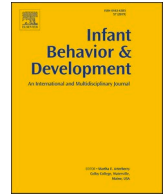




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Sharing food with infants in Hadza communities in Tanzania[☆]

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ABSTRACT

By analyzing mealtime interactions of Tanzanian Hadza infants with their interactional partners, we explored how two foundational schemas, namely giving/sharing and autonomy are realized and fostered in infants. We focused on three aspects of the mealtime interactions, namely how the infants' share was protected, whether independent eating was fostered by the infants' interactional partners, and how infants were encouraged to share food. To answer these questions, we also considered the settings that were created for infant eating, persons involved, and characteristics of the foods. Hadza infants ($N = 24$) between the ages of approximately 6 and 27 months were video recorded in mealtime situations. The videos were analyzed qualitatively and revealed the following patterns: First, infants' shares were protected by eating meals in secluded places or providing infants with separate dishes. Second, independent eating was situational. It can be limited according to the child's interest in the food or by the interactional partner. Some caregivers subtly enhanced independence by appearing unaware of infants' signals. Third, sharing was encouraged and supported when it occurred spontaneously. Infants were also asked to share and occasionally tricked into sharing. Tolerated scrounging seemed to be generally accepted by both infants and caregivers. However, we also observed conflicts in competitive situations and somewhat overwhelmed infants. These results are discussed in light of hunter-gatherers' foundational schemas and livelihood changes observed in the Hadza.

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1. Introduction

1.1. Food sharing

Food sharing can be construed as “voluntary transfer” of a “defensible food-item” from a “food motivated individual” to another (Feistner & Mc Grew, 1989; p. 23). This can include active giving or passive sharing, such as when a theft of food is not resisted (Feistner & Mc Grew, 1989). A common pattern in many species is for parents, especially mothers, to share food with their offspring, and it is assumed that this behavior has its evolutionary motivation in kin-selection (Feinman, 1979; Jaeggi & Van Schaik, 2011). In humans, infants and children are dependent on receiving food for an extended period of time to survive, and individuals benefit from sharing throughout their lives (Gurven & Jaeggi, 2015). Reasons for this can be found in access to mates and coalition building, but also in reciprocity which buffers against misfortunes, such as unreliable hunting success (Feinman, 1979; Gurven & Jaeggi, 2015; Jaeggi & Van Schaik, 2011). It has been argued that food sharing has shaped how humans relate to each other (Gurven & Jaeggi, 2015). Researchers interested in the evolutionary history of human behavior and psychology have therefore long studied food sharing in hunter-gatherers (e.g. Isaac, 1978). Hunter-gatherers are assumed to live life in similar ways as our ancestors. They are also known to commonly share food, especially those without food storage traditions, such as the Hadza (Feinman, 1979; Testart, 1982).

The Hadza are a tribe with a population of app. 1000 that lives in an area around Lake Eyasi in the north of Tanzania and has until the recent past lived as hunter-gatherers. They have been characterized as central place provisioners, meaning that members of the community leave the camp (the central place) to hunt or gather food and then return with (some of) the food to share it with others (Marlowe, 2006). Indeed, besides egalitarianism and autonomy, giving/sharing has been described as one of the “foundational schemas” among hunter-gatherers (Hewlett, 2016). Foundational schemas can be understood as “ways of thinking that influence many domains of (.) life” (Hewlett, 2016, p. 3). A major area of cooperation of hunter-gatherers is in terms of food and the Hadza are no exception. Food is shared widely among people living in the same camp or even in other camps (Hawkes et al., 2001; Marlowe, 2003).

As mentioned above, provisioning offspring has been identified as one of the motives for the widespread food sharing (Gurven & Jaeggi, 2015). Accordingly, research on the Hadza has shown that fathers bring home food more frequently than single men, implying that there is special attention paid to the provisioning of children (Wood, 2006; Wood & Marlowe, 2013). This notion is supported by men stating that they hide food from others to provide for their families (Marlowe, 2003). Another important contributor to infants’ nutrition are their grandmothers (Hawkes et al., 1997).

Nevertheless, there are some characteristics, which may make it difficult for infants to profit from the general tendency to share. Although it has been known for a long time that some of the food hunted or gathered is already eaten outside of the camp, this was generally considered an exception (Berbesque et al., 2016). A more recent study has shown that the amount of food eaten outside the camp can be substantial (Berbesque et al., 2016). For example, in most seasons men consume on average several thousand calories of honey on walkabouts outside the camp (Berbesque et al., 2016). In fact, for most foods, except large game, the majority is eaten on the spot (Berbesque et al., 2016). As infants are usually carried along by their mothers or left in camp once they are slightly older (Marlowe, 2010), these consumption patterns may put some food outside their reach.

An additional characteristic is the way in which sharing has been described for adults. A common pattern of sharing seems to be sharing on demand, that is sharing after being verbally or nonverbally requested to do so (Wood & Marlowe, 2013). In contrast to sharing on demand is “tolerated theft” (Blurton Jones, 1987) or “tolerated scrounging” (e.g. Marlowe, 2003) in which one person takes food from the owner without the owner complaining about it. In both of these strategies the person who wants food has to become active to acquire it. Thus, acquiring food may be difficult for infants. Most Hadza infants possess the necessary motor skills to take or demand food by the time they are weaned. However, -at least in children- there does not seem to be a preference to share with younger group members (Crittenden & Zes, 2015). If infants are in possession of food, others might take it from them if there are no special measures in place to protect them or their share.

A typical Hadza mealtime consists of several individuals, often in gendered groups, gathered around a shared meal, which is eaten by hand from common pots or dishes. The first research question in this paper was therefore how infants’ caregivers ensure that infants receive food in this setting or whether variations of this setting are chosen to ensure the infant’s provisioning.

