

Ref, Country	Study design	SCI-Q	FFQ details	Validation metrics reported in manuscript?	†Substitution examined	Ref	n in validation study and reference method	Variable	Validity data			^Adjusted r or p			Difference from reference method										
									Male	Female	Total	Male	Female	Total	Male	Female	Total								
Australia																									
Melaku <i>et al.</i> 2019	Prospective cohort	Q1	DOES-V3.1 121-item, semi-quantitative	N	Macronutrients with each other	Hodge <i>et al.</i> 2000	63 females; 7d WFR	Energy	-	0.23	-	-	-	-	-	6.0%	-								
								Protein	-	0.36	-	-	0.32	-	-	1.4%	-								
								CHO	-	0.37	-	-	0.7	-	-	17.6%	-								
								Sugars	-	0.45	-	-	0.66	-	-	21.2%	-								
								Starch	-	0.35	-	-	0.29	-	-	10.6%	-								
								Fat	-	0.36	-	-	0.68	-	-	-2.4%	-								
								SFA	-	0.36	-	-	0.59	-	-	5.4%	-								
								PUFA	-	0.52	-	-	0.55	-	-	-9.7%	-								
								MUFA	-	0.41	-	-	0.59	-	-	-8.1%	-								
								Alcohol	-	0.58	-	-	0.61	-	-	-23.9%	-								
								Fibre	-	0.47	-	-	0.66	-	-	23.4%	-								
Brazil																									
Ferreira <i>et al.</i> 2024	Prospective cohort	Q2	114-item semi-quantitative	N	Unprocessed/Minimally processed food (NOVA-1) and culinary ingredients (NOVA-2) for ultra-processed foods (NOVA-4)	Molina <i>et al.</i> 2013	136 males + 145 females; 2 x 3d FR	Energy	-	-	-	-	-	-	-	-	36.2%								
								Protein	-	-	-	-	-	-	-	-	38.8%								
								CHO	-	-	-	-	-	-	-	43.6%									
								Fat	-	-	-	-	-	-	-	26.4%									
								Fibre	-	-	-	-	-	-	-	78.3%									
China																									
Chiu <i>et al.</i> 2018	Cross-sectional	-	64-item quantitative	Y, specific p	Meat or fish for soy Refined grains, fruit or fruit juice for whole grains	Reported in-text	No information provided for no. of participants	Energy	-	-	0.58	-	-	-	-	-	3.4%								
								Protein	-	-	0.50	-	-	0.49	-	-	-5.8%								
								Chiu <i>et al.</i> 2014	21 males and 57 females; 3d FR	CHO	-	-	0.66	-	-	0.44	-	-	7.6%*						
										Fat	-	-	0.30	-	-	0.44	-	-	-8.9%						
										SFA	-	-	0.42	-	-	0.46	-	-	-5.0%						
										PUFA	-	-	0.17	-	-	0.15	-	-	-17.2%*						
										MUFA	-	-	0.41	-	-	0.44	-	-	-15.7%*						
										Fibre	-	-	0.47	-	-	0.55	-	-	-19.4%						
										Soy	-	-	0.41	-	-	-	-	-	-						
										Meat	-	-	0.46	-	-	-	-	-	-						
										Fish	-	-	0.55	-	-	-	-	-	-						
										Eggs	-	-	0.47	-	-	-	-	-	-						
										Dairy	-	-	0.39	-	-	-	-	-	-						
										Vegetables	-	-	0.47	-	-	-	-	-	-						
										Fruits	-	-	0.30	-	-	-	-	-	-						
										Grains	-	-	0.68	-	-	-	-	-	-						
										Macronutrients	-	-	0.56-0.74	-	-	-	-	-	-						
										SFA	-	-	0.29	-	-	-	-	-	-						
										PUFA	-	-	0.37	-	-	-	-	-	-						
										Costa Rica															
Sun <i>et al.</i> 2023	Prospective cohort	Q2	266-item quantitative	N	Wholegrain for refined grain	Woo <i>et al.</i> 1997	500 males + 510 females; 1 x 24HR	Energy	-	-	-	-	-	-	2.2%	-4.6%	-								
								Protein	-	-	-	-	-	-	-	-	-								
								CHO	-	-	-	-	-	-	-	-	-								
								Fat	-	-	-	-	-	-	-	-	-								
								PUFA	-	-	-	-	-	-	-	-	-								
Yang <i>et al.</i> 2022a	Prospective cohort	Q2	107-item semi-quantitative	Y, specific r for protein and range for other nutrients	Protein for fat or CHO	Cheng <i>et al.</i> 2008	125 females; 6 x 24HR	Energy	-	†0.68	-	-	-	-	-	11.9%	-								
								Protein	-	†0.61	-	-	†0.22	-	-	8.2%	-								
								CHO	-	†0.68	-	-	†0.49	-	-	10.5%	-								
								Fat	-	†0.55	-	-	†0.49	-	-	24.9%	-								
								Fibre	-	†0.63	-	-	†0.34	-	-	10.2%	-								
Wu <i>et al.</i> 2022	Cross-sectional	Q2	Inadequate information provided	Y, specific p for energy only	Fresh vegetables for preserved vegetables	Reported in text only	200 males + females; 2 x 24HR	Energy	-	-	0.60	-	-	-	-	-	-								
Costa Rica																									
Luan <i>et al.</i> 2020	Cross-sectional	Q2	135-item semi-quantitative	N	Alternative protein (fish, chicken without skin or fat, chicken with skin and fat, low fat milk, total milk and legumes) for red meat	Kabagambe <i>et al.</i> 2001	78 males + 42 females; 7 x 24HR	Energy	-	-	-	-	-	-	-	-	25.5%								
								Protein	-	-	†0.39	-	-	†0.46	-	-	16.9%								
								CHO	-	-	†0.47	-	-	†0.50	-	-	17.1%								
								Fat	-	-	†0.59	-	-	†0.74	-	-	50.8%								
								SFA	-	-	†0.58	-	-	†0.71	-	-	55.0%								
								MUFA	-	-	†0.49	-	-	†0.64	-	-	54.5%								
								PUFA	-	-	†0.54	-	-	†0.75	-	-	50.0%								
								Fibre	-	-	†0.65	-	-	†0.72	-	-	25.0%								
								Denmark																	
								Nielsen <i>et al.</i> 2022	Prospective cohort	Q2	192-item semi-quantitative	N	Fish, poultry and red meat with each other	Tjønneland <i>et al.</i> 1991	59 males + 85 females; 2 x 7d WFR	Energy	0.40	0.23	-	-	-	-	-1.8%	-2.1%	-
Ibsen <i>et al.</i> 2019	Prospective cohort	Q2	Y, range of p	Protein	0.41	0.14	-	0.52	0.26	-	-7.4%	-8.2%	-												
Lasota <i>et al.</i> 2019	Prospective cohort	Q2	N	CHO	0.44	0.34	-	0.40	0.47	-	13.9%	22.8%	-												
Vene <i>et al.</i> 2018	Prospective cohort	Q1	N	Fat	0.54	0.27	-	0.67	0.48	-	-13.2%	-13.2%	-												
