers may find it difficult to affect change for themselves and, by extension, their equids (Ali *et al* 2015). If equid owners sell equids to free up capital, it may disrupt the development of mutually trusting human-animal relationships and negatively influence welfare (Goodwin & Hughes 2005; Waiblinger *et al* 2006). As casual workers, brick kiln workers are subjected to excessively long working hours, with no paid overtime, as workers strive to maximise their productivity (Anti-Slavery International 2017). Whilst productivity may increase with a larger group of equids (Hassan *et al* 2011), this option may be limited to owners with more financial security and the impact of increasing group size on welfare is currently unclear.

For non-government organisations working to support livelihoods, understanding the role of equids is key to creating successful programmes within the brick kilns. For interventions aimed at improving equid welfare to be sustainable, there often needs to be a demonstrable socioeconomic incentive for equid owners to motivate a long-term change (Pritchard *et al* 2018). Development organisations, however, tend to work in silos in the brick kilns, with animal welfare seen as a peripheral issue within human development spheres, and *vice versa* (Mitra & Valette 2017). The SDGs aim to tackle this by promoting collaboration between sectors at a local, national and global level, through SDG 17: Partnerships for the goals. The 'One Welfare' concept echoes and supports this goal, by highlighting the deep connections between animal and human health and well-being, human development, and environmental conservation as a basis for collaborative action (Garcia Pinillos 2018). Whilst links between human and environmental health and poverty are well established, correlations between these factors and animal welfare have been subject to less attention. Although the welfare of working equids has been previously examined in the brick kilns (eg Burn *et al* 2010b; Ali *et al* 2015; Norris *et al* 2020), to our knowledge only one study has included consideration of the socioeconomic status of the owners and how the fate of humans and animals interlink (Watson *et al* 2020).

Following on from an exploration of the influence of human culture on donkey welfare and the cultural 'blind spots' that may hinder efforts to improve welfare (Watson *et al* 2020), we aim to help practitioners in the fields of both development aid and animal welfare to untangle the complex relationships between poverty, donkey ownership and donkey welfare.

Using a combination of quantitative and qualitative socioeconomic data and welfare assessments, we outline and compare the demographic profile of donkey owners and non-owners in the brick kilns of Ahmedabad in India, focusing on social indicators of poverty. We then assess the impact of donkey ownership on income poverty and financial security, as well as the potential role of working donkeys in providing a sustainable route out of debt and influencing financial aspirations. Finally, by focusing solely on donkey owners, we assess the links between financial status and donkey welfare, providing much-needed evidence upon which to build the effective partnerships emphasised by the sustainable development goals and advocated by the One Welfare concept.

Materials and methods

Study sites and participants

Fieldwork was conducted between 30 April and 14 May 2018. Study sites consisted of 14 brick kilns situated in and around Ahmedabad, Gujarat state, India. Specific brick kilns were selected based on accessibility (travelling distance from the study base and entry permission from the kiln owner). Permission was gained via Donkey Sanctuary India (DSI; now named Donkey Sanctuary Welfare Association), who provided logistical support and interpretation services throughout the study. Donkey Sanctuary India had provided veterinary interventions to participants within the kilns accessed for the study, and we acknowledge that this may have influenced some responses during interviews. Without this assistance, however, gaining access to sites would have been extremely difficult and potentially dangerous for both researchers and participants. No other human development nor animal welfare organisations were acknowledged by participants to have accessed the kilns.

Participants were classified as donkey owners (brick transporters, with donkeys working as pack animals), *thekedars* (contractors in a supervisory role) and non-owners (brick moulders, stackers and firemen). *Thekedars* oversee a specific job role within the kilns; we interviewed *thekedars* who oversaw the brick transporters. All *thekedars* also owned and worked with donkeys.

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Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki, and the protocol approved by the Ethics Committee of The Donkey Sanctuary UK, Project Number 2018-VOD-INDIA.

During May, kiln work is usually conducted overnight to avoid extreme daytime temperatures. All fieldwork was, therefore, conducted between 0800 and 1300h, when kiln work had finished for the day, so as not to distract people from their work duties. Researchers ensured that people had a chance to rest, eat and recover and that donkeys had been fed and watered before conducting assessments and interviews. All participants provided recorded verbal informed consent, and it was made clear that participation was entirely optional.

While it can be argued that researchers that are unfamiliar with a particular experience may address it from a "fresh and different viewpoint" (Berger 2013), researchers from a different cultural background to participants may not develop questions that are in line with the participants' perspective, and may misinterpret their answers. To reduce this impact, the principal researchers worked closely with colleagues from DSI during the development of questions, and continuously reflected upon both the questions and the responses of participants throughout the study. We acknowledge, however, the inevitable bias that our presence may have elicited in a strongly hierarchical culture. We addressed this as much as possible during the pre-interview discussion, whereby participants were given the right to withdraw within two weeks of data collection, assured of their anonymity (in accordance with data protection guidelines), and invited to ask questions about the process.

