

# A longitudinal study of the cost of food in Victoria influenced by geography and nutritional quality

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Access to, and the affordability of, a nutritious diet are determinants of food choice and can be modified to improve health.<sup>1,2</sup> Evidence suggests that nutritious diets are more expensive.<sup>3</sup> Monitoring the cost and availability of a nutritious basket of food can provide useful information on economic and physical access to nutritious food. Comparison to average household income can measure changes in affordability of a healthy diet over time. A range of healthy food basket surveys have been developed in Australia and internationally<sup>4-7</sup> and have been deemed to be an effective instrument to measure economic food access.<sup>8</sup> In order to influence policy, there is a need to develop approaches to measure food affordability and, in particular, the difference between the price of nutritious and non-nutritious foods and diets.

While there is acknowledgement for the need of a national food cost monitoring system in Australia,<sup>1</sup> the cost of a healthy basket has been assessed across the different states using different methods over the past 15 years. In summary, this work has found that food prices in remote areas are consistently higher than prices in the closest rural towns.<sup>9-12</sup> In urban areas, the cost of food has increased over time<sup>13</sup> and there seems to be no consistent association between the cost of food and socioeconomic status of the area.<sup>13-16</sup> Less is known about the price of nutritious food in rural areas and more densely populated states of Australia.<sup>12,17</sup> While measurement of the cost of a representative sample of supermarkets has been undertaken in states with remote food

## Abstract

**Objective:** To monitor the cost and affordability of a nutritious diet and to assess the influence of distance from the capital city and socioeconomic status on the cost of nutritious food in Victoria.

**Methods:** Twenty-six of Victoria's 79 local government areas (33%) were randomly chosen for inclusion in the study. A random sample of stores was selected for inclusion from each local government area. The cost of the 44 'healthy' and 10 'discretionary' food and drinks in the healthy food basket for a family of four for a fortnight was collected during the winter and summer of 2012, 2013 and 2014.

**Results:** The mean cost of the basket increased from \$424.06 ± 38.22 in winter 2012 to \$451.19 ± 33.83 in summer 2014 ( $p < 0.001$ ), representing about 31% of government benefit household income. Fruit and vegetables prices were the most varied over time. Distance of the store from state capital city centre predicted difference in food cost.

**Conclusions:** These findings show that a healthy diet may be unaffordable for some Victorians.

**Implications:** The cost of food is a key factor influencing intake. Public health strategies may need to consider strategies to make healthy food more affordable for some.

**Key words:** food cost, nutrition, rural, socioeconomic

supply (Western Australia and Queensland)<sup>9,18</sup> there is a need to determine the cost of nutritious food in more populated states, in both urban and rural centres, using appropriate sampling methodology. This data is currently not available and is fundamental to understanding determinants of food costs and potential national and state policy responses. None of the previous studies have investigated the effect of seasonality on price. This study aimed to determine the cost and affordability of a nutritious diet in Victoria for a family of four and to monitor this cost over time. The study also aimed to measure if the cost of a healthy diet was correlated to distance from the state capital city and the socioeconomic status of the area where the store was located, and if there were any trends in cost related to season.

## Methods

This study took the opportunity for data collection as part of a broader obesity prevention effort that is taking a complex systems approach to prevention, under the platform of Healthy Together Victoria.<sup>19</sup> A sample of 26 (33%) local government areas (LGAs) was selected. This sampling involved selecting 14 LGAs from communities in the bottom three quintiles of the Socio-Economic Index for Area for inclusion and 12 LGAs matched for socioeconomic characteristics and behavioural risk factors, including: overweight and obesity; fruit and vegetable consumption; and tobacco use. Suburbs in each LGA were determined using shire and council websites. The Australia Post postcode directory<sup>20</sup> was used to establish a list of

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postcodes for all suburbs and towns within each LGA. All supermarkets for all postcodes were obtained from the relevant supermarket websites. They were divided into five categories: Coles; Woolworths/Safeway; IGA; Foodworks; and general stores. The Yellow Pages Online 'supermarket/grocery stores' category was searched for each postcode to locate other independent stores. Council website business directories were searched for general stores. The postcode for the sample town was entered into each separate store website, enabling a complete sample of supermarkets to be established for each LGA. The final list included 428 individual stores.