As described above, the Hadza lived as hunter-gatherers until recently. In this context, their food consisted of five categories: honey, meat, baobab, tubers and berries, supplemented by some other food types, such as vegetables, nuts and cultivated foods (Berbesque et al., 2009). However, many Hadza are transitioning towards a more mixed subsistence in which rice and corn have become staples for some (Crittenden et al., 2017). Between 2005 and 2017, juvenile participation in foraging activities dropped from 90% to 54% (Pollom et al., 2020). Honey, figs and tubers were not gathered at all in 2017, although they all were rather large sources of energy in 2005 (Pollom et al., 2020). Instead, females concentrated on collecting berries and baobab, while males concentrated on hunting and baobab acquisition (Pollom et al., 2020). Tubers have been described as an unattractive “fallback” food (Marlowe & Berbesque, 2009) and may therefore receive little attention when other options are available. In the past, Hadza caregivers tried to shield children from dietary changes even if adults were exposed to them. During previous attempts to settle the traditionally nomadic Hadza, children were left in bush camps to maintain their traditional diet (Blurton Jones et al., 1992). In the meantime, general changes in subsistence patterns and exposure to formal education have changed children’s diets (Pollom et al., 2020).

1.2. The mealtime as socialization site

Obviously, mealtimes are times of nourishment. However, they are also social events that are structured in culture-specific ways. Meals involving children can thus be considered as “cultural sites for the socialization of persons into competent and appropriate

members of a society” (Ochs & Shohet, 2006, p. 35). As both giving/sharing and autonomy have been identified as foundational schemas among foragers (Hewlett, 2016), it can be assumed that both will be encouraged in Hadza mealtime situations. Two behaviors that can be related to these foundational schemes are discussed here: independent eating and sharing food.

1.2.1. Development of independent eating

Eating independently is dependent on certain motor skills, for example oral skills such as munching and chewing (e.g. Törölä et al., 2012), but also milestones relating to maintaining an upright posture and grasping food and bringing it to the mouth (Cameron et al., 2012a). The majority of infants attain these skills by approximately six months of age (Cameron et al., 2012a; Törölä et al., 2012). Despite this early motor attainment, there are cultural differences in the age at which caregivers expect children to eat independently. For example, college educated Anglo-American mothers from mainland USA expected their children to start self-feeding at 10.4 months, more than six months earlier than college educated Puerto-Rican mothers on average (Schulze et al., 2002). Their strategies and rationales also differed to some extent. Anglo mothers used more child centered and fewer parent guided approaches than Puerto-Rican mothers (Schulze et al., 2002). Puerto Rican mothers emphasized infants’ abilities/development and instrumental independence more and emotional autonomy less than Anglo mothers (Schulze et al., 2002). These differences are also reflected and maybe even emphasized in mothers’ behaviors in which Puerto-Rican mothers most frequently spoon fed their 13-months olds while Anglo mothers most frequently let their children self-feed (Harwood et al., 1999). Another indication that there are cultural differences in this domain is provided by the discomfort that African refugee student teachers feel at the way children are intentionally left to struggle with self-feeding in North-American daycare institutions (Massing, 2018). Applying broad cultural categories of communities fostering autonomy in their infants and the ones encouraging early independent eating seem to correspond (Keller, 2007).

However, there may be costs associated with independent eating. For example, independent eating is perceived as time consuming (Abebe et al., 2017), although other mothers see it as a way to save time when infants eat on their own (Nankumbi & Muliira, 2015). Mothers also occasionally comment on the “mess” that self-feeding children cause, for example by playing with their food (e.g. Cameron et al., 2012b; Horodynski et al., 2009). Thus, in contexts of food scarcity, feeding infants may be preferable because less food is wasted (see e.g. Affleck & Pelto, 2012).

In addition, in a paper comparing infants being fed mashed food versus eating finger food independently, the self-fed group weighed less at 18–24 months and had a higher proportion of underweight children than the mash-fed group (Carnell & Wardle, 2007). Less weight may be a benefit of self-feeding in contexts with an over-abundance of food and rising proportions of obese infants. However, the situation may be different in a context in which food might be getting scarce due to the erosion of resources to maintain the groups’ livelihood, as is the case for the Hadza. Nevertheless, intervention programs in poor countries expect, but do not necessarily find, greater weight gain in infants who are allowed to eat independently (e.g. Aboud et al., 2009), assuming that independent eating improves healthy self-regulation (e.g. Cameron et al., 2012a).

Previous research on Hadza infants has stated that although they are weaned at age 2 or 2 1/2, they eat adult foods from approximately 1 year of age (Blurton Jones et al., 1989; Blurton Jones et al., 1992; Crittenden, 2016a). Foods mentioned as traditional weaning foods are baobab and honey, but also tubers, animal fat and pre-masticated meat (Blurton Jones et al., 1989; Crittenden, 2016a; Marlowe, 2010, 2003). How these foods are consumed by the infants and whether they are still used as weaning foods in light of changing subsistence patterns is not sufficiently clear. Previous literature describes how Hadza children use food items they have acquired themselves (for example bird fledglings) as decoration or toys as well as food (Crittenden, 2016b). This finding could indicate that children are granted a great degree of independence in their eating, including the opportunities to play and “mess” around with food. Playing with food while learning to eat independently has been described as an expression of self-determination and autonomy (Kessler et al., 2010; Scheer et al., 2007). Our second research question was (a) whether independent eating was fostered in Hadza infants and (b) if so, how.

1.2.2. Development of sharing food in infancy

Sharing is part of an array of prosocial behaviors that humans show and that are observed from infancy (e.g. Dahl & Brownell, 2019). Sharing has been described for infants in the second year of life, with few sharing before 15 months of age (Hay, 1979; Rheingold et al., 1976). Some authors have suggested that infants start sharing in the first year of life (Dahl, 2019; Hay & Cook, 2007) but without the prosocial motivation that emerges in the second year of life which leads infants to show more spontaneous prosocial behaviors without being prompted (Dahl & Brownell, 2019). Which types of prompts are effective to elicit infants’ prosocial behavior may be dependent on the cultural community and its values (Köster et al., 2016).

While there seem to be dispositional differences in children’s prosocial behaviors (see Malti & Dys, 2018 for an overview), infants’ experiences play a role in their sharing behavior. For example, infants who were encouraged to talk about emotions more (Brownell et al., 2013) or whose mothers were more sensitive and talked about mental states more (Newton et al., 2016) also showed more sharing behaviors. Providing opportunities to practice was effective in increasing sharing behavior in 3–5 year old children (Barton, 1981; Shepherd & Koberstein, 1989). Practice even helped 7.5-month-old infants learn to release objects in a social context, which can be seen as an early sharing behavior (Xu et al., 2016). Relatedly, scaffolding has been shown to be related to helping behavior (Hammond & Carpendale, 2015) and similar effects can be expected for sharing.

