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Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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Detailed methods

The protocol for this review has been previously published with BMJ Open(1) and has been uploaded to PROSPERO (CRD42019125013) and reported according to PRISMA guidance. The overall objective of the review was to identify studies evaluating price reductions on healthier foodstuffs targeted directly at consumers (as subsidies aimed at suppliers or wholesalers may not always be wholly passed on to consumers). We used study authors' definitions to determine what was considered to be a "healthier" food type. In practice most studies evaluated reductions in price of Fruit and Vegetables (F&V), and some also translated this to nutritional intakes (e.g. effects on salt or saturated fat purchases, or total calories). Other "healthy foods" were pre-defined by studies including consumption of salads, low energy density foods, or a composite index of "healthier products" determined according to national or international nutritional standards(2).

Search strategy

Our search strategy was based on an earlier review (3). Medline, EconLit, Embase, Cinahl, Cochrane Library, and Web of Science were searched in February 2019 and updated in December 2021. Searching was supplemented by checking references of other reviews and publications (3, 4) (please find the detailed searching terms at the end of this section).

Types of studies included

We included any studies reporting on a key intervention that altered the price paid by the consumer. In brief, these included direct price reductions or indirect price reduction via supermarket vouchers, loyalty cards, and other incentive schemes. We included studies of multi-component interventions if the effect of the price reduction alone was discernible or the price reduction was the major component of the intervention (e.g. a price reduction in a store or canteen with some banners or advertising to highlight the price reduction). We included studies reporting a range of outcome measures including patterns of purchasing, self-reported consumption, participant weight, BMI or other markers of anthropometry, as well as intake of specific nutrients (sodium, saturated fats), and any related nutritional outcomes. We included all publications regardless of language, but excluded publications where the price data had been obtained before the year 1990, as changes in food consumption and pricing patterns may shift over time.

Exclusion criteria

We excluded interventions where it was clear that the price reduction was not passed on to the consumer (subsidies targeted at wholesalers, shops, schools or caterers), as whilst such interventions might increase availability of healthier foods, they do not necessarily alter the price paid by the consumer. Interventions of very short duration (< 4 weeks) or targeting only limited snacking behaviour (e.g. vending machines), were excluded. We exclude experimental studies (i.e. using scenario technique) or modelling studies.

Study screening and data extraction

We downloaded all records retrieved by searches into Endnote and two of three reviewers (FP or CW and JAC) independently identified studies to assess for inclusion by screening titles and abstracts. Five independent reviewers (PH, JAC, FMA, CW and FP) carried out double data extraction using a predesigned and piloted Excel form. Disagreements were resolved by discussion or involving a 3rd researcher.

Study data was extracted on the study design and setting, brief characteristics (e.g. community, supermarket, canteen), targeted food and beverage items, pricing changes, details of any other concurrent intervention, impact on purchases or consumption, duration of change, follow-up time points, other reported results and signalling questions of the Newcastle Ottawa Scale and Cochrane Risk of Bias 2. Where possible, if data was missing or unclear, study authors were contacted for clarification.

Data analysis

We assessed the impact of percentage price reductions on percentage change in outcomes reported consistently by at least three studies included in the review. The mean percentage differences in this outcome between the intervention (price reduction) and comparator groups and their error measures were used as the effect sizes in the

meta-analysis. Where studies reported outcome data at several time points, the final intervention time point was included. For many studies (n=11), the standard error of differences in purchases or consumption across groups from baseline to the end of the study were missing, and we estimated these using standard Cochrane Collaboration methods(5). We carried out random effects meta-analysis in STATA using a weighted least fit method, assuming a linear relationship between percentage reduction in price and percentage change in the outcome in order to standardise for variation in the size of the percentage reduction offered by the intervention(3). Studies with absolute financial subsidies (i.e. cash back, vouchers, or coupons) where percentage price change could not be calculated from data available in the study were not included in the pooled analysis to avoid introducing bias due to heterogeneity of different currencies and inflation. Where feasible, studies were stratified according to their enrolled populations (general population or low income / marginalised populations) according to author's descriptions. We also stratified by study settings (i.e. supermarket, canteen, communities). Statistical heterogeneity within strata was investigated by computing the I² statistic.

To provide a study-centric summary of quality the following validated tools were used and outputs assessed independently by two of five reviewers (PH, JAC, FMA, FP, CW): the Newcastle Ottawa Score (NOS) for observational studies(6) and Cochrane Risk of Bias 2 for randomised control trials(7).

Search strategy

Search Query for Medline using PubMed

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(((((("National"[tiab] OR "Nationwide"[tiab] OR "state"[tiab] OR "statewide"[tiab] OR "city"[tiab] OR "Workplace"[MeSH Major Topic] OR "Workplace"[tiab] OR "Schools"[MeSH Terms] OR "School"[tiab] OR "School$"[tiab] OR "Supermarket$"[tiab] OR "restaurant$"[tiab] OR "fast food"[tiab] OR "store$"[tiab] OR "cafe"[tiab] OR "cafeteria"[tiab]))) AND ((("taxes"[MeSH Terms] OR "tax"[tiab] OR "taxation"[tiab] OR "subsidy"[tiab] OR "subsidies"[tiab] OR "incentive"[tiab] OR "price"[tiab] OR "pricing"[tiab] OR "voucher"[tiab] OR "coupon"[tiab] OR "rebate"[tiab] OR "elasticity"[tiab] OR "elasticities"[tiab]))) AND ((("Food and Beverages"[MeSH Terms] OR "fruit"[MeSH Terms] OR "fruit"[tiab] OR "vegetables"[MeSH Terms] OR "vegetables"[tiab] OR "fat"[tiab] OR "Sugar-sweetened beverage"[tiab] OR "soda"[tiab] OR "meat"[tiab] OR "dairy"[tiab] OR "candy"[tiab] OR "obesity"[MeSH Terms] OR "obesity"[tiab] OR "BMI"[tiab] OR "body weight"[MeSH Terms] OR "sodium, dietary"[MeSH Terms] OR "sodium"[tiab] OR "Body Mass Index"[MeSH Major Topic] OR "Adiposity"[MeSH Major Topic] OR "Adiposity"[tiab] OR "food consumption"[tiab] OR "Overweight"[MeSH] OR "Overweight"[tiab] OR "calorie"[tiab] OR "calorie$"[tiab]))) AND 2014/01:2019/02 [mhda]
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Search Query for EconLit

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(ti(National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria) OR ab(National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria)) AND (ti(tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity) OR ab(tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity)) AND (ti (Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie) OR ab(Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie))
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Search Query for Embase

All Queries

(National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria) AND (tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity) AND (Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie) limit to yr="2013 -Current"

Search Query for CINHAL

All Queries

AB ((National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria)) AND AB ((tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity)) AND AB ((Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie))

Search Query for Cochrane Library

((National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria)) AND ((tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity)) AND ((Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie))

Search Query for Web of Science

(TI=(National OR Nationwide OR state OR statewide OR city OR Workplace OR Schools OR Supermarket OR restaurant OR fast food OR store OR cafe OR cafeteria)) AND (TI=(tax OR taxation OR subsidy OR subsidies OR incentive OR price OR pricing OR voucher OR coupon OR rebate OR elasticity)) AND (TI=(Foods OR Beverages OR fruits OR vegetables OR fat OR soda OR meat OR dairy OR candy OR obesity OR Adiposity OR Overweight OR Calorie))

Appendix Table S1 Characteristics of included studies

	Study design	Country	Study population	Sample size	Study period	Age (mean (SD))	Sex (% female)	Study inclusion	Targeted foods or measures	Other components of intervention	Price data source	Duration of intervention	Outcome	Outcome ascertainment
A. Supermarket; coupon														
Moran et al (2019) (8)	RCT	USA (Maine)	Low-income households with at least one child	605	Oct 2016 – Sept 2017	37.1	505 (83%)	Adult, living with at least one child age ≤18, primary shopper in the household, reporting doing ≥50 percent of grocery shopping at the study store, and reading and understanding English	Fruit and vegetables	A Cooking Matters class: included education about food shopping and preparation (emphasising the use of fruit and vegetables).	Coupon/Loyalty card: obtained through retail scanner data; food frequency questionnaire	10 weeks	Purchases and consumption	Retail scanner data and FFQs
Andreyeva and Luedicke (2015) (9) and Andreyeva and Tripp (2016)(10)	NRI	USA (New England)	Low-income households participating in WIC	2137 households; 1303 comparison households	Jan 2009 – Sep 2010	NR	NR	WIC participants who made WIC purchases during each quarter pre-voucher and post-voucher receipt	Fruit and vegetables; wholegrain products; fruit and vegetables; milk; cheese; juice	None	Loyalty card; sales data; each product sold with a unique code	9 months	Purchases	Scanner sales data and loyalty cards
Phipps et al (2013)(11)	NRI	USA (Philadelphia)	Low-income households	25	3 months in 2010	42 (14.3)	27 (93%)	Main shopper (aged ≥18 years) for households with ≥1 child; loyalty card holders with ≥1 month shopping history	Fruit and vegetables	None	Participants' loyalty cards	4 weeks	Purchases	Shopping transaction
Vadiveloo et al (2020)(12)	RCT	USA (Rhode Island)	Primary household shoppers	224	July 2018 – May 2020	55.4 (14.0)	187 (90%)	English-speaking primary household shoppers (aged ≥18 years); not pregnant; purchased ≥50% of their groceries with the supermarket; willing to use the store's loyalty card and receive weekly emails	Healthier food alternatives	1 personalised email a week and 5% store discount beginning of enrolment	Coupon	12 weeks	Purchases	Grocery Purchase Quality Index-2016 questionnaire
B. Supermarket; discount														
Ball et al (2015)(13)	RCT	Australia	Female primary household shoppers	574	May 2011 – Nov 2012	43.7 (9.9)	574 (100%)	Women (aged 18 –60 years) shopping once or more every 2 weeks at the target stores; loyalty card holders	Fruit and vegetables; sugar sweetened beverages	Skills building	Loyalty cards	3 months	Purchases	Electronic sales data collected from supermarket
Brimblecombe et al (2017)(14)	RCT	Australia	Remote Indigenous communities	8515 (estimated total population for communities combined)	Jul 2012 – Dec 2014	NR	NR	Severely restricted access and extremely socioeconomic disadvantaged community in very remote regions of the Northern Territory. Community store with no other food outlet within 20 km.	Fresh and frozen fruit and vegetables; bottled water; artificially sweetened drinks	Nutrition education	Objective weekly sales data	24 weeks	Purchases	Sales data
Ni Mhurchu et al (2010)(15) and Blakely (2011)(16)	RCT	New Zealand	Household shoppers	1028	Feb 2007 – Feb 2009	44 (13.0)	944 (86%)	Main household regular shopper aged ≥18 years; registered user of the Shop 'N Go system	Predefined and classified healthier food; all eligible healthier food items*	Tailored nutrition education programme	Handheld barcode scanners in store plus a personalised scannable card (shop and Go system)	24 weeks	Purchases	Electronic sales data
Olsho et al (2016)(17)	RCT	USA (Massachusetts)	SNAP participants (low-income)	2009	Jul 2011 – Nov 2012	38	1372 (68.3%)	SNAP households within Hampden County	Fruit and vegetables (fresh, canned, frozen, and dried) without added sugars, fats, or oils†	None	Delivered through SNAP EBT cards	12 months	Consumption	24 h dietary recall by telephone surveys
Polacek et al (2018)(18)	RCT	USA (Maine)	SNAP participants (low-income)	354	Oct 2015 – Apr 2016	37.8	Intervention: 164 (80%); control: 152 (77%)	Household with a child aged <18; regular use of study store (≥50% of the time).	Fruit and vegetables (fresh, frozen canned)	A 5% discount on all purchases (excluding alcohol, tobacco, lottery, and pharmacy) for all participants. Intervention arm also received a limit of US\$10 benefit per household per	Loyalty cards, identical for intervention and control, intervention embedded with discount codes	4 months	Weekly purchase on fruit and vegetables	Through participants' loyalty card, and transaction number of the purchase

