

# Evaluation of heart rates to measure emotionality and “stress” in semi-domestic african elephants engaged in activities with humans

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## ABSTRACT

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**Aim:** The study was aimed to find out any physical or mental suffering during the training and riding of a group of semi-captive elephants (*Loxodonta africana*).

**Method and Materials:** The behavior of four of these elephants was monitored for evidence of behavioral distress (e.g. the occurrence of stereotypies or increase in aggression). We also obtained novel data on the heart rates of these elephants during typical daily activities, such as being cooperatively taught and handled, interacting with tourists and being asked to lie down.

**Results:** The heart rate recordings provided no evidence that any of these activities caused “stress” to the elephants. When ridden with and without tourists, heart rates increased as a result of walking exercise but at no time did heart rates reach higher levels than expected to meet these metabolic demands. The afternoon resting heart rates were also significantly higher that may reflect a rise in core temperature.

**Conclusion:** Elephants can be handled, taught, ridden and interact with tourists without causing them suffering or distress. It is HOW these things are done not IF they are done which matters. The development of welfare and conservation standards for all aspects of elephants’ lives in any form of captivity or sanctuary is crucial if elephants are to survive and have a life of quality in the future.

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## Introduction

There have recently been many statements made by animal welfare organizations concerning the suffering and stress suffered by semi domestic elephants being ridden and having other contact with humans in Asia, here are some quotes:

“Elephants are beaten into submission when young and then forced to let travelers take rides on their backs and to perform confusing and sometimes painful tricks but the abusive training methods and deprivation are often the same and make the elephants

follow the trainers' commands to let people ride, feed, touch, or bathe them".

"Training" begins immediately. The babies are tied down and beaten with bull hooks and other instruments designed to inflict pain until their spirits are broken and they're willing to obey their "trainers" to avoid pain".

To make a wild animal such as an elephant compliant and able to be controlled by humans they are often deprived of food and sleep, they are subject to regular beatings using the ankus or billhook, and physical restraint such as chaining and shackling. According to right tourism, the training that's required to make them safe around people is often akin to torture, as demonstrated by the traditional Thai "phajaan" or "crush," where young animals spirits are systematically broken through torture and social isolation. (ABTA Animal Welfare Guidelines, Phajaan - crushing an elephants spirit)".

"As young elephants, they are torn from their mothers and entrapped in a small confine, then ritualistically abused with bull hooks and bamboo sticks spiked with nails, as well as starved, deprived of sleep and worse, to crush their spirits and become submissive to humans" (PETA. <https://www.peta.org/blog/9-jumbo-reasons-to-avoid-elephant-rides/>)".

Even when the training and keeping of the elephants is not violent or "cruel", an argument used by animal welfare organizations is that activities with humans are "demeaning to the animal". Certainly some activities performed by elephants, including dressing them up, promote a wrong idea about conservation, but to date there is no

evidence that "demeaning" is an emotion that elephants suffer, although self-awareness and confidence are part of any normal elephant's cognitive abilities (Kiley-Worthington 2000, 2011).

Another argument often used by those opposed to having any contact with traditionally wild animals is that they must not learn to do "unnatural" acts. The problem comes with what are considered "unnatural acts". It is certainly natural for all mammals to learn to do voluntary acts and acquire knowledge which is crucial for their survival. Thus the same species learns different things in different areas which results in them having different habits, traditions, knowledge and cultures (Avital & Jablonka 2000, Kiley-Worthington 2000). Using "the performance of natural acts" to define what any mammal should do is an unsatisfactory way of outlining what mammals should learn to do. A better way to argue for improved welfare therefore is to ensure that, whatever the individual mammal is taught, does or learns, is acceptable to him provided he does not suffer in either the learning or the doing of it. It may also be important that doing it could help with his or others' life enrichment and conservation.

There are places in Asia and possibly Africa, where bad practices occur, but despite a widely held belief, not all of them follow these types of practices. Therefore, there is worldwide a desperate need for standards for good welfare in all aspects of the elephants' care to ensure that elephants have a life of quality, which is at least as good as in the wild and indicates that the elephants' welfare is a priority.

As a result of much publicity concerning the poor welfare of elephants, many travel agents discourage or prevent clients going to places who ride or even have close contact with captive or semi-domestic elephants (e.g. [travelconcern.org.uk](http://travelconcern.org.uk) web site 2019, with references to Elephant Asia Rescue and Survival Foundation, Elephant riding in Cambodia: Should you?", The ethical elephant experience, Why you shouldn't ride elephants in Thailand. Elephant Asia, World Animal Protection Society Internet site). Riding, in particular, has been widely criticized, for example: "Despite their size elephants are not designed for carrying people on their back which can often lead to permanent spinal injuries. However, it is not just the weight on their spines - the chair or Howdah attached to their backs also rubs on their back, causing blisters that can get infected". ([travelconcern.co.uk](http://travelconcern.co.uk)). But, there is no evidence that riding, interacting with and teaching elephants has to cause suffering any more than it does for other mammals. Although discouraging people from visiting places where elephants have been shown to suffer is important, it is unjustified to argue that these activities inevitably will cause both physical and mental suffering and therefore are unethical.

