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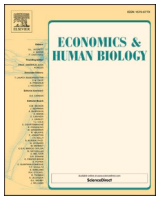

Influence of poverty concerns on demand for healthier processed foods: A field experiment in Mexico City

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ABSTRACT

Living in poverty can present cognitive biases that exacerbate constraints to achieving healthier diets. Better diets could imply food choice upgrades within certain food categories, such as electing processed foods with an improved nutritional profile. This study evaluated the influence of monetary and health concerns on the willingness to pay (WTP) for healthier processed foods in a low-income section of Mexico City. We employed priming techniques from the scarcity literature, which are applied for the first time to healthier food purchasing behaviours in low-income settings. Our predictions are based on a dual system framework, with choices resulting from the interaction of deliberative and affective aspects. The WTP was elicited through a BDM mechanism with 423 participants. Results showed that induced poverty concerns reduced the valuations of one of the study's healthier food varieties by 0.17 standard deviations. The latter effect did not differ by income level. The WTP for a healthier bread product but one with relatively high sugar and fat content was reduced by induced poverty concerns only among certain consumers without bread purchasing restrictions (78% of the sample). Potential mechanisms were assessed through regression analysis and structural equation modelling. The relationship between poverty concerns and WTP was mediated by increased levels of stress. While we could not rule out impact on cognitive load, it was not deemed a mediator in this study. Our findings signal that improvements in economic and psychological well-being among low-income consumers may aid to increase their demand for healthier processed foods.

1. Introduction

Currently, the low- and middle-income countries (LMICs) have the highest burden of the obesity pandemic (Ford et al., 2017). In some LMICs, obesity and unhealthy dietary behaviours have tended to have higher prevalence in urban areas and in higher-socioeconomic status groups. Yet, such habits are expanding in rural areas and among those in lower-socioeconomic status groups (Rivera-Dommarco et al., 2018). Even certain upgrades in terms of the food choices within certain categories such as processed foods, may help low-income consumers' diets to become healthier (de Brauw et al., 2019). However, transcending such trends is challenging for consumers because food choices are constrained by multiple factors such as availability, affordability, marketing strategies, lack of understandable information about food products' nutritional profile, the food selection environment, taste and convenience (Mancino et al., 2018). Additionally, biases and heuristics in decision-making induce consumers to deviate from deliberative, conscious decisions and intensify some of the factors just described (van Kleef and van Trijp, 2018; Wilson et al., 2016). Hence food choices are likely driven by affective motivations, especially in poverty contexts (Beenackers et al., 2018; Kremer et al., 2019; Ruhm, 2012). Poverty entails particular psychological consequences that may render individuals more prone to make decisions based on convenience, taste, or the desire to feel full, as well as to neglect nutrition/health information and to choose foods with less nutritional value (Haushofer and Fehr, 2014; Just and Gabrielyan, 2018; Zhao and Tomm, 2017). Therefore, the demand for healthier foods in low-income settings is not only hindered by restricted budgets and other traditional factors, but also by persistent psychological constraints.

The literature on *scarcity* has expanded over the last decade and deepened our understanding on how the psychology of poverty impedes economic decision-making and behaviours (Bruijn, 2021). For instance,

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poverty may reduce attention to other important aspects of life by inducing a focus on the most pressing needs (Mani et al., 2013). Poverty may also increase time discounting and risk aversion through its adverse effects on cognitive functions (Bartoš et al., 2021; Ong et al., 2019). Cognitive load and stress are among the main potential mechanisms in the related literature. For example, financial worries induced in lab experiments increased cognitive load among shoppers in the United States and farmers in Brazil (Lichand and Mani, 2020; Mani et al., 2013). These findings were confirmed in the field by the same authors, who also observed that such adverse effects were more prevalent in the poor as compared to the better off. Using a similar lab manipulation, Dalton et al. (2019) showed that exposing Vietnamese owners of small retail businesses to financial worries increased their level of perceived stress, but did not alter cognitive load. Prior research also suggested that stress caused by poverty changed people's revealed preferences (e.g., risk and time preferences), which may have lowered their willingness to adopt new technologies and invest in long term outcomes regarding education and health (Haushofer and Fehr, 2014). Other studies have shown mixed results with regards to stress and its links to executive control functions, and economic behaviours like temporal discounting (Kremer et al., 2019; Tsai et al., 2018). Although chronic stress associated with poverty induces unhealthier eating behaviours (Ford et al., 2017; Siahpush et al., 2014), there is scarce research linking issues in the poverty psychology with food purchasing behaviours. There are a few studies that have analysed these aspects through willingness to pay methods, but they did not have a particular focus on consumer preferences for healthier foods, while only one of them manipulated financial concerns and had a predominantly low-income sample (Huijsmans et al., 2019; Schofield and Venkataramani, 2021).

We address this gap in the literature by assessing the influence of poverty related concerns on the potential demand for healthier processed foods in three lower-income municipalities of Mexico City. Specifically, we elicit the willingness to pay (WTP) of primary household shoppers for healthier packaged bread. Mexico City, as well as other large cities in Latin America, is experiencing a pronounced shift towards more convenient products, for instance from maize tortilla to wheat bread (Dominguez-Viera et al., 2022; Popkin and Reardon, 2018). The breads used in this study were richer in protein and fibre and had less sodium content than the highly consumed white packaged breads available in the market. From a consumer perspective, switching consumption from white bread to the selected breads would thus contribute to healthier diets (Dominguez-Viera et al., 2022). Recent research has shown that the availability of healthier variants of processed wheat products in Mexico City is even more limited in low- than in high-income neighbourhoods (Marrón-Ponce et al., 2020). The limited availability of healthier foods in retail outlets may actually be the consequence of the predominantly affective nature of consumers' dietary behaviours, which is usually exacerbated in the presence of high stress (Ruhm, 2012). Hence the relevance to shed light on the potential negative impact of poverty concerns on the acceptance and WTP for healthier foods among lower-income consumers. The sources of worry in low- income areas are diverse, including financial hardship, neighbourhood level stressors, such as crime and noise, and limited access to health care (Shafir, 2017). In our experiment, we chose financial and health concerns, as the former is an obvious problem, and the latter was predetermined as a major source of concern during focus groups in the research area. Additionally, we try to understand the uptake of nutrition and health information when low-income individuals face such challenging situations. To test this process, we induced the concerns after providing participants with information about the nutritional and health profile of the healthier products. The effective use of information requires cognitive efforts, processes that are compromised for those living in poverty as explained above. Thus, we expect that the effectiveness of information is reduced with increased poverty concerns. Further assumptions are provided in detail in the following section.

