Cognitive Development 54 (2020) 100873

Contents lists available at ScienceDirect

Cognitive Development

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

What should we eat for breakfast? American and Chinese children's prescriptive judgments about breakfast foods

Lin Bian[a,*], Ellen M. Markman[b]

[a] Department of Human Development, Cornell University, 110 Plantations Road, Ithaca, NY 14850, United States
[b] Department of Psychology, Stanford University, 450 Serra Mall, Stanford, CA 94305, United States

ARTICLE INFO

Keywords:
Cognition
Healthy eating
Food selection
Breakfast

ABSTRACT

Despite the numerous positive benefits of consuming nutritious food, American breakfasts are notoriously unhealthy. Recent research with U.S. adults found that the resistance to include nutritious foods at breakfast is due in part to misconceptions about what "breakfast" should be. Here, we assessed the development of these misconceptions in 4- and 5-year-old children. Similar to American adults, U.S. children perceive typical breakfast foods as especially appropriate for breakfast and believe that alternatives typically consumed at lunch or dinner are less suitable for breakfast. This leads them to be unwilling to add nutritious alternatives to their breakfast repertoire. Unlike U.S. children, Chinese children are not as likely to hold these mistaken beliefs and are more motivated to try healthy alternatives at breakfast. Our findings cast light on the developmental roots of Americans' tendency to consume unhealthy breakfasts and have implications for interventions to boost healthy eating behaviors from early on.

1. Introduction

American diets are notorious for including many sugary, unbalanced, and oversized foods (Bowman et al., 2018). Among others, the traditional American breakfast is probably the least healthy meal, which serves basically "disguised desserts" (Belluz & Zarracine, 2018). For example, sugar-laden or high carbohydrate foods, such as cold cereal, fruit juice and bread, are among the most common foods Americans have for breakfast (Langer, 2005; The NPD Group, 2013). Even worse, many of the unhealthy breakfast foods are marketed directly to children (World Health Organization, 2016). According to the Center for Science in the Public Interest (2013), nearly 70 percent of the food advertisements during popular children's shows on the Nickelodeon network are for foods of poor nutritional quality, and unsurprisingly, sugary cereals are one of the most common products in these children-oriented food ads. Therefore, just as many unhealthy eating habits observed in adulthood are established in early childhood (e.g., Demory-Luce et al., 2004; Kemm, 1987; Van Tine, McNicholas, Safer, & Agras, 2017), unhealthy breakfasts have been found in children as well (Public Health England, 2016). A recent survey conducted by the Public Health England (2016) found that children under age ten are currently consuming more than 50 % of the recommended daily allowance of sugar at breakfast in the form of sweetened cereals, sugary drinks and spreads. In the present research, we investigate young children's conceptions of breakfast traditions, which can provide insights into the development of effective interventions to improve both children's and adults' eating habits.

Our recent studies with American adults indicate that one's *prescriptive beliefs* about what the first meal of the day should be exhibit an influence on what they choose to eat at breakfast (Bian and Markman, 2020). To elaborate, despite the fact that many of the usual breakfast items are deficient in nutrients, American adults tend to believe that breakfast staples are particularly well suited

* Corresponding author.
E-mail address: lb592@cornell.edu (L. Bian).

https://doi.org/10.1016/j.cogdev.2020.100873
Received 31 May 2019; Received in revised form 18 November 2019; Accepted 5 March 2020

for breakfast, whereas more nutritious alternatives consumed at lunch or dinner are less appropriate for breakfast (Bian and Markman, 2020). As a result, people are unwilling to add healthy alternatives to their breakfast repertoire, setting up barriers for pursuing a healthy diet overall. However, after learning that many foods became breakfast staples because of intensive marketing campaigns, and that people in other cultures readily include lunch or dinner foods on their breakfast plate, American adults revised their prescriptive beliefs about breakfast foods, which in turn led them to become more motivated to adopt a healthier breakfast diet.

Moreover, Bian and Markman (2020) hypothesized that the inherence heuristic (e.g. Cimpian & Salomon, 2014) could be a cognitive mechanism underlying people's misconceptions of breakfast foods. The inherence heuristic is a cognitive bias that leads people to explain observed (even arbitrary) regularities (e.g. girls wear pink) in terms of the information concerning the entity itself ("inherent" information; e.g., Pink is soft and feminine) as opposed to the contextual information relevant to the entity ("extrinsic" information; e.g., Girls wear pink because of marketing campaigns; e.g., Hussak & Cimpian, 2018; McRae, Cree, Seidenberg, & McNorgan, 2005). Equipped with these inherent explanations, it becomes reasonable to conclude that the regularities are natural and ought to be the way they are (e.g., "It is good that girls wear pink") and vice versa, violating these regularities seems undesirable and inappropriate ("It would be bad if boys wore pink"). Consistent with the hypothesis that the inherence heuristic could be playing a role in American's beliefs about breakfast, Bian and Markman (2020) found that American adults who rely heavily on the inherence bias when reasoning about breakfast traditions (e.g., "Cereal is eaten at breakfast because it's filling") also tend to evaluate typical breakfast foods more positively than atypical food items.

The present research focuses on young children's prescriptive beliefs about breakfast foods, and how these beliefs relate to their intention to include healthy alternatives in their morning meal. We explore whether, like adults, children would perceive the typical breakfast foods as more appropriate and desirable than foods consumed at lunch or dinner. As outlined earlier, people have the tendency to reason from "what is typical" to "what is good" (e.g., Eidelman & Crandall, 2014). More recently, this tendency has been traced back to early childhood (e.g., Roberts, Gelman, & Ho, 2017; Tworek & Cimpian, 2016). Roberts et al. (2017) introduced children to two novel social groups, who endorsed distinct types of behaviors (e.g., Hibbles eat green berries and Glerks eat orange berries). Children as young as age 4 evaluated individuals who do not conform to group norms negatively. More generally, four- to seven-year-olds make sociomoral judgments about arbitrary patterns (e.g., "It is good that girls wear pink"): They perceive typical patterns as good and right, and the alternatives as bad and wrong (Tworek & Cimpian, 2016). Young children have also been found to rely on inherence heuristic to explain such arbitrary regularities (e.g., Cimpian & Steinberg, 2014), which fosters value-laden inferences about reality, leading children to justify and adhere to social norms (Hussak & Cimpian, 2015; Tworek & Cimpian, 2016). The fact that young children use descriptive regularities to make prescriptive judgments raises the possibility that children's perceived suitability of a food for breakfast may be closely related to its typicality at breakfast. Thus, it is possible that children who apply inherent reasons to explain current breakfast traditions may also evaluate breakfast staples as more suitable for breakfast than other foods.

