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Taming requirements in the domestication process of donkeys: The methods and concepts of the training among the Afar pastoralists in Ethiopia

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Abstract

To clarify the system involved in the initial domestication of asses, this study explores breaking and the consequent establishment of tameness through focusing on a human ecological approach based on reports of the epigenetic inheritance of human-induced stress in animals. The research subjects are Afar pastoralists who use donkeys for packing loads in two areas (A and B) in the Afar Regional State of Ethiopia; both areas are home to an endangered species of wild ass. Interviews were conducted on the methods of wild ass capture that caused initial human-induced stress. Next, the method currently adopted for breaking donkeys for packing which the Afar pastoralists considered to promote tameness was investigated. The number of informants from Community (A) who answered in the negative to the possibility of capturing wild asses for domestication was significantly greater than those who replied in the positive. However, four suggestions were made for capturing wild asses for domestication. In both areas, the target age for breaking the donkeys for packing was 1 to 3 years inclusively. Differences, however, were seen between Afar communities with regard to whether training for packing should happen in a series of processes and with regard to the number of days needed for the process. The training methods characteristically used in both areas includes forelimbs tying, jaw tying, and ears tying. A combination of these methods was observed to be a neuro-physiologically effective approach, promoting obedience while controlling stress; stress caused by jaw and forelimbs tying was nullified by ears tying, which produced an analgesic effect. Therefore, for domestication during the ancient period and maintaining the tame status of donkeys, the age for training for packing and controlling stress by tying the forelimbs, jaws, and ears might have been the effective techniques in taming the animal through epigenetic mutations.

Keywords: African wild ass, Breaking, Domestication, Donkey, Stress, Tying jaw

Introduction

Genetic analysis (mtDNA) has proved that the currently existent donkey was domesticated by ca. 3500 BCE mainly from the Nubian wild ass (*Equus africanus africanus*), a subspecies of the African wild ass (endangered species CR, Red list). Also pointed out is the genetic involvement of the Atlas wild ass (*E.a.atlanticus*) or the Somali wild ass (*E.a.somaliensis*), both of which are similarly subspecies (Beja-Pereira et al. 2004; Kimura et al.

2011) of the African wild ass. Domestication of asses is presumed to be promoted by pastoralists in the Eastern African desert areas (Rossel et al. 2008; Marshall and Weissbrod 2011). Atlas wild asses are extinct and Nubian wild asses are considered to have become extinct as a wild species. There are, however, reports on the survival of small populations of Somali wild asses or their pedigrees in Sudan, Eritrea, the Ethiopian Danakil Desert, and northern Somalia (Moehlman et al., 2015).

Domestication is defined as animals whose reproduction is under human control (Herre and Rohrs 1973), and especially for draft and mount animals, acquisition of tameness to humans is of importance as great as that of

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reproduction control. Through reproduction control by means of individual selection, it is possible to produce individual animals that are obedient to some degree in terms of temperament (Belyaev et al. 1985), and in reality, most of domesticated animals are obedient compared to wild species (Herre and Rohrs 1973). The ancient ass domestication process is presumed to have been slow according to morphometric evidence found in archeological remains (Rossel et al. 2008). Now approximately 5000 years later, however, initial taming of domestic *Equus*, including donkeys and horses, is still being carried out. For this reason, it can be assumed that it is difficult to achieve complete tameness (obedience) through breeding and reproduction only and that the involvement of epigenetic control by means of training actions that cause stress is necessary.

From reports on the traditional training methods for donkeys in Nubian communities residing in Egypt and Sudan (Kimura 2017), it can be surmised that processes, such as feeding, capturing, corralling, early training and training for using them as a mount, were necessary methods of human intervention in the early stages of domestication. These Nubian communities are, however, full-time farming and settled populations, and the current generation of Nubian people does not live in direct contact with wild asses. Accordingly, it would have been difficult to obtain a complete picture of such processes without obtaining data on ass-related capturing, taming, and training methods from pastoralists who had knowledge and experience in handling wild asses.

