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Supplementary appendix

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Supplementary material for the manuscript:

FOOD PROCESSING AND CANCER RISK: RESULTS FROM THE EUROPEAN PROSPECTIVE INVESTIGATION INTO CANCER AND NUTRITION (EPIC)

Supplementary tables:

Supplementary Figures:

Supplementary table 1. Codes for the cancer types and subtypes included in the study.

Cancer type	Subtype/ Subsite	Site code	Morphological code Included or censored*
Head and Neck[1]	Oral cavity Oropharynx Hypopharynx Larynx	C019 & C02 to C06 C09 to C10 C13 to C14 C32	-
Oesophagus[1,2]	All Oesophagus Adenocarcinoma Oesophagus SCC	C15 C15 C15	- 8140/3, 8144/3, 8480/3, 8481/3 & 8490/3 8070/3, 8071/3, 8072/3 & 8074/3
Stomach[1,2]	All Stomach cardia Stomach noncardia	C16 C160 C161 to C166	- - -
Colon[1,2]	All	C18	-
Rectal[1,2]	All	C199 to C209	-
Liver[1,2]	All HCC	C220 to C221 C220 to C221	- 8170/3, 8171/3 & 8180/3
Gallbladder[1,2]	-	C239 to C249	-
Pancreas[1,2]	-	C250 to C25.3 & C257 to C259	8150/3*, 8151/3*, 8153/3*, 8155/3*, 8240/3*, 8246/3* & 9591/3*
Lung[1,2]	-	C339 to C349	-
Leukemia[2,3]	-	C42	9800/3, 9801/3, 9802/3, 9820/3, 9821/3, 9824/3, 9825/3, 9830/3, 9835/3, 9836/3, 9840/3, 9841/3, 9850/3, 9860/3, 9861/3, 9863/3, 9866/3, 9867/3, 9868/3, 9872/3, 9873/3, 9874/3, 9875/3, 9876/3, 9891/3, 9895/3, 9900/3, 9910/3, 9931/3, 9932/3 & 9945/3
Multiple Myeloma[2,4]	-	C421	9731 & 9732
Skin[1,2]	All Melanoma	C44 C44	- 8720/3, 8721/3, 8722/3, 8723/3, 8728/3, 8730/3, 8740/3, 8741/3, 8742/3, 8743/3, 8744/3, 8745/3, 8746/3, 8761/3, 8770/3, 8771/3, 8772/3, 8773/3, 8774/3 & 8780/3
Breast[1,2]	-	C50	-
Cervical[1]	-	C53	-
Endometrium[1,2]		C54	-
Ovary[1,2]	-	C589	-
Prostate[1,2]	All	C619	-
Kidney[1,2]	All RCC	C649 C649	- 8312/3
Bladder[1,2]	-	C659 to C689	-
Brain[2]	All Glioma	C70 C710 to C719	- 9380/3, 9381/3, 9382/3, 9391/3, 9400/3, 9401/3, 9411/3, 9420/3, 9421/3, 9440/3, 9441/3, 9442/3, 9450/3, 9451/3 & 9473/3
Thyroid[2]	-	C739	-
Non-Hodgkin lymphoma[2,3,4]	-		9670/3, 9671/3, 9673/3, 9675/3, 9678/3, 9679/3, 9680/3, 9684/3, 9687/3, 9689/3, 9690/3, 9691/3, 9695/3, 9698/3, 9699/3, 9700/3, 9700/3, 9700/3, 9700/3, 9701/3, 9702/3, 9705/3, 9709/3, 9714/3, 9717/3, 9718/3, 9719/3, 9727/3, 9728/3, 9731/3, 9732/3, 9733/3, 9734/3, 9761/3, 9820/3, 9823/3, 9826/3, 9827/3, 9831/3, 9832/3, 9833/3, 9835/3, 9836/3, 9837/3, 9940/3, 9948/3

Note. Codes defined using the 10th Revision of the International Classification of Diseases (ICD-10) and the 2nd or 3rd Revision of the International Classification of Diseases for Oncology (ICDO-2 or ICDO-3). Included based on [1]WCRF/AIRC, 2018 and on [2]Lauby-Secretan et al., 2016. [3]There are some coding overlap. [4] There are some coding overlap.

Supplementary table 2. Baseline characteristics by sex-specific quartiles of relative intake of NOVA groups 1, 2 & 3 (% g/day)

Characteristics	Quarters of NOVA group 1 in %g/d*		Quarters of NOVA group 2 in %g/d*		Quarters of NOVA group 3 in %g/d*	
	1st Mean/N (SD/%)	4th Mean/N (SD/%)	1st Mean/N (SD/%)	4th Mean/N (SD/%)	1st Mean/N (SD/%)	4th Mean/N (SD/%)
NOVA group, %g/d	56.3 (9.5)	84.4 (4.1)	0.2 (0.1)	2.8 (0.8)	4.8 (1.8)	26.3 (10.3)
NOVA group, %kcal/d	28.7 (7.9)	44.5 (10.2)	1.4 (1.1)	15.9 (4.5)	13.3 (6.2)	26.6 (9.5)
Age, years	48.6 (9.9)	53.8 (8.9)	51.3 (11.1)	50.3 (8.4)	52 (10.9)	50.7 (8.6)
Height, cm	166.1 (8.7)	165.7 (8.9)	167.5 (8.4)	163.3 (8.8)	166.7 (8.7)	164.7 (8.8)
BMI, kg/m^2	25.4 (4.3)	25.3 (4.2)	25.6 (4.3)	25.4 (4.3)	25.5 (4.4)	25.4 (4.2)
Sex, n(%)						
Women	82,511 (70.4)	77,829 (71.6)	83,480 (70.1)	68,521 (72.7)	82,026 (70.6)	79,691 (70.2)
Education, n(%)						
None	4,335 (3.7)	3,636 (3.3)	317 (0.3)	8,075 (8.6)	1,693 (1.5)	6,964 (6.1)
Primary school	32,919 (28.1)	26,459 (24.3)	27,451 (23.1)	33,181 (35.2)	27,960 (24.1)	34,111 (30)
Secondary or technical school	51,250 (43.7)	46,840 (43)	56,216 (47.2)	33,539 (35.6)	52,756 (45.4)	43,357 (38.2)
Longer education	26,057 (22.2)	26,583 (24.4)	27,705 (23.3)	17,883 (19)	24,183 (20.8)	27,623 (24.3)
Not specified	2,646 (2.3)	5,246 (4.8)	7,352 (6.2)	1,548 (1.6)	9,532 (8.2)	1,501 (1.3)
Smoking status, n(%)						
Never	52,814 (45.1)	56,041 (51.5)	52,546 (44.1)	48,641 (51.6)	56,965 (49.1)	52,280 (46)
Former	31,396 (26.8)	29,416 (27)	37,015 (31.1)	20,389 (21.6)	31,739 (27.3)	29,940 (26.4)
Current	31,326 (26.7)	20,909 (19.2)	27,861 (23.4)	23,909 (25.4)	24,904 (21.4)	29,831 (26.3)
Unknown	1,671 (1.4)	2,398 (2.2)	1,619 (1.4)	1,287 (1.4)	2,516 (2.2)	1,505 (1.3)
Smoking intensity [n(%)]						
Never	47,406 (40.4)	47,144 (43.3)	51,667 (43.4)	39,282 (41.67)	53,130 (45.8)	42,844 (37.7)
Current, 1-15 cig/day	15,854 (13.5)	10,839 (10)	14,789 (12.4)	11,616 (12.3)	13,347 (11.5)	14,227 (12.5)
Current, 16-25 cig/day	9,465 (8.1)	5,575 (5.1)	7,792 (6.5)	7,367 (7.8)	7,036 (6.1)	8,958 (7.9)
Current, 26+ cig/day	2,781 (2.4)	1,197 (1.1)	1,521 (1.3)	2,236 (2.4)	1,326 (1.1)	2,843 (2.5)
Former, quit <=10 years	12,500 (10.6)	9,445 (8.7)	12,515 (10.5)	8,648 (9.2)	10,629 (9.2)	11,660 (10.3)
Former, quit 11-20 years	10,098 (8.6)	8,518 (7.8)	10,914 (9.2)	6,912 (7.33)	8,798 (7.6)	10,204 (9)
Former, quit 20+ years	7,863 (6.7)	10,017 (9.2)	11,856 (10)	4,400 (4.7)	10,690 (9.2)	7,186 (6.3)
Current, pipe/cigar/occasionally	8,187 (6.9)	12,281 (11.3)	3,870 (3.3)	12,107 (12.8)	6,535 (5.6)	13,188 (11.6)
Unknown	3,053 (2.6)	3,748 (3.4)	4,117 (3.5)	1,658 (1.8)	4,633 (4.0)	2,446 (2.2)
Physical Activity, n(%)						
Inactive	23,293 (19.9)	22,530 (20.7)	19,243 (16.2)	26,752 (28.3)	23,656 (20.4)	27,258 (24.0)
moderately inactive	39,286 (33.5)	36,728 (33.8)	37,248 (31.3)	33,880 (36)	36,298 (31.3)	40,917 (36.0)
moderately active	31,780 (27.1)	27,457 (25.2)	31,017 (26.1)	20,633 (21.9)	30,134 (25.9)	26,448 (23.3)
Active	20,561 (17.5)	20,622 (18.9)	28,515 (24.0)	12,174 (12.9)	23,114 (19.9)	18,000 (15.9)
Missing	2,287 (2.0)	1,427 (1.3)	3,018 (2.5)	787 (0.8)	2,922 (2.5)	933 (0.8)
Energy intake, kcal/d	2,236.8 (669.1)	1,852.5 (527.8)	1,922.6 (566.6)	2,245.7 (638.4)	1,903.1 (573)	2,268.5 (645.6)
Alcohol intake, g/d	19.6 (24.3)	5.6 (7.7)	12.5 (17.9)	10.4 (15.2)	3.7 (5.8)	24.66 (24.5)
Fiber intake, g/d	21.8 (7.3)	23.0 (8.2)	23.3 (8.3)	22.5 (7.5)	23.1 (8.5)	22.1 (7.4)
Calcium intake, g/d	1,020.2 (410.2)	1,118.5 (494.4)	1,028.4 (412.2)	1,087.6 (430.7)	1,053.3 (442.8)	1,078 (443.1)
Total fat intake, g/d	86.0 (30.9)	72.9 (26.6)	70.9 (26.6)	92.6 (30.1)	73.3 (28.1)	87.3 (29.5)
Sodium intake, g/d	2,811.4 (1271)	2,394.2 (1036.6)	2,564 (1138.9)	2,462.2 (987.0)	2,292 (1025.3)	2,829.8 (1164.0)
Carbohydrate intake, g/d	267.2 (87.6)	233.1 (72.5)	252.9 (81.8)	260.1 (80.0)	256 (87.1)	254.3 (78.5)
Mediterranean diet, n(%)						
Low	29,820 (25.4)	26,450 (24.3)	39,132 (32.8)	12,664 (13.44)	37,472 (32.3)	18,788 (16.5)
Medium	56,011 (47.8)	51,981 (47.8)	55,344 (46.5)	39,580 (42)	55,645 (47.9)	51,202 (45.1)

High	31,376 (26.8)	30,333 (27.9)	24,565 (20.6)	41,982 (44.6)	23,007 (19.8)	43,566 (38.4)

Note. *Sex-specific quartiles for relative intake of N1 (minimally processed foods), N2 (processed culinary ingredients) and N3 (processed foods) in %g/d. P<0.001 for all quartiles differences.