2. Theoretical predictions and hypotheses

A large body of research has relied on dual system frameworks to explain food choice (Carroll et al., 2018; Just and Gabrielyan, 2018; van Kleef and van Trijp, 2018). These models explain human behaviour as the outcome of interactions between two systems that govern decision-making: 1) the affective system (System 1), that encompasses emotions and other motivational states and generally focusses on the here and now; and the deliberative system (System 2), that assesses options in a broad and goal-oriented perspective and is more concerned with long term outcomes (Fudenberg and Levine, 2006; Loewenstein et al., 2015).

When making decisions about food, both these systems may play a role (Ruhm, 2012). Since System 1 is always involved in any decision, as it is effortless and automatic and always 'on', the extent to which health considerations influence the decision depends on the extent to which System 2 is activated. It is likely that in most routine consumer decisions, where System 1 dominates the decision-making process, consumers will focus on aspects like familiarity, availability, immediate gratification (e.g., taste), cues about affordability and relative price differences (Azar, 2011). For consumers to consider more abstract attributes, such as long term health concerns and absolute price differences, System 2 needs to be active. Therefore, since healthier processed food options are usually relatively more expensive, less familiar, less palatable and less available than the regular options, consumers who do not consider the long-term health effects of their decisions will value healthier food below the market price. Furthermore, the demand for healthier foods in lower-income contexts tends to be bounded by the absence of understandable nutrition information (Mancino et al., 2018). It has been shown that without providing such information, low-income consumers would undervalue healthier foods (Birol et al., 2015). Nutrition information is effective to increase the valuation of healthier foods, but tends to be used scantly in the packaged foods available in lower-income areas (de-Magistris and López-Galán, 2016; Fernández--Gaxiola et al., 2022). Thus, in general we expect the following:

H1. WTP for healthier processed food is below its market price in low-income communities.

It has been shown that willpower is required to control System 1 motivations and allow System 2 to influence decision-making (Shiv and Fedorikhin, 1999). Loewenstein et al. (2015) developed a tractable dual system framework where the latter processes are modelled. We specified utility in the WTP space. This is a convenient re-parameterization of the conventional specification of utility on the preference space, which provides more reasonable distributions (Hess and Train, 2017; Train and Weeks, 2005). Following Loewenstein et al.'s approach, we can express WTP as follows:

$$WTP_i = u(x,D)\left\{\frac{1+h[W(\tau),\sigma]a_x}{1+h[W(\tau),\sigma]a_m}\right\} = u(x,D;I)\left\{\frac{1+h[W(\tau(P)),\sigma(P)]a_x}{1+h[W(\tau(P)),\sigma(P)]a_m}\right\}$$

where WTP is the willingness to pay, $u(x,D)$ is the value assigned to a food item x by System 2, which leaves a disposable income D if purchased; $h(W(\tau),\sigma)$ is the cost to System 2 of exerting willpower to control System 1 motivations (i.e., ability to exercise self-control (Ruhm, 2012)). This cost is increasing in the level of competing cognitive demands σ (e.g., cognitive load) and decreasing in terms of willpower strength $W(\tau)$. As an addition to Loewenstein et al.'s model, we assume that willpower strength is a function of the stress level τ (Ruhm, 2012). This is consistent with studies that link chronic financial stress with smoking relapse and unhealthy eating behaviours (Beenackers et al., 2018; van Rongen et al., 2019). The relationship between stress and motivations is generally considered to be an inverted U shape, where outcomes improve from low to medium stress levels, but decrease if

stress levels continue to rise after certain threshold level (Cahlíková et al., 2020; Egeth and Kahneman, 1975). As our participants live in a relatively stressful environment with high levels of poverty and insecurity, we expect the effect of additional stress to be negative. Moreover, a_x and a_m are the positive affective intensities for the food item x and money, respectively. If a_x increases, *WTP* increases; whereas if $a_m$increases, *WTP* decreases. As feelings of money scarcity create a greater focus on cues associated with money, we posit that for low-income individuals $(a_m/a_x)\rangle 1$ (Zhao and Tomm, 2017).

We assume that poverty concerns P increase σ and τ (Haushofer and Fehr, 2014; Mani et al., 2013; Schilbach et al., 2016). Consequently, exerting willpower becomes more costly when poverty concerns increase, making it less likely that people engage their System 2 processes. Given that $(a_m/a_x)\rangle 1$, this results in a negative deviation from the deliberative valuation of x, which translates into a lower WTP. As they persistently experience these situations, such concerns are plausibly more disturbing for the poor than for the rich (Mani et al., 2013). Thus, we posit that the above effects will be exacerbated for the lower-income categories. From this, the following mediation hypothesis arises naturally:

H2. Poverty related concerns increase cognitive load and stress, which then leads to a lower WTP for healthier processed food. The latter effect is higher among lower-income groups.

To effectively use information individuals require substantial cognitive efforts to consider future implications and trade-offs regarding nutrition, health and costs (Hunter et al., 2018). Hence nutrition and health information are more likely to affect decisions when System 2 is engaged (Just and Gabrielyan, 2018). In fact, when new knowledge I signals positive benefits of healthier foods, System 2′s valuation $u(x, D)$ increases. However, when σ and τ increase, System 1 becomes more dominant, which makes individuals more prone to unhealthier food choices and to counteract the positive effect of information (Carroll et al., 2018). Altogether, this leads to the following interaction hypothesis:

H3. Nutrition information leads to increased WTP for healthier processed food, but the effect is smaller when poverty related concerns are present.

3. Materials and methods

Field work in Mexico City was carried out between September-October 2019 in six locations between 9 am and 4 pm during twenty weekdays. Subjects were fully informed about the procedures and signed consent forms. A pre-analysis plan that included the above hypotheses was registered before data collection (see http://egap.org/registration/6042). The research design received ethical approval from Wageningen University's Social Sciences Ethics Committee, and CIMMYT's Institutional Research Ethics Committee.

3.1. Participants

We used venue-based sampling and purposely selected three densely populated municipalities in peri urban Mexico City (Chimalhuacan, Chicoloapan and Texcoco). These municipalities comprised high or very high levels of poverty according to the Index of Urban Marginalization elaborated by the *National Population Council* (CONAPO, by its initials in Spanish). This index includes ten indicators covering four dimensions: education, health, housing conditions, and asset ownership. Within these municipalities, we purposely selected six sites where we were likely to encounter people belonging to our target group of primary shoppers. All sites were in areas with high levels of poverty, but to increase the likelihood of encountering both poor and less poor people, we included sites surrounded by areas with medium level poverty. The selected sites for data collection were a central square, a shopping mall, and locations in streets close to schools.

