Re: Chiavaroli L, et al. Important food sources of fructose-containing sugars and adiposity: a systematic review and meta-analysis of controlled feeding trials

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Supplementary Table 1: Search strategy for controlled trials assessing the effect of important food sources of fructose-containing sugars on adiposity

Database and search terms		
MEDLINE	Embase	The Cochrane Library of Controlled Trials
1 exp fructose/	1 exp fructose/	1 exp fructose/
2 fructose.mp.	2 fructose.mp.	2 fructose* .mp
3 exp dietary sucrose/	3 exp sucrose/	3 Sucrose/
4 sucrose.mp.	4 sucrose.mp.	4 Dietary Sucrose/
5 sugar*.mp.	5 sugar*.mp.	5 sucrose* .mp
6 SSB.mp.	6 SSB.mp.	6 HFCS* .mp.
7 sweeten.mp.	7 sweeten.mp.	7 sugar* .mp
8 soft drink*.mp.	8 soft drink*.mp.	8 exp honey/
9 cola.mp.	9 cola.mp.	9 honey* .mp
10 exp Honey/	10 exp Honey/	10 high fructose corn syrup .mp
11 honey.mp.	11 honey.mp.	11 molasses .mp
12 fruit.mp.	12 fruit.mp.	12 SSB .mp
13 exp fruit/	13 exp fruit/	13 sugar sweetened beverage .mp
14 exp soft drink/	14 exp soft drink/	14 fruit .mp
15 exp carbonated beverage/	15 exp carbonated beverage/	15 Fruit/
16 carbonated beverage*.mp	16 carbonated beverage*.mp	16 sweeten*.mp
17 exp energy drink/	17 exp energy drink/	17 exp soft drink/
18 energy drink*.mp	18 energy drink*.mp	19 soft drink*.mp
19 HFCS.mp.	19 HFCS.mp.	20 exp carbonated beverages/
20 sugar* sweetened beverage*.mp	20 sugar* sweetened beverage*.mp	21 carbonated beverage*.mp
21 exp soft drink/	21 exp soft drink/	22 exp energy drinks/
22 or 1/21	22 or 1/21	23 energy drink*.mp
23 exp body weight/	23 exp body weight/	24 Or 1/23
24 body weight*.mp	24 body weight*.mp	25 exp body weight/
25 exp body mass index/	25 exp body mass index/	26 body weight* .mp
26 body mass index.mp.	26 body mass index.mp.	27 Body Mass Index/
27 BMI.mp.	27 BMI.mp.	28 body mass index .mp
28 exp waist circumference/	28 exp waist circumference	29 BMI .mp
29 waist circumference.mp	29 waist circumference.mp	30 exp Waist Circumference/
30 exp waist-hip ratio/	30 exp waist-hip ratio/	31 waist circumference .mp
31 waist-hip ratio.mp	31 waist-hip ratio.mp.	
	32 exp overweight/	
	33 overweight.mp	
	34 exp obesity/	
	35 exp obesity, abdominal/	

32	exp overweight/	36	exp obesity, morbid/	32	exp Waist-Hip ratio
33	overweight.mp	37	obesity.mp.	33	exp overweight/
34	exp obesity/	38	body fat.mp.	34	overweight .mp
35	exp obesity, abdominal/	39	exp adiposity/	35	waist-hip ratio .mp
36	exp obesity, morbid/	40	adiposity.mp	36	Obesity/
37	obesity.mp	41	Or 23/40	37	exp Obesity, Morbid
38	body fat.mp	42	22 and 41	38	exp Obesity, Abdominal/
39	exp adiposity/	43	exp cohort analysis/	39	obesity .mp
40	adiposity.mp	44	exp longitudinal study/	40	body fat .mp
41	Or 23/40	45	exp prospective study/	41	Or 25/40
42	22 and 41	46	exp follow up/	42	24 and 41
43	exp cohort studies/	47	cohort$.mp	43	limit 42 to medline records
44	cohort$.mp	48	exp case control study/	44	42 not 43
45	epidemiological methods/	49	(case$ and control$).mp	45	limit 44 to embase records
46	exp case-control studies/	50	case report/	46	44 not 45
47	(case$ and control$).mp	51	(case$ adj2 report$).mp		
48	(case$ and series).mp	52	(case$ adj2 stud$).mp		
49	case reports.pt	53	exp case study/		
50	(case$ adj2 report$).mp	54	(case$ and series).mp		
51	(case$ adj2 stud$).mp	55	Or 43/54		
52	Or 43/51	56	42 NOT 55		
53	42 NOT 52	57	clinical trial.mp		
54	clinical trial.mp	58	clinical trial.pt		
55	clinical trial.pt	59	random:.mp		
56	random:.mp	60	tu.xs.		
57	tu.xs.	61	Or 57/60		
58	Or 54/57	62	53 AND 58		
59	53 AND 58	63	limit 62 to animals		
60	limit 59 to animals	64	62 NOT 63		
61	59 NOT 60				

Supplementary Table 2: PICOTS framework of the search strategy

PICOTS framework defined in the present systematic review and meta-analysis					
Participants	**Interventions**	**Comparators**	**Outcomes**	**Time**	**Study design**
Adults ≥18-years of age and of all health backgrounds	Food sources of fructose-containing sugars	Diets and foods free or lower (minimum 5g sugar difference) in fructose-containing sugars	Body weight, BMI, body fat (%), waist circumference, waist-to-hip ratio and visceral adipose tissue, mean difference and 95% confidence intervals	≥14 days	Controlled trials done in humans

BMI, body mass index; PICOTS, participants, interventions, comparators, outcomes, time and study design

Supplementary Table 3: Food source definitions

Food source of fructose-containing sugars	Definition
SSB	Carbonated or non-carbonated beverages where all or the majority of sugars are added sugars. This also includes interventions where sugars were provided to participants as crystalline packages and where they are instructed to add or incorporate into beverages.
Sweetened dairy	Animal dairy products sweetened with added sugars and where the control includes non-dairy products. These would contain both added and naturally occurring sugars.
Sweetened dairy alternatives (soy)	Soy-based dairy products sweetened with added sugars and where the control includes non-soy-based dairy products.
Sweetened dairy alternative (other)	Other plant-based dairy products sweetened with added sugars and where the control includes non-plant-based dairy products.
Fruit drink	Fruit drinks which are derived from fruit juices or fruit flavouring with added sugars. These must contain added and may also contain naturally occurring sugars.
100% Fruit juice	Fruit juice which is derived 100% from fruits with no added sugar. The one exception was cranberry juice, in which a small amount of added sugars was added for palatability.
Fruit	Includes whole fruit, freeze-dried powdered fruit, smoothies in which the only difference between intervention groups is the fruit present. The dose of the sugars under investigation is naturally occurring coming from fruit.
Dried fruit	Includes unsweetened and sweetened dried fruit. Sugars can be naturally occurring, or both naturally occurring and added.
Mixed fruit forms	Interventions include two or more of the food sources of fruit sugars (i.e., fruit, dried fruit, 100% fruit juice). Sugars are naturally occurring coming from fruit.
Sweetened cereal grains and bars	Includes sweetened dried cereal, nut bars and fruit and nut bars. Sugars are added.

Sweets and desserts	Includes cookies, cakes, muffins, confectionaries, fondant, etc. Sugars are added.
Honey	Honey was provided to participants.
Added nutritive (caloric) sweetener	Sugars provided to participants as crystalline packages, where they are instructed to add or incorporate it to various foods. Sugars are added regulatory designations.
Mixed sources (with SSBs)	Interventions where fructose-containing sugars were consumed in the form of SSBs in addition to other food sources. Examples include whole dietary interventions. Sugars can be added, or both naturally occurring and added.
Mixed sources (without SSBs)	Interventions include two or more of the above food sources of fructose-containing sugars with the exception of SSBs. Sugars can be added, or both naturally occurring and added.

SSB, sugar-sweetened beverages

Supplementary Table 4: Trial characteristics

Table of Characteristics of Substitution Trials

Study, Year	Participants	Setting	Baseline			Design	Feeding Control[a]	Randomization	Fructose-Containing Sugar Dosage, g/d (% E)[b]	Sugar Source and Control Source	Intervention or Control	Diet[c]	Energy Balance[d]	Follow-Up	Funding Sources[e]
			Mean Age, years (SD or Range)	Mean Body Weight, kg (SD or range)	Mean BMI, kg/m^2 (SD)										
Substitution Studies															
SSBs															
Aeberli et al. 2011	29 NW (29 M, 0 F)	OP, Switzerland	26.3 (6.6)	73.7 (8.8)	22.4 (1.9)	C	Supp	Yes					Positive	3 wk	A, I
Intervention									80 (~13)	Fructose	Fructose SSB	~55:32:13			
Intervention									80 (~13)	Sucrose	Sucrose SSB	~55:32:13			
Intervention									40 (~7)	Fructose	Fructose SSB	~51:35:14			
Control										Glucose	Glucose SSB (40g)	~53:32:13			
Control										Glucose	Glucose SSB (80g)	~57:31:13			
Aeberli et al. 2013	9 NW (9 M, 0 F)	OP, Switzerland	22.8 (1.7)	NR	22.6 (1.4)	C	Supp	Yes	80 (~14)				Positive	3 wk	A, I
Intervention										Fructose	Fructose SSB	~56:31:13			
Intervention										Sucrose	sucrose SSB	~54:30:16			
Control										Glucose	Glucose SSB	54:31:14			
Engel et al. 2018	29 OW/OB (12 M, 17 F)	OP, Denmark				P	Supp	Yes					Positive	6 mo	A, I
Intervention	14 OW/OB (8 M, 6 F)		37.8 (8.0)	94.9 (11.6)	30.8 (2.8)				~106 (~21)	Sucrose	1 L/d sucrose-sweetened regular cola (50% glucose 50% fructose)	`54:31:13			
Control	15 OW/OB (4 M, 11 F)		37.7 (9.1)	94.0 (17.1)	31.4 (3.0)					Lactose	1 L/d semi-skimmed Milk	`47:33:18			
Geidl-Flueck et al. 2021	68 OW/OB (68 M, 0 F)	OP, Switzerland	22.7 (2.4)	71.5 (7.7)	21.8 (1.6)	P	Supp	Yes					Positive	7wk	A
Intervention	23 OW/OB (23 M, 0 F)			69.2 (7.7)	21.2 (2.3)				79.8 (16.2)	Fructose	200ml fructose SSB consumed 3 times/day with meals	55:30:15			
Intervention	23 OW/OB (23 M, 0 F)			75.5 (7.3)	22.9 (1.4)				79.8 (14.3)	Sucrose	200ml sucrose SSB consumed 3	52:33:16			

Control	22 OW/OB (22 M, 0 F)			71.6 (6.8)	22 (2.3)					Glucose	200 ml glucose SSB consumed 3 times/day with meals	56:31:15			
Johnston et al. 2013 (ISO)	32 OW (32 M, 0 F)	OP, UK	34 (9.9)	95.26 (5.7)		P	Met	Yes				55:30:15	Neutral	2 wk	A
Intervention	15 OW (15 M, 0 F)		35 (11)	96.8 (7.4)	30.0 (1.4)				~221 (25)	Fructose	Fructose dissolved in water				
Control	17 OW (17 M, 0 F)		33 (9)	93.9 (8.7)	28.9 (1.7)					Glucose	Glucose dissolved in water				
Johnston et al. 2013 (Hyper)	32 OW (32 M, 0 F)	OP, UK	34 (9.9)	95.26 (5.7)		P	Supp	Yes				55:30:15	Positive	2 wk	A
Intervention	15 OW (15 M, 0 F)		35 (11)	96.8 (7.4)	30.0 (1.4)				~221 (25)	Fructose	Fructose dissolved in water				
Control	17 OW (17 M, 0 F)		33 (9)	93.9 (8.7)	28.9 (1.7)					Glucose	Glucose dissolved in water				
Koivisto and Yki-Järvinen 1993	10 DM2 (4 M, 6 F)	IP, Finland	61 (10)	81.9 (15.4)	27.5 (4.1)	C	Met	Yes				50:30:20	Neutral	4 wk	A, I
Intervention				82.0 (15.8)					~55 (~10)	Fructose	Fructose dissolved in water				
Control				81.8 (15.8)						Starch	Placebo drink; all carbohydate ingested was complex carbohydrate				
Silbernagel et al. 2011	20 MW (12 M, 8 F)	OP, Germany	30.5 (8.9)	80.5 (4.2)	25.9 (2.3)	P	Supp	Yes				50:35:15	Positive	4 wk	A
Intervention	10 MW (7 M, 3 F)		32.8 (9.3)	80.3 (9.1)	25.5 (2.2)				150 (~22.1)	Fructose	Fructose dissolved in water				
Control	10 MW (5 M, 5 F)		28.2 (8.4)	80.7 (7.5)	26.2 (2.4)					Glucose	Glucose dissolved in water				
Sweetened Dairy															
Angelopoulos et al. 2016	267 MW (96 M, 171 F)	OP, USA	37.7 (12.1)	73.8 (12.4)	26.3 (3.3)	P	Supp	Yes					Neutral	10 wk	I
Intervention	65 MW		38.7 (12.2)	75.7 (14)	26.5 (3.33)				~50 (9)	Fructose	9% Fructose in milk	52:28:19			
Intervention	64 MW		39.8 (13.2)	73.5 (12.4)	26.8 (3.5)				~104 (18)	Sucrose	18% Sucrose in milk	57:25:17			
Intervention	61 MW		36.3 (10.7)	73.7 (11.9)	26.3 (3.2)				~108 (18)	HFCS	18% HFCS in milk	55:26:18			
Control	77 MW		36.1 (12.1)	72.3 (11.3)	25.7 (3.14)					Glucose	9% Glucose in milk	52:29:19			
Lowndes et al. 2015	156 MW (69 M, 87 F)	OP, USA				P	Supp	Yes					Neutral	10 wk	I
Intervention	30 MW (16 M, 14 F)		35.6 (10.4)	74.3 (13.1)	26 (3.8)				~49.5 (9)	Fructose	Fructose sweetened low fat milk	52:29:20			
Intervention	28 MW (11 M, 17 F)		36.5 (11.3)	73.3 (13.2)	26.5 (3.5)				~107.3 (18)	HFCS	HFCS sweetened low fat milk	55:28:18			

Intervention	33 MW (15 M, 18 F)		34.1 (11)	72.1 (14.1)	25.6 (3.5)				~ 112.1 (18)	Sucrose	Sucrose sweetened low fat milk	55:28:18			
Control	34 MW (17 M, 17 F)		37 (11.7)	76.2 (12.2)	26.5 (3.3)				~49.5 (9)	Glucose	Glucose sweetened Low Fat Milk	52:30:19			
Control	31 MW (10 M, 21 F)		35.3 (12.5)	72.3 (12.2)	25.6 (3.6)					Lactose	Unsweetened Low Fat Milk / Diet Alone	49:32:20			
Sweetened Dairy Alternative (Soy)															
Eslami et al. 2019	64 OW/OB (19 M, 45F)	OP, Iran	45.7 (10.1)			P	Supp	Yes				55:30:15	Negative	8 wk	A, I
Intervention	32 OW/OB (10 M, 22F)		46.3 (10.5)	83.8 (9.8)	30.9 (3.6)				5 (1)	Sucrose	240 mL/d sweetened soy beverage				
Control	32 OW/OB (9 M, 23F)		45.2 (9.9)	84.5 (14.0)	31.4 (3.7)					Mixed	One serving of grains/starches and fats/oils food groups				
100% Fruit Juice															
Ponce et al. 2019	72 MetS (23 M, 49 F)	OP, Brazil	48 (9)	95 (16)	34.6 (4.1)	P	Supp	Yes					Neutral	12 wk	A, I
Intervention	36 MetS (12 M, 24 F)		49 (9)	96 (16)	34.0 (4.2)				44 (~12.2)	Fruit	500mL/d 100% orange juice	49:27:24			
Control	36 MetS (11 M, 25 F)		46 (9)	95 (15)	35.1 (4.1)					Fat	Energy equivalent nuts	48:28:24			
Ribeiro et al. 2017	78 OB (24 M, 54 F)	OP, Brazil	36 (1.0)	97.5 (12)	33 (3.0)	P	Supp	Yes				~60:35:15	Negative	3 mo	A, I
Intervention	39 OB		37 (1.0)	97 (12)	33 (3.0)				44 (~8.8)	Fruit	500mL/d orange juice				
Control	39 OB		33 (1.0)	98 (12)	35 (4.0)					Mixed	Energy equivalent food item				
Fruit Drink															
Hieronimus et al. 2020		OP/IP, USA				P	Supp+Met	No				55:30:15	Positive	2w	A
Intervention	28 MW (15 M, 13 F)		27 (6)	78 (13)	25 (4)				(25)	fructose	25% E as fructose-sweetened Kool-Aid				
Intervention	28 MW (15 M, 13 F)		27 (7)	73 (15)	25 (4)				(25)	HFCS	25% E as HFCS-sweetened Kool-Aid				
Control	28 MW (15 M, 13 F)		26 (6)	76 (13)	26 (3)					glucose	25% E as gluctose-sweetened Kool-Aid				
MacDonald et al. 1965	5 MW (0 M, 5 F)	IP, UK	(21-25)	60.5-70.5	NR	C	Met	No				78:11:10	Neutral	25 d	I
Intervention									450 (72.1)	Sucrose	Sucrose slurry (with water and lemon juice)				

Control										Starch	Maize Starch slurry (with water and lemon juice)				
McAteer et al. 1987	10 DM2 (10 M, 0 F)	OP, Ireland	64.4 (54-71)	59.3 (5.4)	NR	C	Supp	No				42:38:20	Neutral	4 wk	I
Intervention									55 (14.7)	Fructose	Fructose dissolved in water with lemon or orange flavor				
Control										Starch	Starch containing foods				
Stanhope et al. 2009	32 OW/OB (16 M, 16 F)	IP/OP, USA				P	Met/Sup p	No				55:30:15	Positive	10 wk	A, I
Intervention	17 OW/ OB (9 M, 8 F)		53 (40-27)	86.7 (10.7)	29.3 (2.6)				(25)	Fructose	25% E as fructose-sweetened Kool-Aid				
Control	15 OW/OB (7 M, 8 F)		54 (40-27)	85.9 (10.5)	29.4 (3.2)					Glucose	25% E as glucose-sweetened Kool-Aid				
Swarbrick et al. 2008	7 OW/OB (0 M, 7 F)	IP, USA	(50-72)	75.7 (24.3)	29.1 (5.8)	C	Met	No				55:30:15	Neutral		A
Intervention									~125 (25)	Fructose	Fructose SSB (12 % solution flavored with unsweetened drink mix)			10 wk	
Control										Starch	Complex carbohydrate sources (bread, rice, pasta)			4 wk	
Fruit															
Agebratt et al. 2016	30 MW (18 M, 12 F)	OP, Sweden	23.5 (3.7)		22.3 (1.9)	P	DA	Yes				NR	Positive	8 wk	A
Intervention	15 MW (7 M, 8 F)			66.5 (8.7)	22.2 (1.6)				96 (~14.6)	Fruit	7 kcal/kg BW/d Fruit				
Control	15 MW (11 M, 4 F)			73.6 (9.0)	22.5 (2.3)					Fat	7 kcal/kg BW/d Walnuts				
Christensen et al. 2013	63 DM2 (31 M, 32F)	OP, Denmark	58 (12)	91.8 (16.9)	32 (5.5)	P	DA	Yes				NR	Negative	3 mo	NR
Intervention	32 DM2 (18 M, 14 F)		59 (12)	92.4 (17)	32 (5)				~23.1 (~4.6)[j]	Fruit	Incorporate ≥ 2 fruit/d into diet				
Control	31 DM2 (13 M, 18 F)		57 (12)	91.2 (17)	32(6)					Mixed	Incorporate ≤ 2 fruit/d into diet				
Conceição de Oliveira et al. 2003	35 OW/OB, HCL (0 M, 35 F)	OP, Brazil	44.0 (4.5)		NR	P	Supp	Yes				55:30:15	Negative	3 mo	A, I

Intervention	26 OW/OB, HCL (0 M, 26 F)		43.7 (4.8)	77.7 (10.8)					Apple, 22.8 (~5.6%); pear, 19.2 (~3.8%)	Fruit	300 g/d apple or 300g/d pear				
Control	9 OW/OB, HCL (0 M, 9 F)		45.0 (3.8)	78.9 (9.7)						Mixed	Oat Cookie				
Du et al. 2019	49 Osteoarthritis (14 M, 35 F)	OP, USA	55.6 (45-79)	NR	32.2 (6.2)	P	Supp	Yes				NR	Positive	4 mo	I
Intervention	27 Osteoarthritis (9 M, 18 F)								30 (6)[k]	Fruit	40g/d freeze dried blueberry powder dissolved in 10-12 oz water				
Control	22 Osteoarthritis (5 M, 17 F)									Starch	40 g/d maltodextrin powder dissolved in 10-12 oz water				
Hegde et al. 2013	123 DM2	OP, India	58.0 (9.2)	NR	24.9 (3.9)	P	DA	No				NR	Positive	3 mo	A
Intervention	60 DM2		58.5 (9.6)		24.4 (3.9)				~16.5 (~3.3)	Fruit	Incorporate 2 fruit/d into usual diet				
Control	63 DM2		57.5 (8.9)		25.3 (3.9)					Mixed	Usual diet				
Lehtonen et al. 2011	80 OW/OB (0 M, 80 F)	OP, Finland	44.2 (6.2)	81.6 (8.5)	29.6 (2.1)	C	Supp	Yes				NR	Neutral	33 - 35 d	A,I
Intervention									8.4 (1.7)[l]	Fruit	100 g/d billberry (frozen, whole)				
Control										Mixed	Usual diet				
Madero et al. 2011	131 OW/OB (29 M, 102 F)	OP, Mexico	38.3 (8.8)	80.9 (13.4)	32.4 (4.5)	P	DA	Yes				55:30:15	Negative	6 wk	A
Intervention	65 OW/OB (15 M, 50 F)		40.2 (8.1)	79.1 (13.4)	32.8 (4.5)				~50-70 (~13.6)	Fruit	Various fruits				
Control	66 OW/ OB (14 M, 52 F)		37.6 (9.3)	82.7 (13.3)	32.9 (4.5)					Starch	Low fructose diet substituted with cereal products				
Moazen et al. 2013	36 DM2 (13 M, 23 F)	OP, Iran	51.6 (11.1)			P	Supp	Yes				NR	Neutral	6 wk	A, I
Intervention	19 DM2		51.9 (8.3)	75.8 (9.3)	27.3 (3.3)				~24.45 (~5.6)	Fruit	Freeze dried strawberry beverage equivalent to 500 g fresh strawberries				

Control	17 DM2		51.2 (13.9)	73.0 (11.8)	28.7 (4.2)					Lactose	Sugar-free strawbery flavored beverage with lactose				
Navaei et al. 2019	40 MetS (10 M, 30 F)	OP, USA	59 (5)	NR	33.2 (4.9)	C	Supp	Yes					Neutral	3 mo	I
Intervention									~16 (3.2)[g]	Fruit	2 medium fresh pears (166 g/d)	48:37:16			
Control										Starch	50 g maltodextrin in 480 mL water	47:39:16			
Rodriguez et al. 2005	15 OB (0 M,15 F)	OP, Spain	32.6 (5.8)			P	DA	Yes				55:30:15	Negative	8 wk	A
Intervention	7 OB (0 M, 7 F)			91.6 (6.0)	34.2 (2.6)				~45.0 (13.8)	Fruit	High fruit diet				
Control	8 OB (0 M, 8 F)			91.1 (13.0)	35.6 (3.3)				~12.6 (4.0)	Starch	Low fruit diet (substitute other carbohydrates for fruit)				
Singh et al. 1997	101 HTN, HCL (88 M, 13 F)	OP, India	50.5 (8.5)			P	Supp	Yes					Neutral	6 mo	NR
Intervention	52 HTN, HCL (43 M, 9 F)		49.1 (7.5)	67.8 (9.6)	25.2 (3.1)				~36.8 (~7)	Fruit	412 g/d guava	63:23:14			
Control	49 HTN, HCL (45 M, 4 F)		52.0 (9.2)	69.2 (11.4)	25.6 (3.6)				~9 (~1.7)	Mixed	Refined carbohydrates, saturated fat, and cholesterol	57:29:14			
Dried Fruit															
Anderson et al. 2014	46 MetS (21M, 25F)	OP, USA	60.6 (NR)			P	Supp	Yes				NR	Neutral	3 mo	I
Intervention	31 MetS (12 M, 19 F)		60.3 (NR)	86.3 (12.2)	30.0 (2.8)				~60 (~12)	Dried fruit	84 g/d Raisins				
Control	15 MetS (9 M, 6 F)		61.1 (NR)	85.2 (12.4)	29.2 (2.3)					Mixed	Processed snacks				
Eid et al. 2015	21 NW (11 M, 11 F)	OP, UK	(18-55)	NR		C	Supp	Yes					Positive	3 wk	A
Intervention					23.28 (2.27)				33 (7)	Dried fruit	50g/d (7 pieces) Ajwa dates	48:35:16			
Control					23.3 (2.59)					Glucose	Maltodextrin (3.9g/d) and Dextrose (33.2g/d) powder	49:33:17			
Kaliora et al. 2016	44 NAFLD (NR)	OP, Greece				P	Supp	Yes				50:30:20	Negative	6 mo	A, I
Intervention	23 NAFLD (NR)		50.7 (10.9)[f]	85.7 (14.3)	29.5 (4.3)				24 (4.9)	Dried fruit	36g/d Corinthian currants				
Control	21 NAFLD (NR)		51.6 (9.4)[f]	82.0 (3.0)	28.2 (3.7)					Mixed	Snacks (low fat yogurt, mini				

											crackers, or bread with low fat cheese)				
Kanellos et al. 2014	48 DM2, OW/OB (25 M, 23 F)	OP, Greece				P	Supp	Yes				NR	Neutral	6 mo	A, I
Intervention	26 DM2, OW/OB (15 M, 11 F)		63.7 (6.3)	83.4 (13.8)	30.5 (4.4)				24 (4.9)	Dried fruit	36 g/d Corinthian raisins				
Control	22 DM2, OW/OB (10 M, 12 F)		63 (8.5)	81.2 (14.3)	30.4 (5.5)					Mixed	Snacks (low fat yogurt, mini crackers, or bread with low fat cheese)				
Kanellos et al. 2017	33 NW Smokers	OP, Greece				P	Supp	Yes					Neutral	4 wk	A, I
Intervention	20 NW Smokers		30.8 (7.5)[f]	77.5 (13.8)	24.4 (2.68)				60 (~12)[g]	Dried fruit	90 g/d Raisins	41:27:13			
Control	13 NW Smokers		29.8 (5.0)[f]	78.1 (14.1)	23.9 (3.24)					Mixed	Snacks (low fat yogurt, mini crackers, or bread with low fat cheese)	43:33:17			
Lehtonen et al. 2011	80 OW/OB (0 M, 80 F)	OP, Finland	44.2 (6.2)	81.6 (8.5)	29.6 (2.1)	C	Supp	Yes				NR	Neutral	33-35d	A, I
Intervention									10.3 (~2)[i]	Dried fruit	100 g/d Sea Buckthorn berry (air dried)				
Control										Mixed	Usual diet				
Puglisi et al. 2008 (P)	22 MW (11 M, 11 F)	OP, USA	56.3 (4.6)	78.6 (16.0)	27.7 (3.8)	P	Supp	Yes					Neutral	6 wk	I
Intervention	10 MW (5 M, 5 F)		57.8 (5.2)	78.4 (15.9)	27.5 (3.8)				86 (~17.2)[g]	Dried fruit	1 cup/d raisins w/ a polyphenol restricted diet and walking	56:29:15			
Control	12 MW (6 M, 6 F)		55.0 (3.8)	78.7 (16.8)	27.9 (3.9)					Mixed	Polyphenol restricted diet and walking	43:40:16			
Puglisi et al. 2008 (C)	12 MW (6 M, 6 F)	OP, USA	54.4 (3.5)	70.8 (12.2)	24.9 (2.3)	C	Supp	No					Neutral		I
Intervention									86 (~17.2)[g]	Dried fruit	1 cup/d raisins w/ a polyphenol restricted diet	`56:31:15		6 wk	
Control										Mixed	Polyphenol restricted diet			2 wk	
Mixed Fruit Forms															
Lehtonen et al. 2010	50 OW (0 M, 50 F)	OP, Finland	42.9 (35-52)	81.8	29.4	P	Supp	Yes					Neutral	20 wk	A, I
Intervention	28 OW (0 M, 28 F)			81.9	29.3 (2.2)				~14.7 (~3.3)[l]	Fruit	Medley of berry containing	~50:32:17			

Control	22 OW (0 M, 22 F)			81.7	29.5 (1.8)					Mixed	products (fresh, juice, powder, dried forms) Regular consumption of snacks	~46:35:19			
Sweets and Desserts															
Brynes et al. 2007	9 DM2, OW (5 M, 4 F)	OP, UK	56 (15.9)	NR	29.8 (8.4)	C	Supp	No					Neutral		A, I
Intervention									88 (15)	Sucrose	3 slices of cake/d with 50g sucrose total	47:39:14		3 wk	
Control										Starch	Usual diet	49:35:15		1 wk	
Claesson et al. 2009	25 MW (11 M, 14 F)	OP, Sweden	23.4 (2.7)	68.0 (6.7)	22.2 (1.7)	P	Supp	Yes					Positive	2 wk	A
Intervention	12 MW (5 M, 7 F)		23.2 (3.5)	67.3 (7.6)	22.2 (1.4)				278 (~36.6)	Sucrose	Candy, 20kcal/kg BW/d	66:22:11			
Control	13 MW (6 M, 7 F)		23.6 (1.8)	68.7 (6.1)	22.2 (2.0)					Fat	Peanuts, 20kcal/kg BW/d	32:48:18			
Dikariyanto et a. 2020	102 pre-CVD (31 M, 71F)[h]	OP, UK				P	Supp	Yes					Neutral	6w	A, I
Intervention	49 pre-CVD		56 (11)[f]		27 (5)[f]				15.1 (3.0)	sucrose	20%E from muffins	45:34:16			
Control	53 pre-CVD		56 (10)[f]		27 (4)[f]					fat	20%E from almonds	34:45:17			
Malerbi et al. 1996 - FRC	16 DM2 (7 M, 9 F)	OP, Brazil	54.2 (9.2)	65.7 (8.1)	25.6 (2.8)	C	Supp	No					Neutral	4 wk	I
Intervention									63.2 (20)	Fructose	85% of the fructose was consumed as pure fructose added to papaya cream sorbet supplemented; 15% fructose came from natural fructose in fruit/veg as advice	55:30:15			
Control										Starch	Starch-containing foods (e.g. bread, potatoes, beans, rice, etc.)	50:35:15			
Reiser et al. 1981 (M)	12 HI (12 M, 0 F)	IP/OP, USA	38.6			C	Met	Yes				~44:41:10	Neutral	6 wk	NR
Intervention									229 (33)	Sucrose	Sucrose Patty				
Intervention									124 (18)	Sucrose	Sucrose Patty				
Control										Starch	Starch Patty				

Reiser et al. 1981 (F)	12 HI (0 M, 12 F)	IP/OP, USA	35.1			C	Met	Yes				~44:41:10	Neutral	6 wk	NR
Intervention									229 (33)	Sucrose	Sucrose Patty				
Intervention									124 (18)	Sucrose	Sucrose Patty				
Control										Starch	Starch Patty				
Sweetened Cereal Grains and Bars															
Carroll et al. 2020	29 MW (7 M, 22 F)	OP, UK	33 (10)	NR	25.0 (5.2)	C	Supp	Yes					Neutral	3 wk	A
Intervention									32 (~5.4)	Sucrose	High-sugar (32g) porridge breakfast	48:32:16			
Control										Starch	Low-sugar (8g) porridge breakfast	46:34:17			
Jones et al. 2014	50 MW	OP, USA	26.2 (7.2)	69.0 (16.0)	23.6 (3.7)	P	Supp	Yes				NR	Neutral	3 mo	I
Intervention	25 MW								6 (~1.2)	Sucrose[o]	Honey roasted peanuts				
Control	25 MW									Fat	Unsalted peanuts				
Zaveri et al. 2009		OP, UK				P	Supp	No					Positive	12w	I
Intervention	13 OW (13 M, 0 F)		36 (7)	96 (10)	30 (4)				~19.2 (~3.9)	mixed type	cereal bar 60g/d	48:38:15			
Control	11 OW (11 M, 0 F)		40 (6)	95 (9)	30 (3)					fat	almonds 56g/d	39:40:15			
Added Nutritive (Caloric) Sweeteners															
Brynes et al. 2003	17 OW/OB (17 M, 0 F)	OP, UK	45 (8)	NR	29.3 (4.0)	C	Supp	Yes					Neutral	24 d	A, I
Intervention									90 (~22)	Sucrose	Table sugar added to the diet, supplemented sucrose	53:34:13			
Control										Fat	Olive oil, full-fat cheese, full-fat spread, supplemented olive oil	30:60:11			
Control										Mixed	High GI diet of high GI foods and gllucose, supplemented with instant potato				
Control										Starch	Low GI diet of low GI foods, supplemented wholegrain rye bread	52:35:13			
Cooper et al. 1988	17 DM2 (6 M, 11 F)	OP, Australia	62.2 (14.0)	69.1 (2.8)	26.0 (3.0)	C	Supp	Yes				NR	Positive	6 wk	I

Intervention									28 (5.6)	Sucrose	28 g sucrose was provided and participants added to hot beverages, fruit juice, milk, cereals, stewed fruit				
Control										Starch	30 g starch and saccharin were provided and participants added to hot beverages, fruit juice, milk, cereals, stewed fruit				
Grigoresco et al. 1988	8 DM2 (5 M, 3 F)	OP, France	40 (6.9)	74.3 (12.4)	26.1 (3.3)	C	Supp	Yes				50:30:20	Neutral	8 wk	A, I
Intervention									30 (8.6-7.5)	Fructose	30 g powdered fructose packs provided and participants instructed to add to food and beverages based on exchange lists to exchange for starch				
Control										Starch	Reduce refined sugars in exchange for starch				
Lock et al. 1980	8 MW (8 M, 0 F)	OP, UK	(31-62)	NR	NR	C	Supp	No					Neutral	12 mo	NR
Intervention									60 (~10.2)	Sucrose	Crystalline and powdered sucrose provided in sachets/jars	41:42:13			
Control										Glucose	Crystalline and powdered dried glucose syrup provided in sachets/jars	42:41:14			
Lock et al. 1980	5 MW (5 M, 0 F)	OP, UK	(31-62)	NR	NR	C	Supp	No					Neutral	12 mo	NR
Intervention									60 (~10.2)	Sucrose	Crystalline and powdered sucrose provided in sachets/jars	41:42:13			
Control										Glucose	Crystalline and powdered dried glucose syrup	42:41:14			

											provided in sachets/jars				
Lock et al. 1980	5 MW (5 M, 0 F)	OP, UK	(31-62)	NR	NR	C	Supp	No					Neutral	12 mo	NR
Intervention									60 (~10.2)	Sucrose	Crystalline and powdered sucrose provided in sachets/jars	41:42:13			
Control										Glucose	Crystalline and powdered dried glucose syrup provided in sachets/jars	42:41:14			
Malerbi et al. 1996 - SUC	16 DM2 (7 M, 9 F)	OP, Brazil	54.2 (9.2)	65.7 (8.1)	25.6 (2.8)	C	Supp	No					Neutral	4 wk	I
Intervention									77.8 (19)	Sucrose	Sucrose was added to fruit, milk, beverages and coffee	55:30:15			
Control										Starch	Starch-containing foods (e.g. bread, potatoes, beans, rice, etc.)	50:35:15			
Osei et al. 1987	18 DM2, OB (3 M, 15 F)	OP, USA	57 (8.6)	82.7 (13.5)	NR	P	Supp	Yes				50:35:15	Neutral	3 mo	A, I
Intervention	9 DM2, OB (2 M, 7 F)		57 (2.9)	82.8 (15.6)					60 (~10.05)	Fructose	Crystalline fructose added to non-alcoholic beverages and cereals				
Control	9 DM2, OB (1 M, 8 F)		57 (3.0)	82.5 (12.0)						Starch	ADA recommended diet - mostly complex carbohydrates as souce of carbohydrates				
Osei et al. 1989	13 DM2, OW/OB (5 M, 8 F)	OP, USA	54 (11)		29.6 (9.4)	C	Supp	Yes				50:35:15	Neutral	6 mo	A, I
Intervention				87.7 (27.4)					60 (10.05)	Fructose	Crystalline fructose added to non-alcoholic beverages and cereals				
Control				88.3 (20.9)						Starch	ADA recommended diet - mostly complex carbohydrates as				

											souce of carbohydrates				
Porta et al. 1989	16 DM2 (8 M, 8 F)	OP, Italy	60 (9.7)	NR		P	Supp	Yes					Neutral	6 mo	A
Intervention	8 DM2 (4 M, 4 F)		60 (8.5)		27.4 (3.1)				~16 (5.3)	Sucrose	10% of starch replaced by sucrose provided as individual packets instructed to be added to coffee, tea and fruit in 2 main meals and instruction to reduce intake of breads and pasta (individual prescription)	54:28:18			
Control	8 DM2 (4 M, 4 F)		60 (11.3)		28.2 (2.5)					Starch	Usual diabetic diet	55:28:18			
Simons et al. 2020	37 OW & fatty liver (12 M, 25 F)	OP, Netherland				P	Supp	Yes					Neutral	6 wk	A
Intervention	21 OW & fatty liver (6 M, 15 F)		51 (19)		32 (5)				~46.9 (9.4)	fructose	fructose packets instructed to mix in water or food 3x/d	~37:39:21			
Control	16 OW & fatty liver (6 M, 10 F)		50 (22)		33 (7)					glucose	glucose packets instructed to mix in water or food 3x/d	~39:38:19			
Vaisman et al. 2006	25 DM2	OP, Israel	62.3 (10.1)		NR	P	Supp	Yes				NR	Neutral	3 mo	NR
Intervention	12 DM2		65.4 (10.7)	82.9 (10.9)					22.5 (~5)	Fructose	7.5g sachets of fructose instructed to be consumed 3x/d after each main meal				
Control	13 DM2		59.5 (9.1)	83.4 (17.6)						Maltodextrin	7.5g sachets of maltodextrin instructed to be consumed 3x/d after each main meal				
Mixed sources (with SSBs)															
Anderson et al. 1989	14 DM2 (14 M, 0 W)	IP/OP, USA	60 (4.0)	112 % IBW (15)	NR	C	Met	No				55:20:25	Neutral		A, I
Intervention									115-125 (25)	Fructose, sucrose	Cookies, lemonade-			6 mo	