In this research, a survey of Ethiopian pastoralists engaged in livestock rearing around wild ass habitats or the like was conducted regarding, among other aspects, 1) their wild ass capture methods (on the assumption that the asses are not domesticated), 2) the traditionally practiced method of early training and training of donkeys, and 3) the use of wild asses that continued up to the 1980s or 1990s. The findings thus obtained may provide integrated data from two directions: human agency toward the domestication of animals and tameness as the response thereto. Hence, these findings from the Afar community make a comparative study with cases from the Nubian community.

Study area

The informants in the survey were 47 Afar people from seven villages in Survey Areas A (a semi-settled community settled around a town in a tropical desert area) and B (a mobile community in a tropical semi-desert area) (Figure 1) in Administrative Zones 1 and 2 located in the central and northern parts of the Afar Regional State of Ethiopia. Of the two areas, in Area A, the survey was conducted with the focus on Serdo town (altitude: 392 m) and Bidu town (altitude: 215 mm). Area A is located in the Danakil Desert, a tropical desert area, which is the natural habitat of the African wild ass (Kebede et al. 2014). Serdo



Figure 1 Map of researched areas in Afar Regional State, Ethiopia

town is located within the Mille-Serdo Wild Ass Reserve range. Area A is in a tropical desert phase, and the neighboring state capital of Semera has an annual mean temperature of 28.0 °C; it touches a maximum of 39.2 °C in June and is lowest at 18.3 °C in January. Area A has an acute water shortage, with annual precipitation of 203 mm, of which approximately 45% occurs during the rainy season from July to August and additional precipitation of 20 mm or more in March (1982–2012: Climate-data.org, n.d.).

Area B is located near Chifra town in the mid-western part of the State (altitude 825 m). The survey was conducted in its pasture zone. Area B is in a tropical semi-desert phase and has a steppe type of climate. Area B has a relatively stable supply of water when compared to Area A, as can be seen in Chifra, where the Mille River supplies water for farming. The annual mean temperature of Chifra is 24.6 °C with the highest temperature touching 36.4 °C in June and the lowest temperature 14.5 °C in January. Moreover, its annual precipitation is 603 mm, predominantly during the rainy season from July to August and includes an additional precipitation of 40 mm or more from March to April and in September, respectively (1982–2012: Climate-data.org, n.d.).

The Afar Regional State has a population of 1,390,273; urban inhabitants number 185,135 or 13.32% of the population, and 409,123 or 29.43% are pastoralists. The Afar people form approximately 90% of the 1.4 million population, and approximately 95% of the population is

Muslim. The CSA estimated in 2005 that farmers in the Afar Regional State had a total of 327,370 cattle, 196,390 sheep, 483,780 goats, 200 mules, 12,270 asses, 99,830 camels. The CSA estimated on the basis of a survey conducted in December 2003 that mobile pastoral inhabitants had 1,990,850 cattle, 2,303,250 sheep, 3,960,510 goats, 759,750 camels, 175,180 asses, 2960 mules, and 900 horses (CSA 2007).

The Afar community in Area A lives by mobile herding while remaining semi-settled in a nearby town. It was confirmed in the preliminary research phase that they often hunted wild asses and used them for medicinal purposes up to the 1970s or 1980s and hence possessed wild ass-related knowledge. The Afar community in Area B lives entirely by mobile herding. Farmed domestic ungulate animals are cattle, sheep, goats, camels, and asses. At least one or two asses trained for packing are retained per household for carrying water. In the urban and suburban parts, asses are used to pull carts as well. The nomadic zone and the wild ass habitat zone, however, do not overlap each other. Therefore, this community (Area B) does not have experience or knowledge about wild asses.

Methods

Interview survey and contents

For data collection, the local staff was briefed in advance, and the informants were gathered for the group interview. The survey was conducted through a semi-structured interview according to the contents of a Q&A sheet prepared in advance (Vaughn et al. 1996). Interviews were conducted through two Afar interpreters living in each area. The contents included asking about the methods of capturing wild asses (on the assumption that the asses are not domesticated), speculation about how wild asses could be captured for domestication, and the usual methods for early training, including training for packing loads (including the age and sex of the donkeys, and the time required for the training). In this survey, the training dedicated for work purposes, including packing loads and riding, is referred to as “training,” and the training for being touched or led by humans that is conducted before work training to accustom animals to being handled is referred to as “early training.”