Supplementary Table 3. Absolute intakes and relative contributions of food groups to the total diet and to each NOVA group (in g/d and %g/d) in EPIC (N=450,111)

NOVA Group/ Food groups		g/d		% in total diet	% within the NOVA group
		Mean	SD	Mean	Mean
N1	Water	340.30	497.80	10.35	17.32
	Fruit	220.40	178.30	8.95	11.22
	Milk and plain yoghurt	243.50	222.40	9.20	12.39
	Cereal, grains and flour made from these foods	41.87	53.35	1.65	2.13
	Potatoes	84.95	69.40	3.32	4.32
	Pasta	37.73	49.55	1.66	1.92
	Beans, lentils and chickpeas	19.07	26.24	0.80	0.97
	Vegetables	174.60	117.10	6.90	8.89
	Nuts and Seeds	2.14	5.36	0.08	0.11
	Eggs	18.05	17.21	0.71	0.92
	Poultry	18.34	18.91	0.76	0.93
	Red meat	46.71	38.20	1.81	2.38
	Fish	22.69	26.97	0.99	1.15
	Sea food	2.91	5.57	0.13	0.15
	Fungi	5.73	8.64	0.21	0.29
	Coffee/tea	631.50	480.50	22.01	32.14
	Fruit juice fresh and smoothies	9.71	24.68	0.37	0.49
	Fruit juice UHT or pasteurised	41.63	71.62	1.56	2.12
	Homemade broth	2.99	7.81	0.10	0.15
N2	Table sugar	9.47	14.14	0.39	32.94
	Plant oil	10.02	13.12	0.46	34.85
	Animal fats	7.75	10.61	0.30	26.96
	Other processed culinary ingredients	1.03	2.41	0.04	3.58
	Salt table	0.48	0.84	0.02	1.67
N3	Cheese	36.59	33.52	1.47	10.24
	Salted, smoked or canned meat, without additives	7.41	15.41	0.33	2.07
	Salted, smoked or canned fish	7.37	10.76	0.29	2.06
	Processed bread (homemade or from bakery)	80.98	90.52	3.39	22.67
	Vegetables and other plant foods preserved	17.95	28.03	0.73	5.02
	Legumes preserved	4.27	12.53	0.18	1.20
	Fruit preserved	16.65	24.03	0.62	4.66
	Nuts salted and nut spreads	1.79	5.00	0.07	0.50
	Beer and Wine	165.10	275.60	5.73	46.21
	Condensed milk, yogurt plain sweetened	6.30	18.07	0.23	1.76
	Bread crumbs	0.31	0.77	0.01	0.09
	Meringue, non-ultra-processed bakeries	8.73	19.05	0.35	2.44
	Sauce homemade, sweet or savoury	3.83	7.82	0.17	1.07
N4	Ultra-processed breads (pre-packed and branded)	43.58	67.37	1.67	11.98
	Pastries, buns, and cakes	22.08	29.22	0.87	6.07
	Biscuits	14.19	18.61	0.59	3.90
	Breakfast cereals	5.03	10.33	0.18	1.38
	Ice cream, ice pops and frozen yogurts	7.50	12.32	0.31	2.06
	Industrial desserts	1.68	10.85	0.07	0.46
	Packaged salty snack	2.05	5.82	0.08	0.56
	Potato products	8.83	17.75	0.32	2.43
	Pizza and focaccia	6.33	11.02	0.27	1.74
	Pasta (Filled)	3.17	8.10	0.14	0.87
	Instant and canned soups	9.72	21.58	0.37	2.67
	Dairy substitute products	3.26	33.51	0.13	0.90
	Processed cheese	2.96	6.86	0.13	0.81
	Sauces, dressing and gravies	10.64	13.47	0.37	2.93
	Vegetable spread and products	0.23	1.45	0.01	0.06
	Soft drinks	51.17	122.80	1.95	14.07
	Dairy desserts and drinks	43.66	69.28	1.62	12.00
	Sweetened beverages	43.96	123.00	1.47	12.09
	Beverages dry weight	0.92	3.81	0.03	0.25
	Alcoholic distilled drinks	8.42	21.05	0.30	2.32
	Artificial sweeteners	0.36	2.18	0.01	0.10
	Sweet snacks	11.95	19.50	0.43	3.29
	Processed meat	36.24	33.55	1.46	9.96
	Meat alternatives	0.81	3.86	0.03	0.22
	Nutrition powders and drinks	0.01	0.53	0.00	0.00

Margarine	13.07	16.81	0.50	3.59
Ready meal	5.68	12.94	0.18	1.56
Alcohol-free versions of alcoholic beverages	2.66	31.19	0.09	0.73
Vegetables and legumes in ultra-processed	3.53	12.99	0.13	0.97
Rice-based dishes (ready-to-eat)	0.00	0.29	0.00	0.00

Supplementary Table 4. Associations between NOVA groups (in % g/day) intake and cancer risk by quartiles in EPIC (N=450,111): results from Model 1

Cancer	cases	Quartile/ P trend	NOVA 1	NOVA 2	NOVA 3	NOVA 4
All	47573	2	0.96 (0.93; 0.98)	1.00 (0.98; 1.02)	0.97 (0.95; 1.00)	1.02 (1.00; 1.05)
		3	0.95 (0.92; 0.98)	0.99 (0.96; 1.01)	1.01 (0.98; 1.03)	1.03 (1.00; 1.06)
		4	0.93 (0.91; 0.96)	1.01 (0.98; 1.05)	1.07 (1.03; 1.10)	1.01 (0.98; 1.04)
		P trend	**<0.0001***	0.681	**<0.0001***	0.119
Head and Neck	821	2	0.66 (0.55; 0.80)	1.05 (0.87; 1.28)	0.88 (0.71; 1.10)	0.96 (0.78; 1.17)
		3	0.56 (0.45; 0.69)	0.87 (0.69; 1.11)	0.99 (0.79; 1.24)	1.03 (0.83; 1.28)
		4	0.57 (0.47; 0.70)	0.81 (0.61; 1.09)	1.43 (1.15; 1.77)	1.17 (0.94; 1.47)
		P trend	**<0.0001***	0.176	**<0.0001***	0.092
Oesophagus adeno[1]	223	2	1.04 (0.68; 1.57)	1.06 (0.76; 1.48)	0.87 (0.62; 1.24)	1.30 (0.80; 2.13)
		3	0.89 (0.58; 1.35)	0.96 (0.65; 1.41)	0.87 (0.58; 1.31)	1.18 (0.71; 1.96)
		4	0.77 (0.50; 1.17)	0.94 (0.53; 1.65)	0.95 (0.60; 1.48)	1.84 (1.12; 3.01)
		P trend	0.119	0.821	0.677	**0.011**
Oesophagus SCC[2]	194	2	0.45 (0.30; 0.67)	0.81 (0.56; 1.16)	0.87 (0.56; 1.36)	1.10 (0.72; 1.67)
		3	0.34 (0.22; 0.51)	0.80 (0.52; 1.23)	1.15 (0.74; 1.83)	0.76 (0.48; 1.20)
		4	0.41 (0.27; 0.60)	0.63 (0.35; 1.15)	2.90 (1.93; 4.36)	0.59 (0.36; 0.99)
		P trend	**<0.0001***	0.123	**<0.0001***	**0.009**
Gastric cardia	239	2	0.93 (0.62; 1.36)	0.88 (0.63; 1.23)	1.12 (0.79; 1.58)	0.96 (0.65; 1.42)
		3	0.86 (0.58; 1.29)	1.15 (0.79; 1.68)	0.94 (0.64; 1.39)	0.74 (0.48; 1.11)
		4	1.00 (0.68; 1.47)	1.26 (0.76; 2.10)	1.01 (0.66; 1.54)	0.98 (0.65; 1.49)
		P trend	0.968	0.357	0.897	0.690
Gastric non-cardia	379	2	1.06 (0.82; 1.39)	1.11 (0.82; 1.53)	0.67 (0.48; 0.94)	1.26 (0.93; 1.71)
		3	0.82 (0.59; 1.11)	1.06 (0.75; 1.50)	0.99 (0.72; 1.36)	1.15 (0.83; 1.59)
		4	0.72 (0.52; 1.00)	1.01 (0.69; 1.53)	1.00 (0.71; 1.41)	1.47 (1.04; 2.06)
		P trend	**0.024**	0.970	0.465	0.060
Colon	3993	2	0.82 (0.75; 0.91)	1.02 (0.93; 1.10)	0.97 (0.89; 1.07)	1.02 (0.93; 1.11)
		3	0.77 (0.71; 0.85)	0.95 (0.86; 1.05)	1.04 (0.94; 1.15)	1.04 (0.94; 1.15)
		4	0.76 (0.69; 0.84)	0.89 (0.78; 1.01)	1.23 (1.11; 1.36)	1.10 (0.99; 1.23)
		P trend	**<0.0001***	0.101	**<0.0001***	0.051
Rectal	2162	2	0.99 (0.87; 1.12)	0.88 (0.79; 0.98)	1.04 (0.93; 1.17)	0.87 (0.76; 0.99)
		3	0.86 (0.75; 0.99)	0.83 (0.73; 0.95)	1.06 (0.93; 1.20)	0.89 (0.79; 1.02)
		4	0.83 (0.73; 0.95)	0.87 (0.73; 1.04)	1.25 (1.09; 1.44)	0.97 (0.85; 1.12)
		P trend	**0.001***	**0.024**	**0.002***	0.925
HCC[3]	215	2	0.49 (0.33; 0.72)	1.17 (0.81; 1.68)	0.98 (0.65; 1.48)	0.67 (0.46; 1.01)
		3	0.29 (0.18; 0.46)	0.81 (0.51; 1.28)	0.77 (0.49; 1.22)	0.74 (0.49; 1.14)
		4	0.52 (0.35; 0.76)	0.89 (0.48; 1.65)	1.40 (0.91; 2.16)	1.15 (0.77; 1.75)
		P trend	**<0.0001***	0.397	0.212	0.321
Gallbladder	335	2	0.86 (0.63; 1.18)	0.79 (0.59; 1.06)	0.92 (0.67; 1.27)	1.18 (0.85; 1.63)
		3	0.88 (0.64; 1.23)	0.81 (0.57; 1.14)	1.12 (0.80; 1.55)	1.05 (0.75; 1.48)
		4	0.86 (0.61; 1.20)	0.70 (0.45; 1.08)	1.13 (0.79; 1.63)	0.98 (0.68; 1.44)
		P trend	0.456	0.104	0.340	0.706
Pancreatic	1236	2	0.82 (0.68; 0.97)	1.03 (0.89; 1.19)	1.03 (0.87; 1.20)	0.99 (0.83; 1.18)
		3	0.90 (0.75; 1.06)	0.84 (0.70; 1.01)	1.06 (0.90; 1.26)	1.07 (0.90; 1.28)
		4	0.92 (0.78; 1.09)	1.04 (0.83; 1.30)	1.13 (0.94; 1.36)	0.89 (0.73; 1.08)
		P trend	0.771	0.619	0.174	0.412
Lung	3783	2	0.98 (0.89; 1.09)	0.86 (0.78; 0.93)	0.85 (0.79; 0.93)	0.96 (0.88; 1.06)
		3	0.96 (0.87; 1.06)	0.90 (0.82; 1.00)	0.85 (0.77; 0.94)	0.85 (0.77; 0.94)