We targeted adult primary shoppers with no allergies or personal reasons preventing them from eating bread and interviewed them on the spot upon accepting to participate. Women comprised the majority of respondents (71 %) (see Table 1), which reflects that they are typically the primary grocery shoppers (Dominguez-Viera et al., 2022). Most participants had consumed packaged bread in the previous week (63 %). The average participant reported a moderately high stress level about being able to afford grocery expenses in the past month (M=3.4 and SD=1.13 on a 1–5 scale). Many respondents (55 %) reported to feel highly or extremely stressed about the situation just described. As seen in Table 1, that was in line with most of the sample (88 %) living in a household with a low-income (maximum monthly income of MXN 11,000 (USD 562)). People with low-income experienced more stress: The share of participants that reported to feel highly or extremely stressed over the past month ranged from 60 % for the bottom income category to 20 % for those in the top income category in the sample (out of 6 categories).

3.2. Experimental treatments

Each subject was randomly allocated to one of four potential treatment groups, based on a 2 × 2 factorial design with two between subjects treatments, namely nutrition information (Yes/No) and poverty concern (High/Low). These treatments are detailed below:

i. *Nutrition and health information.* Before the elicitation of WTP, an enumerator explained that both products were high in fibre, low in fat, high in whole grains content and that consuming a diet rich in whole grains reduced the risk of constipation and colon cancer (see

Table 1
Summary statistics.

Indicator	Mean (1)	Std. Dev. (2)	Min (3)	Max (4)
Demographics				
Female	0.71	0.45	0	1
Age (years)	42.60	15.01	18	84
In partnership[1]	0.64	0.48	0	1
Children dependency ratio[2]	0.22	0.21	0	1
Household size	4.48	2.14	1	17
No formal education	0.03	0.18	0	1
Primary education	0.54	0.50	0	1
Secondary education	0.30	0.46	0	1
Tertiary education	0.13	0.34	0	1
In a remunerated activity	0.67	0.47	0	1
Weekly grocery expenses (MXN)	713.31	404.73	30	3000
Monthly household income (yes=1)				
Very low (MXN 0–2500)	0.22	0.41	0	1
Low (MXN 2501–5000)	0.37	0.48	0	1
Middle-low (MXN 5001–11,000)	0.30	0.46	0	1
Middle-high (MXN 11,001–17,000)	0.08	0.28	0	1
High (MXN 17,001–29,000)	0.02	0.14	0	1
Very high (MXN 29,001 - More)	0.01	0.11	0	1
Food consumption previous week (yes=1)				
Tortilla	0.97	0.18	0	1
Baguette	0.86	0.35	0	1
Packaged bread	0.63	0.48	0	1
Bread preferences (yes=1)				
Purchases packaged bread weekly	0.52	0.50	0	1
Restricts bread for HH member's health	0.22	0.42	0	1
Willingness to pay (MXN)				
Green bread	30.68	9.57	0	60
Red bread	36.02	9.50	11	60
Psychological measures (yes=1)[3]				
Not in a hurry	0.39	0.49	0	1
Not tired	0.54	0.50	0	1
Highly stressed past month[4]	0.55	0.50	0	1

Notes: [1]Incudes married and living together. [2]Children below 12 years of age divided by household size. [3]Median splits of scales from 1 to 5. [4]Highly or extremely worried about affording grocery expenses in the past month.

materials in Annex B of the supplementary information). Afterwards, the enumerator asked two questions to assess knowledge acquisition and level of attention.

ii. *Poverty concern.* An enumerator presented a hypothetical scenario to bring pre-existent worries top of mind. We followed standard priming techniques used previously elsewhere (Bartoš et al., 2021; Dalton et al., 2019). Participants were asked to consider a course of unfortunate events intended to create different levels of stress and cognitive load. Three focus groups were organized before data collection and helped shape the scenario to the local context. It comprised two associated sources of hardship, both with high and low versions: an economic shock resulting from a health problem of a household member. This was the exact wording used:

High (**Low**) condition: Imagine that an unexpected expenditure of MXN 20,000 (USD 1020.4) (**MXN 50 (USD 2.6)**) arises for a major (**minor**) medical treatment for one of your family members. You do not have health insurance and must go to a private health centre. Imagine how would you respond to this situation. Would you have to borrow money or pawn your belongings to cover this expense? Would you have to adjust your weekly budget for food? How stressed would you feel in this situation?

The questions about borrowing and pawning were part of the poverty concern inducement described above and served to verify the level of hardship of the scenario. To avoid a lengthy interview, we asked closed questions instead of the conventionally used open questions. The final question was our measure of stress caused by the scenario. It was set in a 1–5 scale, from no stress to extremely stressed.

3.3. Procedure and materials

To estimate the effects of our treatments on the WTP for healthier processed food, we used two bread products, which throughout the rest of the text we refer to as *green* and *red* based on the packaging colours. We focused on bread because of its increasing popularity as substitute for traditional Mexican foods like tortilla among low- and middle-income consumers in urban areas like Mexico City (Dominguez-Viera et al., 2022). The products were selected from a set of seventeen packaged breads available in Mexico City, which were classified as healthier by Marrón-Ponce et al. (2020) following the Pan American Health Organization's Nutrient Profile Model (PAHO, 2016). The model calculates nutrition scores according to calories, sugar, saturated fat, sodium, protein and fibre content (see Table A.1 in the supplementary information). After focus group discussions, we selected the two final products, which: a) had the traditional sandwich like slice; b) had a colour that was appealing to consumers in the area (not black) and signalling healthiness (not white); c) were not readily available in the research zones; and d) were not of the same brand (the brands were not visible for participants). According to data collected by Marrón-Ponce et al. (2020) in selected retail outlets (e.g., supermarkets, independently owned grocery stores, corner stores and convenience stores) of Mexico City, their mean prices were MXN 49 (USD 2.25) and MXN 44 (USD 2.51) for the red and green products, respectively.

We used the Becker–DeGroot–Marschak (BDM) mechanism to elicit WTP for the products. Fig. 1 depicts the basic elements of the experiment (see materials and full protocol in Annex C of the supplementary information). We started with the provision of information for those subjects selected into the treatments with information. Next, participants engaged in sensory evaluations, where they rated both products on a scale of 1–7 regarding smell, taste, texture, appearance, colour and size. Subsequently, a practice auction round was implemented using a bar of soap and fake money. In a fourth step, we induced the poverty concerns. Afterwards, participants were endowed with MXN 60 (USD 3.06), an amount that was enough to buy a package of either of the products at market prices, and they placed their bids for both products. Finally, one of the two varieties was randomly selected to be used in the auction, and a random price was drawn from a bag that contained five numbers set around the market prices of packaged bread. If the bid was higher or equal to the random price, a participant won the auction, paid the randomly generated price, kept the change and received the product. Otherwise, he/she lost the auction and kept the endowment in full.

After the auction, we used two raven matrices to assess cognitive skills (see materials in Annex D of the supplementary information).