Our second goal is to examine if the tendency to assign value-laden judgments to breakfast foods varies cross-culturally. Most of the research on the role of cognition in shaping eating behaviors relies on samples recruited from WEIRD (Western, Educated, Industrialized, Rich, and Democratic) cultures (e.g., O'Sullivan, Scholderer, & Cowan, 2005). The lack of comparative studies is problematic because it sets the WEIRD cultures as the standard and overlooks the differences that exist across distinct food cultures. In particular, no research to date has considered differences in Chinese and American children's food cognition. To begin to explore possible cultural differences, we tested how children recruited in mainland China think about breakfast foods.

Our focus on Chinese children was motivated by the fact that China presents a food culture that is distinctly different from the typical American diet. The Chinese diet is well known for its variety and abundance in terms of its dishes, ingredients and ways of cooking (e.g., Yang & Zhang, 2010). As a result, in contrast to American children, Chinese children may not perceive the boundaries between breakfast and lunch or dinner foods as strictly defined. Thus, although prior research has suggested that children from both the United States and mainland China use descriptive regularities to make prescriptive judgments (Roberts, Guo, Ho, & Gelman, 2018), Chinese children may not form strong prescriptive judgments about which foods are suitable for breakfast, and therefore, might be more open to include other food choices at breakfast. On the other hand, however, because of an increasing exposure to globalization of diet patterns, Chinese people's food consumption patterns are changing rapidly by incorporating the habits of consumers in western countries (e.g., Veeck & Burns, 2005; Veeck & Veeck, 2000), which raises the alternative possibility that Chinese children living in this changing food culture may develop similar beliefs about breakfast foods as their American counterparts.

1.1. Overview of studies

Overall, the present research investigated three main questions. First, we examined American preschoolers' prescriptive judgments about typical vs. atypical breakfast foods. Are foods typically consumed at breakfast evaluated to be more suitable for breakfast than other foods (Studies 1 and 2)? Second, we assessed to what extent preschoolers are motivated to include nutritious alternatives to their breakfast menu and how their prescriptive judgments relate to their motivation (Studies 2 and 3). Lastly, to test whether our findings vary cross-culturally, we recruited preschoolers from mainland China and measured their prescriptive judgments about breakfast foods and their willingness to eat nutritious alternatives at breakfast (Study 3). Across studies, we explored the effect of the inherence bias in children's explanations on their prescriptive judgments.

Together, the three studies reported here present evidence showing that 4- and 5-year-old children from the United States (especially children who rely on the inherence heuristic) already assign mistaken value-laden judgments to breakfast foods, so that they believe the foods typically eaten in the morning are more suited for breakfast than foods eaten at other times of the day. These

prescriptive beliefs predict their weak intention to include lunch or dinner foods at breakfast. In contrast, Chinese children tend not to endorse such differential attitudes about typical vs. atypical breakfast foods, and they are more willing to expand their breakfast repertoire than U.S. children.

2. Study 1

Study 1 tested whether preschoolers in the American culture judge foods typically consumed at breakfast as better for breakfast than other foods. We presented U.S. children with some food items that are typically consumed at in the morning and some other food items that are typically consumed at other times of the day, and assessed the perceived suitability of each food for breakfast. Our main prediction was that the typical breakfast foods should be perceived as better for breakfast than the atypical breakfast foods.

2.1. Method

2.1.1. Participants

Children between the ages of 4 and 5 – the period during which the "descriptive regularities to prescriptive judgments" tendency emerges (e.g., Roberts et al., 2017) – were recruited from a university-affiliated preschool (N = 77; 45 girls; mean age = 4.86). Children came from predominantly middle- and upper-middle-class families. Ethnicity information was available for 97.4 % of our participants. Of these children, 53 % were European American, 17 % were Asian American, 4 % were Hispanic American, and 25 % were Multi-racial American. Trained experimenters had spent at least two 3-h session in the children's classrooms prior to testing.

2.1.2. Procedure and materials

Children were introduced to a puppet matched with their gender (Jimmy or Susie), and were asked to teach the puppet some knowledge about breakfast. Then, they were presented with six food items one after another. Three of the items are typically consumed at breakfast (i.e., orange juice, cereals, and bread), and the other three foods are typically consumed at lunch or dinner (mac and cheese, lamb chops, and chili). Half of the children saw the typical items first, and half of the children saw the atypical items first. Within each typicality category, the order of the food items was randomized.

For each food, the experimenter showed children a picture of it and asked children to name the food. The experimenter corrected the child if the answer was incorrect. Next, the experimenter asked children, "Is it good or bad to have X (e.g., cereal) for breakfast?" This measure has been used in previous research to gauge children's prescriptive judgments (e.g., Roberts et al., 2017; Tworek & Cimpian, 2016). We calculated the number of typical vs. atypical trials in which children answered "good" (scores could range from 0 to 3).

Children who responded "good" were then presented a scale with three increasingly thumb-up signs and asked, "Is it sort of good, good, or really good to have cereal for breakfast?", whereas children who responded "bad" were presented with another scale with three increasingly thumb-down signs and asked, "Is it sort of bad, bad, or really bad to have cereal for breakfast?" Overall, each question was rated on a 6-point scale (1 = really bad, 6 = really good). These scores were used as the dependent variable reflecting children's prescriptive judgments.