Different interactional partners may play different roles in the development of prosocial behaviors. While peers may help infants understand others’ needs, (adult) caregivers help in developing prosocial behaviors through their interactions, for instance joint activities (Dahl & Brownell, 2019). When it comes to sharing food, many infants start sharing when their interactional partner communicates their need or a request for food sometime during the second year of life (Brownell et al., 2009; Barragan et al., 2020). Infants do so even when they are assumed to be hungry themselves (Barragan et al., 2020).

When considering food sharing in hunter-gatherers, sharing food is not considered a unidirectional process from parent to child (Bird-David, 2008). Hunter-gatherer infants, though also being frequent recipients of food from multiple interactional partners, are also asked to share food (Morelli et al., 2019; Peterson, 1993). Hadza children have been observed to share the food they themselves have acquired from approximately three years of age (see Crittenden, 2016a; Crittenden & Zes, 2015). They share based on reciprocity and kinship, not on recipient's age and gender (Crittenden & Zes, 2015). The amount of food shared also increases with the sharer's age, with older children sharing more frequently than younger children (Crittenden & Zes, 2015). Several processes with which Hadza children learn to share food have been described: observation and imitation, participation, positive and negative reinforcement, play, and teaching (Crittenden, 2016a). The third research question of this paper was how infants share food among the Hadza and thereby expand the literature on Hadza food sharing into a younger age group. We also contribute a detailed analysis of mealtime behaviors of infants and caregivers.

1.3. Overview of the present study

The goal of the study was to elucidate how Hadza mealtime interactions that include infants are organized. More concretely, our first question was how infants' provisioning was ensured, given the practices of sharing on demand and tolerated theft in adult hunter-gatherers. The second research question was whether the hunter-gatherer foundational schema autonomy was expressed in eating situations. We expected Hadza caregivers to encourage independent eating and related behaviors in infants. Finally, our third research question was how sharing is encouraged and practiced by Hadza infants. We expected that sharing would be encouraged because of giving/sharing being a foundational schema amongst hunter-gatherers.

The study was conducted with the Tanzanian Hadza who are transitioning from hunting and gathering to mixed subsistence. The focus was on infants between approximately 6 and 27 months which is the time infants transition to eating solid foods. The infants were observed in their naturally occurring eating situations with the help of video recordings which were analyzed qualitatively.

2. Methods

2.1. Participants

2.1.1. Infants' approximate age and development

Twenty-four infants (10 girls, 14 boys) and their communities participated in this study. Two additional boys had been contacted but one was not available for video recording. The other was not video recorded while eating and therefore not included in the analysis. Participating infants were estimated to be between 6 and 27 months old. 10 were below 18 months (called "younger"), 14 were above (called "older"). Infants' caregivers and the community were asked for infants' birthdates, but these were often unknown or doubtful. An attempt was made to certify dates through reference to memorable events, seasons, or the availability of certain foods at the time of birth. In addition, caregivers were asked to indicate relative age (older, younger, same) in relation to other known infants, leading to an approximate age ranking of the participating infants. Only two of the infants could not locomote at the time of data collection, and 21 were able to walk at least a few steps independently. Although the study's aim was to focus on preverbal infants, some were already quite proficient speakers (see Abels et al., 2021).

2.1.2. Infants' siblings

One firstborn girl got a younger sibling during the data collection for this project, all others were their caregiver's youngest child. See Table 1 for infants' older siblings. Not all siblings were present in the camps the infants lived in. Some older siblings went to boarding schools and were absent for extended periods. In other cases, siblings lived in different places. For instance, one later born boy who was usually with his grandmother, had an older sister who was sometimes in the grandmother's camp and sometimes in a neighboring camp with their mother.

2.1.3. Infants' caregivers and camp environment

The infants had different living situations with 18 living with their mothers, five with their grandmother and one with his father. Caregivers' ages are unknown., Their levels of formal education are displayed in Table 2. The camps that the infants lived in differed from each other in terms of size and in the means of livelihood. The smallest camp consisted of only one family while the largest ones consisted of many families, with huts spread over a large area. Some camps seemed to engage in many of the traditional activities for

Table 1
Participating Infants' Birth Order and Gender.

Birth order	Females	Males	Total
1st	4	3	7
2nd	2	2	4
3rd	1	3	4
4th	2	3	5
6th, 8th (one each)	0	2	2
Unknown	1	1	2
Total	10	14	24

Table 2
Parents' Formal Education.

Education (years)	Mothers	Fathers	Primary caregiving grandmothers
0	12	7	3
1–5	4	1	1
6–9	6	3	1
> 9	0	1	0
Unknown	2	12	0
Mean (SD)	2.59 (3.17)	3.08 (4.21)	1.4 (2.61)

acquiring food (hunting, gathering honey, gathering berries, digging for tubers) while other families engaged in activities related to tourism (hunting tours for tourists, sale of handicrafts) or some other livelihood activities.

2.2. Procedure

The research project was reviewed and approved by the Tilburg School of Humanities Research Ethics Committee, the European Commission, the Tanzania Commission of Science and Technology, and the Tanzanian National Health Research Ethics Committee and conducted following these institutions' guidelines. The first author and a local assistant who was familiar with the Hadza visited camps in which infants were known or suspected to live. After explaining the project to the members of the camp in Kiswahili, a language which the Hadza understand and use when dealing with their neighbors and attaining consent from the infants' caregivers and the inhabitants of the camp in general, the camp was visited for several days, in which the infants and their interactions were observed. Infants were video recorded, usually at the end of this observation period (but due to technical problems sometimes with a delay). All the eating situations were recorded in or close-by the camps which the infants rarely left, most of them being too old to be carried along regularly but too young to venture far from their camp. After the completion of the field work in one camp, the research team started work in a different camp. Because of the high mobility of the Hadza, several infants were met repeatedly and occasionally also video recorded in several different locations.

Video recordings lasted on average 113 min per infant (Range: 33–176 mins) and were aimed to cover situations in which the infants were with their primary caregiver, playing with other children, and eating. The length and frequency of eating episodes varied for the 24 infants. Some were only video recorded snacking on something, whereas others were observed with different caregivers and different types of food (see Table 3 for an overview). Some of the infants also received breastmilk in addition to solid foods, but breastfeeding episodes were not included in this analysis.

