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Food scarcity and disease concern reduce interdependence when people eat together

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Abstract

Food sharing is central to the human experience, serving biological and sociocultural functions. Historically, food sharing has allowed people to manage food shortages, creating positive interdependence among those who pool calories and other sources of risk. However, sharing food may lead to negative outcomes when food is scarce, or when there is a threat of disease. We found that sharing food (compared with sharing pencils) led to reduced cooperation with an experiment partner (Study 1) and that perceived scarcity partially mediated a negative association between zero-sum orientation and perceived interdependence with people involved in a recently shared meal (Studies 2–3). Disgust was also associated with lower perceived interdependence toward people involved in a shared meal (Study 3; $N_{Total} = 1126$). Our results suggest that scarcity and disgust can interfere with the positive feelings people might otherwise experience when eating together, warning against lay beliefs that 'breaking bread' necessarily brings people together.

KEYWORDS
commensality, cooperation, disease concern, food sharing, interdependence, scarcity

1 | INTRODUCTION

Home-cooked meals, holidays, first dates, birthdays, weddings, religious ceremonies and many of life's most memorable moments involve shared food. Why might sharing food bring such positive experiences to mind? People attach a great deal of meaning to eating together, suggesting commensality is an important practice that can be a source of positive perceived interdependence. Early in development, sharing food helps infants distinguish ingroups from outgroups (Fischler, 2011; Liberman et al., 2016) and children as young as 3 years old like those who like similar foods (Fawcett & Markson, 2010). During adulthood, shared meals help people build trust (Neely et al., 2014) and some people even report eating disliked foods to gain inclusion with their peers (Mead et al., 2010). These positive social experiences surrounding shared meals are likely universal across cultures, in part due to human's long history of collaborative foraging (Tomasello, 2012).

1.1 | Food sharing is a recurrent source of fitness interdependence

Fitness interdependence refers to the degree to which the outcomes of two or more individuals are correlated (Aktipis et al., 2018). This concept builds upon Hamilton's (1964) rule and is formally defined as the idea that individuals will invest in others to the extent that their survival and reproduction are positively intertwined (Roberts, 2005)—in other words, when the benefits of helping, by way of interdependent outcomes, outweigh the costs. Genetic relatedness is a significant factor in determining the level of fitness interdependence between individuals because relatedness indirectly contributes to one's own reproductive success. The more closely related two individuals are, the more strongly their outcomes are correlated.

In addition to genetic relatedness, other sources such as shared descendants, intergroup conflict and mutual support through risk pooling and exchange can give rise to positive fitness interdependence

(Cronk et al., 2019). This fitness interdependence shapes how people perceive interdependence in their relationships (Tooby & Cosmides, 1996) and across specific situations (Balliet et al., 2017). Although objective sources of fitness interdependence might not map perfectly onto perceived interdependence—the perception that others' outcomes are correlated with one's own outcomes—people who perceive high interdependence in their relationships value the welfare of such relationships more highly. In turn, perceptions of interdependence predict higher willingness to help partners when in need and without expecting reciprocity (Ayers et al., 2022).

Historically, food sharing has been one of the most important sources of fitness interdependence (Cronk, Steklis, et al., 2019; Dunbar, 2017). Among subsistence groups, acquiring nutritionally dense food is most successfully accomplished in coordination with others (Kaplan et al., 2000) because injuries, illness and other challenges can interfere with an individual's ability to forage (Sugiyama, 2004; Sugiyama & Chacon, 2017). These challenges result in highly variable return rates from hunting (Hill & Hurtado, 2009). Consequently, pooling calories and other sources of risk allow individuals to collectively manage food shortfalls, and hence forge fitness interdependence through this mutual reliance on food acquisition and redistribution (Allen-Arave et al., 2008; Cronk, Berbesque, et al., 2019; Cronk & Aktipis, 2021; Gurven, 2004; Gurven et al., 2000; Kaplan et al., 1985; Smith et al., 2019; Tomasello, 2012).

Food sharing might solve the problem of food shortfalls but it does not solve the free-rider problem that arises within cooperative relationships (Aktipis, 2016). Exploitation can still happen when people ask for help when they are not in need (i.e., act greedily), or if they do not share when successful (i.e., act stingily). For example, people are more likely to act stingily and greedily in need-based transfer scenarios when resources can be hidden (Claessens et al., 2020). Because of this and other ways that people can be exploited, people are incentivized to detect conspecifics who violate social contracts (Cosmides et al., 2010). This ability to detect free-riders further allows people to interact with cooperative partners (Noë & Hammerstein, 1994) while at the same time avoiding non-beneficial relationships (Aktipis, 2004).

Due to the changing nature of the costs and benefits afforded by different kinds of relationships, people are also incentivized to keep close track of their outcome interdependence with various partners (Balliet et al., 2017; Krems et al., 2023; Tooby & Cosmides, 1996). The act of sharing food might allow people to both communicate that they value the welfare of their commensal partner, while at the same time distinguishing greedy or stingy partners from cooperative ones. Partners who share food and eat together might therefore perceive greater positive interdependence with one another.

1.2 | The present study

Commensality is defined as the act of eating at the same table with others (Fischler, 2011). However, commensality has many elements that can influence whether eating with others is perceived as a positive experience. It is possible that it is not eating together itself, but rather the communicative value of offering food, the convivial interactions that people have while eating, or the coordination that emerges when people share food that fosters perceived interdependence and cooperation.

Giving a portion of one's food communicates to the recipient that one values the recipient's wellbeing and it is thus this willingness to give that may increase perceived interdependence (Hamburg et al., 2014; Jaeggi & Gurven, 2013). However, conviviality can arise when people eat together even when people do not share food, or when there are no clear giving and receiving roles, such as when people eat at restaurants. For example, people who frequently eat with others report greater life satisfaction, meaning in life and closeness than people who eat meals alone. This may be in part because of the laughter and reminiscing that occurs during shared meals (Dunbar, 2017).

In addition to willingness to give and conviviality, how and what people eat can also shape the influence of commensality on trust, belongingness, and cooperation. In a set of studies, participants who ate the same foods were more trusting than participants who ate dissimilar foods (Woolley & Fishbach, 2017), whereas those who could not eat the same foods as others during a meal felt lonelier than people who could (Woolley et al., 2019). In addition, participants who ate from the same (versus different) plates were more cooperative in a negotiation task (Woolley & Fishbach, 2019).

One hypothesis is that sharing food may be a privileged form of sharing, one that, in comparison with other types of resources, more readily facilitates perceptions of interdependence among its participants (Cronk & Aktipis, 2021; Dunbar, 2017; Hamburg et al., 2014). However, an alternative hypothesis is that sharing food increases cooperation via the enhanced coordination that emerges from more general behaviours such as turn taking (Woolley & Fishbach, 2019). The research reviewed thus far indicates that commensality can increase trust, belongingness, and cooperation but the processes and mechanisms underlying these effects need further explanation.

Previous research suggests that the positive effects of commensality on perceived interdependence and cooperation may arise from the act of sharing food or the social aspects of eating together, such as giving, conviviality, or coordination. For example, the endorphin system may play a role in mediating this association (Dunbar, 2017). And both Chinese and US adults believe that sharing food fosters greater intimacy and trust in comparison with sharing non-food items (Wang et al., 2021). Furthermore, participants who were allowed to choose whom to share food with perceived their partner to be more prosocial than those who did not have a choice (Wang et al., 2020). Research has also demonstrated that people rate chocolates as more desirable when they are labeled as 'eating together' versus 'eating alone' (Huang et al., 2022). Finally, participants who shared a milkshake provided by an experimenter reported feeling closer to their partner due to enhanced positive affect (Cummings & Tomiyama, 2019).

Taken together, the research above suggests that eating a shared food with another may lead to greater perceptions of interdependence via a combination of the positive affect people experience when eating appetizing food and a process of associative learning between the rewarding experience of eating and the target of commensal

behaviours. In particular, we hypothesize that the act of eating shared food may indicate that a) the target can be trusted, b) one is likely to encounter the target again in the future and c) the target shows cooperative potential.