Data collection

Quantitative and qualitative data were collected using livelihood questionnaires, semi-structured interviews (SSIs) and welfare assessments, all of which were conducted at the kilns, usually outside the temporary lodgings of the participant or at a location of their choosing. Participants were recruited based on their availability at the time of the visit, willingness to participate and their job role in order to obtain a stratified sample of job roles within the kiln environment. Questionnaires and SSIs were conducted by principal researchers in English and interpreted to and from Hindi *in situ* by Indian colleagues from DSI.

The questionnaire was used to collect information on demographic outline (age, sex, education level, land, home and asset ownership), income (earnings during the kiln season and off season, receipt of advance payments), donkey ownership and donkey care (Table S1). Assets were selected from the following: radio, TV, mobile phone, computer/laptop, motorbike, tractor. The list was adapted from the Global Multidimensional Poverty Index (Alkire *et al* 2020), using local knowledge from DSI, to reflect the items considered an asset to participants. Participants were able to opt-out of any questions they did not wish to answer; whilst the majority of participants answered all questions, occasional omissions mean that sample sizes in some cases may differ from the total cohort.

SSIs were used to explore the pre-determined themes of financial dependence on equids and kiln work, equid ownership as a route out of debt, financial aspirations, and equid welfare and income poverty (Table S2). The semi-structured approach allowed for new topics to arise, in addition to the pre-determined themes, based on the unique perspectives and experiences of participants both inside and outside of the kilns. SSIs lasted from 10 to 50 min, with an average time of 35 min, and were audio-recorded and later transcribed *verbatim*. Whilst both a questionnaire and SSI were conducted wherever possible, when a participant was short on time or did not wish to participate in part of the study, the SSI was not conducted.

Welfare was assessed by trained welfare assessors using the EARS (Equid Assessment Research and Scoping) tool (Raw *et al* 2020).

Qualitative analysis

All SSI transcripts were analysed using thematic analysis in N-Vivo (V12.2, QSR International, London, UK). Deductive coding was conducted on all interviews to identify responses relating to the pre-determined themes of the research piece and to add greater depth to responses from the livelihood questionnaire, such as why a participant answered a structured question in a particular way, or to provide richness and reasoning to a trend found in the quantitative data. In addition, whilst most of the discussions were categorised under the pre-determined themes, the application of inductive coding allowed new themes and sub-themes to emerge from the data.

Coding was performed in several iterations, where nodes relating to the pre-determined themes were split into sub-nodes based on the content of the interviews, and new themes and sub-themes were noted wherever they emerged. The analysis was repeated until the coding was considered complete when no new themes emerged. This process allowed for researchers to understand and present the views of participants in a more holistic manner.

Quantitative analysis

Quantitative data were analysed in R (V 3.6.1, R Core Team 2019) using R Studio (V 1.2.5001; Racine 2012). To allow a direct comparison of variables of interest between *thekedars*, donkey owners and non-owners, one-sample analysis of variance tests were performed throughout. Differences in variables of interest between the kiln-season and off-season for each job role were tested using paired *t*-tests. Prior to each test, a Sharipo test for normality and an *F*-test for homogeneity of variance were performed. Data that did not follow a normal distribution were log-transformed and the Sharipo test repeated to confirm normality before proceeding. For the assessment of relative differences in wages during the kiln season and off-season, mean wages per week per family were used after testing that family sizes for each group were not significantly different.

To assess links between donkey welfare and poverty indicators, donkey welfare was aggregated into a score for both health and behaviour following Step One of the Welfare

Aggregation and Guidance (WAG) tool outlined in Kubasiewicz *et al* (2020). Following this protocol, a score from zero (worst welfare) to 100 (best welfare) was assigned to each animal based on the welfare conditions outlined within a decision-tree relating to health, and behaviour, respectively. Mean scores for each donkey owner for both health and behaviour were then calculated. The average number of seasons donkeys are kept by the owner was also included to enable the assessment of longevity of ownership. Poverty indicators were taken from the livelihood questionnaire; these included number of assets, home ownership, money borrowed for donkey purchase, average donkey cost, and number of donkeys. Number of adults working in the kilns was included following indication by participants that it influenced the number of donkeys owned. Data were first assessed for missingness using the md.pattern function from the MICE package (van Buuren & Groothuis-Oudshoorn 2011). As data were found to be missing, we used Multivariate Imputation by Chained Equations (MICE) to impute the missing data (Harrison 2014). The MICE method implements fully conditional specification, where each incomplete variable is imputed by a separate model. The MICE algorithm can impute continuous, binary, and categorical data making it well suited to this mixed dataset. Percentages were recalculated and the associations between welfare and poverty indicators were tested using Factor Analysis of Mixed Data (FAMD; Lê *et al* 2008).

Results

In total, 43 participants conducted livelihood questionnaires, including 32 donkey owners, five *thekedars* and six non-owners. Thirty-four participants completed SSIs, including 24 donkey owners, four *thekedars* and six non-owners.