A random sample of stores was selected for inclusion from each LGA. Unlike other random sampling techniques for healthy food basket surveys that stratified based on remoteness,<sup>11,21</sup> stores were stratified into three categories: Coles; Woolworths/Safeway; and Independents (IGA, Foodworks and general stores) based on existing data showing variation in cost based on store type.<sup>22</sup> Previously, there was found to be little variation in cost among Coles and Woolworths stores, so only one of each was chosen in the random sample. There was greater variation in cost of the basket among independent stores and so three independent stores were chosen for the random sample.<sup>22</sup>

The store samples were determined by randomly numbering the complete data set list using a random numbering table from statistical text<sup>23</sup> and choosing the stores allocated the lowest random numbers for each category. Where no Coles or Woolworths existed within a LGA, no store was selected. Where a store was found to not exist or where it contained fewer than 90% of the items from the healthy food basket, the next lowest randomly numbered store was included in the final sample. The total sample included 115 stores. The Socio-Economic Index for Advantage and Disadvantage (SEIFAD) for the postcode in which the store was located was determined from the Australian Bureau of Statistics.<sup>24</sup> Google Maps was used to calculate the store's distance from the state capital city centre.<sup>25</sup>

The Victorian healthy food basket is a list of 44 core foods (fruit, vegetables, meat and meat products, milk and milk products, breads and cereals) and non-core foods (margarine, oil, sugar) that are commonly consumed by families and, in specified quantities, provide nutrients that meet the nutritional

**Table 1: Mean cost of healthy food basket for a fortnight winter and summer 2012, 2013 and 2014 for all stores.**

\$basket for typical family of four	Winter 2012 n=108	Summer 2012 n=114	Winter 2013 n=114	Summer 2013 n=115	Winter 2014 n=115	Summer 2014 n=115
Mean ± SD	424.06 ± 38.22	427.04 ± 40.10	426.28 ± 34.32	447.24 ± 34.78	447.40 ± 31.73	451.19 ± 33.83

requirements of reference families for a fortnight.<sup>26</sup> Healthy food basket data was collected either on a standardised collection sheet or using an iPad Application with accompanying detailed instructions.<sup>27</sup> All data collectors were trained in the appropriate methodology, previously described,<sup>26</sup> and were either research officers or health promotion officers based in the town where data collection took place, or nutrition and dietetics students from the lead author's university. If a price was missing, the product price from a benchmark store (a large independent supermarket in an LGA separate to the study) was substituted.

Data collection was carried out over four eight-week periods, during winter (July–August) and summer (December–January) 2012, and again for the same months in 2013 and 2014. Permission to collect the food cost data from the store manager was sought prior to entering each store. Based on advice from the Monash University Human Research Ethics Committee, given that data collection was not being collected from humans, ethics approval was not required. Data was unable to be collected from some of the sample stores because entry to the store was refused by the manager or because the store had closed down before an alternative store was able to be identified. Altogether there were 108 stores providing data in winter 2012, 114 stores in summer 2012, 114 stores in winter 2013, 115 stores in summer 2013 and 115 stores in both winter and summer 2014.

Data was analysed using SPSS (version 20, for Windows). Descriptive statistics on the average basket cost for the typical family of four (two adults, two children aged 8 and 18 years) and its variation over time and season were calculated. Affordability was assessed by calculating the mean costs of the basket as a percentage of estimated Centrelink fortnightly payments<sup>28</sup> for the family of four. To explore the change in cost of the healthy food basket over six points in time, the difference in mean cost from winter 2012 to summer 2014 was compared using a one-way between groups analysis of variance. Standard multiple regressions across all six time points were used to identify how well the SEIFAD for the suburb of the store location or distance from Melbourne

predicted the total cost of the healthy food basket. Multi-collinearity tests confirmed a weak correlation between cost of the basket and SEIFAD (Pearson correlation=0.106) and distance from Melbourne (Pearson correlation=0.194). Statistical significance was determined if  $p < 0.05$ .

## Results

The demographics of 26 LGAs included in the study demonstrate the representativeness of the data to the whole state's population (see Supplementary Table 1, available with the online version of this article). The cost of food remained relatively stable from winter 2012 to winter 2013; however, increased by about \$20 in summer 2013 and then remained stable (Table 1). There was a statistically significant difference in cost across time ( $p=0.000$ ). *Post hoc* comparison indicated that the mean cost at winter and summer 2012 and winter 2013 was significantly different to summer 2013, and winter and summer 2014 ( $p=0.000$ ). The cost of the basket represented 31% of families' Centrelink household income in June 2012 of \$1,357.00 and January 2014 of \$1,435.50.<sup>28</sup> There was no trend in cost related to season (summer versus winter).