Control											Starch	flavored drink, crystalline fructose High carb, high fiber control diet			8 wk + 5 d	
Bantle et al. 1992	6 DM1+12 DM2 (7 M, 11 F)	IP/OP, USA	DM1: 23 (18-34) + DM2: 62 (40-72)		NR	C	Met	Yes					55:30:15	Neutral	4 wk	A, I
Intervention				80 (5)					~120 (20)	Fructose	Baked goods, beverages, breakfast cereals					
Control				81 (5)						Starch	Starch containing foods					
Bantle et al. 1993	12 DM2 (4 M, 8 F)	IP/OP, USA	62 (40-72)		NR	C	Met	Yes					55:30:15	Neutral	4 wk	A, I
Intervention				86.0 (22.5)					~114 (19)	Sucrose	Baked goods, beverages, breakfast cereals					
Control				86.9 (22.2)						Starch	Starch containing foods					
Bantle et al. 2000	24 MW (12 M, 12 F)	OP, USA	41.3 (13.5)		25.1 (2.4)	C	Met	Yes					55:30:15	Neutral	6 wk	A
Intervention				74.1 (7.3)					~85 (17)	Fructose	Baked goods, beverages, breakfast cereals					
Control				74.1 (6.9)					15 (3)	Glucose	Baked goods, beverages, breakfast cereals					
Black et al. 2006	13 MW (13 M, 0 F)	OP, UK	33 (11)	86.0 (12.3)	26.6 (3.2)	C	Met	Yes					55:33:12	Neutral	6 wk	A
Intervention									~199 (25)	Sucrose	High sucrose diet (25% E)					
Control										Starch	Low sucrose diet (10% E)					
Blayo et al. 1990	20 DM1/DM2	OP, France	46.9 (13.1)	NR		P	Supp	Yes					55:30:15	Neutral	1 yr	A, I
Intervention	6 DM1/DM2		51 (12)		23 (5.63)				20-30 (5.6)	Sucrose	20-30 g sugar/d in the form of drinks, desserts, meals					
Intervention	6 DM1/DM2		48 (17)		23.0 (2.1)				20-30 (5.6)	Fructose	20-30 g sugar/d in the form of drinks, desserts, meals					
Control	8 DM1/DM2		43.0 (11.0)		22.0 (1.6)					Starch	Isocaloric substitution of sugar with starch					
Brymora et al. 2012	28 CKD (17 M, 11 F)	OP, Poland	59 (15)	85.8 (11.5)	29.9 (4.2)	C	DA	No					55:30:15	Neutral		A
Interventions									~59 (10.2)	Fructose, sucrose	Usual diet				2 wk	

Interventions									~53 (9.1)	Fructose, sucrose	Resumed diet post low fructose diet			6 wk	
Control										Starch	Isocaloric low fructose diet through reduction of fruits and added sugars			6 wk	
Dominguez-Coello et al. 2020	239 OW/OB (87 M, 152 F)	OP, Spain	47.2 (8.6)			P	DA	Yes					Negative	6 mo	A
Intervention	118 OW/OB (45 M, 73 F)		48.0 (8.7)	93.1 (13.6)	34.2 (2.7)				~33 (9.8)	Fructose	Low-calorie diet, basal fructose intake	49:30:21			
Control	121 OW/OB (42 M, 79 F)		46.3 (8.4)	92.8 (12.7)	34.3 (2.8)					Mixed	Low-calorie diet, low-fructose diet	49:35:17			
Dunnigan et al. 1970	9 CND/CAD (6 M, 3 F)	IP, Scotland	51.8 (8.1)	63.1 (10.5)	NR	C	Met	No				45:40:15	Neutral	4 wk	NR
Intervention									169 (~34)	Sucrose	70% carbohydrate intake as sucrose				
Control										Starch	85% carbohydrate intake as wheat, potato or maize starch				
Emanuele et al. 1986	5 DM2, HLP (5 M, 0 F)	IP, USA	59 (6.7)		NR	C	Met	Yes					Neutral	4 wk	NR
Intervention				93 (24.6)					220 (~39)	Sucrose	220 g/d sucrose was given incorporated into beverages and cereals, gelatin desserts, artificially flavored beverages, jelly spreads	63:22:15			
Control				94 (22.4)						Mixed	Isocaloric low sucrose (≤ 3 g/d), low CHO diet	38:39:22			
Fry et al. 1972	19 MW (19 M, 0 F)	IP, Antartica	24.7 (20.8-40.8)	76.9 (8.4)	NR	C	Met	No				44:43:13	Neutral		NR
Intervention									97 (~13)	Sucrose	Sucrose-containing diet	43:42:12		18 wk	
Control										Glucose	Sucrose-free diet with glucose syrup and calcium cyclamate	43:42:12		14 wk	
Gatenby et al. 1997	32 MW (0 M, 32 F)	OP, UK		NR		P	DA	Yes					Neutral	10 wk	NR
Intervention	13 MW (0 M, 13 F)		34.5 (8.4)		24.2 (3.3)				55 (10)	Sucrose	Usual diet	50:35:15			

Intervention	17 MW (0 F, 17 M)		36.8 (7.6)		22.7 (3.1)				48 (9.7)	Sucrose	Reduced fat diet	48:37:13			
Control	19 MW (0 M, 19 F)		31.5 (5.8)		22.4 (2.9)					Starch	Reduced sugar diet	49:37:14			
Hendler et al. 1986	6 OB (0 M, 6 F)	OP, USA	(20-44)	111 (10)	NR	C	Met	No					Negative	15 d	A, I
Intervention									~190 (95)	Sucrose	High sucrose diet	96:04:00			
Control										Protein	High protein diet				
Hernandez-Rios et al. 2013	36 OW (21 M, 15 F)	OP, Mexico		NR		P	DA	Yes				NR	Neutral	4 wk	A
Intervention	21 OW (12 M, 9 F)		49.7 (7.9)		32.2 (3.6)				~70 (~9.3)	Fructose, sucrose	Low-sodium diet, basal fructose intake				
Control	15 OW (9 M, 6 F)		44.6 (8.9)		32.7 (3.7)					Mixed	Low Sodium Diet with <20g of fructose and 2.5g/d sodium intake				
Jalilvand et al. 2020	40 DM2 (16 M, 24 F)	OP, Iran				P	DA	Yes				55:30:15	Neutral	8 wk	A
Intervention	20 DM2 (8 M, 12 F)		53.03 (7.38)	63.31 (6)	24.18 (1.58)				25 (5.0)	Mixed	Conventional diabetic diet from ADA 2017 guideline				
Control	20 DM2 (8 M, 12 F)		53 (7.96)	63.60 (5.41)	24.56 (1.35)				8.7 (1.8)	Mixed	Low fructose diet; Restrict sucrose-sweetened and artificially sweetened drinks and foods				
Kuo et al. 1965 - HTG	5 HTG (4 M, 1 F)	IP, USA	42-58	NR	NR	C	Met	No				55:30:15	Neutral	5 wk	A
Intervention									200-240 (~43)	Sucrose	High sugar diet				
Control										Starch	High starch diet				
Lewis et al. 2013	13 OW/OB (9 M, 4 F)	OP, UK	46.1 (6.9)	92 (10.5)	31.7 (3.2)	C	Met	Yes					Neutral	6 wk	I
Intervention									~101.8 (15)	Sucrose	High sucrose diet (15% E)	~55:33:12			
Control										Starch	Low sucrose diet (5% E)	~55:33:12			
Luukkonen et al. 2018	38 OW/OB (17 M, 21 F)	OP, Finland		92.1 (17)		P	Supp	Yes					Positive	3 wk	A
Intervention	12 OW/OB (6 M, 6 F)		45 (10)		33 (6)				250 (~33)	Mixed	2.8 dL orange juice, 4.3 dL SSBs, and 200 g candy	64:24:12			
Control	12 OW/OB (5 M, 7 F)		52 (10)		31 (6)					Fat	36 g olive oil, 26 g pesto, 54 g pecan	60:23:13			

Control	14 OW/OB (6 M, 8 F)		48 (8)		30 (6)					Fat	nuts, and 20 g butter 30 g coconut oil, 40 g butter, 100 g of 40% fat containing blue cheese	26:59:15			
Madero et al. 2015	72 OW/OB (44 M, 28 F)	OP, Mexico			NR	P	DA	Yes				NR	Neutral	4 wk	NR
Intervention	38 OW/OB (22 M, 16 F)		48 (7)	86 (16)					164 (23)	Fruit, Sucrose	Low-sodium meal plan, includes added sugars and fruits				
Control	34 H OW/OB (22 M, 12 F)		44 (9)	90 (16)						Starch	Low sodium and low fructose meal plan - fruit and added sugar replaced by carbohydrates				
Maki et al. 2015	34 pre-DM2, OW/OB (17 M, 17 F)	OP, USA	53.8 (12.2)	93.79	32.2 (4.7)	C	Supp	Yes					Neutral	6 wk	A, I
Intervention									~92 (~17)	Sucrose	SSB and non-dairy pudding	57:29:15			
Control										Lactose	2% milk and sugar-free low fat yogurt	47:33:19			
Mann et al. 1972 (BJN)	9 MW (9 M,0 F)	OP, South Africa	(30-40)	NR	NR	C	Met	No				NR	Neutral	2 wk	NR
Intervention									~140 (24.4)	Sucrose	Usual diet (12-21% Sucrose)				
Control										Starch	Sucrose of the diet was replaced with potato and rice				
Mann et al. 1972 (SAMJ)	34 MW (34 M, 0 F)	OP, South Africa	(36-55)		NR	P	DA	Yes				43-47:35-36:15-17	Neutral	22 wk	I
Intervention	16 MW (17 M, 0F)			73.7					85.3 (15)	Sucrose	Sugars, desserts, cakes, sweets and chocolates, drinks, high sugar fruit				
Control	17 MW (17 M, 0F)			78.4						Mixed	Bread, Potato, cereal, milk, meat, fish, eggs, biscuits, low sugar fruit, yoghurt, nuts, NNS/NSBs				
Mann et al. 1973	9 MW (9 M, 0 F)	IP, South Africa	(28-39)	NR	NR	C	Met	No				54:30:16	Neutral	2 wk	I

Intervention									160 (34)	Sucrose	High sucrose and saturated fat diet				
Control									80 (17)	Starch	High starch and saturated fat diet				
Mann et al. 1974	7 HTG (7 M, 0 F)	OP, South Africa	(30-44)	NR	NR	C	DA	No				NR	Neutral	2 wk	NR
Intervention									(12-21)	Sucrose	Usual diet				
Control										Starch	Replace sucrose in the diet with starch				
Nilholm et al. 2021	105 IBS (23 M, 82 F)	OP, Sweden	44.88		NR	P	DA	Yes					Neutral	4 wk	A
Intervention	25 IBS (3 M, 22 F)		35 (29-50)	68 (57-75)					20 (6.3)	Sucrose	Regular diet	42:38:17			
Control	80 IBS (20 M, 60 F)		48 (37-57)	72 (64-85)						Mixed	Starch and sucrose reduced, increased protein, fat and dairy	25:47:21			
Paineau et al. 2008	595 (103 M, 492 F)	OP, France				P	DA	Yes				NR	Neutral	8 mo	A, I
Intervention	297 (55 M, 242 F)		40.4 (5.3)	66.8 (13.5)	24.2 (4.5)				17.8 (4.4)	Mixed type	Reduced fat, increased complex carbohydrates				
Control	298 (48 M, 250 F)		40.3 (5.4)	67.3 (16.0)	24.6 (5.7)					Starch	Reduced fat, reduced extrinsic sugars, increased complex carbohydrates				
Parry et al. 2020	16 OW (16 M, 0 F)	OP, UK	47.9 (4.4)		27.7 (1.6)	C	Supp	Yes					Neutral	4 wk	A
Intervention				89.8 (10)					~100 (~20)	Mixed type	20%E from free sugars provided as candy and SSB	65:20:15			
Control				89.3 (10.4)						Fat	20%E from saturated fat	40:45:15			
Smith et al. 1996	32 HTG	OP, New Zealand			NR	P	DA	Yes					Neutral	6 mo	A
Intervention	22 HTG		50 (11)	84.3 (14.8)					66 (11.8)	Sucrose	Usual diet	48:38:14			
Control	10 HTG		53 (9)	87.9 (13.2)					18 (3.6)	Starch	Sucrose replaced with high starch foods	45:40:15			
Souto et al. 2013	33 DM1 (21 M, 12 F)	OP, Brazil	21.7 (5)	NR		P	DA	No					Neutral	3 mo	NR
Intervention	15 DM1 (8 M, 7 F)				24.0 (2.6)				~162 (27)	Sucrose	encouraged to select Sucrose containing foods from an exchange list	58:26:20			

Control	18 DM1 (12 M, 6 F)				22.4 (2.7)					Starch	Isocaloric exchange of sucrose for sucrose-free foods based on an exchange list	53:24:20			
Surwit et al. 1997	42 OB (0 M, 42 F)	OP, USA	40.2 (7.6)			P	Met	Yes					Negative	6 wk	A, I
Intervention	20 OB (0 M, 20 F)		40.6 (8.2)	96.1 (13.7)	35.9 (4.8)				121.2 (43)	Sucrose	High-sucrose, low fat diet	73:11:19			
Control	22 OB (0 M, 22 F)		40.3 (7.3)	96.7 (12.6)	34.9 (4.4)					Starch	Low-sucrose, low fat diet	71:11:20			
Swanson et al. 1992	14 MW (7 M, 7 F)	IP/ OP, USA	34 (19-60)		NR	C	Met	Yes				55:30:15	Neutral	4 wk	A, I
Intervention				68.6 (3.1)					100 (20)	Fructose	83% of fructose was consumed as crystalline fructose which was provided within baked goods, beverages, and breakfast cereals while 17% was consumed as fruits and vegetables and in brand-name products used in the study				
Control				68.5 (3.0)						Starch	Starch was consumed as naturally found in the foods provided including breads and potatoes (52%), and wheat, oat and corn flour				
Szanto et al. 1969	19 MW (19 M, 0 F)	OP, UK	28 (21-44)	73.1 (58.5-81.5)	NR	C	DA	No				NR	Neutral	2 wk	A
Intervention									438 (~52)	Sucrose	High sucrose diet				
Control										Starch	High starch diet				
Umpleby et al. 2017 (NAFLD)	11 NAFLD (11 M, 0 F)	OP, UK	59 (40-65)	90.0 (2.2)	28.9 (1.0)	C	Supp	Yes					Neutral	3 mo	A
Intervention									~160 (26)	Sucrose	High sugar diet with intake above 2.5th percentile of non-milk extrinsic sugars intake in the UK population	50:28:15			

Control										Starch	Low sugar diet with intake below 2.5th percentile of non-milk extrinsic sugars intake in the UK population	42:33:17			
Umpleby et al. 2017 (Ctrl)	14 OW/OB (14 M, 0 F)	OP, UK	54 (40-65)	89.7 (2.4)	28.4 (1.9)	C	Supp	Yes					Neutral	3 mo	A
Intervention									~160 (26)	Sucrose	High sugar diet with intake above 2.5th percentile of non-milk extrinsic sugars intake in the UK population	54:26:15			
Control										Starch	Low sugar diet with intake below 2.5th percentile of non-milk extrinsic sugars intake in the UK population	44:34:16			
Volp et al. 2007 (G1)	10 NW (0 M, 10 F)	OP, Brazil	22.5 (2.1)			P	DA	Yes					Neutral	14d	A
Intervention	5 NW (0 M, 5 F)			54.9 (48.8-64.5)[p]	21.7 (20.2-25.0)[p]				110 (~22)	sucrose	High sucrose diet	59:28:13			
Control	5 NW (0 M, 5 F)			55.8 (48.0-65.6)[p]	21.3 (19.4-24.8)[p]						high fat diet	42:45:13			
Volp et al. 2007 (G2)	10 OW (0 M, 10 F)	OP, Brazil	21.8 (2.8)			P	DA	Yes					Neutral	14d	A
Intervention	5 OW (0 M, 5 F)			73.9	29.1				130 (~23)	sucrose	High sucrose diet	59:28:13			
Control	5 OW (0 M, 5 F)			72	28.7						high fat diet	42:45:13			
West et al. 2001	68 OW/OB	OP, UK				P	DA	Yes					Negative	8 wk	I
Intervention	33 OW/OB		37 (8.5)	84.5 (13.2)	30.1 (4)				44 (10)	Sucrose	Diet with 10% energy from sucrose	46:33:21			
Control	35 OW/OB		42 (10.4)	81.5 (13.1)	29.2 (2.3)					Starch	Diet with reduced sucrose	43:37:20			
White et al. 2010	126 OW/OB	OP, UK	37 (14.6)			P	DA	Yes					Negative	3 mo	NR
Intervention	43 OW/OB			82.3 (15.1)	31 (4.6)				~39 (7.8)	Sucrose	Reduced energy and fat; maintain 10%E as sucrose	49:29:17			
Control	44 OW/OB			83 (13.9)	31 (4.6)				~29 (5.8)	Starch	Reduced energy, fat and sucrose	49:26:19			
Yudkin et al. 1972	11 (11 M, 0 F)	OP, UK	29 (21-44)	NR	NR	C	DA	No					Neutral		I
Intervention									441 (~53)	Sucrose	Usual diet	~59:30:10		2 wk	

Control									148 (~18)	Starch	Substitute sugar for starch from usual diet	~58:30:10		1 wk	
Mixed sources (without SSBs)															
Goss et al. 2020	34 OB (12M, 22F)	OP, USA				P	Supp	Yes					Neutral	8 wk	A
Intervention	15 OB (5M, 10F)		70.1 (2.5)	96.8 (30.9)	34.7 (3.8)				78 (20.3)	Mixed	low-fat diet, avoid whole eggs, breakfast bars	55:20:25			
Control	19 OB (7M, 12F)		70.3 (3.7)	93.7 (15.1)	34.0 (3.4)					Fat	Eggs, high-fat diet	10:65:25			
Gostner et al. 2005	19 MW (7 M,12 F)	OP, Germany	(21-53)	NR	NR	C	Met	Yes				46:39:14	Neutral	4 wk	A
Intervention									30 (5.3)	Sucrose	30g/d Sucrose mixed in marmalade, junket, yoghurt, biscuits, chocolate, puddings and candies				
Control										Mixed	30g/d Isomalt mixed in marmalade, junket, yoghurt, biscuits, chocolate, puddings and candies				
Maki et al. 2020	30 MetS (11 M, 19 F)	OP, USA	54.1 (10.4)	89.6 (13.1)	31.9 (3.8)	C	Supp	Yes					Neutral	4 wk	I
Intervention									25 (4.7)	Mixed	Breakfasts included ready-to-eat cereals with milk, waffles with syrup, granola bar, fresh and dried fruits	~60:31:12			
Control										Protein	Rotation of 3 egg-based breakfasts each providing 2 eggs/d, 6 d/wk	~41:32:26			
Palacios et al. 2020	33 pre-DM (17 M, 16 F)	OP, USA	48 (13)	89 (17)	31 (4)	C	Supp	Yes					Neutral	6w	I
Intervention									~36(6.4)	mixed	carbohydrate snacks (dried mango, jello pudding, cookie wafers, fruit & grain bar, rice cakes)	53:32:16			

Control										fat	3oz almonds	37:47:19			
Peterson et al. 1986 (DM1)	12 DM1 (10 M, 2 F)	OP, UK	52 (11)	NR	24.9 (21.2-27.9)	C	DA	Yes				50:30:20	Neutral	6 wk	NR
Intervention									45 (~9.4)	Sucrose	45g carbohydrate replaced by sucrose in food (e.g. marmalade, toffee, sugar) based on an exchange list provided				
Control										Starch	British Diabetic Association recommended diet				
Peterson et al. 1986 (DM2)	11 DM2 (7 M, 4 F)	OP, UK	56 (9)	NR	24.7 (20.1-28.0)	C	DA	Yes				50:30:20	Neutral	6 wk	NR
Intervention									45 (~9.4)	Sucrose	45g carbohydrate replaced by sucrose in food (e.g. marmalade, toffee, sugar) based on an exchange list provided				
Control										Starch	British Diabetic Association recommended diet				
Santacroce et al. 1990	12 DM1 (6 M, 6 F)	OP, Italy	27 (16-46)	NR	22.3 (19.8-25)	C	DA	Yes				52:31:17	Neutral	8 wk	NR
Intervention									30 (~5.9)	Sucrose	Sucrose as a sweetener added to foods and sucrose-containing foods as part of mixed meals; provided an exchange list of sucrose-containing foods including eggnog, chocolate cake, apple tart, ring-shaped cake				
Control										Starch	High glycemic index bread (white bread)				

Van Meijl et al. 2011	35 OW/OB (10 M, 25 F)	OP, Netherland	49.5 (13.2)	NR	32.0 (3.8)	C	Supp	Yes						Neutral	8 wk	I
Intervention									70.2 (~12.8)	Sucrose	Fruit Juice (600 mL), fruit biscuits (43 g)	53:30:16				
Control										Lactose	Low fat milk (500 mL), low fat yogurt (150 g)	46:33:19				

A= agency; ADA= American Diabetes Association; BJN=British Journal of Nutrition; BW=body weight; C= crossover; CAD= coronary artery disease; cal=calories; CHO=carbohydrate; CKD= chronic kidney disease; CND= chronic neurological disease; ctrl=control; CVD= cardiovascular disease; d=days; DM1= Diabetes Mellitus Type 1; DA= dietary advice; DM2=Diabetes Mellitus Type 2; E=energy; F= female; FRC=fructose; G1=group 1; G2=group2; HC= high carbohydrate; HCL= hypercholesterolemic; HD=high dose; HFCS= high fructose corn syrup; HI=hyperinsulinemic; HLP= hyperlipidemia; HTG = hypertriglyceridemia; HTN=hypertension; hyper=hypercaloric; I= industry; IBS=irritable bowel syndrome; IBW= ideal body weight; IGT= impaired glucose tolerance; IP=inpatient; ISO=isocaloric; kg=kilograms; LC= low carbohydrate; M= male; mo=months; MD=moderate dose; Met=metabolic; MetS=metabolic syndrome criteria; MRW= mean relative weight; MW=mixed weight; NAFLD=non-alcoholic fatty liver disease; NGT=normal glucose tolerance; NNS= non-nutritive sweetener; NSB= non-nutritive sweetened beverage NR= not reported; NW=normal weight; OB= obese; OP=outpatient; OW= overweight; P=parallel; SAMJ= South African Medical Journal; SCHO=simple carbohydrates; SD=standard deviation; SG= study group; SSB=sugars-sweetened beverage; SUC=sucrose; Supp=supplemented; TEI= total energy intake; USA=United States of America; UK=united kingdom; wk=weeks; yr= year

[a] Metabolic feeding control included provision of all study foods, supplement feeding control included provision of study supplements only, and dietary advice included dietary counseling without the provision of any dietary foods or supplements.

[b] Doses preceded by "~" represent approximate amounts calculated on the basis of average body weight or energy intake reported by participants. In the absence of this data, an average of 70 kg body weight or 2000 kcal/d was assumed.

[c] Total energy intake in the form of carbohydrate:fat:protein

[d] Positive energy balance included interventions designed to consume excess calories on top of a baseline diet. Negative energy balance included interventions designed to create a caloric deficit compared to the baseline diet. Neutral energy balance included interventions designed to continue habitual caloric intake.

[e] Agency funding included government, not-for profit health agencies or University sources.

[f] Data based on baseline participants, including drop-outs

[g] Fructose-containing sugar dose estimated based on data from the Canadian Nutrient File

[h] Number of male and female participants calculated from ratio of baseline male and female participants

[i] Fructose-containing sugar dose estimated based on data from the Nutritionix Database (UK region)

[j] Represents average of entire study cohort, including other study arms from comparison of interest

[k] Fructose-containing sugar dose estimated based on data from United States Department of Agriculture (USDA) nutrient database

[l] Fructose-containing sugar dose estimated based on data from the Finland National Food Composition Database

[n] Fructose-containing sugar dose estimated based on Mandasoy products (plain soymilk)

[o] Although honey roasted peanuts were provided as the intervention, sucrose was the main sugar used to sweeten the study products

[p] Values reported as medians and inter-quartile ranges (IQR)

[q] Fructose-containing sugar dose estimated from total used in study products

[r] Half of the participants were assigned to groups according to personal preference, while the other half of the participants were randomly allocated

[s] Fructose-containing sugar dose estimated from simple carbohydrate intake

Table of Characteristics of Addition Trials

Study, Year	Participants	Setting	Baseline: Mean Age, years (SD or Range)	Baseline: Mean Body Weight, kg (SD or range)	Baseline: Mean BMI, kg/m^2 (SD)	Design	Feeding Control[a]	Randomization	Fructose-Containing Sugar Dosage, g/d (% E)[b]	Sugar Source and Control Source	Intervention or Control	Diet[c]	Energy Balance[d]	Follow-Up	Funding Sources[e]
Addition Trials (Hypercaloric comparison)															
SSBs															
Aeberli et al. 2011 (HD)	29 NW (29 M, 0 F)	OP, Switzerland	26.3 (6.6)	73.7 (8.8)	22.4 (1.9)	C	Supp	Yes	80 (~13)				Positive	3 wk	A, I
Intervention										Fructose	Fructose SSB	~55:32:13			
Intervention										Sucrose	Sucrose SSB	~55:32:13			
Control										Mixed	Reduce free fructose intake	~46:38:16			
Aeberli et al. 2011 (MD)	29 NW (29 M, 0 F)	OP, Switzerland	26.3 (6.6)	73.7 (8.8)	22.4 (1.9)	C	Supp	Yes	40 (~7)				Positive	3 wk	A, I
Intervention										Fructose	Fructose SSB	~51:35:14			
Control										Mixed	Reduce free fructose intake	~46:38:16			
Busing et al. 2019-SSB	26 MW (13 M, 13 F)	OP, Germany	25 (3)	70 (14)	23 (3)	C	Supp	No				NR	Positive		A
Intervention	26 MW								(20)	HFCS	caffeine-free cola			2wk	
Control	26 MW									diet alone	no beverage			1wk	
Engel et al. 2018	45 OW/OB (16 M, 29 F)	OP, Denmark				P	Supp	Yes					Positive	6 mo	A, I
Intervention	14 OW/OB (8 M, 6 F)		37.8 (8)	94.9 (11.6)	30.8 (2.8)				~106 (~21)	Sucrose	1 L/d sucrose-sweetened regular cola (50% glucose 50% fructose)	54:31:13			
Control	16 OW/OB (5 M, 11 F)		39 (7.3)	98.4 (21.9)	31.5 (4.5)					Water	Water	`44:39:16			
Control	15 OW/OB (3 M, 12 F)		39 (7.6)	94.5 (12.6)	33.4 (4.1)					NNS	1 L/d aspartame-sweetened NSB	46:34:15			
Geidl-Flueck et al. 2021	70 OW/OB (70 M, 0 F)	OP, Switzerland	22.7 (2.4)	71.5 (7.7)	21.8 (1.6)	P	Supp	Yes					Positive	7wk	A
Intervention	23 OW/OB (23 M, 0 F)			69.2 (7.7)	21.2 (2.3)				79.8 (16.2)	Fructose	200ml fructose SSB consumed 3 times/day with meals	55:30:15			

Intervention	23 OW/OB (23 M, 0 F)			75.5 (7.3)	22.9 (1.4)				79.8 (14.3)	Sucrose	200ml sucrose SSB consumed 3 times/day with meals	52:33:16			
Control	24 OW/OB (24 M, 0 F)			70.4 (8.1)	21 (2.8)					diet alone/no SSB	Usual diet with abstinence of SSB intake, no supplementation	48:34:18			
Johnston et al. 2013	32 OW (32 M, 0 F)	OP, UK	34 (9.9)			P		No				55:30:15	Positive	2 wk	A
Intervention	15 OW (15 M, 0 F)		35 (11)	96.8 (7.4)	30.0 (1.4)		Supp		~221 (25)	Fructose	Hypercaloric period: fructose dissolved in water				
Control	17 OW (17 M, 0 F)		33 (9)	93.9 (8.7)	28.9 (1.7)		Met			Glucose	Isocaloric period: glucose dissolved in water				
Koopman et al. 2014 (HS-F)	13 NW (13 M, 0 F)	OP, Netherlands				P	Supp	Yes					Positive	6 wk	A
Intervention	8 NW (8 M, 0 F)		21.9 (2.8)	81.0 (8.8)	22.6 (1.8)				~237 (27)	Sucrose	3 servings/d sucrose-sweetened SSB	~56:29:12			
Control	5 NW (5 M, 0 F)		23.0 (3.1)	76.6 (7.7)	22.6 (2.3)					Diet alone	No beverage	NR			
Koopman et al. 2014 (HS-S)	12 NW (12 M, 0 F)	OP, Netherlands				P	Supp	Yes					Positive	6 wk	A
Intervention	7 NW (7 M, 0 F)		22 (2.5)	77.4 (7.9)	21.7 (1.1)				~237 (27)	Sucrose	3 servings/d sucrose-sweetened SSB	~58:27:12			
Control	5 NW (5 M, 0 F)		23.0 (3.1)	76.6 (7.7)	22.6 (2.3)					Diet alone	No beverage	NR			
Lê et al. 2006	7 NW (7 M, 0 F)	OP, Switzerland	24.7 (3.4)	69.3 (6.9)	(19-25)	C	Supp	No				55:30:15	Positive		A
Intervention									~104 (18)	Fructose	20% Fructose solution			4 wk	
Control										Diet alone	No beverage			2 wk	
Njike et al. 2011	39 OW (6 M, 33 F)	OP, USA	52.2 (10.6)			C	Supp	Yes			Sucrose		Positive	6w	A, I
Intervention			52.2 (11.0)	81.8 (11.0)	30.5 (3.4)				91 (18.2)	Sucrose	Sugar-sweetened hot cocoa beverage	~55:29:15			
Control			52.5 (10.4)	81.3 (10.9)	30.2 (3.4)					Diet alone	Sugar-free hot cocoa beverage	~48:35:17			
Reid et al 2007	133 MW (0 M, 133 F)	OP, UK	31.8 (9.1)	61.35 (8.37)	22.5 (2.8)	P	Supp	Yes				63:19:19	Positive	4w	A
Intervention	65 MW (0 M, 65 F)								105 (20)	Sucrose	1 L/d sucrose sweetened "Irn-Bru"				
Control	68 MW (0 M, 68 F)									NNS	1 L/d aspartame sweetened "Irn-Bru"				
Reid et al. 2010	53 OW (0 M, 53 F)	OP, UK	33.6 (20-50)	NR		P	Supp	Yes					Positive	4w	A, I
Intervention	24 OW (0 M, 24 F)				27.8 (1.3)				~105 (~21)	Sucrose	Sugar Sweetened"Irn Bru" (250 mL/d x 4)	58:27:15			

Control	29 OW (0 M, 24 F)				27.2 (2.1)					NNS	Diet "Irn Bru" (251 mL/d x 4)	49:35:16			
Reid et al. 2014	41 OB (0 M, 41 F)	OP, UK	34.85 (20-50)			P	Supp	Yes					Positive	4 wk	A
Intervention	20 OB (0 M, 20 F)		35.1 (9.9)	88.4 (6.8)	32.9 (1.8)				~105 (~21)	Sucrose	Sugar Sweetened"Irn Bru" (250 mL/d x 4)	57:29:12			
Control	21 OB (0 M, 21 F)		34.6 (8.5)	86.1 (10.1)	32.7 (2.2)					NNS	Diet "Irn Bru" (251 mL/d x 4)	47:35:14			
Sanchez-Delgado et al. 2021	38 NW (11 M, 27 F)	OP, Mexico				P	Supp	Yes					Positive	6 wk	None
Intervention	12 NW (3 M, 9 F)		22 (4)	59 (9)	23 (2)				40 (8)	Sucrose	Sucrose 8 packets x5g/day	49:31:18			
Control	13 NW (3 M, 10 F)		22 (4)	57 (8)	22 (2)					NNS	Sucralose 4 packets x1g/day	45:35:20			
Control	13 NW (5 M, 8 F)		24 (5)	59 (7)	22 (2)					NNS	Steviol glycosides 4 packets x1g/day	45:33:22			
Silbernagel et al. 2011	10 MW (7 M, 3 F)	OP, Germany	32.8 (9.3)	80.3 (9.1)	25.5 (2.2)	C	Supp	No				50:35:15	Positive		A
Intervention									150 (~22.1)	Fructose	Fructose dissolved in water			4w	
Control										Diet alone	Usual diet, no beverage			2w	
Tordoff et al. 1990	30 MW (21 M, 9 F)	OP, USA	24.5 (6.3)	74.5	NR	C	Supp	No					Positive	3w	A
Intervention									133 (24.4)	HFCS	1135g/d SSB	~56:33:11			
Control										NNS	Aspartame sweetened beverage	~43:42:15			
Control										Diet alone	Usual diet, no beverage	~49:38:13			
Villano et al. 2021	136 OW (80 M, 56 F)	OP, Spain				P	Supp	Yes			citruis juice and maqui extract with different sweeteners added	NR	Positive	60 d	A
Intervention	45 OW (26 M, 19 F)		42 (7)	85 (12)	29 (3)				24.75 (5)	Sucrose	7.5g/100mL and consumed 330 mL/day				
Control	46 OW (27 M, 19 F)		44 (7)	83 (11)	28 (3)					Stevia	4mg/100mL and consumed 330 mL/day				
Control	45 OW (27 M, 18 F)		42 (8)	82 (11)	28 (2)					Sucralose	4mg/100mL and consumed 330 mL/day				
100% Fruit Juice															
Abedini et al. 2020	42 PCOS (0 M, 42 F)	OP, Iran				P		Yes					Positive	8 wk	A
Intervention	21		24.76 (5.2)	78.04 (12.1)	29.65 (3.2)		Supp		24.75 (4.7)	Fruit	45mL/d concentrated pomegranate juice +180mL water, and routine recommendations for their conditions	56:30:14			
Control	21		25.57 (5.0)	83.26 (12.2)	31.86 (5.3)		DA			Diet alone	Routine recommendations for their condition	59:27:14			