Whilst the majority of topics discussed by participants related to the pre-determined themes of financial dependence on equids and kiln work, equid ownership as a route out of debt, financial aspirations, and equid welfare and income poverty, the following sub-themes also emerged from the data: perceptions of power to affect change; balancing equid care and earning power; equid welfare and longevity of ownership. These themes have been referenced where they most appropriately enhance the narrative.

All of the equids within the kilns included in the study were donkeys, although there was mention of brick kilns within Gujarat that employ mules where there is space for carts. None of the participants had knowledge of horses working in other kilns, although this does not rule out their presence. Welfare assessments were completed for 220 donkeys belonging to 34 donkey owners and five *thekedars* (mean = 6 donkeys per owner).

Demographic outline of participants

Participants ranged from 18 to over 50 years old, with the majority of owners (56%; n = 18) and non-owners (67%; n = 4) aged between 30 and 50. All except one *thekedar* were over 50 years old (80%; n = 4; Table 3).

Four participants were female, all of whom were classified as donkey owners (Table 3). Female donkey owners are, however, likely to account for a higher proportion of total donkey owners than represented by our sample; female non-owners were also observed working in the kilns, although none wished to be interviewed. Women from all cohorts declined to be interviewed on several occasions, reporting that they were either too busy with household chores (usually cooking, as interviews were conducted during mid to late morning), or felt that a male family member would be more able to answer questions (for an in-depth assessment of social status and gender within the current cohort, see Watson *et al* [2020]). All male donkey owners reported to owning the donkeys themselves or that they were owned by another male family member. Two female donkey owners reported that their spouse owned the donkeys, one owned them jointly with her spouse and one owned the donkeys herself.

All participants except for four donkey owners (13%) owned their own home. Two *thekedars* (40%), two donkey owners (6%), and two non-owners (33%) either rented or owned land (Table 3). The number of assets owned did not differ significantly between *thekedars*, donkey owners or non-owners ($F = 1.3$, df = 2; $P = 0.27$). All *thekedars* and all donkey owners (except for one) lived within the state of Gujarat during the off-season, with a single equid owner travelling from Uttar Pradesh. All workers resided within the kilns during the kiln season.

The majority of *thekedars* (60%; n = 3), donkey owners (63%; n = 20) and non-owners (67%; n = 4) reported to having no formal education. The remaining non-owners reported that they could read and write, whilst the remaining owners and *thekedars* varied between reading and writing, and primary education, with a single donkey owner having had a secondary education (Table 3).

Does income differ between job roles and seasons?

The number of adults per family did not significantly differ between *thekedars*, donkey owners or non-owners ($F = 2.4$, df = 2; $P = 0.11$).

During the kiln season, *thekedars* earned, on average, 33% more than other donkey owners, and donkey owners earned an average of 18% more than non-owners (Figure 1), although these differences were not significant ($F = 2.1$, df = 2; $P = 0.14$). During the off-season, *thekedars* earned an average of 46% more than donkey owners, who earned 37% less, on average, than non-owners ($F = 0.82$, df = 2; $P = 0.45$; Figure 1).

Non-owners earned a comparable weekly wage during the kiln season and the off-season ($t = –0.34$, df = 5; $P = 0.74$). Donkey owners earned significantly more during the kiln season than the off-season ($t = –3.12$, df = 22; $P < 0.01$). *Thekedars* earned 50% more during the kiln season, although this difference was not significant ($t = –2.92$, df = 2; $P = 0.10$; Figure 1).

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Table 3 Demographic profile of *thekedars* (contractors), equid owners and non-owners in the brick kilns, Ahmedabad, India.

Demographic		*Thekadar*		Equid owner		Non-owner	
		%	(n)	%	(n)	%	(n)
Total participants			**5**		**32**		**6**
Gender	Female	0	(0)	13	(4)	0	(0)
	Male	100	(5)	88	(28)	100	(6)
Age	18–30	20	(1)	28	(9)	33	(2)
	31–50	0	(0)	56	(18)	67	(4)
	Over 50	80	(4)	16	(5)	0	(0)
Home ownership	Own	100	(5)	88	(28)	100	(6)
	Rent	0	(0)	13	(4)	0	(0)
	None	0	(0)	0	(0)	0	(0)
Land ownership	Own	40	(2)	6	(2)	33	(2)
	Rent	0	(0)	0	(0)	0	(0)
	None	60	(3)	94	(30)	67	(4)
Assets	5	0	(0)	0	(0)	0	(0)
	4	40	(2)	22	(7)	0	(0)
	3	20	(1)	31	(10)	17	(1)
	2	40	(2)	25	(8)	50	(3)
	1	0	(0)	13	(4)	33	(2)
	0	0	(0)	9	(3)	0	(0)
Education	University/college	0	(0)	0	(0)	0	(0)
	Secondary	0	(0)	3	(1)	0	(0)
	Primary	20	(1)	16	(5)	0	(0)
	Read and write	20	(1)	16	(5)	33	(2)
	None	60	(3)	63	(20)	67	(4)
	Did not answer	0	(0)	3	(1)	0	(0)