Figure 1 presents the trends in cost of each food group as a component of the basket across the six rounds of data collection. The cost of vegetables and fruits varied over time and between seasons more than other food groups. An increase from winter 2012 to summer 2014 of \$20.83 in the cost of the fruit component of the basket was recorded. The non-core foods (sugar, oil, margarine) varied the least over time. Vegetables were consistently the most expensive component of the basket over the six time periods. Meats, breads/cereals and dairy foods remained fairly stable over time (Figure 1).

The standard multiple regression model aimed to predict how well the cost of the healthy basket for the family of four related to the distance the store was from the state capital city, and also the SEIFAD code for the town of the stores location. At each separate time point, our regression model explains between 6.0 and 11.9% of the variance in the cost of the healthy basket. The distance the store is from Melbourne makes the largest

contribution to the variance in cost and this was statistically significant across all time points (Table 2). The further the store is from Melbourne, the higher the total cost of the healthy food basket. The association between cost of the basket and socioeconomic status of the store's location, represented by the SEIFAD index of the town where the store was located, was not as strong a predictor nor was it statistically significant over time (Table 2).

## Discussion

Our study aimed to determine the cost of a nutritious diet for a family and the factors associated with the cost of food in Victoria, Australia. The findings of food cost from a representative sample of urban and rural stores showed that average cost of the healthy food basket increased marginally (about 6% or \$20) over a three-year period. The cost of fruit and vegetables were more variable than meats, breads/cereals, dairy foods and non-core foods. The data also suggested that the cost of the healthy food basket may be higher for stores further from the city centre. This is despite much of Victoria not being considered very remote.<sup>29</sup> No

association was found between basket cost and the socioeconomic index of the town in which the store was located. These findings provide new and unique insights into the cost of food as a key determinant of health in a populated state such as Victoria.

The main increase in the cost of the healthy basket that was seen between the winter and summer of 2013 (an increase of 4.9%) may be explained by Consumer Price Index (CPI) for fruit and vegetables, which showed increases of 8.1% and 7.1%, respectively, in the December quarter of 2013. The CPI for fruit and vegetables may be a better indication of the change in cost of a healthy diet compared to the whole food and non-alcoholic beverages group, which reported a 0.2% increase in the June to September 2013 quarter and a 1.2% increase in the September to December 2013 quarter.<sup>30</sup> While healthy food baskets provide an estimation of what it costs to eat well, they do not measure what households are spending on food. The recent release of the Australian Health Survey,<sup>32</sup> with data on nutritional intake of Australians, also provides an opportunity to model a typical diet of Australians and its cost. It builds on international work in this field and

contributes to the development of a better system for monitoring food cost in Australia. There is a need for a national approach to monitoring the cost of a healthy diet and typical consumption pattern to assist in better informing policy direction.<sup>1</sup>

The findings of this study add to previous work discussing whether a healthy diet is unaffordable for families in Australia.<sup>16,21</sup> The mean cost of the healthy basket for a typical family from this data represents about 31% of this household income. Given the rising costs of living pressures<sup>32</sup> and related 'food stress',<sup>18</sup> eating a healthy diet may be less attainable for those on lower incomes. While the relationship between socioeconomic status of the stores' location and food cost has been varied across other studies,<sup>32-34</sup> this study did not show a consistent relationship between the area's socioeconomic position and the cost of food. There is an urgent need to investigate policy options to make healthy food more affordable in Australia. These strategies should not necessarily target local food producers that are already struggling to remain sustainable and economically viable; however, targeted strategies are needed to modify the food system for low income earners – especially those living further from Melbourne or on minimum wages – together with whole-of-population approaches to promote consumption of healthy choices.

Figure 1: Mean cost of different food group components of the basket required for the family to meet nutritional requirements over time.