In this study, we investigated whether specifically sharing food promotes social bonding. We hypothesized that eating food together, as opposed to engaging in a non-commensal activity, would enhance perceived interdependence and cooperation. We further predicted that sharing food would yield greater perceived interdependence and cooperation than either eating without sharing or sharing in a non-commensal activity. Whereas previous studies have manipulated other aspects of commensality, they have not manipulated the unique impact of sharing food on perceived interdependence and cooperation (Cummings & Tomiyama, 2019; Wang et al., 2020; Woolley & Fishbach, 2017, 2019). To ensure that our results were not confounded by conviviality and coordination, we limited interactions between participants to 2 minutes and restricted sharing food to a single instance of splitting a cookie. Study 1 yielded unexpected results, prompting us to explore alternative hypotheses in Studies 2–3.

2 | DOES SHARING FOOD FOSTER PERCEIVED INTERDEPENDENCE AND COOPERATION? (STUDY 1)

2.1 | Method

2.1.1 | Participants

A power analysis in G*Power 3 (Faul et al., 2007) showed that 244 participants would yield 80% power to detect a medium effect size ($f^2 = 0.15$, $\alpha = .05$). We recruited 250 undergraduates during the Spring and Fall of 2019, before coronavirus disease 2019 (COVID-19) reached the United States. To mask the purpose of the experiment, we advertised a 'Consumer Goods, Consumer Satisfaction, and Social Relationships' study (Woolley & Fishbach, 2017). A total of 29 participants were excluded: 11 who knew their experiment partner prior to the study, 17 who indicated that they did not understand the instructions, and one who correctly guessed the purpose of the study. This yielded an effective $N = 221$ (51% women, $M_{age} = 19.3$, $SD_{age} = 2.5$).

2.1.2 | Materials and procedure

In a 2 (resource: food | pencil) × 2 (condition: sharingno sharing) between-subjects design, we recruited two participants matched by sex per session. Following consent, an assistant instructed participants to sit face-to-face across a table in an experiment room. In the no-sharing pencil condition, participants were each given a box of colouring pencils and told to colour on a sheet of paper. In the sharing pencil condition, one box of colouring pencils was provided. In the no-sharing food condition, each participant was given an individual cookie (~32 g). In the food-sharing condition, participants were given a single large cookie, which was placed on the middle of the table (~70 g) next to a pizza cutter.

We limited interactions to 2 minutes, after which an assistant returned to the experiment room to instruct participants to complete a three-item product survey (e.g., *how likely would you be to recommend this product?*). Then, the assistant explained that participants would again be paired with each other for a pilot study. One participant was instructed to remain in the room and the other participant was guided into an adjacent room to complete the second part of the study. Participants in all conditions played a Trust Game with $3.00 (using a slider bar ranging from $0 to $3, in which transfers could be made to the cent) and were told that the money transferred would be doubled. We were interested only in measuring the amount transferred from player A to player B, thus both participants assumed the role of player A (see Supplemental Information S3.1).

After deciding how much to transfer to player B, but before receiving feedback on player's B response, participants played a one-shot dictator game with 10 chocolates (all participants assumed the dictator role and were compensated by an assistant at the end of the study), completed a six-item measure of trustworthiness (e.g., my research partner is: *Trustworthy, has integrity*; 1 = *Extremely unlikely*, 7 = *Extremely likely*; $\alpha = 0.78$); the Inclusion of Other in the Self (Aron et al., 1992) and six items assessing closeness modified from Wolley and Fischback (2017) (e.g., *how likable was the participant you were paired with? I would like to spend more time with the person I was paired with*; 1 = *Not at all*, 6 = *Extremely*; $\alpha = 0.76$). Participants then answered the Shared Fate Scale, which measures perceptions of shared fate (e.g., *What is good for the participant I was paired with is good for me*; 1 = *Do not agree at all*, 7 = *Strongly agree*; $\alpha = 0.83$) and emotional shared fate (e.g., *When the participant I was paired with succeeds, I feel good*; $\alpha = 0.69$) (Ayers et al., 2022). To control for any influences of hunger on perceived interdependence and cooperation, participants reported how hungry they were at the beginning of the study session (1 = *Not at all*, 5 = *Extremely*). Table 1 shows descriptive statistics and Table S1 shows correlations among key variables. We report supplemental analyses and tables in SI S1–S2.

2.1.3 | Transparency and openness

This project was approved by the Institutional Review Board of Arizona State University (STUDY00008951). The study was pre-registered. We have reported all manipulations, measures, and exclusions. Data, analysis plan, and analysis code are available at https://osf.io/bw4xu/.

2.2 | Results

We ran general linear models with resource type (food | pencil), sharing condition (share | no-share), and their interaction as predictors of trustworthiness, trust, generosity, closeness, perceived shared fate, and emotional shared fate. We expected to find the strongest positive effects when participants shared and ate together. Controlling

TABLE 1 Descriptive statistics (Study 1).

	No-sharing pencil($n = 57$)		Sharing pencil ($n = 57$)		No-sharing cookie ($n = 55$)		Sharing cookie ($n = 52$)	
	M/freq.	*SD*/%	*M*/freq.	*SD*/%	*M*/freq.	*SD*/%	*M*/freq.	*SD*/%
Sex (women)	27	47.4	27	47.4	28	50.9	27	51.9
Age	19.8	3.6	18.9	1.4	19.6	2.7	18.9	1.5
Hunger	1.44	1.36	1.54	1.41	1.58	1.51	2.04	1.68
Closeness (IOS)	1.77	1.25	2.04	1.20	2.02	1.13	1.88	1.06
Partner evaluation	4.40	0.79	4.68	0.84	4.43	0.71	4.40	0.76
Perceived shared fate	4.11	1.51	4.07	1.48	3.93	1.42	3.72	1.36
Emotional shared fate	4.75	1.22	4.91	1.15	4.58	0.94	4.48	1.26
Trustworthy	4.94	0.84	5.02	0.85	4.93	0.65	4.92	0.73
$ Invested	2.01	0.77	2.14	0.83	2.28	0.82	1.94	0.77
Chocolates given	5.86	1.84	6.04	2.34	6.10	2.01	5.00	1.85

TABLE 2 Univariate effects of sharing and resource type on trustworthiness, trust, and generosity.

	Resource type			Sharing condition			Resource × sharing		
	F(*df*)	*p*	η_p^2	*F*(*df*)	*p*	η_p^2	*F*(*df*)	*p*	η_p^2
Trustworthiness	0.24 (1,217)	.622	0.001	0.12 (1, 217)	.732	0.001	0.22 (1, 217)	.637	0.001
Trust ($ transferred)	0.10 (1, 217)	.749	0.001	1.07 (1, 217)	.302	0.01	4.72 (1, 217)	.031	0.02
Chocolates given	1.96 (1, 197)	.163	0.01	2.61 (1, 197)	.107	0.01	4.98 (1, 197)	.027	0.02

for hunger did not change results; thus here we report the primary analyses.

2.2.1 | Did sharing food influence trust and generosity?

We found no main effect of resource type or sharing on trustworthiness. However, we found a sharing × resource interaction effect on trust (Table 2), such that participants transferred less money in the sharing-food condition than in the no-sharing food condition (Table 3; Figure 1). No other pairwise comparison on trust was statistically significant ($p > .077$). We also found no main effect of sharing condition or resource type on generosity, but we found a resource type × sharing condition interaction (Table 2), which indicated that participants gave the fewest chocolates in the sharing-food condition in comparison with all other conditions (Table 3; Figure 1). No other pairwise comparisons on generosity were statistically significant ($p > .557$) (Table 3).

2.2.2 | Did sharing food influence perceived interdependence?

We found no effects of sharing condition or resource type on closeness, partner evaluation (e.g., *how likable was the participant you were paired with?*), or perceived shared fate (e.g., *what's good for [target], is good for me*). We also found no effect of sharing condition on emotional shared fate (Table 4). Although participants reported slightly lower emotional shared fate towards their partner (e.g., *when [target] succeeds, I feel good*) in the food conditions in comparison with the pencil conditions ($M_{diff} = -0.22$, $CI_{95\%}$ [−0.46, 0.02], $t(219) = -1.78$, $p = .077$, $d = 0.25$), this effect was not statistically significant.

