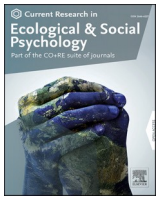
Current Research in Ecological and Social Psychology 5 (2023) 100152

Contents lists available at ScienceDirect

Current Research in Ecological and Social Psychology

journal homepage: www.elsevier.com/locate/cresp



From self-deprivation to cooperation: How Ramadan fasting influences risk-aversion and decisions in resource dilemmas

Mostafa Salari Rad

New School for Social Research, New York, NY, United States

ARTICLE INFO

Keywords:
Fasting
Risk-taking
Cooperation
Social dilemmas
Ramadan
Rituals
Self-deprivation
Social Coordination
Scarcity

ABSTRACT

Across the world, many cultural and religious groups participate in collective deprivation rituals such as the Ramadan fast. It is not obvious why people willingly deny themselves sustenance for prolonged periods of time. Apart from the physical hardship, fasting may have psychological and behavioral consequences comparable to those associated with involuntary scarcity and poverty, including susceptibility to impaired cognitive performance or increased risk-aversion and delay discounting. In this paper I propose and investigate one explanation for communal fasting rituals, that it is associated with increased cooperation over common resources, in part, through increased risk-aversion. I test the two prongs of this hypothesis in a series of studies. Studies 1a–c investigate the relation between the Ramadan fast and risk-taking, finding lower risk-taking in fasters than non-fasters and during Ramadan than after. In a repeated measures design, Study 2 ($N = 283$) finds that in multiparty resource dilemmas, people make smaller requests from commons with unknown size during Ramadan than after, and this difference is associated with corresponding shifts in risk-taking, but not indices of trust or social preferences. I propose that collective deprivation rituals may have served an adaptive sociocultural function in times of scarcity when incomplete information about the availability of resources and other people's response could increase defection and threaten commons with rapid depletion. Along with implications for research into the psychology of fasting, rituals, and cooperation in resource dilemmas under uncertainty, these results demonstrate Ramadan's potential as a natural laboratory for cognitive and behavioral research.

> "It was funk, bred of hunger that kept him virtuous. With only two or three sound meals in his belly, he would have found courage to steal the milk."
>
> - Down and Out in Paris and London, 1933 (Orwell, 1933/1961)

Introduction

Abstention from some or all types of food for specific periods is a common practice across cultural and religious groups and predates antiquity. In hippocratic medicine, fasting was prescribed to treat certain illnesses, and for indigenous tribes of Mesoamerica as well as Pagan or Buddhist traditions, it was an essential ritual for embarking on spiritual journeys (Arbesmann, 1951; Carrasco, 2006; Mattson, 2022; Michalsen, 2010). The Old Testament describes Moses fasting for forty days before receiving the ten commandments (Exodus 34:27). In addition to individuals fasting due to specific conditions or certain roles, fasting as a collective ritual is also prevalent across societies and religious groups. Hinduism, Buddhism, Judaism, Orthodox Christianity, and Islam all have periods of complete or partial fasting (Kerndt et al., 1982; Ryan, 2005; Shatenstein and Ghadirian, 1998). The long history and the diversity of societies where periodic collective self-deprivation rites are customary raise questions about their origin and purpose. Given that responding to ecological scarcity is a primary objective of living organisms, why do people deliberately self-deprive and impose scarcity on themselves? What could be gained from such endeavors to alter food habits collectively?

Within traditions that require it, fasting is often thought to have therapeutic or restorative functions for the individual's health, as well as mental and spiritual well-being. Some religious traditions view fasting as a sacrificial endeavor to balance or correct previous indulgences, a coping response in times of grief and mourning, or an act of penance and atonement (Tamney, 1986). In this view, fasting can heal the body or cleanse the soul, elevate a person spiritually by eschewing carnal desires, or provide an opportunity to atone for one's sins (Glucklich, 2001; Grimm, 2002; Kalian et al., 2008; Lambert, 2003; Rooth and Carlström,

E-mail address: mrad@princeton.edu.

https://doi.org/10.1016/j.cresp.2023.100152
Received 31 December 2022; Received in revised form 4 July 2023; Accepted 25 August 2023
Available online 9 September 2023

1970; Wimbush and Valantasis, 2002). Others construe fasting as an exercise that builds and challenges willpower, develops self-discipline and grit, enabling practitioners to cultivate virtues of patience and self-control toward meaningful pursuits (Chawla, 1992; G. Loewenstein, 2000). Practicing partial self-denial, in this rendition, is closely related to a nearly universal lay belief that '*hardship brings growth*', a recurrent and influential theme across religious and cultural groups (Cook, 2015; Deezia, 2017; Essen, 2009; Finn, 2009; Fitouchi et al., 2022; Nietzsche, 2012; M. Weber, 2012).

Secular scholarship tends to offer a different class of explanation for collective fasting, focusing on the social identity functions of ritual. Food taboos and dietary restriction have long been a means of upholding group identity and social cohesion (Brown and Mussell, 1984; Camp et al., 1986; Messer, 1984; Rozin, 1996). Muslims do not eat or drink, have sex or smoke between sunrise and sunset in the month of Ramadan, Jews will not eat or drink on Yom Kippur, while Orthodox Christians avoid meat, fish, and dairy products on certain days of the week, and Hindus avoid beef all year. Within cultural groups too, there are detailed regulations over the types of food consumed by whom, when, and how (Harris, 1987; Harris and Ross, 1987; Kerndt et al., 1982; Meyer-Rochow, 2009; Rozin and Vollmecke, 1986). The underlying premise of these conventions reflects another cross-culturally familiar lay belief, that '*you are what you eat*' (Mascaró, 2003; Shapin, 2014). In this sense, just as in other rituals, customary practices surrounding food such as periodic fasting, can reify group identity and strengthen the sense of belonging (Brown and Mussell, 1984; Fischler, 1988; Schielke, 2009). They can also serve as costly signals of commitment to the group and so facilitate cooperation among other functions (Atran and Henrich, 2010; Hobson et al., 2017; Irons, 2001; Ruffle and Sosis, 2007).

While the identity functions may apply to any collective activity or group-specific ritual that marks people's affiliation, I propose and investigate a complementary explanation for collective fasting, theorizing that periodic, temporary, and partial self-deprivation rituals have particular cognitive and behavioral footprints that manifest in a risk-averse and cooperative adaptations. More specifically, in this paper I argue that fasting is associated with a general increased tendency to prefer small but certain gains over large but uncertain rewards. This increase in risk-aversion, in turn, could usher in prosocial and cooperative behavior. In other words, by tapping into cognitive processes associated with weighing rewards and probabilities as well as broader self-control, periodic collective deprivation rituals could facilitate a more sustainable and efficient distribution of scarce common resources under incomplete information. And by relying for enforcement on social norms and religious commitment, they may have served as an effective cultural response to social coordination problems arising in times of uncertainty.

With the invention of agriculture, the transition to sedentary lifestyles and the emergence of large-scale societies, humans have faced increasingly complex challenges coping with fluctuating food supplies while maintaining social cohesion and fostering cooperation (Bevan et al., 2017; Dirks et al., 1980; Halstead and O'Shea, 2004; Messer, 1984; Tsegaye et al., 2013; Winterhalder et al., 1999). When scarcity was anticipated, such as in times of famine or drought, collective consumption control programs requiring limited direct oversight could reduce pressure on the commons and prevent the dynamic growth of demand for scarce resources, thereby saving them from rapid depletion. Meanwhile, they could foster prosocial behavior through processes related to perspective taking, generosity, gratitude, altruism, and reappraisal, while cultivating self-control via exercising cognitive processes linked to inhibition, willpower, and rituals. Although there is little empirical evidence for these ramifications, lay and expert reasoning often converge on similar speculations about the functions and motives behind collective self-deprivation rituals. For example, prior theorizing on Ramadan fasting, a prominent contemporary self-deprivation ritual in Islam, emphasizes a similar variety of functions: '*One has to abstain from food and drink in order to feel in one's body what the poor and hungry feel: thus social responsibility is being hammered into human consciousness as a religious postulate. The other purpose of fasting during Ramadan is self-discipline, an aspect of individual morality strongly accentuated in all Islamic teachings*' (Asad, 1954).

Nevertheless, the hypothesis linking collective self-deprivation to risk-aversion and cooperation is also backed by empirical findings from a number of independent research areas. The link to cognitive processes implicated in risk-taking specifically is predicted by evidence from research on self-control and impulsivity. Temporary voluntary fasting is at its heart, an exercise in self-restraint, goals-pursuit, and delaying gratification. It requires sustained inhibition of impulses along with a conscious effort to abide by the strict rules of the ritual. To the extent that self-control improves with practice (Berkman, 2016; Miles et al., 2016), we might expect Ramadan participants to emerge from the month with improved inhibitory control. People also have to plan for their fast, prepare by adjusting their schedules and daily routines, and adopt strategies that help maintain goal-directed behavior with less effort. Such fundamental changes involving basic needs are unlikely to leave cognitive and behavioral processes untouched.

In a longitudinal randomized control study of $N = 190$ fasters, Rad et al. (2022) showed that when they were reminded of food prior to completing an inhibitory control task, Ramadan participants made more errors and responded more slowly during relative to after Ramadan. Control participants, who were also fasters but responded to non-food related probes, performed similarly across time. Moreover, the reminder of food interfered with the speed of responding regardless of when people had last eaten. In contrast, controls performed significantly better early in the fast than later. Even so, despite the short-term susceptibility to cognitive underperformance, inhibitory control has been also found to improve over the course of a month of fasting (Rad, 2023a; Balkaya-Ince et al., 2023). That is, following a month of everyday self-regulatory practice, people may exhibit better control over their choices. These findings culminate in two conclusions: (a) cognitive control processes, specifically inhibitory control, are active, engaged, and stimulated during fasting, and (b) this influence is present early in the fasting states, when people are not necessarily hungry, yet are aware of restrictions imposed by the fast. Consequently, to the extent that impulsivity, self-control, and risk-taking tap into overlapping cognitive processes, one might predict Ramadan participation to be associated with a general reduced tolerance for risky and explorative behaviors.

Risk-taking, however, is also a multidimensional construct with unique adaptive and context sensitive properties, despite its overlaps with impulsivity and disinhibition (Crone et al., 2016; Figner et al., 2009; Nigg, 2017; Nigg and Nagel, 2016). In this research, I adopt the following definition of risk-taking from (Figner and Weber, 2011): preference for higher outcome variability. Whether positive or negative, choosing an outcome with higher degree of variance in probable gains or losses indicates greater risk tolerance. There is a well-established pattern of variation in risk-taking across domains, as well as demographic variables including gender, age, and socioeconomic status (Amir et al., 2018; Blais and Weber, 2006; Defoe et al., 2015; Falk and Hermle, 2018; Frey et al., 2023; Telzer et al., 2013; Willoughby et al., 2013). In addition, a major research program has shown that risk attitudes and decisions vary systematically based on contextual factors such as choice framing, reference points, time scales, and uncertainty levels (Ruggeri et al., 2020; Tversky & Kahneman, 1992). Accordingly, the physiological and psychological changes that occur during fasting may also systematically influence risk thresholds and subsequently, fasters' judgment and decision-making.

Fasters have to evaluate their day-to-day decisions against the risk of compromising the overarching goal of surviving and completing the fast. Although fasting is planned, temporary, and to the extent that it is considered voluntary, can be ended at will (unlike involuntary hunger and starvation), people still need to be cautious in order to prevent risk of serious damage to their health. They should be somewhat mindful about their routine activities and schedules as well as energy levels and

expenditure, by and large, in order to stay the course of the fast without compromising their concurrent goals. In addition to continuous monitoring and self-control exercise necessary to manage the fast, balancing the body's energy and water reserves versus expenditure, along with evaluating and adopting behavioral strategies conducive to the fasters' experience and goals, constitute an ongoing risk evaluation process. Arguably, one with a conservative bias. Rather than rewarding impulsivity, fasting with a predetermined timing and format is likely to favor risk-aversion and low-variance outcomes.[1]

Such cognitive behavioral adaptations predictably result in broader sociocultural and economic shifts (Aksoy and Gambetta, 2022; Campante and Yanagizawa-Drott, 2015; Roky et al., 2004; Schofield et al., n. d.; Toda and Morimoto, 2004; Waterhouse et al., 2008; Yucecan et al., 2000). For example, increased length of fasting days has been shown to increase Islamist party's vote share in parliamentary elections in Turkey, reduce labor productivity and caloric intake in Indian farmers, but increase trust and subjective well-being on a global scale. Another study found that Indian and Pakistani judges ruled more leniently in Ramadan (Mehmood et al., 2023).

In sum, people maintain their fast while avoiding starvation by being mindful of their energy levels, the remaining fasting time, and their expenditure rates. Because of this, they are likely to weigh their choices more frugally and adapt their behavioral routines, psychological tendencies, and ecological patterns accordingly. This includes attitudes towards taking risks. Adaptive risk sensitivity model posits that as long as their energy reserves are not critically low (e.g., reference point), humans and other animals are likely to maintain a risk-averse strategy and choose sources of food with smaller outcomes but higher consistency (i.e., lower mean and variance) (Goldshmidt, 1997; Kacelnik and Bateson, 1996; McDermott et al., 2008; McNamara and Houston, 1985; Mishra, 2014; Stephens, 1981; Stevens and Stephens, 2010; Winterhalder et al., 1999). Torpor and hibernation are examples of adaptive energy-conserving responses in mammals facing food deprivation and harsh environments (Hrvatin et al., 2020). In humans too, adaptive risk responses are found in contexts involving scarce resources such as time, money, or security (Amir et al., 2020; Cahlíková and Cingl, 2017; Fang et al., 2021; Gloede et al., 2015; Yesuf and Bluffstone, 2009). Under time pressure, for example, people have been found to take fewer risky gambles (Ben Zur and Breznitz, 1981), and are increasingly risk-averse when it comes to losses (Kocher et al., 2013). As such, one might expect the fasters' adaptive response or energy budgeting measures (e.g., limited movement, adjusted sleep cycles) to result in a general decrease in the threshold for acceptable risk.