Riding horses and training dogs is still, alas, sometimes done badly in some places, but it is not justified to argue that doing these activities will inevitably cause the subjects to suffer. Frequently it is the way it is done not whether it is done that is important from the animals' point of view (Kiley-Worthington & Rendle-Worthington

2012). Stopping visitors and banning activities with elephants can, and is in some cases, causing more suffering and death of elephants than recognizing that tourist or community activities with elephants can be safe and fun for all. Before it is too late and elephant's numbers have declined to a point where they cannot be sustained, it is important to recognize why such activities can be well done and are often very significant for the wellbeing and survival of the species, as well as other mammals.

Due to human population growth (Erlich & Erlich 1990. Meyer & Turner 1990) and consumerism, there is now no truly "wild" world. The areas in which all large mammals live are controlled by some form of human activity. These include agriculture, fences, infrastructure such as roads, buildings, towns, and destruction of habitat which inevitably leads to the remaining populations of elephants having to be "managed" in some way or another, whether this is that the population is control by "culling" or hunting, restricting movements or capturing, transporting and relocating. Thus both the issues of the individual elephant's welfare and their conservation are intertwined; both must be carefully considered in each individual case.

The growth in human population and consumerism is now causing an exponential in-crease in species extinction (IUCN figures for 2019: 7,000 species added to the red list). As a result, if megafauna such as elephants are to survive, they will be (and often already are) in some form of semi-domestic/captive/managed situation. Since these animals are sentient feeling

beings when under our jurisdiction, we have a duty of care to them. The duty of care, has parallels with the universal declaration of human rights (<https://www.un.org/en/universal-declaration-human-rights/>), since both humans and elephants are mammals. It involves providing them with appropriate type and quantify of food, water, shelter and health care. But, it also involves recognizing that all mammals have mental and emotional “needs” (Broom 2001, Kiley-Worthington 2015). When under human jurisdiction, they should be provided with a life of quality where all their various needs (physical, social, emotional and mental/cognitive) are met. This may be in a national park, wildlife reserve, “sanctuary”, zoos or any form of semi-domestic situation including working with tourists.

Some internet sites are beginning to understand this, for example, later in the article quoted above [travelconcern.co.uk](http://travelconcern.co.uk) admits that: “Whilst it is clear that the process of training elephants (Phajaan) is cruel and barbaric and must be stopped there are a couple of issues which complicate an outright ban – firstly we need to make sure that the alternatives to trekking are not more harmful to the elephants and secondly there are examples where elephant trekking is helping conserve even more endangered animals such as tigers and rhinos.”

It is conceded that: “there are examples, such as the Chitwan National Park in Nepal where elephant rides are being used as a positive force for conservation. The park and its buffer zone protect some of the last remaining Bengal tigers and Indian rhinoceroses,

as well as wild elephants and leopards. Elephant safaris are one of the most popular – and safe – ways to discover these exceptionally rare species in Chitwan, and revenue from these safaris contributes greatly to the upkeep of the park and surrounding area, and the protection of its wildlife”.

A careful study of all aspects of elephants’ lives and how to provide a life of quality for them requires a detailed study of their epistemology that is their “take” on the world or world view (Kiley-Worthington 2000). Thereafter, research should be conducted on how to fulfill all the various needs of elephants in order to provide them with a life of quality. Here, we report an investigation into whether riding and interaction by tourists or handlers inevitably causes “stress” (Selye 1950, Scott et al 2007) and/or behavioural distress (Kiley-Worthington 1990, Broom 2001, Mason & Veasey 2010, Duncan. 2016) for the elephants in Jafuta Nature Reserve, Zimbabwe.

A major difficulty is how to ensure and measure, that the animals have their psychological/mental needs fulfilled. One way is to provide choices for the animal in what he does, where he goes, what he eats, who he associates with etc (e.g. Kurtycz 2015). Another way of addressing cognitive/mental needs is to providing “enrichment”, this means that the individual must be provided with different experiences, for example by going to different places, meeting different species and individuals, learning different and new things. In this way they have mental stimulation as they do in the wild. Provided the experiences and work are not “stressful”

and reinforced in a positive way, these experiences can include being ridden, working with timber, agricultural work and positive interactions with the local community. Because close positive safe contact with other species, including recognizing and exchanging emotions, is one of the most important ways of interesting people in the conservation of that species, such contact increases people's interest in elephants welfare and conservation, whether they are local people or tourists.