										shopping day. Monthly messages were sent to intervention arm participants for discount reminders.				
Toft et al (2017)(19)	NRI	Denmark	Population on an island	Not clear (total population of the island is 40 000)	Aug 2011 – Jan 2013	NR	NR	NR	Fruit and vegetables	A space intervention: shelf space for fruit and vegetables in both intervention supermarkets increase in high traffic areas with approximately 6 cm x 60 cm x 40 cm bin display plus one small island bin display. Fruit and vegetables replace non-food snacks and candy. The other intervention (in one of the two supermarkets) was a 20% discount introduced for 3 months (Sept to Nov 2012)	Sales data from supermarkets	3 months	Sales in fruit and vegetables	Weekly sales data for all products by Netto (a large discount supermarket chain)
Waterlander et al (2013)(20)	RCT	Netherlands	Lower SES in general	173 (included in analyses)	Sept 2010 – Jul 2011	51.7 (12.4)	166 (96%)	Supermarkets in areas with no other outlets nearby. Participants with higher educational levels excluded; participants had to be frequent shoppers in the participating stores, aged ≥18 years	Fruit and vegetables	Nutrition education, incentives (several small gifts to prevent dropout). On study completion, meetings at all four supermarkets gave participants a box filled with groceries (€40 value) and a gift coupon (€5; non-discount groups) or a €5 discount coupon only (discount groups).	Use of coupons from store management.	6 months	Fruit and vegetables purchase	Cash receipts, FFO
C. Supermarket; cash back, rebate, or gift card														
Rummo et al (2019)(21)	Quasi – RCT	USA (Michigan)	SNAP participants (low-income)	32 supermarkets ; about 1 173 434 individuals	Jan 2015 – Dec 2016	NR	NR	SNAP participants	Fresh produce	None	Loyalty card	14 months	Purchases	Transaction data from supermarket
An and Sturm (2017)(22) and Sturm and An (2013)(23)	NRI	South Africa	Private health insurance holder	333 751	2009–2012	No rebate: 36-32 (10-35); 25% rebate: 36-91 (10-33)	No rebate: 97 369 (50-3%); 25% rebate: 78 067 (55-7%)	Only purchases with a visa credit card issued by Discovery analysed; purchases from competing supermarkets or other stores and unlinked cash purchases were excluded	Fruit and vegetables; wholegrain foods; foods high in sugar; foods high in salt; fried foods; processed meats; fast food; non-fat dairy products	None	Purchases made with a specially issued visa card	Ongoing; measured monthly	Self-reported food intake using health risk assessment survey tool; monthly purchase	Self-reported survey questionnaire; scanner data from participating supermarkets for credit card purchases were linked to households
Phipps et al (2013b)(24) and Phipps et al (2015)(25)	RCT and prospective cohort study	USA (Philadelphia)	Low-income households	58 households	Dec 2010 – Oct 2011	NR	47 (81%)	Adults who were the main grocery shopper, ≥1 child, household income under US\$60 000 per year; ≥8 weeks history of shopping at the store; shopping ≥3 times per month; buying half or more food and half or more fresh fruit and vegetables there; having a loyalty card	Fresh or frozen fruit and vegetables	4 study-specific newsletters containing nutritional information and recipes involving fruit and vegetables were sent to participants	Gift cards provided to participants	Intervention of 8 weeks, tapering of 4 weeks	Purchase or sales; also reported probability of purchase within the intervention group	Point of sale, data from supermarket using loyalty card

Steele-Adjognon et al (2017)(26)	NRI	USA (Detroit)	Low-income area; predominantly Hispanic community	12 699	May 2014 – Jan 2015	NR	NR	Only SNAP beneficiaries were eligible to participate in the project	Fruit and vegetables	None	SNAP benefits card; loyalty card; debit or credit card; or WIC account	4 months	Fruit and vegetables expenditure	Scanner data from an independent supermarket
D. Canteen; discount														
Fernandez-Torres et al (2014)(27)	NRI	Spain	University students and staff	9530 (observations of lunch made over the study period)	2010–2012	NR	NR	All users of canteen	Calories; lipids; cholesterol; sodium (compared to RDA)	Leftovers of the food were also assessed; information on dishes with a logo showing the nutritionally recommended dish; television screens showing the nutritional profile of all the dishes offered that day	Canteen sales data	NR	Percentage of RDA supplied by the lunch: total calories, lipids, cholesterol, sodium	Assessment of nutritional content of canteen meals against a standardised database; observing purchases
Geaney et al (2016)(28)	NRI	Ireland	Employees in manufacturing companies	517	Nov 2012 – Mar 2014	40-8	124 (24%)	Workplaces with >250 employees and a daily workplace canteen. Only permanent, full-time employees who consumed >1 main meal from their canteens per day were eligible.	Salt intake; fat intake; sugar and fibre intake; nutrition knowledge; BMI; weight; midway waist circumference; resting blood pressure	Nutrition education; environmental dietary modification (ie, menu modification, increase in fibre, fruit and vegetables, price discounts for whole fresh fruit, strategic positioning of healthier alternatives, portion size control); combination of both interventions	NR	9 months	Saturated fat; salt; nutrition knowledge; BMI; energy intake	Questionnaires and physical examination
Kotke et al (2013)(29)	NRI	USA (Minneapolis)	Workers at the Health Partners headquarters	2643 (from 1 corporate cafeteria)	Feb – Jun 2012	NR	NR	NR	Salad	None	Cash register and weight	1 month	Salad sales	Averaged point of sales daily data aggregated for and by specific food categories
Lowe et al (2010)(30)	RCT	USA (Philadelphia)	Worksite cafeterias in two hospitals	96	2003–2005	44-2 (9-9)	78 (81%)	Hospital or university employees aged 21–65 years who ate lunch in a cafeteria ≥ 2 times a week†	Lower energy density food	Introduction of ten new low energy density foods; provision of labels for all foods sold at lunch (listed nutrition content); pricing incentives for purchasing low-ED foods and education about low-ED eating delivered in four, 1 h group sessions	Scan card and cafeteria cash register	3 months	Purchased kcal; purchased percentage of calories from protein and carbohydrate; food recall; total calories; weight; total cholesterol; HDL; LDL; triglycerides	Physical examination; dietary recall; cash register
Michels et al (2008)(31)	NRI	USA (Boston)	University staff and students	NR	4 months in 2001	NR	NR	Patrons who used the university cafeteria	Healthy foods (salad bar, stir-fried dishes, a nutritionally optimised entrée, wholegrain pizza, yogurt, and fruit) and less healthy foods (regular entrée, regular pizza, hamburger, hot dogs, fries, cookies, cakes, desserts)	Nutrition education;	Electronic transaction data; free blood pressure reading	5 weeks	Food purchased in servings and weight (eg, salad bar)	Transaction data at cafeteria

Patsch et al (2016)(32)	NRI	USA (Colorado Springs)	Hospital employees	2800	Jul 2011 – Jun 2012	NR	2307 (82.8%)	NR	Paired swaps: burgers (traditional hamburger swapped for healthier turkey burger) and salads (traditional salad vs healthier salad).	Marketing (logo and signage pointing); nutritional criteria signage highlighting taste, cost, and health benefits	Cash register data	9 months	Sales; profit; healthy foods sale proportion	Cafeteria cash register data; financial data provided by the hospitals
Velema et al (2018)(33)	RCT	The Netherlands	Cafeteria consumers	30 worksite cafeterias	Mar – Jun 2016	NR	NR	Worksite cafeterias with ≥100 lunch customers and a cash register system to measure sales	Snacks; fruits; salad; cheese; meat; sandwiches	14 strategies in total, based around product, place, price and promotion. Product (≥1 produce or “better choice” visibly offered; a warm lunch offered in smaller portion, fruit and vegetables offered, free water offered, visible share of health products is at least 60%); place (health products at beginning of route, better choice product is most visible, shelf with fruit and vegetables on top or front of shelf and at cash register).	Canteen sales data	12 weeks	Sales	Scanner data from sales; also used a scan to assess intervention fidelity and a questionnaire with staff
E. Canteen; cash back														
Thorndike et al (2016)(34)	RCT	USA (Massachusetts)	Hospital employees	2672	Sep 2012 – Mar 2013	42	1888 (72.4%)	Employees who used their workplace card for ≥3 separate transactions per month in the main cafeteria during 2 month period before study start date were eligible.	Green items (all items labelled as green, yellow, or red based on positive criteria [fruit and vegetables, wholegrains, and lean protein or low-fat dairy as main ingredient] and negative criteria (saturated fat and calories)	Peer comparison feedback about food purchases	Purchase on the employee platinum plate card	3 months	Purchase data in proportion	Monthly sales data from cafeteria cash registers
F. Community based; coupon														
Bihan et al (2012)(35)	RCT	France	Low-income adult individuals	302	2007–2008	Advice group: 44.9 (SD 8.1); vouchers group: 44.4 (SD 8.2)	76 (56%)	Participants undergoing health examinations at a French National Insurance centre (social security), aged ≥18 years, not pregnant, only one individual per household could be enrolled	Received vouchers for fresh fruit and vegetables (not processed, tinned or frozen)	Education	Vouchers sent out upfront	Up to 12 months	Fruit and vegetable consumption	Self-reported questionnaire for consumption; measurement and lab tests (for anthropometry, blood pressure, lipids, and glucose)