After making judgments for each food, children were asked to generate explanations for their answers. We coded children's explanations to examine the role of inherence heuristic in forming misconceptions about breakfast foods. According to Cimpian and colleagues (e.g., Cimpian & Salomon, 2014), inherent information refers to the features of the entity itself without making reference to external factors, historical events or personal preferences. To capture children's misconceptions about breakfast foods, however, we limited the scope of inherent responses to three sub-categories focusing on: digestion (e.g., "Cereal is light"), energy (e.g., "It gives you energy"), and meal script (e.g., "It's a dinner thing"). For each food item, participants received 1 if they provided any inherent responses and 0 otherwise. The six scores were summed into an overall inherence score for each participant. All responses were coded for inherence by the first author, and a trained research assistant who was unaware of the hypothesis. The intercoder agreement was 91.3 %.

2.1.3. Analytic strategy

The data for this study, as well as all other studies reported here, are available on Open Science Framework: https://osf.io/s94tj/?view_only=25af39893e824686864186d2891127b0. In all three studies, we performed mixed-effects models using the *lme4* package in R (Bates, Sarkar, Bates, & Matrix, 2007). Unless otherwise noted, these mixed-effects models included random intercepts for both items and subjects.

2.2. Results and discussion

The primary goal of this study is to test if children assign value-laden judgments to breakfast foods. If children by this age have already formed misconceptions about what should be consumed at breakfast, they should evaluate the foods typically eaten at breakfast as better suited for breakfast than foods typically eaten at other times of the day. The secondary goal was to examine the role of inherence reasoning in forming prescriptive judgments. Does children's tendency to use inherent features to explain the breakfast traditions predict their evaluations about typical vs. atypical breakfast foods?

As a first look at the prescriptive judgements of children, we calculated the number of times out of 3 with which children answered "good" to the typical vs. atypical trials. Consistent with our hypothesis, the typical food items (M = 2.45) were approved

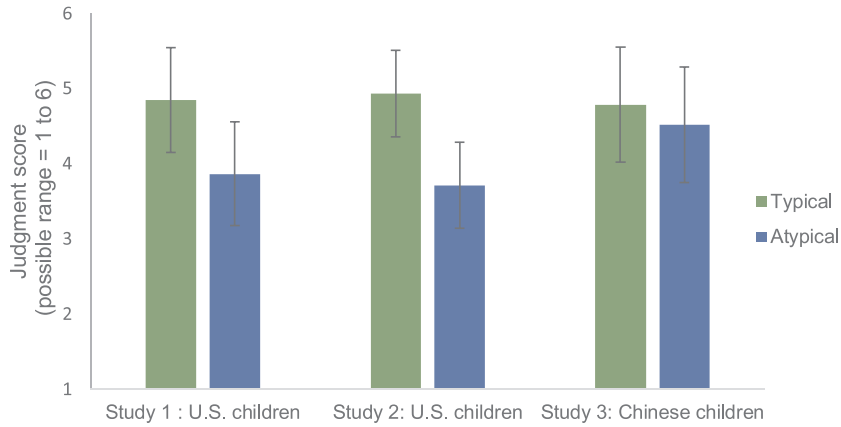

Fig. 1. Children's prescriptive judgments of typical vs. atypical breakfast food items, across Studies 1–3. Error bars represent 95 % confidence intervals.

for breakfast more frequently than the atypical food items (M = 1.70), $t(76)$ = 5.17, p < .001.

For our main analyses, we used participants' 6-point judgment scores and performed a multilevel mixed-effects linear regression on their judgment score about each food item (level 1), nested within participant (level 2). The model included typicality (0 = typical, 1 = atypical; level-2 predictor), gender of the participant (0 = girl, 1 = boy; level-2 predictor), children's inherence scores (level-2 predictor), and the two-way and three-way interactions between the predictors as fixed effects and random intercepts for participant and item. Although children tended to evaluate the traditional breakfast foods (M = 4.85, SE = 0.35) as slightly better suited for breakfast than traditional "lunch" or "dinner" food (M = 3.87, SE = 0.35), the main effect of typicality was not significant, b = 1.10, SE = 0.49, t = 2.23, p = .071 (see Fig. 1). However, this effect was qualified by an interaction between typicality and inherence, b = 0.36, SE = 0.18, t = 2.03, p = .043, suggesting that inherence bias moderated children's tendency to favor typical breakfast foods in their evaluations (see Fig. 2). To further understand this interaction, we used the inherence score to divide children into a low-inherence group (scores at 0; n = 43) and a high-inherence group (scores above 0; n = 34). Children who attributed the breakfast traditions to inherence judged the typical breakfast foods (M = 5.00, SE = 0.36) as more appropriate than the atypical foods (M = 3.55, SE = 0.36), p = .029; whereas children who did not endorse these inherent attributions did not perceive differences between the typical (M = 4.67, SE = 0.35) and atypical food items (M = 4.11, SE = 0.35), p = .298. This supports the proposal that the inherence heuristic underpins the tendency to justify the current breakfast traditions.