Hansen <i>et al.</i> 2021	Prospective cohort	Q2	Y, range of p	SFA	0.42	0.26	-	0.46	0.39	-	-3.6%	-6.3%	-												
Wurtz <i>et al.</i> 2021a	Prospective cohort	Q2	N	PUFA	0.53	0.28	-	0.60	0.31	-	-7.2%	3.1%	-												
Pokharel <i>et al.</i> 2024	Prospective cohort	Q2	N																						
Laursen <i>et al.</i> 2018	Prospective cohort	Q1	Y, quintile agreement	Dairy products with each other																					
Ibsen <i>et al.</i> 2021	Prospective cohort	Q2	N																						
Kvist <i>et al.</i> 2020	Prospective cohort	Q2	N																						
Laursen <i>et al.</i> 2022	Prospective cohort	Q2	N																						
Lyskjaer <i>et al.</i> 2020	Prospective cohort	Q1	N	Oatmeal, eggs, yoghurt and white bread for each other																					
Finland																									
Ahola <i>et al.</i> 2018	Cross-sectional	Q1	19-item qualitative	N	Macronutrients with each other	Ahola <i>et al.</i> 2017	238 males + 304 females; 2 x 3d FR	Energy	-	-	0.73	-	-	-	-	-	-								
								Other macronutrients	-	-	>0.43	-	-	-	-	-									
Maukonen <i>et al.</i> 2023	Prospective cohort	Q1	110-item semi-quantitative	N	Red meat or processed meat with plant-based foods (legumes, vegetables, fruits, cereals, or a combination of these)	Männistö <i>et al.</i> 1996	152 females; 2 x 7d FR	Energy	-	-	†0.23	-	-	-	-	-	-								
								Protein	-	-	†0.23	-	-	†0.63	-	-	-								
								CHO	-	-	†0.25	-	-	†0.49	-	-	-								
								Fat	-	-	†0.30	-	-	†0.44	-	-	-								
								SFA	-	-	†0.37	-	-	†0.59	-	-	-								
								Beef, pork	-	-	†0.37	-	-	†0.42	-	-	-								
								Poultry	-	-	†0.45	-	-	†0.54	-	-	-								
								Sausages	-	-	†0.47	-	-	†0.61	-	-	-								
								Vegetables	-	-	†0.60	-	-	†0.70	-	-	-								
								Fruits	-	-	†0.62	-	-	†0.70	-	-	-								
								Wheat products	-	-	†0.45	-	-	†0.62	-	-	-								
								Rye products	-	-	†0.37	-	-	†0.48	-	-	-								
								France																	
								MacDonald <i>et al.</i> 2023	Prospective cohort	Q2	208-item semi-quantitative	Y, specific p	MUFA, PUFA, CHO, and animal or vegetable protein for SFA	van Liere <i>et al.</i> 1997	119 females; 9-12 x 24HR	Energy	-	-	0.40	-	-	-	-	38.1%*	-
Thao <i>et al.</i> 2023	Prospective cohort	Q2	Y, specific p	Processed red meat, non-processed red meat, poultry, fish, eggs and vegetables for each other	Protein	-	-	0.29	-	-	0.56	-	-			40.8%*	-								
					CHO	-	-	0.42	-	-	0.64	-	-			27.6%*	-								
								Fat	-	-	0.49	-	-	0.49	-	-	47.3%*	-							
Germany																									
Inan-Eroglu <i>et al.</i> 2024	Prospective cohort	Q2	105 to 149-item semi-quantitative	N	Total protein for CHO	Kroke <i>et al.</i> 1999	75 males + 59 females; 3 x 24HR + urinary nitrogen (protein) + DLW (energy)	Energy	-	-	†0.48	-	-	-	-	-	-22.2%								
								Protein	-	-	†0.41	-	-	-	-	-	-22.7%								
								CHO	-	-	†0.56	-	-	†0.54	-	-	8.6%								
								Fat	-	-	†0.59	-	-	†0.71	-	-	-4.2%								
								SFA	-	-	†0.62	-	-	†0.70	-	-	-10.9%								
								MUFA	-	-	†0.59	-	-	†0.71	-	-	-15.5%								
								PUFA	-	-	†0.47	-	-	†0.60	-	-	1.7%								
								Fibre	-	-	†0.47	-	-	†0.50	-	-	24.3%								
Harris <i>et al.</i> 2018	Prospective cohort	Q1	80-item quantitative	N	CHO with different FAs	None cited in text; Steigler <i>et al.</i> 2010	52 males + 49 females; 1 x 24HR	Energy	-	-	-	-	-	-	-	-	9.6%								
								Protein	-	-	-	-	-	-	-	-	8.3%								
								CHO	-	-	-	-	-	-	-	-	20.6%								
								Fat	-	-	-	-	-	-	-	-	1.6%								
								SFA	-	-	-	-	-	-	-	-	8.0%								
								MUFA	-	-	-	-	-	-	-	-	0.0%								
								LA	-	-	-	-	-	-	-	-	14.3%								
								AA	-	-	-	-	-	-	-	-	83.1%								
								EPA	-	-	-	-	-	-	-	-	466.7%								
								DHA	-	-	-	-	-	-	-	-	151.7%								
								Greece																	
								Kouvari <i>et al.</i> 2024	Prospective cohort	Q2	156-item semi-quantitative	N	Dairy product sub-types for each other	Katsouyanni <i>et al.</i> 1997	42 males + 38 females; 12 x 24HR + biomarkers	Energy	0.63	0.46	-	0.66	0.50	-	7.3%	31.6%	-
								Protein	0.67	0.54	-	0.56	0.44	-	-7.4%	0.0%	-								
								SFA	0.68	0.49	-	0.47	0.49	-	-4.6%	15.5%	-								
								MUFA	0.64	0.41	-	0.29	0.41	-	26.4%	68.4%	-								
								PUFA	0.56	0.24	-	0.15	0.21	-	56.0%	58.6%	-								
								Fibre	0.27	0.31	-	0.41	0.19	-	27.8%	93.0%	-								
Iran																									
Mirmiran <i>et al.</i> 2020	Prospective cohort	Q2	168-item semi-quantitative	Y, specific r	Total red and processed meat with low-fat dairy, nuts, wholegrains and legumes	Mirmiran <i>et al.</i>	61 males + 71 females; 12 x	Energy	†0.55	†0.46	-	†0.55	†0.46	-	12.0%	26.0%	-								

Ref, Country	Study design	SCI-Q	FFQ details	Validation metrics reported in manuscript?	Substitution examined	Ref.	n in validation study and reference method	Validity data																																																																																																																																																																																																																																																													