Segura-Perez et al (2017)(36)	RCT	USA (Hartford)	Local residents (low-income families as within SNAP program)	193	NR	32 (8-8)	185 (96%)	Non-pregnant adult Hartford residents with children aged ≤5 years, attending a SNAP-Ed My Plate educational session and willing to receive daily text messages for 4 weeks.	Fruit and vegetables	Text message lasted for 4 weeks, nutrition education, coupons to be used over a 6 week period	Coupon sent upfront	4 weeks	Fruit and vegetable intake	Phone interview survey
G. Community based; discount														
Harnack et al (2016)(37)	RCT	USA (Minneapolis)	Low-income adults not enrolled in SNAP	265	Aug 2013 – May 2015	44-5 (13-2)	214 (81%)	Not currently participating in SNAP; household income ≤200% of federal poverty level	Fresh fruit and veg subsidised, sugar beverage candy and baked goods restricted	Food restriction	Study specific debit card with funds were added regularly; receipts to check intakes during study; compared with bank transaction data to verify accuracy.	12 weeks	Consumption	24 h dietary recall
Black et al (2013)(38)	NRI	Australia	Low-income Aboriginal families with ≥1 child	174	Dec 2008 – Sep 2009	7-6 (4-2)	92 (53%)	Low-income families with ≥1 child, aged <17 years. Many children were identified as underweight or overweight, with chronic or recurrent infections, or presented frequently with episodes of illness	Fresh fruit and vegetables	Nutrition education, health check	Record at the local fruit and vegetable shop	1 year	Consumption; biomarkers (including carotenoid, vitamin A, vitamin E, vitamin C, lipids, and C-reactive protein)	24 h dietary recall, plasma blood sample
H. Farmers' markets or mobile markets; token or coupon														
Anderson et al (2001)(39)	RCT	USA (Michigan)	WIC and CSFP participants	455	Jun – Sep (year NR)	29-5 (range 17–61)	455 (100%)	WIC and CSFP participants who were pregnant, lactating, or caring for young children	Fruit and vegetables	Nutrition education	Coupons distributed upfront	2 months	Fruit and vegetables	Self-reported questionnaires
Durward et al (2019)(40)	NRI	USA (Utah)	SNAP participants (low-income adults)	339 completed baseline survey; 139 follow up	2015	40 (13-0)	262 (77%)	DUFEB participants were approached as they received their SNAP and DUFEB tokens. All DUFEB customers over several weeks were asked to participate	Fruit and vegetables	None	Tokens for use	Average 7 weeks follow – up	Fruit and vegetables consumption	Self-reported questionnaires
Lindsay et al (2013)(41)	NRI	USA (California)	SNAP participants (low-income adults)	7298	June 2010 – Dec 2011	38-6	6164 (84-6%)	SNAP, SSI, and WIC participants all eligible	Fruit and vegetables	Outreach and media efforts from June 2011 (including 22 weeks of television advertisements, direct mail flyers sent 6 times to 130 000 homes, and posters on buses and at bus stops). Researchers provided Fresh Fund informational flyers to non-profit community-	Fresh fund booth token	18 months	Food consumption	Self-reported questionnaire

										based organisation for distribution to their clients.				
Olsho et al (2015)(42)	Cross – section al	USA (New York)	Low-income neighbourhood	Neighbourhood resident survey (997); farmers’ market shopper survey (2287); CHS from 2002, 2004, 2008, 2009 (35 606 individual observations across 4 years)	2002– 2010	48	1781 (78.0%)	Local residents aged ≥18 years who were primary food shopper for their household.	Fruit and vegetables	None	Electronic benefit transfer cards by SNAP participants	Program me started in 2005	Purchase amount; consumption	Survey questionnaires
Ratigan et al (2017)(43)	NRI	USA (San Diego)	Low-income individuals receiving governmental benefit	7298	June 1, 2010– Jan 31, 2012	median 34 (range 7–100)	6164 (84.6%)	Individuals receiving government assistance from SNAP, WIC, or SSI. Individuals younger than 18 years were eligible if they received disability income or were eligible for WIC because of pregnancy or having children aged <5 years	Fruit and vegetables	None	Fresh fund booth	7 months	Consumption	Survey questionnaires
Savoie- Roskos et al (2016)(44)	NRI	USA (Utah)	SNAP participants; low-income households	54	NR	38	40 (74%)	Aged ≥18 years, receiving SNAP benefits, participating in the DUFB program at the Salt Lake City Downtown Farmers Market	Fruit and vegetables	None	Collected when onsite purchase	4 weeks	Consumption	Survey questionnaires
Young et al (2013)(45) ⁶⁸	Cross-section al	USA (Philadelphia)	SNAP participants Low-income households	662	Sept – Nov, 2011	47-7	443 (73%)	SNAP participants who shopped at farmers’ market	Fruit and vegetables	None	Unique serial number on each coupon	1 year program me, but this is only a survey, there is no follow-up	Fruit and vegetable intake	Survey questionnaires

* Eligible food included cereals and cereal products, fats and oils, fruit and vegetables, meat and meat alternatives, and milk and milk products. These were predefined using the Heart Foundation’s Tick program nutrient profiling criteria. In total, 1032 database products (35%) met the Tick criteria and were classified as healthier.

†Excluding white potatoes, mature legumes (dried beans and peas), and 100% juice.

‡ Excluded individuals with chronic disease or condition, or taking medication, known to affect appetite or body weight, or were pregnant or planning to become pregnant within the next 24 months, were enrolled or had plans to enrol within the next 24 months in weight management program, or had plans to terminate hospital employment within the next 12 months.

RCT= randomised control trial. NRI= non-randomised intervention. NR=not recorded. WIC= Special Supplemental Nutrition Assistance Program for Women, Infants and Children (an American Programme offering additional benefits to low resource women with children younger than 5 years). SNAP= Supplemental Nutrition Assistance Programme (an American programme providing food benefits to low-income families). EBT= electronic benefit transfer. SES=socioeconomic status. FFQ=food frequency questionnaires.

RDA=recommended daily allowance. ED=energy density. CSFP= Community Action Agency Commodity Supplemental Food Programme. DUFB=double up food bucks (an American programme provided matched benefit from fruit and vegetable purchases). SSI= Supplemental Security Programme (an American programme offering addition benefits to low resource disabled adults and children). CHS=community health survey.

Appendix Table S2 Table of results for studies reporting consumption data

a) Setting: supermarket; subsidy type: coupon								
Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Moran 2019(8)	RCT	US (Maine)	Low income households with at least one child	F & V	10 weeks	50% off through coupon or loyalty card, obtained through retail scanner data (double dollar incentive, up to \$10).	FFQ	Estimated consumption: Primary shopper (n=317) overall difference between intervention and control groups = -0.26 servings (half-cup as one serving), for reference child (n=309) overall difference = -0.22 servings (half-cup as one serving). The differences between intervention and control groups were not significant.
b) Setting: supermarket; subsidy type: discount								
Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Ball 2015(13)	RCT	Australia	Female primary household shoppers	F & V Sugar sweetened beverages	3 months	20% discount	Validated self-reported questionnaires	At 3 months (end of the intervention), price reduction group had a reduction of 0.05 (SE 0.11) servings of vegetable intake compared to the control group, and 0.16 (SE 0.09) serving increase in fruit intake ¹ . In the adjusted models, total vegetable consumption had no significant changes at 3 months (-25.8g/week; 95%CI: -145.4, 93.8; P=0.672) or 6 months (22.8g/week; 95%CI: -90.6, 136.2; P=0.694); total fruit consumption increased by 167.0 g/week (95%CI: -26.4, 136.2; P=0.091) at 3 months though statistically borderline significant, but there was a significant increase at 6 months post intervention at 243.2 g/week (95%CI: 50.2, 436.2; P=0.014). There was a 73.4ml/L (0.7, 146.2) increase in sugar sweetened beverage in price only arm compared to control group P=0.048.
Olsho 2016(17)	RCT	US (Massachusetts)	SNAP participants (low income)	F & V (fresh, canned, frozen, and dried) without added sugars, fats, oils, or salt ⁱⁱ	12 months	30% discount	24-hour dietary recall	0.24 cup-equivalents/d (95% CI: 0.13, 0.34 cup-equivalents/d) higher among Healthy Incentives Pilot participant - 23% increase in intake of targeted fruit, and a 30% increase in intake of targeted vegetables. There was a statistically significant 8% increase in a score of overall dietary quality; Healthy Index (HEI)-2010.
Waterlander 2013(20)	RCT	Netherlands	lower SES in general	F & V	6 months	50% discount	FFQ	Participants who consumed sufficient amounts of F&V increased from 42.5% to 61.3% at 6 months in the discount groups (p=0.03). Whilst in non-discount groups, no significant change was found (from 52.7% to 52.5%, p=0.80).
c) Setting: supermarket; subsidy type: cash back/rebate/gift card								
Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results

An 2017(22) & Sturm 2013(23)	NRI	South Africa	Private health insurance holder	F & V, wholegrain foods, foods high in sugar, foods high in salt, fried foods, processed meats, fast-food, non-fat dairy products	On-going; measured monthly	10% and 25% rebate	Limited self-reported questionnaire	Participants with 25% rebate had 3.87 servings/day of F&V, and compared to those with no rebate at 3.17 servings/day. 10% and 25% discount on healthy food purchases is associated with an increase in F&V consumption by 0.38 (95% CI: 0.37 – 0.39) and 0.64 (95% CI: 0.62 – 0.65) servings/day, respectively.
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d) Setting: canteen; subsidy type: discount

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Geaney 2016(28)	NRI	Ireland	Employees in manufacturing companies	Salt intake, fat intake, sugar and fibre intake, nutrition knowledge, BMI, weight, midway waist circumference, resting blood pressure	9 months	Not stated	24-hour dietary recall	Salt intake decreased at -1.3g/day (95%CI: -2.3, -0.3; P=0.01) between intervention and control group; reduction in daily saturated fat intake was also seen at -5.2 (-9.4, -1.1; P=0.013)
Lowe 2010(30)	RCT	US (Philadelphia)	Worksite cafeterias in 2 hospitals	Lower energy density food	3 months	15% for low energy density foods and 25% for very low energy density foods (as defined in study)	24-hour dietary recall	Both the environmental intervention and environmental + discount intervention groups had energy content lunch purchases decreased from 656.09 kcal (\pm 183.83) to 585.47 kcal (\pm 170.09) baseline to one month - all time points showed statistically significant differences (p<0.01). % energy from fat also declined (p=0.001). 24-hour dietary recall showed no statistically significant changes over time in reported intake of total energy, vegetables, bread products, or dairy products. The environmental + discount group (includes subsidies) increased their fruit intake (from 0.77 servings to 0.98 servings) while the environmental group (no subsidies) decreased theirs (from 1.41 servings to 0.96 servings; p <0.05). Participants in both groups decreased their meat intake during the cafeteria monitoring period (p = 0.06).