In addition to the above, questions regarding the use of wild asses up to the 1970s or 1980s were also asked, in order to understand the background. The questionnaire results were statistically processed by a chi-square test.

Results

How does one capture wild asses for the purpose of domestication? (on the assumption that the asses are not domesticated)

Purpose

This question was asked on the premise of capturing wild asses to tame them (imagination about how wild

asses could be captured). This was asked only of people in Area A because they had knowledge of wild asses and could imagine the possible methods.

Methods

The answers given by the people of Area A could largely be categorized into the following five ideas: 1) it is impossible to consider the capture of wild asses because their running speed was high, and the animals were very cautious; 2) individual animals could be captured when they approach female donkeys for mating during the rainy season (such as a decoy); 3) they could be captured by luring them to water in vessels (buried in the soil) during the dry season; 4) traps such as pitfalls could be used to capture them; and 5) they could be captured by taking advantage of the terrain. A number of answers emerged as a combination of the previous five answers (Figure 2). While “impossible for capturing” accounted for half of the answers, there were no significant differences among the proposed capture methods (χ^2 test, $p < 0.05$). (Because some of the people who answered “impossible” gave multiple answers, the percentage for the “impossible” answer differs between Figure 2 and Figure 3.)

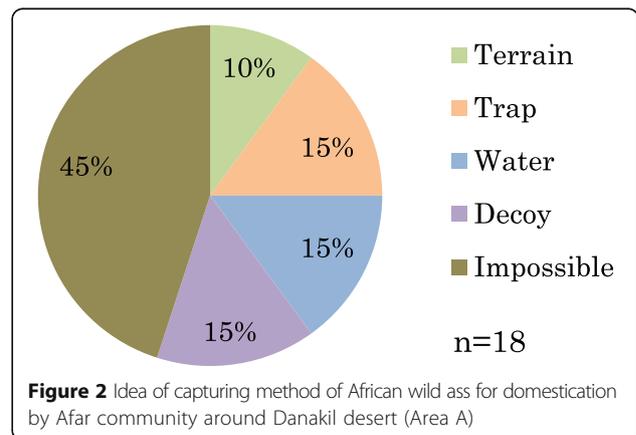
Target ages

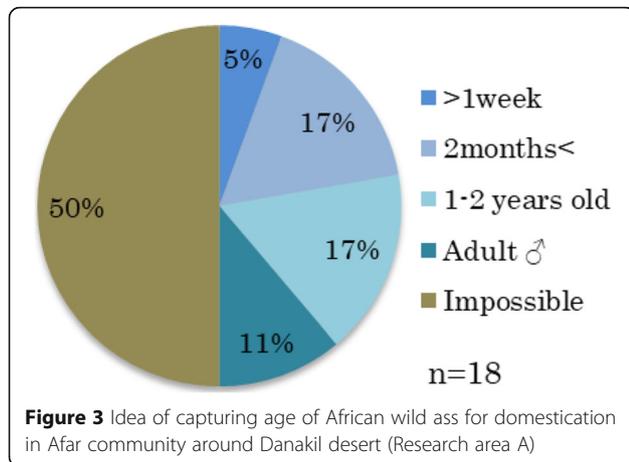
Answers were obtained from those who had answered in the positive to the question regarding the possibility of capturing wild asses. The answers to the question regarding the age at which it was desirable to capture the wild ass age fell into the following four categories: 1) one week after birth; 2) approximately two months after birth; 3) 1 to 2 years old; and 4) adult (Figure 3); there were no significant differences among these answers (χ^2 test, $p < 0.05$).

Duration (required time): It takes a longer time to tame wild asses than to tame donkeys.