2.3. Video analysis

Under the supervision of the first author, native speakers of Hadzane transcribed the child-directed speech in the videos. The English translations of the transcriptions were then entered into ELAN, which was used for the video analysis. The first author identified situations in which eating or drinking were observable and analyzed the video data with the second author. After viewing

Table 3
Characteristics of the Video Recorded Eating Situations.

Food type	Frequency	Infant's age		Social situation			
		Younger	Older	women	men	children	family
Hunted and gathered foods							
Baobab	6	3	7	1	2	2	1
Grilled meat	2	1	2	1	1	–	–
Berries	1	1	–	1	–	–	–
Tubers	1	1	–	–	–	–	1
Fruit	1	1	–	–	–	–	1
Farmed and processed foods							
Ugali ^a	12	8	8	6	2	2	2
Rice	4	1	3	2	–	–	2
Farmed fruit ^b	2	–	2	1	–	1	–
Spaghetti ^c	1	–	3	1	–	–	–
Boiled corn	1	–	2	–	1	–	–
Mandazi (Fried dough) ^c	1	–	3	1	–	–	–
Packaged snacks ^c	1	–	3	1	–	–	–
Unidentified	1	1	–	1	–	–	–
Drinks (e.g. cola)	7	–	7	4	2	1	–

Note:

^a ugali was frequently eaten with a sauce often made of hunted or gathered ingredients that are not listed separately here,

^b one of the fruits was of uncertain origin,

^c were all eaten in the same camp by the same infants

some of the videos together, the first and second authors viewed videos independently annotating behaviors related to the research questions. The first and second authors discussed their observations and interpretations of the videos regularly to arrive at a shared understanding.

3. Results

We begin with an overview of the eating situations that were video recorded and occasionally complemented by the first authors' observations in the field. Table 3 shows the frequency and some characteristics of the eating situations. The food types are listed separately for those that are acquired through hunting and gathering and those that are farmed and/or processed. The two most frequently video recorded food types were baobab fruit and ugali. Baobab fruit are fruit of the baobab tree that consist of an outer shell, which is hard and needs to be cracked open before the dry, edible pulp that surrounds the seeds can be eaten. The seeds are also used by the Hadza, but they need further processing and did not appear frequently in their processed form in the infants' video recorded eating situations. Ugali is a stiff porridge, which is made by boiling water and corn flour together while stirring frequently. It is often eaten together with boiled meat or vegetables, and it is a staple food of the people surrounding the Hadza. Each infant is listed only once for each food type, even if he or she participated in several situations involving the same food (for example, eating ugali both with the men and the women of the camp). As can be seen from the table, there were often several infants who participated in a situation.

3.1. Research question 1: protecting the infant's share

3.1.1. Meals in hiding

Marlowe (2003) described how Hadza men occasionally smuggle food into their hut to avoid being seen by others with food and thus avoiding scrounging by others. As he put it: "what others do not see, one does not have to share" (Marlowe, 2003, p.24–25). We observed a similar strategy in some of the meals with infants. In these cases, meals were eaten in private or secluded settings, such as a family's hut. Thereby the meal was shielded from other persons' view, thus exempting it from the compulsion to share it with others. An example of this strategy was observed with Jana, a boy in the younger age group. Jana's mother was not feeling well on the day of the video recording and was resting underneath a tree. At some point she withdrew with Jana into a neighbor's hut, becoming concealed from other camp inhabitants and also the research team. When the first author followed them with the camera, she realized that they were eating. Jana's mother and the neighbor immediately invited the author to join them in their meal, illustrating the point that when others join, it is customary to share the meal with them.

The strategy of eating in hiding was not observed very frequently. Successful meals in hiding occur only in three video recordings. The infrequency of these observations may be due to the strategy being unsuccessful at times, when others notice that a meal is taking place and participate. At other times the strategy may have been so successful that the researcher did not observe the occurrence of the meal.

3.1.2. Separate dishes and other allocation strategies

In some cases, infants were provided with separate plates which ensured that a portion was demarcated for the infant or children who received it. Separate plates also enable the infants to eat independently, as illustrated in the observation of Anisa, a girl in the younger age group which demonstrates this strategy (Observation 1; Fig. 1; Fig. S1).

3.1.2.1. Observation 1. In the video, the women and some children were getting ready to eat. A pot of ugali and a pot of cooked meat were brought. While the other participants in the meal, mainly women and children, were still washing their hands in a pot with water, Anisa's mother arrived with a small plastic bowl. She poured some of the meat soup into it and added some ugali, which she kneaded in her hand and broke into smaller pieces before putting it into the bowl. She placed the bowl in front of Anisa, who was vocalizing and gesturing with her arms, seemingly impatient to get her food. Anisa started to eat while the women and some children gathered around

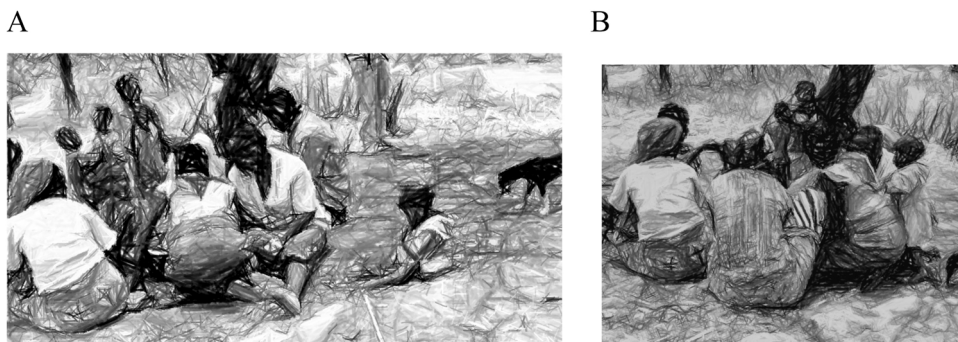


Fig. 1. Child with Separate Plate. Note. The infant has her own bowl initially (A), but it is removed when dogs start eating the food. The infant then seeks food from the adults (B).

the pots. Anisa sat a little outside the circle the women and children formed around the food, eating from her private bowl. The women, including Anisa's mother were almost completely focused on the food, even though they were sitting only a little more than arm length from Anisa. Although the mother checked on Anisa briefly just before, after approximately four minutes after receiving her bowl, the camp's dogs started to feed on the food from Anisa's bowl. Anisa moved her arms, either in protest or helplessness, but the dogs continued and the adults did not notice immediately. However, 10 s later, a man sitting with the women noticed the dogs, got up, shouted and threatened the dogs to chase them away. Anisa's mother then took the bowl and placed it in the center of the circle, leaving Anisa in a position in which she had to demand food from the women sitting around the pots, which she did, touching them and gesturing.