2.3 | Discussion

We found that participants who shared food trusted their partner less and were less generous than participants who ate together but did not share. Although we predicted that perceived interdependence would mediate the effect of sharing food on trust and generosity, we found no evidence for this indirect effect (see SI S1.1).

We were surprised by these findings and subsequently developed three hypotheses about why sharing food could interfere with perceived interdependence and reduce cooperation. One possibility is that food scarcity can activate a zero-sum psychology, turning conspecifics into competitors for limited calories. Consistent with this hypothesis, participants in the sharing-food condition were less generous toward their partner when there was less of the shared cookie left over ($r(48) = -0.32$, $p = .028$, $CI_{95\%}$ [−0.55, −0.04]). Participants also reported lower means on emotional shared fate, money transferred, and chocolates given when they indicated that the shared cookie was split unevenly, in comparison with when they perceived the cookie

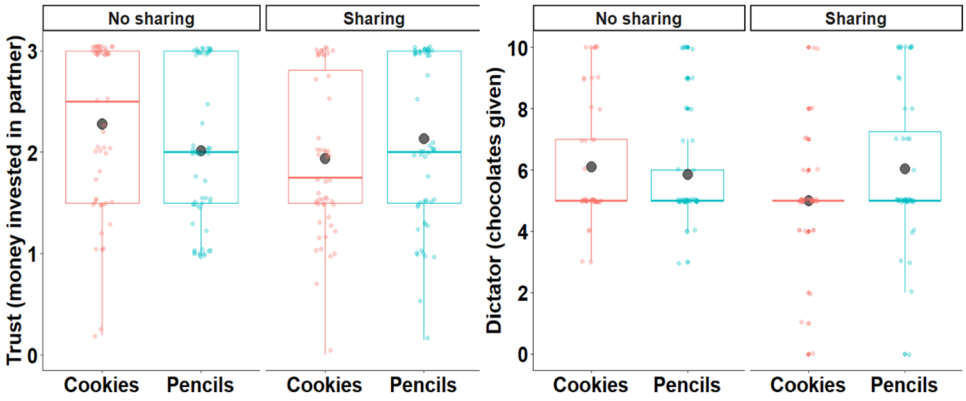

FIGURE 1 Trust and generosity (Study 1). *Note*. Left panel: participants trusted their experiment partner less after sharing food (red right column) in comparison with participants who ate without sharing (red left column). Right panel: participants were the least generous towards their partner after sharing food (red right column).

TABLE 3 Pairwise comparisons between study conditions on trust and generosity.

Trust ($ transferred)						
Comparison	M_{diff}	**Lower 95% CI**	**Upper 95% CI**	***t***	***p***	***d***
Food sharing vs no food sharing	−0.34	−0.65	−0.04	−2.23	0.026	0.43
Food no sharing vs no pencil sharing	−0.27	−0.56	0.03	−1.77	0.077	0.34
Generosity (chocolates given)						
Comparison	M_{diff}	**Lower 95% CI**	**Upper 95% CI**	***t***	***p***	***d***
Food sharing vs no pencil sharing	−0.86	−1.66	−0.06	−2.12	0.035	0.46
Food sharing vs pencil sharing	−1.04	−1.84	−0.24	−2.56	0.011	0.49
Food sharing vs no food sharing	−1.10	−1.91	−0.29	−2.69	0.008	0.57

TABLE 4 Univariate effects of sharing and resource type on perceived interdependence.

	Resource type			**Sharing condition**			**Resource × sharing**		
	F	***p***	η_p^2	***F***	***p***	η_p^2	***F***	***p***	η_p^2
Closeness (IOS)	0.09 (1, 217)	.760	0.0004	0.17 (1, 217)	.679	0.001	1.60 (1, 217)	.207	0.01
Partner evaluation	1.45 (1, 216)	.229	0.006	1.33 (1, 216)	.249	0.006	2.13 (1, 216)	.146	0.01
Perceived shared fate	1.76 (1, 217)	.186	0.01	0.43 (1, 217)	.512	0002	0.20 (1, 217)	.656	0.001
Emotional shared fate	3.15 (1, 217)	.077	0.01	0.21 (1, 217)	.647	0.001	0.42 (1, 217)	.518	0.002

was split evenly, although these differences were not statistically significant (see SI S1.1).

Another explanation for this counterintuitive finding could be that sharing food can make people susceptible to disease from foodborne pathogens and expose them to transmissible diseases. Thus, eating with a stranger may have raised disease-related concerns, interfering with participants' ability to build perceived interdependence with others. Finally, a third possibility is that preparing food together is an important antecedent that allows people to build perceived interdependence and cooperation following commensality, which was missing from the experiment design. We test these possibilities in Study 2.

3 | FOOD SCARCITY, DISEASE CONCERN, OR COOPERATION? (STUDY 2)

We tested three hypotheses that could help explain why sharing food might reduce perceived interdependence: food scarcity, disease concern and absence of a broader cooperative context. We also predicted that the negative effects of perceived scarcity and disease concern on perceived interdependence would be attenuated when eating with valued partners, in comparison with less valued others. We tested these hypotheses both at the situational level by asking participants to recall a shared meal and by looking into individual differences,

by measuring zero-sum orientation, disease avoidance, disgust and food-sharing attitudes.

3.1 | Scarcity and disease concern

3.1.1 | Scarcity can undermine positive perceived interdependence and cooperation

Scarcity can have complex effects on cooperation (e.g., Benenson et al., 2008). In cases of extreme scarcity, such as famine, cooperation can be undermined because individuals lack the resources to provide for themselves, let alone help others (Townsend et al., 2020). Ironically, abundance can also interfere with cooperation because individuals are likely to have enough resources not to need to ask for help (Cronk & Aktipis, 2021). For example, country-level water scarcity is most strongly associated with cooperation (as measured by shared water agreements) when water is moderately scarce but less so at very high or very low water scarcity (Dinar et al., 2011). Similarly, people appear least likely to exploit shared resources at moderate scarcity, relative to low or high scarcity (Gatiso et al., 2015).

While moderate scarcity can encourage cooperation, run-away scarcity in zero-sum situations can also hinder it. As resources dwindle, individuals tend to take more for themselves, leaving less for others (Pfaff et al., 2015), which can hasten the depletion of shared resources (Blanco et al., 2015; Osés-Eraso et al., 2008). Under these circumstances, individuals may become negatively interdependent: others' gains become your losses. Even recalling experiences of scarcity can induce a competitive mindset that prioritizes self-interest over others, thereby inhibiting prosocial behaviour (Roux et al., 2015). Simply asking people to remember times in which they have experienced scarcity can induce a competitive mindset, promoting people to engage in antisocial behaviour aimed at diminishing others' earnings as a means to improve one's relative standing (Prediger et al., 2014). Moreover, prolonged scarcity can shape individual differences, leading to a psychology that perceives resources as zero-sum across situations and fostering competitive orientations (Ongis & Davidai, 2021; Różycka-Tran et al., 2015).

3.1.2 | Disease threat can undermine positive perceived interdependence and cooperation

Just as there may be something psychologically 'special' about sharing food (versus other goods) for bonding (Dunbar, 2017), sharing food may also bring unique risks of disease transmission. For example, blowing on hot food can transmit herpesviruses (HHV-8), which can lead to health complications later in life (Crabtree et al., 2017). Sharing food within households has also been associated with a greater likelihood of contracting meningococcal disease, which can result in severe complications such as meningitis (Baker et al., 2000). Similarly, caregivers who share food while caring for the sick are at increased risk of infection (Islam et al., 2014). At larger scales, ritualized festivals that involve food consumption can promote bonding, but they can also lead to disease transmission because people eat from the same sources during these events (Centers for Disease Control and Prevention, 2014; Kitamoto et al., 2009; Lee et al., 1991; Ratcliffe et al., 2019). Furthermore, sharing food such as popcorn from a common bowl can transmit disease-inducing bacteria, such as *Escherichia coli* (Baker et al., 2015). Thus, shared meals may elicit disease concern, reducing perceptions of positive interdependence that might otherwise emerge from commensal behaviours.