Use of the wild ass up to the 1970s or 1980s

In Survey Area A, wild ass hunting by shooting was practiced up to the 1970s or 1980s. The purpose and intended





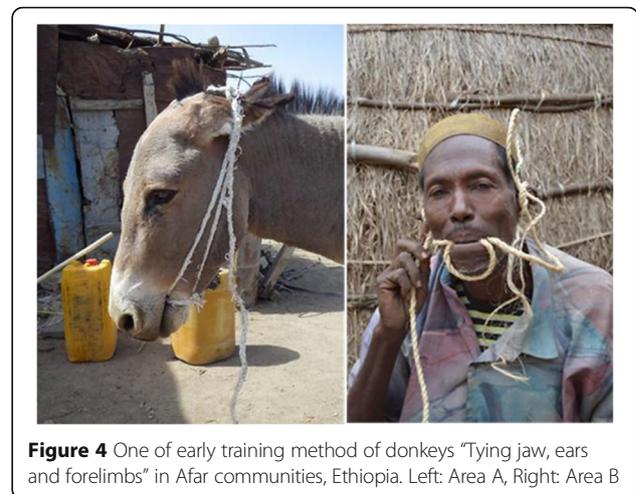
use of the hunted asses largely fell into the following categories: 1) for exorcism - cutting hooves off from the limbs, stuffing them (their bottom) with waste grass, and burning them; 2) in the treatment of epileptic seizures-burning the fat of dried wild ass meat for smoke bathing; 3) in the treatment of asthma -by crushing the dried pancreas of the wild ass and dressing the crushed pieces with honey for oral administration; and 4) for edible meat procurement and treatment of tuberculosis; 5) treatment of skin by applying the blood of wild ass. None of these are practiced today. It also turns out that specialist ostrich hunters had sometimes been hired for wild ass hunting.

Usual methods of early training and training for packing load of donkeys

The interview regarding this matter was conducted in both Survey Areas A and B.

Methods

Initially, the asses are left lying with their forelimbs tied together using a cord during the daytime, and one forelimb is tied to a stake at night. Then a thin rope is tied over the corners of the mouth pushing down the lower jaw (avoiding the tongue). Disobedient animals have their ears tied as well for load adjustment. In Area A, donkeys had both ears tied and defeated back (Figure 4). In Area B, their ears were tied separately. This regional difference was perceived as falling within the range of variation rather than as a difference in effect. Donkeys have their lower jaws or ears tied like this for strictly a day at the most. When in this condition, asses are not pulled. In principle, the locals do not use harnesses, such as halters, bridles, or bits, for daily use or for early training or training the donkeys for packing loads. In other words, this lower-jaw tying involves the use of a mouth harness, which, unlike a bit, is not used as a leading harness intended for control; rather, it is a breaking technique used to accustom donkeys to being restrained and to



teach them to obey. Locals believe that this process makes donkeys easier to handle.

In the next phase, half-tamed donkeys are driven from behind to walk together with other tamed donkeys several kilometers for purposes such as carrying drawn water. Once accustomed to this, they are made to carry a light load, together with carpeting such as jute, on their backs. Then, the weight of the load is gradually increased. Foals grown around the mother donkeys put to work are often already pre-trained because they walk along with their mothers to and from wells or carry empty poly-tanks or other loads on their backs (Figure 5). Hence, in this phase, the main objective is to accustom the foals to the weight of the load rather than to carry it. Eventually, they are able to carry up to 40 l of water. Water drawing labour is women's work. Therefore, women carry out the task of donkey management, including taming. The techniques of training for packing are generally the same in both Areas A and B.



Target age

The target age for early training and training for packing loads is within 1 to 3 years in both areas, but the two areas differed on whether foals should or should not undergo training for packing in a series of processes (χ^2 test, $p < 0.001$) (Figure 6). In Area B, there is a clear tendency to finish training foals for packing almost simultaneously by the time they are 1 to 2 years old. In Area A, the locals tend to spend a longer time training foals for packing after early training and finish the training them by the time they are 3 years old. A shared view among the locals of both areas is that a foal can be easily tamed during the period when it is with the mother ass until the mother gives birth to the next foal, and that donkeys older than 3 years are difficult to tame. In neither area do the locals castrate donkeys or control their breeding, including mating.

Duration (required time)

A significant difference was observed between Areas A and B (χ^2 test, $p < 0.001$) regarding the duration of training. In Area B, the locals finished training donkeys for packing almost simultaneously in a series of processes over a relatively short period ranging from 3 to 14 days, whereas the locals of Area A allowed more time in training donkeys for packing after early training them and spent 5 days to 2 months in doing so (Figure 7).