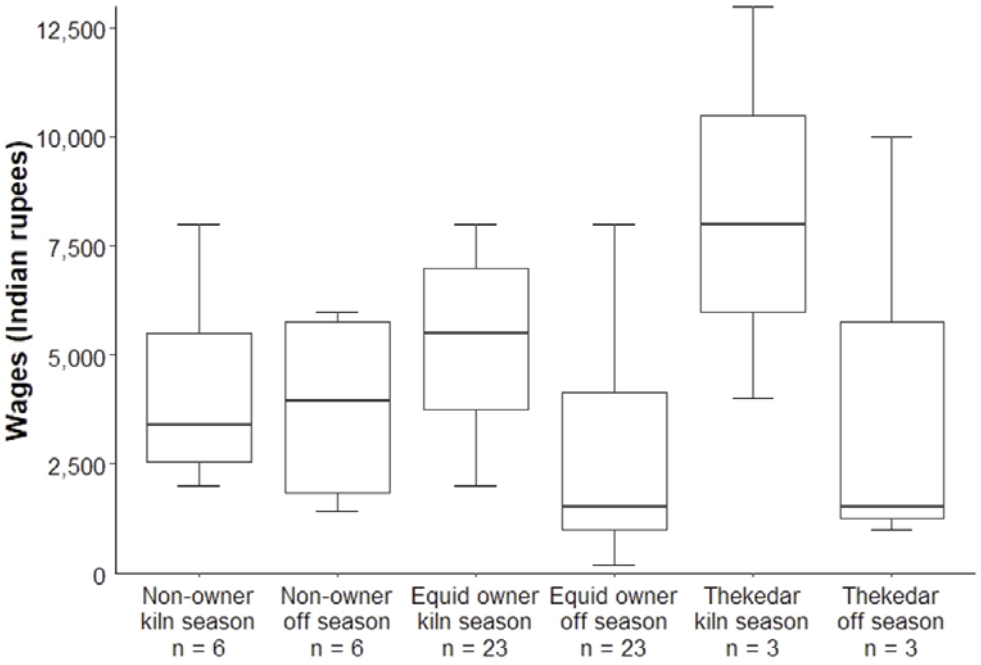
Does equid ownership affect dependence on kiln work?

When asked directly, 97% (n = 31) of owners and 100% (n = 5) of *thekedars* reported that they relied on their donkeys during the kiln season for their main source of income. Only six percent of donkey owners (n = 2) worked their donkeys during the off-season as pack animals in the construction industry.

All donkey owners that discussed non-donkey, off-season work during SSIs completed some form of labour work, including driving tractors and stacking or loading fired bricks. Whilst six donkey owners reported owning a tractor, only one of these participants cited tractor work during the off-season as their main source of income. All except one participant reported that off-season work was sporadic and that earnings were unreliable. Instead, any money saved from in-season kiln work was used to cover living expenses through the off-season, with the addition of advance payments from kiln owners for work the next year. None of the donkey owners felt they had the opportunity for any skilled work outside of the kiln season.

Only three *thekedars* offered information about their wages during the off-season, with results being highly varied. This discrepancy is likely due to the type of work carried out; the higher-earning *thekedar* owned a truck and worked as a truck driver and, despite claiming to be reliant on his donkeys,

Figure 1



Boxplot of wages (Indian rupees) per week per family for non-owners, equid owners and *thekedars* during the kilns season and the off season. Sample sizes are provided below each category.

earned reportedly steady wages during the off-season. The two remaining *thekedars* carried out labour work.

Sixty-seven percent of non-owners (n = 4) considered brick kiln work to be their main source of income. Two non-owners reported the type of work they did during the off-season during SSIs, with both doing tailoring work, stitching and labour work. Mixed views were expressed on the reliability of work in each season, with kiln work reported as being reliable but poorly paid, whilst off-season work tended to be more sporadic and short-term but, potentially, better paid:

> Here [in the brick kilns] I don't earn anything, there [at home, tailoring] I earn more. By earning money from here I'll save that money for marriage, ready for my daughters.

> It [tailoring work] is not continuous, sometimes we may get some work, sometimes not get, so it is not a continuous income… it's 6 months in the brick kilns, and off-season we do stitching to maintain.

Is donkey ownership a sustainable route out of debt?

During SSIs, several owners reported to have initially bought working donkeys as a source of additional income because the pay they received for labour work was insufficient to cover ongoing basic expenses for their family. Working with donkeys also provided a route out of unexpected debt for some. One participant, who had owned donkeys for eight years, discussed her reasons for purchasing donkeys:

> Initially we were doing labour work, but during that time my daughter met with an accident and she lost both her legs. I had to take an advance from somebody, so I took nearly 400,000 rupees, and I had to give that money back to that person. So I thought of keeping donkeys so that I could earn something. We are giving in bits after the brick kiln finishes, whatever we earn, we give a part of that to the lender. It will take some time now, still a bit left. I don't feel good about it, I am spending sleepless nights like I have to give money to somebody, you know, I have to give back the money so I have to earn and I have to save.