3.4. Empirical strategy

The primary outcome of the study is the estimated WTP for each healthier bread variety. Secondary outcomes used to explain the mechanism behind our results are stress level and cognitive skills. We defined stress level as a dummy, which is 1 if the individual indicated feeling very or extremely stressed in the poverty concern treatment, 0 otherwise. Cognitive skills were measured as the number of correct answers (0−2) to the raven matrices. Finally, we added two variables to further explore the potential stress caused by the poverty concern: dummy variables for whether respondents would have to engage in borrowing *or pawning* or to a*djusting grocery expenses*, respectively, in response to the concerns raised.

The general specification to estimate the main results is as follows:

$$Y_{ij} = \alpha_j + \beta_1 I_{ij} + \beta_2 P_{ij} + \beta_3 I_{ij} P_{ij} + \beta_4 W_{ij} P_{ij} + \gamma W_{ij} + \delta X_{ij} + \varepsilon_{ij}$$

where i indexes individual participants and j the interview site; Y represents our various outcomes of interest (i.e., WTP, level of stress, cognitive skills, financial decisions); P is a dummy for poverty concern -equal to 1 if the subject was confronted with the high condition, 0 if presented with the low condition; I is a dummy for the information treatment, which is 1 if treated with the nutrition and health information, 0 otherwise; W is a dummy for being in the *lower-income* categories (maximum household monthly income of MXN 5000 (USD 255)), which were determined by a median split of the 6 income categories in the data (see Table 1); X are control variables, including sociodemographic variables, dummies to proxy hunger and the psychological condition of the participants, and bread preferences. α_j is a set of location specific intercepts. β, γ and δ are parameters, with β our parameters of interest -the effects of the treatments.

Sociodemographic controls are *age* in years, *household size*, *dependency ratio*, calculated dividing the number of children below 12 years of age by the household size; and dummies for being *female*, *in a partnership*, *in a remunerated activity*, and having *secondary education and above*. The hunger dummy was measured as equal to 1 if the last meal happened recently (<4 h), 0 otherwise. The psychological dummies are *not in a hurry*, *not tired* and *high stress level past month*. Bread preferences cover a *sensory index*, constructed as the first principal component of the seven factors rated in the sensory evaluations; and a dummy indicating *bread restrictions*, which is 1 if purchases of bread are restricted due to a

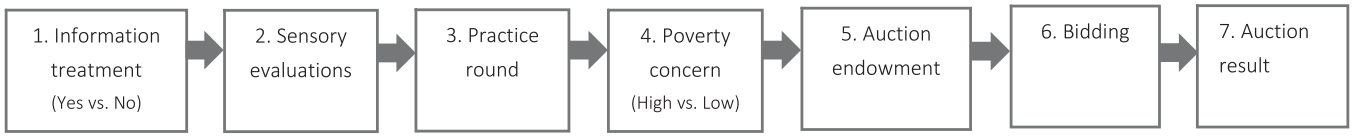

Fig. 1. Elements in the experimental procedure.

household member's health condition, 0 otherwise.

Randomization checks provided only slight unbalances between treatment groups for these controls (see Table 2). Moreover, joint tests of orthogonality (i.e., binary probit with the treatment variable on the left-hand side and controls on the right-hand side) suggested that the groups in the poverty concern (Prob>χ^2 =0.117) and information (Prob>χ^2 =0.341) treatments are comparable to the control group. Likewise, we checked if enumerator's characteristics caused sample bias. We focused on enumerators' gender, as the team was mainly heterogenous in this aspect (3 males and 3 females). While there were only a few differences in the characteristics of participants interviewed by male and female enumerators (see Table A.2 in the supplementary information), a test of orthogonality showed that these were jointly significant (Prob>χ^2 =0.047). Hence, we will add enumerator fixed effects in our regressions as a robustness check.

All regression analyses were performed through OLS. Note that the estimation method for the dichotomous dependent variables is a linear probability model. An alternative would be using logit or probit estimation. However, the latter methods have issues with estimating the marginal effects for interaction terms, which are important in our estimations (Belot et al., 2016). Estimated standard errors are robust. We control for multiple hypothesis testing using the false discovery rate (FDR) of Anderson and the Romano-Wolf multiple hypothesis correction to control the familywise error rate (FWER) (Anderson and Mellor, 2008; Clarke et al., 2019). Finally, we performed an influential points analysis (*lvr2plot* in Stata), resulting in the deletion of 25 observations from the sample which had cook's distance values that were higher than $4/(N-k-1)$. The final sample size was 423 participants.

We deviated from the pre-analysis plan (PAP) in four aspects. First, we changed the income variable from using the lowest income category to a group determined by a median split. We proceeded in that way because this categorization is easier to interpret and is often employed in scarcity papers (Mani et al., 2013; Shah et al., 2015). This change did not alter our findings (see Tables A.3a and A.3b in the supplementary information). Second, we indicated in the PAP that we would cluster standard errors at the location level. We used robust standard errors instead, as it is standard practice in similar experimental designs with randomization at the individual level (Bartoš et al., 2021). This gives almost identical results. Third, we did not anticipate the influential points analysis, which we implemented to avoid outliers affecting the accuracy of our regressions. Deletion of the influential observations did not affect our manipulation checks but strengthened our main results. Lastly, the PAP did not mention the Romano-Wolf method for correcting for multiple hypothesis testing. We added this method because it is more conservative than the FDR method, which is more suitable for testing a large number of hypotheses (Clarke et al., 2019).

Table 2
Randomization checks.

Variable	Poverty concern		*p*-value†	Information		*p*-value†
	High	Low		Yes	No	
Female (dummy)	0.72	0.71	0.781	0.72	0.70	0.582
Age (years)	42.94	42.25	0.640	42.30	42.90	0.678
In partnership (dummy)[1]	0.66	0.62	0.404	0.67	0.62	0.226
Children dependency ratio[2]	0.24	0.20	0.087	0.22	0.22	0.880
Household size	4.36	4.61	0.226	4.35	4.61	0.224
Above secondary education (dummy)	0.43	0.43	0.990	0.48	0.38	0.058
In a remunerated activity (dummy)	0.69	0.65	0.354	0.69	0.66	0.467
HH with lower-income (dummy)	0.56	0.60	0.415	0.59	0.58	0.786
Restricts bread for a household member's health condition (dummy)	0.24	0.20	0.349	0.25	0.20	0.212
Had last meal recently (dummy)	0.54	0.47	0.133	0.54	0.47	0.189
Not in a hurry (dummy)	0.33	0.46	0.004	0.37	0.42	0.329
Not tired (dummy)	0.51	0.58	0.146	0.54	0.55	0.817
Highly stressed past month (dummy)[3]	0.51	0.58	0.174	0.54	0.55	0.894
Sensory index green bread	-0.06	0.06	0.234	0.04	-0.04	0.388
Sensory index red bread	-0.00	0.00	0.989	-0.07	0.07	0.126
N	216	207		210	213	

Notes: [1]Incudes married and living together. [2]Children below 12 years of age divided by household size. [3]Highly or extremely worried about affording grocery expenses in the past month. †If dummy variable, *p*-value is based on Pearson $\chi 2$ test for the independence between variables, otherwise, it is based on a t-test on equality of means between groups. * p < 0.1, ** p < 0.05, *** p < 0.01.