Disgust is part of the behavioural immune system—a set of mechanisms that mobilize affect and cognition to reduce the likelihood of contracting disease. These include the ability to detect dangers from putrefied food and infectious conspecifics, inducing disgust, avoidance behaviours (Schaller, 2011) and diminished affiliation (Mortensen et al., 2010). Inducing disgust makes people less cooperative in ultimatum games (Moretti & di Pellegrino, 2010), exacerbates prejudices (Dasgupta et al., 2009) and promotes target-devaluing behaviours like damaging a target's reputation (Molho et al., 2017). Conversely, people are more willing to engage in disgust-inducing behaviours (e.g., drinking from a shared cup) with valued partners, relative to less valued others (Tybur et al., 2020).

In Study 1, we predicted that sharing food would increase perceived interdependence and cooperation. However, we found that people who shared food were less cooperative than people who ate together without sharing. Combined with the literature reviewed above, findings suggest that concern about transmission of disease and perceptions of scarcity while sharing could reduce positive feelings around eating with others, a hypothesis which we tested here.

3.2 | Method

This study was pre-registered. We report all manipulations, measures and exclusions. Data, analysis plan and analysis code are available at https://osf.io/yq25u/.

3.2.1 | Participants

A post hoc sensitivity analysis for multiple linear regression with three predictors (i.e., condition, perceived scarcity, disease concern) in G*Power showed that the experiment was adequately powered (80%) to detect an effect as small as $f^2 = 0.027$ ($\alpha = 0.05, N = 415$). During the Spring of 2020, in-person data collection was started with undergraduates ($N = 94$, $M_{age} = 19.2$, $SD_{age} = 1.1$, 54.5% men). However, given safety considerations surrounding in-person data collection amidst the pandemic, we stopped it and resumed through Prolific.co in the Fall of 2020. We restricted recruitment to the United States ($N = 351$, $M_{age} = 31.2$, $SD_{age} = 10.4$, 52.6% women). Sixteen participants were removed for failing more than 20% of attention checks and 14 for failing to adequately answer the prompt: *please describe the last meal you shared with at least one other person* (e.g., just writing 'very nice'). Combined, the effective sample was $N = 415$ ($M_{age} = 28.6$, $SD_{age} = 10.4$, 51.1% women).

TABLE 5 Measures (Study 2).

Variable	Labels/sample items	Scoring
Perceived food scarcity	*I was worried that I or others would still be hungry afterward; There was not enough food for everybody.*	1 = *Strongly disagree* 5 = *Strongly agree*
Disease concern	*I worried about getting sick from the people I ate with; I was worried about the cleanliness of the food or how it was prepared.*	1 = *Strongly disagree* 5 = *Strongly agree*
Sharing food behaviors	*Sitting close to others; Eating from a shared plate; Drinking from a shared cup; Preparing/cooking food together. Tasting the food while cooking.*	0 = *No*1 = *Yes*
Emotional shared fate (Ayers et al., 2022)	*When they succeed I feel good* (3 items, $\alpha = .51$).	1 = *Do not agree at all* 7 = *Strongly agree*
Perceived shared fate (Ayers et al., 2022)	*We rise and fall together* (3 items, $\alpha = .78$).	1 = *Do not agree at all* 7 = *Strongly agree*
Disease avoidance (Neel et al., 2016)	*I worry about catching colds and flu from too much contact with other people* (6 items, $\alpha = .78$).	1 = *Strongly disagree* 7 = *Strongly agree*
Disgust at human contaminated food (Hartmann & Siegrist, 2018)	*If [target] touched my food* (3 items, $\alpha_{family} = .89$, $\alpha_{friend} = .87$, $\alpha_{acquaintance} = .88$).	1 = *Not at all disgusting* 6 = *Totally disgusting*
Zero-sum Orientation (Sznycer et al., 2015)	There simply isn't enough food for everyone (7 items, $\alpha = .61$).	1 = *Strongly disagree* 7 = *Strongly agree*
Perceived risk of COVID-19 infection	*How likely do you think it is that you will become infected with COVID19?*	1 = *Not at all* 7 = *Extremely*
Sharing food attitudes	*I enjoy sharing food with [target]; I enjoy sharing food with [target] even when I know I may be a little hungry afterward* (7 items, $\alpha_{family} = .87$, $\alpha_{friend} = .90$, $\alpha_{acquaintance} = .93$).	1 = *Strongly disagree* 5 = *Strongly agree*

3.2.2 | Procedure and measures

Participants were randomly assigned into a 'presence of food-related cooperation' group ($n = 215$), or an 'absence of food-related cooperation group' ($n = 200$) by reading one of the following prompts:

Presence of cooperation: 'Think of the last time you shared a meal. Think of a time when you cooked or helped to prepare a meal with others before sharing (i.e., ate at the same time as others). Think of a time when at least one other person was involved.'

Absence of cooperation: 'Think of the last time you shared a meal. Think of a time when you just ate together but did not cook or help to prepare a meal with others before eating (i.e., ate at the same time as others). Think of a time when at least one other person was involved.'

Participants were then asked to describe, in 3–5 sentences, their last shared meal and to indicate whether people involved in the meal were acquaintances, friends, family, or a romantic partner. Participants then reported their perceptions of food scarcity, disease concern, perceived shared fate, personality measures and attitudes towards sharing food (see Table 5). Supplemental Information S3.2 includes further details regarding the measures employed.

3.3 | Results

We report supplemental analyses and tables in SI S1-S2.

3.3.1 | Sharing food was associated with disease concern and perceived scarcity

Participants who engaged in behaviours such as eating from a shared plate reported greater perceptions of food scarcity and food-related disease concern. Perceived and emotional shared fate were highly positively correlated, but food scarcity and disease concern were only negatively correlated with emotional shared fate (Table 6).

3.3.2 | Did scarcity, disease concern, or cooperation shape perceived interdependence?

We ran multiple linear regressions with food-related cooperation condition, perceived food scarcity, and disease concern (mean-centred and standardized) as predictors of perceived and emotional shared fate. Results indicate that perceived shared fate was not influenced by either of the predictor variables ($F(3, 410) = 0.28$, $p = .839$, $R^2 = 0.002$; Table 7). However, perceived food scarcity was associated with lower emotional shared fate toward the people involved in the meal ($F(3, 411) = 4.23$, $p = .006$, $R^2 = 0.03$; Table 7). This effect held when controlling for perceived COVID-19 risk and was not attenuated when participants shared a meal with more valued targets, in comparison with less valued targets (see SI S1.2).

TABLE 6 Associations among sharing food, scarcity, disease concern and perceived interdependence.

	Reported behaviour	Condition	Food scarcity	Disease concern	Perceived shared fate	Emotional shared fate
Shared plate	31.3%	0.05	0.27***	0.19***	0.12**	0.06
Shared cup	21.7%	0.004	0.22***	0.22***	0.11**	−0.04
Prepared food together	43.9%	0.24***	0.18***	0.05	0.14**	−0.01
Tasted food while cooking	25.3%	NA	0.15*	0.01	0.12*	−0.07
Ate the same foods	83.1%	0.16**	−0.01	0.003	0.08*	0.01
Sat close while eating	81.9%	0.10*	−0.01	−0.09*	0.11*	0.04
Condition (food-related cooperation)	0.52%	-	0.006	−0.03	0.01	−0.004
Perceived food scarcity	-	-	-	0.63***[r]	−0.01[r]	−0.17***[r]
Disease concern	-	-	-	-	0.02[r]	−0.13***[r]
Perceived shared fate	-	-	-	-	-	0.69***[r]

Note. ***= $p < .001$.
**= $p < .01$.
*= $p < .05$. r = Pearson's r. All other associations show Kendall tau-b correlations. % shows the proportion of people who indicated engaging in the behaviours while sharing food. NA = Only participants in the presence of food-related cooperation condition were asked if they tasted the food while preparing food.

TABLE 7 Multiple linear regression predicting perceived interdependence (Study 2).