One alternative explaining children's preference for breakfast items over non-breakfast items is that they do not like the atypical

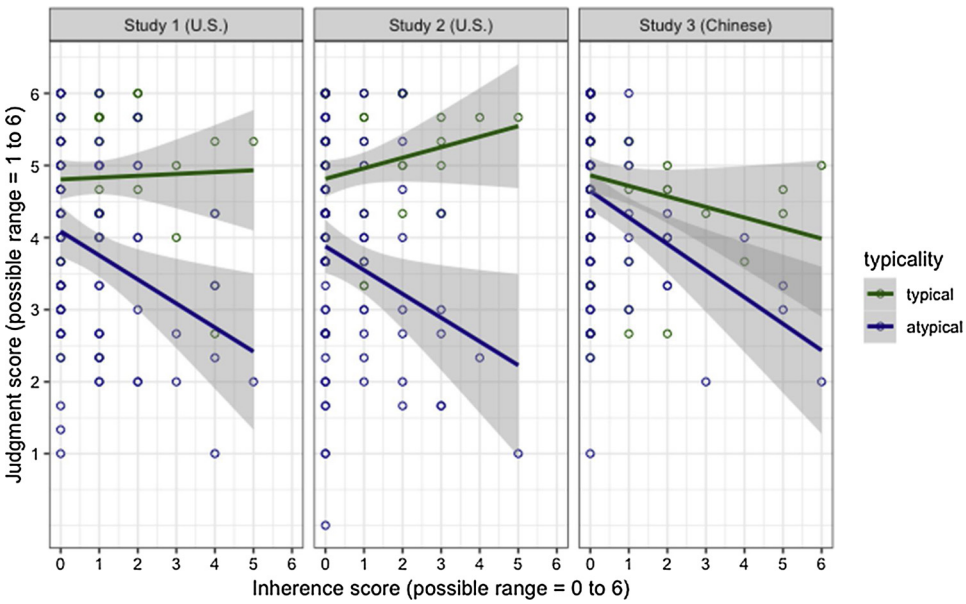

Fig. 2. Scatterplot showing the association among inherence score, judgment score and typicality condition, across Studies 1–3. The lines show the predicted values from a linear regression model predicting children's prescriptive judgment scores; the circles represent the data of individual participants.

food items in general. If this alternative held, children would be more likely to justify their rejection via their food preferences as opposed to some inherent reasons. We coded the explanations of children who rejected the atypical breakfast foods, and contrary to this alternative, 35 % of the children provided inherent reasons to explain their negative prescriptive judgments, whereas only 13 % of them referred to their food preferences. These findings provide evidence against the hypothesis that atypical items are rejected for breakfast just because they are not liked.

The model also revealed a main effect of the participant's gender on prescriptive judgments, $b = 0.67$, $SE = 0.30$, $t = 2.25$, $p = .026$. Girls ($M = 4.48$, $SE = 0.26$) provided lower evaluations of the food items than boys ($M = 4.21$, $SE = 0.25$). This main effect was qualified by a significant interaction between gender and typicality, $b = -0.90$, $SE = 0.37$, $t = -2.42$, $p = .016$. Follow-up pairwise comparisons suggest that girls evaluated the typical breakfast foods ($M = 4.90$, $SE = 0.34$) as better suited for breakfast than the atypical breakfast foods ($M = 3.51$, $SE = 0.34$), $p = .035$; however, this difference did not reach significance in boys' prescriptive judgments ($M_{typical} = 4.73$, $SE = 0.36$; $M_{atypical} = 4.23$, $SE = 0.36$), $p = .350$. This gender difference was not seen in Study 2, so it does not seem to be a reliable finding.

2.2.1. Conclusion

These findings suggest that children as young as age 4 hold misconceptions about breakfast foods. They assign value-laden judgments to food items, perceiving the foods typically consumed at breakfast as better suited for breakfast than other foods. This effect was particularly strong for children who explained the breakfast traditions via inherent features.

3. Study 2

Study 2 was a direct replication of Study 1. Moreover, we examined whether children's prescriptive judgments about breakfast foods relate to their willingness to include nutritious alternatives to their breakfast repertoire. Thus, in addition to measuring children's evaluations about the suitability of certain foods for breakfast, we also measured their willingness to include a set of lunch or dinner foods to their breakfast repertoire.

3.1. Method

3.1.1. Participants

Four- to 5-year-old children ($N = 78$; 44 girls; mean age = 4.84) from two university-affiliated preschools participated in this study. Children came from predominantly middle- and upper-middle-class families. Ethnicity information was available for 89.6 % of our participants. Of these children, 45 % were European American, 10 % were Asian American, 7 % were Hispanic American, 3 % were African American, and 35 % were Multiracial American. Trained experimenters had spent at least two 3-hr session in the children's classrooms prior to testing. Six additional children who refused to complete the study were excluded from analyses.

3.1.2. Procedure and materials

The procedure of Study 2 was essentially identical to that of Study 1, except that children also received a willingness measure assessing their intention to include lunch or dinner foods to their breakfast plate. The order of the judgment and willingness measures was counterbalanced across participants.

The willingness measure consisted of three new food items presented in a random order: stew, peanut butter and jelly sandwich, and a bowl of chicken noodle soup. For each food, the experimenter showed children a picture of it and asked children to name the food. The experimenter corrected the child if the answer was incorrect. Then children were asked to what extent they want to have this food for breakfast. These questions were rated on a 4-point scale (1 = "Really not want to" to 4 = "Really want to").

As in Study 1, children's justifications for their prescriptive judgments about breakfast foods were coded for inherence by the first author and a trained research assistant (unaware of the hypothesis). The intercoder agreement was 95.4 %.

3.2. Results and discussion

We had two primary predictions in this study. First, replicating the previous study, children (especially those who rely on the inherence heuristic) should evaluate the foods typically eaten in the morning as better suited for breakfast than foods typically eaten at other times of the day. Second, children's judgments about the appropriateness of atypical breakfast foods for the morning meal should predict their motivation to include nutritious alternatives into their breakfast menu.

3.2.1. Prescriptive judgments

As in Study 1, we first calculated the number of times out of 3 in which children answered "good" to the typical vs. atypical trials. Replicating the previous study, the typical food items ($M = 2.56$) were perceived as "good" for breakfast more frequently than the atypical food items ($M = 1.62$), $t(77) = 6.56$, $p < .001$.