Whilst the situation was undoubtedly causing continued stress, the participant reportedly felt that she had made the correct choice. Donkey ownership, however, was not seen as a long-term solution due to the loss of a family member who helped manage the donkeys:

> …we both decided to get the donkeys [referred to her father-in-law] but in that particular season only my father-in-law died, so I was the one who managed. I am not sure about it. If I get a good price I might sell the donkeys…. If we don't have the donkeys my husband will somehow continue tractor work, he loads sand in his village, then I'll be free and see what work I get, then only decide if not keeping the donkeys.

Owners must balance any financial gain from purchasing working donkeys with the additional expense of caring for their donkeys throughout the year, a factor which may reduce their ability to alleviate short-term debt:

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> The money we save over the kiln season is not sufficient as we have ten donkeys to feed, so we have to take an advance.

Does donkey ownership affect future aspirations?

For some, donkey ownership provided a 'stepping stone' to more profitable avenues of work, affording them a level of freedom from the cycle of debt those on the poverty line often experience. During SSIs, one donkey owner said that he had had saved enough from his work in the kilns to purchase a tractor, which supplemented the family income during the off-season. This participant reported that he no longer felt "bound to the kilns" in the long term. Whilst positive, this situation was not common amongst donkey owners, 96% (n = 31) of whom required advanced payments from the kiln owner to sustain them through the off-season, which they repay from their wages in the next season (Kubasiewicz *et al* in prep). When asked about their aspirations for the future in terms of employment, many donkey owners were uncertain, responding with phrases such as 'what's the point?' or similar, furthering the sense of powerlessness to affect change.

Although donkey owners reported a slightly higher level of education than non-owners (Table 3), members of both cohorts reported feeling that their lack of education was a barrier to seeking work outside of the kilns:

> Kiln is the only industry which will employ us illiterates so because of that reason we can't go to any factories, we have to come only to brick kiln this is the only industry that employs uneducated [non-owner].

> If I had studied, I wouldn't be working with the donkeys. Because I am illiterate, I am supposed to do the donkey work [donkey owner].

Donkey ownership was not considered to be an option by non-owners. Rather than feeling limited (or driven) financially, non-owners spoke of a lack of interest in donkey ownership for practical reasons, referencing a lack of experience with donkeys and a lack of space to keep them during the off-season. Social reasons were also given, with one non-owner stating that he would be willing to keep donkeys.

> only if all the moulders [keep donkeys], I don't want to be the stand out from the community [by] having a donkey.

Is equid welfare linked to poverty?

Forty-three percent of donkey owners and *thekedars* (n = 16) purchased at least some of their donkeys from other donkey owners, 35% (n = 13) purchased from local donkey fairs, 5% (n = 2) purchased from 'nomads' (a traditional community of donkey breeders), whilst 17% did not provide an answer (n = 7).

Donkeys obtained a mean (± SD) behaviour score of 62.4 (± 11.5) and a mean health score of 66.8 (± 20.8) per owner. The proportion of data imputed for each variable are provided in Table S4 in the Supplementary material. When observed at a distance, 56% (n = 123) of donkeys were at ease or relaxed, a further 34% (n = 75) were actively interested in their surroundings, whilst 10% (n = 21) appeared apathetic, depressed or withdrawn. During further observation, 22% of donkeys (n = 48) presented sudden 'startle' responses, 15% (n = 33) displayed head shyness and 8% (n = 18) made unpredictable or sudden movements.

Owners with higher wages in the brick kilns, and owners that did not have to borrow money to purchase their donkeys (from either an advance or alternative money-lender), owned donkeys with higher behaviour scores than those with lower wages or who relied upon borrowed money (Figure 2).

Neither health nor behaviour were associated with the number of assets owned by a family, although this poverty indicator was associated with family size, with larger families owning more assets.

There was an association between the health of donkeys and longevity of ownership of the same donkeys, with higher health scores for donkeys that were kept for at least five years; this association was, however, not as strong for donkeys kept for the rest of their life. The majority of owners that said they "keep the donkeys for the rest of their lives" brought all of their donkeys to the kilns, including those that could no longer work, which may account for the slightly lower health scores for these owners. The association between poverty, donkey health and longevity of ownership is recognised by the donkey owners, indicating that a lack of resources, rather than a lack of care or desire, prevent welfare standards from being maintained:

> Our intention is to keep them [for a long time], but we don't have enough food, money and other resources to keep them well.