Amagase et al. 2009	60 MW	OP, China			NR	P	Supp	Yes				NR	Positive	4 wk	I
Intervention	30 MW		58.7 (5.3)	61.78 (9.69)					~12 (2.4)	Fruit	L. Barbarum (goji berry) juice 120mL/d				
Control	30 MW		59.05 (5.6)	60.91 (9.53)						NNS	Artificially sweetened placebo drink 120mL/d				
Aptekmann et al. 2010	26 OW/OB (0 M, 26 F)	OP, Brazil	30-48			P	Supp	Yes				NR	Positive	3 mo	A,I
Intervention	13 OW/OB (0 M, 13 F)			74.6 (13)	28.4 (4.46)				~49 (~10.2)	Fruit	Fruit juice (500ml/d orange juice) + aerobic exercise	~47:36:17			
Control	13 OW/OB (0 M, 13 F)			76.3 (15.3)	29.0 (5.53)					Diet alone	Baseline diet + aerobic exercise	~47:37:16			
Banini et al. 2006	23 OW (11 M, 12 F)	OP, USA		NR		P	Supp	Yes				~50:31:19	Positive	4w	A, I
Intervention	8 OW (3 M, 5 F)		50 (13)		29.3 (4.0)				22 (4)[k]	Fruit	150mL Muscadine grape juice				
Control	15 OW (8 M, 7 F)		56 (7.5)		27.5 (5.4)					Diet alone	No Muscadine grape juice				
Busing et al. 2019-FJ	26 MW (13 M, 13 F)	OP, Germany	25 (3)	70 (14)	23 (3)	C	Supp	No				NR	Positive		A
Intervention	26 MW (13 M, 13 F)								20	Fruit	orange juice			2w	
Control	26 MW (13 M, 13 F)									diet alone	no beverage			1w	
Fidelix et al. 2020	10 MW (0 M, 10 F)	OP, Brazil	26.8 (4.6)	63.4 (9.6)	24.1 (3.3)	C - no w/o	Supp	No				52:30:19	Positive		A, I
Intervention									25.0 (5.2)	Fruit	300mL/d 100% Orange juice			60d	
Control										Diet alone	No orange juice			30d	
González-Ortiz et al. 2011	20 OB (M, F)	OP, USA				P	Supp	Yes				NR	Positive	1 mo	NR
Intervention	10 OB (M, F)		36.3 (8.3)	89.5 (9.5)	35.2 (3.1)				16.5 (~3.3)	Fruit	120mL/d pomegranate juice				
Control	10 OB (M, F)		38.3 (10.4)	83.8 (10.5)	33.8 (4.1)					NNS	Placebo drink (Citric Acid, Maltodextrin, Aspartame,Natural Flavor, Ascorbic Acid, Magnesium Oxide, Acesulfame Potassium, Blue 1, Red40 with less than one kcal)				
Hollis et al. 2009	51 OW	OP, USA	27 (9)	78.3 (10.4)	27.1 (1.5)	P	Supp	Yes					Positive	3 mo	I
Intervention	26 OW		26 (9)	79.0 (10.7)	27.0 (1.5)				82 (~17)	Fruit	100% Concord Grape Juice	~50:35:15			
Control	25 OW		28 (10)	77.6 (10.3)	27.3 (1.5)					Diet alone	No grape flavored drink	~50:34:16			
Karlsen. 2010	62 pre-CVD	OP, Norway				P	Supp	Yes				NR	Positive	4 wk	A

Intervention	31 pre-CVD (21 M, 10 F)		53 (34-68)	79.4 (58-105)	25.6 (19.9-31.7)				38.98 (7.8)	Fruit	330ml Bilberry juice diluted with water to 1L				
Control	31 pre-CVD		53 (30-68)	81.3 (56-112)	25.5 (17.8-31.5)					Water	1L Water				
Kojadinovic et al. 2017	23 MS (0 M, 23 F)	OP, Serbia	(40-60)	NR		P	Supp	Yes				NR	Positive	6 wk	A
Intervention	12 MS (0 M, 12 F)				31.98 (3.57)				37 (7.8)	Fruit	300 mL/d Polyphenol-rich pomegranate juice				
Control	11 MS (0 M, 11 F)				27.83 (7.84)					Water	300 mL/d water				
Kojadinovic et al. 2021	24 HCL (8 M, 16 F)	OP, Serbia				P	Supp	Yes				NR	Positive	2 wk	A
Intervention	12 HCL (4 M, 8 F)		54.42 (6.26)	87.53 (16.20)	29.02 (3.80)				37 (7.8)	Fruit	300 mL/d Polyphenol-rich pomegranate juice				
Control	12 HCL (4 M, 8 F)		52.38 (13.31)	88.75 (20.33)	27.85 (2.49)					Water	300 mL/d water				
Kurowska et al. 2000	25 HLP (16 M, 9 F)	OP, Canada	55 (11)	78 (13)	27.9 (4.4)	C	Supp	No					Positive		NR
Intervention									23 (6.9)	Fruit	Tropicana Pure Premium Orange Juice 250 mL	~56:27:16		4 wk	
Intervention									46 (12.5)	Fruit	Tropicana Pure Premium Orange Juice 500 mL	~55:28:18		4 wk	
Intervention									69 (17.7)	Fruit	Tropicana Pure Premium Orange Juice 750 mL	~59:25:16		4 wk	
Control										Diet alone	No orange juice	~53:29:18		5 wk	
Lazavi et al. 2018	46 DM2 (19 M, 27 F)	OP, Iran				P	Supp	Yes					Positive	8 wk	A
Intervention	23 DM2 (9 M, 14 F)		56.86 (8.47)	74.76 (11.22)	29.22 (3.98)				17 (2.9)	Fruit	200 mL/d Barberry juice/d	~56:24:20			
Control	23 DM2 (10 M, 13 F)		53.95 (6.57)	72.56 (9.90)	27.78 (3.45)					Diet alone	No barberry juice	~57:23:20			
Manthou et al. 2017	10 MW (5 M, 5 F)	OP, Greece	31.8 (6.6)	66.2 (12.9)		C	Supp	Yes					Positive	2 wk	I
Intervention					22.1 (3.3)				58 (~13)	Fruit	500mL/d fresh pomegranate juice	44:39:16			
Control					22.2 (3.2)					Diet alone	No pomegranate juice	45:38:16			
Ravn-Haren et al. 2013	23 MW (9 M, 14 F)	OP, Denmark	36.2 (17.9)	NR	22.3 (2.6)	C	Supp	Yes				NR	Positive	4 wk	A
Intervention									63 (~12.6)	Fruit	Polyphenolic and pectin restricted diet with 500 mL clear apple juice /d				
Intervention									51 (~11.8)	Fruit	Polyphenolic and pectin restricted diet with 500 mL cloudy apple juice /d				
Control									2.1 (~0.004)	Fruit	Polyphenolic and pectin restricted diet with 22 g apple pomace/d				

Control										Diet alone	Polyphenolic and pectin restricted diet				
Fruit Drink															
Baleerio et al. 2021	17 MW (17 M, 0 F)	OP, Brazil	24.92 (4.34)	75.62 (11.0)	24.59 (3.98)	C	Supp	Yes				55:30:15	Positive	15d	A
Intervention									300 (~12)	Sucrose	1.5L/d containing 300g sucrose + citric extract added to a flavoured unsweetened juice				
Control										NNS	1.5L/d flavoured unsweetened juice (0g carbohydrate)				
Hieronimus et al. 2020		OP/IP, USA				P	Supp+ Met	No				55:30:15	Positive	2w	A
Intervention	28 MW (15 M, 13 F)		27 (6)	76 (13)	25 (4)				(25)	fructose	25% E as fructose-sweetened Kool-Aid				
Intervention	22 MW (11 M, 11 F)		26 (5)	73 (15)	25 (4)				(17.5)	fructose	17.5% E as fructose-sweetened Kool-Aid				
Intervention	28 MW (15 M, 13 F)		27 (7)	73 (15)	25 (4)				(25)	HFCS	25% E as HFCS-sweetened Kool-Aid				
Intervention	16 MW (7 M, 9 F)		25 (5)	70 (14)	24 (3)				(17.5)	HFCS	17.5% E as HFCS-sweetened Kool-Aid				
Control	23 MW (11 M, 12 F)		25 (6)	72 (11)	25 (3)					NNS	aspartame in Koolaid				
Higgins et al. 2019	154 OW/OB	OP, USA				P	Supp	Yes				NR	Positive	12w	A
Intervention	39 OW/OB (18 M, 21 F)		28.2 (9.5)	90.2 (18.1)	30.4 (4.1)				100, 120, 140 (~24)	Sucrose	added to 1.25-1.75 L/d KoolAid				
Control	29 OW/OB (12 M, 17 F)		25.8 (6.9)	84.4 (16.9)	28.8 (4.4)					NNS	0.73g/d saccharin powder added to 1.25-1.75 L/d KoolAid				
Control	30 OW/OB (15 M, 15 F)		29.5 (12)	87.6 (15.7)	30.3 (5.3)					NNS	0.58g/d aspartame powder added to 1.25-1.75 L/d KoolAid				
Control	28 OW/OB (10 M, 18 F)		27.1 (9.6)	84.4 (12.3)	29.9 (3.8)					NNS	0.66g/d RebA powder added to 1.25-1.75 L/d KoolAid				
Control	28 OW/OB (12 M, 16 F)		25.9 (9)	82.9 (10.6)	28.7 (4.0)					NNS	0.16g/d sucralose powder dissolved in 1.25-1.75 L water				
Hollis et al. 2009	51 OW	OP, USA	27 (9)	78.3 (10.4)	27.1 (1.5)	P	Supp	Yes					Positive	3 mo	I
Intervention	26 OW		26 (9)	79.0 (10.7)	27.0 (1.5)				82 (~17)	Sucrose	Grape flavored drink	~48:36:16			
Control	25 OW		28 (10)	77.6 (10.3)	27.3 (1.5)					Diet alone	No grape flavored drink	~50:34:16			
Stanhope et al. 2009	17 OW/OB (9 M, 8 F)	IP/OP, USA	53 (40-27)	86.7 (10.7)	29.3 (2.6)	C	Met/Supp	No				55:30:15	Positive		A, I

Intervention									~125 (25)	Fructose	25% E as fructose-sweetened Kool-Aid			10 wk	
Control										Diet alone	Usual diet, no beverage			2 wk	
Stanhope et al. 2015		IP/OP, USA				P	Supp	No				55:30:15	Positive	2 wk	A
Intervention	18 MW (9 M,9 F)		28 (6)	70.9 (2.4)	24.9 (3.8)				~58 (10)	HFCS	10% E as HFCS-sweetened Kool-Aid				
Control	23 MW (11 M, 12 F)		25 (6)	72 (11)	25 (3)					aspartame	aspartame				
Fruit															
Basu et al. 2010 (BB)	48 MetS (4 M, 44 F)	OP, USA	49.8 (15.3)	NR	37.8 (11.2)	P	Supp	Yes				NR	Positive	8 wk	A, I
Intervention	25 MetS (2 M, 23 F)		51.5 (15.0)		38.1 (7.5)				30 (~6)	Fruit	50g Freeze dried blueberry as abeverage				
Control	23 MetS (2 M, 21 F)		48.0 (15.8)		37.5 (14.4)					Water	Water				
Basu et al. 2010 (SB)	27 MetS (2 M, 25 F)	OP, USA	46.7 (16.6)	102.3 (9.5)	37.8 (8.9)	P	Supp	Yes					Positive	8 wk	A, I
Intervention	15 MetS (0 M, 15 F)		48.0 (20.5)	102.0 (11.6)	39.0 (7.7)				~24.45 (~5.6)	Fruit	50g Freeze dried strawberry as a beverage	45:37:13			
Control	12 MetS (2 M, 10 F)		45.0 (10.4)	102.7 (6.6)	36.4 (10.4)					Water	Water	46:35:15			
Conner et al. 2020	158 MW	OP, New Zealand	21.69 (3.54)	68.01 (15.71)	23.84 (4.44)	P	Supp	Yes					Positive	4wk	A, I
Intervention	55 MW		20.28 (1.87)	68.47 (13.29)	23.98 (3.65)				18 (~3.9)	Fruit	2 SunGold kiwifruit/d	46:35:18			
Control	51 MW		22.95 (4.46)	67.82 (14.92)	23.7 (3.76)					Diet alone	No kiwi, chewable vitamin C tablet	44:38:17			
Control	52 MW		21.87 (3.31)	67.72 (18.83)	23.85 (5.73)					Diet alone	No kiwi, chewable placebo tablet	43:39:17			
Cressey et al. 2014 (DM2)	15 DM2	OP, Thailand	52.8 (5.23)			C	Supp	No					Positive		A
Intervention				61.8 (13.3)	25.8 (4.7)				~30.6 (5.6)	Fruit	1 banana/d (250 g)	~57:25:18		4 wk	
Control				62.3 (13.0)	25.9 (4.6)					Diet alone	No banana	~53:29:19		8 wk	
Cressey et al. 2014 (HCL/HD)	15 HCL	OP, Thailand	43.1 (7.5)			C	Supp	No					Positive		A
Intervention				59.6 (11.8)	24.0 (3.94)				~61.2 (~10.6)	Fruit	2 banana/d (500 g)	~57:26:17		12 wk	
Control				59.3 (12.1)	24.1 (4.2)					Diet alone	No banana	~49:34:17		8 wk	
Cressey et al. 2014 (HCL/LD)	15 HCL	OP, Thailand	44.8 (10.3)			C	Supp	No					Positive		A
Intervention				61.5 (10.9)	24.8 (4.0)				~30.6 (5.9)	Fruit	1 banana/d (250 g)	~56:27:17		12 wk	
Control				61.5 (10.7)	24.8 (4.3)					Diet alone	No banana	~47:35:17		8 wk	

Dow et al. 2012	71 OW/OB (17 M, 54 F)	OP, USA	41.2 (11)	91.7 (13.6)	32.1 (4.1)	P	Supp	Yes					Positive	6 wk	A
Intervention	39 OW/OB (19 M, 29 F)								~24 (4.8)[g]	Fruit	~450 g grapefruit/d (1/2 fruit 3x/d)	~50:34:16			
Control	32 OW/OB (7 M, 25F)									Diet alone	Low fruit/vegetable diet (restricted fruits and veg with high polyphenol and carotenoid content)	~48:37:16			
Ezzat-Zadeh et al. 2021	14 MW (6 M, 8 F)	OP, USA	29.7 (7.9)	78.4 (14.6)	27.2 (4.9)	C	Supp	No				NR	Positive		A, I
Intervention									~7.04 (~1.4)	Fruit	2x13g/d freeze-dried strawberry powder mixed in water at breakfast and dinner			4wk	
Control										Diet alone	No strawberries			2wk	
Franck et al. 2020	48 risk of MetS (16 M, 32 F)	OP, Canada		NR		P	Supp	Yes					Positive	8 wk	I
Intervention	24 (7 M, 17 F)		32.46 (10.12)		30.42 (5)				12.4 (2.4)	Fruit	280g frozen raspberries (2 cups)/d	48:35:17			
Control	24 (9 M, 15 F)		31.92 (8.05)		29.38 (3.94)					Diet alone	Usual diet, no supplementation	42:40:18			
Kumari et al. 2016	45 MW (31 M, 14 F)	OP, India	18-25			P	Supp	Yes				NR	Positive	6 wk	A
Intervention	15 MW			59 (8.9)	21.8 (2.4)				~35.7 (7.1)[g]	Fruit	400 g/d guava with peel				
Intervention	15 MW			63 (10.8)	22.2 (2.8)				~35.7 (7.1)[g]	Fruit	400 g/d guava without peel				
Control	15 MW			62 (11.9)	21.7 (3.1)					Diet alone	No guava				
Liddle et al. 2021	44 OW/OB (14 M, 30 F)	OP, Canada				P	Supp	Yes					Positive	6 wk	A,I
Intervention	22 OW/OB (7 M, 15 F)		43 (19-69)	95 (23)	33 (6)				17.5 (3.2)	Fruit	3 whole small Gala apples (200g edible parts)	49:34:16			
Control	22 OW/OB (7 M, 15 F)		48 (24-69)	97 (19)	33 (6)					Diet alone	No apples	43:40:17			
Moazen et al. 2013	19 DM2	OP, Iran	51.9 (8.2)	75.79 (9.02)	27.36 (4.23)	C	Supp	No				NR	Positive		A, I
Intervention									~24.45 (~5.6)	Fruit	50g pure freeze dried strawberry powder with 2 cups of water			6 wk	
Control										Diet alone	Usual diet, avoid flavonoid rich foods			2 wk	
Ravn-Haren et al. 2013	23 MW (9 M, 14 F)	OP, Denmark	36.2 (17.9)	NR	22.3 (2.6)	C	Supp	Yes				NR	Positive	4 wk	A
Intervention									51 (~10.2)[q]	Fruit	Polyphenolic and pectin restricted diet with 550 g whole apples/d				

Control									2.1 (~0.004)	Diet alone	Polyphenolic and pectin restricted diet with 22 g apple pomace/d				
Control										Diet alone	Polyphenolic and pectin restricted diet, no apple				
Shanely et al. 2020	45 OW/OB (0 M, 45 F)	OP, USA	59.8 (5.84)	83.3 (16.1)	30.7 (4.7)	P	Supp	Yes				NR	Positive	6wk	A
Intervention	26 OW/OB (0 M, 26 F)		59.5 (4.36)	82.6 (16.1)	30.9 (5.6)				43.7 (8.74)	Fruit	710mL/d 100% watermelon puree				
Control	19 OW/OB (0 M, 19 F)		60.1 (8.16)	82.4 (18.9)	30.3 (3.9)					Diet alone	No watermelon puree				
Tutino et al. 2021	40 OW/OB (11 M, 29 F)	OP, Italy				P	Supp	Yes				NR	Positive	3wk	A
Intervention	21 OW/OB (6 M, 15 F)		47.4 (9.5)	67.53 (12.96)	25.30 (4.01)				~57.1 (~11.4)	Fruit	5g/kg BW/d, ~350g/d black seedless grapes (Autumn Royal)				
Control	19 OW/OB (5 M, 14 F)		44.1 (10.1)	78.01 (18.01)	27.86 (4.39)					Diet alone	No grapes				
Whybrow et al. 2006	62 MW (34 M, 28 F)	OP, Scotland	42.6 (11.1)			P	Supp	Yes				NR	Positive	8 wk	I
Intervention	20 MW (10 M, 10 F)		44.3 (11.2)	66.9 (11.2)	23.1 (2.5)				~28 (~5.2)	Fruit	300g Tangerines, apples, oranges bananas, pears, grapes				
Intervention	25 MW (14 M, 11 F)		43.4 (11.8)	71.1 (14.4)	24.2 (3.1)				~57 (~11.0)	Fruit	600g Tangerines, apples, oranges bananas, pears, grapes				
Control	17 MW (10 M, 7 F)		39.4 (9.6)	71.3 (11.3)	23.8 (2.6)					Diet alone	Usual diet, no supplemented fruit				
Dried Fruit															
Alalwan et al. 2020	96 DM2	OP, Bahrain	56 (3.35)	-	29.22 (6.11)	P	Supp	Yes					Positive	16wk	None
Intervention	46 DM2								13 (~2.3)	Fruit	3 Khudary cultivar dates/d	47:28:16			
Control	50 DM2									Diet alone	No dates	52:30:16			
Al-Dashti et al. 2019	27 MW (0 M, 27 F)	OP, USA	59 (5.2)	NR	24.5 (4.2)	C	Supp	Yes				NR	Positive	2 wk	A, I
Intervention									~16 (3.8)	Dried fruit	~42g of prunes incorporated in usual diet				
Intervention									~5.3 (1.2)	Dried fruit	~14g of prunes incorporated in usual diet				
Control										Diet alone	Usual diet - run-in phase				
Control										Diet alone	Usual diet - washout phase				
Irannejad et al. 2020	72 DM2 (21 M, 51 F)	OP, Iran				P	Supp	Yes					Positive	12w	A

Intervention	36 DM2 (8 M, 28 F)		53 (8)	76 (13)	29 (4)				~14.3 (3.8)	fruit	30g/d z. vulgaris	70:18:16			
Control	36 DM2 (13 M, 23 F)		57 (6)	75 (11)	28 (4)					diet alone	diet alone	69:17:15			
Samar and Beyleroglu 2020	24 MW (24 M, 0 F)	OP, Turkey				P	Supp	Yes				60:18:22	Positive	6wk	A
Intervention	6 MW (6 M, 0 F)		24 (2.53)	74.78 (11.86)	24.67 (3.83)				~13.68 (3.04)	Fruit	30g/d dried goji berries				
Intervention	6 MW (6 M, 0 F)		21.83 (3.37)	80.88 (19.51)	25.31 (4.52)				~13.68 (3.04)	Fruit	30g/d dried goji berries and exercise				
Control	6 MW (6 M, 0 F)		22.33 (3.93)	77.68 (13.68)	21.43 (2.48)					Diet alone	No goji berries				
Control	6 MW (6 M, 0 F)		20.33 (2.42)	67.57 (9.73)	25.97 (3.92)					Diet alone	No goji berries or exercise				
Sweetened Cereal Grains and Bars															
Davidi et al. 2011	94 OW (20 M, 74 F)	OP, USA				P	Supp	Yes				NR	Positive	8 wk	A
Intervention	49 OW (11 M, 38 F)		52.6 (13)	89.2 (17.3)	32.7 (5.3)				24 (5)	Mixed	Dried fruit & nut bars sweetened with honey and glucose				
Control	45 OW (9 M, 36 F)		54.8 (15.7)	94.6 (20.4)	34.7 (5.3)					Diet alone	Baseline diet				
Mietus-Snyder et al. 2012	25 MW (10 M, 15 F)	OP, USA	44.9 (15.8)	NR	25.7 (14.3)	C	Supp	No				NR	Positive	2 wk	A, I
Intervention									15.2 (3)	Mixed	Dark chocolate, fruit and nut bars				
Control										Diet alone	No fruit & nut bars				
Zaveri et al. 2009		OP, UK				P	Supp	No					Positive	12w	I
Intervention	13 OW (13 M, 0 F)		36 (7)	96 (10)	30 (4)				~19.2 (~3.9)	mixed type	cereal bar 60g/d	48:38:15			
Control	12 OW (12 M, 0 F)		44 (6)	94 (8)	29 (2)					diet alone	diet alone	43:32:15			
Sweets and desserts															
Alavinejad et al. 2015	42 NAFLD (33 M, 9 F)	OP, Iran				P	Supp	Yes				NR	Positive	3 mo	A, I
Intervention	21 NAFLD (15 M, 6 F)		38.18 (11.04)	88.59 (13.17)	30.27 (3.58)				~6.1 (1.2)[g]	Sucrose	30g/d dark chocolate (83% cocoa) (~171kcal)				
Control	21 NAFLD (18 M, 3 F)		37.95 (10.34)	84.92 (20.64)	29.69 (5.752)					Fat	Sugar free white chocolate (~87kcal)				
Ayoobi et al. 2017	44 DM2 (17 M, 27 F)	OP, Iran				P	Supp	Yes					Positive	8w	A
Intervention	21 DM2 (7 M, 14 F)		51 (8)	~70.75	~27.83				~5.5 (~1.1)	sucrose	84% dark chocolate	56:27:18			
Control	23 DM2 (10 M, 13 F)		51 (8)	~74.95	~27.75					diet alone	no chocolate	58:23:19			
Leskinen et al. 2014	50 MW (21 M, 29 F)	OP, Finland				P	Supp	No				NR	Positive	2 wk	A, I

Intervention	20 MW (8 M, 12 F)		33.6 (2)	70 (9)	23.3 (1.9)				~88 (17.6)	Sucrose	~50-60g/d d Liquorice (Halva or Kouvola brand)p providing 290-370mg of glycyrrhizin				
Control	30 MW (13 M, 17 F)		33.8 (8.1)	71 (9)	23.0 (2.7)					Diet alone	No liquorice				
Martini et al. 2021	21 NW (11F, 10M)	OP, Italy	22.9 (2.3)	67 (12.4)	22.3 (7.8)	C	Supp	Yes					Positive	4 wk	I
Intervention									43.4 (8.2)	Sucrose	1 cup espresso + 2 cocoa-based products containing coffee/d	47:37:16			
Control										Water	1 cup espresso/d	49:38:13			
Honey															
Bahrami et al. 2009	48 DM2 (13 M, 35 F)	OP, Iran	57.2 (8.4)	70.8 (10.6)	NR	P	Supp	Yes					Positive	8 wk	A
Intervention	25 DM2			71.3 (12.7)					~125 (~33)	Honey	Honey added to diet	64:23:15			
Control	23 DM2			70.3 (8.1)						Diet alone	No honey	60:22:15			
Jayadi et al. 2019	46 OW/OB	OP, Indonesia				P	Supp	No				NR	Positive	60 d	A
Intervention	23 OW/OB		39.7 (9.24)	75.2 (11.28)	28.9 (3.3)				57.5 (14)	Honey	70g/d Honey in 250ml water + obesity diet education				
Control	23 OW/OB		44 (9.8)	72.3 (11.3)	29.57 (3)					Diet alone	Obesity diet education				
Tang et al. 2020	95 HIV (81 M, 14 F)	IP, Malaysia	(21-58)			P	Met	Yes				NR	Positive	6 mo	A
Intervention	26 HIV			56 (8)	22 (3)				16.4 (3.2)	honey	Tualang honey (20g/d) instructed to be consumed followed by a glass of water an hour before their meal - 20g packet 1x/d				
Intervention	24 HIV			59 (8)	22 (3)				32.8 (6.2)	honey	Tualang honey (40g/d) instructed to be consumed followed by a glass of water an hour before their meal - 20g packet 2x/d				
Intervention	22 HIV			55 (7)	21 (2)				49.3 (9.0)	honey	Tualang honey (60g/d) instructed to be consumed followed by a glass of water an hour before their meal - 20g packet 3x/d				
Control	23 HIV			58 (7)	23 (3)					diet alone	No honey				
Added Nutritive (caloric) Sweeteners															

Colagiuri et al. 1989	9 DM2 (8 M, 1 F)	OP, Australia	66 (5)	70.3 (8.1)	26.4 (2.1)	C	Supp	No				NR	Positive	6 wk	A
Intervention									45 (~9)	Sucrose	Sucrose sachets added to beverages and meals				
Control										NNS	Aspartame sachets added to beverages and meals				
Mixed sources (with SSBs)															
Ahmad et al. 2020	25 risk of CVD (25 M, 0 F)	OP, UK	56.8 (6.5)	89.6 (8.5)	28.6 (1.5)	C - 4wk w/o	Met	Yes					Neutral	12wk	A
Intervention									173 (28)	Sucrose	High sugar diet (200kcal/d more than control diet)	53:27:15			
Control									56 (9)	Starch	Low sugar diet, replace sugar with starch	44:34:16			
Raben et al. 2002	41 OW/OB (6 M, 35 F)	OP, Denmark				P	Supp	Yes					Positive	10 wk	A, I
Intervention	21 OW/OB		33.3 (9.17)	82.5 (7.79)	28.0 (2.29)				~160 (23)	Sucrose	Sucrose-sweetened foods: soft drinks, fruit juices, yogurt, marmalade, ice cream, stewed fruit	~57:29:11			
Control	20 OW/OB		37.1 (9.84)	79.2 (8.94)	27.6 (2.24)					NNS	Artificially sweetened foods: soft drinks, fruit juices, yogurt, marmalade, ice cream, stewed fruit	~45:33:15			
Werner et al. 1984	12 MW with gall stones (4 M, 8 F)	OP, UK	48 (26-69)	NR	NR	C	DA	Yes				NR	Positive	6 wk	I
Intervention									112 (23.7)	Sucrose	Sucrose, SSB, cakes, biscuits etc.				
Control									16 (4.2)	NNS	NSBs, mixed sources, avoid sugar				

A= agency; ADA= American Diabetes Association; BB=blueberries; bw=body weight; C= crossover; cal=calories; CHO=carbohydrate; CVD= cardiovascular disease; d=days; DM1= Diabetes Mellitus Type 1; DA= dietary advice; DM2=Diabetes Mellitus Type 2; E=energy; F= female; HCL= hypercholesterolemic; HD=high dose; HFCS= high fructose corn syrup; HI=hyperinsulinemic; HIV=human immunodeficiency virus; HLP= hyperlipidemia; HS-F=high sugar-fructose; HS-S=high sugar-sucrose; HTG = hypertriglyceridemia; HTN=hypertension; I= industry; IGT= impaired glucose tolerance; IP=inpatient; kg=kilogram; LD=low dose; M= male; mo=months; MD=moderate dose; Met=metabolic; MetS=metabolic syndrome criteria; MW=mixed weight; NAFLD=non-alcoholic fatty liver disease; NNS= non-nutritive sweetener; NSB= non-nutritive sweetened beverage NR= not reported; NW=normal weight; OB= obese; OP=outpatient; OW= overweight; P=parallel; PCOS= polycystic ovarian syndrome; SB= strawberries; SD=standard deviation; SSB=sugars-sweetened beverage; Supp=supplemented; TEI= total energy intake; UK=United Kingdom; USA=United States of America; wk=weeks; yr= year

[a] Metabolic feeding control included provision of all study foods, supplement feeding control included provision of study supplements only, and dietary advice included dietary counseling without the provision of any dietary foods or supplements.

[b] Doses preceded by "~" represent approximate amounts calculated on the basis of average body weight or energy intake reported by participants. In the absence of this data, an average of 70 kg body weight or 2000 kcal/d was assumed.

[c] Total energy intake in the form of carbohydrate:fat:protein

[d] Positive energy balance included interventions designed to consume excess calories on top of a baseline diet. Negative energy balance included interventions designed to create a caloric deficit compared to the baseline diet. Neutral energy balance included interventions designed to continue habitual caloric intake.

[e] Agency funding included government, not-for profit health agencies or University sources.

[f] Fructose-containing sugar dose estimated based on data from the Canadian Nutrient File

[g] Fructose-containing sugar dose estimated from total used in study products

Table of Characteristics of Subtraction Trials

Study, Year	Participants	Setting	Baseline: Mean Age, years (SD or Range)	Baseline: Mean Body Weight, kg (SD or range)	Baseline: Mean BMI, kg/m^2 (SD)	Design	Feeding Control[a]	Randomization	Fructose-Containing Sugar Dosage, g/d (% E)[b]	Intervention or comparator	Food source	Diet[c]	Energy Balance[d]	Follow-Up	Funding Sources[e]
Subtraction Trials (Hypocaloric comparisons)															
SSBs															
Campos et al. 2015 (G1)	12 OW/OB, IHCL<60 mmol/l (3 M, 9 F)	OP, Switzerland	28.3 (6.5)			P	Supp	Yes					Negative	3 mo	A
Intervention	6 OW/OB			85.6 (11.3)	30.1 (4.9)					NNS	Replace SSB with NSB	~46:38:16			
Control	6 OW/OB			78.5 (7.1)	26.9 (1.2)				86.8 (~15)	sucrose	Usual SSB consumption (≥ 2 SSB/d)	~51:34:15			
Campos et al. 2015 (G2)	15 OW/OB, IHCL>60 mmol/l (11 M, 4 F)	OP, Switzerland	29.1 (6.9)			P	Supp	Yes					Negative	3 mo	A
Intervention	7 OW/OB			102.2 (12.2)	32.5 (4.5)					NNS	Replace SSB with NSB	~46:38:16			
Control	8 OW/OB			100.0 (11.6)	33.8 (5.6)				86.8 (~15)	sucrose	Usual SSB consumption (≥ 2 SSB/d)	~51:34:15			
Ebbeling et al. 2020-ASB	120 MW (72 M, 48 F)[f]	OP, USA				P	Supp	Yes				NR	Negative	12 mo	A, I
Intervention	60 MW (36 M, 24 F)[f]		26.7 (5.7)[g]	76.8 (16.7)[g]	26.1 (5.2)[g]					NNS	substitute all SSB with ASB				
Control	60 MW (36 M, 24 F)[f]		25.9 (5.1)[g]	75.5 (15.6)[g]	25.8 (4.7)[g]				~84.5 (15.3)	HFCS	SSB (usual intake)				
Ebbeling et al. 2020-USB	126 MW (75 M, 51 F)[f]	OP, USA				P	Supp	Yes				NR	Negative	12 mo	A, I
Intervention	66 MW (39 M, 27 F)[f]		27.9 (6.0)[g]	77.5 (16.1)[g]	26.6 (4.6)[g]					water	substitute all SSB with water				
Control	60 MW (36 M, 24 F)[f]		25.9 (5.1)[g]	75.5 (15.6)[g]	25.8 (4.7)[g]				~84.5 (15.3)	HFCS	SSB (usual intake)				
Hernandez-Cordero et al. 2014	240 OW/OB (0 M, 240 F)	OP, Mexico				P	DA/Supp	Yes				NR	Negative	9 mo	A, I
Intervention	120 OW/OB (0 M, 120 F)		33.5 (6.7)	76.9 (3.3)	31.0 (1.1)					Water	Substitute water for SSBs, general recommendations for healthy eating				

Control	120 OW/OB (0 M, 120 F)		33.4 (6.7)	76.0 (3.3)	31.0 (1.1)				~102.7 (20)	sucrose	Usual SSB consumption (≥250 kcal/d), general recommendations for healthy eating				
Tate et al. 2012	318 OW/OB (50 M, 268 F)	OP, USA				P	DA/S upp	Yes				NR	Negative	6 mo	I
Intervention	108 OW/OB (12 M, 96 F)		41.2 (11.2)	100.9 (15.7)	36.1 (6.2)					NNS	≥2 SSB/d replaced with NSB				
Intervention	105 OW/OB (23 M, 82 F)		43.2 (10.6)	98.4 (17.0)	35.8 (5.2)					Water	≥2 SSB/d replaced with water				
Control	105 OW/OB (15 M, 90 F)		41.6 (10.4)	102.6 (18.3)	36.8 (6.2)				~55.7 (~13.8)	HFCS	Usual SSB consumption of ≥280 kcal/d				
Mixed sources (with SSBs)															
Mann et al. 1972 (BJN)	8 H (8 M, 0 F)	OP, South Africa	(30-44)	NR	NR	C	Met	No				NR	Negative	2 wk	NR
Intervention										Diet Alone	Removed sucrose containing foods				
Control									~140 (24.4)	Sucrose	Usual diet (12-21% Sucrose)				
Mann et al. 1974	7 HTG (7 M, 0 F)	OP, South Africa	(30-44)	NR	NR	C	DA	No				NR	Negative	2 wk	NR
Intervention										Diet Alone	Removed sucrose containing foods				
Control									(12-21)	Sucrose	Usual diet				
Rifkind et al. 1966	11 Post-MI (11 M, 0 F)	OP, UK	(33-51)	69 (7)	NR	C	DA	No				NR	Negative	10 wk	A
Intervention										Diet Alone	Avoid sweets, chocolate, lemonade, fruit quash, cakes, biscuits puddings etc				
Control									NR	Sucrose	Usual diet				
Vazquez-Duran et al. 2016	146 MW (26 M, 120 F)	OP, Mexico	21.99 (0.25)	66.78 (1.10)	26.24 (0.36)	P	DA	Yes				NR	Negative	6 mo	NR

Intervention	48 MW	22.55 (0.51)	69.13 (2.11)	27.27 (0.70)			Water	Allowed only water, coffee or tea with no sugar
Intervention	49 MW	21.46 (0.31)	65.48 (1.92)	25.48 (0.62)			NNS	Allowed only NSB, water, coffee or tea with no sugar
Control	49 MW	21.98 (0.45)	65.75 (1.67)	26.00 (0.55)		25.8 (5.1)	Mixed	Usual SSB intake (a variety of sweetened drinks, including juices)

A= agency; ASB= artificially sweetened beverage; C= crossover; DA= dietary advice; E=energy; F= female; G1=group 1; G2=group2; H=healthy; HFCS= high fructose corn syrup; HTG = hypertriglyceridemia; I= industry; IHCL=intrahepatocellular lipid concentrations; IP=inpatient; M= male; mo=months; Met=metabolic; MI=myocardial infection; MW=mixed weight; NNS= non-nutritive sweetener; NSB= non-nutritive sweetened beverage NR= not reported; OB=obese; OP=outpatient; OW= overweight; P=parallel; SD=standard deviation; SSB=sugars-sweetened beverage; Supp=supplemented; wk=weeks; UK=United Kingdom; USA=United States of America; USB=unsweetened beverage

[a] Metabolic feeding control included provision of all study foods, supplement feeding control included provision of study supplements only, and dietary advice included dietary counseling without the provision of any dietary foods or supplements.

[b] Doses preceded by "~" represent approximate amounts calculated on the basis of average body weight or energy intake reported by participants. In the absence of this data, an average of 70 kg body weight or 2000 kcal/d was assumed.

[c] Total energy intake in the form of carbohydrate:fat:protein

[d] Positive energy balance included interventions designed to consume excess calories on top of a baseline diet. Negative energy balance included interventions designed to create a caloric deficit compared to the baseline diet. Neutral energy balance included interventions designed to continue habitual caloric intake.

[e] Agency funding included government, not-for profit health agencies or University sources.

