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2 Associations between mothers' perceptions of the cost of fruit and vegetables and children's diets:  
3 Will children pay the price?

4 Abstract

5 **Background** Perceptions that fruit and vegetables are expensive are more common amongst socio-  
6 economically disadvantaged groups and linked to poorer dietary outcomes. Such perceptions may  
7 be exacerbated in countries recently affected by natural disasters where devastation to fruit and  
8 vegetable crops has resulted in price increases of fruit and vegetables. Examining associations of  
9 perceptions of fruit and vegetable affordability and children's diets can offer insights into how the  
10 high prices of fruit and vegetables might impact the diets of children. **Subjects/Methods:** We  
11 analysed data from 546 socio-economically disadvantaged mother-child pairs to assess the  
12 relationship between maternal perceptions of fruit and vegetable affordability and the diets of their  
13 children. **Results:** Fruit consumption was lower among children whose mothers felt the cost of fruit  
14 was too high. Maternal perceptions of fruit and vegetable affordability were not associated with any  
15 other aspect of child's diet. **Conclusions:** Our results suggest a possible role for maternal perceptions  
16 of fruit affordability with children's diet, though further research is warranted.

17 The cost of food is the second-most important factor affecting food decisions, behind taste<sup>2</sup>. Some  
18 evidence shows that healthy foods offer lower economic value than calorie-dense foods high in  
19 sugar and fat<sup>3-4</sup>. Obesity and nutrition follow a socioeconomic gradient, with higher rates observed  
20 among those residing in deprived areas, with low incomes or low education<sup>5</sup>. Therefore, as the costs  
21 of fruit and vegetables increase, families with limited resources may perceive healthy food as  
22 unaffordable and consequently turn toward more affordable options high in sugar and fat that  
23 potentially increase their risk of poor nutrition and obesity.

24 Perceptions that fruit and vegetables are expensive may be particularly exacerbated following a  
25 series of recent natural disasters that, for several nations, including Japan<sup>1</sup> and Australia, have  
26 devastated local agriculture commodities, resulting in depleted fruit and vegetable crops and  
27 consequently soaring prices of a wide range of commonly-consumed fruits and vegetables. For  
28 example, earlier this year, the Australian agricultural sector was devastated by cyclone and floods,  
29 with crop losses estimated at \$1.4 billion. More than 85% of banana crops were eradicated, with  
30 prices consequently expected to increase 400-500%. Bananas were not the only lost commodity;  
31 flood-and cyclone-related food shortages are anticipated to drive up prices of a wide range of fruit  
32 and vegetables.

33 Perceptions of healthy food as unaffordable are more prevalent among socioeconomically  
34 disadvantaged women, and these perceptions have been linked to poorer dietary outcomes<sup>6</sup>. Less is  
35 known about the role of mother's perceptions of fruit and vegetable affordability on the diets of  
36 their children. Such evidence can offer insights into the expected impact rising prices of fruit and  
37 vegetables might have on the diets of children.

38 Participants were drawn from a larger study of 4349 women who participated in the Resilience for  
39 Eating and Physical Activity Despite Inequality (READI) study, a longitudinal cohort study examining  
40 resilience to obesity among women and children residing in socially and economically  
41 disadvantaged neighbourhoods in rural and urban areas of Victoria, Australia<sup>7</sup>. Using data from 546  
42 mother and child pairs we assessed whether mother's perceptions of fruit and vegetable  
43 affordability were related to children's diet. To assess perceived cost of fruit and vegetables,  
44 mothers were asked to indicate their level of agreement with the statements 'I do not buy many  
45 fruits (vegetables) because they cost too much'. Responses 'Strongly disagree', 'Disagree', and  
46 'Neither agree nor disagree' were collapsed into one category, 'Do not agree'. Responses 'Agree'  
47 and 'Strongly agree' were collapsed into the category 'Agree'.

48 Participants were asked how many serves per week of fruit and vegetables their child consumed.  
49 They were also asked how often their child ate the following foods: salty snacks, chocolate/lollies,

50 cakes/doughnuts/sweet biscuits, and fast foods. Due to severe skew, consumption frequency of  
51 salty snacks, chocolate/lollies, and cakes/doughnuts/sweet biscuits were dichotomised into 'Up to  
52 once per week' or 'More than once per week'. Similarly, consumption of fast foods was  
53 dichotomised into 'Less than once per month' or 'At least once per month'.