Owners recognised the health benefits of keeping the same donkeys for an extended period of time. When asked why her donkeys displayed fewer bite wounds than those kept by other kiln workers, one donkey owner responded:

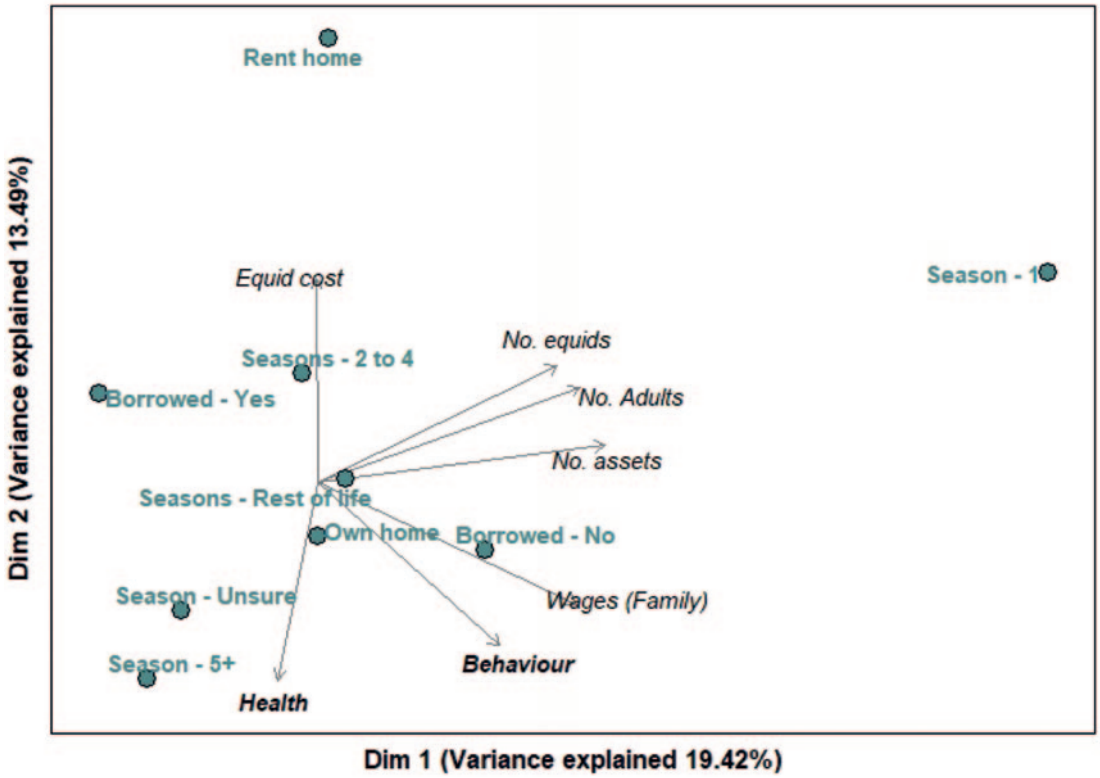
> These donkeys have been with us for so many years, so they are a bit bonded with each other, so they don't fight.

Health scores were higher for owners that owned their home and lower for larger groups of donkeys, although these factors were not associated with income (Figure 2). Health scores were, however, lower where an owner had paid more for their equids.

The number of adults per family was closely associated with the number of donkeys kept per family. This increase in workers was, however, not associated with a proportional increase in family wages (Figure 2). Fifty-one percent (n = 19) of owners and *thekedars* purchased the maximum number of donkeys they could manage during the kiln season, and during SSIs participants confirmed that the number of equids they purchased was limited by the number of family members available to work them. Workers are required to meet a quota, agreed between the worker and *thekedar,* for how many bricks they need to move each day. Whilst 5% (n = 2) of owners and *thekedars* worked their donkeys on a rotation, leaving one or two to rest per day, the majority required all of their donkeys to work every day, which may have impacted their welfare:

> If two or three donkeys don't work it's a big problem for me…. I can't do my full quota with the remaining donkeys.

Figure 2



Factor Analysis of Mixed Data (FAMD) bi-plot showing the association between categorical (grey points; bold grey labels) and numeric (line; italic black labels) welfare and poverty indicators. The covariates 'Behaviour' and 'Health' are in bold for emphasis. The factor 'Borrowed' refers to whether a donkey owner borrowed money to purchase their donkeys; 'Season' refers to the number of seasons owners usually keep their donkeys. Factor levels are indicated following the dash after the factor name. The strength of association between indicators is reflected in the proximity of points (co-factors) to each other and to lines (covariates), and similarity in the direction of the lines (covariates). Here, for example, higher wages per family ('Wages [Family]') and positive donkey behaviour ('Behaviour') are associated with owners who did not borrow money to purchase their donkeys.

Discussion

We provide an in-depth assessment of the financial and social situation of donkey owners in the brick kilns of Gujarat, India. By comparing donkey owners to non-donkey-owning kiln workers, we provide an insight into the nuanced relationship between donkey ownership and poverty and demonstrate a clear connection between poverty and donkey welfare.