In our main analyses, we submitted the 6-point judgment scores of each food item (level 1) to a multilevel mixed-effects linear regression, nested within participant (level 2). The model included typicality (0 = atypical, 1 = typical; level-2 predictor), gender of the participant (0 = girl, 1 = boy; level-2 predictor), children's inherence scores (level-2 predictor), and the two-way and three-way interactions between the predictors as fixed effects and random intercepts for participant and item. Replicating Study 1, we found a significant interaction between typicality and inherence, $b = 0.41$, $SE = 0.16$, $t = 2.52$, $p = .012$, suggesting that children's reliance

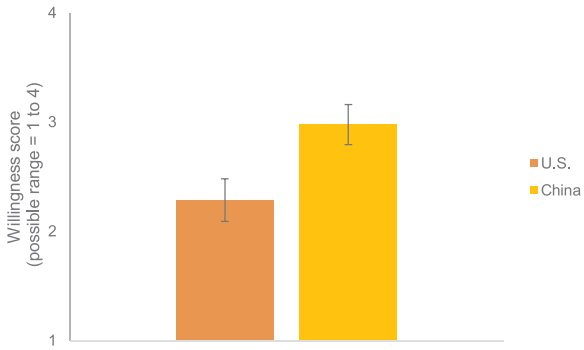

Fig. 3. Children's willingness to include healthy alternatives at breakfast in Studies 2 (U.S.) and 3 (China). Error bars represent 95 % confidence intervals.

on the inherence bias moderated their tendency to favor typical breakfast foods over atypical breakfast foods in their evaluations (see Fig. 2). Next, children were divided into a low-inherence group (inherence scores at 0; $n = 50$) and a high-inherence group (inherence scores above 0; $n = 27$). Children in the high-inherence group judged the typical breakfast foods ($M = 5.03$, $SE = 0.34$) as more appropriate for breakfast than the atypical foods ($M = 3.29$, $SE = 0.34$), $p = .008$; whereas children in the low-inherence group perceived the typical ($M = 4.83$, $SE = 0.31$) and atypical food items ($M = 3.79$, $SE = 0.31$) as not significantly different in their suitability for breakfast, $p = .060$.

To rule out the alternative that children's negative attitudes about the atypical breakfast foods were due to their dislike of these foods, we coded the explanations of children who rejected these foods. More of the justifications for the negative prescriptive judgments were based on inherent reasons (28 %) rather than food preferences (20 %), suggesting that it is unlikely that children's prescriptive judgments were simple reflections of their dietary preferences. Our model did not yield any gender differences in forming prescriptive judgments about breakfast foods, $ps > .50$, suggesting that the gender differences revealed in Study 1 may be restricted to the sample.

3.2.2. Willingness

We first conducted a single sample *t*-test on participant's willingness score averaged across the three items, to examine whether American preschoolers are willing to try lunch or dinner foods at breakfast. Preschoolers were unwilling to expand their breakfast menu compared to the chance level (2.5), $M = 2.98$, 95 % $CI = [2.80, 3.17]$, $t(76) = -2.16$, $p = 0.034$ (see Fig. 3).

We also explored whether children's prescriptive judgment of atypical breakfast foods predicts their willingness to try other nutritious alternatives. We performed a multilevel mixed-effects linear regression on participant's composite willingness score (level 1), nested within participant (level 2). The model included the children's judgment score about atypical breakfast foods (level-2 predictor) as a fixed effect and a random intercept by participant. Consistent with our prediction, children's prescriptive judgment of atypical breakfast foods positively predicted their willingness to eat healthy lunch or dinner food for breakfast, $b = 0.18$, $SE = 0.06$, $t = 2.84$, $p = .006$. Children who believed that the non-traditional breakfast foods were not well suited for breakfast were also less willing to try other nutritious alternatives at breakfast, highlighting the power of beliefs in guiding children's food choices.

3.2.3. Conclusion

Replicating Study 1, we found evidence showing that U.S. preschoolers perceive foods typically eaten at breakfast as better and more suitable for the breakfast than foods typically eaten at other times of the day. Moreover, these mistaken beliefs predict children's reluctance to adopt a healthy morning diet. These results bolster our claim of a link between children's prescriptive beliefs about breakfast foods and their eating behaviors.

4. Study 3

The first two studies provide consistent evidence demonstrating that preschoolers in the United States hold prescriptive beliefs about breakfast foods, which may undermine their motivation to eat healthy alternatives at breakfast. In the current study, we aim to examine whether these results vary cross-culturally by testing preschoolers from mainland China.

4.1. Method

4.1.1. Participants

Four- to 5-year-old children ($N = 79$; 38 girls; mean age = 4.96) from the People's Republic of China were recruited. All children were tested by the first author from a local kindergarten in Hebei Province, which has a population of approximately 75.2 million residents and is demographically 96 % ethnic Han Chinese.

4.1.2. Measures and materials

The measures and procedure of Study 3 were essentially identical to those of Study 2, except that we used a new set of food items that are representative in Chinese diet culture and appropriate for Chinese preschoolers. In particular, we used three typical Chinese breakfast food items (bread, rice porridge, and fried stick) and three atypical Chinese breakfast food items (roasted chicken drumstick, fried fish and steamed corn) in the judgment measure. In the willingness measure, we used another set of three atypical Chinese breakfast food items including stir-fry vegetables, stew and firm tofu. Howden et al. (1993) and Parkinson (2019) provided support for the typicality of the selected items for the Chinese breakfast.

The first author and a trained native Mandarin speaker (unaware of the hypothesis) coded children's justifications for inherence. The intercoder agreement was 92.5 %.

4.2. Results and discussion

4.2.1. Prescriptive judgments

As before, to take a look at binary prescriptive judgements of, we calculated the number of times out of 3 with which children answered "good" to the typical vs. atypical trials. Chinese children approved the typical food items ($M = 2.39$) more frequently than the atypical food items ($M = 2.16$), $t(78) = 2.35$, $p = .021$; however, this tendency was weaker compared to that of American preschoolers (see Studies 1 and 2 Results), resulting in a significant interaction between typicality and culture, $F(1, 232) = 15.26$, $p < .001$.