4. Results

4.1. Willingness to pay in the absence of nutrition information

Without providing nutrition information, average bids for the red and green varieties were MXN 35.8 (95% CI 34.5–37.1) and MXN 30.9 (95% CI 29.5–32.2), respectively. The higher valuation for the former variety aligned with the sensory evaluations, where the red product had significantly higher scores than the green product across all attributes (see Table A.4 in the supplementary information). Regarding the ingredients that usually improve sensory characteristics, the former had a higher saturated fat and sugar content than the latter (see Table A.1 in the supplementary information). The valuations of both products were significantly lower than their market prices (MXN 44–49). Thus, our results support hypothesis 1, leading to the following result:

Result 1: WTP for both healthier processed food items are below their market prices in low-income communities.

4.2. Manipulation checks

The average score in terms of stress for participants in the high poverty concern was 4.0 (*SD*=1.02) on a scale of 1–5, compared to 2.9 (*SD*=1.25) for the low poverty concern. Furthermore, the reported likelihood of borrowing/pawning and adjusting grocery expenses was 26.7 % and 12.7 % points higher under the high condition (see Table 3). While individuals treated with the high condition had a higher level of stress than those in the low condition, their cognitive capacity was not affected (see Table 3). Whether the respondent won or lost the auction also did not affect cognitive load. The additional effect of the high condition on stress for those in the bottom income categories was positive, but statistically insignificant (see interaction terms in Table 3, columns 3, 6, 9, 12). The findings regarding the effects of the main treatment effect and interaction terms on stress level did not change when using a 5-point scale stress measurement (see Table A.5 in the supplementary information). Similarly, the results for the binary outcomes remained robust when using probit estimations (see Table A.6 in the supplementary information). The FDR and FWER corrections did not alter the statistical significance assessments. This leads to the following statement underling the mechanism of the study (H2):

Result 2a: Poverty related concerns increase stress but do not affect cognitive load. The effect on stress does not differ by income level.

Respondents were not inattentive to the information: Around 80% of participants recalled one or more attributes for both the nutrition and health components of the information provided. These figures did not differ by poverty concern condition and/or income. Unfortunately, we cannot be sure that the information increased knowledge, as we did not

Table 3
Effect of poverty concerns on reported stress level, measured cognitive skills and reported financial decisions.

Dependent variable	Highly stressed (dummy)			Cognitive skills (0–2)			Borrowing or pawning (dummy)			Adjusting grocery expenses (dummy)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
High poverty concern	0.481***	0.449***	0.473***	0.024	0.071	0.001	0.267***	0.253***	0.308***	0.127***	0.065	0.135**
	(0.041)	(0.059)	(0.065)	(0.054)	(0.079)	(0.069)	(0.040)	(0.055)	(0.065)	(0.038)	(0.054)	(0.067)
p-value	*0.000*	*0.000*	*0.000*	*0.326*	*0.185*	*0.495*	*0.000*	*0.000*	*0.000*	*0.001*	*0.116*	*0.022*
FDR q-value	*0.001*	*0.001*	*0.001*	*0.254*	*0.276*	*0.493*	*0.001*	*0.001*	*0.001*	*0.003*	*0.228*	*0.080*
FWER p-value	*0.000*	*0.000*	*0.000*	*0.323*	*0.208*	*0.461*	*0.000*	*0.000*	*0.000*	*0.001*	*0.208*	*0.044*
Information	0.016	-0.018	0.016	0.097**	0.145**	0.097**	-0.006	-0.021	-0.008	0.015	-0.049	0.014
	(0.042)	(0.062)	(0.042)	(0.054)	(0.078)	(0.054)	(0.038)	(0.066)	(0.039)	(0.038)	(0.059)	(0.038)
p-value	*0.354*	*0.388*	*0.351*	*0.037*	*0.031*	*0.036*	*0.437*	*0.375*	*0.421*	*0.348*	*0.202*	*0.352*
FDR q-value	*0.254*	*0.386*	*0.459*	*0.049*	*0.116*	*0.097*	*0.280*	*0.386*	*0.459*	*0.254*	*0.276*	*0.459*
FWER p-value	*0.659*	*0.898*	*0.659*	*0.128*	*0.113*	*0.125*	*0.659*	*0.898*	*0.659*	*0.659*	*0.898*	*0.659*
High poverty concern*Information		0.065			-0.095			0.029			0.125*	
		(0.083)			(0.105)			(0.077)			(0.076)	
p-value		*0.216*			*0.816*			*0.351*			*0.050*	
FDR q-value		*0.276*			*0.480*			*0.386*			*0.142*	
FWER p-value		*0.495*			*0.821*			*0.578*			*0.178*	
High poverty concern*Lower-income			0.015			0.041			-0.070			-0.015
			(0.085)			(0.107)			(0.082)			(0.081)
p-value			*0.432*			*0.352*			*0.197*			*0.427*
FDR q-value			*0.459*			*0.459*			*0.459*			*0.459*
FWER p-value			*0.787*			*0.787*			*0.792*			*0.787*
Lower-income	0.053	0.055	0.045	-0.093*	-0.095*	-0.114*	0.083**	0.083**	0.119**	0.078**	0.081**	0.086*
	(0.044)	(0.044)	(0.064)	(0.060)	(0.061)	(0.086)	(0.042)	(0.042)	(0.071)	(0.042)	(0.042)	(0.065)
Constant	-0.064	-0.052	-0.060	1.900***	1.884***	1.911***	0.471***	0.477***	0.452***	0.449***	0.470***	0.445***
	(0.129)	(0.131)	(0.131)	(0.175)	(0.176)	(0.178)	(0.127)	(0.127)	(0.132)	(0.128)	(0.125)	(0.131)
R^2	0.337	0.338	0.337	0.119	0.121	0.119	0.182	0.182	0.183	0.154	0.159	0.154
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean (Low)	0.32			1.75			0.65			0.75		

Notes: OLS estimations and observations equal to 423 in all columns (422 in 4,5,6). Robust standard errors in parentheses. All regressions include controls for demographics, restricts bread, sensory indices of the red and green varieties, psychological measures and location fixed effects. p-value corresponds to one-sided OLS p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, based on OLS p-values. FDR q-values calculated according to Anderson and Mellor (2008). FWER corrected p-values based on Clarke et al. (2019), with 3000 replications. FDR and FWER calculated pooling the specifications in the following groups of columns: a) 1,4,7, 11; b) 2, 5, 8, 11; c) 3, 6, 9, 12.

ask knowledge questions to participants who did not get the information treatment. Also, while we do sensory evaluations for taste, appearance and the like, we do not assess perceptions of healthiness. Any results of the information treatment could therefore result from increased knowledge or increased salience of nutrition and health.