		4	1.10 (1.00; 1.21)	0.96 (0.84; 1.09)	0.97 (0.87; 1.07)	0.83 (0.75; 0.93)
		P trend	**0.042**	0.152	0.303	**<0.0001***
RCC[4]	464	2	1.01 (0.77; 1.32)	0.73 (0.57; 0.95)	0.98 (0.76; 1.28)	1.22 (0.90; 1.66)
		3	1.13 (0.86; 1.49)	1.14 (0.86; 1.51)	1.02 (0.78; 1.35)	1.45 (1.06; 1.97)
		4	1.07 (0.80; 1.43)	0.78 (0.53; 1.15)	0.82 (0.60; 1.11)	1.45 (1.05; 1.99)
		P trend	0.504	0.577	0.296	**0.015**
Bladder	1586	2	1.06 (0.91; 1.23)	1.07 (0.94; 1.23)	0.97 (0.84; 1.12)	0.96 (0.83; 1.10)
		3	1.07 (0.91; 1.24)	1.03 (0.88; 1.22)	1.02 (0.88; 1.19)	0.97 (0.83; 1.13)
		4	1.03 (0.88; 1.20)	1.04 (0.85; 1.25)	0.97 (0.83; 1.15)	1.00 (0.87; 1.18)
		P trend	0.778	0.708	0.973	0.895
Glioma	653	2	1.07 (0.86; 1.34)	1.31 (1.08; 1.67)	1.17 (0.94; 1.46)	0.97 (0.73; 1.21)
		3	1.01 (0.79; 1.27)	0.97 (0.76; 1.26)	1.24 (0.97; 1.57)	0.98 (0.76; 1.27)
		4	0.94 (0.74; 1.20)	0.86 (0.62; 1.20)	1.22 (0.94; 1.60)	0.90 (0.68; 1.18)
		P trend	0.522	0.518	0.098	0.492
Thyroid	759	2	1.00 (0.81; 1.24)	1.28 (0.98; 1.66)	0.93 (0.74; 1.16)	1.10 (0.91; 1.35)
		3	1.01 (0.80; 1.27)	0.98 (0.73; 1.31)	0.75 (0.59; 0.94)	1.18 (0.94; 1.48)
		4	1.10 (0.87; 1.39)	1.07 (0.78; 1.46)	0.75 (0.59; 0.96)	1.18 (0.90; 1.55)
		P trend	0.398	0.710	**0.008**	**0.049**
Multiple myeloma	588	2	0.98 (0.77; 1.25)	1.10 (0.88; 1.38)	1.08 (0.87; 1.36)	1.20 (0.92; 1.56)
		3	1.01 (0.78; 1.30)	1.09 (0.84; 1.41)	0.92 (0.72; 1.19)	1.07 (0.81; 1.40)
		4	0.89 (0.69; 1.16)	1.17 (0.85; 1.61)	1.12 (0.85; 1.49)	1.21 (0.91; 1.61)
		P trend	0.455	0.334	0.701	0.402
NHL[5]	2356	2	0.96 (0.86; 1.09)	1.00 (0.90; 1.11)	1.00 (0.90; 1.12)	1.07 (0.93; 1.22)
		3	1.06 (0.95; 1.21)	1.03 (0.91; 1.17)	0.97 (0.86; 1.11)	1.03 (0.90; 1.19)
		4	0.96 (0.84; 1.10)	1.08 (0.92; 1.27)	1.03 (0.89; 1.18)	1.07 (0.92; 1.23)
		P trend	0.948	0.358	0.912	0.519
Leukemia	503	2	1.10 (0.85; 1.41)	1.06 (0.84; 1.35)	1.12 (0.87; 1.43)	0.98 (0.73; 1.31)
		3	0.97 (0.74; 1.28)	1.12 (0.85; 1.46)	1.13 (0.87; 1.48)	1.10 (0.82; 1.48)
		4	0.82 (0.61; 1.09)	1.17 (0.84; 1.66)	0.97 (0.72; 1.34)	1.29 (0.92; 1.70)
		P trend	0.100	0.315	0.934	0.072
Melanoma	2312	2	0.92 (0.82; 1.05)	1.02 (0.91; 1.12)	1.02 (0.91; 1.15)	1.10 (0.96; 1.25)
		3	1.01 (0.89; 1.15)	0.99 (0.87; 1.12)	1.04 (0.91; 1.17)	1.03 (0.89; 1.18)
		4	1.02 (0.89; 1.17)	0.90 (0.76; 1.06)	0.95 (0.82; 1.08)	1.12 (0.97; 1.30)
		P trend	0.382	0.375	0.586	0.259
Breast (pre)[6]	2223	2	1.05 (0.92; 1.21)	1.12 (0.94; 1.33)	1.04 (0.88; 1.23)	0.94 (0.80; 1.10)
		3	1.03 (0.88; 1.22)	1.15 (0.95; 1.38)	0.99 (0.83; 1.18)	0.96 (0.80; 1.14)
		4	1.00 (0.83; 1.18)	1.12 (0.92; 1.39)	0.95 (0.77; 1.17)	0.92 (0.76; 1.11)
		P trend	0.973	0.288	0.592	0.467
Breast (post)[7]	7724	2	0.93 (0.86; 0.99)	0.98 (0.91; 1.06)	0.97 (0.90; 1.04)	1.12 (1.04; 1.20)
		3	0.92 (0.84; 0.99)	1.00 (0.92; 1.09)	1.05 (0.97; 1.13)	1.06 (0.99; 1.16)
		4	0.88 (0.81; 0.95)	1.03 (0.93; 1.14)	1.11 (1.02; 1.20)	1.05 (0.95; 1.16)
		P trend	**0.004**	0.555	**0.009**	0.187
Cervical	354	2	1.12 (0.80; 1.58)	1.01 (0.72; 1.41)	0.97 (0.70; 1.36)	1.19 (0.81 1.75)
		3	1.02 (0.70; 1.48)	0.97 (0.65; 1.45)	0.91 (0.63; 1.31)	1.13 (0.75; 1.70)
		4	1.02 (0.69; 1.50)	1.02 (0.62; 1.67)	0.81 (0.54; 1.22)	1.12 (0.73; 1.75)
		P trend	0.953	0.986	0.323	0.731
Endometrial	1932	2	1.01 (0.87; 1.17)	1.10 (0.96; 1.27)	1.06 (0.92; 1.23)	1.05 (0.90; 1.22)
		3	1.07 (0.91; 1.26)	1.01 (0.85; 1.20)	1.05 (0.90; 1.23)	1.00 (0.84; 1.18)
		4	0.97 (0.82; 1.15)	1.24 (1.01; 1.52)	0.99 (0.83; 1.18)	1.09 (0.90; 1.31)
		P trend	0.893	0.110	0.967	0.489

Ovarian	1415	2	0.95 (0.79; 1.14)	0.90 (0.77; 1.06)	0.86 (0.73; 1.00)	0.88 (0.73; 1.07)
		3	1.06 (0.88; 1.29)	0.97 (0.80; 1.17)	0.87 (0.73; 1.04)	1.05 (0.86; 1.28)
		4	1.08 (0.89; 1.31)	0.98 (0.77; 1.25)	0.85 (0.69; 1.04)	0.97 (0.77; 1.17)
		P trend	0.229	0.875	0.100	0.805
Prostate	6926	2	1.04 (0.96; 1.12)	1.00 (0.94; 1.07)	0.98 (0.93; 1.06)	1.02 (0.94; 1.10)
		3	1.05 (0.97; 1.13)	1.00 (0.93; 1.08)	0.96 (0.90; 1.04)	1.05 (0.97; 1.13)
		4	1.05 (0.98; 1.14)	1.03 (0.93; 1.12)	0.98 (0.91; 1.07)	1.02 (0.94; 1.10)
		P trend	0.273	0.705	0.586	0.466

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA 1=minimally processed foods; NOVA 2=processed culinary ingredients; NOVA 3=processed foods; NOVA 4=ultra-processed foods. Quartile 1 contains participants with the lowest consumption of that specific NOVA group and was used as the reference group. [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma.[3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Model 1 was stratified by age and center and adjusted for sex, smoking, education, physical activity, height and diabetes. RCC was further adjusted for hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.