[f] Number of male and female participants calculated from ratio of baseline males and females participants

[g] Data based on baseline participants, including drop-outs

Table of Characteristics of *Ad libitum* Trials

Study, Year	Participants	Setting	Baseline			Design	Feeding Control[a]	Randomization	Fructose-Containing Sugar Dosage, g/d (% E)[b]	Intervention or comparator	Food source	Diet[c]	Energy Balance[d]	Follow-Up	Funding Sources[e]
			Mean Age, years (SD or Range)	Mean Body Weight, kg (SD or range)	Mean BMI, kg/m^2 (SD)										
Ad Libitum Trials (Free Feeding Comparison)															
Sweets and Desserts															
Chantelau et al. 1985	10 DM1 (2 M, 8 F)	OP, Germany	(25-43)	66.7 (7.6)	<25	C		Yes					Neutral	4 wk	NR
Intervention							DA		24 (~5)	Sucrose	Ad libitum sucrose-containing food consumption; sucrose-containing soft drinks discouraged	43.2:49.1:18			
Control							Supp			NNS	Ad libitum sodium cyclamate tablets and liquids	38.2:37.8:15.4			
Mixed Sources (with SSBs)															
Drummond et al. 1998	49 MW (49 M, 0 F)	OP, Scotland				P	DA	Yes				43:36:15	Neutral	6 mo	A
Intervention	25 MW (25M, 0 F)		46 (3.82)	90.7 (13.94)	28.2 (3.79)				(20)	Sucrose	Low Fat Diet Recommendation replacing with Sugar and Complex Carb				
Control	24 MW (24 M, 0 F)		46.8 (3.85)	89.7 (8.71)	27.5 (3.1)				(17)	Starch	Low Fat Low Sugar Recommendation replacing with complex carb				
Markey et al. 2016	50 MW (16 M, 34 F)	OP, UK	31.6 (9.5)	69.8 (11.4)	24.0 (3.3)	C	Supp	Yes					Neutral	8 wk	I
Intervention									32 (~6)	Sucrose	Exchange ≥1 food portion and ≥1 beverage per day from habitual diet with sugar containing products	54:30:14			

Control										NNS	Exchange ≥1 food portion and ≥1 beverage per day from habitual diet with sugar reformulated products	48:33:15			
Poppitt et al. 2002	28 MetS (11 M, 17 F)	OP, UK				P	Supp	Yes					Neutral	6 mo	A, I
Intervention	14 MetS (6 M, 8 F)		45.9 (5.0)	89.3 (15.7)	30.9 (3.0)				~165.4 (29)[f]	Sucrose	Ad libitum low-fat Simple CHO diet	~59:20:22			
Control	14 MetS (5 M, 9 F)		44.2 (5.5)	91.2 (9.5)	32.3 (3.6)					Starch	Ad libitum low fat Complex CHO diet	53:23:24			
Raben et al. 1997 (PO)	9 PO (0 M, 9 F)	OP, Denmark	39 (9.0)	63.9 (5.4)	22.9 (2.1)	C	Met	Yes					Neutral	2 wk	A, I
Intervention									(23)	Sucrose	Ad libitum sucrose diet	59:28:13			
Control									(2)	Fat	Ad libitum fat diet	41:46:13			
Control									(2)	Starch	Ad libitum starch diet	59:28:13			
Raben et al. 1997 (Ctrl)	11 NW (0 M, 11 F)	OP, Denmark	38 (9.9)	61.9 (4.0)	22.6 (1.3)	C	Met	Yes					Neutral	2 wk	A, I
Intervention									(23)	Sucrose	Ad libitum sucrose diet	59:28:13			
Control									(2)	Fat	Ad libitum fat diet	41:46:13			
Control									(2)	Starch	Ad libitum starch diet	59:28:13			
Roberts et al. 1973 (HTG)	5 HTG (5 M,0 F)	OP, Antarctic	24.5	82.7 (3.3)	NR	C	Supp	No				NR	Negative	14 wk	I
Intervention										Glucose	Substitute all sucrose-containing foods with glucose syrup, except fruit				
Control									82 (11)	Sucrose	Usual diet				
Roberts et al. 1973 (LTG)	13 LTG (13 M, 0 F)	OP, Antarctic	24.5	75.8 (1.3)	NR	C	Supp	No				NR	Negative	14 wk	I
Intervention										Glucose	Substituted all sucrose-containing foods with glucose syrup, except fruit				
Control									103 (13.2)	Sucrose	Usual diet				
Saris et al. 2000	159 OW (79 M, 80 F)	OP, Netherlands				P	Met/ Supp	Yes					Neutral	6 mo	A, I

Intervention	76 OW (36 M, 40 F)		41 (9)	90.7 (12.7)	30.9 (2.8)				~183 (~29.5)[f]	Mixed	Ad libitum Low-fat high simple CHO diet	~56:26:16				
Control	83 OW (43 M, 40 F)		38 (9)	87.9 (11.6)	30.2 (2.8)					Starch	Ad libitum low-fat high complex CHO diet	~52:28:18				
Mixed Sources (without SSBs)																
Thornton et al. 1983	13 MW (3 M, 10 F)	OP, UK	46	NR	NR	C	DA	Yes					Neutral	6 wk	A	
Intervention									106 (19)	Mixed (sucrose, honey)	refined carbohydrate diet, mainly sugar (including honey), white flour and white rice (no mention of SSBs)	49:38:14				
Control										Starch	unrefined carbohydrate diet, mainly whole grains	37:45:18				

A= agency; C= crossover; CHO=carbohydrate; Ctrl=control; DA= dietary advice; DM1= Diabetes mellitus 1; E=energy; F= female; HTG = hypertriglyceridemia; I= industry; IP=inpatient; M= male; LTG=low triglycerides; mo=months; Met=metabolic; MetS=metabolic syndrome; MW=mixed weight; NNS= non-nutritive sweetener; NW=normal weight; NR= not reported; OB=obese; OP=outpatient; OW= overweight; P=parallel; PO=post-obese; SD=standard deviation; SSB=sugars-sweetened beverage; Supp=supplemented; wk=weeks

[a] Metabolic feeding control included provision of all study foods, supplement feeding control included provision of study supplements only, and dietary advice included dietary counseling without the provision of any dietary foods or supplements.

[b] Doses preceded by "~" represent approximate amounts calculated on the basis of average body weight or energy intake reported by participants. In the absence of this data, an average of 70 kg body weight or 2000 kcal/d was assumed.

[c] Total energy intake in the form of carbohydrate:fat:protein

[d] Positive energy balance included interventions designed to consume excess calories on top of a baseline diet. Negative energy balance included interventions designed to create a caloric deficit compared to the baseline diet. Neutral energy balance included interventions designed to continue habitual caloric intake.

[e] Agency funding included government, not-for profit health agencies or University sources.

[f] Fructose-containing sugar dose estimated from simple carbohydrate intake

Supplementary Table 5: Sensitivity analyses of the use of correlation coefficients of 0.25 and 0.75 for crossover trials in the primary analysis of the effect of important food sources of fructose-containing sugars on body weight (kg) and by food source

	MD (95% CI), P-value **I^2, P-value**		
	Correlation Coefficient **used in the Primary Analysis**	Correlation Coefficient used in **Sensitivity Analyses**	
Energy Design and Food Source (no. crossover trial comparisons/total)	**0.5**	**0.25**	**0.75**
Body weight (kg)			
Substitution (60*/119)	**0.04 [-0.07, 0.16], P_{MD}=0.469 I^2=2.7%, P_Q=0.401**	**-0.01 [-0.12, 0.10], P_{MD}=0.831 I^2=0.0%, P_Q=0.482**	**0.10 [-0.03, 0.22], P_{MD}=0.128 I^2=9.7%, P_Q=0.200**
SSB (6/12)	-0.23 [-0.65, 0.19], P_{MD}=0.285 I^2=0.0%, P_Q=0.756	-0.23 [-0.66, 0.19], P_{MD}=0.284 I^2=0.0%, P_Q=0.764	-0.22 [-0.64, 0.19], P_{MD}=0.288 I^2=0.0%, P_Q=0.731
Sweetened dairy (0/7)	0.33 [-2.24, 2.89], P_{MD}=0.804 I^2=0.0%, P_Q=1.000	NA	NA
Sweetened dairy alternatives (soy) (0/1)	-0.16 [-1.07, 0.75], P_{MD}=0.729 I^2= , P_Q=	NA	NA
100% Fruit juice (0/2)	0.28 [-1.19, 1.76], P_{MD}=0.707 I^2=0.0%, P_Q=0.608	NA	NA
Fruit drink (3/7)	-0.46 [-0.97, 0.04], P_{MD}=0.073 I^2=17.1%, P_Q=0.299	-0.47 [-0.98, 0.03], P_{MD}=0.066 I^2=16.0%, P_Q=0.308	-0.43 [-0.94, 0.08], P_{MD}=0.096 I^2=20.2%, P_Q=0.275
Fruit (2/10)	-0.38 [-0.57, -0.20], P_{MD}<0.001 I^2=0.0%, P_Q=0.708	-0.38 [-0.57, -0.19], P_{MD}<0.001 I^2=0.0%, P_Q=0.670	-0.38 [-0.56, -0.19], P_{MD}<0.001 I^2=0.0%, P_Q=0.660
Dried Fruit (2/7)	0.34 [-0.47, 1.15], P_{MD}=0.408 I^2=0.0%, P_Q=0.915	0.37 [-0.47, 1.20], P_{MD}=0.391 I^2=0.0%, P_Q=0.919	0.28 [-0.45, 1.02], P_{MD}=0.450 I^2=0.0%, P_Q=0.903
Sweetened cereal grains and bars (1*/3)	0.23 [-0.33, 0.79], P_{MD}=0.415 I^2=0.0%, P_Q=0.798	NA	NA
Sweets and desserts (6/7)	0.44 [-0.27, 1.15], P_{MD}=0.222 I^2=0.0%, P_Q=0.999	0.46 [-0.26, 1.18], P_{MD}=0.211 I^2=0.0%, P_Q=1.000	0.40 [-0.29, 1.08], P_{MD}=0.259 I^2=0.0%, P_Q=0.995
Added nutritive (caloric) sweetener (10/13)	0.66 [0.13, 1.19], P_{MD}=0.014 I^2=0.0%, P_Q=0.968	0.53 [0.05, 1.01], P_{MD}=0.032 I^2=0.0%, P_Q=0.987	0.36 [0.04, 0.68], P_{MD}=0.027 I^2=0.0%, P_Q=0.794
Mixed sources (with SSBs) (23/42)	0.27 [0.09, 0.45], P_{MD}=0.003 I^2=0.0%, P_Q=0.675	0.27 [0.09, 0.45], P_{MD}=0.004 I^2=0.0%, P_Q=0.726	0.27 [0.10, 0.44], P_{MD}=0.002 I^2=0.0%, P_Q=0.511
Mixed sources (without SSBs) (7/8)	0.40 [-0.24, 1.03], P_{MD}=0.218 I^2=46.3%, P_Q=0.072	0.45 [-0.26, 1.15], P_{MD}=0.214 I^2=45.2%, P_Q=0.078	0.33 [-0.20, 0.86], P_{MD}=0.220 I^2=48.5%, P_Q=0.059
Addition (32*/90)	**0.28 [0.06, 0.50], P_{MD}=0.011 I^2=57.4%, P_Q<0.001**	**0.27 [0.05, 0.48], P_{MD}=0.014 I^2=50.7%, P_Q<0.001**	**0.29 [0.07, 0.51], P_{MD}=0.010 I^2=67.8%, P_Q<0.001**
SSB (11/21)	0.49 [0.24, 0.74], P_{MD}<0.001 I^2=40.0%, P_Q=0.029	0.47 [0.22, 0.72], P_{MD}<0.001 I^2=32.1%, P_Q=0.079	0.51 [0.26, 0.77], P_{MD}<0.001 I^2=53.4%, P_Q=0.002
100% Fruit juice (7/17)	-0.13 [-0.54, 0.28], P_{MD}=0.536 I^2=51.0%, P_Q=0.008	-0.14 [-0.58, 0.29], P_{MD}=0.520 I^2=47.5%, P_Q=0.016	-0.11 [-0.50, 0.27], P_{MD}=0.557 I^2=58.3%, P_Q=0.001
Fruit Drink (2/14)	0.90 [0.34, 1.45], P_{MD}=0.001 I^2=42.0%, P_Q=0.049	0.89 [0.37, 1.40], P_{MD}<0.001 I^2=32.8%, P_Q=0.113	0.91 [0.31, 1.51], P_{MD}=0.003 I^2=53.3%, P_Q=0.010
Fruit (7/19)	-0.16 [-0.49, 0.18], P_{MD}=0.366 I^2=0.0%, P_Q=0.996	-0.21 [-0.59, 0.17], P_{MD}=0.284 I^2=0.0%, P_Q=0.997	-0.08 [-0.34, 0.19], P_{MD}=0.569 I^2=0.0%, P_Q=0.989
Dried fruit (0/3)	-1.29 [-2.01, -0.57], P_{MD}<0.001 I^2=0.0%, P_Q=0.913	NA	NA
Sweetened cereal grains and bars (1*/3)	0.30 [-0.07, 0.66], P_{MD}=0.116 I^2=0.0%, P_Q=0.849	NA	NA
Sweets and desserts (1/4)	0.08 [-0.61, 0.77], P_{MD}=0.818 I^2=0.0%, P_Q=0.886	0.08 [-0.61, 0.77], P_{MD}=0.818 I^2=0.0%, P_Q=0.886	0.08 [-0.61, 0.76], P_{MD}=0.820 I^2=0.0%, P_Q=0.886
Honey (0/5)	-1.65 [-2.46, -0.85], P_{MD}<0.001 I^2=0.0%, P_Q=0.654	NA	NA
Added nutritive (caloric) sweetener (1/1)	0.60 [-5.09, 6.29], P_{MD}=0.836 I^2=, P_Q=	0.60 [-6.37, 7.57], P_{MD}=0.866 I^2=, P_Q=	0.60 [-3.44, 4.64], P_{MD}=0.771 I^2=, P_Q=

Mixed sources (with SSBs) (2/3)	2.77 [1.97, 3.57], P_{MD}<0.001 I^2=0.0%, P_Q=0.953	2.76 [1.83, 3.69], P_{MD}<0.001 I^2=0.0%, P_Q=0.965	2.77 [2.14, 3.41], P_{MD}<0.001 I^2=0.0%, P_Q=0.917
Subtraction (4/13)	**-0.96 [-1.78, -0.14], P_{MD}=0.022 I^2=69.0%, P_Q<0.001**	**-0.98 [-1.81, -0.16], P_{MD}=0.020 I^2=67.9%, P_Q<0.001**	**-0.94 [-1.75, -0.12], P_{MD}=0.024 I^2=71.0%, P_Q<0.001**
SSB (0/7)	-0.44 [-1.22, 0.34], P_{MD}=0.269 I^2=0.0%, P_Q=0.996	NA	NA
Mixed sources (with SSBs) (4/6)	-1.30 [-2.54, -0.06], P_{MD}=0.040 I^2=83.0%, P_Q<0.001	-1.35 [-2.60, -0.10], P_{MD}=0.035 I^2=81.8%, P_Q<0.001	-1.24 [-2.47, -0.02], P_{MD}=0.047 I^2=85.0%, P_Q<0.001
***Ad libitum* (9*/12)**	**0.77 [-0.29, 1.82], P_{MD}=0.154 I^2=79.9%, P_Q<0.001**	**0.72 [-0.25, 1.69], P_{MD}=0.145 I^2=75.4%, P_Q<0.001**	**0.65 [-0.49, 1.79], P_{MD}=0.263 I^2=87.5%, P_Q<0.001**
Sweets and Desserts (1/1)	-0.80 [-5.59, 3.99], P_{MD}=0.743 I^2=, P_Q=	-0.80 [-6.66, 5.06], P_{MD}=0.789 I^2=, P_Q=	-0.80 [-4.19, 2.59], P_{MD}=0.644 I^2=, P_Q=
Mixed sources (with SSBs) (7*/10)	0.41 [0.09, 0.73], P_{MD}=0.012 I^2=0·0%, P_Q=0.520	0.43 [0.10, 0.75], P_{MD}=0.009 I^2=0.0%, P_Q=0.612	0.35 [-0.15, 0.84], P_{MD}=0.167 I^2=11.3%, P_Q=0.339
Mixed sources (without SSBs) (1/1)	3.10 [2.39, 3.81], P_{MD}<0.001 I^2=, P_Q=	3.10 [2.25, 3.95], P_{MD}<0.001 I^2=, P_Q=	3.10 [2.58, 3.62], P_{MD}<0.001 I^2=, P_Q=

CI, confidence interval; MD, mean difference; no., number; SSB, sugar sweetened beverage
*For one crossover trial, a correlation coefficient was not used since a p-value was provided for the mean difference between treatment changes.

Supplementary Table 6: Summary of sensitivity analysis of the removal of the 5 trial comparisons (3 reports) that reported non-mean summary statistics which were using to estimate means*

	Original mean (95% CI)	**Sensitivity analysis* mean (95% CI)**
Body Weight (kg)		
Substitution trials		
Total fructose-containing sugars (removed N=2)	0.04, (-0.07, 0.16), P=0.469 I^2=2.7%, P=0.401 P-interaction<0.001	0.06 (-0.06, 0.18), P=0.348 I^2=4.3%, P=0.35 P-interaction<0.001
Mixed sources (with SSBs) (removed N=2)	0.27 (0.09, 0.45), P=0.003 I^2=0.0%, P=0.675	0.27 (0.09, 0.45), P=0.003 I^2=0.00%, P=0.59
Addition trials		
Total fructose-containing sugars (removed N=3)	0.28 (0.06, 0.50), P=0.011 I^2=57.4%, P<0.001 P-interaction<0.001	0.28 (0.06, 0.51) P=0.012 I^2=58.8%, P<0.001 P-interaction<0.001
SSB (removed N=2)	0.49 (0.24, 0.74), P<0.001 I^2=40.0%, P=0.029 Linear dose response per serving (8%E): 1.04 (0.54, 1.54), P-linear<0.001	0.49 (0.23, 0.76) P<0.001 I^2=46.4%, P=0.01 Linear dose response per serving (8%E): 1.06 (0.56, 1.58), P-linear<0.001
Sweets & desserts (removed N=1)	0.08 (-0.61, 0.77), P=0.818 I^2=0.0%, P=0.886	0.12 (-1.78, 2.02) P=0.901 I^2=0.0%, P=0.73
BMI (kg/m^2)		
Substitution trials		
Total fructose-containing sugars (removed N=2)	-0.01 (-0.07, 0.05), P=0.629 I^2=0.0%, P=0.77 P-interaction=0.005	-0.02 (-0.08, 0.05), P=0.623 I^2=0.0%, P=0.72 P-interaction=0.05
Mixed sources (with SSBs) (removed N=2)	0.16 (0.05, 0.27), P=0.004 I^2=0.0%, P=0.911	0.16 (0.05, 0.27), P=0.004 I^2=0.0%, P=0.84
Addition trials		
Total fructose-containing sugars (removed N=3)	-0.01 (-0.07, 0.05), P=0.629 I^2=40.2%, P<0.001 P-interaction<0.001	0.16 (0.03, 0.29) P=0.016 I^2=42.4%, P<0.001 P-interaction<0.001
SSB (removed N=2)	0.21 (0.09, 0.33), P<0.001 I^2=0.0%, P=0.504 Linear dose response per serving (8%E): 0.46 (0.20, 0.70), P-linear<0.001	0.24 (0.10, 0.39) P=0.001 I^2=6.3%, P=0.38 Linear dose response per serving (8%E): 0.48 (0.216, 0.736), P-linear<0.001
Sweets & desserts (removed N=1)	0.01 (-0.46, 0.47), P=0.977 I^2=0.0%, P=0.871	-0.11 (-0.67, 0.45) P=0.696 I^2=0.0%, P=0.92
Body Fat (%)		

Substitution trials		
Total fructose-containing sugars (removed N=2)	-0.06 (-0.29, 0.17), P=0.615 I^2=0.0%, P=0.971 P-interaction=0.57	-0.07 (-0.30, 0.16), P=0.569 I^2=0.0%, P=0.97 P-interaction=0.61
Mixed sources (with SSBs) (removed N=2)	n/a (no interaction by food sources)	n/a (no interaction by food sources)
Addition trials		
Total fructose-containing sugars (removed N=3)	0.45 (0.11, 0.78), P=0.009 I^2=9.4%, P=0.319 P-interaction=0.003	0.39 (0.02, 0.75) P=0.037 I^2=16.63% P=0.22 P-interaction<0.001
SSB (removed N=2)	-0.16 (-1.04, 0.72), P=0.721 I^2=0.0%, P=0.979	-0.20 (-1.09, 0.69) P=0.661 I^2=0.00%, P=0.98
Sweets & desserts (removed N=1)	0.29 (-4.73, 5.32), P=0.909	n/a (only 1 trial comparison)
Waist circumference (cm)		
Substitution trials		
Total fructose-containing sugars (removed N=2)	-0.19 (-0.44, 0.06), P=0.142 I^2=0.0%, P=0.92 P-interaction=0.62	-0.19 (-0.44, 0.07), P=0.148 I^2=0.0%, P=0.88 P-interaction=0.62
Mixed sources (with SSBs) (removed N=2)	n/a (no interaction by food sources)	n/a (no interaction by food sources)
Addition trials		
Total fructose-containing sugars (removed N=1)	0.20 (-0.33, 0.74), P=0.454 I^2=39.6%, P=0.011 P-interaction<0.001	0.31 (-0.22, 0.85) P=0.249 I^2=29.6%, P=0.06 P-interaction=0.01
Sweets & desserts (removed N=1)	-0.64 (-1.34, 0.06), P=0.072 I^2=0.0%, P=0.545	0.72 (-1.83, 3.26) P=0.582 I^2=0.0%, P=0.84
Waist-to-hip ratio (:)		
Substitution trials		
Total fructose-containing sugars (removed N=2)	0.002 (-0.001, 0.005), P=0.249 I^2=0.0%, P=0.967 P-interaction=0.379	0.002 (-0.001, 0.005), P=0.241 I^2=0.0%, P=0.944 P-interaction=0.35
Mixed sources (with SSBs) (removed N=2)	0.008 (0.001, 0.014), P=0.028 I^2=0.0%, P=0.922	0.008 (0.001, 0.015), P=0.023 I^2=0.0%, P=0.860

*Sensitivity analyses for the removal of trials which did not report a mean, but reported summary statistics (e.g.medians, interquartile ranges, minimum, maximum and/or 95% confidence intervals) which were used to estimate means and SEs for inclusion in the meta-analysis. Removal in substitution trials included Volp et al. 2007 (2 trial comparisons, under the food source mixed sources (with SSBs)), and in addition trials, included Sanchez-Delgado et al. 2021 (2 trial comparisons, under the food source 'SSB') and Ayoobi et al. 2017 (1 trial comparison, under the food source 'sweets & desserts')

BMI, body mass index; CI, confidence interval; SSB, sugar sweetened beverage

Supplementary Table 7: Sensitivity analyses of the use of correlation coefficients of 0.25 and 0.75 for crossover trials in the primary analysis of the effect of important food sources of fructose-containing sugars on BMI (kg/m^2) and by food source

	MD (95% CI), P-value **I^2, P-value**		
	Correlation Coefficient **used in the Primary Analysis**	Correlation Coefficient used in **Sensitivity Analyses**	
Energy Design and Food Source (no. crossover trial comparisons/total)	**0.5**	**0.25**	**0.75**
BMI (kg/m^2)			
Substitution (25/70)	**-0.01 [-0.07, 0.05], P_{MD}=0.629 I^2=0.0%, P_Q=0.770**	**-0.02 [-0.08, 0.04], P_{MD}=0.569 I^2=0.0%, P_Q=0.816**	**0.00 [-0.06, 0.05], P_{MD}=0.897 I^2=0.0%, P_Q=0.586**
SSB (5/11)	-0.16 [-0.43, 0.11], P_{MD}=0.244 I^2=0.0%, P_Q=0.994	-0.17 [-0.45, 0.12], P_{MD}=0.245 I^2=0.0%, P_Q=0.995	-0.14 [-0.37, 0.09], P_{MD}=0.234 I^2=0.0%, P_Q=0.989
Sweetened dairy (0/3)	0.13 [-0.73, 0.99], P_{MD}=0.763 I^2=0.0%, P_Q=0.971	NA	NA
Sweetened dairy alternatives (soy) (0/1)	-0.03 [-0.30, 0.24], P_{MD}=0.829 I^2= , P_Q=	NA	NA
100% Fruit juice (0/2)	0.41 [-0.17, 0.98], P_{MD}=0.164 I^2=0.0%, P_Q=0.390	NA	NA
Fruit drink (1*/4)	-0.17 [-0.56, 0.22], P_{MD}=0.384 I^2=46.7%, P_Q=0.131	NA	NA
Fruit (2/9)	-0.21 [-0.39, -0.02], P_{MD}=0.032 I^2=0.0%, P_Q=0.923	-0.20 [-0.39, -0.01], P_{MD}=0.043 I^2=0.0%, P_Q=0.879	-0.18 [-0.35, 0.00], P_{MD}=0.045 I^2=0.0%, P_Q=0.794
Dried Fruit (2/5)	0.12 [-0.25, 0.48], P_{MD}=0.533 I^2=0.0%, P_Q=0.892	0.15 [-0.26, 0.56], P_{MD}=0.479 I^2=0.0%, P_Q=0.910	0.07 [-0.21, 0.35], P_{MD}=0.635 I^2=0.0%, P_Q=0.865
Mixed fruit forms (0/1)	-0.11 [-0.26, 0.04], P_{MD}=0.151 I^2= , P_Q=	NA	NA
Sweetened cereal grains and bars (1*/3)	0.16 [-0.13, 0.46], P_{MD}=0.283 I^2=0.0%, P_Q=0.972	NA	NA
Sweets and desserts (4**/6)	-0.01 [-0.19, 0.17], P_{MD}=0.897 I^2=0.0%, P_Q=0.537	NA	NA
Added nutritive (caloric) sweetener (0/1)	-0.10 [-0.49, 0.29], P_{MD}=0.612 I^2= , P_Q=	NA	NA
Mixed sources (with SSBs) (9/22)	0.16 [0.05, 0.27], P_{MD}=0.004 I^2=0.0%, P_Q=0.911	0.16 [0.05, 0.28], P_{MD}=0.005 I^2=0.0%, P_Q=0.943	0.15 [0.06, 0.24], P_{MD}=0.002 I^2=0.0%, P_Q=0.786
Mixed sources (without SSBs) (1/2)	0.62 [-1.08, 2.32], P_{MD}=0.474 I^2=36.8%, P_Q=0.208	0.69 [-1.05, 2.43], P_{MD}=0.434 I^2=28.8%, P_Q=0.236	0.55 [-1.10, 2.19], P_{MD}=0.514 I^2=44.8%, P_Q=0.178
Addition (25/82)	**0.16 [0.03, 0.28], P_{MD}=0.012 I^2=40.2%, P_Q<0.001**	**0.16 [0.04, 0.28], P_{MD}=0.012 I^2=33.8%, P_Q=0.002**	**0.16 [0.03, 0.28], P_{MD}=0.017 I^2=51.3%, P_Q<0.001**
SSB (9/21)	0.21 [0.09, 0.33], P_{MD}<0.001 I^2=0.0%, P_Q=0.504	0.23 [0.10, 0.35], P_{MD}<0.001 I^2=0.0%, P_Q=0.534	0.19 [0.08, 0.30], P_{MD}=0.001 I^2=0.0%, P_Q=0.460
100% Fruit juice (5/14)	-0.21 [-0.42, 0.01], P_{MD}=0.050 I^2=12.0%, P_Q=0.326	-0.22 [-0.44, -0.01], P_{MD}=0.043 I^2=9.5%, P_Q=0.349	-0.20 [-0.42, 0.01], P_{MD}=0.065 I^2=14.9%, P_Q=0.290
Fruit Drink (1/12)	0.57 [0.40, 0.74], P_{MD}<0.001 I^2=0.0% , P_Q=0.882	0.55 [0.36, 0.74], P_{MD}<0.001 I^2=0.0%, P_Q=0.902	0.60 [0.46, 0.75], P_{MD}<0.001 I^2=0.0%, P_Q=0.849
Fruit (4/15)	-0.06 [-0.23, 0.11], P_{MD}=0.500 I^2=0.0%, P_Q=0.955	-0.06 [-0.23, 0.11], P_{MD}=0.489 I^2=0.0%, P_Q=0.958	-0.05 [-0.22, 0.11], P_{MD}=0.531 I^2=0.0%, P_Q=0.948
Dried fruit (4/8)	-0.45 [-1.37, 0.46], P_{MD}=0.332 I^2=22.2%, P_Q=0.253	-0.50 [-1.45, 0.45], P_{MD}=0.302 I^2=19.3%, P_Q=0.277	-0.37 [-1.20, 0.46], P_{MD}=0.383 I^2=28.3%, P_Q=0.203
Sweetened cereal grains and bars (0/2)	0.20 [-0.45, 0.85], P_{MD}=0.546 I^2=14.8%, P_Q=0.279	NA	NA
Sweets and desserts (1/4)	0.01 [-0.46, 0.47], P_{MD}=0.977 I^2=0.0%, P_Q=0.871	0.01 [-0.47, 0.48], P_{MD}=0.975 I^2=0.0%, P_Q=0.871	0.01 [-0.42, 0.43], P_{MD}=0.978 I^2=0.0%, P_Q=0.871
Honey (0/4)	0.13 [-1.04, 1.29], P_{MD}=0.831	NA	NA

	I^2=0.0%, P_Q=0.970		
Mixed sources (with SSBs) (1/2)	0.90 [0.58, 1.22], P_{MD}<0.001 I^2=0.0% , P_Q=1.000	0.90 [0.54, 1.26], P_{MD}<0.001 I^2=0.0%, P_Q=1.000	0.90 [0.64, 1.16], P_{MD}<0.001 I^2=0.0%, P_Q=1.000
Subtraction (0/5)	**-0.57 [-1.37, 0.22], P_{MD}=0.157 I^2=80.7%, P_Q<0.001**	**NA**	**NA**
SSB (0/3)	-0.45 [-2.66, 1.77], P_{MD}=0.694 I^2=0.0%, P_Q=0.965	NA	NA
Mixed sources (with SSBs) (0/2)	-0.59 [-1.51, -0.33], P_{MD}=0.210 I^2=95.2%, P_Q<0.001	NA	NA
***Ad libitum* (1/4)**	**0.13 [-0.09, 0.35], P_{MD}=0.239 I^2=0.0%, P_Q=0.431**	**NA**	**NA**
Mixed sources (with SSBs) (1*/4)	0.13 [-0.09, 0.35], P_{MD}=0.239 I^2=0.0%, P_Q=0.431	NA	NA

CI, confidence interval; BMI, body mass index; MD, mean difference; no., number; SSB, sugar sweetened beverage

*For this crossover trial, a correlation coefficient was not used since a P-value was provided for the mean difference between treatment changes.

** For the 4 crossover trial comparisons, from Reiser et al. 1981, the correlation coefficient was not used because the SE_{MD} was borrowed.

Supplementary Table 8: Sensitivity analyses of the use of correlation coefficients of 0.25 and 0.75 for crossover trials in the primary analysis of the effect of important food sources of fructose-containing sugars on body fat (%) and by food source

	MD (95% CI), P-value **I^2, P-value**		
	Correlation Coefficient **used in the Primary Analysis**	Correlation Coefficient used in **Sensitivity Analyses**	
Energy Design and Food Source (no. crossover trial comparisons/total)	**0.5**	**0.25**	**0.75**
Body Fat (%)			
Substitution (13/35)	**-0.06 [-0.29, 0.17], P_{MD}=0.615 I^2=0.0%, P_Q=0.971**	**-0.10 [-0.33, 0.13], P_{MD}=0.393 I^2=0.0%, P_Q=0.964**	**-0.10 [-0.30, 0.09], P_{MD}=0.308 I^2=0.0%, P_Q=0.937**
Addition (9/30)	**0.45 [0.11, 0.78], P_{MD}=0.009 I^2=9.4%, P_Q=0.319**	**0.54 [0.24, 0.84], P_{MD}<0.001 I^2=0.0%, P_Q=0.533**	**0.26 [-0.13, 0.65], P_{MD}=0.183 I^2=32.3%, P_Q=0.047**
SSB (5/9)	-0.16 [-1.04, 0.72], P_{MD}=0.721 I^2=0.0%, P_Q=0.979	-0.12 [-1.15, 0.92], P_{MD}=0.823 I^2=0.0%, P_Q=0.988	-0.21 [-0.86, 0.44], P_{MD}=0.527 I^2=0.0%, P_Q=0.937
100% Fruit juice (2/6)	-0.71 [-1.74, 0.32], P_{MD}=0.176 I^2=16.7%, P_Q=0.306	-0.79 [-1.82, 0.25], P_{MD}=0.139 I^2=12.5%, P_Q=0.335	-0.58 [-1.57, 0.41], P_{MD}=0.253 I^2=24.8%, P_Q=0.248
Fruit drink (1*/7)	0.59 [0.16, 1.02], P_{MD}=0.007 I^2=0.0%, P_Q=0.972	NA	NA
Fruit (0/2)	0.24 [-1.44, 1.92], P_{MD}=0.780 I^2=0.0%, P_Q=0.603	NA	NA
Dried fruit (0/2)	-1.78 [-7.52, 3.95], P_{MD}=0.542 I^2=0.0%, P_Q=0.721	NA	NA
Sweetened cereal grains and bars (0/1)	0.80 [-2.14, 3.74], P_{MD}=0.594 I^2= , P_Q=	NA	NA
Sweets and desserts (0/1)	0.29 [-4.73, 5.32], P_{MD}=0.909 I^2= , P_Q=	NA	NA
Mixed sources (with SSBs) (1/2)	1.36 [0.85, 1.87], P_{MD}<0.001 I^2=0.0%, P_Q=0.385	1.34 [0.74, 1.94], P_{MD}<0.001 I^2=0.0%, P_Q=0.389	1.38 [0.99, 1.76], P_{MD}<0.001 I^2=0.0%, P_Q=0.382
Subtraction (0/2)	**-0.64 [-1.53, 0.24], P_{MD}=0.152 I^2=66.4%, P_Q=0.085**	**NA**	**NA**
SSB (0/2)	-0.64 [-1.53, 0.24], P_{MD}=0.152 I^2=66.4%, P_Q=0.085	NA	NA
***Ad libitum* (1/2)**	**0.07 [-0.18, 0.32], P_{MD}=0.595 I^2=24.6%, P_Q=0.249**	**NA**	**NA**
Mixed sources (with SSBs) (1*/2)	0.07 [-0.18, 0.32], P_{MD}=0.595 I^2=24.6%, P_Q=0.249	NA	NA

CI, confidence interval; MD, mean difference; no., number; SSB, sugar sweetened beverage
*For this crossover trial, a correlation coefficient was not used since a P-value was provided for the mean difference between treatment changes.

Supplementary Table 9: Sensitivity analyses of the use of correlation coefficients of 0.25 and 0.75 for crossover trials in the primary analysis of the effect of important food sources of fructose-containing sugars on waist circumference (cm) and by food source

	MD (95% CI), P-value **I^2, P-value**		
	Correlation Coefficient **used in the Primary Analysis**	Correlation Coefficient used in **Sensitivity Analyses**	
Energy Design and Food Source (no. crossover trial comparisons/total)	**0.5**	**0.25**	**0.75**
Waist Circumference (cm)			
Substitution (12/44)	**-0.19 [-0.44, 0.06], P_{MD}=0.142 I^2=0.0%, P_Q=0.142**	**-0.19 [-0.45, 0.06], P_{MD}=0.134 I^2=0.0%, P_Q=0.856**	**-0.24 [-0.48, 0.00], P_{MD}=0.049 I^2=0.0%, P_Q=0.745**
Addition (10/33)	**0.02 [-0.33, 0.74], P_{MD}=0.454 I^2=39.6%, P_Q=0.011**	**0.23 [-0.22, 0.68], P_{MD}=0.314 I^2=15.2%, P_Q=0.223**	**0.34 [-0.25, 0.93], P_{MD}=0.256 I^2=54.6%, P_Q<0.001**
SSB (4/8)	0.16 [-0.92, 1.23], P_{MD}=0.777 I^2=0.0%, P_Q=1.000	0.12 [-1.09, 1.32], P_{MD}=0.850 I^2=0.0%, P_Q=1.000	0.21 [-0.64, 1.06], P_{MD}=0.622 I^2=0.0%, P_Q=0.999
100% Fruit juice (1/9)	-0.35 [-1.29, 0.58], P_{MD}=0.457 I^2=0.0%, P_Q=0.999	-0.34 [-1.32, 0.65], P_{MD}=0.501 I^2=0.0%, P_Q=0.999	-0.37 [-1.24, 0.50], P_{MD}=0.399 I^2=0.0%, P_Q=0.999
Fruit Drink (2/3)	1.39 [-0.17, 2.95], P_{MD}=0.081 I^2=47.0%, P_Q=0.153	1.73 [0.90, 2.55], P_{MD}<0.001 I^2=43.8%, P_Q=0.169	1.92 [1.36, 2.50], P_{MD}<0.001 I^2=49.7%, P_Q=0.137
Fruit (0/5)	0.03 [-0.80, 0.86], P_{MD}=0.944 I^2=0.0%, P_Q=0.658	NA	NA
Sweetened cereal grains and bars (1*/3)	-0.58 [-1.58, 0.43], P_{MD}=0.261 I^2=18.1%, P_Q=0.295	NA	NA
Sweets and desserts (1/3)	-0.64 [-1.34, 0.06], P_{MD}=0.072 I^2=0.0%, P_Q=0.545	-0.66 [-1.36, 0.05], P_{MD}=0.067 I^2=0.0%, P_Q=0.588	-0.59 [-1.28, 0.09], P_{MD}=0.089 I^2=0.0%, P_Q=0.439
Honey (0/1)	-0.30 [-4.90, 4.30], P_{MD}=0.898 I^2= , P_Q=	NA	NA
Mixed sources (with SSBs) (1/1)	3.40 [1.60, 5.20], P_{MD}<0.001 I^2=, P_Q=	3.40 [1.22, 5.58], P_{MD}=0.002 I^2=, P_Q=	3.40 [2.10, 4.70], P_{MD}<0.001 I^2=, P_Q=
Subtraction (0/5)	**-1.79 [-3.53, -0.05], P_{MD}=0.044 I^2=91.1%, P_Q<0.001**	**NA**	**NA**
SSB (0/3)	-0.76 [-2.21, 0.68], P_{MD}=0.301 I^2=49.6%, P_Q=0.137	NA	NA
Mixed sources (with SSBs) (0/2)	-2.83 [-5.31, -0.35], P_{MD}=0.025 I^2=94.7%, P_Q<0.001	NA	NA
***Ad libitum* (0/1)**	**4.10 [-1.05, 9.25], P_{MD}=0.118 I^2= , P_Q=**	**NA**	**NA**
Mixed sources (with SSBs) (0/1)	4.10 [-1.05, 9.25], P_{MD}=0.118 I^2= , P_Q=	NA	NA

CI, confidence interval; MD, mean difference; no., number; SSB, sugar sweetened beverage
*For this crossover trial, a correlation coefficient was not used since a P-value was provided for the mean difference between treatment changes.