"Stress" parameters that can be measured non invasively may help to identify poor welfare (Beerda et al, 1997). Physiological measures of stress vary from monitoring cortico-steroids: in blood, faeces or saliva; to recording blood pressure and heart rates. A previous study (Vassey 2017) used fresh faeces to measure corticosteroids of ridden elephants. In the present study, the least invasive and simplest way to obtain immediate data on any "stress" suffered by the elephants during activities was to record heart rates (HR) (von Borell et al 2007). Like other physiological measures, HRs rise as a result of exercise, and are expected to rise as one of the physiological responses of the General Adaptive Syndrome (Selye 1950), which prepares the body for action. There are also behavioural measures of prolonged stress that are not invasive and can be monitored such as the performance of stereotypes (Beerda et al, 1997; Mason & Vaesey 2010), changes in time budgets, increase in aggression and behaviours related to frustration (Kiley-Worthington 1990). Since both physiological and behavioural changes occur with arousal or excitement, there

is no definitive way of knowing whether the changes are because the animal is having a pleasant or unpleasant experience (e.g. Bindra 1959). Consequently their interpretation is uncertain. For example, vocalizations in elephants and other mammals occur with arousal or excitement (e.g. Kiley-Worthington 1974, Wood et al 2005), but whether this excitement is due to unpleasant or pleasant emotional experiences, can only be assessed from the context. There may also be individual variations in stress measurements due to a number of factors (age, gender, past experiences), particularly in field conditions (Beerda et al, 1997).

Elephant heart rates vary from around 22 to 200+ bpm (Sikes, 1971; Gupta, 1928; Schmidt, 1986; Spinage, 1994; Osofsky, 1997), and are usually between 22 and 36 bpm when resting (Firyal & Naureen, 2007; Francis et al, 1936), but they have rarely been measured (except during veterinary treatment). By measuring heart rates and monitoring behaviour over short periods of time during various activities, and by carefully considering the contextual and individual factors in play, our aim was to assess whether the subjects were aroused and/or possibly "stressed" while doing these activities.

## Methods and Materials

Zimbabwe Elephant Welfare and Conservation Trust (ZEWACT) was the location for these observations. For the last 2 years, the welfare in all aspects of husbandry has been monitored in the 10 elephants living there, giving rides and interacting with tourists. Four elephants were chosen for this investigation

because of their differences in age and sex. All the elephants at ZEWACT are accustomed to handling and teaching during a 30 minute session each morning, being saddled up and ridden by the handler and tourists for an hour, and have a 15 minute session when the tourists interacting and feeding them. In the afternoon sometimes there is a further tourist ride and interaction. For the rest of the day, they wander at will with guards in attendance, since there are also wild elephants, in a 10,000h reserve. At 5pm they return with the guards/handlers to their stabling complex for the night. At night as the result of research on compatible groups (Marmonier & Kiley-Worthington in prep), 3 young females are kept together in an enclosure and an adult female and a young male in another; the 4 remaining elephants are tethered by one hind leg where they can see and smell others. The tethers are padded and long enough for the elephant to lie down flat on a dry bed of hay or soft earth, to walk 2 paces forward and back, and to touch their neighbor with stretched out trunks. All the elephants have free access to water all night are fed 5kg horse mix nuts, 20kg Bana Grass (*Pennisetum purpureum* x *americanum*) and ad libitum hay at night. The nutritional level of this diet is the subject of another study (in prep).

For the first couple of sessions, each individual was made familiar with the attachment of the heart rate monitor electrodes, one stuck with tape behind the left ear and the other under the saddle girth on the left-hand side. The monitor was a Polar Equine RS800CX G3 developed for monitoring heart rates during exercise for equines. Establishing

contact with the electrodes was not easy as each area had to be moist and the elephants had to stay still for their attachment. The recordings without a saddle were done by placing the electrode behind a girth. The HR was recorded every two minutes once the monitor was performing well, and the elephant was standing relaxed with or without a saddle. After the sessions, the data were transcribed onto a computer and analyzed.

The HR's were also recorded as the elephant was ridden by a handler, (i) down to a familiar area where the tourists had a stand from which they were able to mount onto the back of the elephant. When mounted (ii) the tourists were taken for a walk around the nature reserve. The load of one handler and the recorder was approximately 4.5% of the elephants' body weight. At the end of the 3/4 hour walk, the elephants returned to the stand, the tourists descended. (iii) On one occasion, one elephant was recorded having an interaction with the tourists on the ground. (iv) The heart rates were also recorded when the elephants were asked to lie down in their home area as there is controversy whether this is acceptable for older elephants to be asked to do. HR recording session varied in duration from 4min to 38min. The number of sessions for each individual and activity were observed (Table 1).

The elephants chosen for this study were one young and one older animal of each sex. They were:

**Doma** - Male 44. years. 6 tons, carried 3% of body weight with 2 people and 20kg saddle.

**Tatu** - Female. 39 years, 4 tons, carried 4.6% of body weight with 2 people and saddle.

**Laduma** - Male. 19 years. 3 tons, carried 6.1% of body weight with 2 people and saddle.

**Wange** - Female. 19 years, 2.5 tons. Carried 7.4% of body weight with 2 people and saddle.

**Table 1.** Number of sessions for each individual for each activity

NUMBER OF OBSERVATIONS	DOMA	TATU	LADUMA	WANGE	TOTAL
Handling/Training with Saddle on	2	3	2	3	10
Handling/Training without Saddle	1	1	1	1	4
Resting time with Saddle on	2	3	1	2	8
Resting time without Saddle am	1	0	1	0	2
Resting time without Saddle pm	1	1	1	1	4
Riding to client's area	2	3	4	2	11
Riding with clients	1	3	3	3	10
Riding with handlers	0	1	0	1	2
Interaction with clients	0	0	0	3	3
Sitting Down	3	4	6	4	17
<b>TOTAL</b>	13	19	19	20	71