	Perceived shared fate					Emotional shared fate				
	b	SE	*p*	95% CI		*b*	SE	*p*	95% CI	
Intercept	5.41	0.09	<.001	5.23	5.59	5.70	0.07	<.001	5.55	5.85
Food-related cooperation	0.05	0.13	.676	−0.20	0.31	−0.03	0.10	.739	−0.24	0.17
Disease concern	0.06	0.08	.433	−0.10	0.23	−0.04	0.07	.511	−0.17	0.09
Perceived food scarcity	−0.06	0.08	.489	−0.22	0.11	−0.15	0.07	.022	−0.28	−0.02

Note: Food-related cooperation: 0 = shared meal but did not prepare together, 1 = prepared together and shared meal. Perceived shared fate measures the extent to which people believe that their outcomes are intertwined with the outcomes of another (e.g., *[target] and I rise and fall together*; 1 = *do not agree at all*, 7 = *strongly agree*). Emotional shared fate measures affective reactivity to the outcomes of targets (*e.g., when [target] succeeds/fails, I feel good/bad*) (1 = *do not agree at all*, 7 = *strongly agree*).

3.3.3 | Does food zero-sum orientation reduce positive perceived interdependence?

Although not part of our pre-registered analyses, we tested a mediation effect of food-zero-sum orientation on emotional shared fate (*e.g., when [target] succeeds/fails, I feel good/bad*) through perceived food scarcity. To do so we regressed perceived food scarcity on food-zero-sum orientation (i.e., *a* path), as well as emotional shared fate on perceived food scarcity (i.e., *b* path) and zero-sum orientation (i.e., *c'* path). We used the *RMediation* program (Tofighi & MacKinnon, 2011) to estimate this indirect effect and found that food-zero-sum orientation was associated with lower emotional shared fate towards people involved in a shared meal via an indirect effect of higher perceived food scarcity (Figure 2).

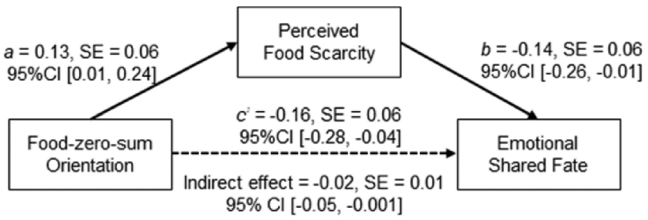

FIGURE 2 Zero-sum orientation was associated with lower emotional shared fate through perceived scarcity (Study 2). *Note.* $F(2, 293) = 6.58$, $p = .002$, $R^2 = 0.04$.

3.3.4 | Individual differences and attitudes toward sharing food

We tested whether zero-sum orientation, disease avoidance, or disgust were associated with sharing food attitudes. Table S2 shows that disease avoidance and disgust to human-food contamination, but not zero-sum orientation, were negatively correlated with sharing food attitudes. We predicted that possible negative effects of zero-sum orientation, disease avoidance, and disgust would be attenuated when targets were valued partners, in comparison with less valued others. To test this, we ran mixed-effects linear models with zero-sum-food orientation, disease avoidance, and disgust to human food contamination as predictors of sharing food attitudes. Measuring disgust towards specific targets allowed us to test the extent to which trait-level disgust

TABLE 8 Mixed-effects linear model predicting positive attitudes towards sharing food.

Obs. = 927	*b*	SE	*t*	*p*	95% CI	
Intercept (acquaintances)	4.75	0.19	25.04	<.0001	4.37	5.12
Friend	0.18	0.17	1.06	.292	−0.15	0.51
Kin	0.05	0.18	0.27	.788	−0.30	0.40
Level-2 disgust (acquaintances)	−0.43	0.05	−8.42	<.0001	−0.53	−0.33
Level-2 disgust × friend	0.14	0.04	3.09	.002	0.05	0.23
Level-2 disgust × kin	0.20	0.05	4.44	<.0001	0.11	0.29
Level-1 disgust	−0.21	0.03	−8.20	<.0001	−0.26	−0.16

Note: $N = 309$, $\tau_{intercept} = 0.37$ ($z = 9.91^{***}$), $\tau_{disgust} = 0.02$ ($z = 2.25^{*}$), $\tau_{intercept.disgust} = 0.71$ ($z = 4.57^{***}$), $\sigma^2{}_{acquaintances} = 0.56$ ($z = 9.69^{***}$), $\sigma^2{}_{friends} = 0.18$ ($z = 7.02^{***}$), $\sigma^2{}_{kin} = 0.20$ ($z = 7.82^{***}$).

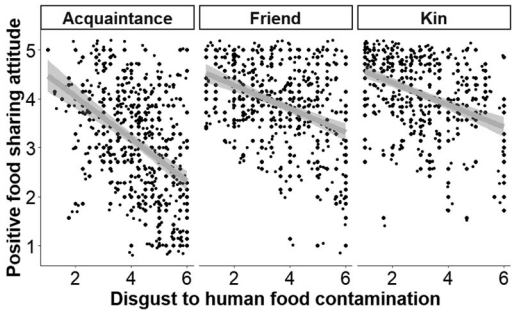

FIGURE 3 Disgust with human food contamination on sharing food attitudes across targets (Study 2). *Note*. Participants who experience higher trait-level disgust when others come into contact with their food reported lower positive attitudes towards sharing food, especially when sharing food with acquaintances (left), in comparison with friends (middle) and family (right).

(i.e., Level-2; between-person) and disgust towards specific targets (i.e., Level-1; within-person) were associated with sharing food attitudes. To obtain both the trait-level and target-specific effect of disgust, we included the cluster mean of disgust (i.e., participants' average disgust across targets) as well as disgust cluster-mean centred (i.e., participants' disgust towards specific targets centred on their cluster mean of disgust). Zero-sum-food orientation and disease avoidance were mean centred. We applied an unrestricted covariance structure for random effects (and their correlation), allowing within-person residual variances for target type to be uniquely estimated (constraining their correlations), using maximum likelihood estimation.

We found that disgust was associated with less positive attitudes towards sharing food, but food-zero-sum orientation and disease avoidance were not associated with sharing food attitudes (Table S3–S4). We then included target type and its interaction with trait-disgust, to test for an attenuating effect of relationship type on sharing food attitudes. Trait and target-specific disgust were associated with less positive sharing food attitudes (Table 8). Furthermore, the negative effect of trait disgust on sharing food attitudes was strongest for acquaintances ($b = -0.43$, SE = 0.05, $CI_{95\%}$ [−0.52, −0.33]), followed by friends ($b = -0.29$, SE = 0.04, $CI_{95\%}$ [−0.36, −0.21]) and kin ($b = -0.22$, SE = 0.03, $CI_{95\%}$ [−0.29, −0.15]) (Figure 3). This model improved fit relative to an intercepts-only model ($\Delta -2LL, \chi^2(8) = 1311.7, p < .001$), explaining 7.5% of the between-person variance and 57% of the within-person variance (ICC = 0.31).

3.4 | Discussion

We tested three hypotheses to help explain why sharing food could hinder perceived interdependence: absence of food-related cooperation, disease concern, and scarcity. Although we found no effect of food-related cooperation or disease concern on perceived shared fate, people high on zero-sum-orientation reported lower emotional shared fate towards people involved in a recent meal. In an exploratory analysis, we found that this effect was partially mediated by greater perceptions of food scarcity. In contrast with our prediction that the negative effect of perceived food scarcity on perceived interdependence would be attenuated for more valued targets, those who perceived more food scarcity reported lower emotional shared fate regardless of the type of relationships involved. Finally, we found that participants with greater disgust sensitivity held less positive attitudes towards sharing food, especially when eating with less valued others. Study 3 evaluates the impact of food scarcity more directly.

4 | SCARCITY MANIPULATION AND REPLICATION (STUDY 3)

We manipulated zero-sum orientation to test a possible causal link between scarcity and perceived interdependence. We predicted that priming scarcity would heighten zero-sum-orientation and bias people to recall greater food scarcity during a shared meal. We also measured perceived interdependence with specific targets, rather than with a group of individuals. Although people can probably estimate their perceived interdependence with groups, it is unclear how much each person contributes to such estimates. Measuring perceived interdependence with specific individuals should provide more accurate assessments of perceived interdependence. Although it was not part of our analysis plan, we also tested whether more food-insecure individuals perceive greater food scarcity during commensality and score higher on food-zero-sum orientation.