f) Setting: community based; subsidy type: coupon

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Bihan 2012(35)	RCT	France	Low income adult individuals	Received vouchers for fresh F&V (NOT processed, tinned or frozen)	Up to 12 months	absolute units (Euros) vouchers dependent on household size and composition (See earlier entry)	Shortened FFQ	Between baseline and 3-months, mean F&V consumption increased significantly in both the 'advice' (0.62 \pm 1.29times/day, P <0.0004) and 'F&V vouchers' groups (0.74 \pm 1.90,P<0.002), with no difference between groups. At 3 months mean consumption per day was 2.51 \pm 1.44 in advice group and 2.93 \pm 1.40 P<0.09 in vouchers group. F&V vouchers group had significantly decreased risk of low F&V consumption (<1 time/day) compared with advice group (P<0.008). 25.8% in advice only group consumed <1 time per day vs 5.5% in voucher group, p <0.001
Segura-Perez 2017	RCT	US(Hartford)	Local residents (low- income family as it is within SNAP program)	F & V	4 weeks	4 \$5 coupons	Phone interview survey	Intervention group had a significant increase in fruit intake (p=0.001), but not in the control group; no comparison across groups was made

g) Setting: community based; subsidy type: discount

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Harnack 2016(37)	RCT	US (Minneapolis)	Low income adults not enrolled in SNAP	Fresh F & V subsidised, sugar beverage candy and baked goods restricted	12 weeks	30% reduction	24-hour dietary recall	Incentive Arm: F intake increased 0.4 servings/d; SE, 0.2) vs control arm (0 servings/d; SE, 0.1). P value (calculated by reviewers) between the two groups approx. p = 0.09. There was no difference in total vegetable intake or total fruit and vegetable intake (0.3 [SE 0.1] in the Int group and 0.1 [SE 0.1] in the control groups; p = 0.68 but a dietary score (HEI-2010) showed a significant improvement in the intervention arm (a difference of 1.6 (SE 1.9) compared with -0.2 (SE 0.4) in the control arm (p< 0.01)

h) Setting: farmers' markets / mobile markets; subsidy type: token/coupon

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Consumption assessment	Results
Durward 2019(40)	NRI	US (Utah)	SNAP participants (low income adults)	F & V	Average 7 weeks follow-up	Up to \$10 worth of vouchers valid for farmers market depending on questionnaire completion (\$2 dollars when baseline questionnaire completed, \$3 posted to ppts at follow up, with an additional \$5 if both questionnaires were completed)	Previous validated survey (consumption for previous 30 days)	Significant increase in median F&V consumption, from a median of 2.82 times per day to 3.29 times per day (IQR 1.48-3.99 and 3.28-5.02, respectively P= .002)
Lindsay 2013(41)	NRI	US (California)	SNAP participants (low income adults)	F & V	18 months	Not stated	Short survey	% respondents reporting eating 5 or more daily servings of F&V increased from 23.7% to 29.6% for at 3 and 6 months and 19.4% to 24.2% at 12 months. P<0.001 for both
Olsho 2015(42)	Cross-sectional	US (New York)	Low income neighbourhood	F & V	Programme started from 2005	Health Bucks scheme offers one \$2 voucher for fresh F&V at farmers markets per \$5 spent from electronic benefit transfer (EBT) cards.	Annual Community Health Survey	Health Bucks users were more likely to report increased consumption (P<0.05). Difference in difference model did not find evidence that the programme increased F&V consumption in the neighbourhood (b=0.013, se:0.013)
Ratigan 2017(43)	NRI	US (San Diego)	low income individuals receiving governmental benefit	F & V	7 months	Money matching scheme for food tokens to be used at farmers market where \$1 could be exchanged for \$2 worth of tokens. Up to \$20 could be exchanged per month.	Self-reported survey	Fresh fund used associated with 2% per month increased F & V servings. OR=1.02 (1.01, 1.03, P=0.003)
Savoie-Roskos 2016(44)	NRI	US (Utah)	SNAP participants low income households	F & V	4 weeks	Money matching scheme of up to \$10 per week to be used at farmers market.	Short but validated survey on F&V	F & V intake was 3.3 (SD 0.8) times/week, and after intervention was 4.0 (0.8) times/week.
Young 2013(45)	Cross-sectional	US (Philadelphia)	SNAP participants low income households	F & V	1-year program but this is only a survey, there is no follow-up	Evaluation of Philly Food Bucks scheme where ppts received a \$2 coupon for every \$5 they spent	Customers' survey by interview	Users were significantly more likely than non-users to report eating more F&V since becoming a market customer (OR=2.4 (95% CI = 1.6 - 3.7)) and to report trying new or unfamiliar F&V since becoming a market customer (OR=1.8 (95% CI = 1.2 - 2.7))

ⁱ Data received from study author through email communication.

ii Excluding white potatoes, mature legumes (dried beans and peas), and 100% juice.

Abbreviations: RCT – randomised control trial; NRI – non-randomised intervention; F & V – Fruit and Vegetables; SNAP – Supplemental Nutrition Assistance Programme, a US program providing food benefits to needy families; SE – standard error; SD – standard deviation; BMI – body mass index; SES – socioeconomic status; FFQ – food frequency questionnaire; OR – odds ratio; IQR – interquartile range.

Appendix Table S3 Study results among those included in the forest plots (cross-reference Figures 2-4)

a) Fruit and vegetables

Low-income population							
Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Results
Brimblecombe 2017(14)	RCT	Australia	Remote Indigenous communities	F & V, water, artificially sweetened soft drinks, regular soft drinks, healthy food (excluding fruit and vegetables), less healthy food, other beverages, and Australian Health Survey (AHS) food groups and nutrients	24 weeks	20% discount	12.7% (95% CI 4.1–22.1) increase in purchases of F & V (grams) during the discount intervention. This even rose to 19.8% (6.2–35.1) increase after the discount intervention stopped.
Harnack 2016(37) ⁱ	RCT	US (Minneapolis)	Low income adults not enrolled in SNAP	Fresh fruit and veg subsidized, sugar beverage candy and baked goods restricted	12 weeks	30% reduction	Incentive Arm: Fruit intake increased 0.4 servings/d; SE, 0.2) vs control arm (0 servings/d; SE, 0.1). There was no change in vegetable intakes
Olsho 2016(17) ^j	RCT	US (Massachusetts)	SNAP participants (low income)	F & V (fresh, canned, frozen, and dried) without added sugars, fats, oils, or salt ⁱⁱ	12 months	30% discount	0.24 cup-equivalents/d (95% CI: 0.13, 0.34 cup-equivalents/d) higher among Healthy Incentives Pilot participant - 23% increase in intake of targeted fruit, and a 30% increase in intake of targeted vegetables
Phipps 2015(25)	RCT & Prospective cohort	US (Philadelphia)	Low income households	Fresh / frozen F & V	Intervention of 8 weeks, tapering of 4 weeks	rebates of 50% during intervention and 25% during tapering F & V purchases	Control households: average 6.4 servings F & V purchased (combined) per week. INT: 16.7 per week; 10.4 more than control (95% CI-4.8, 17.8; P.002) households. After adjustment for weekly price changes difference between INT and controls was 10.2 servings (95% CI = 3.6, 25.7; p= 0.001). Int households consumed 8 more serving of V than controls (95% C 1.5 to 16.9, p<0.001)
Polacsek 2018(18)	RCT	US (Maine)	SNAP participants (low income)	F&V (fresh, frozen canned)	4 months	5% discount on all items and 2 for 1 for F&V	Total weekly F&V spending increased in the INT compared to control (\$1.83, 95% CI=\$0.29, 3.88). The largest increase was for fresh F&V (\$1.97, 95% CI=\$0.49, 3.44).
Waterlander 2013(20)	RCT	Netherlands	lower SES in general	F & V	6 months	50% discount	Discount group increase purchases by: +3.9 kg; 95% CI: 1.5, 6.3 kg; discount plus education intervention (+5.6 kg; 95% CI: 3.2, 7.9 kg) at 6 months compared with control. At 6 months, the discount group purchased 5.3kg (95%CI 2.8, 7.7) more F & V than the control group (P<0.001); similar pattern found among discount plus education group (5.4kg [95%CI 3.0, 7.8], P<0.001). The difference remained significant in adjusted models: discount group at 3.9kg (95%CI 1.5, 6.3), discount plus education group at 5.6kg (95%CI 3.2, 7.9). More participants who consumed sufficient amounts of F&V increased from 42.5% to 61.3% at 6 months in the discount groups (P = 0.03). Whilst in non-discount groups, no significant change was found (from 52.7% to 52.5%, P = 0.80).
General population							
Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Results
An 2017(22) ^j	NRI	South Africa	Private health insurance holder	F & V, wholegrain foods, foods high in sugar, foods high in salt, fried foods, processed meats, fast-food, non-fat dairy products	On-going; measured monthly	10% and 25% rebate	Participants with 25% rebate had 3.87 servings/day of F & V, and compared to those with no rebate at 3.17 servings/day. 10% and 25% discount on healthy food purchases is associated with an increase in F & V consumption by 0.38 (95% CI: 0.37 – 0.39) and 0.64 (95% CI: 0.62 – 0.65) servings/day, respectively. Rebates of 10% and 25% associated with increases in ratio of expenditure on healthy foods to total food by 6.0% (95% CI 5.3, 6.8) and 9.3% (95% CI 8.5, 10.0); F&V 5.7% (95% I 4.5, 6.9) and 8.5% (95% CI 7.3, 9.7).
Ball 2015(13) ^j	RCT	Australia	Female primary household shoppers	F & V	3 months	20% discount	At 3 months total F&V purchase increased by 584.1 g/wk. (SE 22.2) in price reduction group compared to the control group (re-calculated by reviewers based on data from study authors).

Ni Mhurchu 2010(15)	RCT	New Zealand	Household shoppers	Predefined and classified healthier food all eligible healthier food items ⁱⁱⁱ	24 weeks	12.5% discount	Intervention group purchased 0.48 kg/week more F & V compared to the control group (P<0.001) at 6 month (a 10% increase from baseline) and an increase of 0.28 kg/wk (95% CI: 0.00, 0.56; P =0.05) at 12 month.
Toft 2017(19)	NRI	Denmark	Population on an island	F & V	3 months	20% discount	Total F&V sales: 15.3% increase (p=0.01) 22.2% increase in sales of fresh vegetables (p=0.001) compared with control supermarkets in space + price. Fresh V sales 18% higher in space + price compared with space only intervention (p=0.02).

b) Healthy food

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Results
Brimblecombe 2017(14)	RCT	Australia	Remote Indigenous communities	F & V, water, artificially sweetened soft drinks, regular soft drinks, healthy food (excluding fruit and vegetables), less healthy food, other beverages, and Australian Health Survey (AHS) food groups and nutrients	24 weeks	20% discount	An insignificant 5.8% (95%CI -0.9, 13.1) increase of healthy food purchase; however, there was a significant increase after the intervention at 10.8% (95%CI 0.2,22.5).
Kottke 2013(29)	NRI	US (Minneapolis)	Workers at the Health Partners headquarters	Salad	1 month	50% discount	Total sales at salad bar (in \$): February 3344, March (intervention month) 6747, April 3629, May 3899, June 3874
Lowe 2010(30)i	RCT	US (Philadelphia)	Worksite cafeterias in 2 hospitals	Lower energy density food	3 months	15% for low energy density foods and 25% for very low energy density foods (as defined in study)	Both the environmental intervention and environmental + discount intervention groups had energy content lunch purchases decreased from 656.09 kcal (±183.83) to 585.47 kcal (±170.09) baseline to one month - all time points showed statistically significant differences (p<0.01). % energy from fat also fell p=0.001. 24-hour dietary recall showed no statistically significant changes over time in reported intake of total energy, vegetables, bread products, or dairy products. The environmental + discount group (includes subsidies) increased their fruit intake (from 0.77 servings to 0.98 servings) while the environmental group (no subsidies) decreased theirs (from 1.41 servings to 0.96 servings; p <0.05). Participants in both groups decreased their meat intake during the cafeteria monitoring period (p = 0.06). But no significant changes in body fat or waist circumference over time. For purchased kcal outcome: baseline month1- 665.1 (SD185.1); baseline month2-572.2 (SD163.4); intervention month1-580.4 (SD159.2); intervention month2-548.5 (SD158.7); intervention month3-570.0 (SD179.9)
Michels 2008(31)	NRI	US (Boston)	University staff & students	Healthy foods (salad bar, stir-fried dishes, Saluté entrée, whole-grain pizza, yogurt, and fruit) and less-healthy foods (regular entrée, regular pizza, hamburger, hot dogs, french fries, cookies, cakes, and desserts)	5 weeks	20% discount on healthy options	6% increase in consumption of healthy options during 5-week intervention compared to baseline (95% CI; 5% to 8%). Healthy food consumption then rose to 17% at 5-week follow up (95% CI; 13% to 20%) 2% decline in consumption of less healthier food options during the 5-week intervention compared to baseline (95% CI; -4% to 1%), which remained the same at the 5-week follow up (95% CI; -5% to 1%).
Ni Mhurchu 2010(15)	RCT	New Zealand	Household shoppers	Predefined and classified healthier food all eligible healthier food items ⁱⁱⁱ	24 weeks	12.5% discount	Saturated fat 6-month outcomes: -0.02% (95% CU -0.4%, 0.36%, p 0.91); 12 months -0.12%; 95% CI: -0.51%, 0.27%; P= 0.54. Also did not differ between intervention groups at 6 or 12 months. Intervention group purchased 0.79 kg/week more healthier products and 0.48 kg/week more F & V compared to the control group (P<0.001).
Patsch 2014(32)	NRI	US (Colorado Springs)	Hospital employees	Paired swops: burgers (traditional hamburger for healthy turkey	9 months	35% discount	PH burgers; traditional burger fell 47.9% p< 0.001 and healthy burgers increased 600% p<0.001. SFMC site, traditional burgers fell 20.4% and healthy ones increased 371.2%. p<0.001 Salads:

c) Unhealthy food

Author year	Study design	Country	Study population	Targeted foods/measures	Duration of intervention	Price change	Results
Ball 2015(13) ⁱ	RCT	Australia	Female primary household shoppers	F & V	3 months	20% discount	Adjusted effect for sugar sweetened beverages purchase: discount only group had increased purchase of 386.2ml/week, 95%CI -52.1, 824.5, P=0.084, discount + behaviour change group was 881.4 ml/week, 95%CI -686.6, 2449.5, P=0.271 compared to the controls. Small increases in SSB self-reported consumption observed at one time point –[3 months – end of intervention]. Increased of 73.4 ml/week, 95% CI .7 to 146.2 ml/week).
Brimblecombe 2017(14)	RCT	Australia	Remote Indigenous communities	F & V, water, artificially sweetened soft drinks, regular soft drinks, healthy food (excluding fruit and vegetables), less healthy food, other beverages, and Australian Health Survey (AHS) food groups and nutrients	24 weeks	20% discount	An insignificant 5.3% (95%CI -1.9, 13.1) increase of unhealthy food purchase; a significant increase after the intervention at 13.4% (95%CI 1.7, 26.4).
Harnack 2016(37) ^{iv}	RCT	US (Minneapolis)	Low income adults not enrolled in SNAP	Fresh fruit and veg subsidized, sugar beverage candy and baked goods restricted	12 weeks	30% reduction	For restricted food, incentive arm had a decreased 0.1 (SD 0.2) servings/day compared to an increase of 0.3 (SD 0.2) servings/day
Ni Mhurchu 2010(15)	RCT	New Zealand	Household shoppers	Predefined and classified healthier food all eligible healthier food items ⁱⁱⁱ	24 weeks	12.5% discount	Saturated fat 6-month outcomes: -0.02% (95% CU -0.4%, 0.36%, p 0.91); 12 months -0.12%; 95% CI: -0.51%, 0.27%; P= 0.54. Also did not differ between intervention groups at 6 or 12 months. . For less healthier food, intervention group had 0.07kg/week increased purchased compared to the control group but not statistically significant.
Patsch 2014(32)	NRI	US (Colorado Springs)	Hospital employees	Paired swops: burgers (traditional hamburger for healthier turkey burger) &salads (traditional salad vs healthy salad).	9 months	35% discount	Two site study; in PH site for burgers; traditional burger sales fell 47.9% p< 0.001 and healthy burgers increased 600% p<0.001. SFMC site, traditional burgers fell 20.4% and healthy ones increased 371.2%. p<0.001 Salads: PH not significant; traditional fell 5.7% and healthy increased 2.6%, p = 0.238. SFMC traditional fell 25.4% & healthy rose 71.1%, p < 0.001

ⁱ Results reported on consumption data; Ball 2015, Lowe 2010 reported both consumption and purchase data; Ball 2015 data was calculated from data requested from study author.

ⁱⁱ Excluding white potatoes, mature legumes (dried beans and peas), and 100% juice.

ⁱⁱⁱ Eligible food included cereals and cereal products, fats and oils, fruit and vegetables, meat and meat alternatives, and milk and milk products. These were predefined using the Heart Foundation's Tick program nutrient profiling criteria. In total, 1032 database products (35%) met the Tick criteria and were classified as "healthier."

^{iv} Results reported on consumption data; Ball 2015 reported both consumption and purchase data.

Abbreviations: RCT – randomised control trial; NRI – non-randomised intervention; F & V – Fruit and Vegetables; SNAP – Supplemental Nutrition Assistance Programme, a US program providing food benefits to needy families; SE – standard error; BMI – body mass index; SES – socioeconomic status; SD – standard deviation; PH – Penrose Hospital (one of two study sites); SFMC – St Francis Medical Centre (one of two study sites).

Appendix Table S4 Income effect (effects of price reductions on purchases of other, less healthy foods)

Study	Design	Setting	Assessment of income effects	Results
Ball 2015(13)	RCT	Australia	Through supermarket purchases, but unable to fully describe due to agreements with industry	Small increases in reported SSB consumption observed at one time point (additional 73.4 ml/week, 95% CI 0.7 to 146.2 ml/week). No statistically significant changes in purchases of SSB at either time point reported.
Brimblecombe 2017(14)	Stepped wedge RCT	20 remote communities with high proportion of indigenous residents in Australia	Weekly store sales data	Statistically significant increases were observed for total sodium during 8.3% (95% CI 0.5–16.6) and after the discount (13.8%, 1.8–27.3) and for total energy during (6.7%, 0.1–13.8) and after the discount period (13.8%, 3.2–25.6)
Ni Mhurchu 2010(15)	RCT	8 supermarkets in New Zealand, serving Maori and Pacific communities	All supermarket purchases categorised as “less healthy” according to a validated approach	No changes in purchases of less healthy foods, similar results in sensitivity analyses
Olsho 2016(17)	RCT	US, low income SNAP participants from about 55,000 households	24-hour dietary recall	Small reduction in refined grain intakes was observed (0.43 ounce-equivalents/d lower (95% CI: -0.69, -0.16 ounce-equivalents/d) in the intervention arm. Overall, Healthy Eating Score was higher due to increased F & V participants (4.7 points; 95% CI: 2.4, 7.1 points).
Toft 2017(19)	Non-randomised control area	Supermarkets on Danish island (Bornholm) compared with a control area	Assessed sales data for confectionary, cakes, sugary beverages (as indicators of unhealthy foods) and fish, wholegrains (As indicators of healthy foods)	No unhealthy substitution effects identified
Waterlander 2014(20)	RCT	The Netherlands	By calculating cross-price elasticities	No significant changes between baseline and 1 month on any other food category
Moran 2019(8)	RCT	US, low-income households who had at least one child	Through retail scanner data and a food frequency questionnaire	There was no evidence of differences in spending on any unhealthful food category between the intervention and control groups.

Appendix Table S5 Risk of biasⁱ assessment for studies with randomised control design

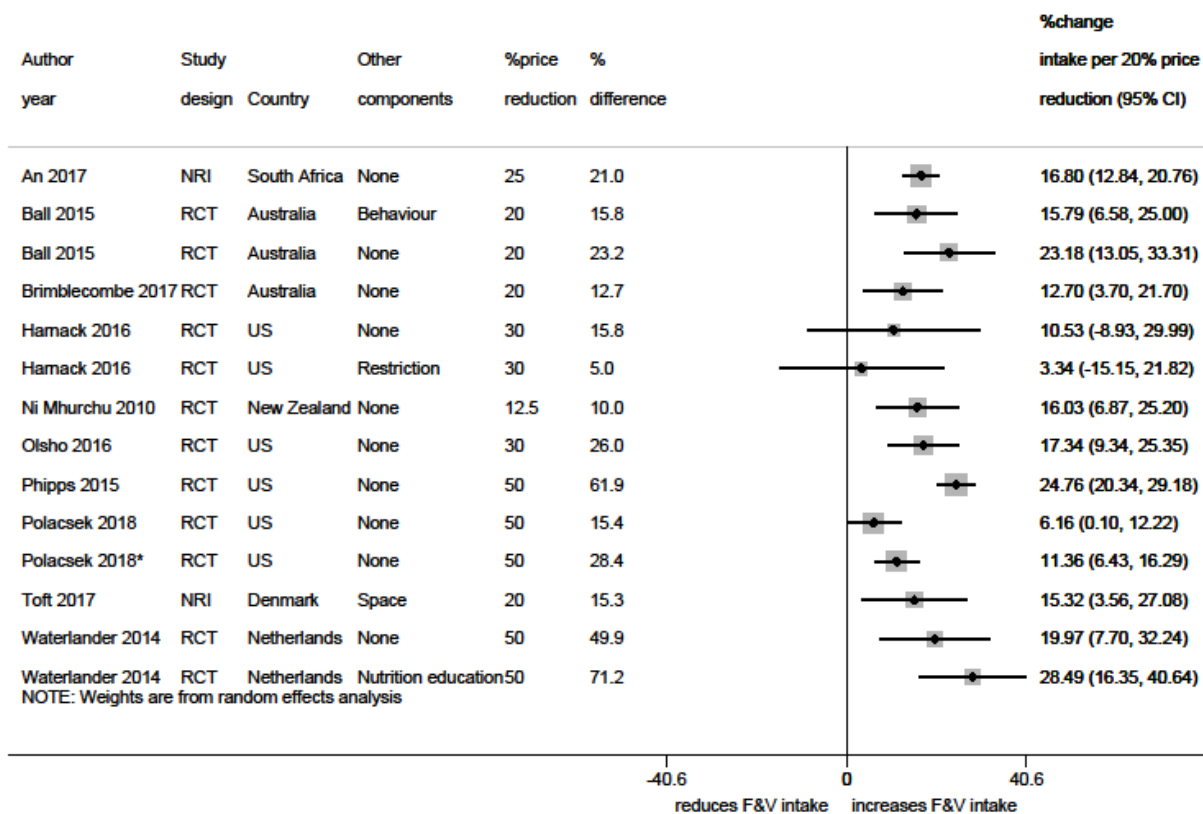
Author year	Selection bias		Outcome assessment blinding	Incomplete outcome data	Selective reporting	Other sources of bias	Final score	Notes
	Randomisation	Concealment						
Anderson 2001(39)	Unclear	Unclear	Low	High	Low	Unclear	High	104 of initial 230 remained within study and contributed data
Ball 2015(13)	Low	Low	Low	Low	Low	Unclear	Low	Not ITT as 68 participants excluded, lost to follow-up, or did not consume any of the targeted products over the duration of the trial. Supermarkets selected at random based on an area-based indicator of socio-economic status
Bihan 2012(35)	Unclear	Unclear	Unclear	High	Low	High	High	All F&V consumption outcomes self-reported, therefore possibly introduced reporting bias. High losses to follow-up; 302 were randomised, 62+73 = 135 at 3 months and then got even worse (and they basically gave up and did not present data on later follow-up time points.
Brimblecombe 2017(14)	Low	Low	Unclear	High	Low	Low	High	"Outcome completeness" was not clearly reported - based on sales data (probably not available). Remote rural region - should be a complete selection of supermarkets available in these areas
Harnack 2016(37)	Low	Low	Low	Low	Low	Low	Low	Per protocol analysis only. 265 of 279 randomised included. Those lost to follow-up were lower in terms of reduction. Used repeated dietary recalls at baseline and intervention time periods i.e. data based on intakes and not just purchases.
Lowe 2010(30)	Unclear	Unclear	Unclear	High	Unclear	Low	High	Total attrition rates were 19.8% at post-intervention (6 months after study initiation), 34.4% at 6-month follow-up (6 months after the conclusion of the intervention), and 42.7% at 12-month follow-up. More were lost from the incentives group (EC plus) than the EC group (p<0.05). African Americans less likely to provide cafeteria register data at month 1 and baseline (p<0.05). All those who took part were volunteers. Nature of intervention makes blinding for participants impossible.
Ni Mhurchu 2010(15)& Blakely 2011(16)	Low	Unclear	Low	Low	Unclear	Low	Low	Only 3000 of the most purchased items were classified in the study, and thus the outcome of "healthy purchases" only based on this sub-set of