54 To determine whether mothers' perceptions of the costs of fruit and vegetables were related to  
55 children's intake of fruit and vegetables, two linear regression models were examined, one with  
56 child fruit consumption as the outcome and maternal perceived cost of fruit as a predictor, and the  
57 other with child vegetable consumption as the outcome and maternal perceived cost of vegetables  
58 as a predictor. Secondly, to determine whether mothers' perceived cost of fruit and vegetables  
59 were related to children's intake of unhealthy foods, a number of binary logistic regression models  
60 were tested with consumption of salty snacks, chocolate/lollies, and cakes/doughnuts/sweet biscuits  
61 as outcomes. For each outcome a separate model was examined with perceived cost of fruit and  
62 perceived cost of vegetables as predictors. All analyses included as covariates child age, maternal  
63 education, and household income, and controlled for clustering by suburb.

64 Descriptive data for covariates, mean weekly serves of fruit and vegetables, percent for categories of  
65 snacks and fast food consumption frequency and percentage of mothers' who agreed/did not agree  
66 that the cost of fruit/vegetables was too high are presented in Table 1. Mothers' perceptions of the  
67 cost of fruit was significantly associated with child fruit consumption ( $\beta=-0.15$ , 95% CI:  $-0.23-0.06$ ,  
68  $p<.0005$ ). Children whose mothers felt the cost of fruit was too high consumed a mean of 11.7  
69 (SD=7.1) serves of fruit per week (or 1.7 serves p/day), while children whose mothers did not feel  
70 this way consumed a mean of 15.2 (SD=7.5) serves per week (or 2.2 serves p/day). Mothers'  
71 perceptions of vegetable affordability were not associated with children's vegetable intakes. There  
72 were no associations between perceived fruit and vegetable affordability and children's intake of  
73 fast food or unhealthy snack foods.

74 One limitation of this study is that the one-item measure of perceived fruit and vegetable  
75 affordability utilised may not capture all aspects of participant's perceptions around cost.  
76 Furthermore, although area-level disadvantage is associated with indicators of poor health  
77 independent of individual-level indicators of socio-economic position (i.e. education level and  
78 income<sup>8</sup>), approximately one quarter of our sample were highly educated and/or had a high income.  
79 This finding could account for the lower than expected rates of poor perceptions of fruit and  
80 vegetable affordability observed in the current study (15% and 8% respectively) compared to values  
81 (approaching 50%) observed elsewhere<sup>9-10</sup>. Consequently personal income and education were  
82 included as covariates in all analyses. The low numbers maintaining negative perceptions of fruit and

83 vegetables affordability, although statistically adequate, may have limited our ability to detect  
84 significant associations between maternal perceptions of fruit and vegetable affordability and  
85 vegetable and snack-food consumption.

86 Acknowledging these limitations and the cross-sectional design of this study, our results suggest that  
87 negative perceptions of fruit affordability may lead to lower fruit intakes for children. Nutrition  
88 promotion efforts should focus on alternative sources of fruit such as tinned, frozen and other  
89 seasonal produce not as affected by price inflation. It is encouraging that children's vegetable  
90 intakes were not associated with mothers' perceptions of vegetable affordability. It is possible that  
91 vegetables are considered a core, or non-negotiable, component of children's diets and as such,  
92 demand is inelastic; mothers may be more prepared to pay higher prices to provide vegetables for  
93 their children. There is some reassurance; we found no evidence that mothers who perceive fruit  
94 and vegetables as unaffordable provided more fast-food or unhealthy snacks as alternatives for their  
95 children.

96

97 **Conflict of Interest**

98 The authors declare there are no conflicts of interest.

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125

126 Table 1. Descriptive statistics for study sample

<b>Sociodemographic</b>		
Child age: Mean(SD), range	9.4 (2.2), 4.9-13.2	
Maternal education	n	(%)
Low (did not complete high school)	142	(26.0)
Medium (completed high school or equivalent)	262	(48.0)
High (university degree or higher)	142	(26.0)
Household income		
Low (\$0-36,999)	150	(27.5)
Medium (\$37,000-77,999)	235	(43.0)
High (\$78,000+)	121	(22.2)
Undisclosed	40	(7.3)
<b>Maternal perceptions of the costs of fruit and vegetables</b>		
Cost of fruit is high		
Agree	82	(15.0)
Disagree	464	(85.0)
Cost of vegetables is high		
Agree	44	(8.1)
Disagree	502	(91.9)
<b>Child food consumption</b>		
Fruit intake (serves/week): Mean(SD), range	14.6 (7.5), 0-42	
Vegetable intake (serves/week): Mean(SD), range	15.0 (8.4), 0-42	
	n	(%)
Chips/salty snacks		
Up to once per week	312	(57.1)
More than once per week	234	(42.9)
Chocolate/lollies		
Up to once per week	279	(51.1)
More than once per week	267	(48.9)
Cakes/doughnuts/sweet biscuits		
Up to once per week	291	(53.3)
More than once per week	255	(46.7)
Fast food		
Less than once per month	179	(32.8)
At least once per month	367	(67.2)