Using per serve pricing to increase fruit and vegetable purchasing

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A/Prof Fiona Newton[1], Prof Josh Newton[2], Prof André Bonfrer[2]

[1]Department of Marketing, Monash Business School, Monash University
[2]Department of Marketing, Deakin Business School, Deakin University

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Background

Guidelines

Regular intake of fruit and vegetables is associated with a range of health benefits, including reduced risks of coronary heart disease and stroke[1]. Like many countries, Australia has consequently introduced recommended daily intakes (RDIs) for fruit and vegetables[2]. Among adults, for example, the Australia RDIs for fruit and vegetables are:

- 2 serves of fruit (1 serve = 150g).
- 5-6 serves of vegetables (1 serve = 75g).

Reality

Most Australians do not currently meet the RDIs for fruit and vegetables. For example, 2022 data indicates only 6.5% of Australian adults met the RDI for vegetables, with 44.1% meeting the fruit RDI[3]. Given these low rates, finding ways to increase fruit and vegetable consumption could play a key role in enhancing the health and wellbeing of the broader Australian community.

Consumer insight & hypotheses

(Un)affordability is a key barrier

Australian research has found that the perceived (un)affordability of fruit and vegetables has a strong influence on their consumption[4]. Potentially contributing to this perception is that fruit and vegetables are traditionally priced by weight (example: apricots priced at $6.99 per kg), which does not align with the quantity of fruit or vegetables that most people consume in a single sitting. By contrast, many other food products are priced around implicit or explicit serving sizes (example: single-serve apricot muesli bar priced at $2.94), which may help people better assess the affordability of what they are planning to consume.

Drawing on this insight, we sought to examine whether pricing fruit and vegetables by nutritional serving size influences fruit and vegetable purchase patterns.

Hypotheses

We hypothesised that:

H1: The presence of per serve (vs. per kg only) pricing will increase (decrease):

- Actual fruit and vegetable purchasing.
- Intention to purchase fruit and vegetables.

H2: Perceived value for money will have a positive indirect effect on the relationship between pricing format (per kg vs. per serve) and purchase intention

Research approach

To test these hypotheses, we conducted a supermarket-based field trial (Study 1) and an online experiment (Study 2).

Footnotes

[1] www.nhmrc.gov.au/guidelines-publications/n55

[2] www.nhmrc.gov.au/guidelines-publications/n55a

[3] https://www.abs.gov.au/statistics/health/health-conditions-and-risks/dietary-behaviour/latest-release

[4] https://doi.org/10.1016/j.appet.2017.02.043

Study 1: Field trial (Methodology)

Store selection

The field trial occurred in collaboration with an independent Australian supermarket retailer. The field trial took place in one store, with four additional stores selected as controls based on having comparable fruit and vegetable assortment, transaction volumes, affluence group share, and price for fruit and vegetables to the trial store. All stores were located within 50km of each other to minimise potential pricing and assortment variations across stores.

Field trial (Ritchies Supermarket)

At the trial store, per serve pricing was displayed on the shelf talkers for loose fruit and vegetables. Owing to Australian legislation mandating the provision of certain minimum information, the shelf talkers also displayed per kilogram pricing (see Figures 1 and 2). Fruit and vegetables sold as pre-bundled packages (e.g., punnets; pre-weighed bags of produce) or priced on a per unit basis (e.g., avocados) were not subjected to per serve pricing as part of the field trial.

Fruit and vegetable purchase data for the retailer's loyalty card members were captured at each store across three consecutive periods:

- Pre-launch baseline period (1 October 2019 to 15 October 2019).
- Soft launch, where per serve pricing was displayed for some loose fruit and vegetables (16 October 2019 to 12 November 2019).
- Full launch, where per serve pricing was displayed for all loose fresh fruit and vegetables (13 November 2019 to 4 December 2019).

Figure 1. Control pricing format (per kg).

Figure 2. Trial pricing format (per serve + per kg).

Across these periods, standard policy for the retailer was for all prices to be set once per week and for those prices to remain constant for the duration of that week. Prices for loose fruit and vegetables were set by the retailer's central office and sent to stores as prices per kilogram, which the trial store subsequently converted to per serve pricing for the purposes of preparing the pricing displays. Accordingly, no local pricing adjustments were implemented to optimise how per serve pricing was displayed at the trial store.