								data on items purchased. These were 65% of total expenditure and 78% of total volume. Data from pilot study suggested that 66% of total household food expenditure was undertaken at participating supermarket stores and 51% captured by using Shop N Go
Olsho 2016(17)	Low	Low	Unclear	High	Low	High	High	A high proportion were lost to follow-up, left SNAP, refused etc or did not complete both follow-up surveys. [2538 were selected for survey data collection in both groups but only 1010 in INT and 999 in control group completed both surveys. NOT all SNAP retailers agreed to take part - about 104 retailers that agreed to participate accounted for 60% of SNAP redemptions in the county. The outcomes were consumption which is self-reported, hence potentially introducing reporting bias.
Phipps 2015 & Phipps 2013(24, 25)	Low	Low	Low	Low	Low	High	High	Participants had to have loyalty card to be enrolled in study, so there is a possibility of selection bias, that is people who shop less frequently might be missed.
Polacsek 2018(18)	Low	Low	Low	Low	Low	Unclear	Low	Study had a means to blind shop assistants by using identical looking cards and not telling checkout operators what the differences were, but this was only during the baseline 3 months period. Selection biases possible as those not redeeming cards had more children (2.0 vs 1.7), higher BMI (28.9 vs 26.2) and were more likely to be in SNAP (35% vs 20%)
Segura-Perez 2017(36)	Unclear	Unclear	Unclear	Low	Low	High	High	Self-reported outcome; though not adjusted for confounders. This study is published only as an abstract so with limited details to assess study quality.
Thorndike 2016(34)	Low	Unclear	Low	Low	Low	Low	Low	Randomisation method is not clearly reported. Study had an opt-out design and almost all employees therefore opted in - so this is real life evidence (not just the motivated consumers who sought out a healthier eating programme). Also, there were apparently no other food outlets on the site, so it is less likely people supplemented with food bought elsewhere. It is limited to just one hospital.
Velema 2018(33)	Low	Low	Low	Unclear	Low	Unclear	Low	Many of the workplaces approached and initially interested did not participate so potentially affecting the generalisability.

Waterlander 2013(20)	Low	Low	Unclear	High	Low	Low	High	4 store owners out of 11 initially approached agreed to take part. Of 199 randomised, 151 were included in primary analyses so >20% drop-out, analysed by ITT but not entirely clear how this was done. Some participants were lost earlier as did not respond to initial questionnaire; n=35
Moran 2019(8)	Unclear	Unclear	Low	High	Unclear	Low	High	605 analysed at baseline, 456 analysed at follow-up. Missing outcome data, reasons for drop-out not provided
Vadiveloo 2020(12)	Low	Low	Unclear	Low	Low	Low	Low	Randomised study, had little attrition; included participants were educated, more affluent, and had higher dietary quality to start with.

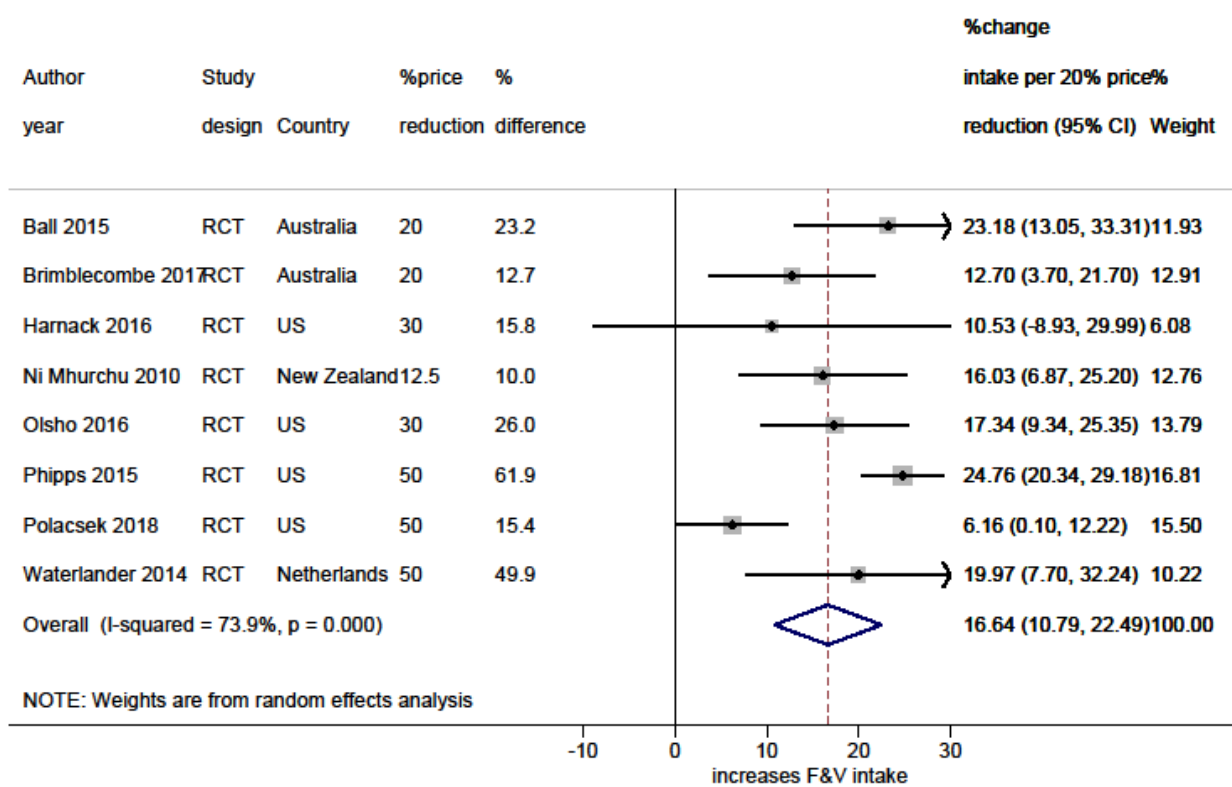
ⁱ Based on Cochrane Risk of Bias for randomised control trials. “High” indicates high risk of bias; “Unclear” indicates unclear information provided therefore possibly some concerns of risk of bias; “Low” indicates low risk of bias; see below for more details of explanation:

- Randomisation assessed as “low” if an unbiased method of randomisation e.g. computer-generated lists or blocks was stated, “high” if a potentially biased method was used e.g. alternate allocation, and unclear if insufficient details were provided.
- Allocation concealment assessed as “unclear” if no method of concealing allocation (e.g. computer generation) was mentioned, otherwise low.
- Blinding of outcome assessors assessed as “low” risk of bias if outcome assessors were unaware of the allocation of the participant (subsides or control group) in studies; “unclear” if not reported
- Incomplete outcome data bias was assessed as “high” if 20% or more of participants recruited were lost to follow-up during the study, otherwise “low”; “unclear” if not reported
- Selective reporting bias assessed as “low” if studies reported on the outcomes originally specified (as best the review authors can tell given the lack of a published protocol for most studies).
- Other sources of bias were assessed as “high” where the assessors identified other potential sources of bias not covered by the previous question e.g. lack of generalisability (many participants excluded from taking part in the study).



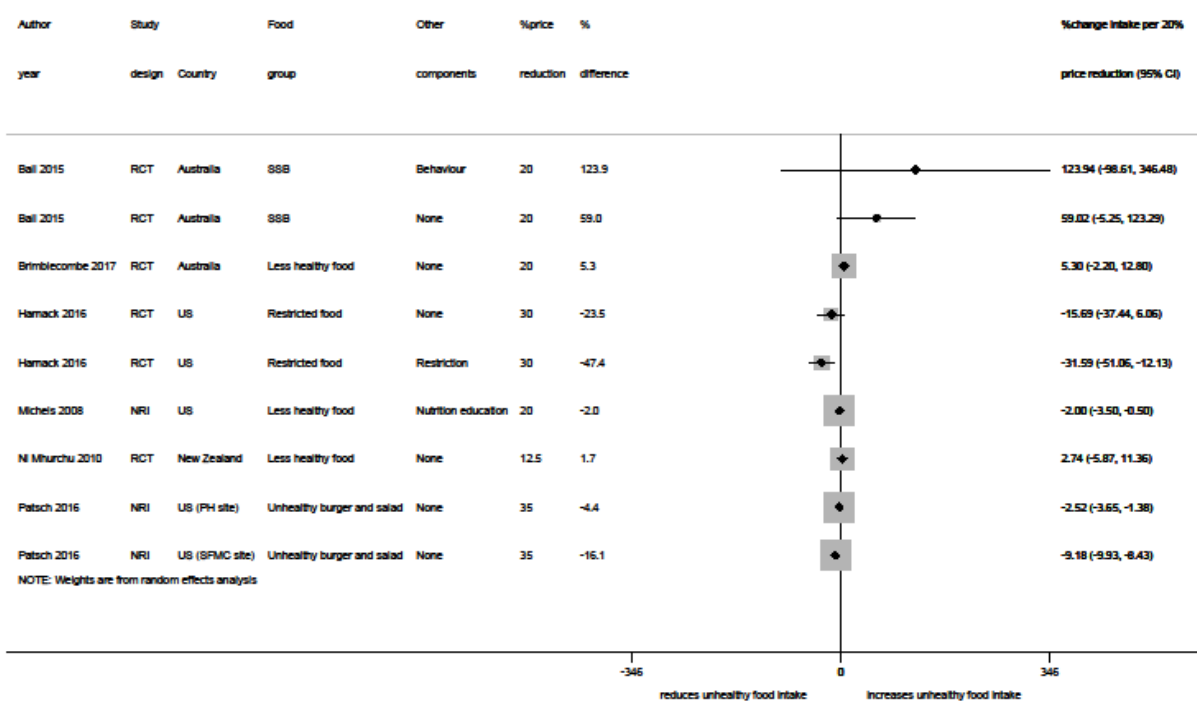
Appendix Figure S1 Price reduction and fruit and vegetable purchase or consumption (study results with separate arms within studies)

Note: a) *indicated subgroup of participants who redeemed the coupon; b) abbreviations: NRI – non-randomised intervention, RCT –randomised control trial