The activities recorded were:

#### *Being handled*

A known handler approaches talking to them, touching, stroking, brushing and naming different parts of their body. Handling was always done with no ankus (bill hook) if the handler was experienced and had qualified with the first level of Cooperative Handling and Teaching examination (ZEWCT 2018). Inexperienced handlers were accompanied by an experienced handler and were allowed to have an ankus but not to use it except in extreme emergency. The ankus was carried when the handlers rode the elephants out into the bush as a safety measure to be used in an emergency when

encountering the wild elephants which could happen at any time.

#### *Training*

The handler asked the elephant to do various movements and learn new ones using words and expression in his voice, with gestures, by moulding, touching and imitation. All handlers had attended courses on cooperative handling (Kiley-Worthington & Rendle Worthington 2012). The elephant might be asked to lift the left or right leg for inspection of the foot, put the trunk up and down, open his or her mouth to inspect the teeth, find and give small objects to the handler, etc. New activities which would demonstrate behaviors that are performed in the bush were also taught such as dust bathing, digging with the tusks and

manipulating with the trunk. The idea of the handling and teaching sessions was to (i) to develop better close relationships between the handlers and the elephants, (ii) to stimulate the elephants to listen to and understand more human language, not just commands. This included adjectives, pronouns, verbs and phrases and is part of an ongoing project studying the ability of non-human mammals to comprehend human language (iii) to provide mental stimulation for the elephant and give him/her new experiences to compensate for loss of any mental stimulation they may have had in the wild.

These handling and teaching sessions typically lasted for around 30 minutes in the early morning (from 6.30 Am - 7.00 Am). During the training, the elephants were tethered with a "soft" tether (chain covered in padding) around one hind ankle.

At the end of these sessions, if that elephant was to be used for riding by clients that day, s/he would be asked to lie down so that the 20k simple canvas padded saddles, with girth around the belly could be fitted.

The handler mounted while the elephant was sitting and then the elephant stood up and waited until the others were ready to walk down to the clients area (approximately 500m). Sometimes this was a fast walk almost an elephant trot.

*Resting time standing* tethered was measured both with and without saddles.

#### *Clients riding the elephants*

The clients mounted the elephants from a loading platform to avoid the elephants having to sit. The recorder

mounted with the handler as part of the group. During the walk, the elephants would browse shrubs they passed, and stop and graze from time to time. The group of 2 to 10 elephants walked on several different tracks, either in a single file or spread out, depending on the terrain. The ride took around 45 minutes and covered a maximum of approximately 3 km. It was always accompanied by an armed guard on foot in case of encounters with wild elephants or lions since the bushes were thick in places.

On return to the venue, the clients dismounted at the platform and the elephants walked down to have an interaction with the clients. Here the elephants first sat down and then the clients went up to them to touch and feed them and talk to the handler about that elephant. Only on one occasion was the heart rate of an elephant recorded during this interaction.

After this, the clients adjourned and the elephants either went to the water hole to bath, drink or dust bathe, or they wandered off to browse and eat. Sometimes the direction was chosen by the handlers, particularly if there were wild elephants in the neighborhood. Sometimes the elephants chose where they would browse and hang out for the rest of the day. At 15:00 hrs there might be another ride and interaction with clients. At 17.30-18.00hrs the elephants returned to their overnight accommodation.

## **Results**

The average heart rate for each individual in each situation is presented (Table 2).



Table 2. Average heart rate for each individual in each situation.

AVERAGE BPM PER ACTIVITY	DOMA	TATU	LADUMA	WANGE	Avg. all four elephants	Total number of observations
Handling/Training with Saddle on	33.4	31.93	36.44	34.33	34.025	120
Handling/Training without Saddle	31.8	29.5	44.42	42.1	36.9675	39
Resting time with Saddle on	32.7	30.54	36.75	32	32.9975	144
Resting time without Saddle am	30.9	*	32.6	*	31.755	34
Resting time without Saddle pm	42.2	41.11	40.25	42.76	41.58	174
Riding to client's area	47.6	43.57	50.8	46.1	47.0175	145
Riding with clients	54.0	51.89	49.02	54.69	52.4175	346
Riding with handlers	*	49.47	*	52.8	51.135	74
Interaction with clients	*	*	*	37.21	37.21	98
Sitting Down	44.1	39.53	48.46	36.87	42.255	68
Total						1242

\*Yellow no recordings.

### Statistical analysis

Although there were only 4 individuals, and not all were recorded in each situation (table 1). Two tailed t tests were used to compare each activity against other activities (recommended by Moye 2016 for heart rate analysis). The number of sessions varies from 1 to 6 for different elephants and activities; therefore the overall average values (one per elephant per activity) are used. Using one value per elephant per activity (which is an average of many 2-min periods and sometimes over more than one session) provides a good level of accuracy. The results are shown in Table 3. Where data permitted, further analysis was conducted using SPSS.