Study 1: Field trial (Results)

Main effect of per serve pricing

A difference in differences approach[5] was used to determine the average treatment effect of per serve pricing on fruit and vegetable purchase volumes. We separately estimated the fruit and vegetable categories, adding fixed effects and controls relating to store, affluence group share, and time (see Table 1). These model specifications are only reported for the vegetables category to show that including these controls had negligible impacts on price elasticity and the treatment effects.

The main set of results are based on Model 4 for vegetables and Model 5 for fruit, each of which include the full set of model controls (Models 1 – 3 include different control variable combinations for vegetables). Model 4 points to a significant 6% increase ($p < .05$) in vegetable purchases following the introduction of per serve pricing, which is consistent with H1. For fruit, no significant change in purchases was observed, with the point estimate showing a small but non-significant decline (-3%; $p > .05$). This finding was not consistent with H1.

Table 1. Effect of per serve pricing on fruit and vegetable purchases.

	Vegetables				Fruit
	Model 1	Model 2	Model 3	Model 4	Model 5
Model variables					
Effect of per serve pricing	0.06**	0.06**	0.06**	0.06**	-0.03
Price elasticity	-0.58***	-0.58***	-0.58***	-0.58***	-0.51***
Perishability	0.14***	0.15***	0.15***	0.15***	0.02***
Trial store	-0.07***	-0.06***	-0.11***	-0.11***	-0.09***
Soft launch	0.04*	0.05*	0.04*	0.05*	-0.02
Time effect 1 (pre-launch period)	0.03***	0.03***	0.03***	0.04**	0.01
Time effect 2 (full launch period)	0.05***	0.05***	0.05***	0.01	0.04
Constant	-0.15***	-0.16***	-0.09***	0.23*	0.45***
Model controls					
Store fixed effect	N	Y	Y	Y	Y
Affluence group fixed effect†	N	N	Y	Y	Y
Time fixed effects	N	N	N	Y	Y

*$p < .05$, **$p < .01$, ***$p < .001$
†Affluence groups: budget, mainstream, premium

Footnotes
[5]https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation

Study 1: Field trial (Results)

Per serve pricing × price interaction

The difference in differences effect reported in Table 1 was then extended to form a difference in difference in difference model so that we could examine whether the effect of per serve price depended on - or more formally, interacted with - the actual price of the fruit or vegetables being sold. As per the main difference in differences model, separate estimates are given for the vegetable and fruit categories, both of which use similar specifications to Models 4 and 5 in Table 1, respectively.

For fruit, inclusion of the pricing interaction saw the main effect of pricing format become marginally significant ($p < .10$; see Table 2). There was also a negative significant interaction between pricing format and price ($p < .01$), indicating that at higher prices, the effect of per serve pricing was negative. More specifically, for the lowest prices (5th percentile; 1 serve of fruit priced at AUD$0.40), per serve pricing had a positive effect of 0.05, which equates to around a 5% increase in fruit purchase volumes. Conversely, for the highest prices (95th percentile; 1 serve of fruit priced at AUD$1.80), the effect of per serve pricing was -0.15, which corresponds to around a 16% decrease in fruit purchase volumes.

For vegetables, the point estimate for the per serve pricing main effect remained around 6%, and this value did not vary by price. However, the per serve pricing main effect was no longer significant. That the main effect was no longer significant once the price interaction term was added to the model may indicate that pricing-related factors – such as perceived value for money – mediate the effect of per serve pricing on purchase volumes. Study 2 consequently provides a direct test of this potential mediating mechanism.

Table 2. Interaction of per serve pricing and price.