4.3. Willingness to pay when poverty concerns are induced

In Tables 4a 4b, we present the main regression analysis for WTP for the two food products. For the green variety, the WTP was significantly lower under the high than under the low poverty concern. On average, a participant induced to think about high poverty concerns offered MXN 1.61 less (USD 0.08), equivalent to roughly 0.17 SD. This result was robust to FWER corrections (see Table 4a), the inclusion of day of the week and enumerator fixed effects (see Table A.7 in the supplementary information). The negative effect of poverty concerns seemed to decrease as the level of appreciation for its sensory attributes increased, but this effect was statistically insignificant (see Table A.8 in the supplementary information).

The effect pointed in the same direction for the red product, but the coefficient was statistically insignificant. The lack of an observed effect could not be explained by its more appreciated sensory attributes (see Table A.8 in the supplementary information). Preferences over bread consumption certainly vary for consumers that had bread purchasing restrictions due to a household member's health condition (22% of the sample). When excluding the mentioned participants, high poverty concerns reduced the WTP for the red bread by MXN 1.73, which was statistically significant even after FWER corrections (see Table A.9 in the supplementary information). Altogether, our main result is as follows:

Result 2b: Poverty related concerns decrease WTP only for one of the healthier processed food items or a subgroup of consumers.

To test hypothesis 2 in full, we performed a mediation analysis through structural equation modelling for the green product (see Fig. 2). The direct effects in the stress path were both significant (top of the figure), while the two direct effects in the cognitive load path were insignificant (bottom of the figure). The indirect effect of the high condition on the WTP for the green product via stress was significant ($\beta = -0.98, \rho = 0.05$), whereas the indirect effect through cognitive load was insignificant ($\beta = 0.014, \rho = 0.70$). The direct effect of the high condition on the green product's WTP was not significant after controlling for the indirect effects ($\beta = 0.60, \rho = 0.51$). This suggested that stress fully mediated the effect of the high condition on the valuation of the green variety. We did an alternative analysis where the mediation happened via stress and cognitive load operating in series, but found that the effect of stress on cognitive load was insignificant. Therefore, we found partial evidence in favour of the mediation hypothesis:

Result 2c: Poverty related concerns decrease WTP for the healthier processed foods via increased stress.

The interaction treatment effects with the lower-income categories for both products were negative, but statistically insignificant in our main regression analysis (see column 6 in Tables 4a and 4b). We did an exploratory analysis with the green bread to determine if there were changes in the distribution of bids by treatment condition and income category. Fig. A.1 in the supplementary information shows that, for the green variety there was a backward shift in the estimated demands among the lower-income participants treated with the high condition, especially around market prices. For higher-income participants the backward shift is only perceptible in the range of lower bids, then the demands crossover around offers equivalent to market prices. A stochastic dominance test showed that only for the lower-income categories the distribution of bids between the high and low conditions significantly differed (Somers' D test : $D = -0.124, \rho = 0.04$, *one − tailed test*). Altogether, our findings did not support the interaction component of hypothesis 2:

Result 2d: The effect of poverty related concerns on WTP for healthier processed foods does not differ between the lower- and higher-income groups.

Table 4a
Regression analysis on willingness to pay for the green bread.

Dependent variable	Willingness to pay ($MXN)					
	(1)	(2)	(3)	(4)	(5)	(6)
High poverty concern	-1.709**	-2.832**	-1.454	-1.612**	-2.403**	-1.561
	(0.864)	(1.275)	(1.472)	(0.834)	(1.258)	(1.400)
p-value	*0.024*	*0.014*	*0.162*	*0.027*	*0.030*	*0.126*
FDR q-value	*0.107*	*0.092*	*0.866*	*0.122*	*0.220*	*0.872*
FWER p-value	*0.048*	*0.026*	*0.260*	*0.056*	*0.059*	*0.203*
Information	-0.081	-1.243	-0.079	-0.669	-1.487	-0.671
	(0.886)	(1.252)	(0.885)	(0.826)	(1.193)	(0.829)
p-value	*0.464*	*0.161*	*0.464*	*0.186*	*0.101*	*0.187*
FDR q-value	*0.356*	*0.252*	*0.866*	*0.229*	*0.297*	*0.872*
FWER p-value	*0.548*	*0.238*	*0.543*	*0.275*	*0.162*	*0.275*
High poverty concern*Information		2.270			1.595	
		(1.771)			(1.708)	
p-value		*0.100*			*0.183*	
FDR q-value		*0.252*			*0.297*	
FWER p-value		*0.150*			*0.273*	
High poverty concern*Lower-income			-0.527			-0.089
			(1.828)			(1.779)
p-value			*0.387*			*0.495*
FDR q-value			*0.866*			*0.872*
FWER p-value			*0.416*			*0.502*
Lower-income			-0.979	-0.849	-0.813	-0.803
			(1.271)	(0.976)	(0.978)	(1.340)
Constant	30.364***	30.857***	31.068***	30.219***	30.481***	30.193***
	(1.482)	(1.508)	(1.747)	(3.037)	(3.042)	(3.107)
R^2	0.099	0.102	0.103	0.200	0.202	0.200
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000

Notes: OLS estimations and observations equal to 423 in all columns (422 in 4,5,6). Robust standard errors in parentheses. All regressions include controls for demographics, restricts bread, sensory indices of the red and green varieties, psychological measures and location fixed effects. p-value corresponds to one-sided OLS p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, based on OLS p-values. FDR q-values calculated according to Anderson (2008). FWER corrected p-values based on Clarke, Romano, and Wolf (2019), with 3000 replications. In the FDR and FWER corrections, the WTP for each variety were pooled as two outcomes.

Table 4b
Regression analysis on willingness to pay for the red bread.