Furthermore, other research on the behavioral outcomes of scarcity and poverty shows that people with fewer resources tend to behave in a more risk-averse manner (Haushofer and Fehr, 2014; Sheehy-Skeffington, 2017). In addition to correlational evidence, experiments show that negative income shocks, as well as anticipation of limited future access to resources, can increase preference for smaller but safer and earlier rewards (Dohmen et al., 2011; Falk et al., 2018; Guisoand Paiella, 2008; Hardeweg et al., 2013; Haushofer et al., 2013). Other research shows that decisions involving scarce resources such as food, money, time, or mates are partially correlated and implicate similar neural valuation centers (Bartra et al., 2013; Briers et al., 2006; Griskevicius et al., 2012; Levy and Glimcher, 2011; Nelson and Morrison, 2005; Strang et al., 2017; Xu et al., 2015). Thus, to the extent that self-deprivation from food and water, even if planned and temporary, simulates a sense of scarcity of valuable resources, it could result in corresponding cognitive and behavioral implications, namely, increased risk-aversion and delay discounting (Rad et al., 2022; Rad and Ginges, 2017; Skrynka and Vincent, 2019).

The argument and reviewed research above provide a basis for a hypothesis that links fasting to cognitive underpinnings of risk-taking, advocating its association with a cautionary, conservative, and risk-averse conduct incompatible with novelty-seeking and exploratory behavior. The second prong of my hypothesis concerns how shifts in risk attitudes relate to cooperation decisions. Prior experimental research finds that risk-aversion influences people's decision to cooperate or defect in resource dilemmas with multiple stakeholders (Amir et al., 2018; Glöckner and Hilbig, 2012; Raub and Snijders, 1997). For example, in multiplayer resource dilemma games, when the size of a common pool is unknown, risk seekers demand larger shares whereas risk avoiders make modest requests, sometimes less than their fair share from the common pool (Budescu et al., 1990; Cárdenas et al., 2017; Wilke et al., 1996). Risk-averse individuals also favor redistributive policies as hedge against adverse events (James and Savedoff, 2010), might have fitness advantage over risk-seekers in certain populations (Okasha, 2007), contribute more to public pools (Cárdenas et al., 2017), and are more likely to assume membership in cooperative risk pooling initiatives (Yu et al., 2021). Therefore, the increase in risk-aversion resulting from collective self-deprivation could coincide with increased cooperation in social resource dilemmas.

This is particularly crucial where the precise size of available resources is unknown, and its provision depends on other people's decisions. When uncertainty surrounding the common pool is high (e.g., during famine or war), people overestimate its size, request bigger shares from them, and expect others to do so as well (Budescu et al., 1990; Wit and Wilke, 1998). Selfish behavior dominates other strategies in such contexts, and if people are risk-seeking, increased uncertainty may increase defection (Biel and Gärling, 1995). Groups facing a shortage of supplies could benefit from interventions that make people more conscientious about risky choices and the consequences of their decisions for the group, and for themselves should the behavior become the norm. Expecting other group members to show self-restraint has been found to curb overuse of the common pools (Messick et al., 1983). In essence, through increased risk-aversion, collective periodic deprivation could potentially address issues arising from both environmental (e.g., the size of the natural resource) and social or strategic uncertainty (e.g., the behaviors of other group members) (Suleiman and Rapoport, 1988).

In the following studies, I first examine the link between fasting and risk-taking, and then investigate how changes in risk-taking correspond with cooperation on multiparty resource dilemmas. This samples consist of Muslims fasting during the month of Ramadan, when the abled and healthy adults in the Islamic world abstain from eating, drinking, smoking, and sexual relations between sunrise and sunset (Bell and Lugo, 2012). Some exceptions include children, travelers, patients under medication, menstruating women, etc. During this time, people are encouraged to attend to their community, self-reflect, and share their resources, especially with those in need. In a sense, this massive lifestyle shift is an intervention aimed to strike an equilibrium between individual desires and societal needs. I also investigate how social preferences and attitudes such as trust, positive and negative reciprocity, altruism, and Social Value Orientation (SVO) are affected by Ramadan participation, and whether they explain additional variability in choices in social resource dilemmas (Balliet et al., 2009; Bogaert et al., 2008; Messick et al., 1983; P. A. M. Van Lange et al., 2013). It is plausible that participating in or observing the Ramadan rituals bring attention to the community, promote other-regarding preferences, and enhance prosociality, independent of risk attitudes.

[1] Note the differences between fasting and hunger. Although people may feel hungry at the end of their fast, they are usually not underfed at the beginning or throughout. They plan and prepare and are arguably more satiated than they are accustomed to at that time early in the fast. And knowing they are able to end their condition at will, their decisions and psychology are likely *adapted to avoid hunger* while fasting. This could manifest in a reduced appetite for risk-taking and associated displays of novelty-seeking or impulsivity.

Overview of studies

Two sets of studies investigate (a) whether Ramadan fasting is associated with reduced risk-taking and (b) how this shift in risk-aversion is associated with cooperation in social resource dilemmas. Study series 1 reports results from three experiments that use different designs (e.g., between and within-subject designs) and methods (e.g., hypothetical games of chance, Balloon Analogue Risk Task or BART) to investigate the hypothesized link between participation in fasting in Ramadan and risk attitudes. Using a repeated measures design, Study 2 examines the link between collective fasting, risk-taking, and cooperation, while testing alternate explanations based on trust, social preferences, and value orientation.

Study 1-a

I measured risk-taking in a sample of employees of several Middle Eastern companies during Ramadan 2016. With the managements' approval, I invited people to take part in a short study with a chance to win a $100 raffle. I asked participants to think carefully about their responses as their choices would be converted to points that would determine their chances of winning the raffle. After signing the consent forms approved by the Institutional Review Board (2016–1077), participants responded to the following questions and tasks using paper and pencil.

Measures

Risk-taking: I used two tasks to measure risk-taking. In one, adapted from Guiso et al. (Guisoet al., 2013), participants read the following scenario: "*Imagine being in a room. To get out you have two doors. If you choose one door you win $10,000. If you choose the other, you get zero. Alternatively, you can get out from the service door and win a known amount. If you were offered $100, would you choose the service door?"* Participants responded on a table that listed the numbers $100, $500, $1500, $3000, $4000, $5000, $6000, $7000, $8000, $9000, and 'larger than $9,000'. They were told to indicate which amounts they were willing to accept to take the 'service door'. The minimum accepted amount by the participants indicates their risk threshold, with lower amounts showing higher risk-aversion. This method also tests task comprehension since people have to check all the amounts larger than their first choice.

In the second risk-taking task, adopted from (Fehr and Götte, 2007), I gave six hypothetical coin toss games to the participants. In each game, a gain of $6 was pitted against a loss of $2, $3, $4, $5, $6, or $7. Participants indicated their willingness to play in each game. Accepting more gambles indicates a higher degree of openness to risk. However, the $2 vs. $6 and $3 vs. $6 games have very high expected values and most people are likely to accept them. Conversely, the $6 vs. $6 and $7 vs. $6 games have very low expected values and most people are expected to reject them. Thus, the critical games where more variability is expected are the $4 vs. $6 and $5 vs. $6 games, whose expected values are positive but not too high. See the supplemental file for instructions in exact words.

Explicit attitudes toward financial risk-taking: Participants responded to a single item on attitudes toward financial risk using, adapted from (Guisoet al., 2013). 'Which of the following statements comes closest to the amount of financial risk that you are willing to take when you make your financial investment: (1) a very high return, with a very high risk of losing money; (2) high return and high risk; (3) moderate return and moderate risk; (4) low return and no risk'.

Demographics and Fasting: Age, gender, monthly income (1 (< *$1000*) - 5 (*$5000* <)).

The last question of the study was, '*Were you fasting while taking this survey?*' (Yes/No). Participants were unaware of the study purpose before this question on fasting and Ramadan.

Sample

I obtained responses from $N = 183$ self-identified Muslims (Age: $M = 32.7$, $SD = 10.9$; Sex: $F = 114$; Income: $M = 2.22$, $SD = 1.05$). Eighty-six participants were fasting while taking the survey. The non-fasters were predominantly female (53% of faster and 73% of non-fasters), but the two groups were similarly distributed in terms of age and income (F's < 1, p's > 0.3). See the supplemental file for the sample details.

Results

Across different behavioral measures of risk preferences, people who completed the study in a fasting state were more risk-averse than those who were not.

Doors task: The choices were coded as 0.1 ($100), 0.5 ($500), 1.5 ($1500), 3 ($3000), 4 ($4000), 5 ($5000), 6 ($6000), 7 ($7000), 8 ($8000), 9 ($9000), and 9.5 (larger than $9,000). The mean amount demanded to avoid the gamble and take the service door by fasters ($M =$ $3791, SD = 2596) was significantly lower (Welch's $t(168.9) = 2.7658$, $p = 0.0063$, Unpaired Cohen's $d = 0.422$ [95CI 0.121; 0.754]) than the amount demanded by non-fasters ($M =$ $4952, SD = 2888). The fasters opted out before the fifth ($M = 4.95$; $SD = 2.49$) choice (i.e., $4000), and the non-fasters opted out above the sixth ($M = 6.04$, $SD = 2.88$) choice (i.e., $5000). Twelve participants had missing values or inconsistent responses and were excluded from this analysis.

Coin toss task: Fasters were more likely to reject gambles with small but positive expected values than the non-fasters. The $5 vs. $6 gamble was rejected by 60% of Fasters and 43% of the non-fasters ($\chi(1) = 6.159$, $p = 0.0130$). Similarly, the $4 vs. $6 gamble was rejected by 77% of Fasters and 59% of the non-fasters($\chi(1) = 4.587$, $p = 0.0322$). Both groups predictably accepted of gambles with high expected values ($2 vs. $6: fasters = 80%, non-fasters = 83%; $3 vs. $6: fasters = 71%, non-fasters = 78%) and rejected gambles with zero or lower expected values ($6 vs. $6: fasters = 71%, non-fasters = 67%; $6 vs. $7: fasters = 82%, non-fasters = 84%). Moreover, the overall expected values for each participant across the six games was calculated using coded values: +2 (win $6 vs. loss $2), +1.5 (win $6 vs. loss $3), +1 (win $6 vs. loss $4), +0.5 (win $6 vs. loss $5), +2 (win $6 vs. loss $6), −0.5 (win $6 vs. loss $7). The total expected value was significantly higher (*Kruskal-Wallis* rank sum test = 5.2876, $p = 0.0214$) in non-fasters ($M = 3.41$, $SD = 1.71$) than the fasters ($M = 3.01$ ($SD = 1.63$).

In contrast to behavioral measures, the two groups did not differ significantly in explicit financial risk preferences ($\chi(3) = 1.85$, $p > 0.6$), and overwhelmingly preferred "*moderate return and moderate risk*" (61% of fasters and 71% of non-fasters).

Discussion

This study provides preliminary evidence that fasting is associated with lower risk-taking. But it has several limitations. For one, it is a correlational study; the two groups could differ in other ways. For example, although all of the participants self-identified as Muslim, those who were fasting could have been more religious, and religiosity is positively associated with risk-aversion (Bartke and Schwarze, 2008; Hilary and Hui, 2009/9). In other words, individual differences other than fasting states could be responsible for the difference in risk-taking. Moreover, the measures I used were hypothetical scenarios involving gambling, which is generally disallowed in Islam. And, they might also require effort to calculate probabilities; the fasters could have been less focused and/or sought to finish the task quickly (this only applies to the doors task, not the coin toss task). I set out to address these issues in the next studies.

Study 1-b

This study sought to rule out a number of alternative explanations for

the results of Study 1-a. Despite all participants identifying as Muslims in that study, those in the fasting and non-fasting groups could differ in terms of religiosity or other characteristics. They could also have differing levels of exposure to Ramadan and its constituent rituals Here, I ensured the sample consists of people who always fast during Ramadan and are thus comparably religious. I then compare people who are in a fasting state while they participate in the survey, with those who are not. Whether or not people are in either group depends on *when* they decided to participate in the study, for example, in the evening versus the daytime. This approach narrows the range of possible ways in which fasting and non-fasting participants could differ from one another, even though alternate explanations such as diurnal shifts in risk-taking remain conceivable. Moreover, I measure risk-taking using the Balloon Analogue Risk Task or BART (Lejuez et al., 2002), which has a game-like format and does not involve gambling or decisions over monetary amounts, nor is it computationally demanding on participants.

Measures

Risk-taking: The Balloon Analogue Risk Task (BART) was used. In each round of BART, the subject sees a balloon in the center of the screen and is given two choices. They can either 'pump' the balloon or 'cash in' and move to the next round. With each pump, they receive a point but they also risk losing the points they have accumulated in that round because the balloon might explode. Before the balloon explodes, however, subjects can save their points by choosing to 'cash in' their points. While the payoff of each pump remains constant, with each additional pump, the probability of loss increases by 1/*Max No. of Pumps*. That is, with each pump the subject is taking more risk and is opting in for a bigger gamble. The variable of interest is the number of pumps in the *rounds on which the subject chooses to 'cash in'* — the point at which subjects decided to forgo further risk and save their points before the balloon exploded (i.e., adjusted pumps) (Lejuez et al., 2002). Note that the participants are not aware of the maximum number of pumps, so as far as they are concerned, each pump might pop the balloons. They are also told that the total number of points will determine their chances in a raffle. To ensure familiarity with the setup, participants were asked to play five practice rounds, followed by 15 test rounds. The maximum number of pumps was 20. Fig. 1 shows the implementation of the BART task used.

Demographics: Participants reported their age, gender, income, living area, education, and responded to self-report questions about patience: '*On a scale of 1–5, how patient do you consider yourself?*' and hunger, '*On a scale of 1–5, how hungry are you?*', and their height and weight. These variables were not associated with risk-taking and will not be discussed further (see the supplemental file for correlations). The last item was a yes/no question, '*Were you fasting while taking this survey?*'

Sample

A market research agency assisted us with recruiting a hundred and ninety-eight subjects who fasted in Ramadan 2017 (Age: $M = 32.08$, $SD = 8.7$; $F = 88$). Data was collected between June 10 and June 25. They were compensated with flat participation fees plus performance-based bonuses. All participants signed the consent form approved by the Institutional Review Board (IRB: 1077–2017). The median monthly income was just below $1500 and over 80% had some college education. Eighty-six participants were fasting while taking the survey and reported significantly higher levels of hunger than the non-fasting participants (*Unpaired Cohen's d* = 0.499 95%CI[0.209, 0.805]) but the two groups did not significantly differ in self-reported patience (*Unpaired Cohen's d* = 0.0842 5%CI[[−0.207; 0.358]). See the supplemental file for other demographic characteristics of this sample.