Supplementary Table 5. Associations between NOVA groups (in % g/day) intake and cancer risk by quartiles in EPIC (N=450,111): results from Model 2

Cancer	Cases	Quartile/ P trend	NOVA 1	NOVA 2	NOVA 3	NOVA 4
All	47573	2	0.98 (0.96; 1.01)	1.01 (0.99; 1.03)	0.97 (0.94; 0.99)	1.03 (1.00; 1.06)
		3	0.98 (0.95; 1.01)	1.00(0.97; 1.03)	0.99 (0.97; 1.02)	1.04 (1.01; 1.07)
		4	0.97 (0.94; 1.01)	1.04 (1.00; 1.08)	1.01 (0.98; 1.05)	1.02 (0.99; 1.06)
		P trend	0.080	0.067	0.583	**0.031**
Head and Neck	821	2	0.80 (0.65; 0.99)	1.10 (0.91; 1.34)	0.83 (0.66; 1.04)	1.04 (0.84; 1.28)
		3	0.73 (0.58; 0.92)	0.92 (0.72; 1.18)	0.83 (0.66; 1.06)	1.18 (0.94; 1.48)
		4	0.79 (0.62; 1.01)	0.93 (0.68; 1.26)	0.85 (0.65; 1.11)	1.44 (1.13; 1.83)
		P trend	**0.049**	0.597	0.244	**0.0001***
Oesophagus adeno[1]	223	2	0.92 (0.59; 1.42)	1.06 (0.75; 1.47)	0.94 (0.65; 1.34)	1.25 (0.75; 2.06)
		3	0.75 (0.47; 1.18)	0.95 (0.63; 1.42)	1.01 (0.64; 1.60)	1.10 (0.65; 1.85)
		4	0.63 (0.38; 1.03)	0.88 (0.49; 1.60)	1.30 (0.70; 2.41)	1.72 (1.01; 2.91)
		P trend	**0.033**	0.733	0.623	**0.037**
Oesophagus SCC[2]	194	2	0.71 (0.46; 1.10)	0.84 (0.57; 1.21)	0.78 (0.49; 1.22)	1.30 (0.85; 2.01)
		3	0.62 (0.38; 1.01)	0.87 (0.56; 1.36)	0.81 (0.50; 1.30)	0.97 (0.59; 1.56)
		4	0.84 (0.53; 1.33)	0.84 (0.45; 1.53)	1.10 (0.66; 1.83)	0.84 (0.48; 1.44)
		P trend	0.468	0.470	0.802	0.234
Gastric cardia	239	2	0.88 (0.55; 1.30)	0.90 (0.64; 1.26)	1.22 (0.86; 1.75)	0.96 (0.65; 1.42)
		3	0.80 (0.46; 1.17)	1.17 (0.79; 1.73)	1.09 (0.72; 1.69)	0.73 (0.47; 1.12)
		4	0.83 (0.51; 1.35)	1.26 (0.74; 2.16)	1.32 (0.75; 2.31)	0.95 (0.61; 1.50)
		P trend	0.622	0.358	0.415	0.576
Gastric non-cardia	379	2	1.07 (0.80; 1.42)	1.09 (0.79; 1.50)	0.67 (0.47; 0.94)	1.27 (0.93; 1.72)
		3	0.82 (0.59; 1.15)	1.02 (0.72; 1.47)	0.98 (0.70; 1.37)	1.14 (0.81; 1.59)
		4	0.75 (0.51; 1.09)	0.98 (0.64; 1.50)	1.01 (0.67; 1.52)	1.40 (0.98; 2.00)
		P trend	0.060	0.896	0.585	0.137
Colon	3993	2	0.87 (0.78; 0.96)	1.03 (0.94; 1.11)	0.98 (0.89; 1.08)	1.02 (0.93; 1.13)
		3	0.84 (0.75; 0.93)	0.96 (0.86; 1.06)	1.03 (0.92; 1.14)	1.04 (0.93; 1.16)
		4	0.83 (0.74; 0.93)	0.91 (0.79; 1.04)	1.14 (1.00; 1.30)	1.07 (0.95; 1.21)
		P trend	**0.005**	0.210	0.064	0.200
Rectal	2162	2	1.10 (0.96; 1.26)	0.89 (0.79; 0.98)	1.00 (0.89; 1.14)	0.87 (0.77; 1.01)
		3	1.01 (0.87; 1.18)	0.83 (0.72; 0.95)	0.97 (0.86; 1.12)	0.91 (0.79; 1.05)
		4	1.02 (0.87; 1.20)	0.88 (0.73; 1.05)	1.02 (0.86; 1.22)	0.97 (0.83; 1.15)
		P trend	0.808	**0.034**	0.945	0.976
HCC[3]	215	2	0.58 (0.39; 0.86)	1.28 (0.88; 1.86)	1.07 (0.70; 1.63)	0.68 (0.46; 1.04)
		3	0.36 (0.22; 0.58)	0.88 (0.55; 1.41)	0.84 (0.52; 1.35)	0.72 (0.47; 1.11)
		4	0.68 (0.44; 1.06)	0.94 (0.52; 1.71)	1.23 (0.73; 2.08)	0.99 (0.63; 1.55)
		P trend	**0.041**	0.729	0.697	0.863
Gallbladder	335	2	0.88 (0.64; 1.23)	0.79 (0.58; 1.06)	0.94 (0.67; 1.30)	1.15 (0.83; 1.58)
		3	0.91 (0.64; 1.29)	0.83 (0.58; 1.18)	1.15 (0.81; 1.63)	1.00 (0.70; 1.43)
		4	0.88 (0.61; 1.29)	0.73 (0.46; 1.16)	1.20 (0.77; 1.86)	0.92 (0.61; 1.36)
		P trend	0.616	0.173	0.305	0.468
Pancreatic	1236	2	0.84 (0.70; 1.00)	1.02 (0.88; 1.19)	1.00 (0.85; 1.18)	1.00 (0.84; 1.19)
		3	0.92 (0.77; 1.11)	0.85 (0.71; 1.03)	1.01 (0.85; 1.22)	0.99 (0.91; 1.31)
		4	0.96 (0.79; 1.17)	1.07 (0.85; 1.36)	1.02 (0.81; 1.28)	0.94 (0.76; 1.16)
		P trend	0.794	0.821	0.830	0.850
Lung	3783	2	1.02 (0.92; 1.12)	0.85 (0.78; 0.93)	0.85 (0.77; 0.94)	0.95 (0.87; 1.05)
		3	1.00 (0.89; 1.11)	0.89 (0.80; 0.98)	0.84 (0.76; 0.93)	0.84 (0.76; 0.94)

		4	1.14 (1.02; 1.28)	0.93 (0.82; 1.06)	0.90 (0.80; 1.04)	0.85 (0.76; 0.96)
		P trend	**0.018**	0.057	**0.027**	**0.001***
RCC[4]	464	2	0.95 (0.72; 1.27)	0.75 (0.58; 0.97)	1.04 (0.79; 1.36)	1.16 (0.85; 1.58)
		3	1.04 (0.76; 1.41)	1.17 (0.88; 1.56)	1.13 (0.83; 1.54)	1.35 (0.98; 1.86)
		4	0.96 (0.69; 1.34)	0.79 (0.53; 1.19)	0.98 (0.66; 1.47)	1.36 (0.97; 1.91)
		P trend	0.920	0.713	0.812	0.054
Bladder	1586	2	1.10 (0.94; 1.30)	1.09 (0.95; 1.26)	0.97 (0.84; 1.12)	0.98 (0.84; 1.12)
		3	1.12 (0.94; 1.33)	1.07 (0.91; 1.26)	1.00 (0.86; 1.18)	0.99 (0.85; 1.16)
		4	1.07 (0.89; 1.29)	1.09 (0.89; 1.35)	0.89 (0.73; 1.10)	1.05 (0.88; 1.25)
		P trend	0.580	0.358	0.516	0.506
Glioma	653	2	1.08 (0.86; 1.37)	1.30 (1.07; 1.61)	1.20 (0.96; 1.51)	0.97 (0.75; 1.24)
		3	1.03 (0.80; 1.33)	0.96 (0.74; 1.25)	1.30 (1.00; 1.67)	0.97 (0.75; 1.25)
		4	0.98 (0.73; 1.28)	0.84 (0.61; 1.18)	1.34 (0.97; 1.87)	0.86 (0.64; 1.14)
		P trend	0.698	0.453	**0.046**	0.320
Thyroid	759	2	0.92 (0.74; 1.14)	1.27 (0.97; 1.66)	0.96 (0.76; 1.20)	1.11 (0.91; 1.35)
		3	0.88 (0.69; 1.13)	0.99 (0.74; 1.32)	0.80 (0.63; 1.03)	1.17 (0.93; 1.47)
		4	0.93 (0.71; 1.20)	1.06 (0.76; 1.47)	0.91 (0.68; 1.22)	1.21 (0.92; 1.58)
		P trend	0.586	0.693	0.305	0.146
Multiple myeloma	588	2	0.97 (0.75; 1.25)	1.11 (0.88; 1.38)	1.11 (0.88; 1.40)	1.18 (0.91; 1.54)
		3	1.00 (0.76; 1.30)	1.08 (0.83; 1.41)	0.97 (0.74; 1.29)	1.04 (0.78; 1.38)
		4	0.89 (0.66; 1.20)	1.14 (0.81; 1.61)	1.28 (0.91; 1.80)	1.14 (0.84; 1.54)
		P trend	0.507	0.418	0.366	0.735
NHL[5]	2356	2	0.97 (0.86; 1.10)	1.00 (0.90; 1.12)	1.01 (0.91; 1.13)	1.06 (0.92; 1.21)
		3	1.07 (0.94; 1.23)	1.03 (0.91; 1.18)	0.99 (0.87; 1.14)	1.01 (0.88; 1.17)
		4	0.98 (0.85; 1.14)	1.08 (0.91; 1.28)	1.06 (0.89; 1.26)	1.02 (0.88; 1.19)
		P trend	0.816	0.389	0.657	0.956
Leukemia	503	2	1.12 (0.86; 1.46)	1.07 (0.84; 1.37)	1.10 (0.85; 1.42)	0.97 (0.72; 1.30)
		3	1.01 (0.76; 1.35)	1.13 (0.86; 1.50)	1.10 (0.82; 1.46)	1.07 (0.79; 1.45)
		4	0.88 (0.64; 1.21)	1.22 (0.84; 1.75)	0.91 (0.62; 1.33)	1.17 (0.85; 1.63)
		P trend	0.284	0.258	0.888	0.201
Melanoma	2312	2	0.93 (0.81; 1.06)	1.02 (0.92; 1.15)	1.03 (0.90; 1.15)	1.11 (0.97; 1.26)
		3	1.00 (0.87; 1.15)	1.03 (0.90; 1.17)	1.04 (0.90; 1.19)	1.04 (0.90; 1.20)
		4	1.00 (0.87; 1.16)	0.95 (0.80; 1.14)	0.94 (0.78; 1.12)	1.15 (0.98; 1.35)
		P trend	0.592	0.919	0.804	0.170
Breast (pre)[6]	2223	2	1.08 (0.94; 1.25)	1.13 (0.95; 1.35)	1.03 (0.87; 1.22)	0.97 (0.82; 1.14)
		3	1.07 (0.91; 1.27)	1.16 (0.96; 1.39)	0.99 (0.82; 1.18)	1.02 (0.85; 1.22)
		4	1.03 (0.85; 1.26)	1.15 (0.92; 1.43)	0.95 (0.77; 1.18)	1.00 (0.82; 1.22)
		P trend	0.646	0.249	0.508	0.878
Breast (post)[7]	7724	2	0.96 (0.88; 1.02)	0.99 (0.92; 1.06)	0.96 (0.89; 1.04)	1.11 (1.03; 1.19)
		3	0.96 (0.88; 1.05)	1.02 (0.94; 1.11)	1.03 (0.95; 1.12)	1.05 (0.96; 1.14)
		4	0.94 (0.86; 1.04)	1.06 (0.95; 1.18)	1.04 (0.94; 1.15)	1.05 (0.95; 1.16)
		P trend	0.329	0.281	0.313	0.482
Cervical	354	2	1.12 (0.79; 1.58)	1.08 (0.77; 1.52)	1.03 (0.74; 1.45)	1.25 (0.85; 1.84)
		3	1.00 (0.67; 1.47)	1.07 (0.71; 1.62)	0.99 (0.67; 1.46)	1.17 (0.76; 1.78)
		4	0.94 (0.61; 1.44)	1.19 (0.71; 1.98)	0.89 (0.54; 1.47)	1.13 (0.70; 1.81)
		P trend	0.664	0.531	0.729	0.741
Endometrial	1932	2	1.01 (0.86; 1.18)	1.18 (1.02; 1.37)	1.16 (1.00; 1.35)	1.06 (0.90; 1.23)
		3	1.06 (0.89; 1.25)	1.15 (0.96; 1.37)	1.22 (1.03; 1.44)	1.00 (0.84; 1.19)
		4	0.92 (0.76; 1.10)	1.49 (1.20; 1.85)	1.23 (1.00; 1.53)	1.03 (0.86; 1.25)
		P trend	0.453	**0.001***	**0.025**	0.911