The t-test gave some guidelines to the significant differences in the HR related to activity, but since there was only one elephant recorded for some interactions, these results cannot be analyzed using a t test. It can also be problematic to perform a large number of t-tests on one dataset. An alternative

approach where there was sufficient data, was to consider activities as a fixed factor, and elephants as a random factor in a repeated measures (across sessions) analysis of variance (SPSS). This showed a significant main effect of activity on heart rate ( $F = 103.86$ ;  $df 3, 9$ ;  $p < 0.001$ ), and also showed that the 4 individual elephants did not differ significantly from each other ( $F = 2.47$ ;  $df 3, 9$ ;  $p = 0.129$ ). Despite large differences in age, experience and temperament, the Heart Rate responses when doing the different activities were surprisingly similar.

Post-hoc analysis using Tukey's HSD test, showed that the low HR when resting with the saddle on and handling/training with the saddle on do not differ from each other. Riding to the client area raised the HR when compared to either resting with the saddle on or handling/training with the saddle on. Riding with clients produced a higher HR than any of the other activities (Table 4).

Table 3. T tests for significance between the average heart rates during the different activities.

Situation	Hd/Tr + saddle	H/Tr - saddle	Resting + saddle	Resting - saddle am	Resting - Saddle pm	Riding to client area	Riding with clients	Riding + handlers	Performing sit down
H/T saddle	X	NS	NS	NS	SIGN +++ -	SIGN ++ -	SIGN +++ -	SIGN +++ -	SIGN +++ -
H/Tr - saddle		X	NS	NS	SIGN +++ -	SIGN +++ -	SIGN +++ -	SIGN +++ -	SIGN +++ -
Resting + saddle			X	NS	SIGN + -	SIGN +++ -	SIGN ++ -	SIGN ++ -	SIGN ++ -
Resting - saddle am				X	SIGN + -	SIGN +++ -	SIGN +++ -	SIGN ++ -	NS
Resting - saddle pm					X	SIGN + -	SIGN +++ -	SIGN +++ -	NS
Riding to clients area						X	NS	NS	NS
Riding with clients							X	NS	SIGN ++
Riding with handlers only								X	SIGN +++ +

Table 4. Means for homogenous subsets

Tukey HSD	Activity	N	Subset		
			1	2	3
	Resting with saddle	4	32.88		
	Handling/training with saddle	4	33.37		
	Riding to clients area	4		46.04	
	Riding with clients	4			52.29

A fuller consideration of some of the comparisons between activities:

1). *The effect of handling and training, resting and wearing a saddle.*

There was a significant increase in the resting HR in the afternoons (yellow in Fig. 1, & shown in Table 3) in comparison with morning periods (green in Fig. 1), which confirms others findings of elephant heart rate (e.g

Gupta 1928; Sikes 1971; Schmict 1986). In some cases, the increased resting heart rate in the afternoon may be to do with increasing core temperature.

The effect of wearing a saddle and of being handled was further analysed using a factorial analysis of variance (SPSS). This showed a significantly higher heart rate when elephants were not wearing saddles ( $F=13.12$ ,  $df$  1,6;  $p = 0.011$ ) (Fig. 2). The heart rates for the individuals when being handled (i.e. talked to, brushed, and stroked) and when being taught were similar to the resting heart rates ( $F = 1.67$ ;  $df$  1,6;  $p = 0.243$ ). There was also no significant interaction between saddle wearing and handling or resting activity ( $F = 4.33$ ;  $df$  1,6;  $p = 0.082$ ). Therefore, there is no evidence that this is stressful for these elephants.

2) *Riding the elephants.* It gave the average heart rates when being ridden, either by the handlers to the client's area, by the handlers and the clients, and by only the handlers (Fig. 3).

With exercise (walking either fast or slow), the HR inevitably rises, but there is no evidence that this is unexpected or higher than expected. The longest distance covered (1-3 km) was riding with clients, but the speeds were slow (3-5km/hr) and the loads were less than 10% of their body weight thus there is little likelihood that the elephant was exhausted or physically "stressed".

3) *Interacting with clients and being asked to lie down*

It showed (Fig.4) that the heart rates of the one elephant interacting with

tourists (being stroked, touched and fed). The HR's for this elephant were only slightly higher than the resting rates, but there is insufficient data for further analysis.

When asked to lie down, the t test (Table 3) shows that there is a significant rise in heart rate (i) when the elephants were asked to lie down. This indicates that this may be a difficult activity. It was also the behaviour which they were most reluctant to perform. As soon as they were asked to sit down, the HR spikes. It was observed that standing up was difficult, particularly for the older elephants who have great weight to raise, nevertheless, 1 min after standing up, their HR's were back to resting rate.