								Variable	^Unadjusted r or p			^Adjusted r or p			Difference from reference method																																																																																																																																																																																																																																																						
Stuber et al. 2021	Prospective cohort	Q3	FFQ details	Y, specific p	FA from dairy substituted with FA from meat	1997b	24HR	Protein	Male	Female	Total	Male	Female	Total	Male	Female	Total																																																																																																																																																																																																																																																				
Visser et al. 2019	Prospective cohort	Q2		Y, specific p	CHO			0.61	0.51	-	0.71	0.67	-	2.1%	2.0%	-																																																																																																																																																																																																																																																					
Scheffers et al. 2022	Prospective cohort	Q2		Y, specific p for fruit	Fat			0.72	0.66	-	0.74	0.76	-	1.0%	2.0%	-																																																																																																																																																																																																																																																					
Liu et al. 2019	Prospective cohort	Q2		Y, specific p for total and individual SFA	SSB or fruit with pure fruit juice			0.69	0.58	-	0.61	0.63	-	11.5%	14.1%	-																																																																																																																																																																																																																																																					
				Y, range of p for total and individual SFA	Energy intake from total SFA with an equal amount of energy from each of the other macronutrients (PUFA, monounsaturated fatty acids (MUFA), trans fatty acids, total carbohydrates, animal protein, and vegetable protein)	Praegman et al. 2016		SFA	0.35	0.64	-	0.55	0.5	-	0.7%	4.7%	-																																																																																																																																																																																																																																																				
								PUFA	0.53	0.44	-	0.52	0.22	-	26.2%*	53.2%*	-																																																																																																																																																																																																																																																				
								MUFA	0.67	0.63	-	0.66	0.58	-	8.9%*	14.3%*	-																																																																																																																																																																																																																																																				
								TFA	0.63	0.56	-	0.53	0.49	-	10.5%*	7.7%	-																																																																																																																																																																																																																																																				
								Milk and milk products	0.71	0.79	-	-	-	-	36.0%*	21.2%*	-																																																																																																																																																																																																																																																				
								Cheese	0.64	0.38	-	-	-	-	16.7%	0.0%	-																																																																																																																																																																																																																																																				
								Meat	0.47	0.70	-	-	-	-	-5.1%	-8.6%*	-																																																																																																																																																																																																																																																				
								Fruit	0.68	0.56	-	-	-	-	-	-	-																																																																																																																																																																																																																																																				
												N	Macronutrients with each other	Goldbohm et al. 1994	59 males + 48 females; 9d FR	Energy	-	-	-	-	-	-	-	-	14.5%																																																																																																																																																																																																																																												
																Protein	-	-	-	-	-	-	-	-	11.5%																																																																																																																																																																																																																																												