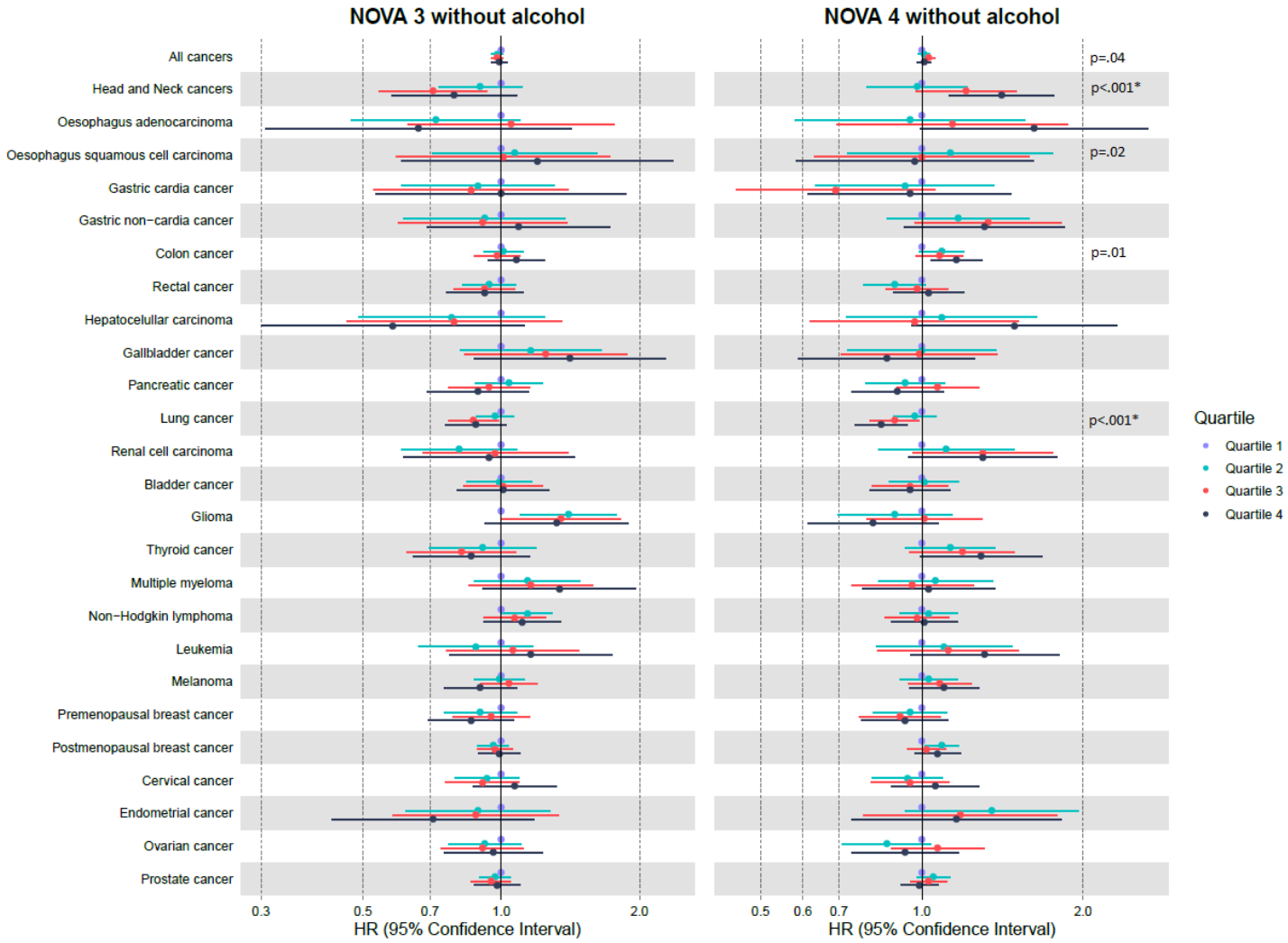
Ovarian	1415	2	0.95 (0.78; 1.14)	0.90 (0.75; 1.06)	0.86 (0.73; 1.01)	0.89 (0.74; 1.07)
		3	1.06 (0.87; 1.29)	0.95 (0.77; 1.15)	0.88 (0.74; 1.07)	1.04 (0.85; 1.28)
		4	1.07 (0.86; 1.32)	0.93 (0.72; 1.20)	0.90 (0.70; 1.15)	0.95 (0.75; 1.18)
		P trend	0.331	0.584	0.320	0.960
Prostate	6926	2	1.04 (0.97; 1.13)	0.99 (0.93; 1.06)	0.98 (0.93; 1.06)	1.01 (0.94; 1.09)
		3	1.05 (0.96; 1.15)	0.99 (0.92; 1.07)	0.97 (0.89; 1.04)	1.04 (0.96; 1.12)
		4	1.06 (0.97; 1.17)	1.00 (0.91; 1.11)	1.00 (0.90; 1.11)	1.01 (0.93; 1.10)
		P trend	0.249	0.872	0.732	0.665

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA group intake in %g/d. NOVA 1=minimally processed foods; NOVA 2=processed culinary ingredients; NOVA 3=processed foods; NOVA 4=ultra-processed foods. Quartile 1 contains participants with the lowest consumption of that specific NOVA group and was used as the reference group. [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma.[3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Models were stratified by age and center and adjusted for sex, smoking, education, physical activity, height, diabetes, body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fiber and calcium intake, while kidney cancer for hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.

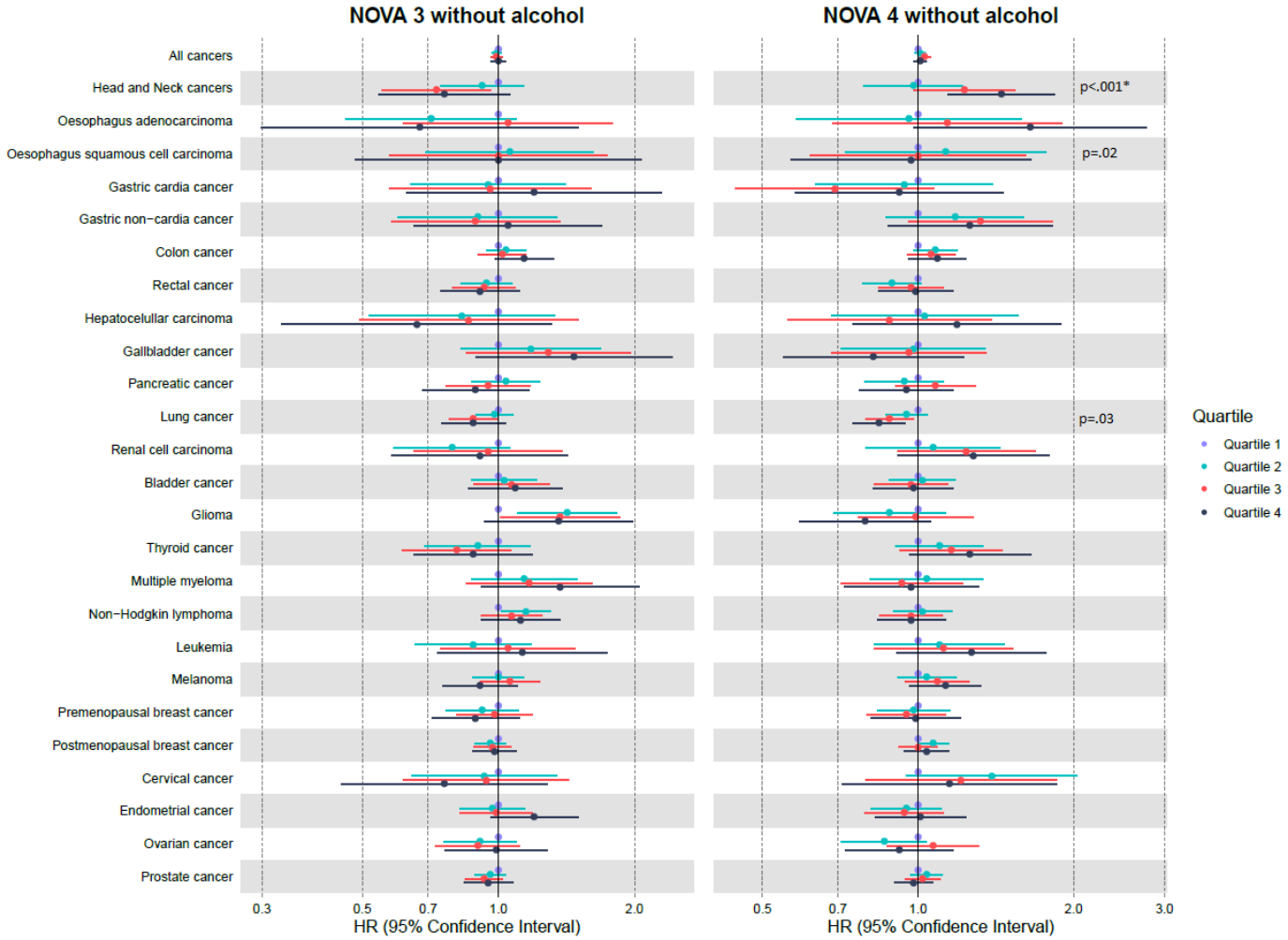
Supplementary Table 6. Associations between NOVA groups 3 and 4 intake (in % g/day without alcoholic drinks) and cancer risk in EPIC (N=450,111)