*Other behaviors indicative of arousal*

Vocalizations have been shown to relate to arousal/excitement (Kiley-Worthington 1976, Wood et al, 2005). They can be either "stressful", such as a scream, or "pleasurable", such as the low rumble. During this study, no vocalizations characteristic of high arousal were recorded from any of the elephants. The few vocalizations that were recorded were rumbles with a slightly higher heart rate than resting rate, but this could be a sign of pleasure. There is always great variation in heart rates within the individual, and they change rapidly. However even the highest HR recorded (87b/m) would be expected with exercise and is well within the range of previously recorded elephant HR's so cannot be evidence of unusual "stress" but recordings of wild

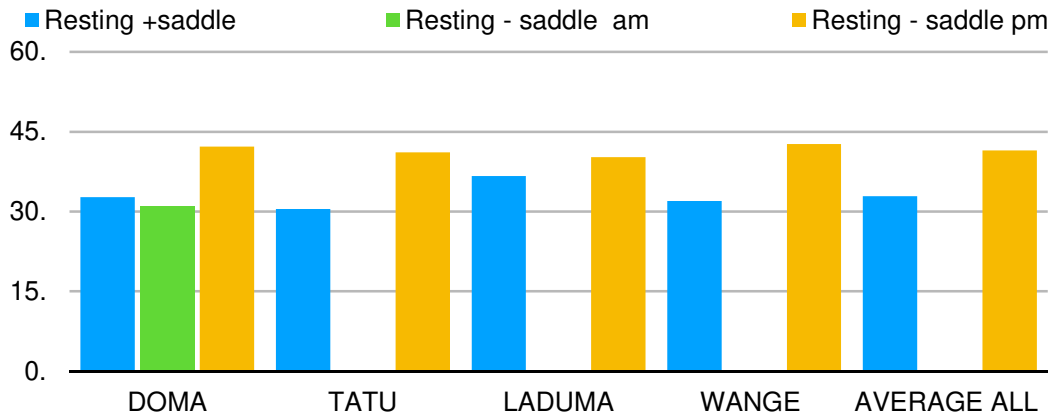


Fig1: The average heart rates for the 4 elephants during their resting time, with and without saddle, both morning (am) and afternoon (pm).

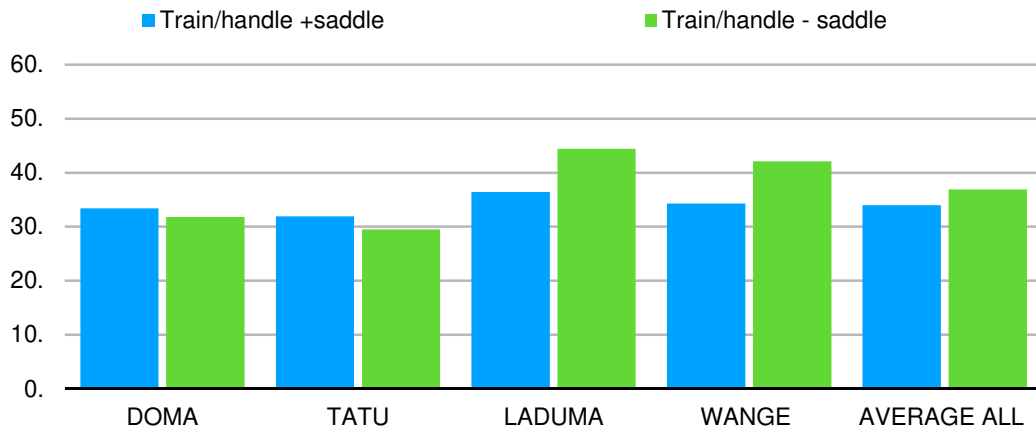


Fig 2: Average heart rates when being trained and handled with and without the saddle