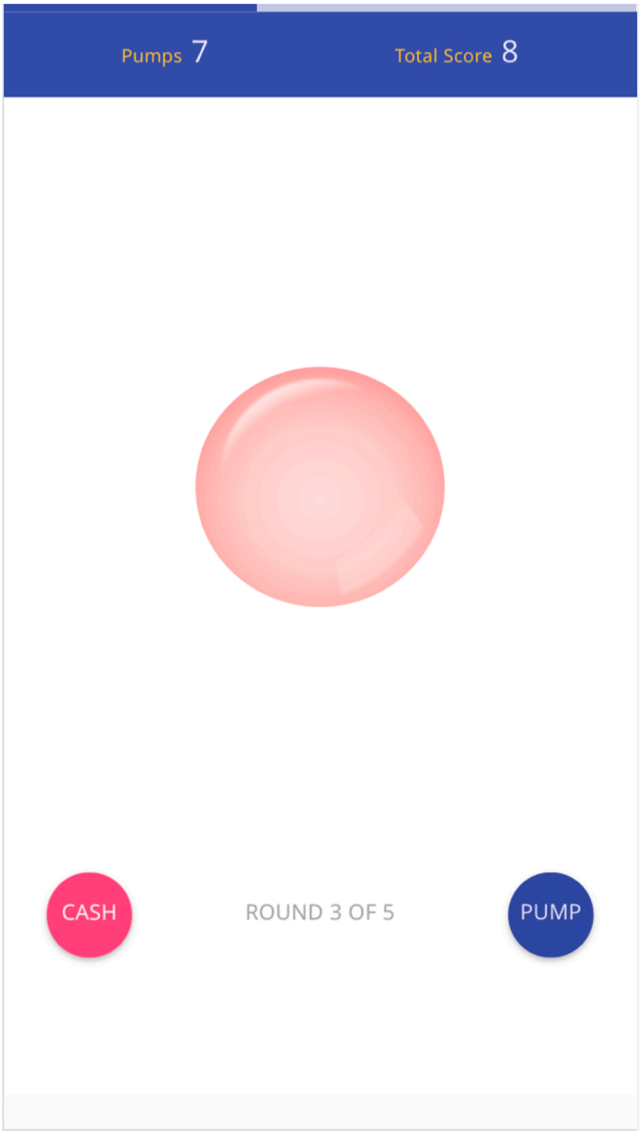


Fig. 1. A screenshot of the BART used in Studies 1-b and 1-c. The '*Pumps*' field on the top left indicates how many points the subject has received in the current round, and the '*Total Score*' shows the number of points across rounds. The task runs on Cut (https://cut.social/), a platform created to design and run online mobile-friendly studies.

Results

Looking at the results from the BART test, the fasters behaved more conservatively and cashed out their points earlier than the non-fasters. Specifically, the average number of pumps before the participants cashed out their points was significantly smaller for fasters than non-fasters (vs. $M_{\text{Fasting}} = 6.73$ ($SD = 2.11$) vs. $M_{\text{Non-Fasting}} = 7.48$ ($SD = 2.12$) $t(189.89) = 2.433$, $p = 0.0159$, *Cohen's* $d = 0.35$, 95%CI[0.06, 0.64]). Meanwhile, the two groups did not significantly differ in the number of rounds on which they cashed out their points ($M_{\text{fasting}} = 44.8\%$ vs. $M_{\text{non-fasting}} = 45.7\%$, $\chi(1) = 0.242$, $p = 0.6225$). Therefore, the results cannot be attributed to a randomization error causing one group's balloons to explode earlier than the other. Among demographic variables, only income was associated with risk-taking, ($\rho = 0.18$, $p = 0.012$). See supplemental file for other correlations.

Discussion

People who were fasting while completing the BART were significantly more likely to cash in their points after a smaller number of pumps than those who were not fasting. In other words, fasters were more risk-averse than non-fasters. This study improves on Study 1-a in several ways. It uses a sample of people who had previously indicated that they fast during Ramadan; they are thus unlikely to vary significantly in religiosity. Whether participants were fasting while participating in the study is up to chance; it only depends on *when* they completed the survey. Another advantage of this study is that I measured risk-taking using multiple rounds of the BART. Unlike economic decision-making tasks, BART does not require calculating expected utilities and probabilities, nor does it demand prior experience with similar tasks. Furthermore, it only indirectly involves monetary outcomes and gambling which could raise moral and religious concerns. Lastly, the association with income suggests that BART scores provide a valid measure of risk-taking.

These results lend support to the findings of Study 1-a, suggesting that fasting is associated with risk-aversion. They also weaken an alternative explanation that fasters are more religious and thus endogenously more risk-averse than the non-fasters. While I did not measure religiosity here, all respondents said they '*always*' fast during Ramadan. Still, different groups of people are being compared, and the fasters and the non-fasters could differ in other ways that were not measured. For example, the non-fasters group consists of people who completed the study after they broke their fast. Assuming this to be a risk (e.g., the risk of forgetting and never taking the survey), the non-fasters group will likely have more risk-seekers. I address this in Study 1-c by looking at within-subject variability in risk-taking across time.

Study 1-c

This study adopted a repeated-measures design, testing participants during Ramadan when they are fasting and after Ramadan. Because the same people are tested repeatedly, changes in their responses are more reliably, but not entirely, attributable to their participation in Ramadan. This addresses some of the limitations that result from between-subject comparisons in the previous studies. Other than increasing the number of rounds on the BART, the methods are identical to Study 1-b. All participants signed the consent form approved by the Princeton University IRB (#10,649).

Measures

Risk-taking: I used the same implementation of BART as in Study 1-b, but increased the number of rounds to 25. Participants still completed 5 practice rounds initially.

Demographics: Participants reported their gender, age, living area, income, and education. They also responded to questions on patience, '*How patient do you consider yourself?*', religiosity, *'How religious do you consider yourself?*' and hunger, '*How hungry are you?*' on *1(not at all) −5 (extremely)* scales. I included the item on attitudes toward financial risk-taking from Study 1-a. As in the previous two studies, the last question of the study was, '*Were you fasting while taking this survey?*' (Yes/No).

Sample

Participants were recruited from several Muslim Students Associations in universities in the United States during the first two weeks of Ramadan of 2018. Compensation was similar to Study 1-b (i.e., flat fee plus variable bonus based on performance). At the end of the survey, participants were asked to submit their email addresses if they were interested in participating in a follow-up study. In total, $N = 37$ fasting subjects completed the study during and after Ramadan, passing attention checks and providing valid answers. Participants were predominantly female, educated, and living in large cities. See the supplemental file for details.

As expected, subjects were also more hungry during than after Ramadan, (*Cohen's d* = −0.893 95%[−1.45, −0.336]). However, neither self-reported religiosity or patience changed from during to after Ramadan (Religiosity: *Cohen's d*= −0.156 95%[−0.626, 0.296]; Patience: *Cohen's d*= −0.443 95%CI[−0.916; 0.0336]).

Results

Participants were less risk-taking during Ramadan than after; they cashed in their points at a lower mean number of pumps ($M_{\text{Ramadan}} = 9.46$ ($SD = 5.85$) vs. $M_{\text{post-Ramadan}} = 10.95$ ($SD = 5.48$), $t(36) = 3.517$, $p = 0.0011$, *Paired Cohen's d* = 0.516, 95%CI[0.0337; 0.99], BCa CIs from 5000 resamples). As in Study 1-b, participants did not differ significantly in the number of rounds on which they chose to cash-in their point ($M_{\text{Ramadan}} = 36.8\%$ vs. $M_{\text{post-Ramadan}} = 35.8\%$, $\chi(1) < 1$, $p > 0.6$). In a linear mixed-effects model predicting the number of pumps with time (Ramadan vs. post-Ramadan), controlling for hunger, patience, age, gender, personal and parental income, religiosity, the effect of time remained significant ($b = -0.117$, 95%CI[0.21 – −0.02], $p = 0.022$) but adding these variables did not significantly improve the model fit, ($p > 0.4$).

Explicit financial risk preferences did not significantly differ between the two times, ($p > 0.3$). As in Study 1-a, over two-thirds of the sample chose '*moderate return and moderate risk*'.

Discussion

Participants were more risk-averse during Ramadan than after. Results are consistent when controlling for age, sex, income, religiosity, as well as self-reported patience and hunger. This result converges with the evidence from Studies 1-b and 1-a, that links fasting to risk-taking. A strength of this study is that it measures the same participants twice, and thus provides a more reliable test of the hypothesis (diurnal variation in risk-taking, for example, cannot account for these results). That is, the same group of people are on average more risk-averse when they are fasting.

A drawback of this study is the small sample size, resulting in the large confidence interval surrounding the effect size. There is an attrition rate of about 35%, which is significant and could filter out people systematically. Moreover, a larger sample would be needed to reliablye estimate the contribution of other variables and examine alternative explanations. Also, while BART might be a more suitable instrument to measure risk-taking in this context, it could introduce its own confound. That is, because it requires effort, when people are fasting they might simply be less engaged with the task and cash their points earlier. Moreover, risk-taking tends to vary by the domain (Dohmen et al., 2011; Weber et al., 2012). I address these issues in Study 2, which also tests the second part of the hypothesis by measuring cooperation on social dilemmas, along with measures of trust and other social preferences.

Study 2

The core proposition of this research is that planned temporary fasting is associated with increased risk-averse behavior, which in turn will be associated with increased cooperation in social dilemmas. Studies 1a–c provide preliminary evidence for the first part of this hypothesis. In the current study, I test both parts of the proposed causal chain by collecting data on both risk-taking and cooperation longitudinally (i.e., during and after Ramadan), from a relatively large sample ($N = 283$). I also refined the measurement of risk-taking by using both standardized scales as well as the BART.

Cooperation is measured using six multi-party resource dilemmas. Data was also collected on a set of additional variables including trust, social preferences as well as value orientation. Together, these indices

present an alternate path through which cooperation could be influenced during Ramadan. People might behave more cooperatively because community focus and resource sharing are prominently encouraged during Ramadan (Blackwell, 2009). This could foster a strong sense of shared identity and a notion of common fate that raises concerns for others' welfare (Durkheim, 1992; Graham and Haidt, 2010). Trust and social value orientation — the degree to which one is concerned about others' welfare— have been shown to promote cooperation on social dilemmas (Balliet et al., 2009; Bogaert et al., 2008; Messick et al., 1983; P. A. M. Van Lange et al., 2013). In essence, people becoming more prosocial in Ramadan may reflect in their explicit preferences and behavior in social dilemmas where joint outcomes are determined by individual decisions. All of the tasks are incentivized and participants receive bonuses based on their performance.

Measures

Risk-taking: Measured using three different methods.

(1) BART: Used the implementation of BART (Lejuez et al., 2002) that was used in Study 1-b and 1-c, with minor modifications. Specifically, the pump button was removed and asked participants to simply tap on the ball to pump it. Participants played 25 rounds and the maximum number of pumps was 20.
(2) Self-report scale: Participants responded to a 6-item scale that measures risk attitudes in different domains: car driving, financial matters, sports/leisure, career, and health, adapted from (Dohmen et al., 2011). Sample questions include, "*When driving a car, are you a person who takes risks or do you try to avoid taking risks as a driver?*" or, "*In your career and social life, are you a person who takes risks (for example, switching jobs mid-career, disagreeing with your boss, moving to a city far from your family, etc.)?*" Responses were collected on an 11-point scale (*Not at all* (0)- *Very much* (10)). Prior studies in large multicultural samples have found somewhat reliable associations between responses to these questions and actual risk behaviors (Dohmen et al., 2011). See the supplemental file for the complete wording of the scale.
(3) Financial risk-preferences: Participants responded to the question about explicit financial risk preferences used in Studies 1-a and 1-c.

Cooperation: In a multiparty resource dilemma task adapted from (Budescu et al., 1990b), participants demanded points from six common pools that had similar mean sizes but differed in uncertainty. All pools had the mean size of 500 points, but the uncertainty over their size increased from 0 (fixed size, 500) to 150 (425–575), 300 (350–650), 450 (275–725), 600 (200–800), 650 (125–875). They started off by reading the following instructions about a pool that had a fixed size (500) and zero uncertainty:

> *In this first task, you are randomly grouped with **4** other participants in this study. Your group is given some bonus points to share. You each privately request some of these points. You will not know how much the others are requesting and you cannot communicate with each other. There are **500 points** available. We will add up the requests from all of you. If the total is less than the number of bonus points available, then you each receive the bonus points you requested. But if the sum of requests is more than the available points, none of you gets anything. So larger requests could get you more bonus points, but you might also end up with nothing if everyone makes large requests. How many points do you request?*

After typing in their demanded number of points, they proceeded to the next dilemma:

> *Now, we don't know the exact number of points but we know it's somewhere between **425 and 575 points**. How many points do you request now? Again, your request will be added to requests by 4 other subjects. If the sum of requests is more than the number of available points, then none of you get any points. How many points do you request?*

Similar messages were provided for pools in the other ranges (350–650, 275–725, 200–800, 125–875. For complete wording of the task see the supplemental file.

Trust: In addition to a modified trust game, participants completed several other scale measuring trust: A behavioral trust scale from (Glaeser et al., 2000), (e.g., *How often do you leave your door unlocked? How often do you lend personal possessions to your friends (books, your car, bicycle, etc.)? How often do you lend money to your friends?* Responded on a scale of *Never* (1), *Rarely* (2), *Sometimes* (3), *Often* (4), *Always* (5)*),* General trust scale from ((Yamagishi, 1986), (e.g., *Most people are basically honest,* responded on a 7-point scale (*Strongly disagree* (1)—*Strongly disagree (7)*), and a single self-report item from (Falk and Hermle, 2018), '*I assume that people have only the best intentions,*' responded on an 1 (*Not at all)*−11 (*Very much*).