Supplementary Table 10: Sensitivity analyses of the use of correlation coefficients of 0.25 and 0.75 for crossover trials in the primary analysis of the effect of important food sources of fructose-containing sugars on waist-to-hip ratio and by food source

	MD (95% CI), P-value **I^2, P-value**		
	Correlation Coefficient **used in the Primary Analysis**	Correlation Coefficient used in **Sensitivity Analyses**	
Energy Design and Food Source (no. crossover trial comparisons/total)	**0.5**	**0.25**	**0.75**
Waist-to-Hip Ratio (:)			
Substitution (5/23)	**0.00 [0.00, 0.01], P_{MD}=0.249 I^2=0.0%, P_Q=0.967**	**0.00 [0.00, 0.01], P_{MD}=0.244 I^2=0.0%, P_Q=0.985**	**0.00 [0.00, 0.01], P_{MD}=0.190 I^2=0.0%, P_Q=0.894**
SSB (3/5)	0.01 [0.0, 0.02], P_{MD}=0.193 I^2=0.0%, P_Q=0.910	0.01 [-0.01, 0.02], P_{MD}=0.277 I^2=0.0%, P_Q=0.947	0.01 [0.00, 0.01], P_{MD}=0.072 I^2=0.0%, P_Q=0.778
100% Fruit juice (0/1)	0.00 [-0.04, 0.04], P_{MD}=1.000 I^2= , P_Q=	NA	NA
Fruit (1/4)	0.00 [0.00, 0.00], P_{MD}=0.757 I^2=0.0%, P_Q=0.465	0.00 [0.00, 0.00], P_{MD}=0.848 I^2=0.0%, P_Q=0.555	0.00 [-0.01, 0.00], P_{MD}=0.658 I^2=8.0%, P_Q=0.353
Dried Fruit (0/3)	0.00 [-0.03, 0.03], P_{MD}=0.963 I^2=0.0%, P_Q=0.977	NA	NA
Sweetened cereal grains and bars (1/2)	0.00 [-0.01, 0.01], P_{MD}=0.998 I^2=0.0%, P_Q=0.921	0.00 [-0.02, 0.02], P_{MD}=0.997 I^2=0.0%, P_Q=0.921	0.00 [-0.01, 0.01], P_{MD}=0.998 I^2=0.0%, P_Q=0.921
Mixed sources (with SSBs) (0/8)	0.01 [0.00, 0.01], P_{MD}=0.028 I^2=0.0%, P_Q=0.922	NA	NA
Addition (10/18)	**0.00 [0.00, 0.00], P_{MD}=0.232 I^2=0.0%, P_Q=0.920**	**0.00 [0.00, 0.00], P_{MD}=0.412 I^2=0.0%, P_Q=0.984**	**0.00 [0.00, 0.01], P_{MD}=0.052 I^2=0.0%, P_Q=0.565**
SSB (3/5)	0.01 [-0.01, 0.02], P_{MD}=0.322 I^2=0.0%, P_Q=0.558	0.01 [-0.01, 0.02], P_{MD}=0.547 I^2=0.0%, P_Q=0.652	0.01 [0.00, 0.02], P_{MD}=0.062 I^2=0.0%, P_Q=0.409
100% Fruit juice (5/6)	0.01 [0.00, 0.01], P_{MD}=0.012 I^2=0.0%, P_Q=0.993	0.01 [0.00, 0.02], P_{MD}=0.039 I^2=0.0%, P_Q=0.997	0.01 [0.00, 0.01], P_{MD}=0.001 I^2=0.0%, P_Q=0.971
Fruit (2/4)	0.00 [0.00, 0.00], P_{MD}=0.934 I^2=0.0%, P_Q=0.972	0.00 [0.00, 0.00], P_{MD}=0.950 I^2=0.0%, P_Q=0.979	0.00 [0.00, 0.00], P_{MD}=0.896 I^2=0.0%, P_Q=0.953
Sweetened cereal grains and bars (0/1)	0.01 [-0.26, 0.28], P_{MD}=0.942 I^2= , P_Q=	NA	NA
Sweets and desserts (0/1)	0.00 [-0.03, 0.03], P_{MD}=1.000 I^2= , P_Q=	NA	NA
Mixed sources (with SSBs) (0/1)	0.00 [-0.03, 0.03], P_{MD}=1.000 I^2= , P_Q=	NA	NA
Subtraction (0/2)	**-0.01 [-0.01, -0.01], P_{MD}<0.001 I^2=0.0%, P_Q=0.695**	**NA**	**NA**
Mixed sources (with SSBs) (0/2)	-0.01 [-0.01, -0.01], P_{MD}<0.001 I^2=0.0%, P_Q=0.695	NA	NA
***Ad libitum* (0/1)**	**0.00 [-0.03, 0.03], P_{MD}=1.00 I^2= , P_Q=**	**NA**	**NA**
Mixed sources (with SSBs) (0/1)	0.00 [-0.03, 0.03], P_{MD}=1.00 I^2= , P_Q=	NA	NA

CI, confidence interval; MD, mean difference; no., number; SSB, sugar sweetened beverage

Supplementary Table 11: GRADE certainty of evidence assessment for the effect of total fructose-containing sugars on markers of adiposity by trial energy control

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias (ROB)	Downgrades: Inconsistency	Downgrades: Indirectness	Downgrades: Imprecision	Downgrades: Publication bias	Upgrades: Dose response		Effect (MD [95% CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
Body weight (kg)											
Substitution (119)	Randomized and non-randomized trials	Serious[1]	Not serious	Very serious[2]	Not serious	None[3]	None	↔	0.04 [-0.07, 0.16], P=0.469	⨁◯◯◯ Very low	No effect
Addition (90)	Randomized and non-randomized trials	Not serious[4]	Not serious[5]	Very serious[2]	Serious[6]	None	Linear DR, no upgrade[7]	↑	0.28 [0.06, 0.50], P=0.011	⨁◯◯◯ Very low	Trivial
Subtraction (13)	Randomized and non-randomized trials	Not serious	Not serious[8]	Very serious[9]	Serious[6]	None	None	↓	-0.96 [-1.78, -0.14], P=0.022	⨁◯◯◯ Very low	Small important
Ad libitum (12)	Randomized and non-randomized trials	Not serious	Not serious[10]	Very serious[2]	Serious[6]	None	None	↔	0.77 [-0.29, 1.82], P=0.154	⨁◯◯◯ Very low	No effect
BMI (kg/m^2)											
Substitution (70)	Randomized and non-randomized trials	Not serious[11]	Not serious	Very serious[2]	Not serious	None[12]	None	↔	-0.01 [-0.07, 0.05], P=0.629	⨁⨁◯◯ Low	No effect
Addition (82)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[2]	Serious[13]	None	Linear DR, no upgrade[14]	↑	0.16 [0.03, 0.28], P=0.012	⨁◯◯◯ Very low	Trivial
Subtraction (5)	Randomized trials	Not serious	Serious[15]	Very serious[8]	Serious[12]	None[16]	None[17]	↔	-0.57 [-1.37, 0.22], P=0.157	⨁◯◯◯ Very low	No effect
Ad libitum (4)	Randomized trials	Not serious	Not serious	Very serious[8]	Serious[12]	None[16]	None[17]	↔	0.13 [-0.09, 0.35], P=0.239	⨁◯◯◯ Very low	No effect
Body fat (%)											
Substitution (35)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None	None	↔	-0.06 [-0.29, 0.17], P=0.615	⨁⨁⨁⨁ High	No effect
Addition (30)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[2]	Serious[18]	None	Linear DR, no upgrade[19]	↑	0.45 [0.11, 0.78], P=0.009	⨁◯◯◯ Very low	Trivial

Subtraction (2)	Randomized trials	Not serious	Serious[20]	Very serious[8]	Serious[21]	None[16]	None[17]	↔	-0.64 [-1.53, 0.24], P=0.152	⨁◯◯◯ Very low	No effect
Ad libitum (2)	Randomized trials	Not serious	Not serious	Very serious[8]	Not serious	None[16]	None[17]	↔	0.07 [-0.18, 0.32], P=0.595	⨁⨁◯◯ Low	No effect
Waist circumference (cm)											
Substitution (44)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[22]	None	None	↔	-0.19 [-0.44, 0.06], P=0.142	⨁⨁⨁◯ Moderate	No effect
Addition (33)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[2]	Not serious	None	Linear DR, no upgrade[23]	↔	0.20 [-0.33, 0.74], P=0.454	⨁⨁◯◯ Low	No effect
Subtraction (5)	Randomized trials	Not serious	Not serious[24]	Very serious[8]	Serious[25]	None[16]	None[17]	↓	-1.79 [-3.53, -0.05], P=0.044	⨁◯◯◯ Very low	Moderate
Ad libitum (1)	Randomized trial	Not serious	Not serious	Very serious[8]	Serious[25]	None[16]	None[17]	↔	4.10 [-1.05, 9.25], P=0.118	⨁◯◯◯ Very low	No effect
Waist-to-hip ratio											
Substitution (23)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[26]	Not serious	None	None	↔	0.002 [-0.001, 0.005], P=0.249	⨁⨁◯◯ Low	No effect
Addition (18)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[26]	Serious[27]	None	None	↔	0.001 [-0.001, 0.004], P=0.232	⨁◯◯◯ Very low	No effect
Subtraction (2)	Randomized trials	Not serious	Not serious	Very serious[8]	Not serious	None[16]	None[17]	↓	-0.009 [-0.014, -0.005], P<0.001	⨁⨁◯◯ Low	Trivial
Ad libitum (1)	Randomized trial	Not serious	Not serious	Very serious[8]	Serious[28]	None[16]	None[17]	↔	0.000 [-0.032, 0.032], P=1.00	⨁◯◯◯ Very low	No effect
Visceral adipose tissue (VAT)*											
Substitution (6)	Randomized and non-randomized trials	Not serious	Not serious	Very serious[29]	Serious[30]	None[16]	None[17]	↔	SMD: 0.19 [-0.51, 0.89], P=0.590	⨁◯◯◯ Very low	No effect
Addition (2)	Non-randomized trials	Serious[31]	Serious[32]	Very serious[8]	Serious[30]	None[16]	None[17]	↔	SMD: 1.31 [-1.56, 4.18], P=0.370	⨁◯◯◯ Very low	No effect
Subtraction (2)	Randomized trials	Not serious	Not serious	Very serious[8]	Serious[30]	None[16]	None[17]	↔	MD: -86.06cm^3 [-273.07, 100.94], P=0.367 SMD: -0.64 [-2.02, 0.75], P=0.367	⨁◯◯◯ Very low	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (ROB) (downgraded if the majority of trials were considered to be at high ROB); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.
[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).
*For VAT, results were reported as standardized mean differences

CI, confidence interval; DR, dose response; MD, mean difference; MID, minimally important difference; NSB, non-nutritive sweetened beverage; ROB, risk of bias; SMD, standardized mean difference; VAT, visceral adipose tissue

[1] Downgrade for serious ROB since the overall pooled estimate was driven by high ROB trials. The "other" risk of bias category of subgroup analyses (which compares high risk of bias due to crossover without washout to low risk of bias from crossover trials with a wash out phase, or parallel trials) was significant where high risk of bias showed a non-significant reduction and low ROB trials showed a significant increase in body weight, and randomization subgroup was significant where randomized trials showed a significant increase while non-randomized trials showed a non-significant decrease, it was judged that these sources of risk of bias were a serious concern since the inclusion of the high ROB trials altered the direction, magnitude or significance of the pooled estimate of effect which showed no overall effect.
[2] Double downgrade for very serious indirectness as there was a significant interaction by food source (P<0.1) indicating that there is biological plausibility of differences in behaviour of foods due to the food matrices.
[3] Although a significant publication bias was detected at P=0.037 in Egger's test, we did not downgrade for publication bias as the imputation of 3 trials from trim-and-fill analyses did not change the significance on the overall effect (Original MD: 0.04kg; 95% CI: -0.07, 0.16, P=0.469; imputed MD: 0.08kg; 95% CI: -0.06, 0.22, P=0.265).
[4] No downgrade for serious risk of bias since the overall pooled estimate was not driven by high ROB trials. There was significant effect modification by allocation concealment (P<0.001) and although high ROB for this domain resulted in a significant increase in body weight whereas trials rated compared to low ROB trials for this domain which resulted in a significant reduction in body weight, the largest proportion of trials were rated as unclear ROB which also showed a significant increase in body weight. Overall, this source of risk of bias did not alter the direction, magnitude and significance of the pooled estimate of the effect which showed a significant increase.
[5] No downgrade for serious inconsistency. The evidence for substantial heterogeneity was driven by food source (P<0.001 for interaction) for which a double downgrade was already made. The significant interaction of food source also altered the evidence for substantial heterogeneity to non-substantial heterogeneity (Original: I^2=57.4%, P_Q<0.001; residual I^2=18%, P_Q=0.078).
[6] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and benefit for body weight (0.5kg).
[7]Although a significant dose response was detected (P_{linear}<0.001), we did not upgrade for dose response as we detected a significant test for interaction by food source (P<0.001), with SSBs and 100% fruit juice driving the signal for dose response.

[8] Although there was substantial heterogeneity in the analysis of the effect of total fructose containing sugars on body weight in subtraction trials, we did not downgrade for serious inconsistency, since it was partially explained when the study by Mann et al. 1974 was removed as part of a priori sensitivity analyses (Original: I^2=69%, P_Q<0.001; after study removed: I^2=47%, P_Q=0.034).
[9] Double downgrade for very serious indirectness as there was only one or two food sources available for analyses, thus limiting the ability to assess differences in food sources.
[10] No downgrade for serious inconsistency. The evidence for substantial heterogeneity was driven by food source (P<0.001 for interaction) for which a double downgrade was already made. The significant interaction of food source also altered the evidence for substantial heterogeneity to non-substantial heterogeneity (Original: I^2=80%, P_Q<0.001; residual I^2=0.0%, P_Q=0.520).
[11] No downgrade for serious ROB since the overall pooled estimate was not driven by high ROB trials. Although sequence generation, allocation concealment and the "other" risk of bias category of subgroup analyses (which compares high risk of bias due to crossover without washout to low risk of bias from crossover trials with a wash out phase, or parallel trials) were significant where high risk of bias showed a significant reduction and low or unclear ROB trials showed no effect in BMI, and the randomization subgroup was significant where non-randomized trials showed a significant reduction while randomized trials showed no effect, it was judged that these sources of risk of bias were not a serious concern since the inclusion of the high ROB trials did not alter the magnitude or significance of the pooled estimate of effect which showed no effect.
[12] Although a significant publication bias was detected at P=0.067 in Egger's test, we did not downgrade for publication bias as the imputation of 3 trials from trim-and-fill analyses did not change the significance on the overall effect (Original MD: -0.01kg/m^2; 95% CI: -0.07, 0.05, P=0.628; imputed MD: -0.02kg/m^2; 95% CI: -0.08, 0.04, P=0.537).
[13] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm or benefit for BMI (0.2kg/m^2).
[14] Although a significant dose response was detected (P_{linear}<0.001), we did not upgrade for dose response as we detected a significant test for interaction by food source (P<0.001), with SSBs, 100% fruit juice and dried fruit driving the signal for dose response.
[15] Downgrade for serious inconsistency. Although the removal of either Vazquez-Duran 2016 (NSB) or (water) explained heterogeneity (Original: I^2=81%, P<0.001; after study removal: I^2=0%, P=0.948 and 0.985, respectively), the removal of Vazquez-Duran et al. 2015 (NSB) also changed the magnitude and significance of the overall effect estimate.
[16] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[17] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[18] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Ahmad et al. 2020 (recalculated MD: 0.25%; 95% CI: -0.08, 0.58; P_{MD}=0.149) or Higgins et al. 2019 (sucralose) (recalculated MD: 0.37%; 95% CI: -0.00 to 0.75; P_{MD}=0.054). There was also a loss of significance in sensitivity analyses with the use of a correlation coefficient of 0.75 (P=0.183).
[19] Although a significant dose response was detected ($coef_{linear}$=0.074; 95% CI: 0.040, 0.109], P_{linear}<0.001), we did not upgrade for dose response as we detected a significant interaction by food source (P=0.003).
[20] Downgrade for serious inconsistency, due to substantial unexplained heterogeneity I^2=66%, P_Q =0.085.
[21] Downgrade for serious imprecision due to gain of significance in sensitivity analyses with the removal of Hernandez-Cordero et al. 2014 (recalculated MD: -2.00%; 95% CI: -3.78, -0.22; P_{MD}=0.027).
[22] Downgrade for serious imprecision due to gain of significance in sensitivity analyses with the removal of Dominguez Coelle et al. 2020 (recalculated MD: -0.26cm; 95% CI: -0.51, -0.00; P_{MD}=0.048). There was also a gain of significance in sensitivity analyses with the use of a correlation coefficient of 0.75 (P=0.049).
[23] Although there was a positive linear dose response gradient ($coef_{linear}$: 0.48cm; 95% CI: 0.16, 0.80, P=0.004 per meal/serving, 6%E, based upon the global median intake of total sugars (~18%E) divided by 3 meals to give amount per meal (or serving) (Walton et al. Current perspectives on global sugar consumption:

definitions, recommendations, population intakes, challenges and future direction. Nutrition Research Reviews. 2021. doi:10.1017/S095442242100024X)), we did not upgrade since we double downgraded for interaction by food source.

[24] No downgrade for serious inconsistency. The evidence for substantial heterogeneity was driven by food source (influence due to only 2 food sources) for which a double downgrade was already made. The influence of food source also altered the evidence for substantial heterogeneity to non-substantial heterogeneity (Original: I^2=91%, P_Q<0.001; residual I^2=29%, P_Q<0.001).

[25] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important benefit and/or harm for waist circumference (0.5cm). Further, in sensitivity analyses, the removal of one of a 4 trials (Tate et al. 2012 Diet-SSB or water-SSB, Vazquez-Duran et al. 2016 NSB or water) resulted in a loss of significance for waist circumference in subtraction trials (recalculated P_{MD}=0.069-0.154).

[26] Double downgrade for very serious indirectness as there was one food source which contributed to the majority of the weight in the analysis (Fruit = 63% weight in substitution and 80% in addition trials), thus limiting the ability to assess differences in food sources.

[27] Downgrade for serious imprecision due to gain of significance in sensitivity analyses with the removal of Dow et al. 2012 (recalculated MD: 0.0063; 95% CI: 0.0002, 0.0114; P_{MD}=0.013).

[28] Downgrade for serious imprecision as the 95% confidence interval (-0.03, 0.03) overlaps the MID of clinically important harm and benefit for waist-to-hip ratio (0.02).

[29] Double downgrade for very serious indirectness as there was only one or two food sources other than mixed sources available for analyses, thus limiting the ability to assess differences in food sources.

[30] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important benefit and/or harm for VAT (0.08 SMD).

[31] Downgrade for serious risk of bias since the two included trials came from one non-randomized study and thus sequence generation and allocation concealment were high risk of bias.

[32] Downgrade for serious inconsistency due to substantial unexplained heterogeneity (I^2=60%, P_Q=0.112).

Supplementary Table 12: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on body weight by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Upgrades: Dose response		Effect (MD [95%CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
Body weight in substitution trials (kg)											
SSB (12)	Randomized and non-randomized trials	Not serious	Not serious	Serious[1]	Serious[2]	None	None	↔	-0.23 [-0.65, 0.19], P=0.285	⊕⊕◯◯ Low	No effect
Sweetened dairy (7)	Randomized trials	Not serious	Not serious	Serious[3]	Serious[2]	None[4]	None	↔	0.33 [-2.24, 2.89], P=0.804	⊕⊕◯◯ Low	No effect
Sweetened dairy alternative (soy) (1)	Randomized trial	Not serious	Not serious	Serious[5]	Serious[2]	None[4]	None[6]	↔	-0.16 [-1.06, 0.74], P=0.729	⊕⊕◯◯ Low	No effect
100% Fruit juice (2)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[6]	↔	0.28 [-1.19, 1.76], P=0.707	⊕⊕⊕◯ Moderate	No effect
Fruit drink (7)	Randomized and non-randomized trials	Not serious[7]	Not serious	Serious[8]	Serious[2]	None[4]	None	↔	-0.46 [-0.97, 0.04], P=0.299	⊕⊕◯◯ Low	No effect
Fruit (10)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None	None	↓	-0.38 [-0.57, -0.20], P<0.001	⊕⊕⊕◯ Moderate	Trivial
Dried fruit (7)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None	↔	0.34 [-0.47, 1.15], P=0.408	⊕⊕⊕◯ Moderate	No effect
Sweetened cereal grains and bars (3)	Randomized and non-randomized trials	Not serious	Not serious	Serious[9]	Serious[2]	None[4]	None[6]	↔	0.23 [-0.33, 0.79], P=0.415	⊕⊕◯◯ Low	No effect
Sweets and desserts (7)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None	↔	0.44 [-0.27, 1.15], P=0.222	⊕⊕⊕◯ Moderate	No effect
Added nutritive (caloric) sweetener (13)	Randomized and non-randomized trials	Not serious[10]	Not serious	Not serious	Serious[2]	None	None	↑	0.66 [0.13, 1.19], P=0.014	⊕⊕⊕◯ Moderate	Small important

Mixed sources (with SSBs) (42)	Randomized and non-randomized trials	Not serious[11]	Not serious	Not serious	Not serious	None	Linear DR, no upgrade[12]	↑	0.27 [0.09, 0.45], P=0.003	⨁⨁⨁⨁ High	Trivial
Mixed sources (without SSBs) (8)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	Linear DR, no upgrade[13]	↔	0.40 [-0.24, 1.03], P=0.218	⨁⨁⨁◯ Moderate	No effect
Body weight in addition trials (kg)											
SSB (21)	Randomized and non-randomized trials	Not serious[14]	Not serious	Not serious	Serious[2]	None	Linear DR[15]	↑	0.49 [0.24, 0.74], P<0.001 **Beta 1.04kg (95% CI:0.54, 1.54) per 1 serving of SSB (355ml, 8%E), P<0.001**	⨁⨁⨁⨁ High	Moderate
100% Fruit juice* (17)											
≤10%E trials (9)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None	Linear DR, no upgrade[16]	↓	-1.30 [-2.38, -0.22], P=0.018	⨁⨁⨁◯ Moderate	Moderate
>10%E trials (8)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[17]	None	None	↔	0.17 [-0.08, 0.41], P=0.185	⨁⨁⨁◯ Moderate	No effect
Fruit drink (14)	Randomized and non-randomized trials	Not serious[18]	Not serious	Not serious	Serious[2]	None	None	↑	0.90 [0.34, 1.45], P=0.001	⨁⨁⨁◯ Moderate	Small important
Fruit* (19)											
≤10%E trials (14)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None	None	↓	-0.60 [-1.19, -0.01], P=0.048	⨁⨁⨁◯ Moderate	Small important
>10%E trials (5)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None	None[6]	↔	0.06 [-0.35, 0.46], P=0.791	⨁⨁⨁⨁ High	No effect
Dried fruit (3)	Randomized trials	Not serious	Not serious	Serious[19]	Serious[20]	None[4]	None[6]	↓	-1.29 [-2.01,-0.57], P<0.001	⨁⨁◯◯ Low	Moderate
Sweetened cereal grains and bars (3)	Randomized and non-	Not serious[21]	Not serious	Not serious	Serious[2]	None[4]	None[6]	↔	0.30 [-0.07, 0.66], P=0.116	⨁⨁⨁◯ Moderate	No effect

	randomized trials										
Sweets and desserts (4)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[6]	↔	0.08 [-0.61, 0.77], P=0.818	⊕⊕⊕◯ Moderate	No effect
Honey (5)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[22]	None[4]	None[6]	↓	-1.65 [-2.46, -0.85], P<0.001	⊕⊕⊕◯ Moderate	Moderate
Added nutritive (caloric) sweetener (1)	Randomized trials	Not serious	Not serious	Serious[23]	Serious[2]	None[4]	None[6]	↔	0.60 [-5.09, 6.29], P=0.836	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (3)	Randomized trials	Not serious	Not serious	Not serious	Not serious	None[4]	None[6]	↑	2.77 [1.97, 3.57], P<0.001	⊕⊕⊕⊕ High	Large
Body weight in subtraction trials (kg)											
SSB (7)	Randomized trials	Not serious	Not serious	Serious[24]	Serious[2]	None[4]	None	↔	-0.44 [-1.22, 0.34], P=0.269	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (6)	Randomized and non-randomized trials	Not serious[25]	Serious[26]	Not serious	Serious[2]	None[4]	None	↓	-1.30 [-2.54, -0.06], P=0.40	⊕⊕◯◯ Low	Moderate
Body weight in *ad libitum* trials (kg)											
Sweets and desserts (1)	Randomized trials	Not serious	Not serious	Serious[27]	Serious[2]	None[4]	None[6]	↔	-0.80 [-5.59, 3.99], P=0.743	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (10)	Randomized and non-randomized trials	Not serious[28]	Not serious	Not serious	Serious[2]	None	None	↑	0.41 [0.09, 0.73], P=0.012	⊕⊕⊕◯ Moderate	Trivial
Mixed sources (without SSBs) (1)	Randomized trials	Not serious	Not serious	Serious[29]	Not serious	None[4]	None[6]	↑	3.10 [2.39, 3.81], P<0.001	⊕⊕⊕◯ Moderate	Large

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.

[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size

categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).
*As both non-linear dose response analyses and categorical subgroup analyses by dose for 100% fruit juice in addition trials for body weight showed significant interaction by dose (with a threshold at 10%E), which explained the serious inconsistency in the total pooled estimate (substantial heterogeneity, I^2=50%, P<0.001), and dose is a major domain of the assessment of certainty of evidence, we presented the data separately for ≤10%E and >10%E, rather than present the total pooled analysis and downgrade for serious inconsistency.
BB, blueberry arm; CI, confidence interval; DR, dose response; LGI-S, low glycmeic index – starch arm; MD, mean difference; MID, minimally important difference; Pmc-Cloudy AJ, pomace compared to cloudy apple juice; SSB, sugar-sweetened beverage; VAT, visceral adipose tissue; w/o, without.
[1] Downgrade for indirectness as the majority of trial comparisons (11 out of 12) come from 5 studies of young (mean ages 22-37y) adults who are normal weight or overweight with only 1 trial of 61-year-old adults with diabetes, which leads to poor applicability of the results to the general adult population.
[2] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and/or benefit for body weight (0.5kg). Further, in sensitivity analyses, the removal of the following individual trials resulted in a loss of significance: Brynes et al. 2003 (LGI-S) for added nutritive sweetener in substitution trials (recalculated MD: 0.36kg; 95% CI: -0.32, 1.04; P_{MD}=0.305); Gonzalez-Oritz et al. 2011 and Lazavi et al. 2018 for 100% fruit juice trials with ≤10%E; Basu et al. 2010 (BB), Dow et al. 2012, Kumari et al. 2016 (w/o peel) for fruit trials ≤10%E; Markey et al. 2016 for mixed sources (with SSBs) in ad libitum trials (recalculated MD: 0.44kg; 95% CI: -0.27, 1.15; P_{MD}=0.226). There was also a loss of significance in sensitivity analyses for mixed sources (with SSBs) in ad libitum trials with the use of a correlation coefficient of 0.75 (P=0.167).
[3] Downgrade for serious indirectness as all trial comparisons come from two studies of all healthy mixed weight, younger (mean 35-38y) adult participants which leads to poor applicability of the results to the general adult population.
[4] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[5] Downgrade for serious indirectness as all trial comparisons come from one study of 64 overweight, middle aged (mean 45y) adult participants which leads to poor applicability of the results to the general adult population.
[6] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[7] No downgrade for serious risk of bias since although the majority of trial comparisons (6 of 7) were not randomized and at high risk of bias for sequence generation and allocation concealment, there was no effect in sensitivity analyses between the effect of the 6 trials and the 1 trial which was randomized.
[8]Downgrade for serious indirectness as the majority of trial comparisons (6 of the 7) come from studies of all healthy mixed weight or overweight, middle-aged (range of means 22-61y) adult participants, with only one small trial of 10 participants with diabetes (mean age 64y), which leads to poor applicability of the results to the general adult population.
[9] Downgrade for serious indirectness as the 3 trial comparisons only included mixed weight or overweight, young (mean 26, 33 and 40y) adult participants which leads to poor applicability of the results to the general adult population.
[10] No downgrade for serious risk of bias. Although 7 and 8 out of 13 trials had high ROB for sequence generation and allocation concealment, respectively, there was no significant effect modification of either of these categories in subgroup analyses (P=0.915 and P=0.962, respectively).
[11]There was significant effect modification for the "other" risk of bias category (P=0.024) and sequence generation (P=0.022), however trials rated as high ROB showed no effect while those rated as low showed a significant increase, therefore the high ROB trials did not drive the overall increase in body weight observed for mixed sources (with SSBs). Similarly, there was effect modification by randomization (P=0.003), however randomized trials showed a significant increase while non-randomized trials showed no significant effect, thus the non-randomized trials did not drive the overall increase in body weight observed.
[12] Although there was a negative linear dose response (P=0.023), for the effect of mixed sources (with SSBs) on body weight in substitution trials, we did not upgrade since the dose response was no longer significant with the removal of one outlier ($P_{-linear}$=0.356).

[13] Although there was a positive linear dose response (P=0.037), as well as a non-linear dose response (P=0.002), for the effect of mixed sources (without SSBs) on body weight in substitution trials, we did not upgrade since the dose response was no longer significant with the removal of one outlier ($P_{\text{-linear}}$=0.905; $P_{\text{-non-linear}}$=0.518).
[14] No downgrade for serious risk of bias. Although 8 of the 21 trials had high ROB for sequence generation and allocation concealment, and were non-randomized, there was no evidence of effect modification by ROB (P=0.541 and P=0.396, respectively), nor by randomization (P=0.396).
[15] Upgrade for significant positive linear dose response gradient ($coef_{linear}$: 1.04kg; 95% CI: 0.54, 1.54, P<0.001 per 355ml serving, 8%E).
[16] Although there was a significant positive linear dose response gradient for the effect of 100% fruit juice on body weight in addition trials with doses ≤10%E ($coef_{linear}$: 1.50kg; 95% CI: 0.43, 2.57, P=0.006 per 125ml serving, 3%E) where greater reductions were seen with smaller doses, we did not upgrade since the estimated dose response was below 0, representing a reduction in body weight across the dose response range.
[17] Downgrade for serious imprecision due to gain of significance in sensitivity analyses with the removal of Ravn-Haren et al. 2013 (Pmc-Cloudy AJ) (recalculated MD: 0.25kg; 95% CI: 0.03, 0.47; P_{MD}=0.027).
[18]No downgrade for serious risk of bias since the overall pooled estimate was not driven by high ROB trials. There was significant effect modification by sequence generation and allocation concealment (P<0.001) however high ROB for this domain showed no effect whereas trials rated compared to unclear or low ROB trials for this domain which resulted in a significant increase in body weight. Further, there was significant effect modification by randomization (P<0.001) however non-randomized trials showed no effect whereas randomized trials showed a significant increase. Overall, these sources of risk of bias did not alter the direction, magnitude and significance of the pooled estimate of the effect which showed a significant increase.
[19] Downgrade for serious indirectness as 2 trial comparisons come from one small study in young (mean 22y) adults with mixed weight, while the third trial comparison is in middle aged (mean 55y) adults with diabetes, the latter of which drives the overall effect, thus leads to poor applicability of the results to the general adult population.
[20] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Irannejad et al. 2020 (recalculated MD: -2.80kg; 95% CI: -13.20, 7.61; P_{MD}=0.598).
[21] No downgrade for serious risk of bias. Although 2 of the 3 trials had high ROB for sequence generation and allocation concealment (due to not being randomized), the effect of these 2 trials was similar to the effect observed for the one trial which was randomized. Overall, this source of risk of bias does not alter the direction, magnitude and significance of the pooled estimate of the effect which showed no effect.
[22] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Bahrami et al. 2009 (recalculated MD: 0.85kg; 95% CI: -2.56, 4.26; P_{MD}=0.625).
[23] Downgrade for serious indirectness as the one trial comparison comes from one study of slightly older (mean 66y) adults with diabetes, which leads to poor applicability of the results to the general adult population.
[24] Downgrade for serious indirectness as the 7 trial comparisons, which came from 4 trials, all participants were younger adults (mean 26-42y) who were either overweight or mixed weight, which leads to poor applicability of the results to the general adult population.
[25] No downgrade for serious risk of bias. Although 4 of the 6 trials had high ROB for sequence generation and allocation concealment (due to not being randomized) and high other ROB for being crossover trials without wash-out periods, sensitivity analyses revealed no difference in effect between those trials with high ROB vs those at low ROB (P=0.797); independently, neither those 4 trials at high ROB, nor those trials at low ROB showed a statistically significant effect, therefore the high ROB trials did not drive the overall effect.
[26] Downgrade for serious inconsistency due to substantial unexplained heterogeneity (I^2=83%, P_Q<0.001).
[27] Downgrade for serious indirectness as the one trial comparison come from one study of younger (mean 34y) adults with diabetes, which leads to poor applicability of the results to the general adult population.
[28] No downgrade for serious risk of bias. Although 6 of the 10 trials had high ROB for sequence generation and allocation concealment, subgroup analyses revealed no effect modification by either subgroup (P=0.188 and P=0.211, respectively).

[29] Downgrade for serious indirectness as the one trial comparison come from one study of middle aged (mean 46y) adults with mixed weight, which leads to poor applicability of the results to the general adult population.