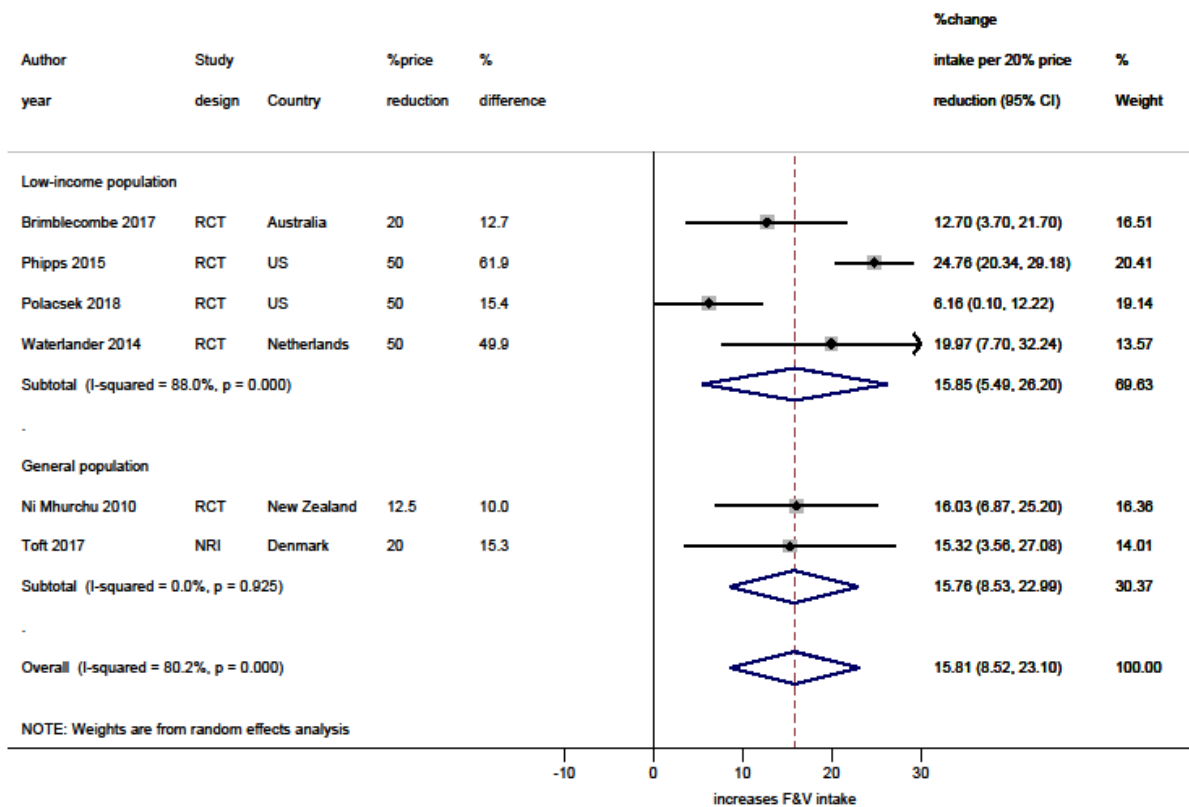
Appendix Figure S2 Price reduction and fruit and vegetable purchase or consumption among RCT studies

Note: abbreviations: NRI – non-randomised intervention, RCT –randomised control trial

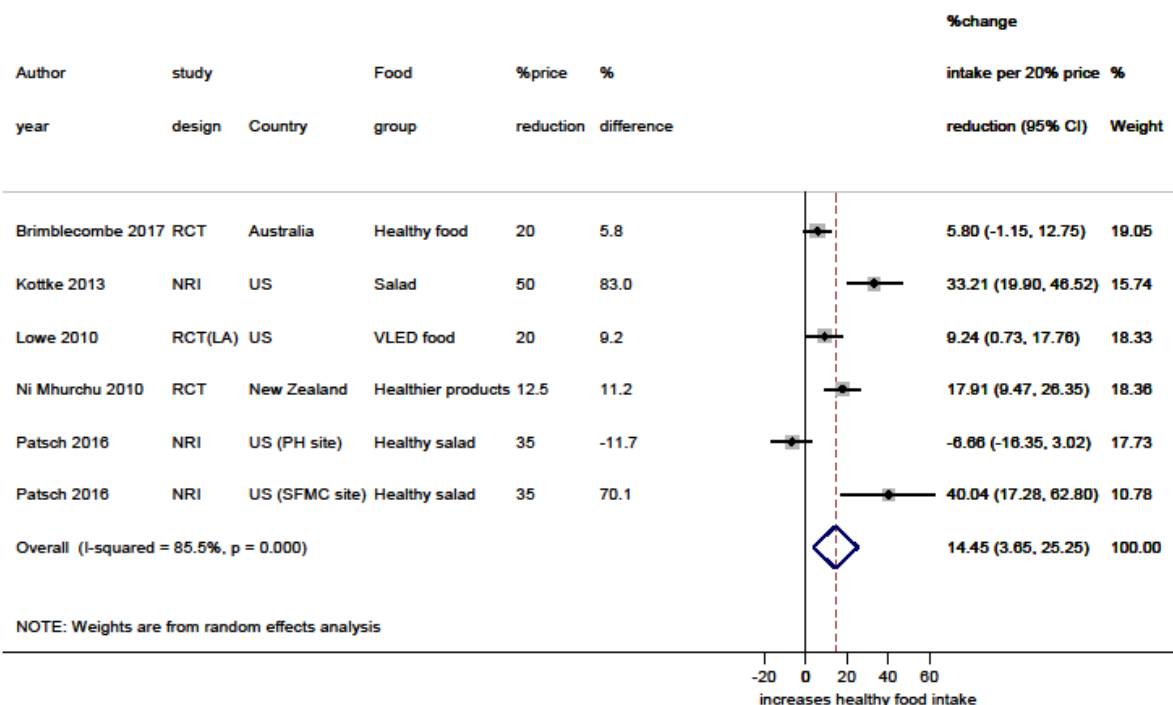


Appendix Figure S3 Price reduction and unhealthy food purchase or consumption (all arms/subgroups within studies)

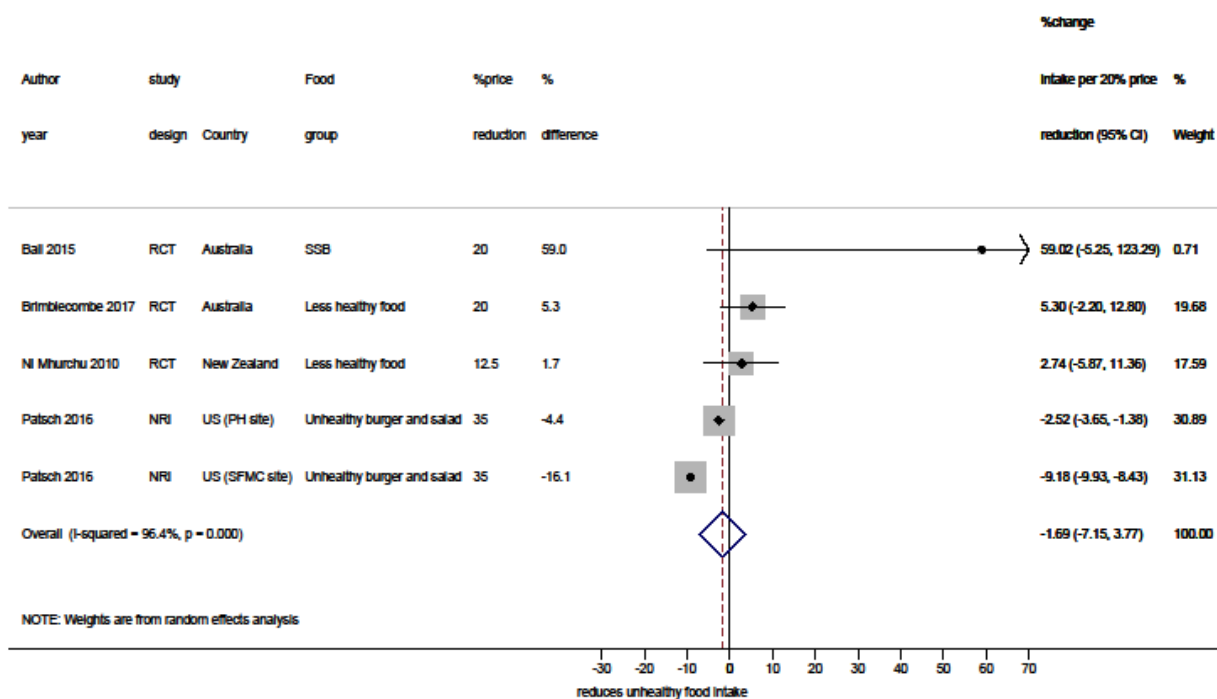
Note: a) Patsch 2016 reported results in two sites, one of them (PH [Penrose Hospital] site) had an existing healthy food promotion programme on top the current intervention, whilst the other (SFMC [St Francis Medical Centre]) did not have, hence we reported the study by sites separately; b) abbreviations: SSB –sugar sweetened beverages, NRI – non-randomised intervention, RCT –randomised control trial



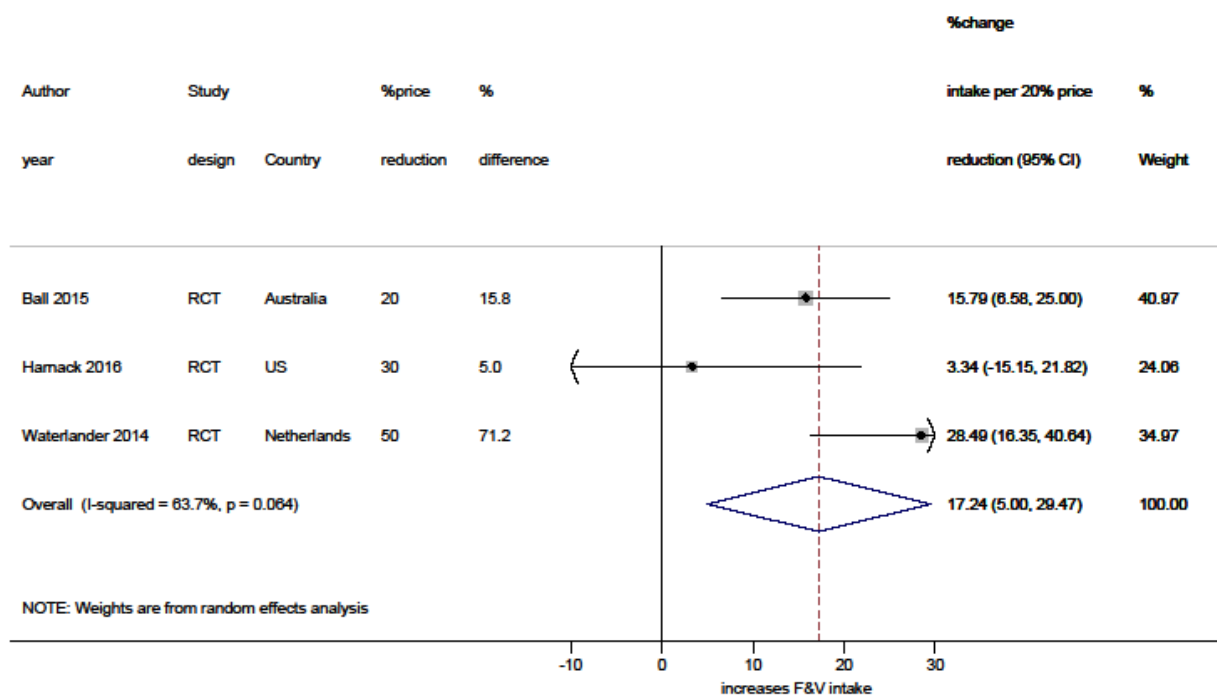
Appendix Figure S4 Sensitivity analysis of price reduction and fruit and vegetable purchase (excluding consumption data)