Special dishes for infants and children were observed in several other instances as well, both when food was provided only for the infant, but also when, as in Observation 1, a meal took place for others as well. Sometimes the allocation was enforced verbally. For example, one mother told her infant son: "go away, you will eat her food"; when a younger girl approached carrying a bowl of food allocated to her. Although we consider providing separate plates a strategy to ensure that the infants receive their allotted portions, it is neither a ubiquitous pattern, nor always successful. In addition, it could be a strategy to prevent large amounts of food from being spoiled because infants may be clumsy and spill or dirty their food when eating independently.

On the other hand, allocation to particular infants can also be achieved in other ways, particularly because separate dishes were exclusively used for boiled foods such as ugali, rice and spaghetti. Other foods were usually not eaten from dishes. For instance, baobab fruit or pieces of a tuber can be distributed to specific recipients. Allocation is also occasionally enforced verbally without the presence of other signs of allocation, for instance when a child is told "don't take the baby's meat" while the two are eating from a common pot.

3.2. Research question 2: fostering independent eating

In this section, we present our analysis regarding the fostering of independent eating. In accordance with the foundational schema related to hunter-gatherers' autonomy, we expected to find autonomy-supporting behaviors from the caregivers and encouragement of independent eating.

3.2.1. Situational factors: Sika eating ugali, meat and baobab

When analyzing independent eating, we found the case of one child (Sika, younger age group) who was video recorded in three different eating situations particularly interesting. The child and her interactional partners showed very different behavioral patterns which might relate among others to the interactional partners and the types of food consumed.

3.2.1.1. Observation 2. Ugali: In a secluded place, Sika and her aunt shared ugali from one pot with a pregnant woman and her daughter. Sika's aunt fed Sika ugali with her hand. Sika was seated in front of her aunt; both were facing the pot. The aunt put food into the infant's mouth app. 2–3 times per minute. She continued putting food into Sika's mouth even when Sika put her own hand into the pot, took out food, held it in her hand, manually explored it, and finally ate it. The whole sequence took Sika more than 2 1/2 min. Her aunt continued feeding Sika who made only one more attempt at self-feeding in this episode. She picked up some food again, licked it, held it in her hand for a very long time, dipped it into a bowl several times, and finally ate it (app. 2 min). Sika seemed fairly passive in this episode and though she opened her mouth when her aunt's hand approached with food, there were few signals suggesting that she was hungry or wanted to be fed. Towards the end of the episode, the aunt's attempts to feed Sika were met with evasive head turns from Sika. The aunt nevertheless made five more feeding attempts before she stopped; two of which were successful, but one also led to Sika spitting out food.

Meat: Sika was with some women and children who were sitting in the women's place of the camp. Her grandmother and another woman encouraged her to go to the men who had been successful in their hunt and were currently grilling meat in the men's place close-by. A slightly older girl finally walked to the men with Sika guiding her with her hand on Sika's upper back. Six men were gathered around the fire. The men were talking, and one was working on the animal's bone with his knife. The head of the camp acknowledged the girls by stating to them "there is meat". The man with the knife put the animal's skull back onto the fire and threw a bone to a dog that was lying on the ground nearby. Sika looked at the dog, then pointed at it, vocalizing. The head of the camp verbally encouraged her to talk but she remained silent. Approximately ten seconds later Sika pointed at the meat on the fire. The head of the camp said "ah?", then continued by saying "meat". Sika pointed again. After a few seconds, a young man, later joined by the head of the camp, turned meat around on a skewer to cook the other side.

The man with the knife took the skull out of the fire again, he waited until it was cooled down a little and then started breaking the skull with his knife. He took some of the brain out of the skull and held it out in front of Sika's mouth so she could eat it. He explained that it is brain and that she should eat, because it is not hot, but Sika did not open her mouth. The men laughed and the man with the knife ate the meat himself. 45 s later, Sika picked up a plant fiber from the ground and took it to her mouth, but nobody seemed to notice.

After another minute in which Sika and the other girl had started playing with the fiber Sika had picked up from the ground, the man with the knife gave some of the meat to the other girl who ate it while Sika held her vertically open hand towards the other girl. The man sitting closest to the girls then held out his open hand palm up, probably modeling for Sika what she was supposed to do. Sika then held out her hand palm up, the man with the knife put some of the brain he had scratched from the animal skull into her hand and after being told by several men to eat, she put it in her mouth. The next three minutes Sika was busy with licking and eating the leftovers on her hand.

In the meantime, the meat on the skewer got done and while the men started cutting and eating the meat, Sika held out her hand for the meat for 13 s. Although nobody reacted immediately, four seconds after the gesture ended, the head of the camp held out a piece of meat to Sika which the other girl took for her and gave it to her, probably because Sika could not reach it. Sika explored the food with her hands and mouth and took tiny bites until she left the men's area for the women's approximately three minutes later taking the rest of her piece of meat.

Baobab: A girl and a woman arrived at the women's place carrying baobab fruit. While the girl started distributing baobab fruit to the women sitting on the ground, Sika approached the woman and stretched out her hand towards the baobab fruit. After receiving one, Sika walked to her grandmother and gave it to her. The grandmother immediately started hitting the baobab against the one she had received earlier and tried breaking it open. When she stopped because it did not work and started talking with the other women after looking around for a stone, Sika picked up a little stick and started hitting the baobab with it. After briefly trying to crack the baobab in this way, she picked up the baobab and hit it on the other one on the ground, as her grandmother had done before. Her grandmother looked and accommodated to Sika's efforts by holding onto the bottom baobab to stabilize it (5 s). The baobab still did not break, Sika held up the fruit, looking at her grandmother, who looked back but did not react in any other way (6 s). When the grandmother did not offer any help, Sika started hitting the baobab on the ground with the other one again. The grandmother glanced at Sika a few times (4 s). After this attempt was also unsuccessful, Sika looked at her grandmother, touched the baobab on the ground (2 s). As a reaction, Sika's grandmother held the fruit for her again, while Sika hit it with the other one (2 s). The next 46 s, Sika tried to break the baobab by hitting it against the other one in several different positions without involving her grandmother, only looking up at her occasionally.