Dependent variable	Willingness to pay ($MXN)					
	(1)	(2)	(3)	(4)	(5)	(6)
High poverty concern	-1.080	-1.479	-0.686	-1.037	-1.031	-0.878
	(0.893)	(1.260)	(1.427)	(0.859)	(1.195)	-1.346
p-value	*0.131*	*0.127*	*0.361*	*0.117*	*0.167*	*0.293*
FDR q-value	*0.245*	*0.252*	*0.866*	*0.213*	*0.297*	*0.872*
FWER p-value	*0.142*	*0.138*	*0.381*	*0.140*	*0.184*	*0.314*
Information	0.667	0.253	0.652	0.250	0.257	0.244
	(0.900)	(1.257)	(0.899)	(0.847)	(1.231)	-0.847
p-value	*0.207*	*0.411*	*0.211*	*0.323*	*0.417*	*0.328*
FDR q-value	*0.262*	*0.319*	*0.866*	*0.306*	*0.379*	*0.872*
FWER p-value	*0.294*	*0.542*	*0.298*	*0.438*	*0.542*	*0.440*
High poverty concern*Information		0.807			-0.013	
		(1.812)			(1.692)	
p-value		*0.313*			*0.441*	
FDR q-value		*0.319*			*0.379*	
FWER p-value		*0.320*			*0.454*	
High poverty concern*Lower-income			-0.704			-0.275
			(1.832)			(1.763)
p-value			*0.318*			*0.388*
FDR q-value			*0.866*			*0.872*
FWER p-value			*0.416*			*0.502*
Lower-income			-0.040	-0.322	-0.323	-0.18
			(1.260)	(0.943)	(0.944)	(1.322)
Constant	35.803***	35.978***	35.880***	37.621***	37.619***	37.545***
	(1.396)	(1.414)	(1.613)	(2.677)	(2.677)	(2.710)
R^2	0.079	0.079	0.079	0.227	0.227	0.227
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000

Notes: OLS estimations and observations equal to 423 in all columns. Robust standard errors in parentheses. Estimations of p-values, FDR q-values, FWER p-values do not include two participants that offered bids equal to 0 in the auction. †Demographics, restricts bread, sensory index (FWER p-value estimations include indices for both products), psychological measures. Location fixed effects included in all columns. p-value corresponds to one-sided OLS p-values. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, based on OLS p-values. FDR q-values calculated according to Anderson and Mellor (2008). FWER corrected p-values based on Clarke et al. (2019), with 3000 replications. In the FDR and FWER corrections, the WTP for each variety were pooled as two outcomes.

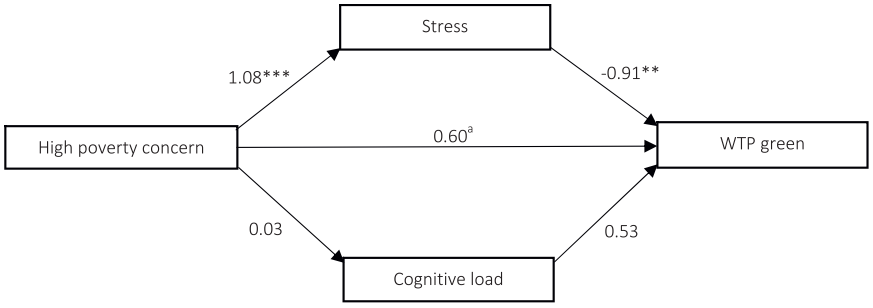

Fig. 2. Simple mediation analysis with high poverty condition as independent variable, stress (categorical variable) and cognitive load as mediators and WTP for the green variety as dependent variable. Notes: Values shown are unstandardized regression coefficients. Estimations performed using robust standard errors and including these covariates: sociodemographics, restricts bread, sensory indices, psychological measures and location fixed effects. [a]Direct effect after controlling for the indirect effects. * $p < 0.1$, * * $p < 0.05$, * ** $p < 0.01$.

4.4. Effectiveness of nutrition information when poverty concerns are induced

Enumerators presented respondents information regarding the nutritional profile and health benefits of both products. As depicted in Tables 4a and 4b, this information did not have a significant effect on WTP for either of the two products. It naturally follows that the interaction effect with the high poverty concern was statistically insignificant. Thus, our findings did not support hypothesis 3.

Result 3: Nutrition and health information do not affect WTP for healthier processed foods. This effect remains unchanged when poverty related concerns are present.

5. Discussion

5.1. Principal findings

When entering a grocery store, lower-income shoppers may face greater internal challenges than their richer counterparts, aspects that go beyond traditional barriers for healthier food choices (e.g., affordability, knowledge, food selection environment). With this idea in mind, we went to low-income areas in Mexico City to test the influence of poverty related monetary and health concerns on the WTP for healthier processed foods.

In general, our findings depict a story where the average participant had a WTP below the market prices for the two food items used in the study (called green and red bread). From a two systems perspective, the low valuations may be explained by aspects that drive System 1 decisions such as less familiarity and less availability of these products in low-income areas of Mexico City (Marrón-Ponce et al., 2020). Whereas System 2′s optimal valuation of healthier foods is likely higher than System 1′s valuation, a relatively low WTP is also explained by deliberative factors such as absolute price differences with the most popular, cheaper options and budget constraint considerations.

Additionally, our causal estimates showed that making individuals think about a major expenditure to cover health care costs (i.e., high poverty concerns) decreased their valuations only for the green variety. For the whole sample, the WTP for the product with more appreciated

taste (i.e., the red bread was sweeter and fattier) was unaffected by the priming procedure. Our data did not show that the lack of an effect for the red bread among the whole sample would be due to its better taste. Nonetheless, we found that the valuation of the red variety was decreased by high poverty concerns for participants without bread purchasing restrictions due to a household's member health condition. Those with such restrictions possibly purchase bread on fewer occasions and very likely limit their options to certain variants of these products, often with healthier attributes like those of the red bred (e.g., non-white, with grains on top) (Dominguez-Viera et al., 2022). It is possible that they were already familiar with health concerns and the scenario presented was less disturbing than for the rest of participants and/or led them to actually value healthier products even more.

The effects of the induced concerns were relatively small, both in terms of monetary value and standard deviations. However, we argue that this is not necessarily an indication that the effect of poverty concerns is of minor importance. If the difference between imagining a minor and major hypothetical economic shock is sufficiently large to be measurable in our data, the effect of actual poverty stress could be substantial. New research, for example based on natural experiments, could shed more light on the effect size of real-life stress.

The effect size of poverty concerns on the valuation of the green product did not differ between the lower- and higher-income groups. We only found suggestive evidence that poverty concerns negatively shifted the estimated demand curve exclusively among the lower-income group. Perhaps we did not find differences in effect sizes because our sample did not resemble the population's income distribution, as most participants belonged to lower-income segments (Mani et al., 2013). Furthermore, the social distance between our participants may not be very substantial, as they lived in the same general area. Therefore, our findings are mainly driven by participants from a low-income context and cannot be generalized to higher-income groups.