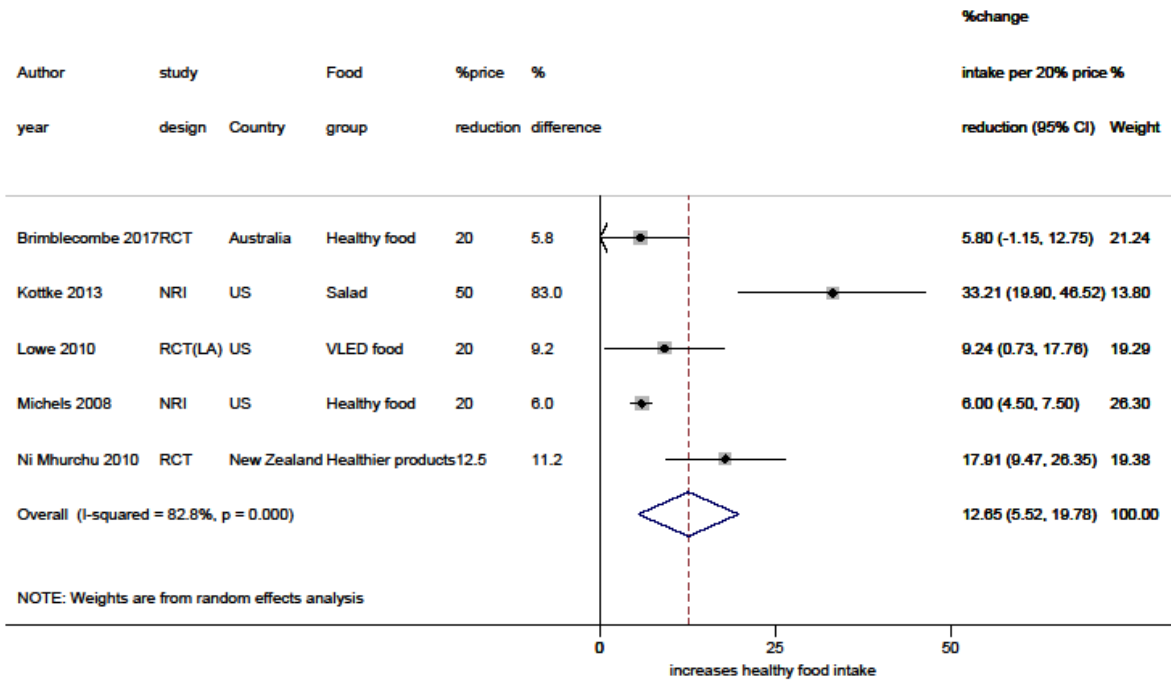
Appendix Figure S5 Sensitivity analysis of price reduction and healthy food purchase (excluding consumption data)



Appendix Figure S6 Sensitivity analysis of price change and unhealthy food purchase (excluding consumption data)

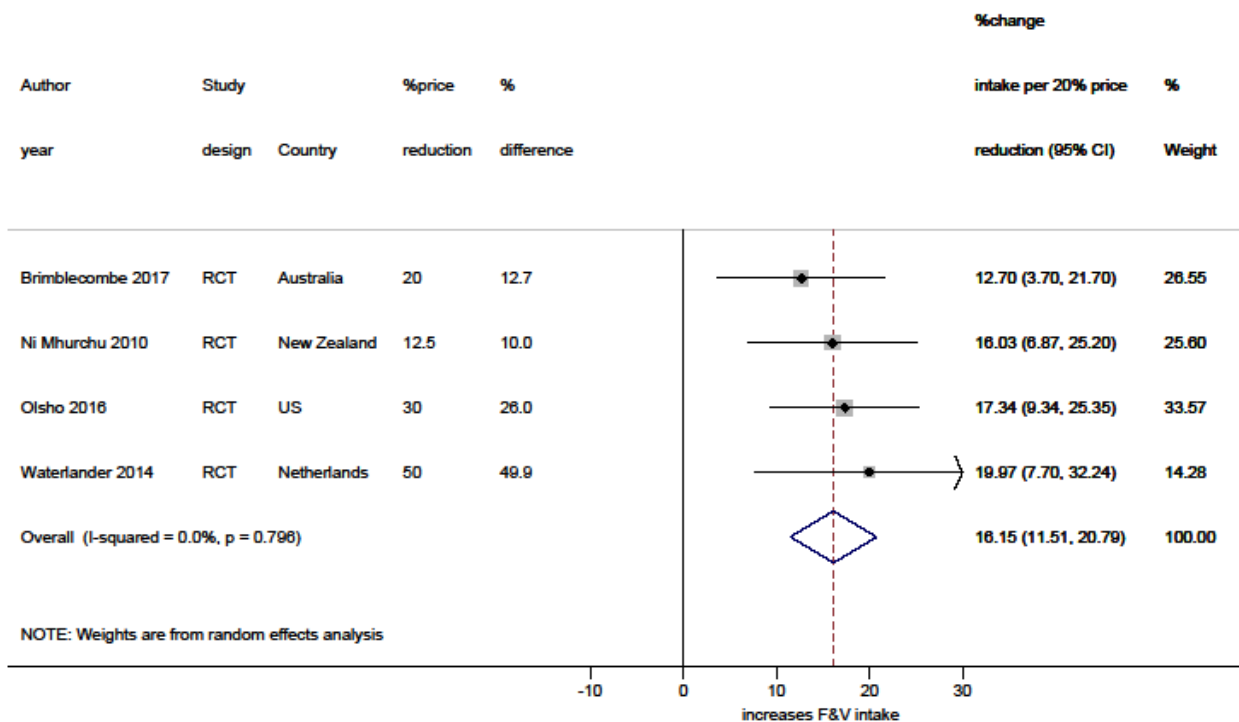


Appendix Figure S7 Price reduction and fruit and vegetable purchase or consumption among studies with combined intervention Note: a) intervention components for the included studies are: behaviour change for Ball 2015; restriction on unhealthy food for Harnack 2016; spatial intervention in supermarket for Toft 2017; nutrition education for Waterlander 2014. b) NRI – non-randomised intervention, RCT –randomised control trial

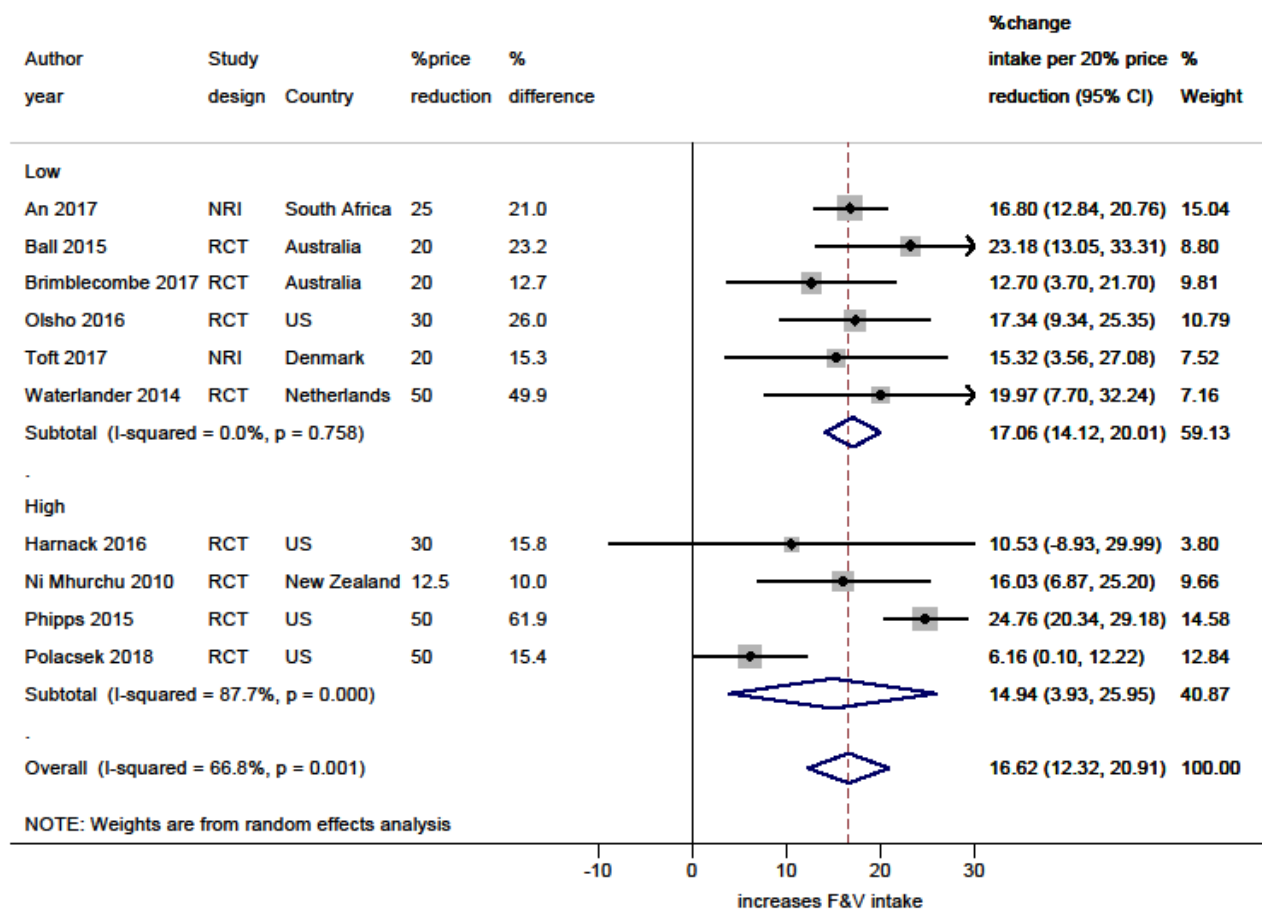


Appendix Figure S8 Price reduction and healthy food purchase or consumption (excluding Patsch 2014 study)

Note: abbreviations: NRI – non-randomised intervention, RCT – randomised control trial, VLED – very low energy density, LA – Longitudinal analysis



Appendix Figure S9 Price reduction and fruit and vegetable purchase or consumption among studies with intervention ≥ 6 months



Appendix Figure S10 Price reduction and fruit and vegetable purchase or consumption by level of intervention agency

Note: high agency meaning that intervention carried out with participants' personal resources, e.g. a physical voucher needs to be presented to get discount; low agency meaning that intervention was more or less automatically done without participants effort e.g. all staff members were qualified for discount deals

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