Finally, another toddler arrived carrying a stone which Sika's grandmother took and hit one of the baobab fruit several times to crack it open. After she opened the baobab, Sika touched the fruit, trying to take it. Her grandmother let her take it after separating the halves. Sika did not start eating immediately but right after her grandmother removed some fibers that were on top of the pulp. Sika ate baobab independently with some interruptions and occasional help from her grandmother for at least the next 17 min. During this time when Sika had finished her own half, the grandmother prepared and took some pulp out of the shell for her. When Sika's grandmother became distracted, Sika vocalized and touched her hands to let her take it. Sika also chose to take the baobab shell at one point, although her grandmother tried to give her some more prepared pulp. Her grandmother never attempted to put anything into Sika's mouth, rather placing the food in her hand instead.

Comparing the situations, Sika appears very different on the three different occasions (Observation 2). She seemed passive in the situation in which her aunt fed her with ugali. She opened her mouth when her aunt's hand approached with food, but there were few signals suggesting that she was hungry or wanted to be fed. Signals that she was full and did not want to continue eating were hardly acknowledged.

In the episode in which the men were grilling meat, Sika was more active in getting food, for example by pointing to the meat. She also refused to be fed and only accepted food into her hand, which she transferred to her mouth herself. The men reacted to her signals by offering her food to take in her hand after she refused being fed and by giving her meat after she pointed at it and held out her hand, though with a certain delay.

Finally, in the episode with the baobab, Sika seemed very active and very persistent. She not only ate independently, but also prepared much of the baobab for eating once the hard shell was cracked. The grandmother supported her in decisive moments but let her try and act on her own for the most part.

3.2.2. Personal differences: active and passive children

Generally, there seemed to be personal differences between the children. Whereas some seemed to be hungry all the time and very active in acquiring food, others seemed less interested or hungry. However, as can be seen from Observation 2 the same child can be more or less active depending on the context.

3.2.3. Playing with food

We have seen little evidence of children playing with food in the eating videos that are the basis of this study. An exception is maybe Anza, an infant who showed a great interest in the green leafy vegetables the women had prepared as a sauce for their ugali. After attempting to feed him with ugali and vegetables, his grandmother finally gave up, filled some of the vegetables into a bowl for the women and let Anza have the pot to eat and play with.

Although these comments are also rare, in some other cases, infants were criticized for playing with food. For example, "Eat now! You are just playing with your food." Criticism of playing with food seems to be in contrast with previous results on Hadza children playing with potential food (Crittenden, 2016b).

3.3. Research question 3: sharing among infants

Whereas we have described some strategies to protect infants' shares in Section 3.1, we elaborate on several different behaviors related to sharing, focusing on socialization to share and tolerated theft.

3.3.1. Socialization to share

Verbal requests using the word "share" were extremely rare (see Abels et al., 2021), though there were some using "give", for example "give me some, my son" or phrasing the request to share more indirectly "allow others to eat it". In addition, we observed a more action-based socialization for infants to share. For instance, a grandmother made her grandson share his cola by guiding the

bottle, which he was still holding, to her mouth. After sharing with his grandmother, he gave his bottle to his aunt and then to another woman of the camp who only said his name. While handing him back the bottle, she thanked him (interestingly in Kiswahili rather than Hadzane).

When the infants themselves attempted to share, the adults generally encouraged these tendencies and helped them successfully execute sharing. In one situation a young man, five small children, and the father of one of them were sitting together sharing a baobab fruit. Shani³ was holding the baobab when the father stretched out his hand for some. Shani did not react initially, so the father took some. Shani then stretched out his hand, offering baobab to the father but withdrew his hand before the father could take it. The young man (Shani's uncle) then guided/pushed Shani's hand towards the father so he could take the baobab from it.

Another example is a situation in which Niara⁴ approached Sika holding out her hand, asking for baobab. Sika in turn held out her hand to offer Niara some. Thus, both were motionless, not managing the transfer. Sika's grandmother took the baobab piece from Sika's hand and gave it to Niara. Then, Sika offered more baobab to Niara, vocalizing "ayaa, ayaa", and after repeating the situation with both outstretched hands, Niara changed her tactic and reached for the baobab on Sika's hand. The sharing was repeated twice more, fluidly.

In another example, Sika was asked to share her meat with an old lady after returning from the men grilling meat (see observation 2: meat). The woman asked her repeatedly to give her the meat and held out her hand to receive it, but Sika did not give it to her. Instead, she offered a stick to the old lady. Sika then became interested in a blanket under which another child was sleeping. She gestured to the child repeatedly before surrendering her meat to the old lady. The woman divided the meat and handed one piece back to Sika. Sika, gesturing to the blanket again, gave it back. The old lady pretended to feed the meat to the child in the blanket but ate it herself, once Sika turned away. In this example, although Sika was ready to share her meat, she was not ready to share it with the old lady who only got a portion through pretense.

3.3.2. Tolerated theft

There were incidences in which food was taken from the infants. We have seen some examples in which the infants themselves did not complain about scroungers, either though sometimes their caregivers defended their share.

Scrounging was not always tolerated or uncontested by the infants themselves. Rather, we see complex patterns of sharing, scrounging and protest in observation 3.

3.3.2.1. Observation 3. There were three infants belonging to the older age group in this camp, along with several older children. During the meal that was video recorded, there were initially adults and children gathered around a pot with ugali. Both adults and children took ugali from the pot, with the adults occasionally distributing food to the youngest of the children. After a short while the adults withdrew -drinking water, washing hands and cleaning up in the area- and left five small children sitting around the pot. Furaha, an infant who was late, was given a share in a pot of her own, while the other children ate the leftovers from the common pot. An older girl approached, looked into the common pot, then took some food and ate it. Another older girl scratched some crumbs from the side of the pot while a small boy had secured a handful ugali and was eating it by the side. One of the older girls approached him, holding her hand out. He quickly put the rest in his mouth, closed it and turned away from her. In the meantime, Furaha ate from her pot without being disturbed. After giving water to the children, most of the adults left; only one woman remained to help the children to wash.