Discussion

Capturing of wild asses (on the assumption that the asses are not domesticated)

Ideas regarding the methods of capturing wild asses for taming them were obtained from locals in Area A who had knowledge of wild asses. Knowing that wild asses run at speeds exceeding 50 km per hour (Nowak 1999)

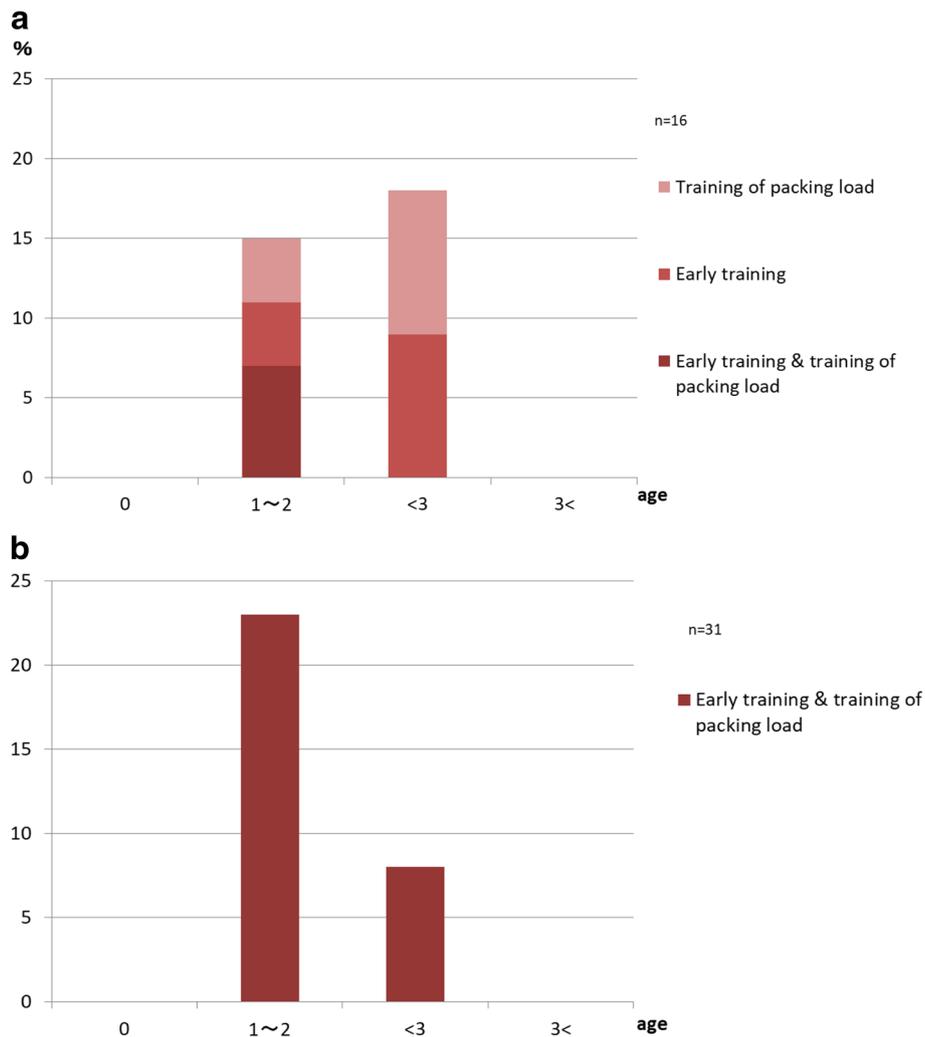


Figure 6 The training ages of donkeys in Afar community. **a** is the number of responses of Area A. **b** is the number of responses of Area B. They trained the donkeys in juvenile period (upper 1 to under 3 ages), but Community A had the tendency of separating the early training and the training of packing load. Community B trained these training into as series almost at the same time. (χ^2 test, $p < 0.0001$)