CHO	-	-	-	-	-	-	-									-	-11.7%																																																																																																																																																																																																																																																				
Fat	-	-	-	-	-	-	-									-	-17.7%																																																																																																																																																																																																																																																				
SFA	-	-	-	-	-	-	-									-	-23.7%																																																																																																																																																																																																																																																				
PUFA	-	-	-	-	-	-	-									-	4.7%																																																																																																																																																																																																																																																				
Fibre	-	-	-	-	-	-	-									-	6.2%																																																																																																																																																																																																																																																				
				Y, specific r for animal protein and SFA	High fat cheese with alternative dairy products	Grootenhuys et al. 1995 (HS1)	33 males + 42 females; DHI									Energy	-	-	-	-	-	-	-	-	0.0%																																																																																																																																																																																																																																												
																Protein	-	-	-	-	-	-	-	-	1.4%																																																																																																																																																																																																																																												
																CHO	-	-	-	-	-	-	-	-	-5.2%																																																																																																																																																																																																																																												
								Fat	-	-	-	-	-	-	-	-	5.6%																																																																																																																																																																																																																																																				
								SFA	-	-	-	-	-	-	-	-	5.6%																																																																																																																																																																																																																																																				
								MUFA	-	-	-	-	-	-	-	-	6.1%																																																																																																																																																																																																																																																				
								PUFA	-	-	-	-	-	-	-	-	11.8%																																																																																																																																																																																																																																																				
								Fibre	-	-	-	-	-	-	-	-	13.0%																																																																																																																																																																																																																																																				
														Streppel et al. 2013 (HS2)	62 males + 66 females; 3 x 24HR	Energy	-	-	-	-	-	-	-	-	1.2%																																																																																																																																																																																																																																												
																Protein	-	-	-	-	-	-	-	-	-5.3%																																																																																																																																																																																																																																												
CHO	-	-	-	-	-	-	-									-	-1.4%																																																																																																																																																																																																																																																				
Fat	-	-	-	-	-	-	-									-	8.6%																																																																																																																																																																																																																																																				