In the trust game, participants only assumed the role of the sender. They were given 1000 points and were told they could send points to another participant, and the sent amount would be tripled before being received. Then the receiver would decide whether to return some or any of the points back to the sender. The number of points participants sent over is a measure of their trustness. *Other measures*: Additional items measuring explicit social preferences (i.e., Positive reciprocity: *When someone does me a favor I am willing to return it.* Negative reciprocity (1): *If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.* Negative reciprocity (2): *How willing are you to punish someone who treats you unfairly, even if there may be costs for you?* Negative reciprocity (3): *How willing are you to punish someone who treats others unfairly, even if there may be costs for you?* Altruism: *How willing are you to give to good causes without expecting anything in return?*) were adapted from (Falk et al., 2018).

I also measured Social Value Orientation (SVO) (P. A. Van Lange et al., 1997), an individual difference variable that measures people's concerns about others' welfare relative to their own. SVO has been shown to influence choices in social coordination problems such as the public goods game and resources dilemma (Mill and Theelen, 2019), particularly in presence of environmental or social uncertainty (e.g., when resource size, group size, or pool replenishment rate is unknown (Kwaadsteniet et al., 2006; Roch and Samuelson, 1997; Snyder and Ickes, 1985). I used the Triple Dominance method which presents participants with three options to allocate points to themselves and other participants in the study (e.g., *Please pick the option that you prefer:* 1. 480 for me, 80 for Other 2. 540 for me, 280 for Other 3. 480 for me, 480 for Other). The three choices in a triad are categorized as either *Prosocial* or *Proself,* and the category with the higher frequency across 9 sets of triad determines a person's SVO (Balliet et al., 2009).

Lastly, I measured patience and religiosity on *0 (not at all) - 11 (very)* scales (e.g., *How patient/religious do you consider yourself?)*. Questions about Ramadan participation were asked at the end of the survey to minimize the influence of social desirability, demand effect, and other biases. Up to this point, in the first wave of data collection (e.g., during Ramadan), the participants are unaware that the study might concern Ramadan. This is important because if people wanted to present an artificially positive image of fasting in Ramadan and Islam, they would have to remember and perform worse across tasks and less prosocially after Ramadan.

Additional data was obtained about participants' country of residence and birth, sex, age, living area, income (self & parents), and education. See the supplemental file for sample details.

Sample

Recruitment processes: I ran a prescreen survey on Prolific.co three weeks before Ramadan 2020 and obtained data on participation in Ramadan from $N = 837$ self-identified Muslims. This survey included

measures of demographic variables along with questions about Ramadan participation. Subjects who indicated that they were *definitely* or *probably* going to fast in Ramadan 2020 ($n = 712$), were invited to participate in the main study. The main study was presented as a *Study on Decision Making* exclusively for these subjects, without any mention of the prescreen survey. Also, the prescreen survey was launched on Qualtrics and the main study was run on Cut, a custom platform, thus further eliminating suspicions of connections between the two surveys. As in Study 1, compensation consisted of a flat fee plus bonuses based on responses and performance. See the supplemental file for the detailed results of the prescreen survey, exclusions, and the demographics of the final sample.

Timeline: Ramadan 2020 began on Thursday evening April 23 and ended on Saturday, May 23 (according to Saudi Arabia). The first wave of data collection (during-Ramadan), began on May 10 and ended on May 22 (the last two weeks of Ramadan). The follow-up survey started two weeks later on June 10, and continued for three weeks, ending on June 29. All participants agreed to the consent form approved by the Institutional Review Board (IRB:1077–2020).

The final sample is $N = 283$ self-identified Muslims who attentively participated in both studies, evident by their correct responses to check questions. The demographics of this sample are shown in Table 1. The majority of the participants resided in the UK (55%), followed by US, Canada, France, and Italy. Pakistan, the US, and Bangladesh accounted for the majority of respondents' birthplaces, after the UK with 42%.

Results

Risk taking: As in study 1, risk-taking was generally lower during Ramadan than after:

(1) On BART, participants were more risk-averse and cashed out their points after fewer number of pumps during Ramadan than after ($t(281) = 3.4$, $p < 0.001$; *Paired Cohen's d* = 0.182 95%CI [0.0191, 0.339]; BCa from 5000 bootstrap resamples).
(2) The six items measuring risk in different domains showed acceptable reliability (α's > 0.71). Two composite scores, denoting attitudes toward risk during and after Ramadan were calculated for each participant. On this scale too, willingness to risk is lower during Ramadan than after ($t(273) = 2.9$, $p = 0.003$; *Paired Cohen's d* = 0.143 95%CI[−0.0152, 0.315]; BCa from 5000 bootstrap resamples).
(3) As in Studies 1-a and 1-c, there are no significant difference in explicit beliefs about investment risk across time ($p < 0.2$), and the majority of participants preferred '*moderate return and moderate risk*' (65% <).

For each participant, two aggregate risk-taking scores were calculated by standardizing and averaging their response on three risk measures in time 1 and time 2 ($\alpha = 0.73$). This overall risk-taking score was also significantly lower during Ramadan than after ($t(273) = 4.18$, $p < 0.0001$; *Paired Cohen's d* = 0.191 95%CI[0.0307, 0.365], BCa from 5000 bootstrap resamples). Fig. 3-A illustrates this effect.

The mean number of pumps on BART, mean scores on the risk scale, and the aggregate scores (including single item financial risk question), were entered as response variable in three mixed effects models, with Time (Ramadan, post-Ramadan), as well as age, sex, living area, income (parent & self), and education as predictors. Except for the consistent significant difference in risk-taking between Ramadan and post-Ramadan across the three models, the only other significant effect indicated that male participants took more risk overall than females (*Unpaired Cohen's d* = 0.387 95%CI[0.216, 0.559]; BCa from 5000 bootstrap resamples). See the supplemental file for details of these models, and additional analyzes.

Social dilemmas: Fig. 2 summarizes the demands from each common pool during and after Ramadan. A rise in both request sizes and their variability is evident as uncertainty about the pool size increases. Moreover, demand amounts seem more varied and have higher medians post-Ramadan than during Ramadan, both of which are consistent with the predictions laid out in the introduction.

A linear mixed effect model was fit too the demand sizes using 2 Time (Ramadan vs. post-Ramadan) X 6 Pool ($500, $425-$575, $350-$650, $275-$725, $200-$800, $125-$875) interaction term as predictors, along with age, sex, living area, income (parent & self), and education, and aggregate risk attitudes, plus random intercepts per subjects and random slopes per time and pool. Results revealed significant main effects of Time ($F(1278.30) = 10.1241$, $p = 0.0016$) and Pool ($F(5,1376.4) = 26.977$, $p < 0.0001$), as well as a two-way Time X Pool interaction ($F(5,1363.3) = 2.6016$, $p = 0.0237$). Across pools, the bootstrapped effect size for the mean difference in request size between Ramadan and post-Ramadan was *Paired Cohen's d* = 0.156 (95%CI[0.089, 0.222], BCa from 5000 bootstrap resamples). Separate estimation of effect sizes for individual pools showed that people demanded smaller shares from commons during Ramadan than after in nearly all cases (*Paired Cohen's ds*: pool with 500 points: 0.17 95%CI[0.000351, 0.336]; pool with 425–575 points: 0.176 95%CI[0.0112, 0.338], pool with 350–650 points: 0.134 95%CI[−0.03, 0.299]; pool with 275–725: 0.166 95%CI[0.000655, 0.328]; pool with 200–800 points: 0.134 95%CI[−0.0302, 0.302]; pool with 125–875 points: 0.187 95%CI[0.02, 0.354]). See Fig. 3-B.

Across time, risk-taking scores also explained significant variance in demands from commons across time ($F(1533.18) = 8.8977$, $p = 0.0029$). Specifically, a standard deviation increase in the aggregate risk score was associated with a 35 point increase in demand size ($SE = 11.7528$, $t(533.1849) = 2.983$, $p = 0.00298$). Among demographic variables, a significant main effect of sex indicated that on average, female participants demanded *more* than male participants ($F(1261.99) = 4.9187$, $p = 0.0274$; *Unpaired Cohen's d* = 0.197 95%CI[0.131; 0.266]). Higher parental income was also associated with increased demand seizure ($F(1527.59) = 4.3363$, $p = 0.0377$). See the supplemental file for detailed results.

To investigate the influence of shifts in risk-aversion on cooperation in resource dilemmas, a metric of change in risk-taking was calculated by subtracting each participant's post-Ramadan score from their Ramadan score. Assuming the post-Ramadan scores serve as a baseline risk-taking level, the difference score indicates the Ramadan-induced risk-aversion among participants. Overall, people were less risk-taking during than after Ramadan ($M = -0.11$, 95%CI[−0.16, −0.05], $t(270) = 4.201$, $p < 0.0001$, *Cohen's d* = 0.255 95%CI[0.015, .49]). This

Table 1
Sample demographics. Over 80% of respondents resided in North America and Europe.

Age	M: 27.4	SD: 7.5	Min: 18	Max: 52			
Sex	F: 144	M: 139					
Living area	Rural	Suburban	Small city (< 1 million)		Large city (> 1 million)		
	4	53	109		119		
Income	<$1000	$1K-$2K	$2K-$3K	$3K-$4K	$4K-$5K	$5k-$6K	$6 K <
- Self	108	97	40	21	10	3	4
- Parents	64	94	54	37	12	3	19
Education	Some school	High school graduate	Some college	College graduate	Graduate	Masters	Doctorate
	5	36	41	109	31	50	11

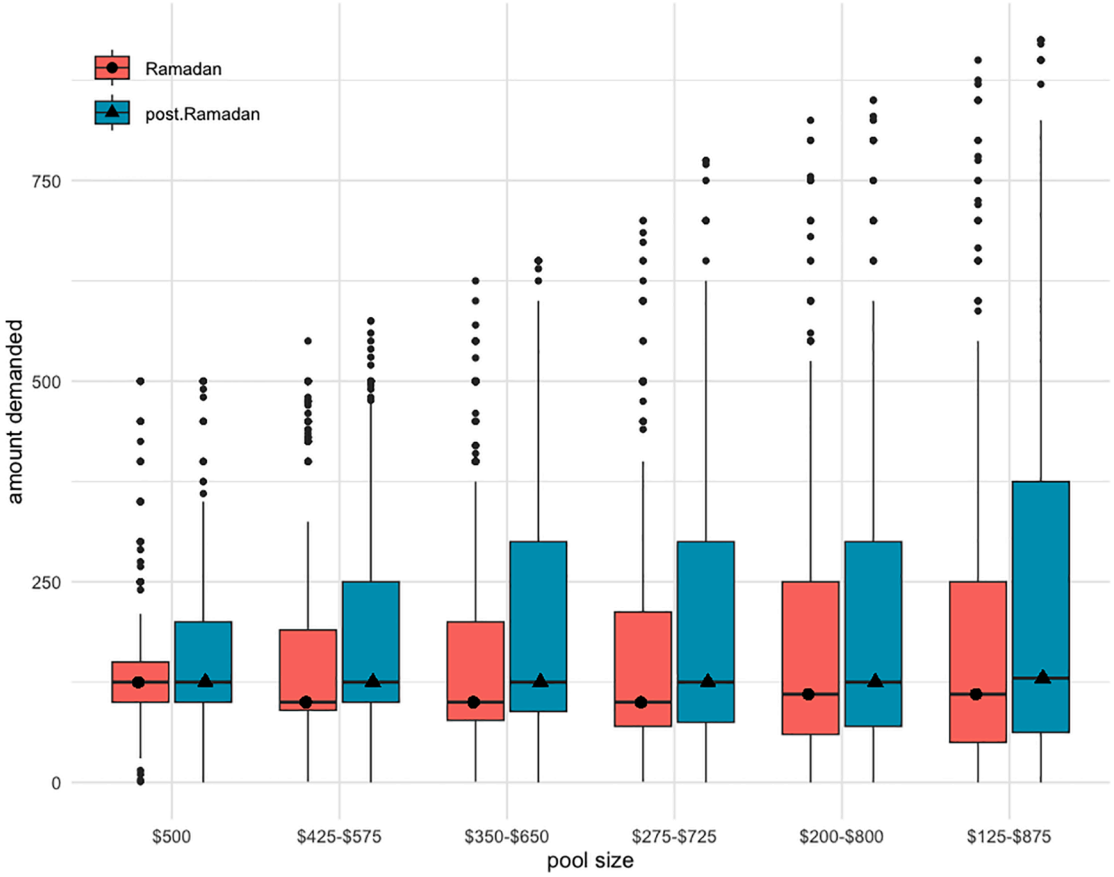


Fig. 2. Depicted are boxplots of amounts demanded in the six multiparty resource dilemmas during ($M = 148$) and after Ramadan ($M = 179$). Across pools, request sizes were significantly larger after Ramadan than during (M_{diff}=30.5, $t(279)$=3.882, $p = 0.0001$). Pool size uncertainty also increased request sizes (Pool size \$500: $M = 130$; \$425-\$575: $M = 155$; \$350-\$650: $M = 161$; \$275-\$725: $M = 165$; \$200-\$800: $M = 178$, \$125-\$875: $M = 192$).

metric was then used as a moderator of the Time X Pool interaction term in a mixed effect model predicting demands from common pools, controlling for demographic variables. Results showed that the Time X Pool interaction was significantly moderated by changes in risk-aversion ($F(5,1340) = 2.412$, $p = 0.0345$). Marginal means were estimated from this model for mean levels of risk-aversion as well as Mean +/- 1SD. Mean demand size was significantly smaller during Ramadan than after at high levels of increased risk-aversion ($M + 1SD$: $M_{diff} = 37.6$, $SE = 10.89$, $t(268) = 3.454$, $p = 0.0006$), as well as mean levels ($M_{diff} = 28.7$, $SE = 7.64$, $t(268)3.760$, $p = 0.0002$). In contrast, at lower levels of or decreases in risk-aversion, mean demand sizes did not significantly differ across time (M-1SD: $M_{diff} = 19.8$, $SE = 710.86$, $t(268) = 1.8282$, $p = 0.0687$). Fig. 3 depicts this result.

Two alternative explanations for greater cooperation during Ramadan than after were tested. People's willingness to trust may increase in Ramadan (Campante and Yanagizawa-Drott, 2015), and in turn promote their prosociality and cooperation. On different measures, however, trust scores varied little across surveys. In the trust game, participants sent comparable amounts during and after Ramadan ($M_{diff} = 18.5$, $t(282) = 1.127$, $p = 0.2605$). Neither did the single-item trust measure or the mean scores on the General Trust scale differ significantly across time (p's > 0.07). In the three behavioral trust items, willingness to *lend personal possessions to your friends (books, your car, bicycle, etc.)* was statisticaly lower after than during Ramadan (*Paired Cohen's d's* $= -0.188$ 95%CI[−0.356; −0.022], BCa 5000 bootstrap resamples), but not *lending money to friends* and *leaving the door unlocked* (p's > 0.2).