Several children then gathered around Furaha. Furaha fought off two attempts to steal some of her food with gestures, but the small boy managed to nick some crumbs off the side of the pot twice. After approximately 2 ½ minutes in which Furaha was undisturbed with her food, another infant, Darweshi approached her. He started entertaining her by putting his hands on his head and pulling them down over his face. After ignoring him for a while, Furaha imitated his actions. He clapped, which she imitated, then he touched her head. When the small boy approached to steal more food (successfully), Darweshi pushed him, then sat down across the pot from Furaha who offered him food now. Panya the third toddler also approached but Furaha moved the pot out of her reach. After taking control of the pot, Furaha shared food neither with Darweshi nor with Panya who both held out their hands. Darweshi went on to take some food, which Furaha tried to wrest out of his hand. One of the older girls came to intervene; she scolded and touched Darweshi's shoulder with her open hand. The older girl then took control of the situation and tidied away the now empty pot.

In observation 3 the situation seems to be dominated by competition rather than giving/sharing. The little boy's behavior illustrates his perception that it might be necessary to grab and secure food to be able to fill his stomach. We observed tolerated scrounging after some affiliative efforts but also protest against it. Furaha's loss of control over the situation towards the end also shows that these complex social negotiations may require additional skills and practice or mediation by older members of the community who were absent in the situation.

Observation 3 was not the only case of scrounging being resisted. In another case, Anza's mother cut up a tuber and distributed pieces to the members of the family. A male youth attempted to take some of the pieces from the younger children who turned away from him to evade the theft and defended their share. Although this interaction may have been playful, inattentive children could have lost their share, nevertheless.

In some cases, "passive sharing" seems like a more appropriate term for what happens in these situations than tolerated theft. We

³ All names used in this paper are pseudonyms.

⁴ There is a break in the video-recording, therefore the exact amount of time is unknown.

understand passive sharing as a behavior in which the intention to share is obvious and possibly already expressed but the recipient takes action and takes the food while the owner takes a passive role. For instance, in one situation (described in Observation 2) a woman and girl returned to Sika's camp with baobab fruit with the intention to share them. Whereas the girl actively distributed the fruit, several infants approached the woman and took the baobab from her which she just let go.

4. Discussion

In this paper we studied the ways in which Hadza mealtime interactions with infants are organized. The first research question addressed how caregivers ensure that infants receive an appropriate share of food. We observed tactics such as hiding with the food and different allocation strategies to protect the infants' share. Our second research question was whether and if so, how independent eating was fostered in infants. We found inconsistent patterns such that independent eating was not consistently fostered. Our third research question related to infants' sharing behavior. We found that attempts to share were positively reinforced and different types of sharing (active, passive, tolerated scrounging) happened. However, sharing did not always occur. Particularly when infants were among their peers, relational and situational factors challenged tendencies to share.

Our analysis revealed that several tactics were employed to protect infants' food shares. One of them was to eat in hiding; another was to provide the infants with a separate dish to signal the infant's share or by demarcating it verbally. Observing these tactics illustrate that there are indeed mechanisms in place to help children get their share. Eating in hiding is in line what has been described for adults in the community before (Marlowe, 2003). The other allocation strategies depart from the adult pattern that requires sharing in the presence of others, especially when they make a demand (Wood & Marlowe, 2013) and allows for "tolerated theft" (Blurton Jones, 1987) or "tolerated scrounging" (e.g. Marlowe, 2003). Securing infants' shares may be particularly necessary in communities in which all the members eat from one set of utensils as the Hadza do and therefore potentially compete directly for shares.

The second research question addressed whether the hunter-gatherer foundational schema autonomy was expressed by fostering independent eating. We found a wide variation of the degree to which infants ate independently, both across infants but also within infants in different situations. We want to put forward two, interrelated interpretations of the differences we have observed between different situations. These concern the characteristics of the food and the role of the interactional partners in these situations. Obviously, the child's degree of hunger may also play a role but unfortunately, we have no possibility to assess that.

Characteristics of the food include attractiveness, ease of consumption, and availability. An influence on the children's behavior can be assigned to the attractiveness of the food. Berbesque and Marlowe (2009) asked Hadza adults to rank their five most important food types, with the result that honey was the most preferred, baobab, berries and meat intermediate, and tubers the least preferable food (Berbesque & Marlowe, 2009). Many of these foods were not encountered frequently during this field trip and accordingly were rarely video recorded (see Table 3). The absence of some of the traditional foods may be due partially to the season of data collection but also to a change in lifestyle and diet (see Crittenden et al., 2017; Pollom et al., 2020). We propose that ugali might have replaced tubers as a starchy fallback food. However, it is unclear where ugali would appear in a food preference ranking. It is quite possible that, like tubers earlier, ugali is not a favored food. This general food preference could underlie Sika's behavior described in Observation 2. She may find baobab a more attractive food than ugali and become more involved when presented with the opportunity to eat baobab.

Another aspect of the food that might need consideration is how easy it is for infants to eat it and how easily it is spoiled. There are several factors pertaining to ease of consumption. One concerns how much the food needs to be chewed. In Observation 2: meat, Sika was first offered brain which is soft and which she ate immediately. The other piece of meat she received was not as easy to chew and she spent the remaining three minutes with the men trying to eat it, licking it, biting off small pieces, finally taking the rest back to the women's place. In contrast, ugali is a rather soft food, which can be easily chewed. Another factor is manageability. Especially when combined with a sauce it might be slightly difficult to handle by an infant. Lastly, both meat and ugali can be hot when first prepared which may add a complication to infants eating it. In addition, there may be some concern about ugali being spoiled when dropped because dust attaches to it and cannot be easily removed. Indeed, when infants shared a dish with somebody else, the complaint repeatedly arose that the infant is spoiling the food. Thus, characteristics of the foods may be related to infants not being provided with opportunities to eat themselves.