SFA	-	-	-	-	-	-	-									-	7.7%																																																																																																																																																																																																																																																				
MUFA	-	-	-	-	-	-	-									-	13.0%																																																																																																																																																																																																																																																				
PUFA	-	-	-	-	-	-	-									-	14.3%																																																																																																																																																																																																																																																				
TFA	-	-	-	-	-	-	-									-	0.0%																																																																																																																																																																																																																																																				
Cheese	-	-	-	-	-	-	-									-	20.0%																																																																																																																																																																																																																																																				
Milk and milk products	-	-	-	-	-	-	-									-	-5.2%																																																																																																																																																																																																																																																				
				N	SSB with LNCB or SSB/LNCB with water	Brouwer-Brolsma et al. 2022	191 males + 210 females; a validated regular FFQ	SSB	-	-	-	-	-	-	-	-	35.0%																																																																																																																																																																																																																																																				
								LNCB	-	-	-	-	-	-	-	-	17.4%																																																																																																																																																																																																																																																				
								Water	-	-	-	-	-	-	-	-	2153.0%																																																																																																																																																																																																																																																				
								Fruit juice	-	-	-	-	-	-	-	-	-6.0%																																																																																																																																																																																																																																																				
								Energy	-	-	-	-	-	-	-	-	-1.8%																																																																																																																																																																																																																																																				
														Siebelink et al. 2011	174 males + 342 females	Energy	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																												
																Protein	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																												
																CHO	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																												
																Fat	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																												
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								Feunekes et al. 1993	95 males + 96 females; DHI + erythrocyte membrane FA (biomarker)	Energy	-	-	-	-	-	-	-	-	3.4%																																																																																																																																																																																																																																																		
										Protein	-	-	-	-	-	-	-	-	-	10.8%																																																																																																																																																																																																																																																	
										CHO	-	-	-	-	-	-	-	-	-	9.3%																																																																																																																																																																																																																																																	
										Fat	-	-	-	-	-	-	-	-	-	8.6%																																																																																																																																																																																																																																																	
										SFA	-	-	-	-	-	-	-	-	-	19.6%																																																																																																																																																																																																																																																	