An alternate explanation holds that people might behave more cooperatively on social dilemmas during Ramadan than after because the collective religious ritual brings focus to the community and fosters prosocial behavior. However, when examining self-reported social preference items, none of the three negative reciprocity items (i.e., willingness to punish or seek revenge for unfair behaviors towards self and others) differed significantly across time (*Paired Cohen's d's* < 0.15 95%CI[−0.0134; 0.32]). Neither did willingness to return favors (i.e., positive reciprocity) or to contribute to good causes (i.e., altruism) significantly differ between Ramadan and after (*Paired Cohen's d's* > -0.11 95%CI[−0.278; 0.0544]).

Looking at repeated measures correlations (i.e., within participant variance partialed out, (Bakdash and Marusich, 2017), while the behavioral trust measures tended to correlate, none were significantly associated with amounts requested from common pools in social resource dilemmas. The mean requests however, were associated with risk-taking, positive reciprocity, and altruism. Fig. 4 presents significant correlations among mean request sizes across common pools, aggregate risk-taking scores, along with different measures of trust, social preferences, religiosity, and patience. Risk-taking was related to lending money and leaving the door unlocked (measure of trust), as well as punishing unjust behaviors toward self and others. Negative reciprocity items were highly consistent and associated with both religiosity and positive reciprocity. Lastly, positive reciprocity was related to altruism and lending money to friends. The supplemental file contains the full correlation tables.

With the Social Value Orientations (SVO) data, participants with over four non-prosocial choices in the nine triads were categorized as *Proself* and the rest as *Prosocial*. The majority of respondents were prosocial (78% vs. 22%) and this was relatively consistent across time (McNemar test $p > 0.245$). A mixed effects model was fit to mean requested points from

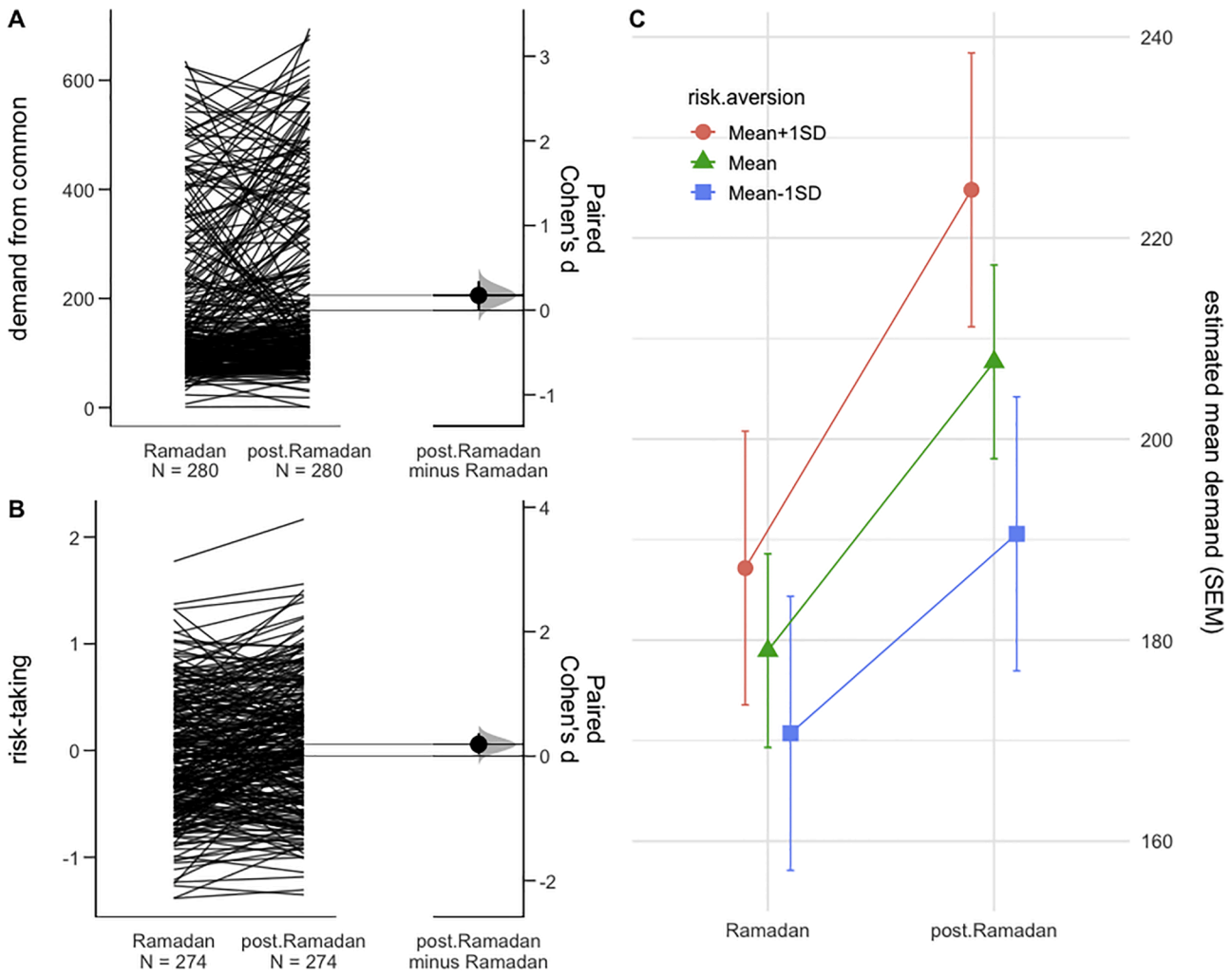


Fig. 3. **Panel A** shows the estimated effect size for change in mean demand from common pools across time, from 5000 bootstrap resamples. Demand sizes were significantly smaller during than after Ramadan. **Panel B** shows a similar bootstrapped effect size for aggregate risk-taking scores (standardized) People were more risk-averse during than after Ramadan. **Panel C** shows mean request sizes during and after Ramadan split by risk-aversion profiles.

commons, with SVO profile (Proself vs. Prosocial) X Time (Ramadan vs. post-Ramadan) as predictor, controlling for demographics variables of sex, age, income (parental & self), living areas, and education, along with random intercepts per participant. The two-way interaction was not significant ($p > 0.11$). Nevertheless, a significant main effect of SVO category ($F(1510.41) = 5.1879$, $p = 0.0231$) indicated that Prosocial participants made smaller requests from common pools than Proself participants in both during Ramadan and after (*Unpaired Cohen's d's* during:−0.306 95% CI[−0.65; 0.0169]; after:−0.409 95%CI[−0.762; −0.0717]; bootstrapped effect sizes from $n = 222$ participants with consistent SVO profiles only). Exploratory analyzes showed that estimated demand sizes from the mixed effect model showed that during Ramadan did not significantly differ between Prosocial and Proself SVOs ($M_{diff} = 15.3$, $SE = 16.8$, $t(449) = 0.907$, $p = 0.3649$). After Ramadan, however, Proself participants made significantly larger demands than Prosocial participants ($M_{diff} = 45.4$, $SE = 16.0$, $t(447) = 2.830$, $p = 0.0049$). Still, given the lack of significant two-way interaction ($F(1311.47) = 2.4851$), this result should be interpreted with caution. Sensitivity analysis indicates that $n = 280$ gives 90% power to detect a mixed interaction effect sized about $\eta^2_{partial} = 0.01$ at $\alpha = 0.05$.

Lastly, these results are robust to individual differences in patience and religiosity, neither of which significantly differed across time ($Fs < 1$, p's > 0.3), nor correlated with variables other than those shown in Fig. 4.

Discussion

In a repeated measures design and multiple methods of assessing risk-taking, participants tend to be less open to risk during Ramadan than after. People are also more cooperative during Ramadan; they make smaller requests from common pools during Ramadan than after. Moreover, the difference in size of demands from commons is associated with the differences in risk-taking across the two surveys. Results are robust to a variety of demographic factors, and effect sizes and confidence intervals are obtained from non-parametric assumption-free bootstrapping methods (Ho, 2020). Still, their accuracy and validity in quantifying the theoretical constructs can undoubtedly be improved. Study 1a-c likely overestimated the effect sizes— the true effects are probably closer to the ones found here given the larger sample size.

Ruling out counter explanations strengthens the argument that religiously inspired collective deprivation increases cooperation under uncertainty via its negative effect on openness to risk-taking. Neither trust, social preference or orientation provide sufficient evidence to offer a viable alternative account. Nevertheless, these parameters were measured using self-report scales and with little incentive for the participants to be truthful, they are quite noisy. In contrast, the social resource dilemma task and the interactive BART were both incentivized. Social value orientation, an individual difference variable that denotes care for welfare of others, explained significant variance in demand from

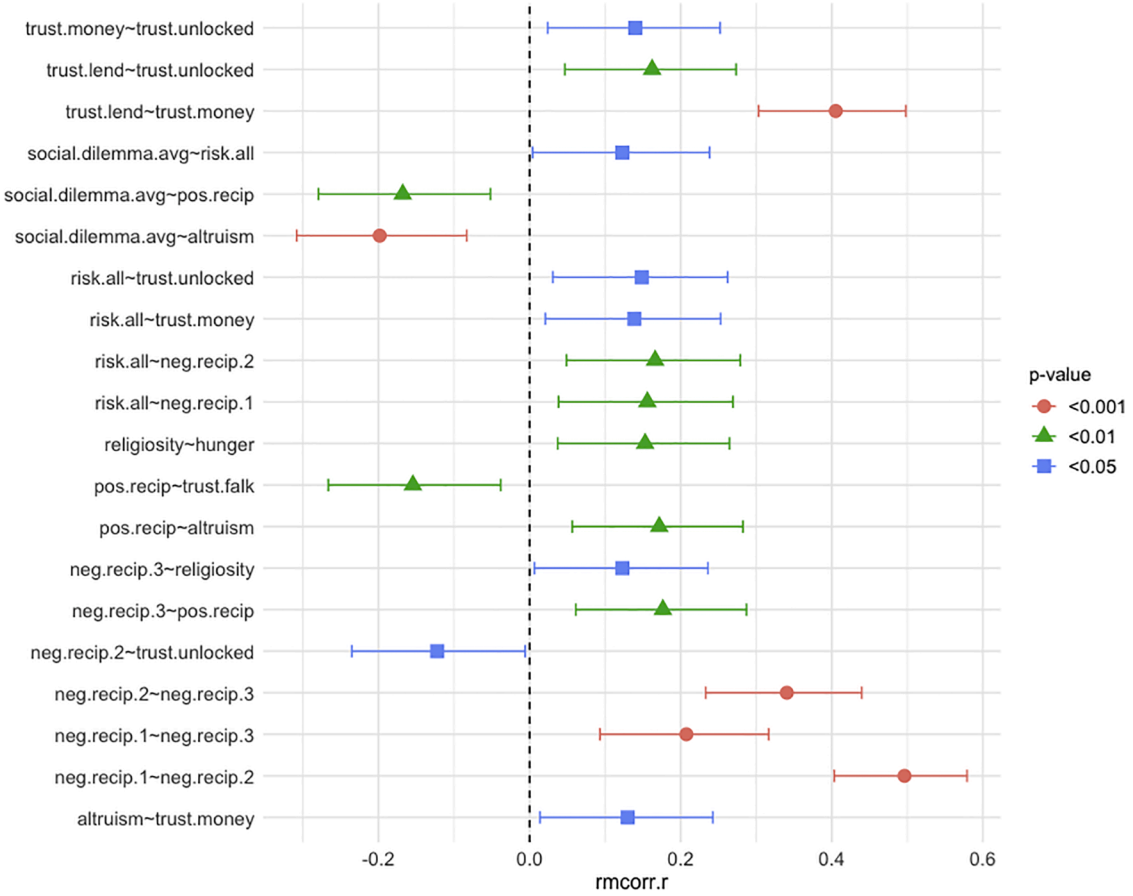


Fig. 4. Significant repeated measures correlations (*r*) of mean demand from common pools, aggregate risk-taking scores (*risk.all*), three negative reciprocity items (neg.recip.1: *If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.;* neg.recip.2: *How willing are you to punish someone who treats you unfairly, even if there may be costs for you?;* neg.recip.3: *How willing are you to punish someone who treats others unfairly, even if there may be costs for you?*), positive reciprocity (pos.recip: *When someone does me a favor I am willing to return it.*), altruism (*How willing are you to give to good causes without expecting anything in return?)*, along with self-report and behavioral measure of trust (trust.unlock: *How often do you leave your door unlocked?*; trust.money: *How often do you lend money to your friends?*; trust.lend: *How often do you lend personal possessions to your friends (books, your car, bicycle, etc.)?*), religiosity, patience, and hunger.

commons, consistent with prior research (Balliet et al., 2009; Kwaadsteniet et al., 2006). However, it did not significantly influence changes in cooperation rates across time, as opposed to increased risk-aversion. This study also had an attrition rate of about 30%, which is inline with study 1-c—this is a substantial fraction that could be systematically excluding participants. Further, although there is no clear reason why people say they fast in prescreens but not in reality, there is no significant effect of hunger across analyzes. Nonetheless, these shortcomings need to be addressed in future research.

General discussion

Self-deprivation practices and beliefs are peculiar cross-cultural phenomena. Whether observed at the individual or collective level, they raise intriguing questions about their origins, workings, and functions. Why do people collectively and willingly deprive themselves of food or other necessities for extended periods of time? What might drive people to act and live as if resources essential to their survival are unavailable? Could it be construed as a simulation of poverty to raise awareness and mutual aid, an exercise to develop willpower and virtue, or a drill to prepare for future ecological scarcity? Answers to these questions and related ones may lie at the intersection of intuitive lay psychology, social and biological needs, along with ecological constraints. After all, in humans, '*food not only nourishes but also signifies*' (Fischler, 1988).