During fieldwork, a small number of women declined to be interviewed, usually deferring to a male within the household. The entrenched perpetuation of cultural biases which value men above women can leave women less likely to vocalise their own views; submitting to their male partners or male elders when asked to express their own opinions (Organisation for Economic Co-operation and Development [OECD] 2014). As the structured questions outlining respondents' finances and donkey care routine pertain to the household, rather than the individual, the impact of gender imbalance in our cohort may not have been substantial for these questions, although some bias may have occurred if a respondent was not personally responsible for the family's finances or equid care. Lack of female representation, however, may have influenced the results of demographic questions and semi-structured interviews. Women in India are less likely to have access to education (Thomas 2013) and often have no control over their finances. Women in the current cohort were observed providing care to their equids; their experiences and aspirations are, therefore, highly likely to have differed from the men in the cohort and their narratives would have added a richness to the dataset.

Donkey owners did not consistently earn more than non-owners during the kiln season and had fewer opportunities for employment outside of the kilns. Asset, home and land ownership did not differ significantly between the two groups and, whilst owners had a slightly higher level of education than non-owners, this advantage did not translate into employment opportunities outside of the kilns. Sample size for non-owners is extremely small, however, and further investigation is needed to confirm if these trends are the norm. Whilst tentative, our results suggest that donkey owners are not necessarily less marginalised than their non-donkey-owning counterparts in the brick kilns, at least in terms of factors outlined here, despite findings to the contrary

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in other locations (Smith 2004; Hassan *et al* 2011). Equid ownership in India is, however, heavily driven by caste and may only be a socially acceptable option for income within certain communities (Watson *et al* 2020). Indeed, non-donkey-owning workers in our cohort perceived that they would 'stand out' from their community by owning an equid. For equid owners, kiln work is made accessible by virtue of their equids, and may be their only opportunity for a 'steady' income in a society where caste and ethnic identity limits access to the labour market (Gupta 2003).

The vast majority of donkey owners were financially dependent on their donkeys and described off-season work as sporadic and poorly paid. For people belonging to communities or castes traditionally known for equid ownership, working equids provide an otherwise inaccessible opportunity for debt alleviation, promoting a state of economic inclusion within the casual worker community as a whole and supporting SDG 10: reduced inequalities. Within communities that are traditionally associated with equid ownership, we therefore support previous findings that donkeys may provide a route out of extreme poverty (Geiger *et al* 2020), and it seems likely that other working equids would perform the same service.

Whilst it is difficult to draw conclusions about wage differences between the kiln- and off-season for *thekedars* due to the small sample in the current cohort, *thekedars* can reportedly accrue much higher earnings during the kiln season, although the recruitment process suggests this is a case of community connection or familial acquaintance (Levien 2018). *Thekedars* had a similar level of education to donkey owners, were the lowest earners during the off-season and all interviewees stated a dependence on their donkeys for their main source of income. *Thekedars* are often "precariously situated one step from their workers" in terms of income (Levien 2018), and so the role of donkeys in providing opportunities for those on the poverty line seems particularly relevant here.

Wages in the brick kilns are decided verbally between *thekedar* and worker (or kiln manager and *thekedar*) and are not formally documented for the employee. They may also be subject to deductions for breakages (Ercelawn & Nauman 2004; Guérin 2014), although the amount is usually estimated by the employer rather than calculated accurately. Wages are, therefore, difficult to report accurately, and the results here should be viewed with this caveat in mind.

Donkey ownership provided an escape from crippling, unexpected debt for some owners, but opportunities for income must be balanced against the additional expense of animal care throughout the year. Zaman *et al* (2014) found that owners in Uttar Pradesh spend one-third of their household income maintaining their working equids. Equids begin kiln work at a time of year where seasonal climate restricts access to adequate forage (Gupta 2003), which forces owners to rely on expensive bought feeds. Participants in the current study also tended to work to capacity, leaving no redundancy should any of the donkeys, or people, become ill. Considering the precarious financial situation of donkey owners, any losses risk trapping owners in a perpetual cycle of debt in the long term. The cost of travel to and from the kilns is usually covered by the worker (Mazumdar *et al* 2015) and, particularly when animals are included, is likely to be considerable. These costs will inevitably have an impact on the earning power of an equid, via both the need to use earnings to pay for their transport, and the deterioration of the equid's health through inadequate transport conditions and subsequent lack of fitness for work (Mitra & Valette 2017). Upward opportunities for both donkey owners and *thekedars* centred around transport, with some participants aiming to purchase a tractor or truck. Vehicle ownership is viewed as aspirational socially, as well as economically (Watson *et al* 2020), suggesting that working donkeys may, in some cases, provide an intermediary step and enable access to less risk-prone sources of income. This aspiration, however, was not shared by all, with a sense of powerlessness over their circumstances expressed by some participants.

We discovered a link between indicators of poverty and donkey welfare, particularly in terms of behaviour, although participants expressed a clear desire to affect change. Owners with donkeys with better behavioural welfare earned higher wages within the kilns. Although a causal relationship between these factors is yet to be established and is likely complex, the link between earning power and equid welfare is apparent.