Supplementary Table 13: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on BMI by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Upgrades: Dose response		Effect (MD [95%CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
BMI in substitution trials (kg/m^2)											
SSB (11)	Randomized trials	Not serious	Not serious	Serious[1]	Serious[2]	None	None	↔	-0.16 [-0.43, 0.11], P=0.244	⊕⊕◯◯ Low	No effect
Sweetened dairy (3)	Randomized trials	Not serious	Not serious	Serious[3]	Serious[2]	None[4]	None[5]	↔	0.13 [-0.73, 0.99], P=0.763	⊕⊕◯◯ Low	No effect
Sweetened dairy alternative (soy) (1)	Randomized trials	Not serious	Not serious	Serious[6]	Serious[2]	None[4]	None[5]	↔	-0.03 [-0.30, 0.24], P=0.829	⊕⊕◯◯ Low	No effect
100% Fruit juice (2)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[5]	↔	0.40 [-0.16, 0.97], P=0.164	⊕⊕⊕◯ Moderate	No effect
Fruit drink (4)	Randomized and non-randomized trials	Not serious[7]	Not serious	Serious[8]	Serious[2]	None[4]	None[5]	↔	-0.17 [-0.56, 0.22], P=0.384	⊕⊕◯◯ Low	No effect
Fruit (9)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None	↓	-0.21 [-0.39, -0.02], P=0.032	⊕⊕⊕◯ Moderate	Small important
Dried fruit (5)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[5]	↔	0.12 [-0.25, 0.48], P=0.533	⊕⊕⊕◯ Moderate	No effect
Mixed fruit forms (1)	Randomized trial	Not serious	Not serious	Serious[9]	Serious[2]	None[4]	None[5]	↔	-0.11 [-0.26, 0.46], P=0.283	⊕⊕◯◯ Low	No effect
Sweetened cereal grains and bars (3)	Randomized and non-randomized trials	Not serious	Not serious	Serious[10]	Serious[2]	None[4]	None[5]	↔	0.16 [-0.13, 0.79], P=0.415	⊕⊕◯◯ Low	No effect
Sweets and desserts (6)	Randomized trials	Not serious	Not serious	Not serious	Not serious	None[4]	None	↔	-0.01 [-0.19, 0.17], P=0.897	⊕⊕⊕⊕ High	No effect

Added nutritive (caloric) sweetener (1)	Randomized trial	Not serious	Not serious	Serious[11]	Serious[2]	None[4]	None[5]	↔	-0.10 [-0.49, 0.29], P=0.612	⨁⨁◯◯ Low	No effect
Mixed sources (with SSBs) (22)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None	None	↑	0.16 [0.05, 0.27], P=0.004	⨁⨁⨁◯ Moderate	Trivial
Mixed sources (without SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[12]	Serious[2]	None[4]	None[5]	↔	0.62 [-1.08, 2.32], P=0.474	⨁⨁◯◯ Low	No effect
BMI in addition trials (kg/m^2)											
SSB (21)	Randomized and non-randomized trials	Serious[13]	Not serious	Not serious	Not serious	None	Linear DR[14]	↑	0.21 [0.09, 0.33], P<0.001 **Beta 0.46kg/m^2 [95% CI: 0.20, 0.70] per 1 serving of SSB (355ml, 8%E), P<0.001**	⨁⨁⨁⨁ High	Moderate
100% Fruit juice* (14)											
≤10%E trials (9)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[15]	None[4]	Linear DR, no upgrade[16]	↓	-0.52 [-0.82, -0.22], P=0.001	⨁⨁⨁◯ Moderate	Moderate
>10%E trials (5)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[5]	↔	-0.06 [-0.22, 0.09], P=0.422	⨁⨁⨁◯ Moderate	No effect
Fruit drink (12)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None	None	↑	0.57 [0.40, 0.74], P<0.001	⨁⨁⨁⨁ High	Moderate
Fruit (15)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None	None	↔	-0.06 [-0.23, 0.11], P=0.500	⨁⨁⨁◯ Moderate	No effect
Dried fruit (8)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	Linear DR[17]		-0.45 [-1.37, 0.46], P=0.332		
								↓	**Beta -4.58kg/m^2 [95% CI: -8.72, -0.43] per 1 serving of dried fruit (60ml, 5.5%E), P=0.030**	⨁⨁⨁⨁ High	Large
Sweetened cereal grains and bars (2)	Randomized and non-	Not serious	Not serious	Serious[18]	Serious[2]	None[4]	None[5]	↔	0.20 [-0.45, 0.85], P=0.546	⨁⨁◯◯ Low	No effect

	randomized trials										
Sweets and desserts (4)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[5]	↔	0.01 [-0.46, 0.47], P=0.977	⊕⊕⊕◯ Moderate	No effect
Honey (4)	Randomized and non-randomized trials	Not serious	Not serious	Serious[19]	Serious[2]	None[4]	None[5]	↔	0.13 [-1.04, 1.29], P=0.831	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[20]	Not serious	None[4]	None[5]	↑	0.90 [0.58, 1.22], P<0.001	⊕⊕⊕◯ Moderate	Moderate
BMI in subtraction trials (kg/m^2)											
SSB (3)	Randomized trials	Not serious	Not serious	Serious[21]	Serious[2]	None[4]	None[5]	↔	-0.45 [-2.66, 1.77], P=0.694	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Serious[22]	Serious[23]	Serious[2]	None[4]	None[5]	↔	-0.59 [-1.51, 0.33], P=0.210	⊕◯◯◯ Very low	No effect
BMI in *ad libitum* trials (kg/m^2)											
Mixed sources (with SSBs) (4)	Randomized trials	Not serious	Not serious	Not serious	Serious[2]	None[4]	None[5]	↔	0.13 [-0.09, 0.35], P=0.239	⊕⊕⊕◯ Moderate	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.

[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).

*As categorical subgroup analyses by dose for 100% fruit juice in addition trials for BMI showed significant interaction (with a threshold at 10%E), and dose is a major domain of the assessment of certainty of evidence, we presented the data separately for ≤10%E and >10%E, rather than present the total pooled analysis and downgrade for serious inconsistency.

BMI, body mass index; CI, confidence interval; DR, dose response; HIV, human immunodeficiency virus; MD, mean difference; MID, minimally important difference; NSB, non-nutritive sweetened beverage; SSB, sugar-sweetened beverage.

[1] Downgrade for indirectness as all trial comparisons come from 5 studies of young (mean ages 23-37y) adults who are normal weight or overweight, which leads to poor applicability of the results to the general adult population.
[2] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and/or benefit for BMI ($0.2kg/m^2$). Further, in sensitivity analyses, the removal of the following individual trials resulted in a loss of significance: Hegde et al. 2013 or Madero et al. 2011 for Fruit in substitution trials (recalculated MD: $-0.21kg/m^2$; 95% CI: -0.42, 0.00; $P_{MD}=0.059$ and MD: $-0.11kg/m^2$; 95% CI: -0.34, 0.12; $P_{MD}=0.338$, respectively); and the following individual trials resulted in a gain of significance: Vieira et al. 2021 for fruit drink in substitution trials (recalculated MD: $-0.39kg/m^2$; 95% CI: -0.60, -0.17; $P_{MD}<0.001$); Alalwan et al. 2020 for dried fruit in addition trials (recalculated MD: $-1.14kg/m^2$; 95% CI: -1.85, -0.42; $P_{MD}=0.002$);
Vazquez-Duran et al. 2016 (NSB) for mixed sources (with SSBs) in subtraction trials (recalculated MD: $-1.06kg/m^2$; 95% CI: -1.35, -0.76; $P_{MD}<0.001$).
[3] Downgrade for serious indirectness as all trial comparisons come from one study of all healthy mixed weight, younger (mean 37y) adult participants which leads to poor applicability of the results to the general adult population.
[4] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[5] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[6] Downgrade for serious indirectness as all trial comparisons come from one study of 64 overweight, middle aged (mean 45y) adult participants which leads to poor applicability of the results to the general adult population.
[7] No downgrade for serious risk of bias since although the majority of trial comparisons (3 of 4) were not randomized and at high risk of bias for sequence generation and allocation concealment, there was no effect in sensitivity analyses between the effect of the 3 trials and the 1 trial which was randomized.
[8] Downgrade for serious indirectness as all trial comparisons come from 3 studies of healthy mixed weight or overweight, middle-aged (mean 24, 27, 61y) adult participants, which leads to poor applicability of the results to the general adult population.
[9] Downgrade for serious indirectness as the single trial comparison comes from one study of 50 overweight, middle aged (mean 42.9y) adult participants which leads to poor applicability of the results to the general adult population.
[10] Downgrade for serious indirectness as the 3 trial comparisons only included mixed weight or overweight, young (mean 26, 33 and 40y) adult participants which leads to poor applicability of the results to the general adult population.
[11] Downgrade for serious indirectness as the single trial comparison only included overweight, middle aged (mean 50) adult participants which leads to poor applicability of the results to the general adult population.
[12] Downgrade for serious indirectness as the two trial comparisons only included overweight or pre-diabetic, middle aged (mean 48 and 70) adult participants which leads to poor applicability of the results to the general adult population.
[13] Downgrade for serious ROB since the overall pooled estimate was driven by high ROB trials. Since in subgroup analyses, allocation concealment risk of bias was significant (P<0.001) where high risk of bias trials showed a significant increase in BMI whereas unclear trials showed no effect, it was judged that this source of risk of bias were a serious concern since the inclusion of the high ROB trials altered the direction, magnitude and significance of the pooled estimate of effect which showed a significant increase.
[14] Upgrade for significant positive linear dose response gradient for the effect of SSB on BMI in addition trials ($coef_{linear}$: $0.46kg/m^2$; 95% CI: 0.20, 0.70, P<0.001 per 355ml serving, 8%E).
[15] Downgrade for serious imprecision as the removal of Lazavi et al. 2018 resulted in a loss of significance (recalculated MD: $-0.32kg/m^2$; 95% CI: -0.68, 0.04; $P_{MD}=0.085$).
[16] Although there was a significant positive linear dose response gradient for the effect of 100% fruit juice on BMI in the addition trials with doses ≤10%E ($coef_{linear}$: $0.91kg/m^2$; 95% CI: 0.05, 1.77, P=0.038 per 125ml serving, 3%E) where greater reductions were seen with smaller doses, we did not upgrade since the majority of the estimated dose response was below 0, representing a reduction in BMI across that range.
[17] Upgrade for significant inverse linear dose response gradient ($coef_{linear}$: $-4.58kg/m^2$; 95% CI: -8.72, -0.43, P=0.030 per 60ml serving, 5.5%E).

[18] Downgrade for serious indirectness as the two trial comparisons only included overweight, middle aged (mean 39 and 53y) adult participants, which leads to poor applicability of the results to the general adult population.
[19] Downgrade for serious indirectness as 3 of the 4 trial comparisons comes from one study of 45-49 HIV positive, middle aged (mean 39.5y) adult participants, which leads to poor applicability of the results to the general population.
[20] Downgrade for serious indirectness as the 2 trial comparisons are from one trial of 41 middle aged (mean 35y) adults who were overweight and one trial of 25 older (mean 57y) adults with metabolic syndrome, which leads to poor applicability of the results to the general population.
[21] Downgrade for serious indirectness as trial comparisons included only young (mean age 28, 29, and 33y) adults who are overweight, which leads to poor applicability of the results to the general population.
[22] Downgrade for serious inconsistency, due to substantial unexplained heterogeneity I^2=95.2%, P_Q <0.001.
[23] Downgrade for serious indirectness as trial comparisons included come from one study of young (mean 22y) adults of mixed weight, which leads to poor applicability of the results to the general population.

Supplementary Table 14: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on body fat by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Upgrades: Dose response		Effect (MD [95%CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
Body fat in addition trials (%)											
SSB (9)	Randomized and non-randomized trials	Not serious	Not serious	Serious[1]	Not serious	None[2]	None	↔	-0.16 [-1.04, 0.72], P=0.721	⊕⊕⊕◯ Moderate	No effect
100% Fruit juice (6)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None	↔	-0.71 [-1.74, 0.32], P=0.176	⊕⊕⊕⊕ High	No effect
Fruit drink (7)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None	↑	0.59 [0.16, 1.02], P=0.007	⊕⊕⊕⊕ High	Trivial
Fruit (2)	Randomized trials	Not serious	Not serious	Serious[3]	Not serious	None[2]	None[4]	↔	0.24 [-1.44, 1.92], P=0.780	⊕⊕⊕◯ Moderate	No effect
Dried fruit (2)	Randomized trials	Not serious	Not serious	Serious[5]	Serious[6]	None[2]	None[4]	↔	-1.78 [-7.51, 3.95], P=0.542	⊕⊕◯◯ Low	No effect
Sweetened cereal grains and bars (1)	Non-randomized trial	Serious[7]	Not serious	Serious[8]	Serious[6]	None[2]	None[4]	↔	0.80 [-2.14, 3.74], P=0.594	⊕◯◯◯ Very low	No effect
Sweets and desserts (1)	Randomized trial	Not serious	Not serious	Serious[9]	Serious[6]	None[2]	None[4]	↔	0.29 [-4.73, 5.32], P=0.909	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[10]	Serious[11]	None[2]	None[4]	↑	1.36 [0.85, 1.87], P<0.001	⊕⊕◯◯ Low	Trivial
Body fat in subtraction trials (%)											
SSB (2)	Randomized trials	Not serious	Serious[12]	Serious[13]	Serious[14]	None[2]	None[4]	↔	-0.64 [-1.53, 0.24], P=0.152	⊕◯◯◯ Very low	No effect
Body fat in *ad libitum* trials (%)											
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[15]	Not serious	None[2]	None[4]	↔	0.07 [-0.18, 0.32], P=0.595	⊕⊕⊕◯ Moderate	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered

to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.
[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).
CI, confidence interval; DR, dose response; MD, mean difference; MID, minimally important difference; SSB, sugar-sweetened beverage; VAT, visceral adipose tissue.

[1]Downgrade for serious indirectness as the 9 trials come from 5 studies in young adults (mean ages range from 22 to 32.8y), which leads to poor applicability of the results to the general adult population.
[2] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[3] Downgrade for serious indirectness as the 2 trial comparisons included overweight, middle-aged (mean 41y and 59y) adult participants which leads to poor applicability of the results to the general adult population.
[4] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[5] Downgrade for serious indirectness as the 2 trial comparisons come from one small study in young (mean 22y) adults with mixed weight, which leads to poor applicability of the results to the general adult population.
[6] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and/or benefit for body fat (2%).
[7]Downgrade for serious risk of bias due to the one trial being not randomized and at high risk of bias for sequence generation and allocation concealment.
[8] Downgrade for serious indirectness as the one trial comparison includes 25 middle-aged (mean 39y) adults who are overweight, which leads to poor applicability of the results to the general adult population.
[9] Downgrade for serious indirectness as the one trial comparison includes 44 middle-aged (mean 51y) adults with diabetes, which leads to poor applicability of the results to the general adult population.
[10] Downgrade for serious indirectness as the two trial comparisons includes one in 41 middle-aged (mean 35y) adults who are overweight, and another in 25 older adults (mean 57y) with metabolic syndrome, which leads to lack of reproducibility and poor applicability of the results to the general adult population.
[11] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Ahmad et al. 2020 (recalculated MD: 0.18%; 95% CI: -2.54, 2.90; P_{MD}=0.899).
[12] Downgrade for serious inconsistency, due to substantial unexplained heterogeneity I^2=66.4%, P_Q =0.085.
[13] Downgrade for serious indirectness as the 2 trial comparisons include overweight, young (mean 28y and 33y) adult participants, which leads to poor applicability of the results to the general adult population.
[14] Downgrade for serious imprecision due to gain of significance with the removal of Hernandez-Cordero et al. 2014 (recalculated MD: -2.00%; 95% CI: -3.78, -0.22; P_{MD}=0.027).
[15] Downgrade for serious indirectness as the 2 trial comparisons included mixed weight, middle-aged (mean 31y and 46y) adult participants, which leads to poor applicability of the results to the general adult population.

Supplementary Table 15: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on waist circumference by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Upgrades: Dose response		Effect (MD [95%CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
Waist circumference in addition trials (cm)											
SSB (8)	Randomized trials	Not serious	Not serious	Serious[1]	Not serious	None[2]	None	↔	0.16 [-0.92, 1.23], P=0.777	⊕⊕⊕◯ Moderate	No effect
100% Fruit juice (9)	Randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None	↔	-0.35 [-1.29, 0.58], P=0.457	⊕⊕⊕⊕ High	No effect
Fruit drink (3)	Randomized and non-randomized trials	Not serious	Not serious	Serious[3]	Serious[4]	None[2]	None[5]	↔	1.39 [-0.17, 2.95], P=0.081	⊕⊕◯◯ Low	No effect
Fruit (5)	Randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None[5]	↔	0.03 [-0.80, 0.86], P=0.944	⊕⊕⊕⊕ High	No effect
Sweetened cereal grains and bars (3)	Randomized and non-randomized trials	Not serious	Not serious	Serious[6]	Not serious	None[2]	None[5]	↔	-0.58 [-1.58, 0.43], P=0.261	⊕⊕⊕◯ Moderate	No effect
Sweets and desserts (3)	Randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None[5]	↔	-0.64 [-1.34, 0.06], P=0.072	⊕⊕⊕⊕ High	No effect
Honey (1)	Non-randomized trial	Serious[7]	Not serious	Serious[8]	Serious[4]	None[2]	None[5]	↔	-0.30 [-4.90, 4.30], P=0.898	⊕◯◯◯ Very low	No effect
Mixed sources (with SSBs) (1)	Randomized trial	Not serious	Not serious	Serious[9]	Serious[4]	None[2]	None[5]	↑	3.40 [1.60, 5.20], P<0.001	⊕⊕◯◯ Low	Large
Waist circumference in subtraction trials (cm)											
SSB (3)	Randomized trials	Not serious	Not serious	Serious[10]	Serious[4]	None[2]	None[5]	↔	-0.76 [-2.21, 0.68], P=0.301	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Serious[11]	Serious[12]	Serious[4]	None[2]	None[5]	↓	-2.83 [-5.31, -0.35], P=0.025	⊕◯◯◯ Very low	Large
Waist circumference in *ad libitum* trials (cm)											
Mixed sources (with SSBs) (1)	Randomized trial	Not serious	Not serious	Serious[13]	Serious[4]	None[2]	None[5]	↔	4.10 [-1.05, 9.25], P=0.118	⊕⊕◯◯ Low	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.
[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).
BMI, body mass index; CI, confidence interval; DR, dose response; MD, mean difference; MID, minimally important difference; SGD, substitute grape-flavored drink; SSB, sugar-sweetened beverage; VAT, visceral adipose tissue.
[1] Downgrade for serious indirectness since 7 of the 8 trial comparisons come from 3 studies of young (mean age range 23-35y) adults with normal weight or overweight/obesity, with only 1 trial comparison from a study of middle aged (mean age 52y) adults who are overweight, which leads to poor applicability of the results to the general adult population.
[2] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[3] Downgrade for serious indirectness as 2 of the trial comparison included young (mean 25 and 26y) adult mixed weight or overweight participants, and one small trial of 17 older (mean 53y) adults who are overweight, which leads to poor applicability of the results to the general adult population.
[4] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and/or benefit for waist circumference (0.5cm). Further, in sensitivity analyses, there was a gain of significance for fruit drink in addition trials with the removal of Hollis et al. 2009 (SGD) (recalculated MD: 2.09cm; 95% CI: 1.32, 2.86; P_{MD}<0.001). There was also a gain of significance in sensitivity analyses for fruit drink in addition trials with the use of a correlation coefficient of either 0.25 or 0.75 (P<0.001).
[5] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[6] Downgrade for serious indirectness as the 3 trial comparisons includes mixed weight or overweight middle-aged adult participants which leads to poor applicability of the results to the general adult population.
[7] Downgrade for serious risk of bias since the 1 trial was non-randomized and thus sequence generation and allocation concealment were high risk of bias.
[8] Downgrade for serious indirectness as the one trial comparison of overweight middle-aged (mean 42y) adult participants leads to poor applicability of the results to the general adult population.
[9] Downgrade for serious indirectness as the one trial comparison of older (mean 57y) adults with metabolic syndrome leads to poor applicability of the results to the general adult population.
[10] Downgrade for serious indirectness as all three trials included overweight middle-aged (mean 33, 41, and 42y) adult participants which leads to poor applicability of the results to the general adult population.
[11] Downgrade for serious inconsistency, due to substantial unexplained heterogeneity I^2=94.7%, P_Q<0.001.
[12] Downgrade for serious indirectness as both trials come from a single study which includes mixed weight young (mean 22y) adult participants which leads to poor applicability of the results to the general adult population.
[13] Downgrade for serious indirectness as the single trial comparison includes 28 middle aged (mean 38y) adult participants with metabolic syndrome which leads to poor applicability of the results to the general adult population.

Supplementary Table 16: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on waist-to-hip ratio by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment: Downgrades: Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Upgrades: Dose response		Effect (MD [95%CI], P_{MD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
Waist-to-hip ratio in substitution trials											
SSB (5)	Randomized trials	Not serious	Not serious	Serious[1]	Not serious	None[2]	None[3]	↔	0.006 [-0.003, 0.016], P=0.193	⊕⊕⊕◯ Moderate	No effect
100% Fruit juice (1)	Randomized trial	Not serious	Not serious	Serious[4]	Serious[5]	None[2]	None[3]	↔	0.000 [-0.044, 0.044], P=1.00	⊕⊕◯◯ Low	No effect
Fruit (4)	Randomized and non-randomized trials	Not serious	Not serious	Not serious	Not serious	None[2]	None[3]	↔	-0.001 [-0.004, 0.003], P=0.757	⊕⊕⊕⊕ High	No effect
Dried fruit (3)	Randomized trials	Not serious	Not serious	Not serious	Serious[5]	None[2]	None[3]	↔	0.001 [-0.029, 0.030], P=0.963	⊕⊕⊕◯ Moderate	No effect
Sweetened cereal grains and bars (2)	Randomized and non-randomized trials	Not serious	Not serious	Serious[6]	Not serious	None[2]	None[3]	↔	0.000 [-0.013, 0.013], P=0.998	⊕⊕⊕◯ Moderate	No effect
Mixed sources (with SSBs) (8)	Randomized trials	Not serious	Not serious	Not serious	Serious[7]	None[2]	None	↑	0.008 [0.001, 0.014], P=0.028	⊕⊕⊕◯ Moderate	Trivial
Waist-to-hip ratio in addition trials											
SSB (5)	Randomized trials	Not serious	Not serious	Serious[8]	Serious[5]	None[2]	None[3]	↔	0.007 [-0.007, 0.020], P=0.322	⊕⊕◯◯ Low	No effect
100% Fruit juice* (6)											
≤10%E trials (1)	Randomized trial	Not serious	Not serious	Serious[9]	Serious[5]	None[2]	None[3]	↔	0.004 [-0.072, -0.080], P=0.920	⊕⊕◯◯ Low	No effect
>10%E trials (5)	Randomized trials	Not serious	Not serious	Serious[10]	Serious[11]	None[2]	None[3]	↑	0.008 [0.002, 0.015], P=0.012	⊕⊕◯◯ Low	Trivial

Fruit (4)	Randomized trials	Not serious	Not serious	Serious[12]	Not serious	None[2]	None[3]	↔	0.000 [-0.003, 0.003], P=0.934	⊕⊕⊕◯ Moderate	No effect
Sweetened cereal grains and bars (1)	Non-randomized trial	Serious[14]	Not serious	Serious[13]	Serious[5]	None[2]	None[3]	↔	0.010 [-0.257, 0.277], P=0.942	⊕◯◯◯ Very low	No effect
Sweets and desserts (1)	Randomized trial	Not serious	Not serious	Serious[14]	Serious[5]	None[2]	None[3]	↔	0.000 [-0.030, 0.030], P=1.000	⊕⊕◯◯ Low	No effect
Mixed sources (with SSBs) (1)	Randomized trial	Not serious	Not serious	Serious[15]	Serious[5]	None[2]	None[3]	↔	0.000 [-0.029, 0.029], P=1.00	⊕⊕◯◯ Low	No effect
Waist-to-hip ratio in subtraction trials											
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[16]	Not serious	None[2]	None[3]	↓	-0.009 [-0.014, -0.005], P<0.001	⊕⊕⊕◯ Moderate	Trivial
Waist-to-hip ratio in *ad libitum* trials											
Mixed sources (with SSBs) (1)	Randomized trials	Not serious	Not serious	Serious[17]	Serious[5]	None[2]	None[3]	↔	0.000 [-0.032, 0.032], P=1.000	⊕⊕◯◯ Low	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.
[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).

*The overall analysis for 100% fruit juice showed a significant increase in waist-to-hip ratio; however, this was driven by 5 of the 6 trials with >10%E. Since there was significant interaction (with a threshold at 10%E) by dose in categorical subgroup analyses for 100% fruit juice in addition trials for body weight and BMI, and dose is a major domain of the assessment of certainty of evidence, we presented the data separately for ≤10%E and >10%E, rather than present the total pooled analysis.

CI, confidence interval; DR, dose response; MD, mean difference; MID, minimally important difference; Pmc-Cloudy AJ, pomace compared to cloudy apple juice; SMD, standardized mean difference; SSB, sugar-sweetened beverage; VAT, visceral adipose tissue.

[1] Downgrade for serious indirectness as the five trial comparisons come from two trials, which include young (mean 26 and 27y) adult participants that were of mixed weight or overweight, leading to poor applicability of the results to the general population.
[2] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[3] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[4] Downgrade for serious indirectness as the single trial comparison includes 78 middle aged (mean 36y) overweight adult participants which leads to poor applicability of the results to the general adult population.
[5] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important harm and/or benefit for waist to hip ratio (0.02).
[6] Downgrade for serious indirectness as the two trial comparisons include middle aged (mean 33 and 39y) overweight or mixed weight adult participants which leads to poor applicability of the results to the general adult population.
[7] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Dominguez-Coello et al. 2020 (recalculated MD: 0.001; 95% CI: -0.012, 0.014; P_{MD}=0.827).
[8] Downgrade for serious indirectness as the five trial comparisons come from two trials, which include young (mean 26 and 27y) adult participants that were of mixed weight or overweight, leading to poor applicability of the results to the general population.
[9] Downgrade for serious indirectness as the one trial comparisons includes 23 middle aged (mean 50y) adult participants with metabolic syndrome, leading to poor applicability of the results to the general population.
[10] Downgrade for serious indirectness as the five trial comparisons come from two trials, which include young (mean 32 and 36y) adult participants that were of mixed weight, leading to poor applicability of the results to the general population.
[11] Downgrade for serious imprecision due to loss of significance in sensitivity analyses with the removal of Ravn-Haren et al. 2013 (Pmc-Cloudy AJ) (recalculated MD: 0.007; 95% CI: -0.001, 0.015; P_{MD}=0.076).
[12] Downgrade for serious indirectness as the four trial comparisons come from three trials, which include middle aged (mean 32, 36 and 41y) adult participants that were of mixed weight or overweight, leading to poor applicability of the results to the general population.
[13] Downgrade for serious indirectness as the single trial comparison includes 25 middle aged (mean 39y) overweight adult participants which leads to poor applicability of the results to the general adult population.
[14] Downgrade for serious indirectness as the single trial comparison includes 42 middle aged (mean 38y) adult participants with non-alcoholic fatty liver disease, which leads to poor applicability of the results to the general adult population.
[15] Downgrade for serious indirectness as the single trial comparison includes 41 middle aged (mean 35y) overweight adult participants, which leads to poor applicability of the results to the general adult population.
[16] Downgrade for serious indirectness as both trial comparisons come from a single study which includes 146 young (mean 22y) adult mixed weight participants which leads to poor applicability of the results to the general adult population.
[17] Downgrade for serious indirectness as the single trial comparison includes 49 middle aged (mean 46y) mixed weight adult participants which leads to poor applicability of the results to the general adult population.

Supplementary Table 17: GRADE certainty of evidence assessment for the effect of fructose-containing sugars on visceral adipose tissue by trial energy control and food source

Outcome and trial (N)	Design	GRADE assessment									
		Downgrades					Upgrades				
		Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Dose response		Effect (SMD [95%CI], P_{SMD})	Certainty of Evidence[a]	Interpretation of magnitude of effect[b]
VAT in substitution trials											
SSB (2)	Randomized and non-randomized trials	Not serious	Not serious	Serious[1]	Serious[2]	None[3]	None[4]	↔	0.59 [-0.90, 2.08], P=0.439	⨁⨁◯◯ Low	No effect
Sweets and desserts (1)	Randomized trials	Not serious	Not serious	Serious[5]	Serious[2]	None[3]	None[4]	↔	-0.80 [-2.40, 0.79], P=0.324	⨁⨁◯◯ Low	No effect
Mixed sources (with SSBs) (2)	Randomized trials	Not serious	Not serious	Serious[6]	Serious[2]	None[3]	None[4]	↔	0.01 [-0.97, 0.99], 0.02 P=0.987	⨁⨁◯◯ Low	No effect
Mixed sources (without SSBs) (1)	Randomized trials	Not serious	Not serious	Serious[7]	Serious[2]	None[3]	None[4]	↔	2.04 [-0.39, 4.47], P=0.100	⨁⨁◯◯ Low	No effect
VAT in addition trials											
SSB (2)	Non-randomized trials	Serious[8]	Serious[9]	Serious[10]	Serious[2]	None[3]	None[4]	↔	SMD: 1.31 [-1.56, 4.18], P=0.370	⨁◯◯◯ Very low	No effect
VAT in subtraction trials											
SSB (2)	Randomized trials	Not serious	Not serious	Serious[11]	Serious[2]	None[3]	None[4]	↔	MD: -86.06cm^3 [-273.07, 100.94], P=0.367 SMD: -0.64 [-2.02, 0.75], P=0.367	⨁⨁◯◯ Low	No effect

[a] Since all included trials were randomized or non-randomized controlled trials, the certainty of the evidence was graded as high for all outcomes by default and then downgraded or upgraded based on pre-specified criteria. Criteria for downgrades included risk of bias (downgraded if the majority of trials were considered to be at high risk of bias); inconsistency (downgraded if there was substantial unexplained heterogeneity [$I^2 \geq 50\%$, $P_Q < 0.10$]; indirectness (downgraded if there were factors absent or present relating to the participants, interventions, or outcomes that limited the generalizability of the results); imprecision (downgraded if the 95% confidence interval crossed the minimally important difference [MID] for harm or benefit set at 0.5kg for body weight, 0.2kg/m^2 for BMI, 2% for body fat, 0.5cm for waist circumference, 0.02 for waist-to-hip ratio (Ge et al. BMJ 2020, Sacks et al. NEJM 2009), 0.08 SMD for VAT (5% of baseline SMD); and publication bias (downgraded if there is evidence of publication bias based on funnel plot asymmetry and/or significant Egger's or Begg's tests (P<0.10) with confirmation by adjustment by Duval and Tweedie trim-and-fill analysis). Criteria for upgrades included a significant dose-response gradient.

[b] For the interpretation of the magnitude, we used the MIDs (see a above) to assess the importance of magnitude of our pooled estimates using the effect size categories according to new GRADE guidance. We then used the MIDs to assess the importance of the magnitude of our point estimates using the effect size categories according GRADE guidance (Santesso et al. 2020, Schunemann et al. 2013, Balshem et al. 2011) as follows: large effect (≥5x MID); moderate effect (≥2x MID); small important effect (≥1x MID); and trivial/unimportant effect (< 1 MID).

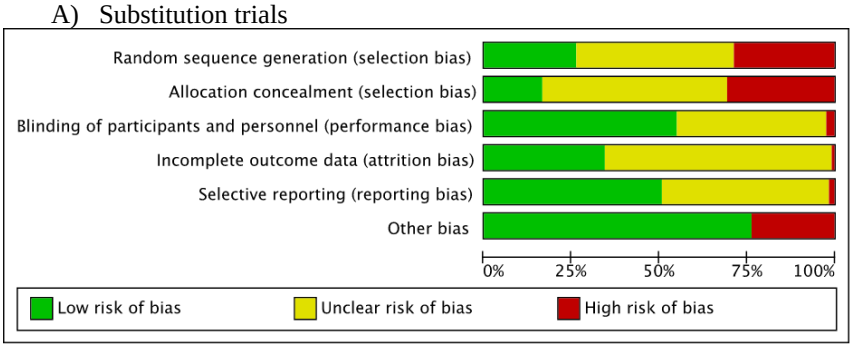
BMI, body mass index; CI, confidence interval; MD, mean difference; MID, minimally important difference; SMD, standardized mean difference; SSB, sugar-sweetened beverage; VAT, visceral adipose tissue.

[1] Downgrade for serious indirectness as the two trial comparisons come from two trials, which include middle-aged (mean 31 and 54y) adult participants that were of mixed weight or overweight, leading to poor applicability of the results to the general population.
[2] Downgrade for serious imprecision as the 95% confidence interval overlaps the MID of clinically important benefit and/or harm for VAT (0.08 SMD).
[3] No downgrade for publication bias, as publication bias could not be assessed due to lack of power for assessing funnel plot asymmetry and small study effects (<10 trial comparisons included in the meta-analysis).
[4] No upgrade for dose-response, as dose-response could not be assessed as <6 trials were available.
[5] Downgrade for serious indirectness as the one trial comparison includes middle-aged (mean 56y) adult participants that at high cardiovascular risk, leading to poor applicability of the results to the general population.
[6] Downgrade for serious indirectness as the two trial comparisons come from one trial, which include middle-aged (mean 48y) adult participants that were overweight, leading to poor applicability of the results to the general population.
[7] Downgrade for serious indirectness as the one trial comparison includes older (mean 71y) adult participants that were overweight, leading to poor applicability of the results to the general population.
[8] Downgrade for serious risk of bias since the two included trials came from one non-randomized study and thus sequence generation and allocation concealment were high risk of bias.
[9] Downgrade for serious inconsistency due to substantial unexplained heterogeneity (I^2=60%, P_Q=0.112).
[10] Downgrade for serious indirectness as the two trial comparisons come from two trials, which include middle-aged (mean 33 and 53y) adult participants that were mixed weight or overweight, leading to poor applicability of the results to the general population.
[11] Downgrade for serious indirectness as the two trial comparisons come from one trial, which include young (mean 29y) adult participants that were overweight, leading to poor applicability of the results to the general population.