This research investigated one possible explanation for such practices, hypothesizing that planned, temporary, and voluntary fasting likely entails cognitive and behavioral adaptations that facilitate the experience for the participants while enabling them to pursue their concurrent goals. Imagine a person whose only source of food is inside a fridge that remains locked for a certain number of hours. Setting aside the question of how they ended up in this situation, knowing that food is out of reach for a foreseeable future is bound to affect their thinking and actions. They must plan and budget their energy levels accordingly to avoid starvation before the fridge door unlocks; they may also employ tactics and tools such as distraction to cope with the situation and carry out their other tasks.[2] They are likely to apply a more conservative and stringent feasibility constraint to their decisions. They probably will not attempt breaking their pushup record, or mastering new statistical techniques is unlikely on their priority list. Instead, they may engage in casual routine and non-demanding activities lest they deplete their energy reserves, and perhaps plan for what they will do after eating. Even so, this does not mean they cannot complete their normal tasks. Rather, in response to their time-restricted access to food, they tend to set goals that seem more practical and attainable. Essentially, a person under these conditions is *avoiding the threat of hunger while anticipating the reward of food*. One way to adapt to this state is to reign in one's ambitions, avoid taking major risks, and behave in a more deliberative, restrained, and at times lax manner.

[2] They may experience opposing pressures given they must both think and not think about food.

I hypothesized that temporarily fasting individuals tend to adhere to a risk-averse regime, favoring modest yet certain rewards over large but uncertain ones. This study provides empirical evidence for this link, finding significant reductions across different measures of risk-taking as a function of people's fasting states. A key underlying assumption, however, is that risk-aversion has a domain-general component which fluctuates systematically across situations and lifespans along other dimensions (Frey et al., 2017; G. F. Loewenstein et al., 2001; Mata et al., 2018). While this assumption is not directly tested here, the pattern of associations between risk-taking scores and other variables provides some insight. In Study 2, for example, measures of risk-taking correlate with punishment of unjust behaviors or leaving one's door unlocked, suggesting that the risk metric could reliably capture a tendency toward high variance outcomes. Its correlation with size of demands from commons further illustrates the construct validity of the risk measure, while lending support to the second part of the hypothesis.

A consistent lower demand from common pools during Ramadan than after suggests that collective self-deprivation rituals may play a role in cooperative behavior under uncertainty. Across time, increased uncertainty about the pool size resulted in larger requests from commons. Although people had no reason to bias their responses in one direction over another, they typically overestimated the size of the pool as uncertainty grew. Meanwhile, anticipating others to do the same, they could have adjusted and curtailed their requests to allay the risk of receiving no points altogether. Such response biasing should be more common the more risk-averse people are, and this is what the results show. Although this risk-request association may partly arise from the way this specific task is designed, it is also consistent with other literature that finds greater cooperation with aversion to risk (Budescu et al., 1990; Cárdenas et al., 2017; Parks, 2004; Raub and Snijders, 1997; Suleiman and Rapoport, 1988; Van Assen and Snijders, 2004). Indirect measures of risk-aversion also find it to reliably correlate with support for redistributive policies (Alesina and La Ferrara, 2005), but this link is likely more complex and context specific (Au et al., 2012; Flache, 2001; Parks, 2004).

Bringing the two results together, a greater decline in risk-aversion from Ramadan to after is associated with a significant rise in share requests from common pools. In other words, Ramadan altered people's willingness to take risks, leading them to demand smaller shares from commons with uncertain size, where individual private decisions determined joint outcomes. This set of relations lends itself to speculation about the functions of mass self-deprivation rituals. Group practices involving large-scale transformations in daily routines and consumption may have emerged as a means of addressing collective action problems in several ways. They could directly impact dietary intake, consistent with evidence that finds declines in daily caloric consumption during Ramadan by roughly equivalent to one meal a day (Schofield et al., n.d.). Moreover, under uncertainty and looming scarcity, the commons could rapidly deplete from selfish behavior, hoarding of resources, and expecting others to follow suit. This dynamic could be alleviated by collective deprivation rituals combined with a religious mandate, where everyone is required to follow strict consumption protocols, and perhaps believe they are monitored by others or overseen by the supernatural. Nonetheless, these findings demonstrate that reduced selfish behavior over commons can be explained in part by increased risk-aversion, and not through promotion of trust and binding morals values, reputational and affiliative motives, or shifting social preferences. It is also less likely that during Ramadan, people are simply nicer and more prosocial and that somehow induces them to also be more risk-averse.

Still, these results do not preclude Ramadan fasting from fulfilling the classical group ritual functions such as reifying group identity, costly signaling, and promoting other-regarding preferences (Atran and Henrich, 2010; Durkheim, 1915; Irons, 2001; Watson-Jones and Legare, 2016). In fact, a core function of Ramadan fasting is presumably experiencing what the poor and deprived experience daily. In this sense, it prominently illustrates a temporary reorganization of large swaths of humanity into a semblance of *communitas*, an unstructured community where people's experiences are leveled and rigid social hierarchies are flattened (Hobson et al., 2017; Turner, 2011). In addition, the temporary suffering and pain caused by practicing self-deprivation could foster gratitude for one's own circumstance, raise conscientiousness, and motivate prosocial behavior (Aarøe and Petersen, 2013; Oishi and Cha, 2023; Olivola and Shafir, 2013). Previous research also finds rituals to improve self-control and performance, or alleviate grief and anxiety (Hobson et al., 2017; Tian et al., 2018). This study extends this literature by shedding light on a novel cognitive pathway to social functions of rituals, namely, one that invites taking a break from the ordinary way of life, a general 'slowing down' that promotes reflection, moderation, and self-inhibition.

This research also raises questions about how rituals are typically defined and studied. Rituals are commonly defined as, 'a predefined sequence of symbolic actions often characterized by formality and repetition that lacks direct instrumental purpose.' (Brooks et al., 2016). But some rituals do have a direct instrumental purpose. Even though they may appear arbitrary at first glance, collective self-deprivation rituals such as the Ramadan fast, for example, clearly affect people's cognitive and behavioral profile in a direct manner (Balkaya-Ince et al., 2023; Purzycki and Sosis, 2022; Rad, 2023b; Rad et al., 2022; Rad and Ginges, 2017). Moreover, while a series of acts and gestures may lack direct instrumental purpose if considered as a single instance in isolation, their repetition by a community over time transforms them into markers of group norms. They could then serve functions such as signifying affiliation, shaping expectations, and reducing prediction errors. In other words, the instrumental functions of many rituals may lie in members of a cultural unit carrying out tasks in a distinctive way that sets them apart from others, rather than performing completely different tasks. However, research into the psychology and anthropology of rituals sometimes focuses on behaviors that are extreme and atypical, such as fire walking or mutilation of body parts (Shweder, 2000; Xygalatas et al., 2013), or somewhat conflated with superstition (Damisch et al., 2010; Zhang et al., 2014). Then again, some of the most prominent and common rituals revolve around *doing ordinary things differently, rather than doing extraordinary things.* They are integrated in people's way of life in the everyday sense, beyond the proverbial image of colorfully dressed groups adorned in makeup performing a coordinated dance and the like. The Passover dinner is an ordinary dinner, but prepared and consumed according to a protocol, just as Ramadan fasting is about altering ordinary food habits. Another example is Wudu, a purification ritual in Islam that requires washing the face and cleansing specific parts of the body in a certain order without a break. Washing one's body is something everyone does, but in this case, it is done in a series of steps and in preparation for prayer. In this rendition, rituals are akin to cultural scripts performed during everyday tasks, integrated in the way of life of sociocultural units, serving to not only maintain their cohesiveness and distinguish them from others, but also directly encouraging certain behaviors.

Ramadan offers an opportunity to examine these and other functions of rituals while minimizing the potential of placebo or demand effects. It is also a unique setting to gain insights into the causal interplay of broader cultural, cognitive, and behavioral phenomena beyond the context of Ramadan. For example, Aksoy and Gambetta (2022) used the shift in duration of Ramadan fast over latitude and time to examine an interesting puzzle (Iannaccone, 1994): Why religious organizations thrive, despite incurring high costs of practice on their following? They demonstrate that a half-hour increase in duration of the fast led to significant increases in religious practice participation rates and the share of votes for Islamist parties in Turkey's parliamentary elections. The underlying mechanism, they find, does not involve weeding out the weakly religious but rather increasing their religiosity. This study also fits well with the current results: That people become more conservative and risk-averse the longer and harsher the fast, and come to rely more on traditional sources of ideological closure. Other researchers have also

utilized the variability in Ramadan fast's length and time to investigate how mass rituals affect economic output, with positive effects on subjective well-being and negative effects on productivity (Campante and Yanagizawa-Drott, 2015; Schofield et al., n.d.).

These findings suggest other implications and related lines of future work. First, with respect to fasting during Ramadan specifically, they suggest that ideologically motivated collective deprivation may share similar outcomes to externally imposed deprivation. This raises a number of interesting questions. When it comes to poverty, it suggests that phenomena like risk avoidance, which might indeed perpetuate individual poverty in capitalist marketplaces, might also serve to adapt to scarcity. Future research could investigate, for example, whether risk avoidance in the face of poverty and involuntary scarcity also increases communal cooperation. Second, these findings raise the possibility that other widespread collective rituals have rational functions beyond social signaling. Religious fasting is not confined to Islam; and it seems more pervasive and severe in places with harsher climates (Dirks et al., 1980), and in societies with 'tight' cultures where social norms are more clearly defined and imposed (Gelfand et al., 2011). Incorporating evolutionary, cognitive, and anthropological arguments, this study illustrates a holistic approach in cognitive science religion (Purzycki and Sosis, 2022), illustrating how religion can be understood as an adaptive cultural system that responds to socio-ecological challenges as well as costly threats to cooperation and reproduction.

Still, more work is needed to determine how culturally specific the present findings are. It is also unclear if other forms of collective deprivation - such as temporary restrictions on the types of foods one might eat, may yield similar effects despite the lack of hunger in such practices. More research is also needed to determine whether secular forms of temporary deprivation, as well as those in other religions produce similar effects. Study designs that examine subjects throughout their fasting day or employ physiological methods to quantify their state could be particularly informative. It would also be valuable to examine how fasting impacts changes in the stress hormone cortisol levels and thereby influences risk-taking and temporal discounting (Bahijri et al., 2013; Cahlíková and Cingl, 2017; Kandasamy et al., 2014; Mather et al., 2009). I focused on Ramadan, arguably the most pervasive form of collective deprivation practice in the world today (*The World's Muslims: Unity and Diversity*, 2012), which offers an opportunity to investigate the broader economic and social impact of costly religious practices across political context and cultural groups. I do not suggest Ramadan has simple direct effects on social and economic life. Nevertheless, it seems that apparently counterintuitive practices like Ramadan may serve positive social outcomes that go beyond signaling and identity functions.

Funding

This publication is based on research supported by the Templeton World Charity Foundation, Inc. (funder DOI 501100011730) under the grant https://doi.org/10.54224/30295 awarded to Mostafa Salari Rad.

Also, this research was funded by grants to Jeremy Ginges from the Templeton Religion Trust (TRT0189) and the NSF (SES-1949467).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cresp.2023.100152.

References

Aarøe, L., Petersen, M.B., 2013. Hunger games: fluctuations in blood glucose levels influence support for social welfare. Psychol. Sci. 24 (12), 2550–2556.
Aksoy, O., Gambetta, D., 2022. Commitment through sacrifice: how longer Ramadan fasting strengthens religiosity and political Islam. Am. Sociol. Rev. 87 (4), 555–583.
Alesina, A., La Ferrara, E., 2005. Preferences for redistribution in the land of opportunities. J. Public Econ. 89 (5), 897–931.
Amir, D., Jordan, M.R., Rand, D.G., 2018. An uncertainty management perspective on long-run impacts of adversity: the influence of childhood socioeconomic status on risk, time, and social preferences. J. Exp. Soc. Psychol. 79, 217–226.
Amir, D., Jordan, M.R., McAuliffe, K., Valeggia, C.R., Sugiyama, L.S., Bribiescas, R.G., Snodgrass, J.J., Dunham, Y., 2020. The developmental origins of risk and time preferences across diverse societies. J. Exp. Psychol. Gen. 149 (4), 650–661.
Arbesmann, R., 1951. Fasting and prophecy in Pagan and Christian antiquity. Traditio 7, 1–71.
Asad, M., 1954. The Road to Mecca. The Book Foundation.
Atran, S., Henrich, J., 2010. The evolution of religion: how cognitive by-products, adaptive learning heuristics, ritual displays, and group competition generate deep commitments to prosocial religions. Biol. Theory 5 (1), 18–30.
Au, W.T., Lu, S., Leung, H., Yam, P., Fung, J.M.Y., 2012. Risk and prisoner's dilemma: a reinterpretation of Coombs' re-parameterization. J. Behav. Decis. Mak. 25 (5), 476–490.
Bahijri, S., Borai, A., Ajabnoor, G., Abdul Khaliq, A., AlQassas, I., Al-Shehri, D., Chrousos, G., 2013. Relative metabolic stability, but disrupted circadian cortisol secretion during the fasting month of Ramadan. PLoS ONE 8 (4), e60917.
Bakdash, J.Z., Marusich, L.R., 2017. Repeated measures correlation. Front. Psychol. 8, 456.
Balkaya-Ince, M., Tahseen, M., Umarji, O., Schnitker, S.A., 2023. Does Ramadan serve as a naturalistic intervention to promote Muslim American adolescents' daily virtues? Evidence from a three wave experience sampling study. J. Posit. Psychol. 1–16.
Balliet, D., Parks, C., Joireman, J., 2009. Social value orientation and cooperation in social dilemmas: a meta-analysis. Group Processes Intergr. Relat.: GPIR 12 (4), 533–547.
Bartke, S., Schwarze, R., 2008. Risk-Averse by Nation or by Religion?: Some Insights on the Determinants of Individual Risk Attitudes. DIW Berlin, The German Socio-Economic Panel (SOEP) (No. 131). https://ideas.repec.org/p/diw/diwsop/diw_sp131.html.
Bartra, O., McGuire, J.T., Kable, J.W., 2013. The valuation system: a coordinate-based meta-analysis of BOLD fMRI experiments examining neural correlates of subjective value. Neuroimage 76, 412–427.
Bell, J., Lugo, L., 2012. The World's Muslims: Unity and Diversity. Pew Forum, Washington, DC.
Ben Zur, H., Breznitz, S.J., 1981. The effect of time pressure on risky choice behavior. Acta Psychol (Amst) 47 (2), 89–104.
Berkman, E.T., 2016. Self-regulation training. Handbook of Self-Regulation: Research, Theory, and Applications, pp. 440–457.
Bevan, A., Colledge, S., Fuller, D., Fyfe, R., Shennan, S., Stevens, C., 2017. Holocene fluctuations in human population demonstrate repeated links to food production and climate. Proc. Natl. Acad. Sci. U.S.A. 114 (49), E10524–E10531.
Biel, A., Gärling, T., 1995. The role of uncertainty in resource dilemmas. J. Environ. Psychol. 15 (3), 221–233.
Blackwell, A.H., 2009. Ramadan. Infobase Publishing.
Blais, A.-R., & Weber, E.U. (2006). *A domain-specific risk-taking (DOSPERT) scale for adult populations*. https://papers.ssrn.com/abstract=1301089.
Bogaert, S., Boone, C., Declerck, C., 2008. Social value orientation and cooperation in social dilemmas: a review and conceptual model. Br. J. Soc. Psychol. 47 (3), 453–480. https://doi.org/10.1348/014466607X244970.
Briers, B., Pandelaere, M., Dewitte, S., Warlop, L., 2006. Hungry for money: the desire for caloric resources increases the desire for financial resources and vice versa. Psychol. Sci. 17 (11), 939–943.
Brooks, A.W., Schroeder, J., Risen, J.L., Gino, F., Galinsky, A.D., Norton, M.I., Schweitzer, M.E., 2016. Don't stop believing: rituals improve performance by decreasing anxiety. Organ. Behav. Hum. Decis. Process. 137, 71–85.
Brown, L.K., Mussell, K., 1984. Ethnic and Regional Foodways in the United States: The Performance of Group Identity. University of Tennessee Press.
Budescu, D.V., Rapoport, A., Suleiman, R., 1990. Resource dilemmas with environmental uncertainty and asymmetric players. Eur. J. Soc. Psychol. 20 (6), 475–487.
Cárdenas, J.-C., Janssen, M.A., Ale, M., Bastakoti, R., Bernal, A., Chalermphol, J., Gong, Y., Shin, H., Shivakoti, G., Wang, Y., Anderies, J.M., 2017. Fragility of the provision of local public goods to private and collective risks. Proc. Natl. Acad. Sci. U.S.A. 114 (5), 921–925.
Cahlíková, J., Cingl, L., 2017. Risk preferences under acute stress. Experiment. Econ. 20 (1), 209–236.
Camp, C., Brown, L.K., Mussell, K., 1986. Ethnic and regional foodways in the United States: the performance of group identity. West Folk 45 (3), 229. https://doi.org/10.2307/1499441.
Campante, F., Yanagizawa-Drott, D., 2015. Does religion affect economic growth and happiness? Evidence from Ramadan. Q. J. Econ. 130 (2), 615–658.