We assume that the availability of food and the changing lifestyle of the Hadza may also play a role in the observed differences. In a recent publication, the Hadza have been characterized as a community troubled by food insecurity (Safari et al., 2021). As discussed in Section 1.2.1, letting infants feed themselves may be hampered by the caregivers' fear of wasted food. As many of the foods we encountered are not acquired through hunting and gathering anymore and are therefore particularly valuable and difficult to attain, the acceptance of infants eating independently and playing with food may have decreased. It seemed that foods acquired by the Hadza themselves were more frequently eaten independently or even played with. Future research could investigate archival film material of hunter-gatherers involving infants and food to investigate whether there have been recent changes in the approach to independent eating.

Independent eating also is influenced by the interaction partner. In the three situations described in Observation 2, Sika's interaction partners reacted very differently to her signals. In the situation in which her aunt fed her ugali, her signals frequently went unnoticed. The way their bodies were positioned, both facing towards the pot, may contribute to signals not being answered, as it was difficult for the aunt to see Sika's face. Similarly, in Observation 1 Anisa's mother initially did not realize that dogs had started eating her food, although the infant showed some agitated gestures. Again, the setting made it difficult for the mother to see her, but in contrast to Sika, Anisa was initially granted much more autonomy in eating ugali from her own dish.

Both the men and the grandmother in the other situations seemed to be more attuned to Sika's signals. Little was said to Sika in these episodes and occasionally the reaction to a child's signal took some time. However, we would like to argue that some of the

inertia we saw in the grandmother is actually an expression of an agenda to socialize children for independence. The grandmother glanced at Sika frequently, enabling her to monitor both Sika's progress and her level of frustration. She helped when necessary but let Sika make her own experiences with the baobab. This strategy seemed to work well, as Sika was very active and self-reliant in this episode. That children are regarded as autonomous also finds its expression in some of the statements interaction partners address to infants. For instance, a father of an older infant said "it's up to you to eat" while putting down a bowl of food for his daughter and another girl.

Although we are uncertain whether there really are any characteristics related to the differences in caregivers' behaviors, our impression is that men and older women are possibly more attuned to the infants' signals and grant them more autonomy compared to their mothers and younger caregivers. It is difficult to verify this hypothesis with our data as most of the eating interactions involve women, often the infants' mothers. We speculate that if men and older women are actually more attuned and autonomy supportive, it might be related to non-maternal caregivers having more choice whether or not to interact with the infants than the mother. For instance in Observation 2: Meat, only two of the six men grilling meat chose to interact with Sika. Maybe they are the ones who are prone to attuned and autonomy-supporting interactions. In addition, autonomy-supporting behavior by older women and men might be related to their livelihood tasks. Grandmothers may have experienced greater autonomy than mothers, due to having been self-determined gatherers in the past. The men are maybe still more autonomous while hunting.

Future research could aim to untangle these factors related to food type and interactional partner by sampling persons and food type more systematically. However, a study with this aim would probably require a more experimental approach because some food types were not observed in some camps and might therefore not reflect infants' everyday experiences.

Our third research question was how sharing is encouraged and practiced by Hadza infants. We assumed that sharing would be encouraged related to the hunter-gatherer foundational schema relating to giving/sharing. Opportunities to share food occurred frequently in the videos, and infants were asked to share with others, including older persons in their environment. We saw tendencies in some of the infants in our sample to share spontaneously with others. When spontaneous sharing happened, caregivers tended to scaffold these behaviors, helping the infants to carry through with their action. Unlike with older children who receive negative feedback for a lack of giving/sharing (Crittenden, 2016a), we observed mainly encouragement to share with the infants, though occasionally also deception (see Section 3.3.1). Some of the behaviors that have been shown to help children develop sharing, such as providing opportunities for sharing, practice and scaffolding (Barton, 1981; Hammond & Carpendale, 2015; Shepherd & Koberstein, 1989; Xu et al., 2016) are implemented in Hadza infants' socialization.

As noted earlier, an important aspect among Hadza adults is that a common pattern of sharing seems to be sharing on demand or tolerated theft. In context of infancy, these sharing strategies may mean that infants should learn to be active in order to receive and keep food, but at the same time accept possible incidences of tolerated theft as a social norm. This doubled (active/passive) strategy is indirectly fostered in infants by caregivers and in interaction with other children during mealtime, as we observed and have labeled "passive sharing".

To summarize, in this study, we analyzed mealtimes that infants participated in as socialization sites. We approached this topic from the point of two foundational schemas found in hunter-gatherers (Hewlett, 2016), namely autonomy and giving/sharing. We found tendencies to foster infants' independence by letting them eat by themselves and resolving issues around sharing on their own. Also, older members of the community protected infants' shares of food. However, we also found expectations to share, both with peers and with adults. The balance between autonomy and giving/sharing that we see expressed in the adults (such as men eating a significant amount outside of the camp while at the same time fathers are bringing more food to the camp) was extended to behaviors we observed in the camps during mealtimes with infants. Independent eating, we argued, is related to autonomy. We found independent eating to be encouraged, especially by grandmothers, but limited by pragmatic concerns. It is likely that changes in diet are related to an erosion in infants' food-related autonomy with foods like ugali becoming a staple in the Hadza diet.

To conclude, cultural values are situationally dependent and negotiated all the time. These negotiations are possibly especially prominent in societies in change, like hunter-gatherers under the pressure of globalisation. This paper gives an insight into how values of giving/sharing and autonomy are negotiated and fostered in Hadza infants in mealtime situations. It contributes to our understanding how societal values are expressed by infants and their caregivers in everyday situations. It also sheds light on how different social and ecological environments influence caregiver infant interactions and thereby infants' development. Future studies could adopt a cross-cultural approach to compare the strategies seen in Hadza interactions with other communities. For example, it could be interesting to study mealtimes with infants in communities that value sharing but not necessarily autonomy as has been described for subsistence farming communities (Keller, 2007).

Authorship statement

All authors have seen and approved the final version of this manuscript. The article is the authors' original work, has not received prior publication and is not under consideration for publication elsewhere. Parts of this research have been previously presented as a poster at the virtual International Congress of Infant Studies, July 6–9, 2020.

Declaration of Competing Interest

The authors declare no competing interests.

Data Availability

The data that has been used is confidential.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.infbeh.2022.101805](https://doi.org/10.1016/j.infbeh.2022.101805).

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