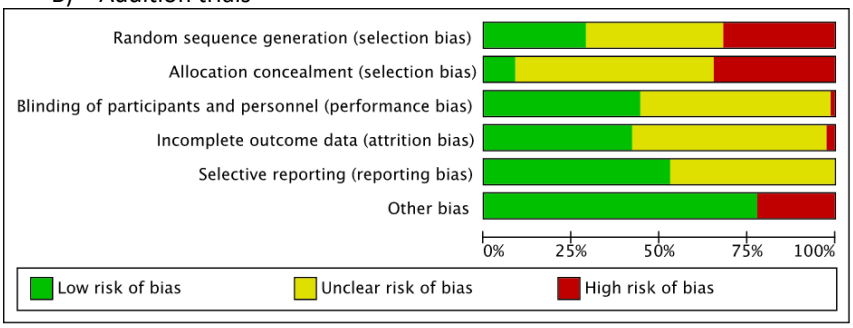
Supplementary Figures

Supplementary Figure 1: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on body weight

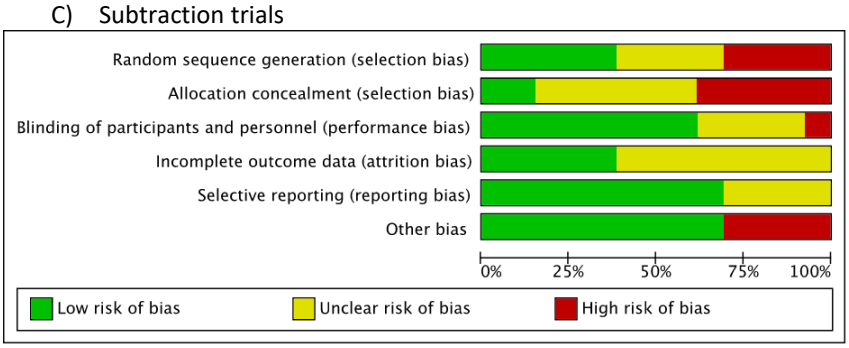
A) Substitution trials



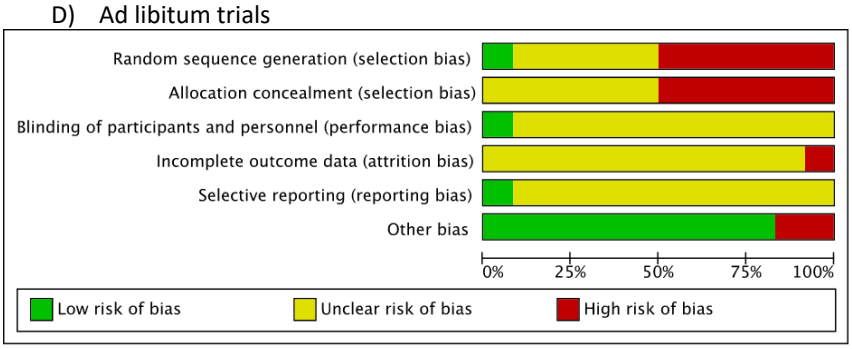
B) Addition trials



C) Subtraction trials



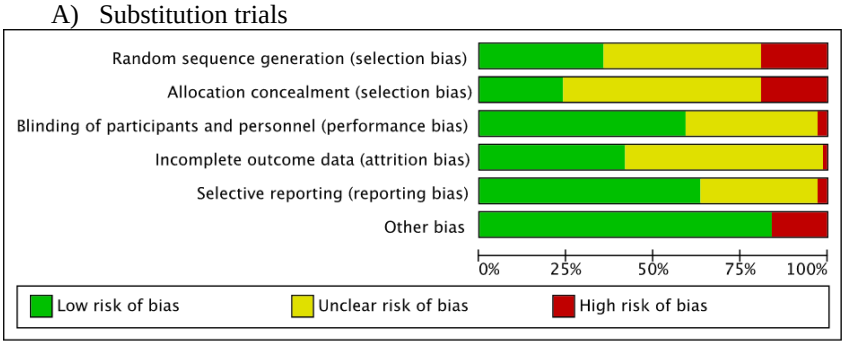
D) Ad libitum trials



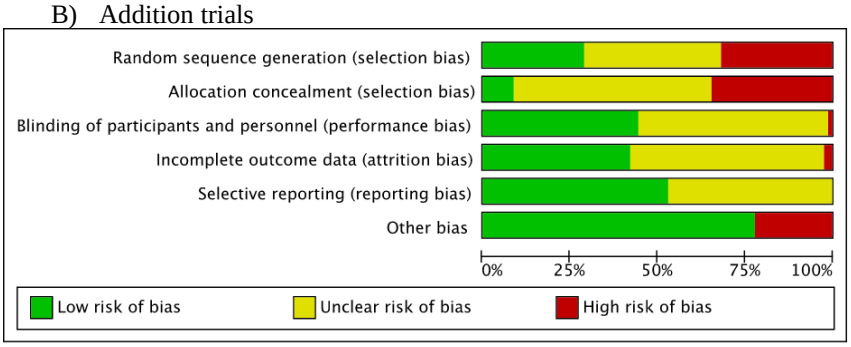
Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Supplementary Figure 2: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on BMI

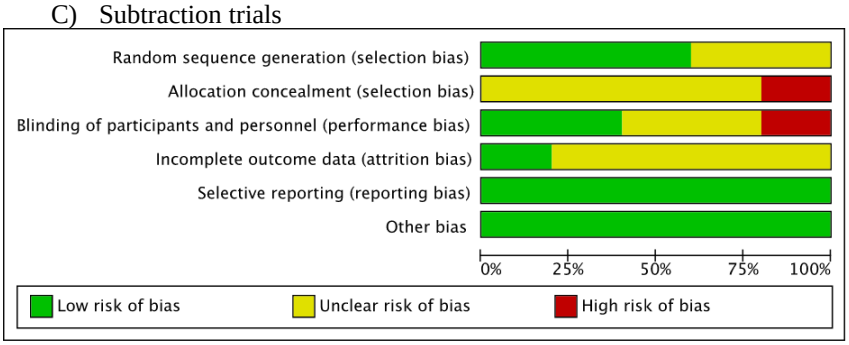
A) Substitution trials



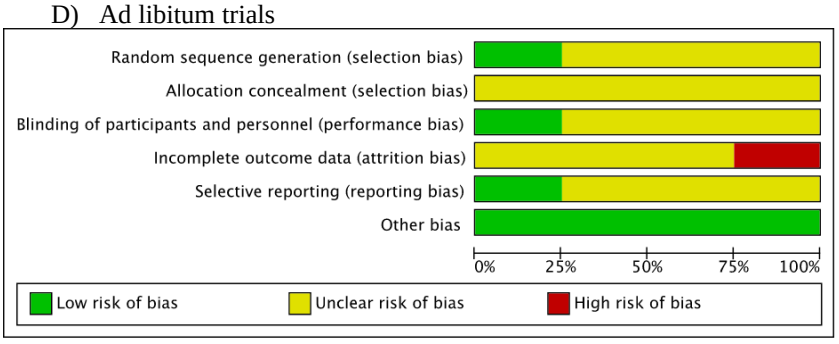
B) Addition trials



C) Subtraction trials



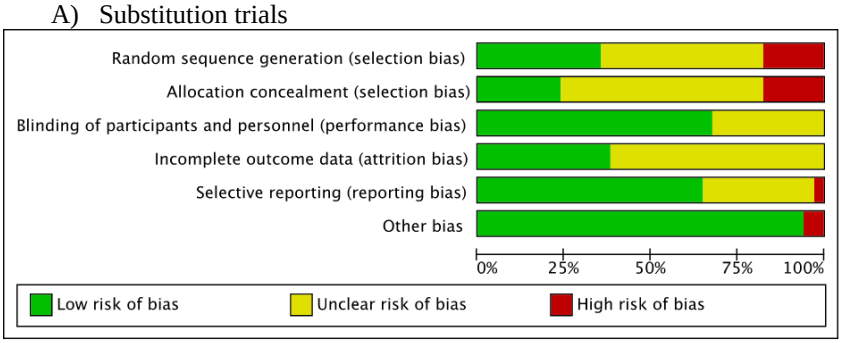
D) Ad libitum trials



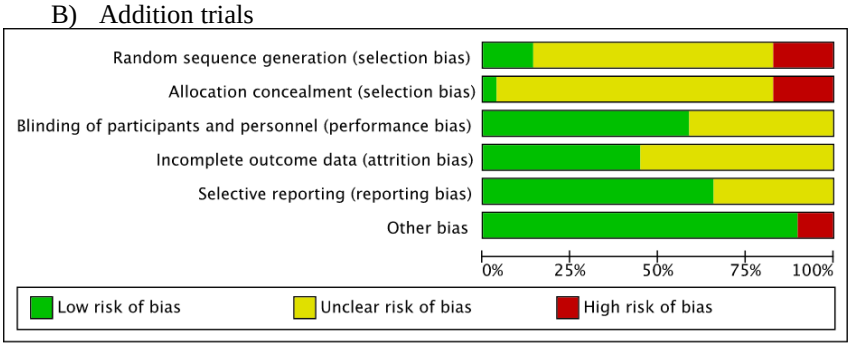
Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Supplementary Figure 3: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on body fat

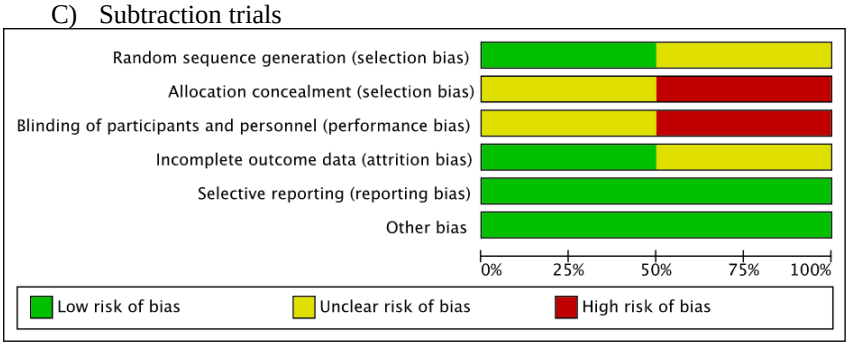
A) Substitution trials



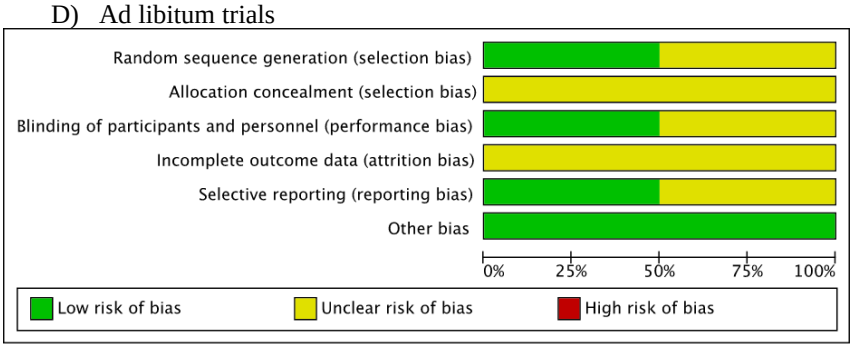
B) Addition trials



C) Subtraction trials



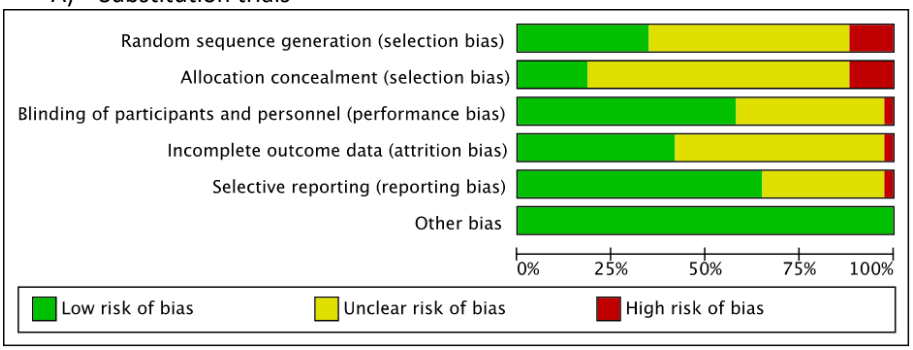
D) Ad libitum trials



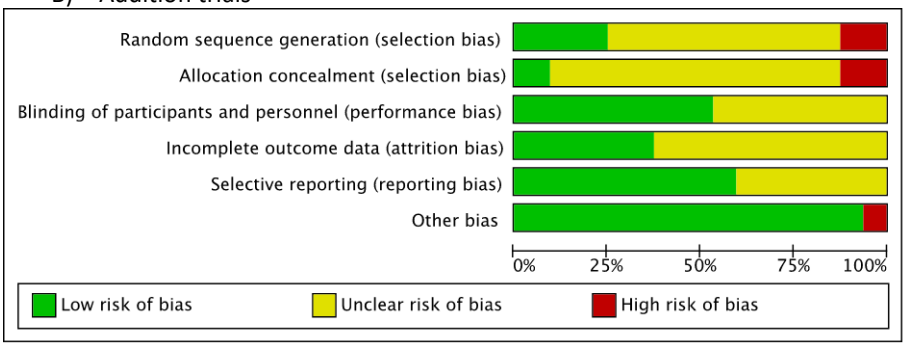
Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Supplementary Figure 4: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on waist circumference

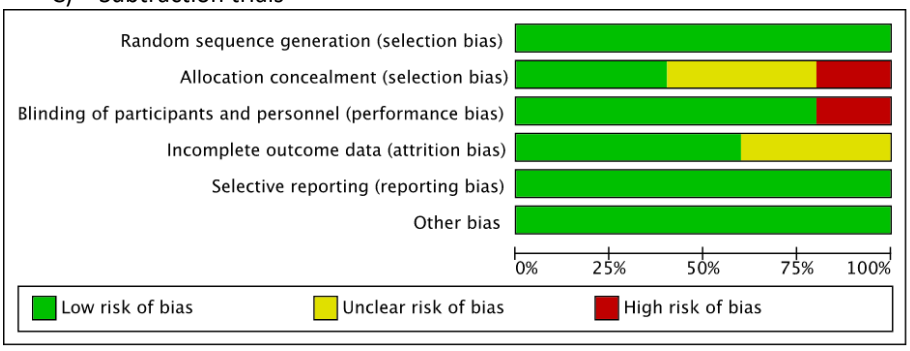
A) Substitution trials



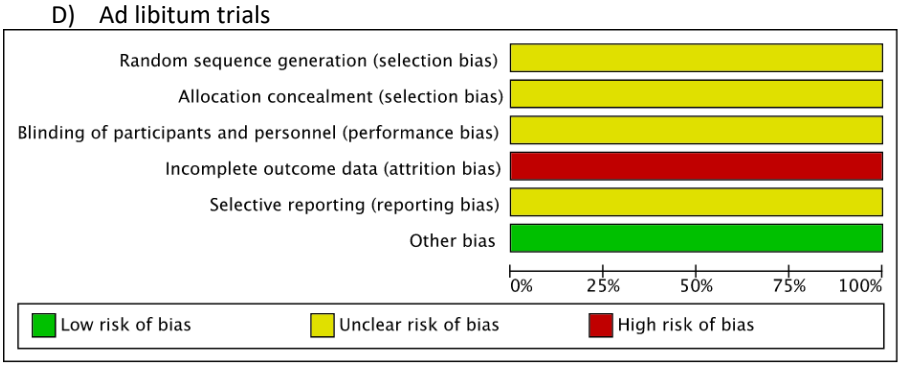
B) Addition trials



C) Subtraction trials



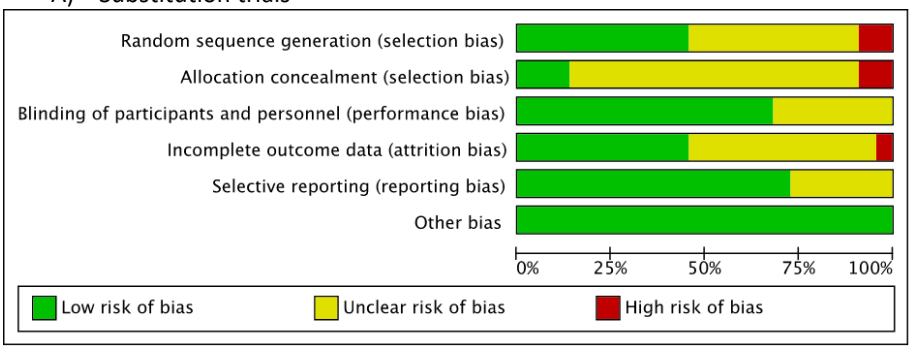
D) Ad libitum trials



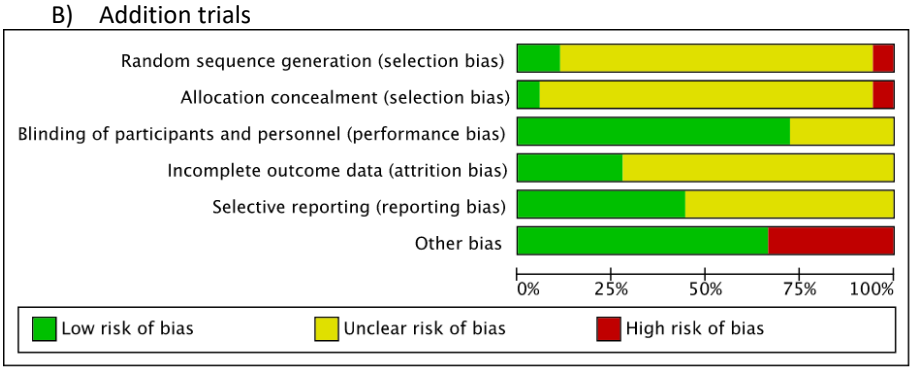
Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Supplementary Figure 5: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on waist-to-hip ratio

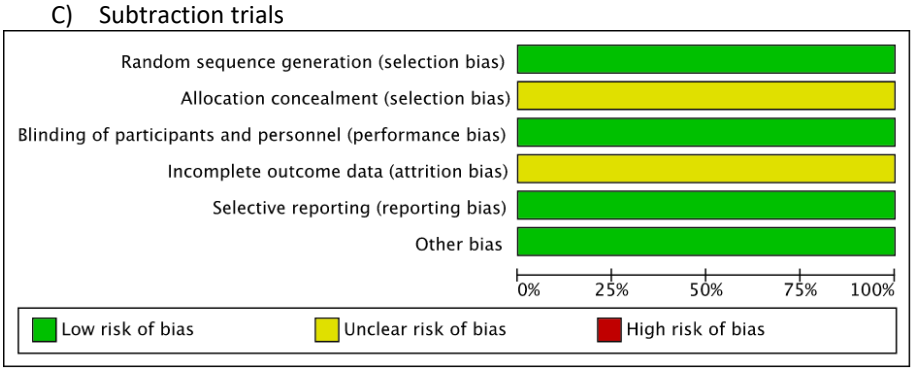
A) Substitution trials



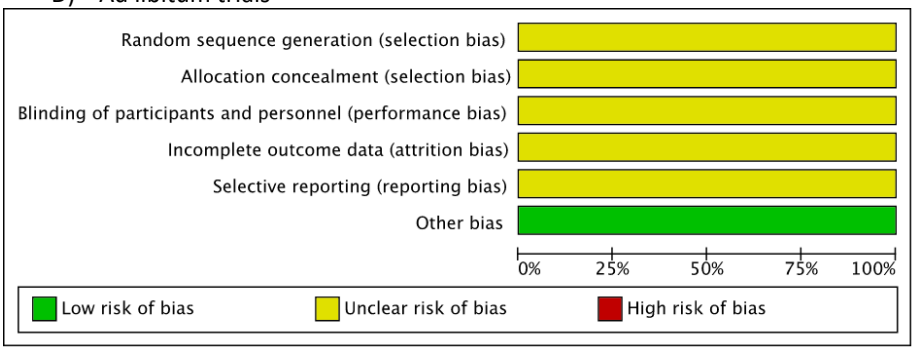
B) Addition trials



C) Subtraction trials



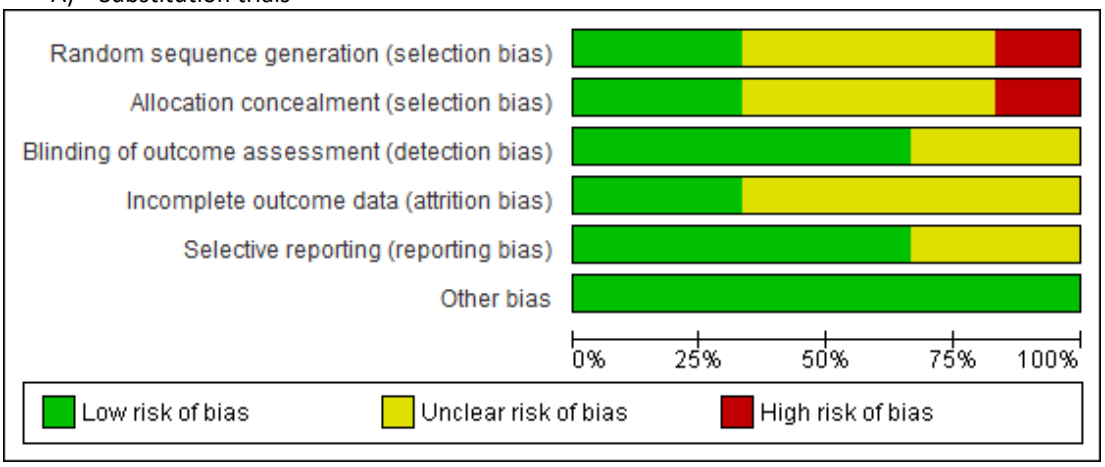
D) Ad libitum trials



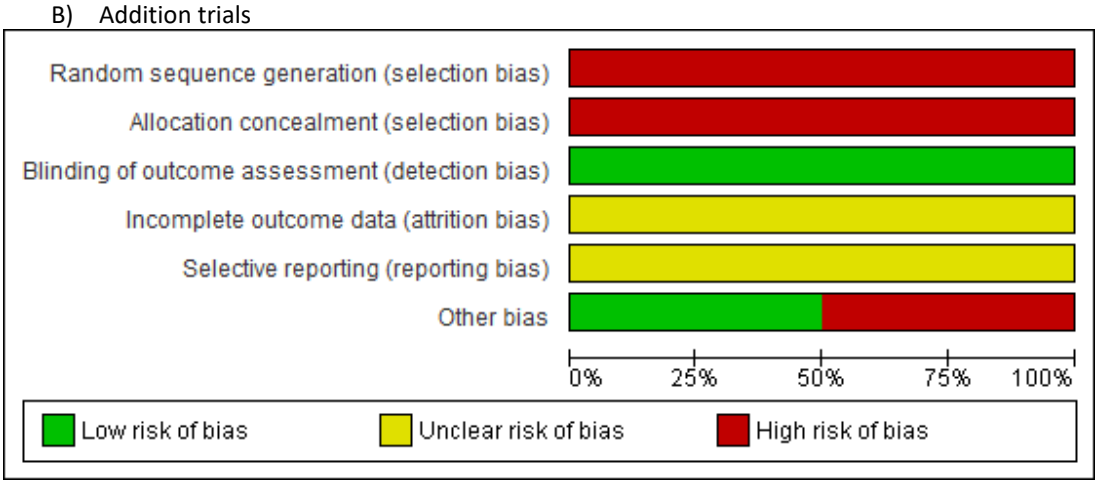
Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Supplementary Figure 6: Risk of bias proportion graph for the effect of important food sources of fructose-containing sugars on VAT

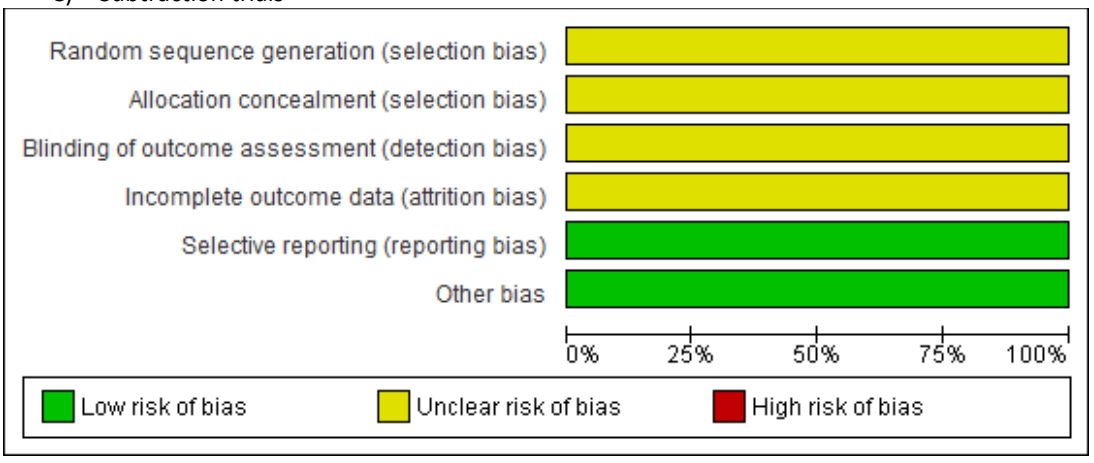
A) Substitution trials



B) Addition trials

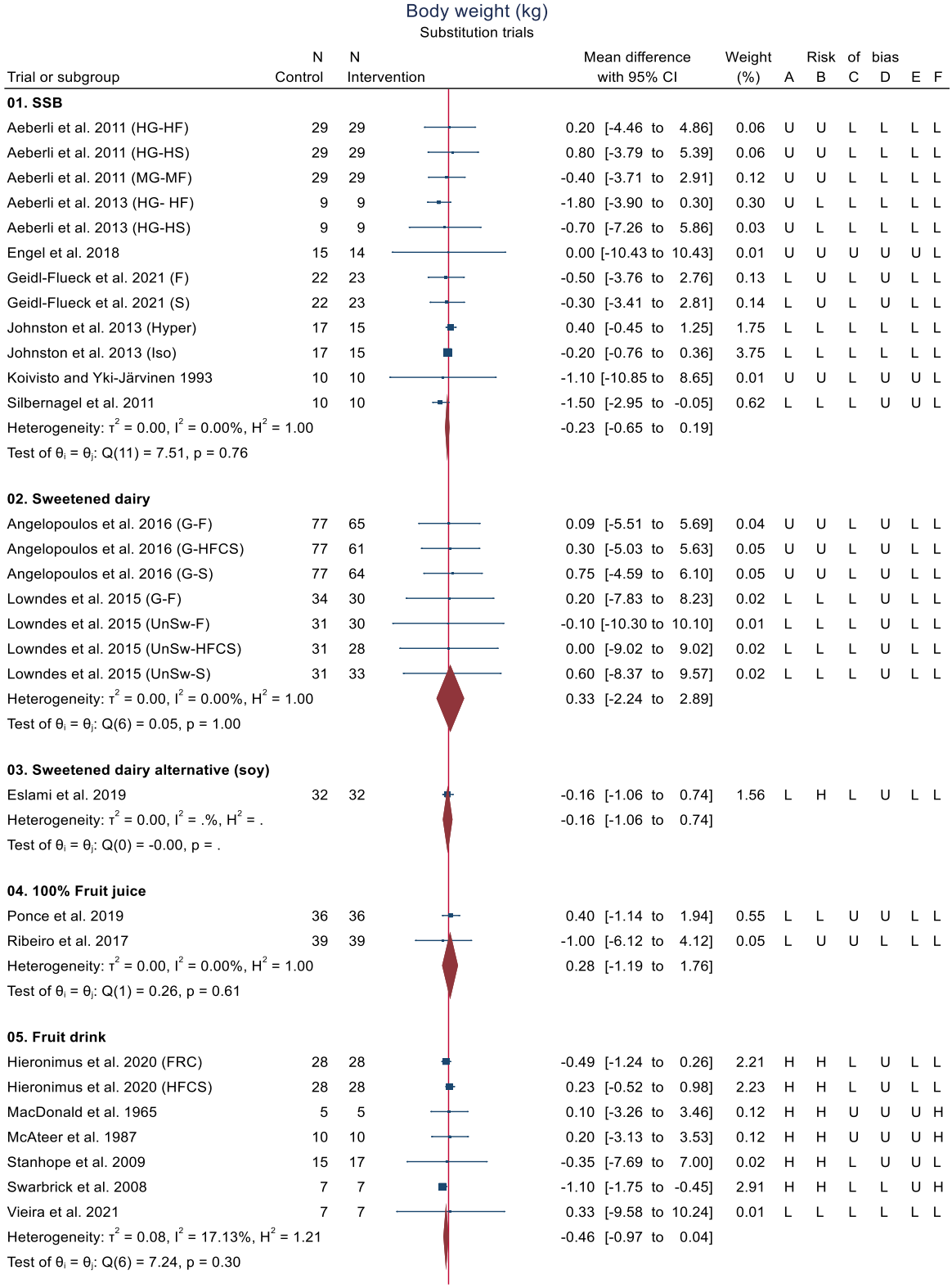


C) Subtraction trials

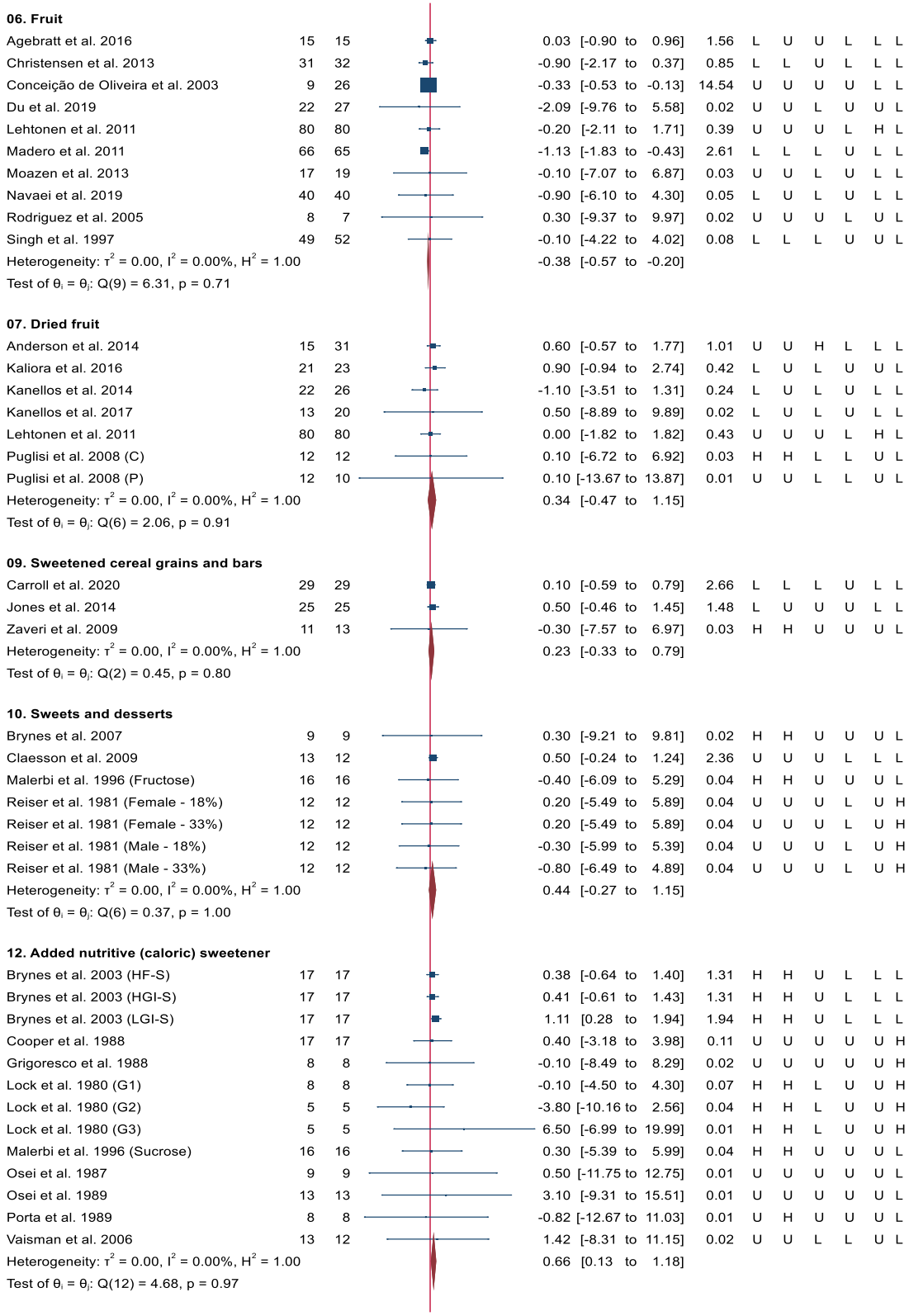


Colored bars represent the proportion of trials assessed as low (green), unclear (yellow) or high (red) risk of bias for the six domains of bias above according to criteria set by the Cochrane Risk of Bias tool.
High other risk of bias (carry-over effect) was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.
VAT, visceral adipose tissue

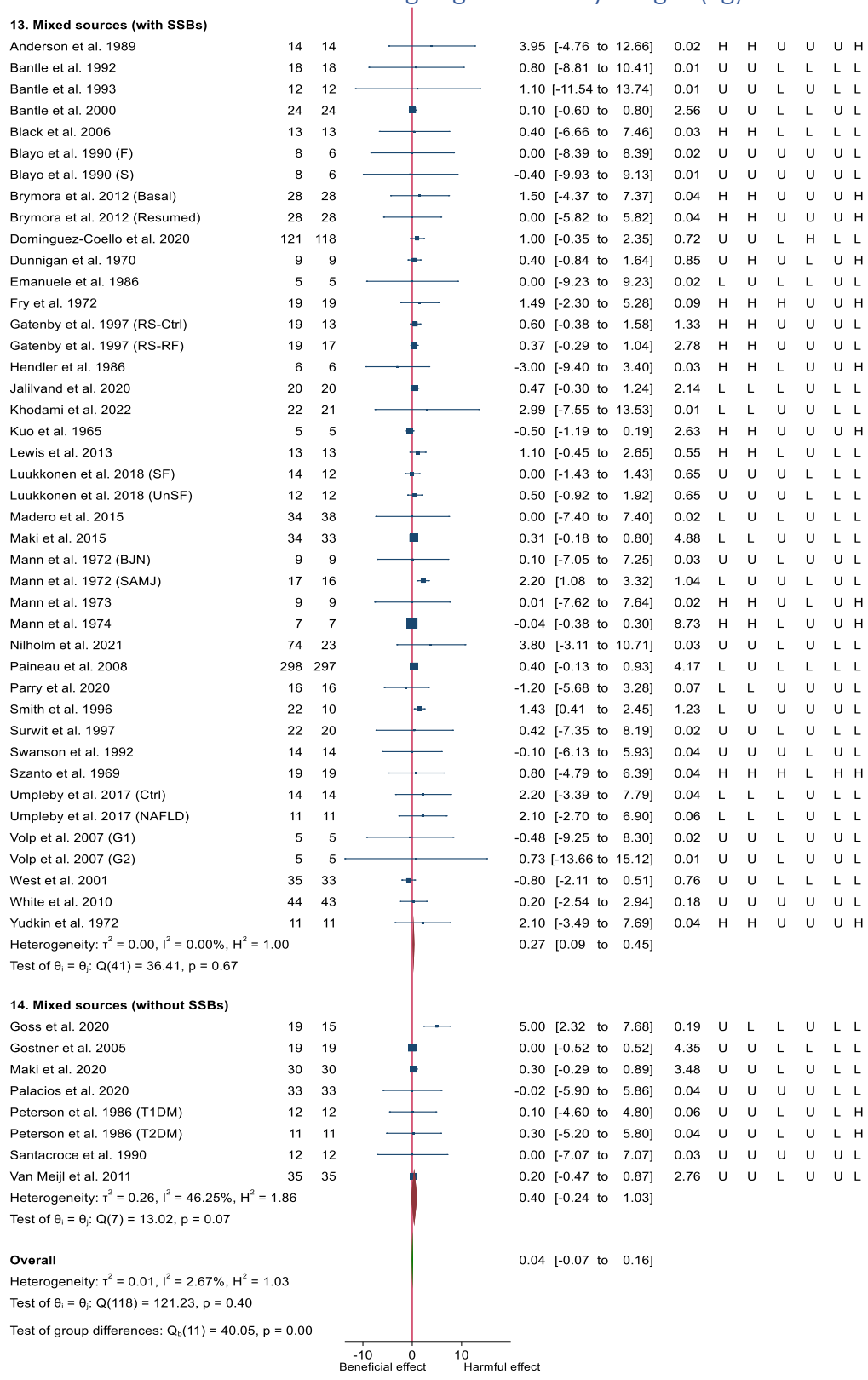
Supplementary Figure 7 (1 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in substitution trials



Supplementary Figure 7 (2 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in substitution trials



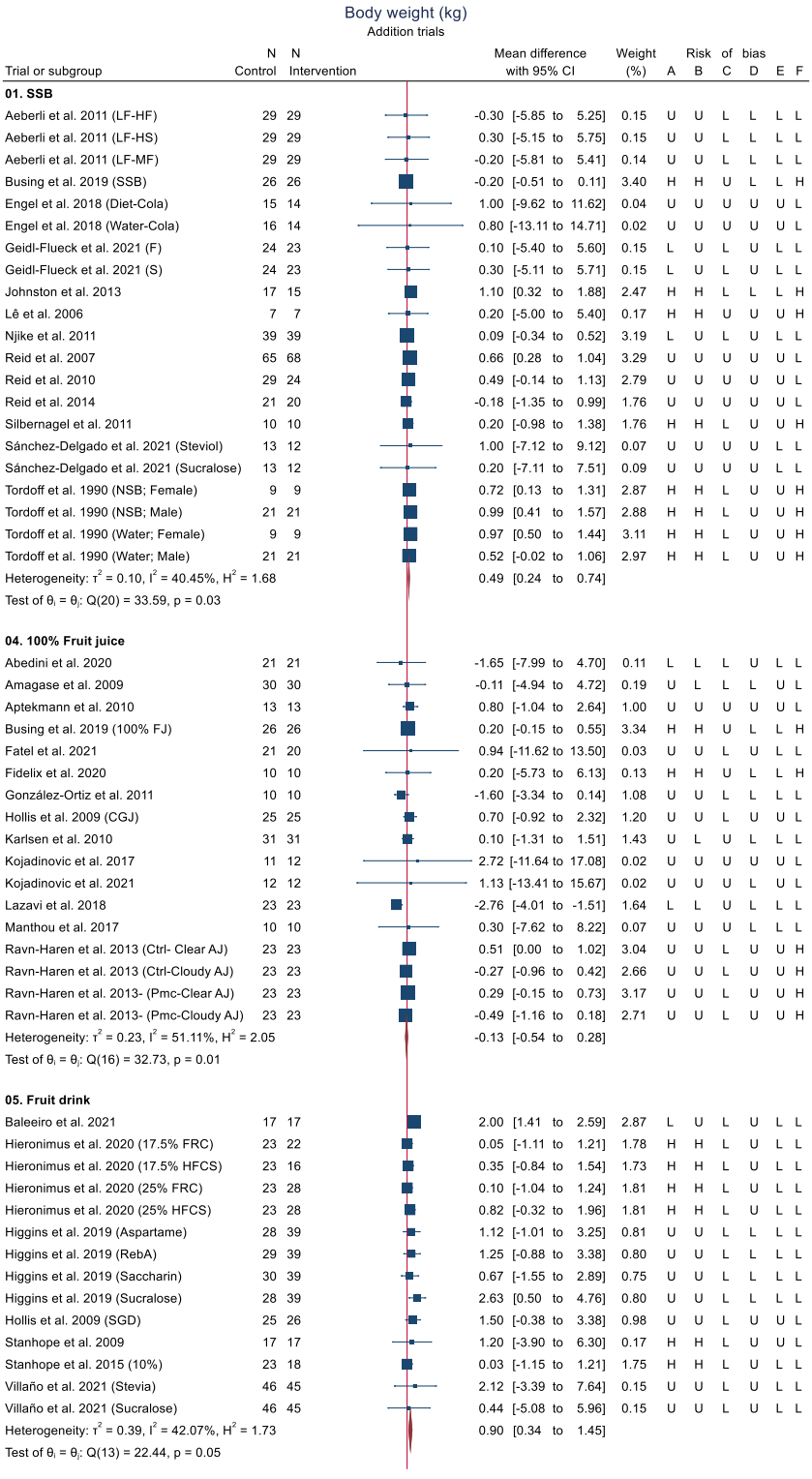
Supplementary Figure 7 (3 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in substitution



Test of θ = 0: z = 0.724, p = 0.469

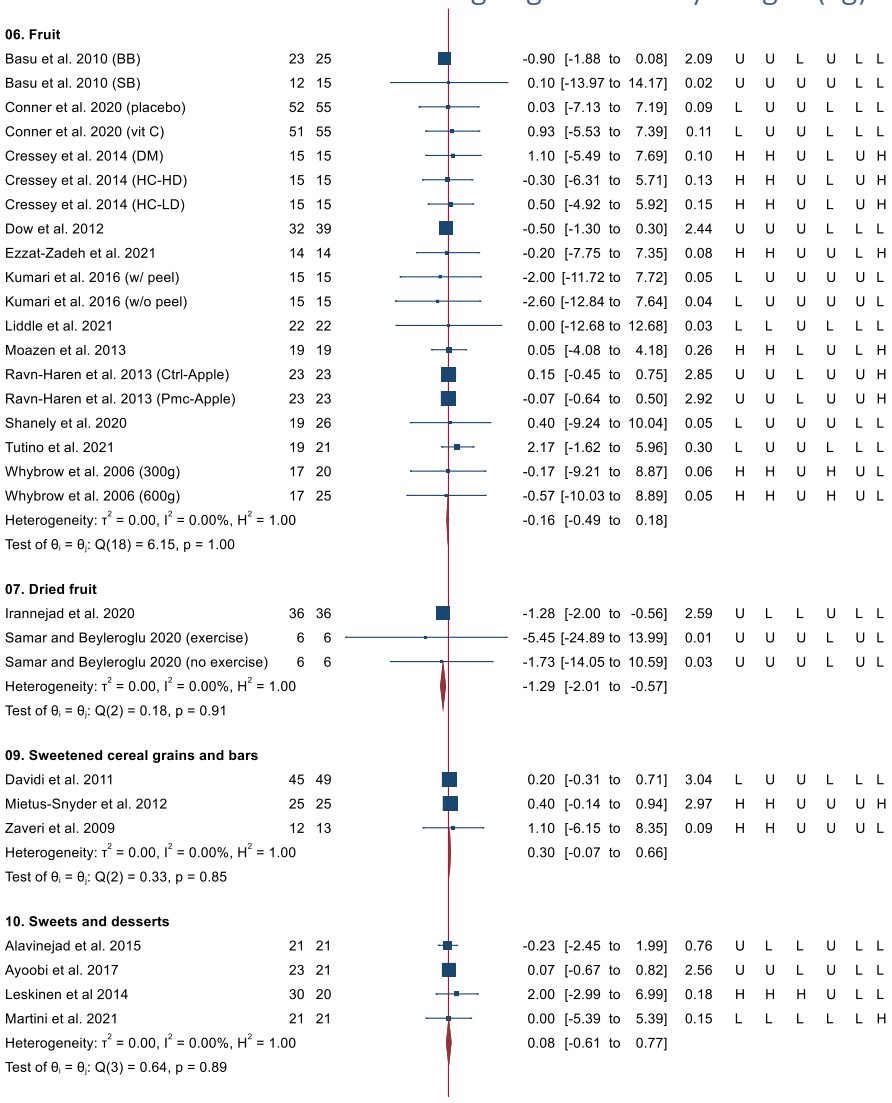
Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.
Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.
Pooled effect summary calculated with the χ^2 test. test for group differences calculated with meta-regression, which uses the Wald test.
BJN=British Journal of Nutrition; C=crossover; CI=confidence interval; Ctrl=control; F=fructose; FRC=fructose; G=glucose; G1=group 1; G2=group 2; G3=group 3; HF=high fructose; HFCS=high fructose corn syrup; HG=high glucose; HGI=high glycemic index; HS=high sucrose; Hyper=hypercaloric; Iso=isocaloric; LGI=low glycemic index; MF=medium fructose; MG=medium glucose; NAFLD=non-alcoholic fatty liver disease; P=parallel; RF=reduced fat; RS=reduced sugar; S=sucrose; SAMJ=South African Medical Journal; SF=saturated fat; SSB=sugars-sweetened beverage; T1DM=type 1 diabetes mellitus; T2DM=type 2 diabetes mellitus; UnSF=unsaturated fat; UnSw=unsweetened.