	Vegetables	Fruit
	Model 1	Model 2
Model variables		
Effect of per serve pricing	0.05	0.18†
Pricing format × price	0.00	-0.14**
Perishability	0.15***	0.02**
Constant	0.22*	0.15
Model controls		
Store fixed effect	Y	Y
Affluence group fixed effect‡	Y	Y
Time fixed effects	Y	Y

$\dagger p < .10$, $*p < .05$, $**p < .01$, $***p < .001$
‡Affluence groups: budget, mainstream, premium

Study 2: Experiment (Methodology)

Background

Study 1 established that the presence of per serve pricing increased sales volumes for loose fresh vegetables, but no equivalent effect was found for loose fresh fruit. One potential explanation for this differential influence is that in Australia, where the field trial was conducted, the serving size for fruit (150g) is double that of vegetables (75g). As a result, and all else being equal, the proportional cost of one serve of fruit will always be double that of one serve of vegetables. This, in turn, may have altered perceptions around the extent to which fruit constituted value for money.

To explore whether per serve pricing has a positive influence on consumer evaluations of fresh fruit and vegetables when serving size is held constant, we conducted a 2 (price format: per kg vs. per serve + per kg) by 4 (produce: green beans vs. mushrooms vs. grapes vs. strawberries) between-subjects online experiment in the UK, where the serving size for fruit (80g) is equivalent to the serving size for vegetables (80g)[6]. We also examined whether perceived value for money mediated the relationship between price format and intention to purchase fresh fruit and vegetables while also testing a competing mediator: perceived healthfulness.

Participants

Eight hundred and three participants (female = 533; 66.4%) ranging between 18 and 80 years of age (M = 35.45, SD = 11.45) completed the study via Prolific, an online participant pool, in return for £0.50. Participation was restricted to UK residents to ensure that all participants were familiar with purchasing fresh produce sold by the kilogram and paid for in pounds sterling.

Procedure

Participants were randomly presented with one of four fresh produce items (green beans; mushrooms; grapes; strawberries) that had been configured to feature one of two pricing formats (per kg; per serve + per kg). Example stimuli can be found in Figure 3. Item pricing was based on UK supermarket prices at the time the study occurred, with two price points being used: £3.00 per kg (grapes; mushrooms) and £5.00 per kg (green beans; strawberries). Participants allocated to the per serve pricing conditions were also reminded at the start of the survey that the UK serving size is 80 grams.

Figure 3. Examples of the per kg (left) and per kg + per serve (right) pricing stimuli.

After viewing the produce, participants were asked to record their produce purchase intention and report whether the item of produce they had seen offered value for money and contributed to healthfulness. Participants were also asked to rate the degree to which they liked the item of produce they had been shown and how often they normally purchased this item. These items were assessed and analysed to rule out the possibility that produce liking and frequency of purchase were driving any observed changes in intentions to purchase. Participants completed the survey after providing their demographic details.

Footnote
[6]https://www.nhs.uk/live-well/eat-well/5-a-day/portion-sizes/

Study 2: Experiment (Results)

Effect of pricing format on purchase intention

When each item of produce was examined individually, the effect of pricing format on purchase intention was consistently in the same direction (*p*'s ≤ .01). The produce conditions were consequently collapsed into fruit (grapes, strawberries) versus vegetables (beans, mushrooms) and examined in a 2 (price format: per kg vs. per serve) by 2 (produce: fruit vs. vegetables) ANOVA. Results indicated significant main effects for price format ($F(1,799) = 70.93$, $p < .001$) and produce ($F(1,799) = 18.82$, $p < .001$), but no significant price format × produce interaction ($F(1,799) = 0.50$, $p = .48$). These findings accord with H1, with the use of per serve pricing increasing intention to purchase both fruit and vegetables (see Figure 4).

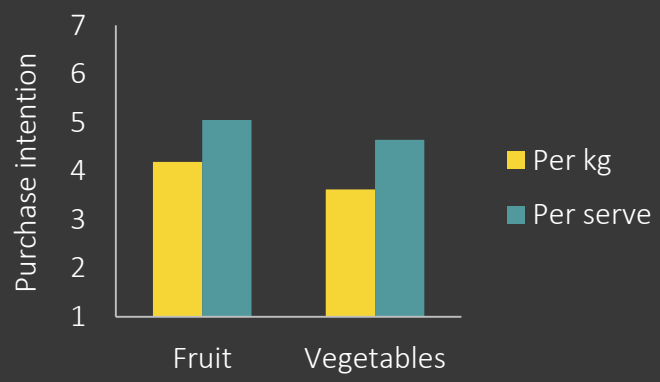

Figure 4. Effect of pricing format on intention to purchase fruit and vegetables.