Cancer	Cases	Model	NOVA 3 (without alcohol) HR (95%CI)	NOVA 4 (without alcohol) HR (95%CI)
All	47,573	1	1.01 (0.99-1.02)	1.01 (1.00-1.02)
		2	1.01 (1.00-1.03)	1.01 (1.00-1.02)
Head and Neck	821	1	0.91 (0.81-1.01)	**1.18 (1.10-1.27)***
		2	**0.87 (0.78-0.98)**	**1.21 (1.12-1.31)***
Oesophagus adeno[1]	223	1	1.00 (0.76-1.32)	**1.22 (1.07-1.41)**
		2	0.98 (0.73-1.32)	**1.24 (1.06-1.44)**
Oesophagus SCC[2]	194	1	**1.36 (1.07-1.73)**	0.98 (0.83-1.17)
		2	1.21 (0.94-1.56)	0.99 (0.82-1.20)
Gastric cardia	239	1	0.97 (0.75- 1.24)	1.01 (0.86-1.17)
		2	0.97 (0.76-1.24)	0.99 (0.84-1.17)
Gastric non-cardia	379	1	1.10 (0.96-1.25)	1.11 (0.99-1.25)
		2	1.07 (0.93-1.24)	1.08 (0.96-1.23)
Colon	3993	1	**1.07 (1.02-1.13)***	**1.06 (1.02-1.10)***
		2	**1.08 (1.03-1.14)***	1.03 (0.99-1.08)
Rectal	2162	1	0.98 (0.91-1.06)	1.02 (0.97-1.08)
		2	0.97 (0.90-1.05)	1.00 (0.94-1.06)
HCC[3]	215	1	0.93 (0.76-1.15)	**1.29 (1.13-1.48)***
		2	0.97 (0.78-1.21)	**1.16 (1.00-1.35)***
Gallbladder	335	1	1.16 (0.98-1.37)	0.98 (0.86-1.12)
		2	1.18 (0.99-1.40)	0.95 (0.82-1.11)
Pancreatic	1236	1	0.95 (0.86-1.05)	1.00 (0.94-1.08)
		2	0.94 (0.85-1.05)	1.03 (0.95-1.11)
Lung	3783	1	1.01 (0.96-1.07)	**0.95 (0.91-0.99)**
		2	1.01 (0.96-1.08)	0.96 (0.92-1.00)
RCC[4]	464	1	1.08 (0.92-1.25)	1.09 (0.97-1.21)
		2	1.07 (0.91-1.26)	1.09 (0.96-1.23)
Bladder	1586	1	1.01 (0.94-1.09)	0.98 (0.92-1.05)
		2	1.04 (0.96-1.13)	0.99 (0.92-1.05)
Glioma	653	1	1.05 (0.93-1.18)	0.98 (0.89-1.08)
		2	1.05 (0.92-1.20)	0.96 (0.87-1.06)
Thyroid	759	1	0.97 (0.87-1.07)	1.08 (0.98-1.19)
		2	0.98 (0.88-1.09)	1.08 (0.98-1.19)
Multiple myeloma	588	1	1.07 (0.94-1.21)	1.05 (0.95-1.15)
		2	1.08 (0.94-1.24)	1.02 (0.92-1.13)
NHL[5]	2356	1	1.05 (0.97-1.12)	1.00 (0.96-1.06)
		2	1.04 (0.98-1.13)	0.99 (0.94-1.04)
Leukemia	503	1	1.03 (0.89-1.18)	1.08 (0.97-1.20)
		2	0.99 (0.85-1.16)	1.05 (0.94-1.17)
Melanoma	2312	1	1.00 (0.93-1.07)	1.02 (0.97-1.08)
		2	1.00 (0.93-1.09)	1.03 (0.97-1.08)
Breast (pre)[6]	2223	1	0.98 (0.91-1.07)	0.94 (0.88-1.01)
		2	1.00 (0.92-1.09)	0.96 (0.89-1.02)
Breast (post)[7]	7724	1	0.99 (0.95-1.03)	1.01 (0.97-1.05)
		2	0.99 (0.94-1.04)	1.00 (0.96-1.04)
Cervical	354	1	0.93 (0.76-1.16)	1.05 (0.91-1.21)
		2	0.97 (0.77-1.21)	1.04 (0.89-1.21)
Endometrial	1932	1	0.99 (0.92-1.09)	1.00 (0.94-1.08)
		2	1.06 (0.96-1.16)	0.97 (0.90-1.05)
Ovarian	1415	1	0.99 (0.89-1.10)	1.03 (0.95-1.12)
		2	1.01 (0.91-1.14)	1.03 (0.94-1.12)
Prostate	6926	1	1.00 (0.96-1.04)	0.98 (0.96-1.01)
		2	0.99 (0.95-1.02)	0.98 (0.95-1.01)

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA group intake in %g/d (1-sd increment). NOVA 3=processed foods (1-sd= 6.3%) & NOVA 4=ultra-processed foods (1-sd= 9.2%). [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma. [3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Model 1 was stratified by age and centre and adjusted for sex, smoking, education, physical activity, height and diabetes. Model 2 was further adjusted for body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fibre and calcium intake in model 2, while Renal Cell Carcinoma for hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy in models 1 and 2. P-value≤0.05 in bold. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.


NOVA 3 without alcohol
NOVA 4 without alcohol
All cancers
Head and Neck cancers
Oesophagus adenocarcinoma
Oesophagus squamous cell carcinoma
Gastric cardia cancer
Gastric non−cardia cancer
Colon cancer
Rectal cancer
Hepatocelullar carcinoma
Gallbladder cancer
Pancreatic cancer
Lung cancer
Renal cell carcinoma
Bladder cancer
Glioma
Thyroid cancer
Multiple myeloma
Non−Hodgkin lymphoma
Leukemia
Melanoma
Premenopausal breast cancer
Postmenopausal breast cancer
Cervical cancer
Endometrial cancer
Ovarian cancer
Prostate cancer
p=.04
p<.001*
p=.02
p=.01
p<.001*
0.3
0.5
0.7
1.0
2.0
0.5
0.6
0.7
1.0
2.0
HR (95% Confidence Interval)
HR (95% Confidence Interval)
Quartile
Quartile 1
Quartile 2
Quartile 3
Quartile 4

(a)



(b)

Supplementary figure 1. Forest plot for the associations between NOVA groups 3 and 4 (in %g/day without alcoholic drinks) intake and cancer risk by quartiles **Note.** NOVA group intake in %g/d. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA 3=processed foods & NOVA 4=ultra-processed foods. (a) Model 1 was stratified by age and centre and adjusted for sex, smoking, education, physical activity, height and diabetes. (b) Model 2 was further adjusted for body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fibre and calcium intake in Model 2 (b), while kidney for hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy in Models 1 (a) and 2 (b).*P-trend significant after Bonferroni correction (p-value of 0.002).

Supplementary Table 7. Associations between NOVA groups intake (in %kcal/day) and cancer risk in EPIC (N=450,111)