Finally, because we found that participants were less cooperative following an act of sharing food (Study 1), we tested whether perceived scarcity with a particular person could have negative lasting consequences on prosociality toward that person. This could suggest that experiences of food scarcity recalibrate people's willingness to help partners. If there were no lasting consequences on prosociality following food scarcity, this could instead suggest that repeated perceptions of negative interdependence are needed to recalibrate people's willingness to help, or that other cues of positive interdependence can compensate for experiences of negative interdependence.

4.1 | Method

This study was pre-registered. We report all manipulations, measures, and exclusions. Data, analysis plan, and analysis code are available at https://osf.io/fwy86/.

4.1.1 | Participants

Based on results from Study 2, we ran a power analysis with simulation in R Studio to determine that $N = 465$ would yield 80% power to detect an interaction between a scarcity manipulation and perceived food scarcity (or zero-sum orientation) as small as $b = -0.13$. We also determined that 562 participants would be necessary to detect an indirect effect of food zero-sum orientation on emotional shared fate via perceived food scarcity based on sample size recommendations for small mediation effects (Fritz & Mackinnon, 2007). We recruited US participants through Prolific.co during the Fall of 2021. Due to funding constraints, we only recruited 500 participants. Ten participants who failed to adequately answer the food sharing vignette (e.g., 'never shared a meal with [targets]') were removed from analyses, yielding an effective $N = 490$ ($M_{age} = 25.8$, $SD_{age} = 7.9$, 78.4% women).

4.1.2 | Materials and procedure

Participants were asked to think of two people with whom they interact frequently and indicate whether these individuals were acquaintances, friends, family members, or romantic partners. Next, participants were randomly assigned into a food scarcity ($n = 243$), or food abundance ($n = 247$) group by reading one of the following prompts:

> *You, [Target 1], and [Target 2] decide to get together for dinner at [Target 1]'s home. You decide to order a large pizza, thinking it will be enough. Surprisingly, the large pizza is much larger than what you need. [Target 1] also recently went grocery shopping, so has plenty of other food to offer. With the food that you have, you will certainly have more than you need, and feel full by the end of the meal.*

> *You, [Target 1], and [Target 2] decide to get together for dinner at [Target 1]'s home. You decide to order a large pizza, thinking it will be enough. Unfortunately, the large pizza is only barely enough for two people. [Target 1] also has not gone grocery shopping in some time, and so does not have any other food to offer. With the food that you have, you will certainly have less than enough, and feel hungry by the end of the meal.*

After reading the prompt, participants read: 'In the space below, please describe in a few sentences how you, [Target 1], and [Target 2] would share (or not) the pizza that you have in the situation described previously.' Participants then answered two items to ensure they understood the vignette (1 = strongly disagree, 7 = strongly agree): 'In the situation that I read, there was enough food for me' and 'In the situation that I read, the more one person eats the less another person would get to eat.' Following Study 2, participants were asked to think of the last time they shared a meal with both of the people they listed. We measured perceived food scarcity with the same items as in Study 2, plus two new items aimed at measuring scarcity more objectively as well as perceptions of stinginess: 'There were not any leftovers' and 'Others ate more than their fair share' (1 = strongly disagree, 5 = strongly agree). We also measured disease concern with the same items used in Study 2, plus two new items aimed at assessing the emotion of disgust: 'I was kind of grossed out by the food' and 'Somebody touched my food or drink and that grossed me out' (1 = strongly disagree, 5 = strongly agree). Next, participants reported their COVID-19 concern ('How concerned were you about the possibility of contracting COVID from the person/people involved in the last meal you shared?' 1 = not at all, 5 = extremely). Participants then reported their emotional shared fate ($\alpha_{\text{Target 1}} = 0.58$, $\alpha_{\text{Target 2}} = 0.70$) with both individuals involved in the meal.

To assess any longer-term effects of food scarcity on later prosociality, participants were asked to choose one of the two people involved in their meal to perform two allocation tasks (i.e., dictator games) with an absent target. In the first task they could win a USD 10 prize and in the second a USD 10 gift card to a restaurant of their choice. Decisions were made with a slider bar ranging from 0 to 100, where they could allocate any amount of lottery tickets between themselves and their selected target. In reality, two participants were randomly selected to receive a USD 10 bonus payment (SI S3.3).

Participants then answered the food-related version of the Zero-sum Orientation–Limited Resources scale ($\alpha = 0.74$). To assess the validity of the composite measure of perceived food scarcity and the food-zero-sum orientation scale, participants also reported on three items of food insecurity over the past year (1 = *Never*, 2 = *Sometimes*, 3 = *Often*), which were summed to create a composite ($\alpha = .80$): *I worried whether my food would run out before I was able to get more*; *I cut the size of meals or skipped meals because there was not enough food*; *I lost weight because there was not enough food* (Goldrick-Rab et al., 2019).

4.2 | Results

We report supplemental analyses and tables in SI S1–S2.

4.2.1 | Did the scarcity condition heighten zero-sum-orientation and bias people to recall greater food scarcity during a shared meal?

Participants understood the scarcity/abundance aspect of the vignettes and participants in the scarcity condition reported greater food-zero-sum orientation than participants in the abundance condition ($d = 0.19$) (see SI S1.2).

Emotional shared fate was negatively correlated with food insecurity, zero-sum orientation, food scarcity, disease concern, and COVID-19 concern (Table S5). Following our preregistered analysis plan, we simultaneously tested for a condition (0 = scarcity, 1 = abundance) × food-zero-sum orientation interaction on perceived food scarcity and a condition × perceived scarcity interaction on emotional shared fate by running Structural Equation Models with the *Lavaan* package (Rosseel, 2012) for R. Emotional shared fate items were averaged across both targets participants listed. We treated food-zero-sum orientation, perceived scarcity, disease concern, food insecurity, and emotional shared fate as latent variables. We first ran a model in which we estimated the paths from food-zero-sum orientation to perceived scarcity and emotional shared fate, from perceived scarcity to emotional shared fate; the main effects of condition on food-zero-sum orientation, perceived food scarcity, and emotional shared fate, as well as the two interaction terms. We found no condition × food-zero-sum interaction on perceived scarcity ($\beta = -.02$, $p = .744$), nor a condition × perceived scarcity interaction on emotional shared fate ($\beta = .003$, $p = .951$). The model also fitted the data poorly ($\chi^2(295) = 1655.85$, Comparative Fit Index = 0.61, Tucker-Lewis Index = 0.57, Root Mean Square Error of Approximation = 0.09, $CI_{90\%}$ [0.09, 0.10], Akaike Information Criterion = 32,068.63).

We then ran a second model in which we estimated the main effect of condition on food-zero-sum orientation, the paths from food-zero-sum orientation to perceived scarcity and emotional shared fate and from perceived scarcity to emotional shared fate; the paths from disease concern and COVID-19 concern on emotional shared fate, as well as the covariances between food insecurity and perceived scarcity and between food insecurity and food-zero-sum orientation. Although this model gave a better fit than the previous model ($\chi^2(246) = 905.17$, CFI = 0.77, TLI = 0.74, RMSEA = 0.07, $CI_{90\%}$ [0.07, 0.08], AIC = 30,263.115), investigating the model indices revealed that fit could be further improved by allowing these additional covariances to be estimated: food-related disease concern with COVID-19 concern, food-zero-sum orientation item 4 with item 6, and emotional shared fate item 4 with item 5. When including these three additional covariances, the model showed adequate fit with the data ($\chi^2(243) = 719.08$, CFI = 0.83, TLI = 0.81, RMSEA = 0.06, $CI_{90\%}$ [0.06, 0.07], AIC = 30,083.03).

Replicating findings from Study 2, we found that people high on zero-sum orientation were more likely to report greater food scarcity and perceived food scarcity was negatively associated with emotional shared fate (e.g., *when [target] succeeds/fails, I feel good/bad*; Figure 4). As expected, food-insecure participants reported greater food scarcity and food-zero-sum orientation. We also found a negative association between disease concern and emotional shared fate. Participants who reported higher food-related disease concern reported higher COVID-19 concern, likely reflecting trait-level disease-avoidance motivations, although concern for COVID-19 was not associated with emotional shared fate.