Carrasco, D., 2006. The Oxford Encyclopedia of Mesoamerican Cultures. Oxford University Press.
Chawla, N. (1992). *Mother Teresa*. https://ixtheo.de/Record/1107678269.
Cook, D., 2015. Mysticism in Sufi Islam. Oxford Res. Encyclopedia Relig. https://doi.org/10.1093/acrefore/9780199340378.001.0001/acrefore-9780199340378-e-51.
Crone, E.A., van Duijvenvoorde, A.C.K., Peper, J.S., 2016. Annual research review: neural contributions to risk-taking in adolescence–developmental changes and individual differences. J. Child Psychol. Psychiatry 57 (3), 353–368.
Damisch, L., Stoberock, B., Mussweiler, T., 2010. Keep your fingers crossed!: how superstition improves performance. Psychol. Sci. 21 (7), 1014–1020.
Deezia, B.S., 2017. Asceticism: a match towards the absolute. IAFOR J. Ethics Relig. Philos. 3 (2) https://doi.org/10.22492/ijerp.3.2.06.
Defoe, I.N., Dubas, J.S., Figner, B., van Aken, M.A.G., 2015. A meta-analysis on age differences in risky decision making: adolescents versus children and adults. Psychol. Bull. 141 (1), 48–84.
Dirks, R., Armelagos, G.J., Bishop, C.A., Brady, I.A., Brun, T., Copans, J., Doherty, V.S., Fraňková, S., Greene, L.S., Jelliffe, D.B., Kayongo-Male, D., Paque, C., Schusky, E.L., Thomas, R.B., Turton, D., 1980. Social responses during severe food shortages and famine [and comments and reply]. Curr. Anthropol. 21 (1), 21–44.
Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., Wagner, G.G., 2011. Individual risk attitudes: measurement, determinants, and behavioral consequences. J. Eur. Econ. Assoc. 9 (3), 522–550.
Durkheim, E., 1915. The Elementary Forms of the Religious Life, trans. Swain JW. Free Press, New York.
Durkheim, E., 1992. The Elementary Form of Religious Life. Free Press, New York.
Essen, J., 2009. Buddhist economics. Handbook of Economics and Ethics. Edward Elgar Publishing.
Falk, A., Hermle, J., 2018. Relationship of gender differences in preferences to economic development and gender equality. Science 362 (6412). https://doi.org/10.1126/science.aas9899.
Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., Sunde, U., 2018. Global evidence on economic preferences. Q. J. Econ. 133 (4), 1645–1692.
Fang, M., Li, H., Wang, Q., 2021. Risk tolerance and household wealth–evidence from Chinese households. Econ. Model. 94, 885–895.
Fehr, E., Götte, L., 2007. Do workers work more if wages are high? Evidence from a randomized field experiment. Am. Econ. Rev. 97 (1), 298–317.
Figner, B., Weber, E.U., 2011. Who takes risks when and why?: determinants of risk taking. Curr. Dir. Psychol. Sci 20 (4), 211–216.
Figner, B., Mackinlay, R.J., Wilkening, F., Weber, E.U., 2009. Affective and deliberative processes in risky choice: age differences in risk taking in the Columbia card task. J. Exp. Psychol. Learn. Mem. Cogn. 35 (3), 709–730.
Finn, R.D., 2009. Asceticism in the Graeco-Roman World. Cambridge University Press.
Fischler, C., 1988. Food, self and identity. Soc. Sci. Inf. (Paris) 27 (2), 275–292.
Fitouchi, L., André, J.-B., Baumard, N., 2022. Moral disciplining: the cognitive and evolutionary foundations of puritanical morality. Behav. Brain Sci. 1–71.
Flache, A., 2001. Individual risk preferences and collective outcomes in the evolution of exchange networks. Rational. Soc. 13 (3), 304–348.
Frey, R., Pedroni, A., Mata, R., Rieskamp, J., Hertwig, R., 2017. Risk preference shares the psychometric structure of major psychological traits. Sci. Adv. 3 (10), e1701381.
Frey, R., Duncan, S.M., Weber, E.U., 2023. Towards a typology of risk preference: four risk profiles describe two-thirds of individuals in a large sample of the U.S. population. J. Risk Uncertain. 66 (1), 1–17.
Gelfand, M.J., Raver, J.L., Nishii, L., Leslie, L.M., Lun, J., Lim, B.C., Duan, L., Almaliach, A., Ang, S., Arnadottir, J., Aycan, Z., Boehnke, K., Boski, P., Cabecinhas, R., Chan, D., Chhokar, J., D'Amato, A., Ferrer, M., Fischlmayr, I.C., Yamaguchi, S., 2011. Differences between tight and loose cultures: a 33-nation study. Science 332 (6033), 1100–1104.
Glöckner, A., Hilbig, B.E., 2012. Risk is relative: risk aversion yields cooperation rather than defection in cooperation-friendly environments. Psychon. Bull. Rev. 19 (3), 546–553.
Glaeser, E.L., Laibson, D.I., Scheinkman, J.A., Soutter, C.L., 2000. Measuring trust*. Q. J. Econ. 115 (3), 811–846. https://doi.org/10.1162/003355300554926.
Gloede, O., Menkhoff, L., Waibel, H., 2015. Shocks, individual risk attitude, and vulnerability to poverty among rural households in Thailand and Vietnam. World Dev. 71, 54–78.
Glucklich, A., 2001. Sacred Pain: Hurting the Body for the Sake of the Soul. Oxford University Press.
Goldshmidt, J.N. (1997). *Risk-taking and Resource scarcity: An integrative Approach to Foraging Problems* (E. J. Fantino (ed.)) University of California, San Diego. https://login.libproxy.newschool.edu/login?url=https://www.proquest.com/dissertations-theses/risk-taking-resource-scarcity-integrative/docview/304358276/se-2.
Graham, J., Haidt, J., 2010. Beyond beliefs: religions bind individuals into moral communities. Personal. Social Psychol. Rev.: An Official Journal of the Society for Personality and Social Psychology, Inc 14 (1), 140–150.
Grimm, V., 2002. From Feasting to Fasting: the Evolution of a Sin. Routledge.
Griskevicius, V., Tybur, J.M., Ackerman, J.M., Delton, A.W., Robertson, T.E., White, A.E., 2012. The financial consequences of too many men: sex ratio effects on saving, borrowing, and spending. J. Pers. Soc. Psychol. 102 (1), 69–80.
Guiso, L., Paiella, M., 2008. Risk Aversion, Wealth, and Background Risk. J. Eur. Econ. Assoc. 6 (6), 1109–1150. https://doi.org/10.1162/jeea.2008.6.6.1109.
Guiso, L., Sapienza, P., Zingales, L., 2013. *Time varying risk aversion* (No. 19284). Nat. Bureau Econ. Res. https://doi.org/10.3386/w19284.
Halstead, P., O'Shea, J, 2004. Bad Year Economics: Cultural Responses to Risk and Uncertainty. Cambridge University Press.
Hardeweg, B., Menkhoff, L., Waibel, H., 2013. Experimentally validated survey evidence on individual risk attitudes in rural Thailand. Econ. Dev. Cult. Change 61 (4), 859–888.
Harris, M., Ross, E.B., 1987. Food and Evolution: Toward a Theory of Human Food Habits. Temple University Press.
Harris, M., 1987. The Sacred Cow and the Abominable Pig: Riddles of Food and Culture. Simon and Schuster.
Haushofer, J., Fehr, E., 2014. On the psychology of poverty. Science 344 (6186), 862–867.
Haushofer, J., Schunk, D., & Fehr, E. (2013). *Negative income shocks increase discount rates*. http://www.princeton.edu/~joha/publications/Haushofer_Fehr_IncomeShocks_2019.pdf.
Hilary, G., Hui, K.W., 2009. Does religion matter in corporate decision making in America? J. financ. econ. 93 (3), 455–473.
Ho, J. (2020). *Package "dabestr."* https://doi.org/10.1038/s41592-019-0470-3.
Hobson, N.M., Gino, F., Norton, M.I., Inzlicht, M., 2017a. When novel rituals lead to intergroup bias: evidence from economic games and neurophysiology. Psychol. Sci. 28 (6), 733–750.
Hobson, N.M., Risen, J., Inzlicht, M., 2017b. The psychology of rituals: an integrative review and process-based framework. SSRN Electr. J. https://doi.org/10.2139/ssrn.2944235.
Hrvatin, S., Sun, S., Wilcox, O.F., Yao, H., Lavin-Peter, A.J., Cicconet, M., Assad, E.G., Palmer, M.E., Aronson, S., Banks, A.S., Griffith, E.C., Greenberg, M.E., 2020. Neurons that regulate mouse torpor. Nature 583 (7814), 115–121.
Iannaccone, L.R., 1994. Why strict churches are strong. Am. J. Sociol. 99 (5), 1180–1211.
Irons, W. (2001). Religion as a hard-to-fake sign of commitment. *Evolution and the capacity for commitment, 292309*. https://www.researchgate.net/profile/William_Irons/publication/285287060_Morality_religion_and_evolution/links/5a72514f458515512075e5f1/Morality-religion-and-evolution.pdf.
James, C., Savedoff, W., 2010. Risk pooling and redistribution in health care: an empirical analysis of attitudes toward solidarity. World Health Rep. https://www.who.int/healthsystems/topics/financing/healthreport/SolidarityNo5FINAL.pdf.
Kacelnik, A., Bateson, M., 1996. Risky theories—the effects of variance on foraging decisions. Integr. Comp. Biol. 36 (4), 402–434.
Kalian, M., Catinari, S., Heresco-Levi, U., Witztum, E., 2008. Spiritual starvation" in a holy space—a form of "Jerusalem syndrome. Ment. Health Relig. Cult. 11 (2), 161–172. https://doi.org/10.1080/13674670600970527.
Kandasamy, N., Hardy, B., Page, L., Schaffner, M., Graggaber, J., Powlson, A.S., Fletcher, P.C., Gurnell, M., Coates, J., 2014. Cortisol shifts financial risk preferences. In: Proc. Natl. Acad. Sci. U.S.A., 111, pp. 3608–3613.
Kerndt, P.R., Naughton, J.L., Driscoll, C.E., Loxterkamp, D.A., 1982. Fasting: the history, pathophysiology and complications. West. J. Med. 137 (5), 379.
Kocher, M.G., Pahlke, J., Trautmann, S.T., 2013. Tempus fugit: time pressure in risky decisions. Manage. Sci. 59 (10), 2380–2391.
Kwaadsteniet, E.W.de, de Kwaadsteniet, E.W., van Dijk, E., Wit, A., de Cremer, D., 2006. Social dilemmas as strong versus weak situations: social value orientations and tacit coordination under resource size uncertainty. J. Exp. Soc. Psychol. 42 (4), 509–516. https://doi.org/10.1016/j.jesp.2005.06.004.
Lambert, D., 2003. Fasting as a penitential rite: a biblical phenomenon? Harv. Theol. Rev. 96 (4), 477–512.
Lejuez, C.W., Read, J.P., Kahler, C.W., Richards, J.B., Ramsey, S.E., Stuart, G.L., Strong, D.R., Brown, R.A., 2002. Evaluation of a behavioral measure of risk taking: the balloon analogue risk task (BART). J. Exp. Psychol. Appl. 8 (2), 75–84.
Levy, D.J., Glimcher, P.W., 2011. Comparing apples and oranges: using reward-specific and reward-general subjective value representation in the brain. The J. Neurosci.: The Official J. Society for Neurosci. 31 (41), 14693–14707.
Loewenstein, G.F., Weber, E.U., Hsee, C.K., Welch, N., 2001. Risk as feelings. Psychol. Bull. 127 (2), 267–286.
Loewenstein, G., 2000. Willpower: a decision-theorist's perspective. Law Philos. 19 (1), 51–76.
Mascaró, J., 2003. The Bhagavad Gita. Penguin.
Mata, R., Frey, R., Richter, D., Schupp, J., Hertwig, R., 2018. Risk preference: a view from psychology. The J. Econ. Perspect.: A J. Am. Econ. Assoc. 32 (2), 155–172.
Mather, M., Gorlick, M.A., Lighthall, N.R., 2009. To brake or accelerate when the light turns yellow? Stress reduces older adults' risk taking in a driving game. Psychol. Sci. 20 (2), 174–176.
Mattson, M.P., 2022. The Intermittent Fasting Revolution: the Science of Optimizing Health and Enhancing Performance. MIT Press.
McDermott, R., Fowler, J.H., Smirnov, O., 2008. On the evolutionary origin of prospect theory preferences. J. Polit. 70 (2), 335–350.
McNamara, J.M., Houston, A.I., 1985. Optimal foraging and learning. J. Theor. Biol. 117 (2), 231–249.
Mehmood, S., Seror, A., & Chen, D.L. (2023). Ramadan fasting increases judicial leniency in judges from Pakistan and India. In *TSE Working Paper* (Vols. 22–1393, p. 52). TSE Working Paper.
Messer, E., 1984. Sociocultural aspects of nutrient intake and behavioral responses to nutrition. In: Galler, J.R. (Ed.), Nutrition and Behavior. Springer, US, pp. 417–471.
Messick, D.M., Wilke, H., Brewer, M.B., Kramer, R.M., Zemke, P.E., Lui, L., 1983. Individual adaptations and structural change as solutions to social dilemmas. J. Pers. Soc. Psychol. 44 (2), 294–309.
Meyer-Rochow, V.B., 2009. Food taboos: their origins and purposes. J. Ethnobiol. Ethnomed. 5, 18.
Michalsen, A., 2010. Prolonged fasting as a method of mood enhancement in chronic pain syndromes: a review of clinical evidence and mechanisms. Curr. Pain Headache Rep. 14 (2), 80–87.