Supplementary Figure 8 (1 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in addition trials

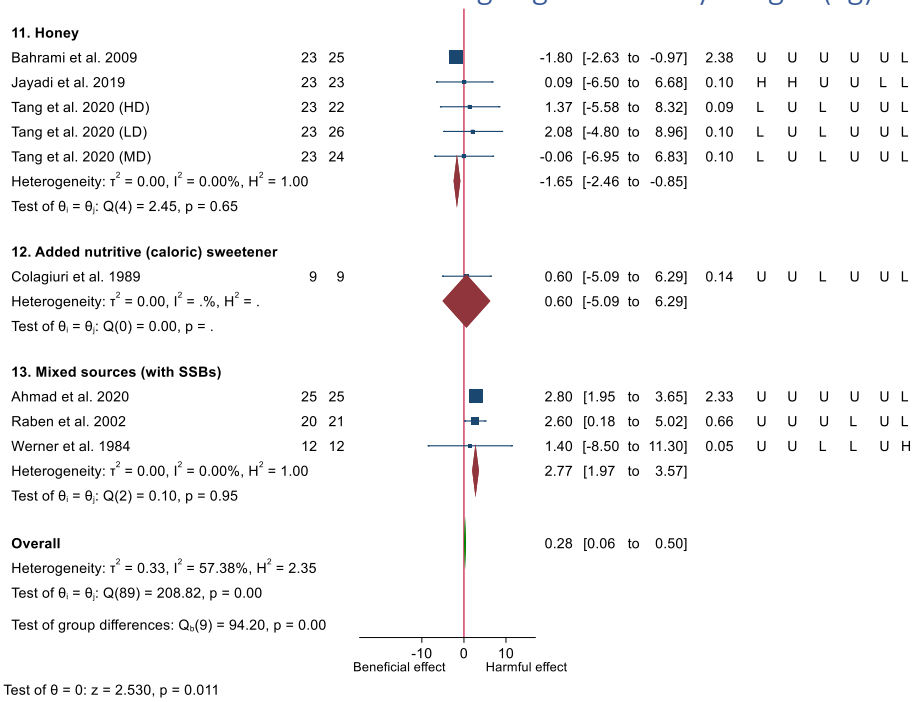


Trial or subgroup	N Control	N Intervention	Mean difference with 95% CI	Weight (%)	Risk of bias A	B	C	D	E	F
01. SSB										
Aeberli et al. 2011 (LF-HF)	29	29	-0.30 [-5.85 to 5.25]	0.15	U	U	L	L	L	L
Aeberli et al. 2011 (LF-HS)	29	29	0.30 [-5.15 to 5.75]	0.15	U	U	L	L	L	L
Aeberli et al. 2011 (LF-MF)	29	29	-0.20 [-5.81 to 5.41]	0.14	U	U	L	L	L	L
Busing et al. 2019 (SSB)	26	26	-0.20 [-0.51 to 0.11]	3.40	H	H	U	L	L	H
Engel et al. 2018 (Diet-Cola)	15	14	1.00 [-9.62 to 11.62]	0.04	U	U	U	U	U	L
Engel et al. 2018 (Water-Cola)	16	14	0.80 [-13.11 to 14.71]	0.02	U	U	U	U	U	L
Geidl-Flueck et al. 2021 (F)	24	23	0.10 [-5.40 to 5.60]	0.15	L	U	L	U	L	L
Geidl-Flueck et al. 2021 (S)	24	23	0.30 [-5.11 to 5.71]	0.15	L	U	L	U	L	L
Johnston et al. 2013	17	15	1.10 [0.32 to 1.88]	2.47	H	H	L	L	L	H
Lê et al. 2006	7	7	0.20 [-5.00 to 5.40]	0.17	H	H	U	U	U	H
Njike et al. 2011	39	39	0.09 [-0.34 to 0.52]	3.19	L	U	L	U	L	L
Reid et al. 2007	65	68	0.66 [0.28 to 1.04]	3.29	U	U	U	U	U	L
Reid et al. 2010	29	24	0.49 [-0.14 to 1.13]	2.79	U	U	U	U	U	L
Reid et al. 2014	21	20	-0.18 [-1.35 to 0.99]	1.76	U	U	U	U	U	L
Silbernagel et al. 2011	10	10	0.20 [-0.98 to 1.38]	1.76	H	H	L	U	U	H
Sánchez-Delgado et al. 2021 (Steviol)	13	12	1.00 [-7.12 to 9.12]	0.07	U	U	U	U	L	L
Sánchez-Delgado et al. 2021 (Sucralose)	13	12	0.20 [-7.11 to 7.51]	0.09	U	U	U	U	L	L
Tordoff et al. 1990 (NSB; Female)	9	9	0.72 [0.13 to 1.31]	2.87	H	H	L	U	U	H
Tordoff et al. 1990 (NSB; Male)	21	21	0.99 [0.41 to 1.57]	2.88	H	H	L	U	U	H
Tordoff et al. 1990 (Water; Female)	9	9	0.97 [0.50 to 1.44]	3.11	H	H	L	U	U	H
Tordoff et al. 1990 (Water; Male)	21	21	0.52 [-0.02 to 1.06]	2.97	H	H	L	U	U	H
Heterogeneity: τ^2 = 0.10, I^2 = 40.45%, H^2 = 1.68			0.49 [0.24 to 0.74]							
Test of $\theta_i = \theta_j$: Q(20) = 33.59, p = 0.03										
04. 100% Fruit juice										
Abedini et al. 2020	21	21	-1.65 [-7.99 to 4.70]	0.11	L	L	L	U	L	L
Amagase et al. 2009	30	30	-0.11 [-4.94 to 4.72]	0.19	U	L	L	L	U	L
Aptekmann et al. 2010	13	13	0.80 [-1.04 to 2.64]	1.00	U	U	U	U	U	L
Busing et al. 2019 (100% FJ)	26	26	0.20 [-0.15 to 0.55]	3.34	H	H	U	L	L	H
Fatel et al. 2021	21	20	0.94 [-11.62 to 13.50]	0.03	U	U	L	U	L	L
Fidelix et al. 2020	10	10	0.20 [-5.73 to 6.13]	0.13	H	H	U	L	L	H
González-Ortiz et al. 2011	10	10	-1.60 [-3.34 to 0.14]	1.08	U	U	L	L	L	L
Hollis et al. 2009 (CGJ)	25	25	0.70 [-0.92 to 2.32]	1.20	U	U	L	U	U	L
Karlsen et al. 2010	31	31	0.10 [-1.31 to 1.51]	1.43	U	L	U	L	L	L
Kojadinovic et al. 2017	11	12	2.72 [-11.64 to 17.08]	0.02	U	U	U	U	U	L
Kojadinovic et al. 2021	12	12	1.13 [-13.41 to 15.67]	0.02	U	U	U	L	U	L
Lazavi et al. 2018	23	23	-2.76 [-4.01 to -1.51]	1.64	L	L	U	L	L	L
Manthou et al. 2017	10	10	0.30 [-7.62 to 8.22]	0.07	U	U	U	L	L	L
Ravn-Haren et al. 2013 (Ctrl- Clear AJ)	23	23	0.51 [0.00 to 1.02]	3.04	U	U	L	U	U	H
Ravn-Haren et al. 2013 (Ctrl-Cloudy AJ)	23	23	-0.27 [-0.96 to 0.42]	2.66	U	U	L	U	U	H
Ravn-Haren et al. 2013- (Pmc-Clear AJ)	23	23	0.29 [-0.15 to 0.73]	3.17	U	U	L	U	U	H
Ravn-Haren et al. 2013- (Pmc-Cloudy AJ)	23	23	-0.49 [-1.16 to 0.18]	2.71	U	U	L	U	U	H
Heterogeneity: τ^2 = 0.23, I^2 = 51.11%, H^2 = 2.05			-0.13 [-0.54 to 0.28]							
Test of $\theta_i = \theta_j$: Q(16) = 32.73, p = 0.01										
05. Fruit drink										
Baleeiro et al. 2021	17	17	2.00 [1.41 to 2.59]	2.87	L	U	L	U	L	L
Hieronimus et al. 2020 (17.5% FRC)	23	22	0.05 [-1.11 to 1.21]	1.78	H	H	L	U	L	L
Hieronimus et al. 2020 (17.5% HFCS)	23	16	0.35 [-0.84 to 1.54]	1.73	H	H	L	U	L	L
Hieronimus et al. 2020 (25% FRC)	23	28	0.10 [-1.04 to 1.24]	1.81	H	H	L	U	L	L
Hieronimus et al. 2020 (25% HFCS)	23	28	0.82 [-0.32 to 1.96]	1.81	H	H	L	U	L	L
Higgins et al. 2019 (Aspartame)	28	39	1.12 [-1.01 to 3.25]	0.81	U	U	L	L	L	L
Higgins et al. 2019 (RebA)	29	39	1.25 [-0.88 to 3.38]	0.80	U	U	L	L	L	L
Higgins et al. 2019 (Saccharin)	30	39	0.67 [-1.55 to 2.89]	0.75	U	U	L	L	L	L
Higgins et al. 2019 (Sucralose)	28	39	2.63 [0.50 to 4.76]	0.80	U	U	L	L	L	L
Hollis et al. 2009 (SGD)	25	26	1.50 [-0.38 to 3.38]	0.98	U	U	L	U	U	L
Stanhope et al. 2009	17	17	1.20 [-3.90 to 6.30]	0.17	H	H	L	U	U	L
Stanhope et al. 2015 (10%)	23	18	0.03 [-1.15 to 1.21]	1.75	H	H	L	U	L	L
Villaño et al. 2021 (Stevia)	46	45	2.12 [-3.39 to 7.64]	0.15	U	U	L	U	L	L
Villaño et al. 2021 (Sucralose)	46	45	0.44 [-5.08 to 5.96]	0.15	U	U	L	U	L	L
Heterogeneity: τ^2 = 0.39, I^2 = 42.07%, H^2 = 1.73			0.90 [0.34 to 1.45]							
Test of $\theta_i = \theta_j$: Q(13) = 22.44, p = 0.05										

Supplementary Figure 8 (2 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in addition trials



Supplementary Figure 8 (3 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in addition trials



Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.

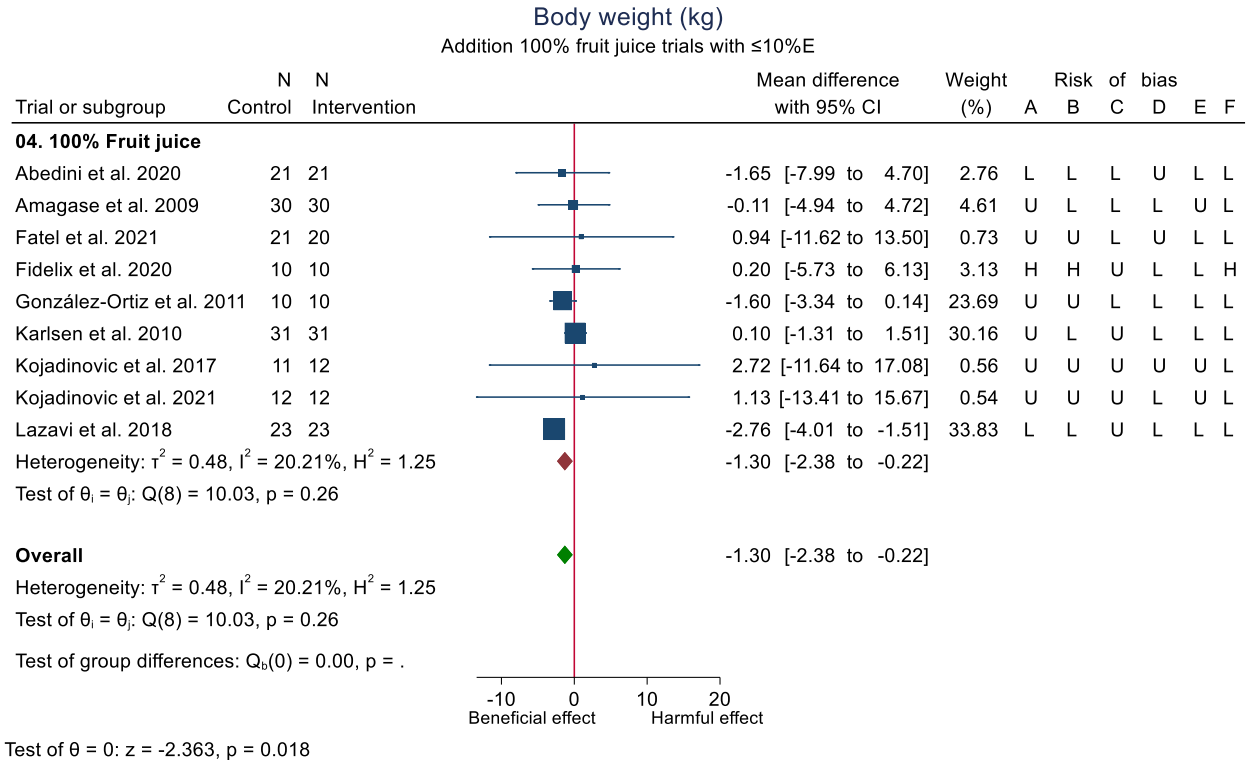
Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Pooled effect summary calculated with the χ^2 test. test for group differences calculated with meta-regression, which uses the Wald test.

AJ=apple juice; BB=blueberries; CI=confidence interval; CGJ=Concord grape juice; Ctrl=control; DM=diabetes mellitus; F=fructose; FJ=fruit juice; FRC=fructose; HC=hypercholesterolemia; HD=high dose; HF=high fructose; HFCS=high fructose corn syrup; HS=high sucrose; LD=low dose; LF=low fructose; MD=mean difference; MF=medium fructose; NSB=non-nutritive sweetened beverage; Pmc=apple pomace; RebA=rebaudioside A; S=sucrose; SB=strawberries; SSB=sugars-sweetened beverage; vit C=vitamin C; w/=with; w/o=without.

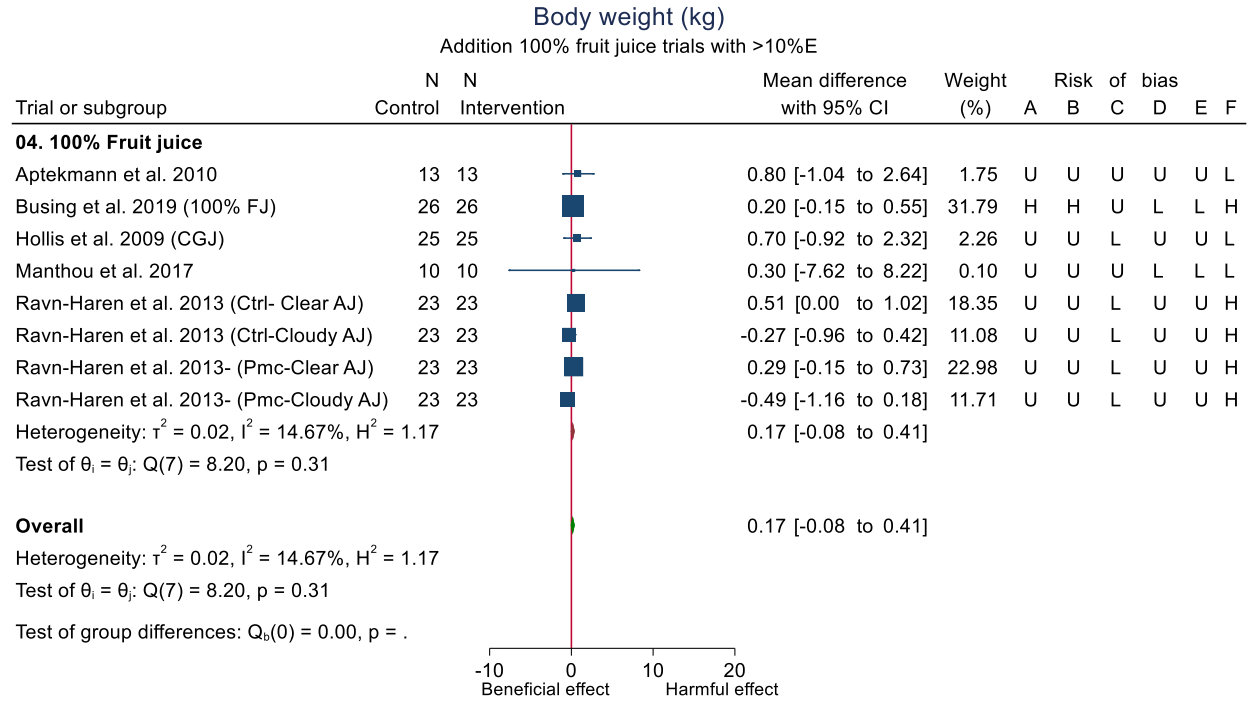
Supplementary Figure 9: Forest plot of controlled trials of the effect of important food sources of 100% fruit juice on body weight (kg) in addition trials with ≤10%E or >10%E

A



Test of θ = 0: z = -2.363, p = 0.018

B



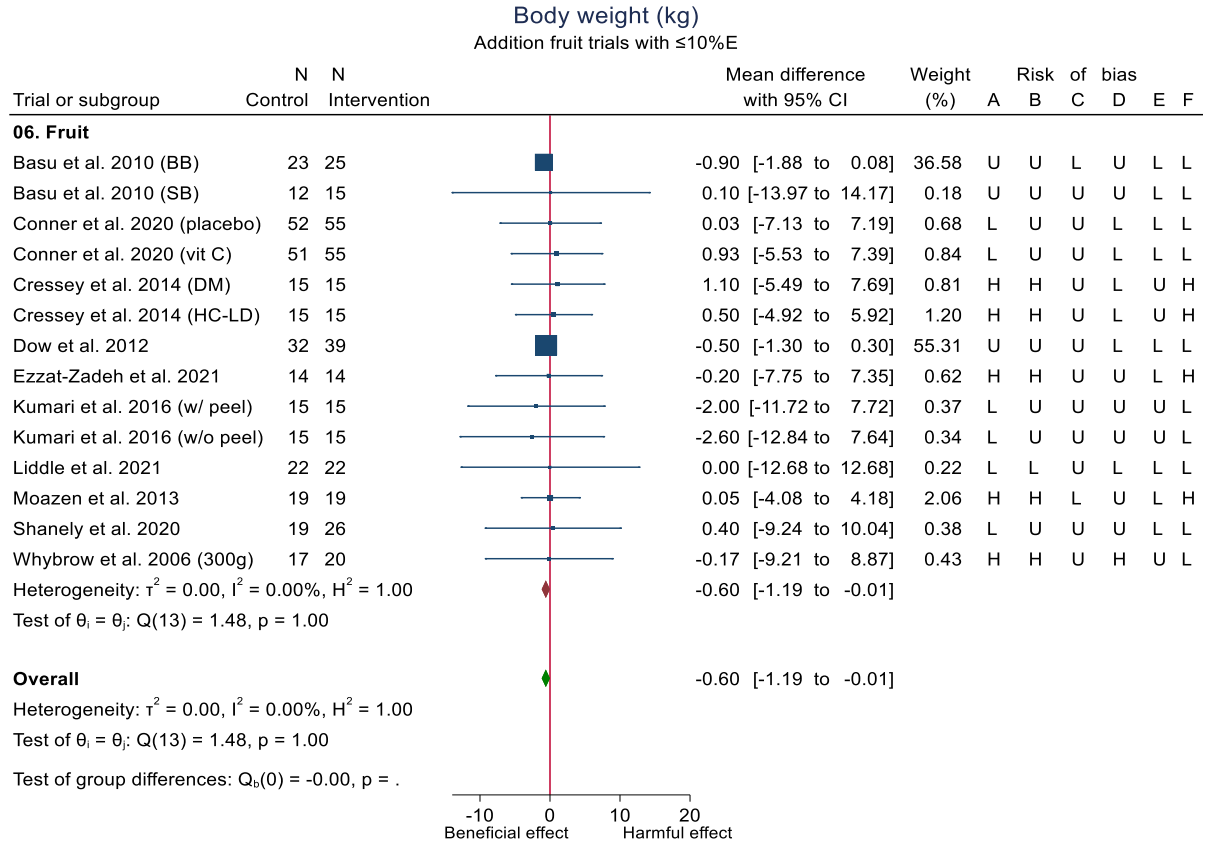
Test of θ = 0: z = 1.327, p = 0.185

Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random

effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.
Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions.
Panel A: 100% fruit juice trials with ≤10%E; B: 100% fruit juice trials with >10%E
AJ=apple juice; CGJ=Concord grape juice; CI=confidence interval; Ctrl=control; %E=percentage of total energy intake; FJ=fruit juice; Pmc=apple pomace

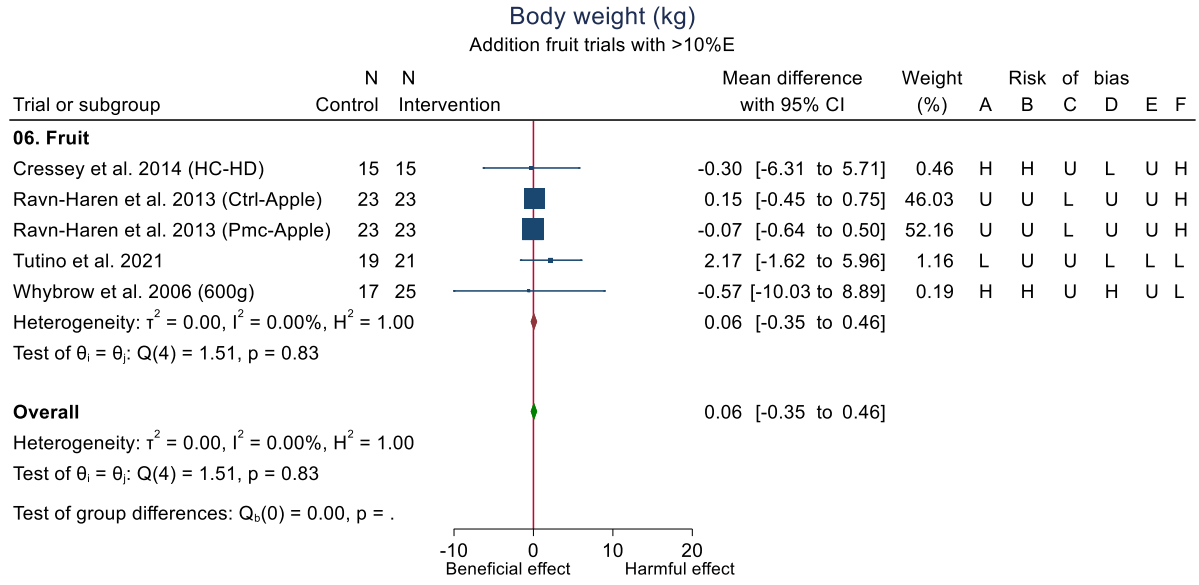
Supplementary Figure 10: Forest plot of controlled trials of the effect of fruit on body weight (kg) in addition trials with ≤10%E or >10%E

A



Test of θ = 0: z = -1.978, p = 0.048

B

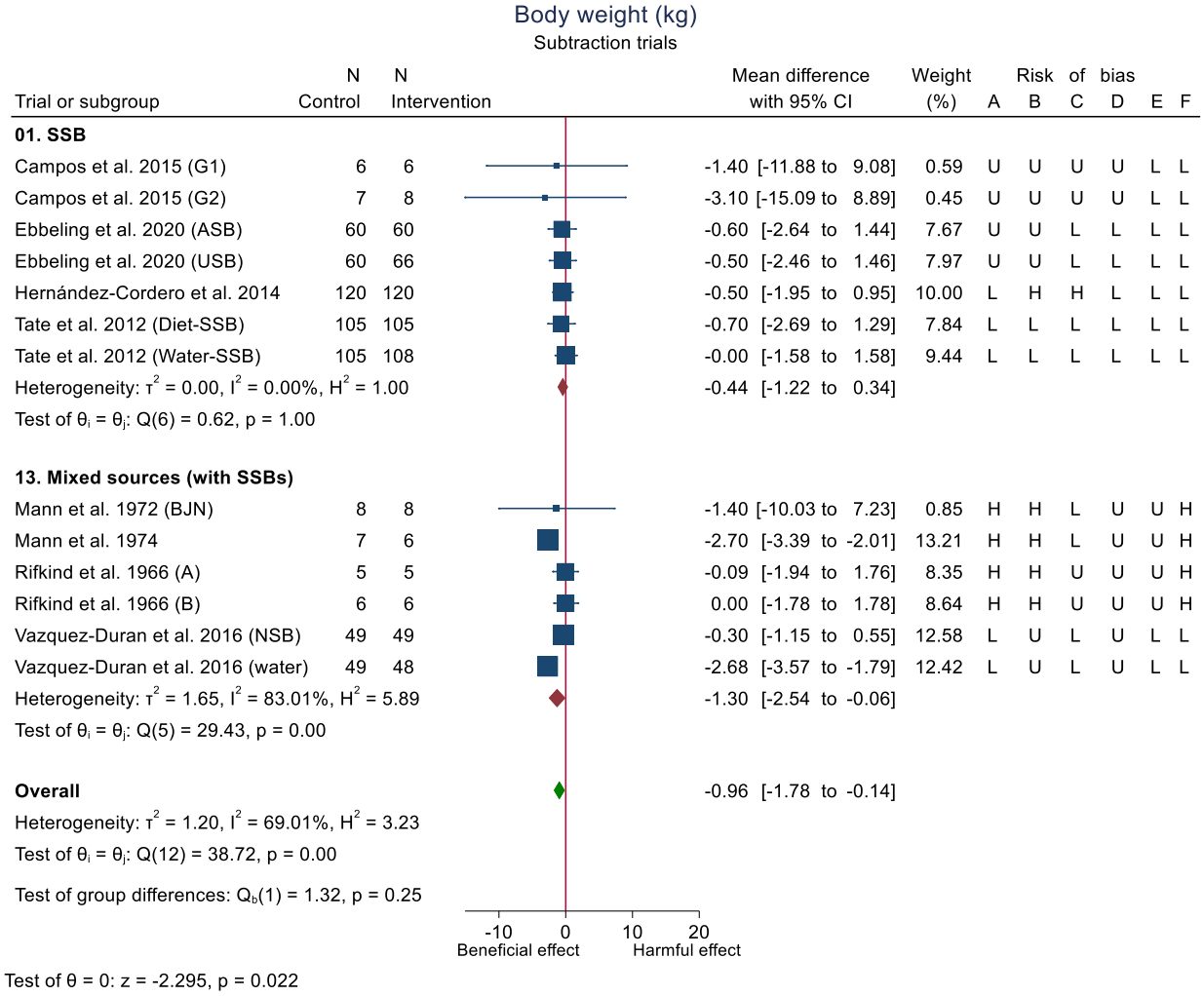


Test of θ = 0: z = 0.265, p = 0.791

Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random

effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.
Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.
Pooled effect summary calculated with the χ^2 test. Test for group differences calculated with meta-regression, which uses the Wald test.
Panel A: addition trials of fruit with ≤10%E; B: addition trials of fruit with >10%E
AJ=apple juice; BB=blueberries; CGJ=Concord grape juice; CI=confidence interval; Ctrl=control; DM=diabetes mellitus; %E=percentage of total energy intake; FJ=fruit juice; HC=hypercholesterolemia; HD=high dose; LD=low dose; Pmc=apple pomace; SB=strawberries; vit C=vitamin C; w/=with; w/o=without.

Supplementary Figure 11: Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in subtraction trials



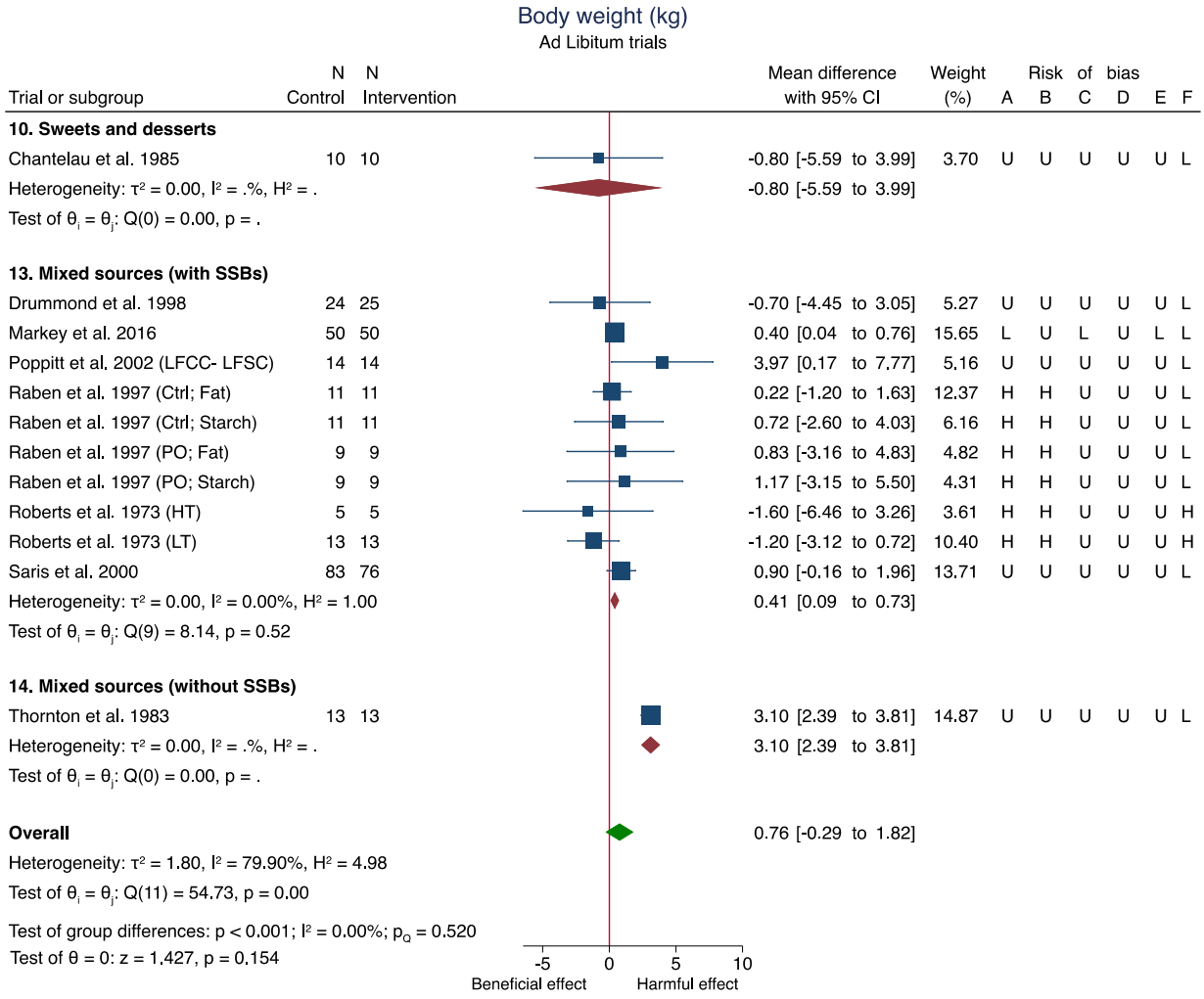
Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.

Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Pooled effect summary calculated with the χ^2 test. Test for group differences calculated with meta-regression, which uses the Wald test.

A=group A; ASB=artificially sweetened beverage; B=group B; BJN=British Journal of Nutrition; CI=confidence interval; G1=group 1; G2=group 2; NSB=non-nutritive sweetened beverage; SSB=sugars-sweetened beverage; USB=unsweetened beverage.

Supplementary Figure 12: Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on body weight (kg) in *ad libitum* trials



Pooled effect estimates for each subgroup and overall effect are represented by the diamonds. Data are expressed as weighted mean differences with 95% confidence intervals using the generic inverse-variance method and random effects DerSimonian-Laird model. Paired analyses were applied to all crossover trials. Inter-study heterogeneity was assessed using the Cochrane Q statistic and quantified using the I^2 statistic, with significance set at $p<0.100$ and $I^2 \geq 50\%$ considered to be evidence of substantial heterogeneity.

Risk of Bias Legend: (H) High Risk; (L) Low Risk; (U) Unclear. The letters represent the following risk of bias domains: A, random sequence generation (selection bias); B, allocation concealment (selection bias); C, blinding of participants and personnel and outcome assessors (performance bias); D, incomplete outcome data (attrition bias); E, selective reporting (reporting bias); and F, other bias. High other risk of bias was given to crossover trials which had no washout between interventions. Trials which did not have this characteristic were rated as Low.

Pooled effect summary calculated with the χ^2 test. test for group differences calculated with meta-regression, which uses the Wald test.

CI=confidence interval; Ctrl=control; HT=high triglyceride group; LFCC=low-fat, complex carbohydrate diet; LFSC=low-fat, simple carbohydrate diet; LT=low triglyceride group; PO=post-obese; SSB=sugars-sweetened beverage.

Supplementary Figure 13 (1 of 3): Forest plot of controlled trials of the effect of important food sources of fructose-containing sugars on BMI (kg/m^2) in substitution trials