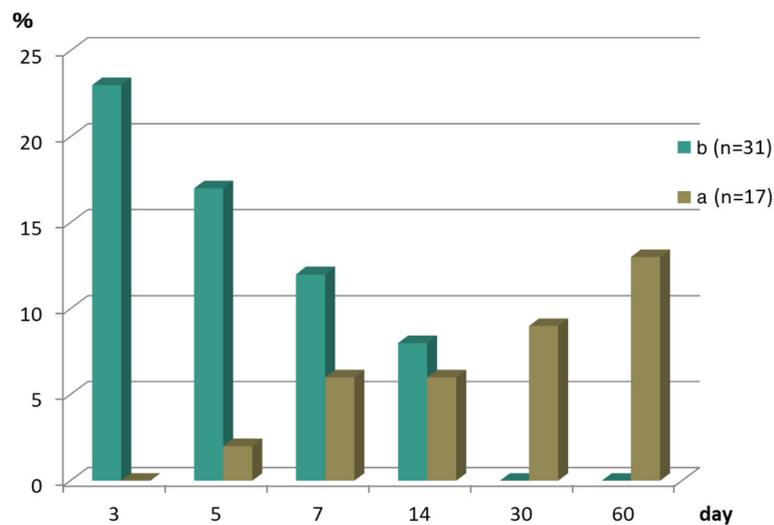


Figure 7 Enquired days for early training and packing load of donkeys in Afar communities. **a** indicates the number of responses in Area A. **b** indicates the number of responses in Area B. There is different between A and B significantly (χ^2 test, $p < 0.0001$)

and are very cautious, half the number of these people answered in the negative to the question regarding the possibility of capturing wild asses. The wild asses here are probably Somali wild asses, which are a subspecies of the African wild ass, or a hybrid of the donkey. They are a subspecies of Nubian wild asses, which are supposed to have made the most significant genetic contributions to domestication and are extinct in the wild. As can be inferred from the cases herein, the strong sense of caution among Somali wild asses and their aggressive, hard-to-tame nature may have resulted in them genetically contributing less to domestication than did their Nubian counterparts (Marshall and Asa 2013). Of course, the temper of the beasts is not the only factor that determines the success of domestication. A comprehensive consideration of the period should be made to cover other factors, including the political and economic conditions, the degree of need for domestication, and the distribution of other more advantageous animal resources at that time (Bokonyi 1989).

With regard to capture methods, unlike the Nubian informant communities in Sudan (Kimura 2017), the Afar community in Area A tends to rely more heavily on methods that cause wild asses to approach, such as decoy tactics during the mating season, lure-by-water tactics during the dry season, and pitfall tactics, than on capturing methods involving aggressive confrontation with individual animals. This is probably because the Afar community has extensive knowledge of the ecology and behavioral characteristics of wild asses and is well aware of the difficulty in capturing them with aggressive methods. The answers to the question regarding the ideal age for capture varied from 2 months old (infant period) to 1–2 years old (juvenile period) to adult age, and there was no unified view. This

suggests that the informants are not very particular about the age of the captured wild asses because they are well aware of the difficulty in capturing these animals.

The wild ass was hunted using guns up to the 1970s or 1980s, which does not give any clue to the reconsideration of domestication techniques used in ancient times.

Early training of donkeys

We see that lower jaw tying provides strong restraining stress that effectively promotes obedience and that the effect of ear tying has the same effect as donkeys' shoeing, which is widely used for horses, or as nose or ear twitching often used when giving an injection. It is neuro-physiologically proven that this pressure (torsion) actually acts to help activate β -endorphin (plasma) that produces an analgesic effect (Lagerweij et al., 1984; Ali et al. 2017). Moreover, endorphins are known to reduce the discomfort of stress and influence the stress-driven learning process commonly seen in animals in general, including horses (Riley et al., 1980; McBride et al. 2017). Stress is induced in donkeys by jaw tying, while ear tying provides an analgesic effect, adjusts the stress, and produces a learning effect that makes the animal obey. However, Afar people do not use bits, bridles, and halters on asses to drive them to work. Therefore, the lower jaw tying described above is a breaking technique used only to teach donkeys to obey rather than to lead or control. In future research, the validity and mechanism of nomadic techniques of breaking donkeys will be made clearer by demonstrating the aspects, such as changes in stress level due to this lower jaw tying and by scientifically clarifying these animals' responses to stress.