When owners are less financially secure, the resulting deterioration in husbandry, management and handling may adversely affect the equid-human relationship and negatively influence the behaviour of the equid through fear, learned helplessness, exhaustion or apathy (Hausberger *et al* 2008; Burn *et al* 2010b). This is particularly true when equids are pushed to their physical and mental limits by desperate owners (Burn *et al* 2010a). Upjohn and Wells (2018) also note that apathetic equids, in particular, can easily be pushed to their physical limits via a negative feedback loop, since they do not refuse tasks that relatively healthy animals would resist. Equid owners have very little autonomy within the brick kiln environment, and those experiencing more extreme poverty (ie those with lower wages and a reliance on loans in the current cohort) are likely to feel powerless to affect change (Juby & Rycraft 2004). This perceived reliance on external forces and lack of control over one's own fate, known as an "external locus of control" (Lefcourt 1982), was seen in the current cohort, and has previously been linked to poor equid welfare in terms of behaviour (Brizgys 2018). Social empowerment is viewed as central to ending the perpetual cycle of debt suffered by those working in the brick kilns (Guérin *et al* 2007) and, as our results suggest, to improving the welfare of working donkeys.

Donkey health increased with longevity of ownership, although it reduced for those who kept their donkeys for the entirety of their lives, likely due to retired ageing donkeys travelling with owners to kilns. It is inevitable that people develop bonds with animals they care for which strengthen

over time, this familiarity can calm animals in potentially aversive situations reducing injury and distress (Waiblinger *et al* 2006). Owners taking a longer view towards their donkeys' overall productivity may become more motivated to use wages to pay for feedstuffs and healthcare. Owners keeping donkeys for shorter terms, perhaps because of less stable economic or social situations, may be more risk averse to spend money as they may not reap the benefits and may, in fact, incur overall losses (Yesuf & Bluffstone 2009; Pritchard *et al* 2018). These owners may find it more economically viable to sell a donkey in preference to paying out costs for care, health or welfare improvements (Pritchard *et al* 2018). Relationships between short-term owner and donkey may fail to develop trust resulting in greater reactivity, potential injury, stress and related health issues, negatively influencing productivity (Waiblinger *et al* 2006).

In some communities, increasing the number of working donkeys has significantly increased earnings (Hassan *et al* 2011). In the brick kilns, however, larger families owning more donkeys did not earn proportionally higher wages, supporting previous reports of a lack of proportional increase in wages for larger cohorts of brick moulders (Anti-Slavery International 2017). Further, poorer health was observed in larger groups of donkeys, which strengthens earlier findings that financial security has a direct impact on donkey welfare, as resources are stretched more thinly for larger families. This may, at least in part, also explain why equid health was better when owners spent more on their equids; these owners were more likely to rent their home rather than own it and own their equids for fewer seasons. It may be that owners that committed a higher initial outlay to purchase their equids did not have the resources to maintain them in good health, although more data would be needed to test this assumption.

Further complexity is found when the connections between income poverty and human and equid health and well-being are considered alongside environmental health in the brick kilns. Brick production involves excavation of fertile topsoil, reducing food security and biodiversity, and increasing land erosion and flood risk (Singh & Sarfaraz Asgher 2005; Biswas *et al* 2018). These impacts are exacerbated by poverty, with farmers turning to the brick kilns for work and often renting out their agricultural land to alleviate debts (Mitra & Valette 2017; Misra *et al* 2020). Traditional 'bull trench' brick kilns, which are prevalent throughout India, produce a plethora of harmful emissions, including PM2.5 (articulate matter with aerodynamic diameter smaller than 2.5 μm) at more than 30 times the concentration recommended by the World Health Organisation (Misra *et al* 2020). The environmental impact of a brick product could, at least in part, be reduced by upgrading to more efficient, mechanised kilns. But, as the level of mechanisation increases, the labour force required is reduced (Schmidt 2013), potentially leaving workers without an income. Strong partnerships between the environmental, humanitarian and animal welfare sectors, as advocated in SDG 17: Partnerships for the goals are, therefore, crucial to ensure that workers to have the support and empowerment to make sure their voices are heard, that opportunities are available, and their well-being and that of their equids is not forgotten.

Animal welfare implications

Whilst donkeys support human livelihoods, a lack of maintenance of donkey welfare standards is detrimental to humans and donkeys alike. The fact that donkeys keep their owners from extreme levels of poverty, however, has the unavoidable outcome that owners may not be able to afford to care for them adequately, despite aspirations to do so. These aspirations are also easily eroded as the pressures of poverty result in a sense of powerlessness to affect change. We provide evidence for a direct correlation between equid welfare and poverty, a key component of the One Welfare framework for which direct evidence was previously lacking. Although situations where owners lack the resources to improve animal welfare present a particularly 'hard-win' for welfare charities (Pritchard *et al* 2018), documenting and understanding the nuanced relationships between animal welfare and all other sectors within the One Welfare framework provides a valuable basis for collaborations between organisations aiming to achieve truly sustainable development.

Declaration of interest

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