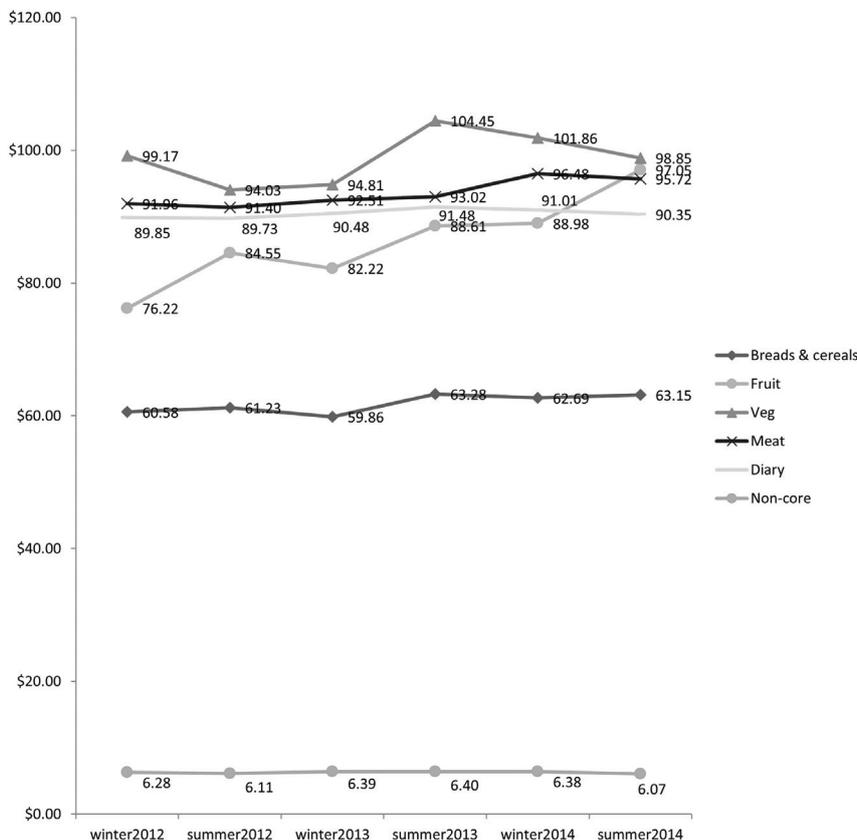


Table 2: Multiple regression analysis for cost of healthy basket for 'typical family' and distance of the store from city centre and SEIFAD for town where store was located.

Time Point	variance explained by model	Standardised Beta Coefficient	p value
Winter 2012	6.9%		
SEIFAD		0.188	0.062
Dist. from city		0.255	0.012
Summer 2012	11.9%		
SEIFAD		0.303	0.002
Dist. from city		0.289	0.003
Winter 2013	11.5%		
SEIFAD		0.296	0.002
Dist. from city		0.286	0.003
Summer 2013	8.8%		
SEIFAD		0.286	0.003
Dist. from city		0.212	0.028
Winter 2014	6.0%		
SEIFAD		0.184	0.060
Dist. from city		0.232	0.018
Summer 2014	11.5%		
SEIFAD		0.188	0.048
Dist. from city		0.349	0.000

This study showed that fruit and vegetables contribute a large proportion of the costs of the basket (about \$80 for fruit and \$100 for vegetables per fortnight) and are more variable over time, which may affect their consumption. Recent national health survey data reports that households spend on average \$27 on vegetables and \$19 on fresh fruit per fortnight, which falls significantly short of the required spend shown in this study for the modelled family.<sup>35</sup> This is a significant finding, given the contribution fruit and vegetables make to human nutrition requirements and health. Improving fruit and vegetable intakes of populations are likely to improve population health outcomes.<sup>36</sup> Strategies such as subsidies for fruit and vegetables that have been shown to be effective for disadvantaged populations<sup>37</sup> may need to be considered in light of this evidence of the financial barrier to increasing consumption of fruit and vegetables. Incentives for farmers to sell produce in areas where physical access may be limited and with links to food assistance programs may also be considered in light of the individual benefit (to farmers and consumers) as well as the economic benefit.<sup>38,39</sup>

While this study implies the cost of food may be increasing over time, it is important to note the limitation that cost has only been monitored over a three-year period. The data is also limited in that it costs a hypothetical healthy diet; that is, what the population should be eating rather than what they are actually eating (and therefore actually spending on food). There is a need for a national approach to monitor costs of ideal diets as well as current consumption patterns.

## Conclusion

This study provides information of the costs required to purchase a healthy diet in Victoria and suggests that the cost of healthy food has remained reasonably stable but may be unaffordable for low-income earners. The cost of healthy food from stores further away from the capital city may be more higher, but season or socioeconomic index of the areas in which the store is located does not appear to affect price. A national approach to monitoring the cost of food in Australia based on actual as well as ideal consumption patterns is needed. This study provides further evidence of the need to make fruit and vegetables relatively more affordable to assist in improving consumption.

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Table 1:** Demographics of random sample of Local Government Areas.