Cancer	cases	Model	NOVA 1	NOVA 2	NOVA 3	NOVA 4
			HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)
All	47,573	1	**0.97 (0.96 - 0.98)***	1.00 (0.99 - 1.01)	**1.01 (1.00 - 1.03)**	1.00 (0.99 - 1.02)
		2	**0.98 (0.97 - 0.99)**	**1.01 (1.00 - 1.03)**	0.99 (0.98 - 1.01)	1.01 (0.99 - 1.02)
Head and Neck	821	1	**0.88 (0.81 - 0.96)**	0.99 (0.90 - 1.09)	**1.12 (1.03 - 1.22)**	0.99 (0.90 - 1.10)
		2	1.00 (0.91 - 1.10)	1.06 (0.95 - 1.17)	**0.88 (0.79 - 0.98)**	1.11 (0.98 - 1.25)
Oesophagus adeno[1]	223	1	0.89 (0.76 - 1.04)	0.99 (0.82 - 1.19)	0.88 (0.73 - 1.06)	**1.28 (1.05 - 1.56)**
		2	0.85 (0.76 - 1.01)	0.98 (0.81 - 1.20)	0.92 (0.73 - 1.16)	**1.27 (1.02 - 1.58)**
Oesophagus SCC[2]	194	1	0.86 (0.72 - 1.01)	0.92 (0.74 - 1.12)	**1.81 (1.53 - 2.14)***	**0.62 (0.49 -0.77)***
		2	1.12 (0.93 - 1.34)	1.04 (0.84 - 1.28)	1.17 (0.95 - 1.46)	**0.74 (0.58 - 0.94)**
Gastric cardia	239	1	0.98 (0.84 - 1.15)	1.11 (0.94 - 1.32)	0.90 (0.76 - 1.08)	1.05 (0.86 - 1.28)
		2	0.93 (0.79 - 1.11)	1.11 (0.93 - 1.33)	0.96 (0.77 - 1.19)	1.04 (0.84 - 1.30)
Gastric non-cardia	379	1	0.95 (0.84 - 1.07)	1.00 (0.87 - 1.14)	1.00 (0.88 - 1.14)	1.07 (0.90 - 1.26)
		2	0.95 (0.83 - 1.10)	1.03 (0.89 - 1.19)	0.98 (0.84 - 1.14)	1.06 (0.88 - 1.27)
Colon	3993	1	**0.94 (0.90 - 0.97)***	0.95 (0.91 -1.00)	**1.07 (1.02 - 1.12)***	1.03 (0.98 - 1.08)
		2	0.96 (0.92 - 1.00)	0.97 (0.92 - 1.01)	**1.05 (0.99 - 1.10)**	1.01 (0.96 - 1.07)
Rectal	2162	1	0.97 (0.92 - 1.02)	0.94 (0.88 - 1.00)	1.06 (1.00 - 1.29)	0.99 (0.93 - 1.06)
		2	1.04 (0.98 - 1.10)	0.95 (0.88 - 1.01)	1.00 (0.93 - 1.07)	0.98 (0.90 - 1.06)
HCC[3]	215	1	0.86 (0.73 - 1.02)	0.98 (0.81 - 1.19)	**1.20 (1.01 - 1.43)**	0.94 (0.75 - 1.17)
		2	0.97 (0.81 - 1.16)	1.06 (0.87 - 1.29)	1.16 (0.94 - 1.44)	0.86 (0.68 - 1.08)
Gallbladder	335	1	0.90 (0.79 - 1.03)	0.89 (0.76 - 1.06)	1.12 (0.97 - 1.30)	1.04 (0.87 - 1.24)
		2	0.90 (0.79 - 1.03)	0.93 (0.77 - 1.09)	1.16 (0.98 - 1.37)	1.03 (0.86 - 1.24)
Pancreatic	1236	1	1.02 (0.96 - 1.09)	0.99 (0.91 - 1.07)	1.01 (0.94 - 1.09)	0.95 (0.87 - 1.04)
		2	1.04 (0.97 - 1.12)	0.99 (0.90 - 1.08)	0.98 (0.89 - 1.06)	0.98 (0.89 - 1.08)
Lung	3783	1	0.98 (0.95 - 1.02)	1.00 (0.96 - 1.05)	**1.04 (1.00 - 1.09)**	0.97 (0.92 - 1.02)
		2	0.99 (0.95 - 1.03)	1.01 (0.96 - 1.05)	1.05 (0.99 - 1.11)	0.97 (0.92- 1.03)
RCC[4]	464	1	0.92 (0.81 - 1.04)	**0.85 (0.73 - 0.99)**	0.95 (0.84 - 1.09)	**1.24 (1.06 - 1.45)**
		2	0.90 (0.79 - 1.04)	0.86 (0.73 - 1.01)	1.04 (0.88 - 1.22)	1.17 (0.99 - 1.40)
Bladder	1586	1	0.99 (0.94 - 1.05)	1.01 (0.95 - 1.08)	1.06 (0.99 - 1.13)	0.93 (0.86 - 1.01)
		2	0.99 (0.92 - 1.06)	1.03 (0.96 - 1.11)	1.07 (0.99 - 1.15)	0.94 (0.86 - 1.03)
Glioma	653	1	0.97 (0.88 - 1.06)	0.95 (0.85 - 1.07)	1.04 (0.94 - 1.16)	1.01 (0.89 - 1.15)
		2	0.97 (0.88 - 1.08)	0.95 (0.84 - 1.07)	1.07 (0.94 - 1.21)	1.00 (0.87 - 1.14)
Thyroid	759	1	1.06 (0.97 - 1.15)	0.99 (0.90 – 1.10)	0.89 (0.81 - 0.97)	1.08 (0.96 - 1.21)
		2	1.03 (0.94 - 1.13)	1.00 (0.89 - 1.11)	0.94 (0.84 - 1.04)	1.04 (0.92 - 1.18)
Multiple myeloma	588	1	0.94 (0.85 - 1.04)	1.04 (0.93 - 1.17)	1.04 (0.92 -1.16)	1.01 (0.89 - 1.16)
		2	0.95 (0.85 - 1.05)	1.03 (0.91 - 1.17)	1.09 (0.95 - 1.25)	0.97 (0.84 - 1.12)
NHL[5]	2356	1	0.99 (0.94 - 1.03)	1.02 (0.97 - 1.09)	1.03 (0.97 - 1.09)	0.97 (0.90 - 1.03)
		2	0.99 (0.95 - 1.05)	1.03 (0.97 - 1.09)	1.06 (1.00 - 1.14)	0.94 (0.87 - 1.01)
Leukemia	503	1	0.91 (0.82 - 1.01)	1.03 (0.91 - 1.16)	1.02 (0.91 - 1.16)	1.08 (0.94 - 1.24)
		2	0.93 (0.83 - 1.04)	1.05 (0.91 - 1.20)	1.01 (0.87 - 1.18)	1.05 (0.90 - 1.22)
Melanoma	2312	1	1.01 (0.97 - 1.06)	0.96 (0.90 - 1.02)	0.96 (0.91 – 1.01)	1.03 (0.97 - 1.10)
		2	1.01 (0.96 - 1.05)	0.98 (0.91 - 1.05)	0.95 (0.88 - 1.01)	1.05 (0.98 - 1.13)
Breast (pre)[6]	2223	1	1.00 (0.94 - 1.07)	1.02 (0.95 – 1.09)	1.05 (0.97 - 1.12)	0.93 (0.86 - 1.01)
		2	1.00 (0.93 - 1.07)	1.01 (0.93 - 1.10)	1.02 (0.94 - 1.10)	0.97 (0.89 - 1.06)
Breast (post)[7]	7724	1	0.98 (0.95 - 1.00)	0.97 (0.94 - 1.01)	1.01 (0.98 - 1.05)	1.02 (0.98 - 1.06)
		2	1.00 (0.97 - 1.03)	0.99 (0.95 - 1.03)	1.00 (0.96 - 1.04)	1.01 (0.97 - 1.06)
Cervical	354	1	1.00 (0.87 - 1.15)	1.07 (0.89 - 1.28)	0.92 (0.77 - 1.10)	1.03 (0.85 - 1.25)
		2	1.00 (0.86 - 1.15)	1.12 (0.94 - 1.35)	0.94 (0.77 - 1.15)	1.00 (0.82 - 1.23)
Endometrial	1932	1	1.03 (0.97 - 1.09)	1.04 (0.97 - 1.13)	0.95 (0.87 - 1.02)	0.99 (0.90 - 1.07)
		2	0.99 (0.93 - 1.06)	1.09 (1.01 - 1.19)	1.01 (0.92 - 1.09)	0.97 (0.89 - 1.05)
Ovarian	1415	1	0.97 (0.90 - 1.04)	1.03 (0.94 - 1.12)	0.95 (0.87 - 1.04)	1.07 (0.97 - 1.78)
		2	0.97 (0.89 - 1.04)	0.99 (0.90 - 1.10)	0.99 (0.89 - 1.09)	1.05 (0.95 - 1.16)

Prostate	6926	1	0.98 (0.95 - 1.00)	1.00 (0.97 - 1.03)	0.98 (0.95 - 1.01)	**1.04 (1.00 - 1.08)**
		2	0.97 (0.94 - 1.01)	1.00 (0.96 - 1.04)	0.98 (0.94 - 1.02)	1.05 (1.00 - 1.09)

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA group intake in %kcal/d (1-sd increment). NOVA 1=minimally processed foods (1-sd= 10.48%); NOVA 2=processed culinary ingredients (1-sd= 6.0%); NOVA 3=processed foods (1-sd=11.8%); NOVA 4=ultra-processed foods (1-sd= 14.9%). . [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma.[3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Model 1 was stratified by age and centre and adjusted for sex, smoking, education, physical activity, height and diabetes. Model 2 was further adjusted for body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fibre and calcium intake in model 2, while Renal Cell Carcinoma hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy in models 1 and 2. P-value≤0.05 in bold. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.

Supplementary Table 8. Associations between NOVA groups intake (in %g/day) and cancer risk in EPIC with model 1 and 2 further adjusted to water intake (N=450,111)

Cancer	cases	Model	NOVA 1	NOVA 2	NOVA 3	NOVA 4
			HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)
All	47,573	1	**0.97 (0.96 - 0.98)***	1.00 (0.99 - 1.02)	**1.04 (1.02 - 1.05)***	1.00 (0.99 - 1.02)
		2	**0.97 (0.96 - 0.98)***	**1.01 (1.00 - 1.03)**	**1.03 (1.01 - 1.05)***	**1.01 (1.00 - 1.03)**
Head and Neck	821	1	**0.76 (0.71 - 0.81)***	0.95 (0.86 - 1.04)	**1.19 (1.13 - 1.27)***	**1.15 (1.07 - 1.24)***
		2	**0.80 (0.72 – 0.88)***	0.98 (0.89 - 1.09)	0.99 (0.90 – 1.09)	**1.28 (1.18 - 1.39)***
Oesophagus adeno[1]	223	1	0.88 (0.76 - 1.03)	1.03 (0.87 - 1.23)	0.97 (0.84 - 1.12)	**1.22 (1.06 - 1.40)**
		2	**0.73 (0.59 – 0.89)**	1.01 (0.84 - 1.22)	1.14 (0.88 – 1.47)	**1.24 (1.05 - 1.46)**
Oesophagus SCC[2]	194	1	**0.60 (0.53 – 0.69)***	0.97 (0.80 - 1.19)	**1.70 (1.53 – 1.91)***	0.83 (0.68 - 1.01)
		2	**0.76 (0.62 – 0.93)**	1.06 (0.86 - 1.30)	**1.38 (1.15 - 1.67)***	0.91 (0.72 – 1.14)
Gastric cardia	239	1	1.00 (0.87 - 1.16)	1.15 (0.97 - 1.36)	0.96 (0.84 - 1.10)	1.03 (0.88 - 1.20)
		2	0.89 (0.73 - 1.10)	1.16 (0.97 - 1.38)	1.08 (0.85 - 1.37)	1.04 (0.87 - 1.24)
Gastric non-cardia	379	1	**0.87 (0.78 – 0.98)**	1.08 (0.96 - 1.21)	1.06 (0.95 - 1.18)	1.10 (0.98 - 1.25)
		2	0.89 (0.76 - 1.05)	1.05 (0.93 - 1.20)	1.07 (0.89 - 1.28)	1.06 (0.91 - 1.20)
Colon	3993	1	**0.88 (0.85 - 0.91)***	0.95 (0.91 -1.00)	**1.12 (1.08 - 1.16)***	**1.04 (1.00 - 1.08)**
		2	**0.90 (0.85 – 0.96)***	0.97 (0.92 - 1.01)	**1.11 (1.04 - 1.18)***	1.02 (0.97 - 1.07)
Rectal	2162	1	**0.90 (0.86 – 0.94)***	0.94 (0.88 - 1.00)	**1.11 (1.06 - 1.17)***	1.01 (0.96 - 1.06)
		2	0.93 (0.86 - 1.00)	0.94 (0.88 - 1.01)	1.08 (1.00 - 1.17)	1.01 (0.95 - 1.08)
HCC[3]	215	1	**0.71 (0.62 - 0.82)***	1.00 (0.83 - 1.19)	**1.20 (1.07 - 1.36)***	**1.26 (1.10 - 1.45)***
		2	**0.73 (0.61 – 0.88)***	1.00 (0.83 - 1.20)	**1.24 (1.01 - 1.52)**	1.16 (0.99 - 1.37)
Gallbladder	335	1	0.95 (0.83 - 1.08)	0.95 (0.81 - 1.10)	1.08 (0.95 - 1.23)	0.97 (0.84 - 1.11)
		2	0.98 (0.81 - 1.17)	0.96 (0.82 - 1.13)	1.17 (0.95 - 1.44)	0.91 (0.78 - 1.07)
Pancreatic	1236	1	0.95 (0.89 - 1.02)	0.97 (0.89 - 1.05)	1.05 (0.98 - 1.12)	0.99 (0.92 - 1.07)
		2	0.94 (0.86 - 1.04)	0.99 (0.90 - 1.08)	1.03 (0.92 - 1.14)	1.03 (0.80 - 1.17)
Lung	3783	1	1.00 (0.97 - 1.04)	1.01 (0.97 - 1.06)	1.02 (0.98 - 1.05)	**0.95 (0.92 – 0.99)**
		2	0.95 (0.90 – 0.99)	1.02 (0.98 - 1.07)	**1.07 (1.01 - 1.13)**	1.00 (0.95- 1.05)
RCC[4]	464	1	1.02 (0.91 - 1.14)	0.88 (0.76 – 1.03)	0.91 (0.83 - 1.03)	1.09 (0.98 - 1.22)
		2	0.98 (0.83 - 1.16)	0.87 (0.75 - 1.02)	0.92 (0.77 - 1.11)	1.07 (0.93 - 1.23)
Bladder	1586	1	0.99 (0.94 - 1.05)	1.03 (0.97 - 1.09)	1.01 (0.96 - 1.06)	0.97 (0.92 - 1.04)
		2	0.99 (0.92 - 1.07)	1.05 (0.98 - 1.12)	0.99 (0.91 - 1.08)	1.00 (0.93 - 1.08)
Glioma	653	1	0.97 (0.88 - 1.06)	0.95 (0.85 - 1.05)	1.05 (0.96 - 1.15)	0.97 (0.88 - 1.07)
		2	1.00 (0.88 - 1.14)	0.92 (0.82 - 1.04)	1.13 (0.97 - 1.31)	0.93 (0.83 - 1.04)
Thyroid	759	1	1.02 (0.93 - 1.12)	1.00 (0.90 – 1.10)	0.89 (0.80 - 0.98)	1.09 (0.99 - 1.19)
		2	**0.86 (0.75 – 0.98)**	1.00 (0.89 - 1.11)	1.08 (0.92 - 1.27)	1.09 (0.98 - 1.21)
Multiple myeloma	588	1	0.94 (0.86 - 1.04)	1.09 (0.98 - 1.20)	1.02 (0.92 -1.12)	1.04 (0.94 - 1.15)
		2	0.93 (0.81 - 1.06)	1.08 (0.96 - 1.20)	1.09 (0.93 - 1.28)	1.01 (0.90 - 1.13)
NHL[5]	2356	1	0.98 (0.94 - 1.03)	1.04 (0.98 - 1.09)	1.01 (0.97 - 1.07)	0.96 (0.96- 1.06)
		2	0.97 (0.90 - 1.03)	1.04 (0.97 - 1.10)	1.07 (1.00 - 1.16)	0.98 (0.93 - 1.05)
Leukemia	503	1	0.94 (0.84 - 1.04)	1.04 (0.92 - 1.17)	1.00 (0.90 - 1.11)	1.08 (0.97 - 1.20)
		2	1.00 (0.86 - 1.15)	1.03 (0.91 - 1.17)	0.93 (0.78 - 1.11)	1.04 (0.91 - 1.16)
Melanoma	2312	1	1.01 (0.96 - 1.06)	0.95 (0.88 - 1.01)	0.97 (0.92 – 1.03)	1.01 (0.96 - 1.06)
		2	1.03 (0.96 - 1.10)	0.96 (0.91 - 1.03)	0.93 (0.84 - 1.01)	1.01 (0.95 - 1.07)
Breast (pre)[6]	2223	1	1.00 (0.94 - 1.07)	1.02 (0.95 – 1.09)	1.08 (0.99 - 1.17)	0.94 (0.88 - 1.01)
		2	1.02 (0.94 - 1.12)	1.03 (0.95 - 1.11)	1.03 (0.91 - 1.17)	0.97 (0.89 - 1.03)
Breast (post)[7]	7724	1	**0.94 (0.90 – 0.97)***	1.00 (0.96 - 1.05)	**1.07 (1.03 - 1.12)***	1.02 (0.98 - 1.06)
		2	0.98 (0.94 - 1.03)	1.01 (0.97 - 1.05)	1.02 (0.96 - 1.09)	1.00 (0.97 - 1.03)
Cervical	354	1	1.00 (0.85 - 1.18)	1.01 (0.85 - 1.21)	0.94 (0.77 - 1.16)	1.03 (0.88 - 1.18)
		2	0.99 (0.81 - 1.22)	1.07 (0.88 - 1.29)	1.00 (0.74 - 1.34)	1.00 (0.85 - 1.17)
Endometrial	1932	1	1.03 (0.95 - 1.11)	1.01 (0.94 - 1.10)	0.92 (0.85 - 1.02)	1.00 (0.94 - 1.07)
		2	1.07 (0.97 - 1.18)	1.07 (0.98 - 1.17)	0.96 (0.84 - 1.10)	0.96 (0.87 - 1.01)
Ovarian	1415	1	0.98 (0.90 - 1.07)	1.00 (0.91 - 1.10)	0.95 (0.85 - 1.05)	1.04 (0.97 - 1.13)
		2	0.92 (0.82 - 1.03)	0.98 (0.88 - 1.08)	1.03 (0.88 - 1.21)	1.05 (0.97 - 1.16)