4.2.2 | Did zero-sum orientation hinder emotional shared fate?

We used *Lavaan* to estimate the indirect effect of food-zero-sum orientation on emotional shared fate via scarcity within the same model depicted in Figure 4. As predicted, we found a negative indirect effect from food-zero-sum orientation on emotional shared fate through perceived food scarcity ($\beta = -.04$, SE = 0.02, $p = .033$, $CI_{95\%}$ [−0.08, −0.003]).

4.2.3 | Does scarcity or disease concern have negative long-term effects on prosociality?

We found no correlation between perceived scarcity and tickets allocated in the dictator game when money was the prize ($r = 0.002$, $p = .961$), or when food was the prize ($r = 0.004$, $p = .926$). Similarly, we found no relationship between disease concern and tickets allocated when money was the prize ($r = -0.003$, $p = .941$), or when food was the prize ($r = -0.05$, $p = .225$).

5 | GENERAL DISCUSSION

We investigated the hypothesis that sharing food would foster perceived interdependence and cooperation. Our experimental design (Study 1) allowed us to investigate specifically the question of whether sharing food increases perceived interdependence and cooperation because it included a control condition in which people shared non-food items and it minimized coordination and conviviality as potential confounding variables. We found that people who shared food were less trusting and generous towards their experiment partners than those who ate together but did not share. Thus, in contrast with our hypothesis, we found that specifically sharing food, rather than sharing other items or simply eating together, reduced cooperation.

Based on these unexpected findings, we developed additional hypotheses and tested them in follow-up studies. We hypothesized that when people share food, competition over resources and worry about disease transmission could reduce perceived interdependence

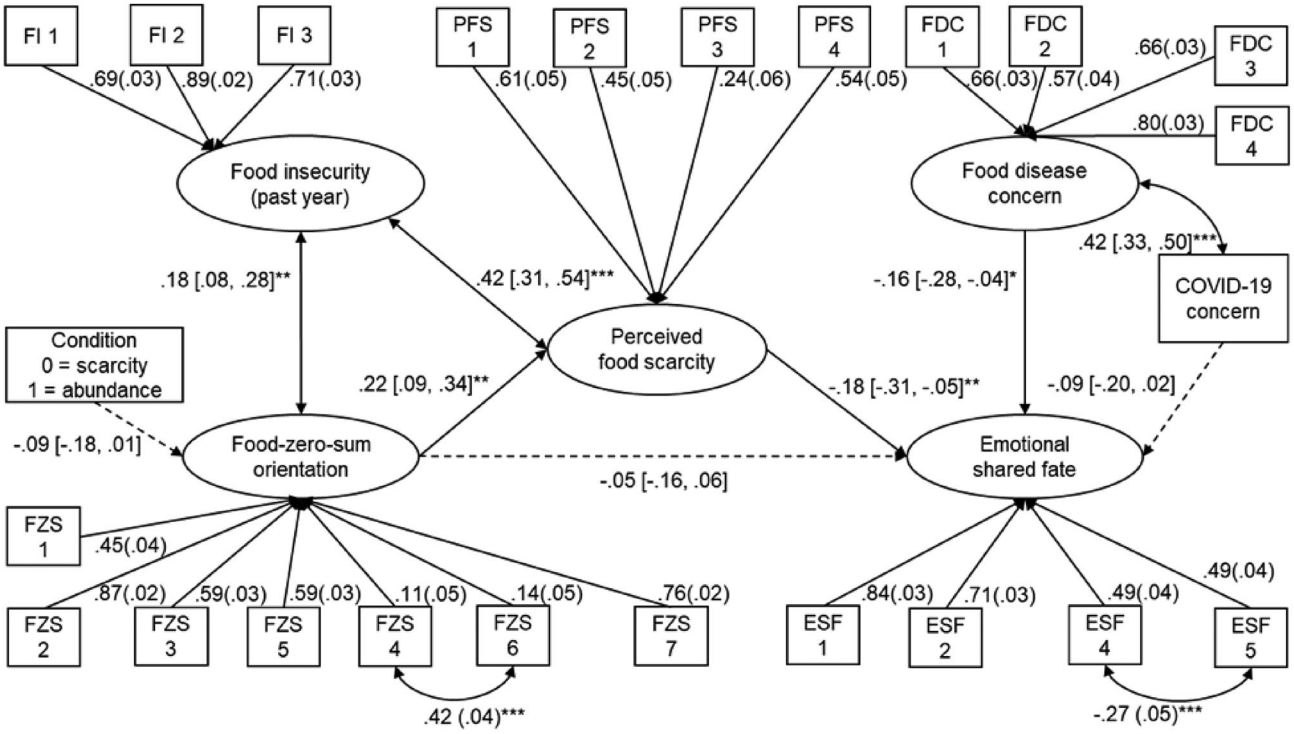

FIGURE 4 Structural Equation Model predicting emotional shared fate (Study 3). *Note.* $N = 467$. *** = $p < .001$, ** = $p < .01$, * = $p < .05$. All values represent standardized coefficients. Numbers in brackets represent 95% confidence intervals and numbers in parentheses are standard errors. Single-arrowed lines show latent paths and double-arrowed lines show correlations. Dashed lines indicate $p > .05$. Boxes represent measured items that contribute to latent factors (shown in ovals), or single-item measures. All factor loadings were statistically significant at $p < .001$, except for FSZ 4 ($p = .028$) and FSZ 6 ($p = .004$). Table S6 shows the residual variances for this model.

and cooperation. We showed that participants who reported greater perceived food scarcity (Studies 2–3) and disgust toward others coming into contact with their food (Study 3) felt lower emotional shared fate towards people with whom they shared a meal. However, perceived food scarcity and disgust did not negatively influence prosociality toward those people (Study 3). While we assessed prosociality (as generosity) immediately after sharing food in Study 1 and found that it was reduced, in Study 3 the most recently shared meal was on average 1–2 weeks before the study. The fact that prosociality was not reduced after 1–2 weeks may suggest that repeated experiences of scarcity or disease concern are needed for people to recalibrate their generosity or willingness to help. We did not find long-term negative impacts of scarcity and disease concern on cooperation but these experiences did have long-lasting negative effects on people's emotional shared fate with others.

5.1 | Perceived scarcity hinders positive perceived interdependence during commensality

Scarcity can induce a zero-sum mindset, allowing people to identify when outcomes become negatively interdependent and motivating people to prioritize their welfare over the welfare of others (Roux et al., 2015). We showed that people who tend to see food as more zero sum reported greater food scarcity during shared meals. Perceived scarcity was also associated with lower emotional shared fate with people with whom participants shared a meal. Moreover, food-insecure individuals reported higher food-zero-sum orientation and greater food scarcity during a shared meal (Study 3).

People are more willing to help valued partners (Delton & Robertson, 2016), so we predicted that sharing food with valued partners would attenuate the negative effect of scarcity on perceived interdependence. Instead, we found that even though people reported greater perceived interdependence toward romantic partners than acquaintances, perceived food scarcity was associated with lower emotional shared fate across relationships (SI S1.2; S1.3).

5.2 | Disease threat may hinder positive perceived interdependence during commensality

Sometimes people engage in behaviours that can increase infection risk (e.g., sharing a plate/cup) when eating together. Infection cues can induce feelings of disgust and motivate distancing behaviours (Tybur & Lieberman, 2016). Accordingly, we found that people with greater trait-disgust sensitivity reported lower positive attitudes towards sharing food and this relationship was strongest for acquaintances than for friends and family, consistent with the view that people are more willing to engage in disease-related risky behaviours with valued partners (Tybur et al., 2020) (Study 2).

We found mixed evidence for the prediction that food-related disease concerns while sharing food reduces perceived interdependence. We found no association between worrying about becoming sick and emotional shared fate with others (Study 2). However, participants who felt 'grossed out' by the food or by someone touching their food reported lower emotional shared fate (Study 3). This difference likely stems from our measure of disease concern used in Study 3 more closely indexing the emotion of disgust, which conveys information regarding infection threat and can lead to the devaluation of conspecifics believed to be sources of infection (Molho et al., 2017; Moretti & di Pellegrino, 2010).