Mediating effects of value for money and healthfulness: Vegetables

Hayes's PROCESS[7] Model 4 with 10,000 bootstraps was used to determine whether value for money and healthfulness mediated the relationship between price format (0 = per kg pricing, 1 = per serve pricing) and intention to purchase vegetables (beans, mushrooms). Consistent with H2, analysis of the overall indirect effects revealed that value for money significantly mediated the relationship between price format and purchase intention (effect = 0.75, 95% CI [0.52, 0.99]). Notably, the competing mediator – healthfulness – did not have a significant indirect effect (effect = 0.03, 95% CI [-0.01, 0.10]).

Mediating effects of value for money and healthfulness: Fruit

PROCESS Model 4 with 10,000 bootstrapped samples was also used to examine whether value for money and healthfulness mediated the relationship between pricing format and intention to purchase fruit (grapes, strawberries). Examination of the overall indirect effects indicated that value for money significantly mediated the relationship between pricing format and purchase intention (effect = 0.50, 95% CI [0.29, 0.72]), supporting H2. However, the indirect effect of healthfulness was not significant (effect = 0.01, 95% CI [-0.02, 0.04]).

Footnote
[7] http://www.guilford.com/p/hayes3

Conclusion

Per serve pricing

The results of our field trial and online experiment suggest that introducing per size pricing in fruit and vegetable retail settings may be a useful means for increasing their purchase by consumers. This effect appears to arise by virtue of per serve pricing's ability to signal fruit and vegetables' perceived value for money. That is, presenting prices by how much people consume (rather than by kg, which typically includes many serves) allows people to better appreciate the value for money that ingredients like fruit and vegetables represent.

What is a serving size?

While the field trial found that per serve pricing significantly increased vegetable purchases, the effect was more complex for fruit; per serve pricing only increased fruit purchasing when the underlying price of fruit was low. One potential reason for the more complex findings associated with fruit is that the Australian serving size for fruit (150g) is double that of vegetables (75g). As a result, the proportional cost of one serve of fruit will always be double that of one serve of vegetables, all else being equal. This, in turn, may have altered perceptions around the extent to which fruit constituted value for money, particularly when consumers can directly compare per serve prices for fruit and vegetables within a single retail context.

Not all countries have different serving sizes for fruit and vegetables. In the UK, for example, the serving size for fruit (80g) is the same as the serving size for vegetables (80g), with RDIs for fruit and vegetables scaled accordingly[8]. Notably, when we conducted an online experiment in the UK and used their fruit and vegetable serving sizes, the presence of per serve pricing increased participants' intention to purchase both vegetables *and* fruit. It is possible, therefore, that the fruit-related effects observed in our field trial may simply be an artefact of how Australia has set its serving sizes for fruit and vegetables.

Increasing fruit and vegetable consumption at scale

Current approaches to increasing fruit and vegetable consumption are often costly or difficult to scale (or both), focusing as they do on attitude or behaviour change campaigns. Our approach, which involves changing how pricing information is presented to consumers at point of sale, provides a potential rare win-win public health strategy: a lost-cost initiative that can be introduced at scale to increase fruit and vegetable purchasing while also providing potential benefits (in the context of enhanced revenues) to the retailers that introduce it.

More broadly, the fact that per serve pricing was found to enhance vegetable purchases is particularly noteworthy given that only 6.5% of Australian adults currently meet the vegetable RDI[9]. Put differently, against a backdrop of very low rates of sufficient vegetable consumption to meet the Australian RDIs, any initiative that can help to increase vegetable purchases – a necessary pre-condition to consumption – is notable.

Footnotes

[8]https://www.nhs.uk/live-well/eat-well/5-a-day/portion-sizes/

[9]https://www.abs.gov.au/statistics/health/health-conditions-and-risks/dietary-behaviour/latest-release

Contact

A/Prof Fiona Newton
T: +61 3 9904 4501
E: fiona.newton@monash.edu

Prof Josh Newton
T: +61 3 9251 7830
E: j.newton@deakin.edu.au

Prof André Bonfrer
T: +61 3 9246 8475
E: andre.bonfrer@deakin.edu.au

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