To capture the nuances in children's judgments, we conducted our main analyses by submitting participants' 6-point judgment scores of each food item (level 1) to a multilevel mixed-effects linear regression, nested within participant (level 2). The model included typicality (0 = typical, 1 = atypical; level-2 predictor), gender of the participant (0 = girl, 1 = boy; level-2 predictor), children's inherence score (level-2 predictor), and the two-way and three-way interactions between the predictors as fixed effects and random intercepts for participant and item. Chinese preschoolers' prescriptive judgments about typical ($M = 4.78$, $SE = 0.38$) vs. atypical breakfast foods ($M = 4.49$, $SE = 0.38$) did not vary significantly, $b = 0.05$, $SE = 0.56$, $t = 0.10$, $p = .927$ (see Fig. 1). These results contrasted with the findings revealed in Studies 1 and 2, in which U.S. preschoolers evaluated the traditional breakfast foods as better and more desirable than the non-traditional breakfast foods, demonstrating the cultural variation in children's perceptions about breakfast foods.

Our model also revealed an interaction between typicality and inherence, $b = 0.36$, $SE = 0.15$, $t = 2.51$, $p = .012$ (see Fig. 2). Compared to children who did not use inherent features to make sense of the current breakfast traditions ($M_{typical} = 4.93$, $SE = 0.39$; $M_{atypical} = 4.65$, $SE = 0.39$), children who used inherent features showed a slightly larger gap in their evaluations about the typical breakfast foods ($M_{typical} = 4.26$, $SE = 0.46$) than the atypical ones ($M_{atypical} = 3.94$, $SE = 0.46$), although neither of these differences reached significance ($p = 0.627$ and $p = 0.608$, respectively).

One question to address is whether the American and Chinese children's prescriptive judgments of the typical vs. atypical breakfast foods could be an outcome of the differential typicality of the selected food items. In other words, do people from the two cultures hold similar perceptions of the typicality of the foods, such that they perceive the typical breakfast items as more appropriate for breakfast and less appropriate for other meals than the atypical breakfast items? To address this possibility, we recruited two separate samples, 30 U.S. participants on Mechanical Turk (19 women, 11 men) and 35 Chinese adult participants (30 women, 4 men, 1 did not provide this information), to rate the appropriateness of each food item for breakfast vs. other meals (i.e., lunch or dinner). A three-way ANOVA involving typicality (typical vs. atypical), meal (breakfast vs. other) and country (U.S. vs. China) revealed a significant interaction between typicality and meal, $F(1, 62) = 210.26$, $p < .001$, while the interaction among typicality, meal and country was not significant, $F(1, 62) = 1.92$, $p = .171$. Across both countries, adults evaluated the typical items ($M_{\text{U.S.}} = 8.04$, $M_{\text{China}} = 7.84$) as more appropriate for breakfast than the atypical items ($M_{\text{U.S.}} = 4.14$, $M_{\text{China}} = 4.60$), $ps < .001$, and they evaluated the atypical items ($M_{\text{U.S.}}$ 7.59 =, $M_{\text{China}} = 7.50$) as more appropriate for lunch or dinner than the typical items ($M_{\text{U.S.}} = 6.55$, $M_{\text{China}} = 4.76$), $ps < .001$. Thus, the typicality of the food items was comparable across the two cultures.

4.2.2. Willingness

We investigated whether Chinese children were motivated to try alternative foods for breakfast. A single sample *t*-test on participant's willingness score averaged across the three items revealed that Chinese preschoolers' willingness to include lunch or dinner foods in their breakfast repertoire was higher than the chance level, $M = 2.98$, 95 % $CI = [2.80, 3.17]$, $t(78) = 5.20$, $p < 0.001$ (see Fig. 2). In contrast, the results of Study 2 suggested that same-age U.S. children's willingness to broaden their breakfast repertoire was reliably lower than the chance level.

Next, we conducted a multilevel mixed-effects linear regression on participant's composite willingness score (level 1) nested within participant (level 2), including the children's judgment score about atypical breakfast foods (level-2 predictor) as a fixed effect and a random intercept by participant. Similar to preschoolers in the United States, Chinese children's prescriptive judgment of atypical breakfast foods positively predicted their willingness to eat healthy lunch or dinner food for breakfast, $b = 0.33$, $SE = 0.07$, $t = 4.95$, $p < .001$. Children who believe that the non-traditional breakfast foods as suitable for breakfast are also more willing to try other nutritious alternatives at breakfast.

4.2.3. Comparisons between U.S. and China

To systematically compare the U.S. vs. Chinese children's prescriptive judgments, we combined the data across the studies. Although the particular food items used necessarily differed across studies because of the cultural differences in cuisine, the studies

were comparable in terms of the perceived appropriateness of typical vs. atypical breakfast foods for breakfast vs. other meals. We report only the effects involving country because cross-cultural differences were our a priori interest.

First, children's composite prescriptive judgment scores in Studies 1–3 were submitted to a multilevel mixed-effects linear regression including typicality (0 = typical, 1 = atypical; level-2 predictor), country (0 = U.S., 1 = China; level-2 predictor), and the interaction between the predictors as fixed effects and a random intercept for participant. The analysis yielded an interaction between typicality and country, $b = 0.81$, $SE = 0.21$, $t = 3.92$, $p < .001$. Consistent with previous results, U.S. children evaluated the typical breakfast foods ($M_{typical} = 4.87$, $SE = 0.09$) as more appropriate to consume in the morning than the atypical breakfast foods ($M_{atypical} = 3.74$, $SE = 0.09$), p < . 001. However, Chinese children did not vary their evaluations based on whether the food was a typical breakfast item ($M_{typical} = 4.79$, $SE = 0.13$; $M_{atypical} = 4.46$, $SE = 0.13$; $p = .203$). To further test the potential cultural variations in children's prescriptive judgments, we also examined the U.S. vs. China differences, separately for the typical items and atypical items. Although U.S. and Chinese children held similar attitudes about the foods typically eaten at breakfast in their culture, $p = .957$, U.S. children had significantly lower evaluations about the suitability of lunch or dinner foods for breakfast than Chinese children, $p < .001$.