										MUFA	-	-	-	-	-	-	-	-	-	22.4%																																																																																																																																																																																																																																																	
										PUFA	-	-	-	-	-	-	-	-	-	76.9%																																																																																																																																																																																																																																																	
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Ref, Country	Study design	SCI-Q	FFQ details	Validation metrics reported in manuscript?	†Substitution examined	Ref	n in validation study and reference method	Validity data																				
								Variable	Male	^Unadjusted r or p	Female	Total	Male	^Adjusted r or p	Female	Total	Difference from reference method											
								Meat or meat products	-	-	-	†0.61	-	-	-	-	-	18.4%										
								Eggs	-	-	-	†0.42	-	-	-	-	-	-15.7%										
								Fruits	-	-	-	†0.57	-	-	-	-	-	-2.4%										
								Total nuts	-	-	-	†0.38	-	-	-	-	-	61.9%										
								Olive oil	-	-	-	†0.55	-	-	-	-	-	-22.4%										
								Dairy products	-	-	-	†0.81	-	-	-	-	-	-33.8%										
								Cereals	-	-	-	†0.58	-	-	-	-	-	-3.0%										
Dierssen-Sotos <i>et al.</i> 2020	Case-control	Q2	140-item semi-quantitative	N	Fat subtypes for each other	Not validated	No information provided	None provided	-	-	-	-	-	-	-	-	-	-										
Sweden																												
Hantikainen <i>et al.</i> 2022	Prospective cohort	Q1	85-item semi-quantitative	N	Dietary fat sub-types with each other	Messerer <i>et al.</i> 2004	248 males; 14 x 24HR	Energy	-	-	-	-	-	-	-	-7.6%	-	-										
								Protein	-	-	-	-	0.44	-	-	6.0%	-	-										
								CHO	-	-	-	-	0.73	-	-	-10.2%	-	-										
								Fat	-	-	-	-	0.70	-	-	-7.4%	-	-										
								SFA	-	-	-	-	0.75	-	-	-2.1%	-	-										
								PUFA	-	-	-	-	0.49	-	-	-8.6%	-	-										
								MUFA	-	-	-	-	0.66	-	-	-13.1%	-	-										
Switzerland																												
Ortega <i>et al.</i> 2024	Prospective cohort	Q1	97-item semi-quantitative FFQ	N	Dairy for meat, fish, eggs, fruits and vegetables	Bernstein <i>et al.</i> 1995	Information from the citation is unavailable online	None reported	-	-	-	-	-	-	-	-	-	-										
UK																												
Wang <i>et al.</i> 2022	Prospective cohort	Q2	Inadequate details provided	N	Poultry or cereal for red meat	None cited	No information provided	None reported	-	-	-	-	-	-	-	-	-	-										
US																												
Lo <i>et al.</i> 2020	Prospective cohort	Q1	110 item quantitative	N	Meat with each other	Block <i>et al.</i> 1986	17 males + 33 females; 1 x 24HR	Energy	-	-	-	†0.82	-	-	-	-	-	-										
Anderson <i>et al.</i> 2018	Case-control	Q1		N	Macronutrients for each other			Fat	-	-	-	†0.73	-	-	-	-	-	-										
Su <i>et al.</i> 2022	Cross-sectional	-	140-item quantitative	N	Fish for red and processed meat, whole grain for refined grain, and whole fruit for fruit juice	Patterson <i>et al.</i> 1999	113 females; 4 x 24HR + 1 x 4d FR	Energy	-	†0.37	-	-	-	-	-	-	-6.6%	-										
								Protein	-	†0.36	-	-	-	†0.51	-	-	-1.5%	-										
								CHO	-	†0.41	-	-	-	†0.67	-	-	-13.0%	-										
								Fat	-	†0.49	-	-	-	†0.64	-	-	0.0%	-										
								SFA	-	†0.44	-	-	-	†0.63	-	-	12.5%	-										
Huang <i>et al.</i> 2020	Prospective cohort	Q1	124-item semi-quantitative	N	Plant protein for animal protein, egg protein or red meat protein	Thompson <i>et al.</i> 2008	987 males + 966 females; 2 x 24HR	Energy	†0.39	†0.22	-	-	-	-	-	-13.6%	-4.9%	-										
Liao <i>et al.</i> 2019	Prospective cohort	Q3		N				Protein	†0.41	†0.30	-	-	†0.43	†0.30	-	-18.2%	-9.5%	-										
Zhao <i>et al.</i> 2024	Prospective cohort	Q1		N	Plant fat with animal fat from red meat, white meat, dairy, egg or fish			CHO	†0.39	†0.32	-	-	†0.71	†0.64	-	-11.9%	-2.2%	-										
								Fat	†0.58	†0.39	-	-	†0.72	†0.62	-	-13.9%	-4.5%	-										
								SFA	†0.65	†0.48	-	-	†0.76	†0.69	-	-17.2%	-10.4%	-										
								F&V	†0.59	†0.46	-	-	†0.72	†0.61	-	0.8%	16.2%	-										
Guasch-Ferré <i>et al.</i> 2022	Prospective cohort	Q1	152-item semi-quantitative	N	Olive oil for margarine, butter, mayonnaise and dairy fat	Yuan <i>et al.</i> 2018	627 females; 2 x 7d FR + 4 x 24HR + biomarkers	Energy	-	0.12	-	-	-	-	-	-	-15.6%	-										
Tessier <i>et al.</i> 2024	Prospective cohort	Q1		N				Protein	-	0.26	-	-	0.28	-	-	0.8%	-											
Lee <i>et al.</i> 2022	Prospective cohort (NHS + HPFS)	Q1		Y, specific p	Plant proteins with animal protein sources (processed red meat, unprocessed red meat, poultry, fatty and non-fatty fish, egg, milk, yoghurt, cheese and other dairy)			SFA	-	0.12	-	-	0.10	-	-	13.4%	-											
Guasch-Ferré <i>et al.</i> 2020	Prospective cohort	Q1		N	Olive oil for margarine, butter, mayonnaise, other plant oil, dairy fat, and all other fats combined			MUFA	-	0.04	-	-	-	0.06	-	-	71.2%	-										