Miles, E., Sheeran, P., Baird, H., Macdonald, I., Webb, T.L., Harris, P.R., 2016. Does self-control improve with practice? Evidence from a six-week training program. J. Exp. Psychol. Gen. 145 (8), 1075–1091.
Mill, W., Theelen, M.M.P., 2019. Social value orientation and group size uncertainty in public good dilemmas. J. Behav. Experiment. Econ. 81, 19–38.
Mishra, S., 2014. Decision-making under risk: integrating perspectives from biology, economics, and psychology. Personal. Soc. Psychol. Rev.: An Official Journal of the Society for Personality and Social Psychology, Inc 18 (3), 280–307.
Nelson, L.D., Morrison, E.L., 2005. The symptoms of resource scarcity: judgments of food and finances influence preferences for potential partners. Psychol. Sci. 16 (2), 167–173.
Nietzsche, F., 2012. The Genealogy of Morals. Courier Corporation.
Nigg, J.T., Nagel, B.J., 2016. Commentary: risk taking, impulsivity, and externalizing problems in adolescent development–commentary on Crone et al. 2016 [Review of *Commentary: risk taking, impulsivity, and externalizing problems in adolescent development–commentary on Crone* et al. *2016*]. J. Child Psychol. Psychiatry 57 (3), 369–370.
Nigg, J.T., 2017. Annual Research Review: on the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. J. Child Psychol. Psychiatry 58 (4), 361–383.
Oishi, S., Cha, Y., 2023. Abstinence and conscientiousness: gratitude or gratitude to God? J. Posit. Psychol. 1–8.
Okasha, S., 2007. Rational choice, risk aversion, and evolution. J. Philos. 104 (5), 217–235.
Olivola, C.Y., Shafir, E., 2013. The Martyrdom effect: when pain and effort increase prosocial contributions. J. Behav. Decis. Mak. 26 (1), 91–105.
Orwell, G., 1933/1961. Down and Out in Paris and London. Harcourt, Brace, Jovanovich, Rpt. New York, p. 61.
Parks, C.D., 2004. Risk preference as a predictor of cooperation in a social dilemma. In: Suleiman, R. (Ed.), Contemporary Psychological Research on Social Dilemmas. Cambridge University Press, pp. 58–70. Vol. 408xiii.
Purzycki, G., Sosis, R., 2022. Religion Evolving: Cultural, Cognitive, and Ecological Dynamics. Equinox Publishing.
Rad, M.S., Ginges, J., 2017. Loss of control is not necessary to induce behavioral consequences of deprivation: the case of religious fasting during Ramadan. Behav. Brain Sci. 40, e338.
Rad, M.S., Ansarinia, M., Shafir, E., 2022. Temporary self-deprivation can impair cognitive control: evidence from the Ramadan fast. Pers. Soc. Psychol. Bull. https://doi.org/10.1177/01461672211070385.
Rad, M.S. (2023a). Self-deprivation and Cognition in Ramadan: Practice Improved Inhibitory Control. *Under Review*.
Rad, M.S. (2023b). Ramadan Fasting as a Goal-Pursuit: Why People Fast, and How Motives Affect Their Experience. *Motivation Science*. 10.1037/mot0000310.
Raub, W., Snijders, C., 1997. Gains, losses, and cooperation in social dilemmas and collective action: the effects of risk preferences. J. Math. Sociol. 22 (3), 263–302.
Roch, S.G., Samuelson, C.D., 1997. Effects of environmental uncertainty and social value orientation in resource dilemmas. Organ. Behav. Hum. Decis. Process. 70 (3), 221–235.
Roky, R., Houti, I., Moussamih, S., Qotbi, S., Aadil, N., 2004. Physiological and chronobiological changes during Ramadan intermittent fasting. Ann. Nutr. Metab. 48 (4), 296–303.
Rooth, G., Carlström, S., 1970. Therapeutic fasting. Acta Med. Scand. 187 (6), 455–463.
Rozin, P., Vollmecke, T.A., 1986. Food likes and dislikes. Annu. Rev. Nutr. 6, 433–456.
Rozin, P., 1996. Towards a psychology of food and eating: from motivation to module to model to marker, morality, meaning, and metaphor. Curr. Dir. Psychol. Sci. 5 (1), 18–24.
Ruffle, B.J., Sosis, R., 2007. Does it pay to pray? Costly ritual and cooperation. B E J. Econom. Anal. Pol. 7 (1) https://doi.org/10.2202/1935-1682.1629.
Ryan, T., 2005. The Sacred Art of Fasting: Preparing to Practice. SkyLight Paths Publishing.
Schielke, S., 2009. Being good in Ramadan: ambivalence, fragmentation, and the moral self in the lives of young Egyptians. J. R. Anthropol. Inst. 15, S24–S40.
Schofield, H., Mullainthan, S., Katz, L., Kremer, M., Cutler, D., Laibson, D., Pande, R., Khwaja, A., Hornbeck, R., Glaeser, E., Loewenstein, G., Volpp, K., Bazerman, M., Bloom, D., Kaur, S., Schilbach, F., Bjorkegren, D., Tomb, I., Naritomi, J., … Trucco, L. (2023). *The economic costs of low caloric intake: evidence from India*. Retrieved June 1, 2023, from https://www.cgdev.org/sites/default/files/Schofield,%20Calories%20and%20Productivity,%202014.01.27(new).pdf.
Shapin, S., 2014. You are what you eat": historical changes in ideas about food and identity. Historical Res.: Bull. Inst. Histor. Res. 87 (237), 377–392.
Shatenstein, B., Ghadirian, P., 1998. Influences on diet, health behaviours and their outcome in select ethnocultural and religious groups. Nutrition 14 (2), 223–230.
Sheehy-Skeffington, J., 2017. How Poverty Affects People's Decision-Making Processes. Joseph Rowntree Foundation.
Shweder, R.A., 2000. What about "female genital mutilation"? And why understanding culture matters in the first place. Daedalus 129 (4), 209–232.
Skrynka, J., Vincent, B.T., 2019. Hunger increases delay discounting of food and non-food rewards. Psychon. Bull. Rev. 26 (5), 1729–1737.
Snyder, M., Ickes, W., 1985. Personality and social behavior. Handbook of Soc. Psychol. 2 (3), 883–947.
Stephens, D.W., 1981. The logic of risk-sensitive foraging preferences. Anim. Behav. 29 (2), 628–629.
Stevens, J.R., Stephens, D.W., 2010. The adaptive nature of impulsivity. In: Madden, G.J. (Ed.), The adaptive nature of impulsivity. Impulsivity: The Behavioral and Neurological Science of Discounting 361–387. Vol. 453xvi.
Strang, S., Hoeber, C., Uhl, O., Koletzko, B., Münte, T.F., Lehnert, H., Dolan, R.J., Schmid, S.M., Park, S.Q., 2017. Impact of nutrition on social decision making. In: Proc. Natl. Acad. Sci. U.S.A., 114, pp. 6510–6514.
Suleiman, R., Rapoport, A., 1988. Environmental and social uncertainty in single-trial resource dilemmas. Acta Psychol. (Amst) 68 (1), 99–112.
Tamney, J.B., 1986. Fasting and dieting: a research note. Rev. Relig. Res. 27 (3), 255–262.
Telzer, E.H., Fuligni, A.J., Lieberman, M.D., Galván, A., 2013. Ventral striatum activation to prosocial rewards predicts longitudinal declines in adolescent risk taking. Dev. Cogn. Neurosci. 3, 45–52.
The World's Muslims: Unity and Diversity. (2012, August 9). Pew research center's religion & public life project. https://www.pewforum.org/2012/08/09/the-worlds-muslims-unity-and-diversity-executive-summary/.
Tian, A.D., Schroeder, J., Häubl, G., Risen, J.L., Norton, M.I., Gino, F., 2018. Enacting rituals to improve self-control. J. Pers. Soc. Psychol. 114 (6), 851–876.
Toda, M., Morimoto, K., 2004. Ramadan fasting – effect on healthy Muslims. Soc. Behav. Pers. 32 (1), 13–18.
Tsegaye, D., Vedeld, P., Moe, S.R., 2013. Pastoralists and livelihoods: a case study from northern Afar, Ethiopia. J. Arid Environ. 91, 138–146.
Turner, V.W., 2011. The Ritual Process: Structure and Anti-Structure. Transaction Publishers.
Van Assen, M., Snijders, C., 2004. Effects of risk preferences in social dilemmas: a game-theoretical analysis and evidence from two experiments. Contemp. Psychol. Res. Soc. Dilemmas 38–65.
Van Lange, P.A., Otten, W., De Bruin, E.M., Joireman, J.A., 1997. Development of prosocial, individualistic, and competitive orientations: theory and preliminary evidence. J. Pers. Soc. Psychol. 73 (4), 733–746.
Van Lange, P.A.M., Joireman, J., Parks, C.D., Van Dijk, E., 2013. The psychology of social dilemmas: a review. Organ. Behav. Hum. Decis. Process. 120 (2), 125–141.
Waterhouse, J., Alkib, L., Reilly, T., 2008. Effects of Ramadan upon fluid and food intake, fatigue, and physical, mental, and social activities: a comparison between the UK and Libya. Chronobiol. Int. 25 (5), 697–724.
Watson-Jones, R.E., Legare, C.H., 2016. The social functions of group rituals. Curr. Dir. Psychol. Sci. 25 (1), 42–46.
Weber, E.U., Blais, A.-R., Betz, N., 2012. Domain specific risk attitude scale. PsycTESTS Dataset. https://doi.org/10.1037/t07700-000.
Weber, M., 2012. The Protestant Ethic and the Spirit of Capitalism. Courier Corporation.
Wilke, M., Rutte, C.G., Bornstein, G, 1996. Reduction of environmental risk as a public good. In: Liebrand, W.B.G., Messick, D.M. (Eds.), Frontiers in Social Dilemmas Research. Springer, Berlin Heidelberg, pp. 157–164. Vol. 20.
Willoughby, T., Good, M., Adachi, P.J.C., Hamza, C., Tavernier, R., 2013. Examining the link between adolescent brain development and risk taking from a social-developmental perspective. Brain Cogn. 83 (3), 315–323.
Wimbush, V.L., Valantasis, R., 2002. Asceticism. Oxford University Press.
Winterhalder, B., Lu, F., Tucker, B., 1999. Risk-sensitive adaptive tactics: models and evidence from subsistence studies in biology and anthropology. J. Archaeol. Res. 7 (4), 301–348.
Wit, A., Wilke, H., 1998. Public good provision under environmental and social uncertainty. Eur. J. Soc. Psychol. 28 (2), 249–256.
Xu, A.J., Schwarz, N., Wyer, R.S., 2015. Hunger promotes acquisition of nonfood objects. Proceed. Nat. Acad. Sci. 112 (9), 2688–2692. https://doi.org/10.1073/pnas.1417712112.
Xygalatas, D., Mitkidis, P., Fischer, R., Reddish, P., Skewes, J., Geertz, A.W., Roepstorff, A., Bulbulia, J., 2013. Extreme rituals promote prosociality. Psychol. Sci. 24 (8), 1602–1605.
Yamagishi, T., 1986. The provision of a sanctioning system as a public good. J. Pers. Soc. Psychol. 51 (1), 110–116.
Yesuf, M., Bluffstone, R.A., 2009. Poverty, risk aversion, and path dependence in low-income countries: experimental evidence from Ethiopia. Am. J. Agric. Econ. 91 (4), 1022–1037.
Yu, L., Chen, C., Niu, Z., Gao, Y., Yang, H., Xue, Z., 2021. Risk aversion, cooperative membership and the adoption of green control techniques: evidence from China. J. Clean. Prod. 279, 123288.
Yucecan, N.K.S., Karaagaoglu, N., Yucecan, S., 2000. Some behavioural changes observed among fasting subjects, their nutritional habits and energy expenditure in Ramadan. Int. J. Food Sci. Nutr. 51 (2), 125–134. https://doi.org/10.1080/096374800100822.
Zhang, Y., Risen, J.L., Hosey, C., 2014. Reversing one's fortune by pushing away bad luck. J. Exp. Psychol. Gen. 143 (3), 1171–1184.