Second, we compared U.S. vs. Chinese children's willingness to consume healthy alternatives at breakfast by conducting a two-sample *t*-test on their composite willingness scores. As predicted, Chinese children expressed stronger willingness to consume healthy alternatives at breakfast than U.S. children, $t(154) = 5.15$, $p < 0.001$ (see Fig. 3).

4.2.4. Conclusion

Study 3, combined with the previous studies, presents a cross-cultural examination of children's prescriptive beliefs about breakfast foods. Although preschoolers from the United States tend to believe that foods typically eaten in the morning are better suited for breakfast than foods eaten at other times of the day, preschoolers from mainland China do not share these beliefs. Moreover, Chinese children are more willing to expand their breakfast plate than their American counterparts. Yet, the relationship between prescriptive judgments about atypical foods and willingness to eat alternatives replicates cross-culturally.

5. General discussion

Starting a day with healthy food has been shown to have a multitude of benefits on improving cognitive function and well-being, preventing weight gain and obesity, and reducing the risk of developing chronic diseases (e.g., Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). Despite this, Americans fall far short of having a healthy breakfast. In fact, many of the American breakfast staples are lacking in nutrition. Even worse, sweetened cereals such as Froot Loops are marketed directly to children, engaging them with animated mascots and interactive games (World Health Organization, 2016), which exacerbates the problem.

The present research takes a developmental approach to understanding the root causes of pursuing unhealthy morning diets. Studies 1 and 2 are the first to investigate four- and five-year-old children's beliefs about what should be eaten at breakfast. The two studies provide consistent evidence suggesting that U.S. children tend to believe that typical breakfast foods are particularly well suited for breakfast, whereas more nutritious alternatives consumed at lunch or dinner are less appropriate. Moreover, we found that the inherence bias that leads people to explain the observed regularities in terms of the inherent features of the entities involved (Cimpian & Salomon, 2014), predicts the tendency to assign value to typical vs. atypical breakfast foods. Children who rely heavily on the inherence bias when reasoning about breakfast traditions also tend to evaluate the typical breakfast foods more positively than the atypical items. These mistaken beliefs have a downstream effect on children's motivation to adopt a healthy morning diet, leading them to avoid nutritious lunch or dinner foods at breakfast. Further work should examine children's eating behaviors in actual settings to bolster the external validity of our conclusions.

Study 3 examines Chinese preschoolers' beliefs about breakfast foods, providing the first documentation of the variations across cultures in children's cognition about breakfast foods. Unlike U.S. children, Chinese children's beliefs about the suitability of a food for breakfast are not related to its typicality at breakfast. They perceive that traditional and non-traditional breakfast foods as similarly suited for the morning meal, and they are more willing to sample healthy lunch or dinner foods at breakfast. Breakfasts in many East Asian countries, such as China and Japan, are nourishing, well-balanced and indistinguishable from their dinner foods (e.g., Sproesser et al., 2018; Walloga, 2015; Yang & Zhang, 2010). Being exposed to diversified diets may allow Chinese children to form more flexible script food categories, which leads them to be more open to including other foods at breakfast than children in the U.S. Additional work is needed to examine these questions more directly with a broader range of cultural contexts, but for now the findings provide empirical evidence that children from two distinct cultural contexts develop distinct beliefs about breakfast foods.

An important direction for future research would be to design a child-friendly intervention to combat children's mistaken beliefs about breakfast foods, to help foster healthy eating habits from early on. Previous work has demonstrated the power of implementing an explanatory framework in boosting healthy behaviors in children (e.g., Au et al., 2008; Gripshover & Markman, 2013; Zamora, Romo, & Au, 2006). For example, after learning a detailed and coherent theory about why it is necessary to eat a variety of foods, preschoolers developed a rich understanding of food as a source of nutrition and increased their vegetable consumption at snack time (Gripshover & Markman, 2013). This leaves us hopeful that a theory-based approach to understanding that breakfast staples are constructed by the society rather than some natural features of these items could be effective in motivating children to eat healthier foods. Indeed, recent studies with American adults provide support for this possibility (Bian and Markman, 2020). After learning that (1) breakfast traditions are a result of intensive marketing campaigns, and (2) people in other cultures consume a variety of foods for breakfast, Americans revised their lay theories about breakfast foods and became more willing to expand the repertoire of what they would eat for breakfast. A similar intervention tailored to be appropriate for children might be able to counter their mistaken beliefs

about breakfast and promote healthier food choices.

Acknowledgements

This research was supported by an Evalyn Edwards Milman Assistant Professor Fellowship from Cornell University (to L.B.).

References

Au, T. K., Chan, C. K. K., Chan, T., Cheung, M. W. L., Ho, J. Y. S., & Ip, G. W. M. (2008). Folkbiology meets micro- biology: A study of conceptual and behavioral change. *Cognitive Psychology, 57*, 1–19.

Bates, D., Sarkar, D., Bates, M. D., & Matrix, L. (2007). The lme4 package. *R Package Version, 2*(1), 74.

Belluz, J., & Zarracine, J. (2018). *We need to call American breakfast what it often is: Dessert.* March 7, Retrieved fromVOXhttps://www.vox.com/2016/7/11/12128372/sugar-cereal-breakfast-nutrition-facts.

Bian, L., & Markman, E. M. (2020). Why do we eat cereal but not lamb chops at breakfast? Investigating Americans' beliefs about breakfast foods. *Appetite, 144*, 104458.

Bowman, S. A., Clemens, J. C., Friday, J. E., Schroeder, N., Shimizu, M., LaComb, R. P., & Moshfegh, A. J. (2018). *Food Patterns Equivalents Intakes by Americans: What We Eat in America, NHANES 2003-2004 and 2015-2016.* Food Surveys Research Group (November). Dietary Data Brief No. 20.