Korat <i>et al.</i> 2019	Prospective cohort	Q1		Y, specific p	Dairy fat with other macronutrients			PUFA	-	0.19	-	-	-	0.17	-	-	-50.4%	-										
Schmid <i>et al.</i> 2020	Prospective cohort	Q1		Y, specific p	Yoghurt with red meat, processed meat, nuts, whole grains, cheese, milk or total other dairy foods			TFA	-	0.30	-	-	-	0.27	-	-	145.5%	-										
Wan <i>et al.</i> 2022	Prospective cohort	Q2		N	Energy from specific types of fat with the equivalent calories from other nutrients	Al-Shaar <i>et al.</i> 2021	671 males; 2 x 7d FR	Energy	0.27	-	-	-	-	-	-	-9.7%	-	-										
Wurtz <i>et al.</i> 2021b	Prospective cohort	Q1		Y, range of p	Red meat with another protein source			Protein	0.22	-	-	0.28	-	-	-	-10.5%	-	-										
Dennis <i>et al.</i> 2023	Prospective cohort	Q1		Y, specific p	Equivalent energy from sugars or starch for an equivalent percentage of energy from total fat; Energy from total glucose equivalent or total fructose equivalent for equivalent energy from vegetable and animal fat			CHO	0.55	-	-	0.75	-	-	-9.9%	-	-											
								Sugars	0.64	-	-	0.70	-	-	-2.7%	-	-	-										
Nassan <i>et al.</i> 2018	Prospective cohort	Q1	152-item semi-quantitative	Y, specific p for poultry and processed red meat	Meat, processed meat or other protein rich foods with fish			Fat	0.43	-	-	0.67	-	-	-	-10.2%	-	-										
								SFA	0.49	-	-	0.71	-	-	-	-14.3%	-	-										
								PUFA	0.42	-	-	0.51	-	-	-	-14.3%	-	-										
								MUFA	0.45	-	-	0.59	-	-	-	-3.1%	-	-										
								Yuan <i>et al.</i> 2017	632 females; 2 x 7d FR	Energy	-	0.28	-	-	-	-	-	6.7%	-	-								
										Protein	-	0.33	-	-	-	0.48	-	-	11.0%	-	-							
										CHO	-	0.41	-	-	-	0.65	-	-	5.3%	-	-							
										Sugars	-	0.53	-	-	-	0.68	-	-	8.7%	-	-							
										Fat	-	0.36	-	-	-	0.59	-	-	4.5%	-	-							
										SFA	-	0.44	-	-	-	0.61	-	-	0.0%	-	-							
										PUFA	-	0.37	-	-	-	0.48	-	-	0.0%	-	-							
										MUFA	-	0.28	-	-	-	0.47	-	-	12.5%	-	-							
										Animal protein	-	0.42	-	-	-	0.56	-	-	10.7%	-	-							
										Vegetable protein	-	0.39	-	-	-	0.66	-	-	11.7%	-	-							
								Song <i>et al.</i> 2016	624 females; 2 x 7d FR	Animal protein	-	-	-	-	-	0.56	-	-	-	-	-	-	-	-				
										Plant protein	-	-	-	-	-	0.66	-	-	-	-	-	-	-	-				
								Hu <i>et al.</i> 1999	127 males; 2 x 7d FR	Processed meat	†0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Meat / red meats	†0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Poultry	†0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Fish / seafood	†0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Low-fat dairy products	†0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										High-fat dairy products	†0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Eggs	†0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Legumes	†0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Nuts	†0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
										Salvini <i>et al.</i> 1989	173 females; 4 x 7d FR	Skimmed milk	-	†0.79	-	-	-	-	-	†0.81	-	-	-	-	-	66.7%	-	-
												Whole milk	-	†0.62	-	-	-	†0.62	-	-	-	-	-	-	-33.3%	-	-	
												Yoghurt	-	†0.74	-	-	-	†0.94	-	-	-	-	-	-	200.0%	-	-	
								Ice cream	-			†0.61	-	-	-	†0.73	-	-	-	-	-	-	0.0%	-	-			
								Cottage cheese	-			†0.68	-	-	-	†0.80	-	-	-	-	-	-	0.0%	-	-			
								Hard cheese	-			†0.49	-	-	-	†0.57	-	-	-	-	-	-	0.0%	-	-			
								Margarine	-			†0.71	-	-	-	†0.76	-	-	-	-	-	-	25.0%	-	-			
Feskanich <i>et al.</i> 1993	157 males; 2 x 7d FR	Butter	-	†0.79	-	-	-	-	-	†0.85	-	-	-	-	-	-40%	-	-										
		Low-fat/skimmed milk	0.82	-	-	-	0.88	-	-	-	33.3%	-	-	-	-	-	-											
		Whole milk	0.59	-	-	-	0.67	-	-	-	-41.2%	-	-	-	-	-	-											
		Yoghurt	0.76	-	-	-	0.86	-	-	-	100.0%	-	-	-	-	-	-											
		Cottage/ricotta cheese	0.28	-	-	-	0.52	-	-	-	0.0%	-	-	-	-	-	-											
		Cream cheese	0.51	-	-	-	0.75	-	-	-	11.1%	-	-	-	-	-	-											
		Other cheese	0.41	-	-	-	0.56	-	-	-	-43.8%	-	-	-	-	-	-											
		Eggs	0.57	-	-	-	0.76	-	-	-	-26.7%	-	-	-	-	-	-											
		Chicken/turkey with skin	0.49	-	-	-	-	-	-	-	83.3%	-	-	-	-	-	-											
		Chicken/turkey without skin	0.30	-	-	-	0.56	-	-	-	-3.6%	-	-	-	-	-	-											
		Processed meats	0.55	-	-	-	0.83	-	-	-	-70.3%	-	-	-	-	-	-											
		Beef/pork/lamb	0.45	-	-	-	0.66	-	-	-	-21.1%	-	-	-	-	-	-											
		Canned tuna	0.56	-	-	-	0.73	-	-	-	57.1%	-	-	-	-	-	-											
		Dark meat fish	0.42	-	-	-	0.58	-	-	-	-18.2%	-	-	-	-	-	-											
		Other fish	0.39	-	-	-	-	-	-	-	6.3%	-	-	-	-	-	-											
Rimm <i>et al.</i> 1992	127 males; 2 x 7d FR	Shrimp/lobster/scallops	0.23	-	-	-	-	-	-	-	-	-	-	-	-40.0%	-	-											
		Energy	†0.40	-	-	-	-	-	-	-	-	-	-	-	7.1%	-	-											
		Protein	†0.25	-	-	-	†0.38	-	-	-	-	-	-	-	-7.7%	-	-											
		CHO	†0.48	-	-	-	†0.69	-	-	-	-	-	-	-	-2.1%	-	-											
		Fat	†0.52	-	-	-	†0.61	-	-	-	-	-	-	-	-14.9%	-	-											
		SFA	†0.63	-	-	-	†0.71	-	-	-	-	-	-	-	-14.2%	-	-											
		MUFA	†0.53	-	-	-	†0.62	-	-	-	-	-	-	-	-14.1%	-	-											
		PUFA	†0.33	-	-	-	†0.29	-	-	-	-	-	-	-	-18.3%	-	-											
								Fibre	†0.49	-	-	-	†0.64	-	-	12.5%	-	-										