Areas A and B showed no differences in answers to the question regarding the target age for early training and

training. The results of the survey conducted in these areas were similar to those obtained from Nubian communities in Sudan (Kimura 2017). These facts suggest that the informants select the juvenile period so that donkeys can be efficiently tamed for use as draft animals.

With regard to the required time, in Area B, the whole process from early training to training for packing is performed all at once. The likely reason for this is that the locals are completely mobile pastoralists; they frequently move from place to place and cannot afford to spend much time training donkeys. In addition, they are accustomed to giving pre-training to foals before regular training. Such pre-training includes making foals carry empty poly-tanks on their backs during the daily task of drawing water. This provides the foundation for foals to become accustomed to packing work and reduces the time required for taming. The locals of Area A are engaged in pasturing near a town built by pastoralists. They are semi-settled people and walk shorter distances to and from wells and less frequently than the locals of Area B; hence, they do not have as many opportunities to pre-train foals. In other words, breaking foals is of high necessity in Area A; sometimes people in Area A purchase asses already broken in the market. In such cases, they need to train foals only for packing. Therefore, locals of Area A tend to perceive the process of breaking and the process of training as two separate stages, while the locals of Area B tend to consider training as a single process. The common point among the two areas and the Nubian communities is that foals grown around mother donkeys put to work are easier to break and that some foals skip the early training period and proceed directly to training for packing.

The tools used by the Afar people to train donkeys are cords or ropes in their simplest form. These tools are considered to have been used unchanged, albeit the change in the material, in their communities since ca. 3500 BCE when asses are said to have been domesticated. This suggests that the taming techniques using tying, which were studied in this survey, have remained almost unchanged since the domestication of asses began. This suggestion will contribute to the consideration of the early stage of the domestication of asses.

Tameness and epigenetic breeding

Experiments on mice (Franklin et al. 2010) demonstrated that strong stress stimuli at young ages cause epigenetic modification (methylation) for the development of emotionally unstable diseases and the modification is also inherited by the next generation. This occurs because the amount of DNA methylation significantly increases in the promoter area of the SERT gene (serotonin transporter: the gene that encodes the protein that helps serotonin, a neurotransmitter, move to the neurons) and the secretion

volume of serotonin changes. In poultry, methylation of a larger number of genes compared to that of red jungle fowl, a wild species, has been confirmed at the hypothalamus that controls aggression (Bélteky et al. 2016). Considering that epigenetic mutations induced by stress loads and their inheritance are involved in the domestication or maintenance of the domesticated state, it can be surmised that the techniques observed in Afar communities, that is, the selection of the target age for efficient early training and load control by tying body parts, such as forelimbs, jaws, or ears, are effective in establishing tameness through epigenetic mutations. The intensity of the load during training and the time required for taming have been reduced when compared with those for the wild species. On considering that if untamed and untrained, donkeys cannot be put to work even after more than 5000 years of domestication, it follows that both the genome inheritance and epigenetic inheritance have contributed to the inheritance of domestication and breeding. The early training method revealed by this survey is effective in maintenance of the tameness (obedient state) of asses as domesticated animals by stress control, and the ease of the early training method is considered to indicate the possibility that it has been practiced since the early stage of domestication. In the future, to clarify the domestication process and the maintenance system for the domesticated state, it will be necessary to research genome inheritance, as well as epigenetic genetics.

Conclusion

The early training methods of donkeys characteristically used in Afar areas including forelimbs tying, jaw tying, and ears tying. A combination of these methods was observed to be a neuro-physiologically effective approach promoting obedience while controlling stress. In ensuring the tameness (obedient state) of asses as domesticated animals, this early training method is considered to be effective, and the ease of the method also indicates the possibility that it has been practiced since the early stage of domestication.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors' contributions

ST interpreted Amharic to English in the interviewing and arranged to select the respondents, research areas, and assistants. RK designed the research project and analyzed the results. She was a major contributor in writing the manuscript. Both of the authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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