Center for Science in the Public Interest (2013). *Nearly 70 % of food ads on Nickelodeon are for Junk.* March 21, Retrieved fromhttps://cspinet.org/new/201303211.html.

Cimpian, A., & Salomon, E. (2014). The inherence heuristic: An intuitive means of making sense of the world, and a potential precursor to psychological essentialism. *The Behavioral and Brain Sciences, 37*(5), 461–480.

Cimpian, A., & Steinberg, O. D. (2014). The inherence heuristic across development: Systematic differences between children's and adults' explanations for everyday facts. *Cognitive Psychology, 75*, 130–154.

Demory-Luce, D., Morales, M., Nicklas, T., Baranowski, T., Zakeri, I., & Berenson, G. (2004). Changes in food group consumption patterns from childhood to young adulthood: The Bogalusa Heart Study. *Journal of the American Dietetic Association, 104*(11), 1684–1691.

Eidelman, S., & Crandall, C. S. (2014). *The intuitive traditionalist: How biases for existence and longevity promote the status quo. Advances in experimental social psychology, Vol. 50*, Academic Press53–104.

Gripshover, S. J., & Markman, E. M. (2013). Teaching young children a theory of nutrition: Conceptual change and the potential for increased vegetable consumption. *Psychological Science, 24*(8), 1541–1553.

Howden, J. A., Chong, Y. H., Leung, S. F., Rabuco, L. B., Sakamoto, M., Tchai, B. S., et al. (1993). Breakfast practices in the Asian region. *Asia Pacific Journal of Clinical Nutrition, 2*(2), 77–84.

Hussak, L. J., & Cimpian, A. (2015). An early-emerging explanatory heuristic promotes support for the status quo. *Journal of Personality and Social Psychology, 109*(5), 739–752.

Hussak, L. J., & Cimpian, A. (2018). Memory accessibility shapes explanation: Testing key claims of the inherence heuristic account. *Memory & Cognition, 46*(1), 68–88.

Kemm, J. R. (1987). Eating patterns in childhood and adult health. *Nutrition and Health, 4*(4), 205–215.

Langer, G. (2005). *Poll: What Americans eat for breakfast. ABC news.* May 17, Retrieved fromhttps://abcnews.go.com/GMA/PollVault/story?id=762685.

McRae, K., Cree, G. S., Seidenberg, M. S., & McNorgan, C. (2005). Semantic feature production norms for a large set of living and nonliving things. *Behavior Research Methods Instruments & Computers, 37*, 547–559.

O'Sullivan, C., Scholderer, J., & Cowan, C. (2005). Measurement equivalence of the food related lifestyle instrument (FRL) in Ireland and Great Britain. *Food Quality and Preference, 16*(1), 1–12.

Parkinson, R. (2019). *Traditional Chinese breakfast foods. From Congee and crullers to hot and dry noodles.* January 22, Retrieved fromhttps://www.thespruceeats.com/traditional-chinese-breakfast-694158.

Public Health England (2016). *The National Diet and Nutrition Survey assesses the diet, nutrient intake and nutritional status of the general population of the UK.* September 9, Retrieved fromhttps://www.gov.uk/government/collections/national-diet-and-nutrition-survey.

Rampersaud, G. C., Pereira, M. A., Girard, B. L., Adams, J., & Metzl, J. D. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association, 105*(5), 743–760.

Roberts, S. O., Gelman, S. A., & Ho, A. K. (2017). So it is, so it shall be: Group regularities license children's prescriptive judgments. *Cognitive Science, 41*, 576–600.

Roberts, S. O., Guo, C., Ho, A. K., & Gelman, S. A. (2018). Children's descriptive-to-prescriptive tendency replicates (and varies) cross-culturally: Evidence from China. *Journal of Experimental Child Psychology, 165*, 148–160.

Sproesser, G., Imada, S., Furumitsu, I., Rozin, P., Ruby, M., Arbit, N., et al. (2018). What constitutes traditional and modern eating? The case of Japan. *Nutrients, 10*(2), 118.

The NPD Group (2013). *The NPD group reports when eating out, breakfast sandwiches outrank coffee!*April 18, Retrieved fromhttps://www.npd.com/wps/portal/npd/us/news/press-releases/breakfast-sandwiches-make-top-10-list-for-americans-in-the-morning/.

Tworek, C. M., & Cimpian, A. (2016). Why do people tend to infer "ought" from "is"? The role of biases in explanation. *Psychological Science, 27*(8), 1109–1122.

Van Tine, M. L., McNicholas, F., Safer, D. L., & Agras, W. S. (2017). Follow-up of selective eaters from childhood to adulthood. *Eating Behaviors, 26*, 61–65.

Veeck, A., & Burns, A. C. (2005). Changing tastes: The adoption of new food choices in post-reform China. *Journal of Business Research, 58*(5), 644–652.

Veeck, A., & Veeck, G. (2000). Consumer segmentation and changing food purchase patterns in Nanjing, PRC. *World Development, 28*(3), 457–471.

Walloga, A. (2015). *What do people eat for breakfast around the world?* November 11https://www.independent.co.uk/life-style/food-and-drink/features/what-people-eat-for-breakfast-around-the-world-a6730126.html.

World Health Organization (2016). *Tackling food marketing to children in a digital world: Trans-disciplinary perspectives.* Retrieved fromhttp://www.euro.who.int/_data/assets/pdf_file/0017/322226/Tackling-food-marketing-children-digital-world-trans-disciplinary-perspectives-en.pdf?ua=1.

Yang, S. S., & Zhang, Y. X. (2010). The research of the differences between Chinese and western diet cultures. *Cross-Cultural Communication, 6*(2), 75–83.

Zamora, A., Romo, L. F., & Au, T. K. (2006). Using biology to teach adolescents about STD transmission and self- protective behaviors. *Journal of Applied Developmental Psychology, 27*, 109–124.