5.3 | Commensality can be a source of positive and negative interdependence

Qualitative and experimental work suggests that sharing food facilitates trust and cooperation (Bernard, 2009; Graham & Mark Lam, 2003; Neely et al., 2014; Woolley & Fishbach, 2017, 2019). However, our results point to another important but less emphasized aspect of commensality: when people eat together, they often engage in behaviours, such as eating from the same plate and drinking from a shared cup, which can sometimes inadvertently activate a zero-sum mindset and feelings of disgust.

There may be many cultural practices around sharing food that are necessary for people to experience the positive effects of shared meals. For example, norms about providing overabundant food when people eat together (e.g., feasting) might be critical for not inducing zero-sum thinking. Talking, laughing and reminiscing could also be crucial contributors to having positive experiences while sharing food (Dunbar, 2017). In our study participants had only 2 minutes with one another while they shared food, which limited their ability to have a meaningful social interaction that might have otherwise had positive effects on cooperation. It might also be that working together to acquire or prepare food or other types of coordinated behaviour (Woolley & Fishbach, 2019) makes it more likely that people will experience food sharing positively. However, we found that people reported greater food scarcity when they prepared food together, suggesting that this relationship is more complicated than we initially hypothesized.

Some have argued that there is something special about sharing food (e.g., Cronk & Aktipis, 2021; Hamburg et al., 2014; Jaeggi & Gurven, 2013). In comparison with other resources, sharing food is hypothesized to facilitate perceived interdependence more readily between the people who eat together. Our study, along with previous research (Cummings & Tomiyama, 2019; Dunbar, 2017; Wang et al., 2020; Woolley & Fishbach, 2017, 2019), indicates that it is not the food itself that makes food sharing special. Rather, sharing food enhances perceived interdependence and cooperation through the communicative act of giving, positive social interactions, and the emergent coordination that occurs during the preparation, sharing, and consumption of food. These bonding components, however, may be less prominent or absent when sharing other types of resources.

It may be that the act of sharing food is—in the absence of other positive cues—perceived as a zero-sum activity. Without plentiful food, enough time to build social relationships, and highly appetizing food (as opposed to disgust-inducing food), the 'default' may then be for people to experience sharing food as a negative activity. If so, this would have implications for practical recommendations, such as eating together during negotiations, as well as for the theoretical understanding of sharing food and cooperation in humans. Cultural practices around sharing food may serve to mitigate negative feelings but further research is needed to understand people's appraisals and concerns about sharing food and whether positive experiences during shared meals can override these concerns.

5.4 | Limitations and future directions

Although we controlled for the size of food across the sharing and no sharing conditions in Study 1, the shared cookie only weighed approximately 72 g. Among subsistence populations, people who are interdependent by way of pooling calories are most likely to share larger amounts of nutritionally dense food that is hard to come by (Allen-Arave et al., 2008; Cronk, Berbesque, et al., 2019; Cronk & Aktipis, 2021; Gurven, 2004; Gurven et al., 2000; Kaplan et al., 1985; Smith et al., 2019; Tomasello, 2012). A shared cookie does not meet these criteria and hence sharing low-value food might not raise perceptions of interdependence when people eat together. Future studies should aim to manipulate the value (i.e., nutrient-density) of the food that people share to test whether perceptions of interdependence depend on the value of the food being shared (see Sznycer, 2022).

We predicted that inducing a zero-sum mindset would exacerbate the negative impact of scarcity on perceived interdependence (Study 3). However, the manipulation only increased zero-sum orientation by a small margin ($d = 0.19$). These results suggest that in-the-moment scarcity concerns may not exacerbate the negative association between zero-sum thinking, and emotional shared fate. However, it may also indicate that the manipulation was too weak to detect a moderating effect. Future studies should try different approaches to try to manipulate zero-sum thinking, such as recalled personal experiences (e.g., Roux et al., 2015).

Another limitation is that most participants reported low food scarcity ($M = 1.65–1.76$, $SD = 0.73–1.0$) and disease concern ($M = 1.36–1.63$, $SD = 0.59–0.96$; scored on 5-point scales; Studies 2–3). Hence, we may have underestimated the negative effects that scarcity and disease concern can have on emotional shared fate in comparison with populations where these cues are more prevalent. However, it is also possible that people who are rarely exposed to scarcity and disease cues, such as the participants in this study, may be more sensitive to such experiences and therefore low tolerance towards these cues may have a more negative impact on their perceived interdependence in comparison with those with higher tolerance. In future studies, it would be interesting to investigate whether experience with scarcity and disgust attenuates or exacerbates perceived interdependence following commensality. For instance, individuals who can avoid contact

with pathogens experience higher disgust sensitivity than those with less control over their exposure to pathogens (Bradshaw et al., 2022) and this higher disgust sensitivity might interfere with people's ability to foster positive feelings of interdependence with others during shared meals.

Studies 2–3 were also situated within a unique historical context—the COVID-19 pandemic—which may have influenced participants' psychology. In comparison with before the pandemic, people around the world reported higher disease avoidance concerns during the midst of the pandemic (Pick et al., 2022). At the same time, people also felt lonelier and more isolated during the pandemic (Ayers et al., 2022). Disease avoidance concerns can reduce affiliation motivations and induce distancing behaviours (Mortensen et al., 2010; Sacco et al., 2014; Sawada et al., 2018). Conversely, affiliation motivations that people experience when they feel lonelier can downregulate disease-avoidance concerns, leading people to prioritize the need to belong over the need to minimize their risk of infection (Brown & Sacco, 2016; 2017). As disease avoidance concerns were higher overall during the pandemic, this might have exacerbated feelings of disgust during shared meals. However, we controlled for perceived risk of COVID-19 infection and showed that it was not associated with emotional shared fate, suggesting that disease avoidance concerns specifically related to the pandemic did not influence results.

In contrast to disease avoidance concerns, many people engaged in social distancing during the pandemic (Pantell & Shields-Zeeman, 2020), leading to feelings of loneliness and isolation (Ayers et al., 2022). Thus, it is possible that heightened affiliation motivations might have reduced participants' disgust during shared meals, or made them more resistant to reporting lower emotional shared fate following a shared meal as a means to satisfy affiliation goals. As we did not measure affiliation motivation (e.g., need to belong) or feelings of loneliness, the present study cannot rule out this possibility. Future studies should aim to manipulate affiliation motivations to test whether such motivational states can attenuate the negative impact of disgust on emotional shared fate following a shared meal.

A final limitation of the present studies is that we relied on the Shared Fate Scale to measure perceptions of interdependence. While this scale has been shown to be valid and reliable, it only captures zero to positive variance in perceptions of interdependence and, hence, does not measure perceptions of negative interdependence. Our results are therefore consistent with three possibilities: perceptions of food scarcity and food-related disease concerns could interfere with perceptions of positive interdependence, reduce perceptions of positive interdependence, or induce perceptions of negative interdependence. More research is needed to differentiate between these possibilities.

6 | CONCLUSION

We set out to investigate the hypothesis that sharing food brings people together. Instead, we found that sharing food reduced cooperation. These results led us to investigate the possibility that competition over food and disease threats reduces positive perceived interdependence and cooperation following a shared meal. We showed that sharing food was associated with behaviours (e.g., eating from a shared plate) that induced perceptions of food scarcity and disgust, which were in turn associated with lower perceptions of positive interdependence.

Our work suggests that future studies on sharing food should not necessarily start with the hypothesis that meals bring people together. Rather, this relationship might be dependent on perceptions of scarcity and disease threats. It is also essential to include non-food controls in future work so that the effects of sharing food can be disentangled from the effects of simply sharing. Despite not finding support for our initial hypothesis, our results suggest several interesting directions for future work, including developing a deeper understanding of the conditions under which sharing food is perceived as a negative rather than positive experience in human social life.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data is available at https://osf.io/fwy86/.

ETHICS STATEMENT

The IRB of Arizona State University approved this study, (STUDY00008951). All participants provided informed consent prior to their inclusion in the study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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