Rational approaches to influence dietary behaviours assume that individuals use all available information to make deliberative and conscious food decisions (Wilson et al., 2016). However, we could not back this argument as information was not effective in increasing the products' valuations. In line with previous studies, it is possible that regardless of the information provided participants already identified both breads as healthier, as brown breads are typically perceived as such (Dominguez-Viera et al., 2022). In this sense, we could not prove that the effect of information was reduced by the induced concerns. Future research may explore if inducing health preoccupations creates a more health-conscious mindset that is more responsive to health information. This aspect is probably more prevalent among women, who comprised the majority of our sample and are often in charge of feeding their family. Health issues usually have strong emotional components (Loewenstein et al., 2015). Anecdotal comments by participants suggest that the health aspect in the scenario was more worrying than the financial source of hardship. This may have resulted in an increased affective intensity and subsequently a higher WTP for healthier foods. We did not ask participants about their current level of concern about health issues, a measure that could have aided to assess the effects of the induced concerns following the Yerkes-Dodson law. It is also likely that high levels of poverty concern may have induced attentional neglect of the information provided, although this outcome is not always successfully replicated (Shah et al., 2019; Zhao and Tomm, 2017). Our survey did not back that proposition either, as most participants recalled aspects of the information provided. Knowledge does not fully guarantee that respondents took the information into account to make their decision, hence this evidence is only suggestive (Gabaix, 2019).

5.2. Mechanisms

We highlighted that the negative effect of poverty concerns on WTP was mediated by increased stress, but not by higher cognitive load. This aligns with past studies that used similar priming techniques (Dalton et al., 2019). Living in poverty and moderate levels of stress can also lead to normative rationality or positive outcomes (Bruijn, 2021). However, considering that baseline stress was above medium level for our sample and rose to high levels after the priming, the Yerkes-Dodson law would predict a negative impact on our outcomes of interest (Egeth and Kahneman, 1975). Our results are also in line with the evidence that links chronic financial scarcity or stress with unhealthy eating behaviours, where lower self-control is a potential mediator (Beenackers et al., 2018; Siahpush et al., 2014). The poverty and self-control association is usually linked to time preferences inconsistencies (Bartoš et al., 2021; Bernheim et al., 2015). While we can assume such relationships from dual system models as illustrated in Loewenstein et al. (2015), we did not elicit time preferences to confirm that. Other mechanisms may have also played a role. For instance, based on our model WTP could also be reduced by a higher affective intensity for money. Scarcity feelings create a greater focus on what is scarce (Zhao and Tomm, 2017), which was confirmed by participants likely borrowing, pawning or adjusting grocery expenses to address the hypothetical monetary scenario. Biological confounders such as differential nutrition or sleep are ruled out, as the stress and cognitive load measurements took place immediately and around 5 min after the priming, respectively (Lichand and Mani, 2020), while we also controlled for factors like level of tiredness and hunger.

5.3. Strengths and limitations

To our knowledge, this is the first application within the poverty psychology literature that employs a scarcity-priming technique to assess its effects on food purchasing behaviours in low-income settings. We also contribute to the mixed evidence on the role of stress on decision-making and to the menu of mediators in this literature that so far has largely focused on cognitive load (Bruijn, 2021). Considering other strengths, the study covered three different municipalities in the largest metropolitan area among low- and middle-income countries, while the products analysed are part of the most prominent processed food category in the Mexican retail sector. However, the study also has a few notable limitations as described below.

Regarding the generalization of our findings, as we did not randomly draw our sample from the population the results are not necessarily externally valid to the municipalities selected nor to Mexico City. We have no reason to believe that poor people in other places would behave differently, but this can only be tested by replicating the experiment in different locations. The main threat to internal validity is participants sharing details of the experiment with future respondents. We think this risk was limited, as we stayed no more than two days in most of the locations and the research took place in very busy locations with environmental noises. We also asked participants not to share details of the interview. Additionally, our data did not capture self-regulatory skills, aspect that could counteract the negative effects of the poverty concern treatment. Moreover, we did not include alternative stress measures such as a cortisol test, which could provide further evidence to test our hypotheses. Yet, perceived stress scales usually report similar results as cortisol measurements (Haushofer and Shapiro, 2016). It is plausible that the priming procedure affected cognitive load, as other scarcity research has stated (Lichand and Mani, 2020; Schofield and Venkataramani, 2021; Shah et al., 2015). Relative to past studies, the lack of a significant result could be due to an insufficient number of raven matrices to enable capturing enough variability. Finally, our results are limited to two healthier products within a single food category. As a result, we cannot rule out that poverty concerns would also negatively affect the valuation of unhealthier options such as white packaged bread. We purposely discarded using such breads as we had a specific focus on healthier processed foods. Yet, the inclusion of such breads could have served as a benchmark, which could have helped to better explain the insignificant result for the read bread among the whole sample.

6. Conclusions

Barriers for lower-income consumers to healthier diets are not only economical but also psychological. Poverty concerns increase stress, which inhibits the ability to exert willpower. This mechanism leads to a decreased valuation of certain variants of healthier processed foods or among certain consumers. This effect does not differ by income level. It was unclear from our findings if poverty concerns only affect healthier processed foods' valuations, as it is possible that such concerns could also affect the valuations of unhealthier variants of processed foods. Further research with other food products with different levels of healthiness and categories is recommended, as our main results for the whole sample are limited to a single variety within one category. Our findings did not shed light on the potential nutrition and health information neglect in the presence of poverty concerns. This aspect is relevant as most food policies rely on educating consumers to make healthier food selections.

This work signals the importance of developing integrative approaches to promote healthier diets in low-income areas. For instance, the results could be interpreted as a cautious call for the expansion of cash transfers to increase purchasing power and relieve some of the poverty-related stress (Haushofer et al., 2021; Haushofer and Fehr, 2014). Whereas the expansion of cash transfers has been generally proposed in the scarcity literature to improve non-food behaviours, in the light of our results we posit that these policies may also aid in the context of food choices. At the same time, improvements in the food environment are needed to reduce the likelihood of affective-based food purchasing behaviours (Ruhm, 2012). Another possibility is to strengthen willpower through psychologically grounded interventions that are effective even in persistent states of poverty (Banker et al., 2020; Duckworth et al., 2018). Such tools are likely relevant to counteract the negative effects of monetary and health challenges on the demand of lower-income consumers for healthier processed foods.

CRediT authorship contribution statement

Marcos E. Dominguez-Viera: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing-Original Draft, Writing-Review and Editing, Visualization, Supervision, Project administration. **Marrit van den Berg:** Conceptualization, Methodology, Formal analysis, Writing-Original Draft, Writing-Review and Editing, Supervision, Project administration. **Michel Handgraaf:** Conceptualization, Methodology, Formal analysis, Writing-Original Draft, Writing-Review and Editing, Supervision. **Jason Donovan:** Resources, Writing-Review and Editing, Project administration, Funding acquisition.

Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ehb.2022.101215.

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