Wesselink <i>et al.</i> 2022	Prospective cohort	Q2	152-item semi-quantitative	Y, range of r or p	Substituting a particular type of protein for fats and carbohydrates Protein-rich food at the expense of another	Subar <i>et al.</i> 2001	403 males + females; 4 x 24HR	Energy	0.49	0.48	-	-	-	-	-	-	-	-										
								Protein	0.47	0.46	-	-	0.57	0.60	-	-	-	-										
								CHO	0.53	0.50	-	-	0.63	0.69	-	-	-	-										
								Fat	0.52	0.55	-	-	0.62	0.66	-	-	-	-										
								SFA	0.57	0.60	-	-	0.68	0.66	-	-	-	-										

Ref, Country	Study design	SCI-Q	FFQ details	Validation metrics reported in manuscript?	Substitution examined	Ref	n in validation study and reference method	Variable	Validity data									
									^Unadjusted r or p			^Adjusted r or p			Difference from reference method			
									Male	Female	Total	Male	Female	Total	Male	Female	Total	
			220-item semi-quantitative			Knudsen <i>et al.</i> 2016	97 females; 1 x 4d FR	Energy	-	-	[†] 0.29	-	-	-	-	-	-	-9.5%
								Protein	-	-	[†] 0.49	-	-	-	-	-	-	-9.5%
								CHO	-	-	[†] 0.63	-	-	-	-	-	-	-8.2%
								Fat	-	-	[†] 0.56	-	-	-	-	-	-	-14.7%
								SFA	-	-	[†] 0.51	-	-	-	-	-	-	-9.9%
								MUFA	-	-	[†] 0.52	-	-	-	-	-	-	-17.5%
								PUFA	-	-	[†] 0.41	-	-	-	-	-	-	-19.0%
								Meat / red meat	-	-	[†] 0.41	-	-	-	-	-	-	-15.4%
								High fat dairy	-	-	[†] 0.42	-	-	-	-	-	-	69.2%
								Low fat dairy	-	-	[†] 0.61	-	-	-	-	-	-	73.6%
								Poultry	-	-	[†] 0.32	-	-	-	-	-	-	25.0%
								Eggs	-	-	[†] 0.47	-	-	-	-	-	-	-4.3%
								Fish / seafood	-	-	[†] 0.38	-	-	-	-	-	-	0.0%
Du <i>et al.</i> 2022	Prospective cohort	Q1	61-item semi-quantitative	N	Unprocessed/Minimally processed food (NOVA-1) and culinary ingredients (NOVA-2) for ultra-processed foods (NOVA-4)	Willett <i>et al.</i> 1985	225 females; 4 x 7d FR	Protein	-	[†] 0.33	-	-	[†] 0.47	-	-	4.7%	-	
								CHO	-	[†] 0.53	-	-	[†] 0.45	-	-	-14.7%	-	
								Fat	-	[†] 0.39	-	-	[†] 0.53	-	-	-18.2%	-	
								SFA	-	[†] 0.44	-	-	[†] 0.59	-	-	-12.0%	-	
								PUFA	-	[†] 0.40	-	-	[†] 0.48	-	-	-32.4%	-	
								Fibre	-	[†] 0.46	-	-	[†] 0.58	-	-	8.0%	-	
Yang <i>et al.</i> 2022b	Prospective cohort	Q1		Y, specific r	Tea, SSB, ASB or FJ with coffee	Salvini <i>et al.</i> 1989	173 females; 4 x 7d FR	Tea	-	[†] 0.75	-	-	[†] 0.93	-	-	42.9%	-	
								Coffee	-	[†] 0.90	-	-	[†] 0.78	-	-	33.3%	-	
								Coke/Pepsi	-	[†] 0.81	-	-	[†] 0.84	-	-	100.0%	-	
								Non-cola carbonated beverages	-	[†] 0.28	-	-	[†] 0.36	-	-	0.0%	-	
Zhu <i>et al.</i> 2019	Prospective cohort	Q1	Block FFQ; 94-items semi-quantitative	N	Empty calories with total fruit, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, and seafood and plant proteins based on HEI-2010 point calculations	Block <i>et al.</i> 1990	260 females; 3 x 4d FR	Energy	-	0.51	-	-	-	-	-	-3.2%	-	
								Protein	-	0.48	-	-	-	-	-	2.5%	-	
								CHO	-	0.51	-	-	-	-	-	-7.7%	-	
								Fat	-	0.6	-	-	-	-	-	-3.9%	-	
								SFA	-	0.63	-	-	-	-	-	-6.1%	-	
								MUFA	-	0.59	-	-	-	-	-	-2.6%	-	
								PUFA	-	0.48	-	-	-	-	-	-5.8%	-	
								None provided	-	-	-	-	-	-	-	-	-	
Lin <i>et al.</i> 2021	Cross-sectional	Q1	166-item semi-quantitative	N	White rice with other grains	None cited	No information provided	None provided	-	-	-	-	-	-	-	-		
Tooze <i>et al.</i> 2020	Prospective cohort	Q1	85-item semi-quantitative	N	PUFAs from different food sources with each other	Liese <i>et al.</i> 2015	80 males + 77 females; 3 x 24HR	Energy	-	-	[†] 0.36	-	-	-	-	-	-16.6%	
								Fat	-	-	[†] 0.40	-	-	[†] 0.41	-	-	-10.0%	
								SFA	-	-	[†] 0.42	-	-	[†] 0.39	-	-	-9.3%	
								Bread, cereal, rice and pasta	-	-	[†] 0.15	-	-	[†] 0.26	-	-	-	
								Fruits and vegetables	-	-	[†] 0.22	-	-	[†] 0.41	-	-	-	
								Dairy	-	-	[†] 0.47	-	-	[†] 0.63	-	-	-	
								Meat (beef, pork, non-poultry lunch meat)	-	-	[†] 0.33	-	-	[†] 0.48	-	-	-	
								Poultry	-	-	[†] 0.22	-	-	[†] 0.24	-	-	-	
								Eggs	-	-	[†] 0.45	-	-	[†] 0.60	-	-	-	
								Nuts and seeds	-	-	[†] 0.25	-	-	[†] 0.41	-	-	-	
								Fats and oils	-	-	[†] 0.08	-	-	[†] 0.09	-	-	-	
								Chips, crackers, popcorn, pretzels	-	-	[†] 0.19	-	-	[‡] -0.04	-	-	-	

Footnotes

[†] **Red** font denotes substitution of non-validated variables; **amber** denotes some substituted variables were

[^] Spearman correlation coefficient displayed unless marked with [‡], which denotes Pearson correlation coefficient is displayed. The FFQs are considered to have poor (correlation < 0.2), fair (correlation between 0.2 – 0.4),

^{*} Significantly different from reference methods. Values not marked with * were either not tested statistically, or

List of abbreviations used

Abbreviation	Full form
24HR	24-hour recall
AOC	Alpha Omega Cohort
CHO	Carbohydrate
DHI	Diet history interview
DLW	Doubly-labelled water
FA	Fatty acid
FFQ	Food frequency questionnaire
FR	Food record
HS1	Hoorn Study 1
HS2	Hoorn Study 2
LA	Linoleic acid
MUFA	Monounsaturated fat
N	No
PUFA	Polyunsaturated fat
Q1	Quartile 1
Q2	Quartile 2
Q3	Quartile 3
Q4	Quartile 4
SCI	Science Citation Index
SFA	Saturated fat
TFA	Trans-fat
WFR	Weighed food record
Y	Yes

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