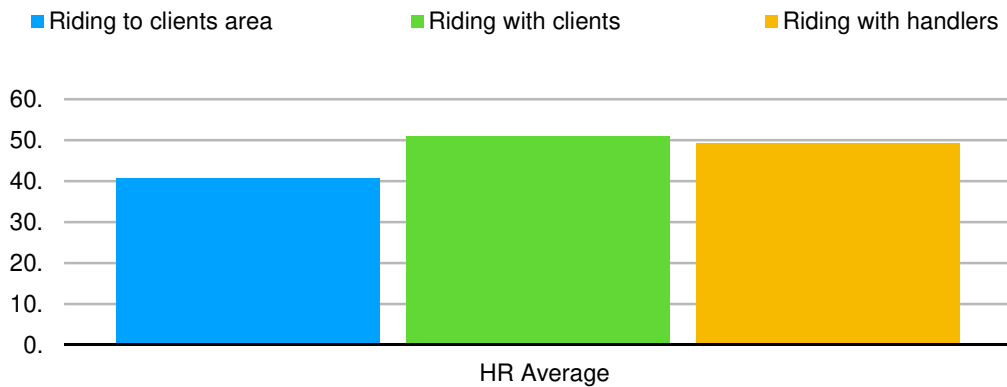


Fig 3: Riding with and without clients

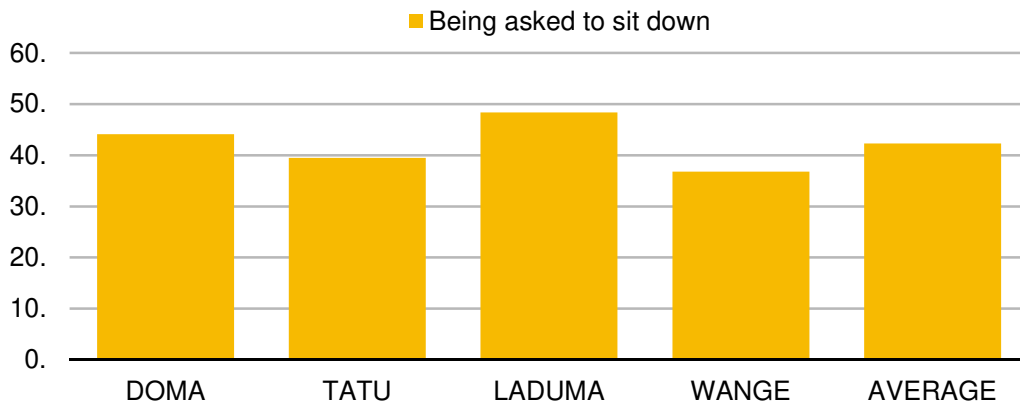


Fig 4: Heart Rates when interacting with clients ( 1 elephant) and being asked to lie down (4 elephants).

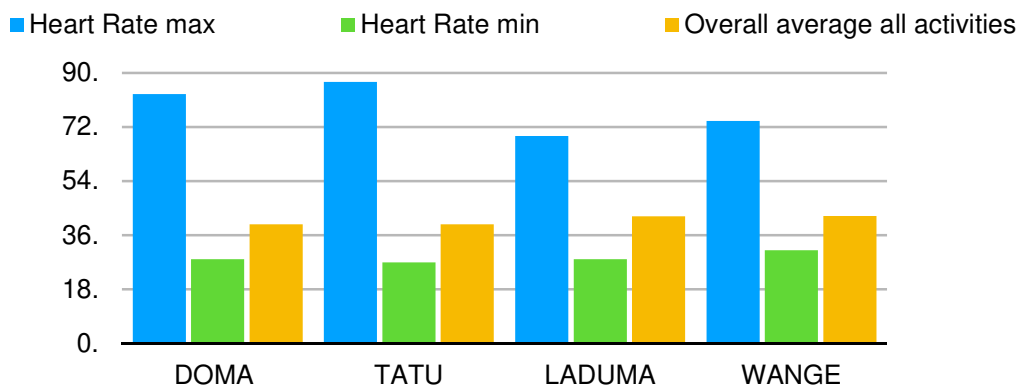


Fig 5: The variations in the heart rates for the four elephants

and free ranging elephants both at rest and during exercise would be interesting.

#### *Individual Elephants*

It gives the variation in of the heart rates for each individual for all the activities recorded (Fig. 5).

### **Discussion**

There is a great variation in HR's both inter- and intra- species. This is of course is because of the differences in size, weight, age, sex, what they do, how they do it, what experiences they have had, what they have learnt about the world as well as their state of physical and psychological health. The full range of elephant heart rates and

their recovery rates after exercise is unknown, as well as its changes with emotionality, whether desirable or not. One curiosity here is that despite the different ages, experiences, sex and size of the four elephants, their heart rates were remarkably similar to each other.

This study is a beginning in assessing whether these elephants (all of whose aspects of life were being monitored) were necessarily stressed when having contact with humans either when being handled and trained by their known care takers, or interacting with strangers such as tourists. There is no evidence that the handling teaching or interacting with

humans caused a significant rise in heart rates.

The significant changes in the heart rates were related to exercise, which is expected. When walking fast, carrying a person and a 20kg saddle, the heart rate increases but this is because of the physical exercise. It would be expected that any undesirable “stress” or arousal would have raised the heart rates much higher. The HR’s at all times were below the maximum recorded previously from elephants when standing. In horses, where there is much more known about exercise physiology, walking fast and carrying a person, the heart rate can sometimes be doubled from the resting rate (e.g. <https://ker.com/equine/news/from-the-heart/> and personal recordings). We know almost nothing about elephant heart rates changes during exercise or in unfamiliar or stressful situations by comparison with humans (Latvala et. al 2016) or equines (above refs) but since the heart rates were not significantly raised during contact with humans (other than as a result of exercise) it is unlikely that these elephants were “stressed” during any of these recordings.

There was a significant difference between the resting heart rate in the morning and in the afternoon, which was occasionally higher than during walking and giving rides. This indicates that elephant HR’s may be greatly affected by ambient temperatures, which has previously been reported (Sikes, 1971; Schmidt, 1986; Gupta 1928). Presumably, the higher heart rate indicates a higher core temperature which because of their size and bulk requires rapid physiological adaption

needing an increase in blood flow. This indicates the importance of assessing heart rate changes as a result of exercise and the fitness of the elephants (assessed from speed of HR recovery) to do the work that is asked of them. For example, when two elephants were pulling a cart less than half one elephants body weight, after 15 minutes the elephants were hot and stopped to regurgitated water to spray on themselves (1996, personal recordings). This may indicate that their physiological fitness for exercise was lower than might be expected although the heart rates were not taken.

During these recordings, there was also no behavioral evidence of “distress” (prolonged stress resulting in severe behavioural changes (Kiley-Worthington, 1990; Mason & Veasey, 2010; Broom, 2001; Duncan, 2016), but there was evidence of increased arousal in their heart rates indicating the experiencing of different emotions, whether pleasant or unpleasant. Vocalization is an indicator of arousal/excitement in many mammals (Kiley, 1974; Wood et al, 2005). In these recordings these were restricted to “rumbles”, which are indicators of pleasure and greeting between individuals (Wood et al 2005).

The conditions in which these elephants are kept and live, their teaching, and the periods giving rides using light equipment are continually monitored for signs of either physical or psychological stress and distress, but there was no demonstration that any of these activities with humans cause them stress, although these activities can be done so they do cause stress and distress.

As a result of this study, together with other research and consultation with animal welfare scientists and animal ethical philosophers, guidelines for maximizing elephants welfare are in the process of development both in theory and practice to ensure the elephants have a life of quality (in prep IEF meeting October 2019). The provisional guidelines have been adhered to for the experimental group. It may be this which is responsible for the evident lack of "stress", arousal and distress in these animals during the reported activities. This could be adopted and monitored in Asia, the rest of Africa and in zoos around the world, where ever there is justified concern in how elephants are kept, trained and used whether in the tourist industry, by the local communities or for conservation.

## Conclusion

There is no evidence that these African elephants whose welfare is a top priority (ZE-WACT) were having an unpleasant experience while being ridden, handled, taught and interacting with the handlers or the clients from recordings of their heart rates or any behavioral changes. This confirms the results of a similar study on riding captive elephants in South Africa (Vessel 2018) which were corticosteroids in the faeces were analyzed to assess any stress. The results here show that semi-captive elephants working in the tourist industry, giving rides and interacting with tourists, can have a life free of prolonged stress and distress. But, it is clear that the good health of the elephant and their general husbandry as well as their training, the weight carried,

and the number of hours per day the elephants are working must be carefully considered and standards for all aspects of their welfare and conservation put into practice and monitored.

It is inappropriate and can be harmful to the survival of many elephants in captive or semi-captive situations if elephants are no longer available for tourists because their lives will then be threatened in the face of lack of resources to sustain them. There is no "wild" to which elephants that have had experience with people can be safely reintroduced. By contrast, income from non stressful activities can pay for their safe, handling, teaching and maintenance.

In restricted areas, such activities can also benefit the elephants further by increasing their cognitive stimulation and fulfilling mental needs. Riding, and other exercise with the tourists, can be beneficial to the elephants as well done, it can enrich their lives and give them as well as the riders, new and different experiences. From the tourist's point of view, riding is one of the most popular activities with elephants, despite the negative worldwide publicity. The popularity of elephant riding is chiefly because it allows a prolonged safe close experience of direct contact with an elephant. This enables more profound appreciation of elephants as a living, feeling mammal, like the clients themselves (Kiley-Worthington 2008). This close safe contact between elephant and riders is a unique experience, and can be example of inter-species collective intentionality (Kiley-Worthington 2008 2019) but there remain bad practices, particularly in Asia.

Interviews with clients who have ridden the elephants confirms that riding the elephant is often the high light of their experiences with wildlife in Africa, and acts as motivator to increase actions for the conservation and welfare of elephants worldwide. There is also some evidence (personal communication with 4 elephant owners and 15 handlers) that when riding is stopped, the easy/cooperative bonding relationship between handlers and elephants is strained. Perhaps this is because they no longer have safe close contact for longer periods. Consequently, the elephant and handler know each other less well; have less confidence in each other, and the bond between them does not develop further. The lack of confidence of the handlers can result in increasing use of the "ankus" (authors personal observations in different localities), which decreases the quality of life and the development of good relationships between elephants and humans and their wellbeing.

The welfare, safety and conservation standards require much thought and care since the activities with any animal as well as their husbandry are very varied. To be widely adopted therefore they must not be impractically prescriptive. The development and monitoring of standards may prove to be a more effective solution for elephant welfare and conservation than preventing, banning or stopping various practices which do not of their nature cause suffering to the elephant. Eventually, with agreement between welfare scientist, animal ethics, conservation, proprietors and handlers, it is possible that the elephants, handlers, the community and tourists

could all have enjoyable and educational times together which are safe and free of "stress" or cruelty which the animal welfare organizations and travel agents should adopt.

In essence, it is NOT WHAT the elephant does with the tourists, the handlers or the community (provided the activity does not of itself cause suffering to elephants or humans), but it is HOW it is done that matters. Done well, it can bring elephants and humans to a greater understanding of each other's world view and a mutual enrichment of their lives.

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