Prostate	6926	1	1.01 (0.99 - 1.04)	1.01 (0.98 - 1.04)	0.98 (0.95 - 1.01)	0.99 (0.96 - 1.02)
		2	1.03 (0.99 - 1.07)	1.01 (0.97 - 1.04)	0.97 (0.93 - 1.00)	0.99 (0.96 - 1.02)

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA group intake in %g/d (1-sd increment). NOVA 1=minimally processed foods; NOVA 2=processed culinary ingredients; NOVA 3=processed foods; NOVA 4=ultra-processed foods. [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma.[3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Model 1 was stratified by age and centre and adjusted for sex, smoking, education, physical activity, height, diabetes and total water intake. Model 2 was further adjusted for body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fibre and calcium intake in model 2, while Renal Cell Carcinoma hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy in models 1 and 2. P-value≤0.05 in bold. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.

Supplementary Table 9. Associations between NOVA groups intake (in %g/day) and cancer risk in EPIC using upper bound scenario (N=450,111)

Cancer	cases	Model	NOVA 1 HR (95%CI)	NOVA 2 HR (95%CI)	NOVA 3 HR (95%CI)	NOVA 4 HR (95%CI)
All	47,573	1	**0.97 (0.96 - 0.98)***	1.01(1.00 - 1.02)	**1.04 (1.03 - 1.05)***	1.01 (1.00 - 1.02)
		2	**0.98 (0.97 - 0.99)***	**1.02 (1.00 - 1.03)**	**1.02 (1.00 - 1.03)**	1.01 (1.00 - 1.02)
Head and Neck	821	1	**0.76 (0.71 - 0.81)***	0.93 (0.85 - 1.02)	**1.20 (1.14 - 1.25)***	**1.09 (1.01 - 1.18)**
		2	**0.85 (0.78 - 0.93)***	0.98 (0.89 - 1.08)	1.02 (0.94 - 1.11)	**1.21 (1.12 - 1.32)***
Oesophagus adeno[1]	223	1	0.88 (0.76 - 1.01)	1.02 (0.86 - 1.21)	0.99 (0.87 - 1.12)	**1.21 (1.05 - 1.39)**
		2	**0.79 (0.66 - 0.94)**	1.01 (0.84 - 1.21)	1.16 (0.93 - 1.44)	**1.21 (1.03 - 1.42)**
Oesophagus SCC[2]	194	1	**0.59 (0.52 - 0.68)***	0.93 (0.77 - 1.14)	**1.59 (1.45 - 1.75)***	0.84 (0.70 - 1.02)
		2	**0.80 (0.67 - 0.96)**	1.05 (0.86 - 1.29)	**1.29 (1.10 - 1.52)***	**0.99 (0.81 - 1.21)**
Gastric cardia	239	1	1.02 (0.89 - 1.18)	1.15 (0.98 - 1.36)	0.98 (0.87 - 1.10)	0.99 (0.85 - 1.15)
		2	0.98 (0.82 - 1.17)	1.15 (0.97 - 1.36)	1.06 (0.86 - 1.31)	0.98 (0.83 - 1.16)
Gastric non-cardia	379	1	**0.89 (0.79 - 1.00)**	1.07 (0.95 - 1.20)	1.04 (0.95 - 1.15)	1.10 (0.99 - 1.24)
		2	0.89 (0.77 - 1.02)	1.08 (0.95 - 1.22)	1.12 (0.94 - 1.32)	1.07 (0.95 - 1.21)
Colon	3993	1	**0.88 (0.85 - 0.91)***	0.97 (0.93 - 1.01)	**1.10 (1.06 - 1.13)***	**1.06 (1.03 - 1.10)***
		2	**0.90 (0.86 - 0.95)***	0.97 (0.93 - 1.02)	**1.10 (1.04 - 1.16)***	**1.06 (1.02 - 1.11)**
Rectal	2162	1	**0.92 (0.87 - 0.96)***	**0.93 (0.88 - 0.99)**	**1.11 (1.07 - 1.15)***	0.98 (0.93 - 1.04)
		2	1.00 (0.94 - 1.07)	**0.93 (0.87 - 1.00)**	1.04(0.97 - 1.12)	0.97 (0.91 - 1.03)
HCC[3]	215	1	**0.97 (0.91 - 1.03)***	0.97 (0.81 - 1.15)	**1.22 (1.10 - 1.35)***	1.12 (0.97 - 1.30)
		2	**0.82 (0.69 - 0.97)**	1.01 (0.84 - 1.21)	**1.26 (1.06 - 1.50)**	1.07 (0.91 - 1.26)
Gallbladder	335	1	0.96 (0.85 - 1.10)	0.95 (0.81 - 1.10)	1.04 (0.93 - 1.17)	1.01 (0.88 - 1.14)
		2	0.98 (0.85 - 1.15)	0.97 (0.83 - 1.14)	1.07 (0.89 - 1.30)	0.99 (0.86 - 1.14)
Pancreatic	1236	1	0.98 (0.91 - 1.04)	0.97 (0.89 - 1.05)	1.06 (1.00 - 1.12)	0.97 (0.90 - 1.03)
		2	1.00 (0.92 - 1.08)	0.98 (0.90 - 1.06)	1.02 (0.93 - 1.12)	0.99 (0.92 - 1.07)
Lung	3783	1	1.01 (0.98 - 1.05)	1.02 (0.98 - 1.06)	1.02 (0.99 - 1.05)	0.95 (0.92 - 0.99)
		2	1.02 (0.98 - 1.07)	1.01 (0.97 - 1.06)	1.01 (0.96 - 1.06)	0.97 (0.93 - 1.01)
RCC[4]	464	1	1.01 (0.91 - 1.13)	0.90 (0.78 - 1.04)	0.90 (0.82 - 0.99)	**1.15 (1.03 - 1.27)**
		2	0.95 (0.83 - 1.08)	0.90 (0.77 - 1.05)	0.89 (0.75 - 1.05)	1.14 (1.01 - 1.29)
Bladder	1586	1	0.99 (0.94 - 1.05)	1.03 (0.97 - 1.09)	1.01 (0.97 - 1.06)	0.99 (0.93 - 1.05)
		2	1.00 (0.94 - 1.07)	1.05 (0.98 - 1.11)	0.97 (0.90 - 1.05)	1.01 (0.95 - 1.08)
Glioma	653	1	0.98 (0.89 - 1.07)	0.95 (0.85 - 1.06)	1.05 (0.98 - 1.14)	0.97 (0.88 - 1.06)
		2	0.99 (0.89 - 1.10)	0.94 (0.84 - 1.05)	**1.16 (1.01 - 1.32)**	0.95 (0.86 - 1.05)
Thyroid	759	1	1.03 (0.94 - 1.13)	1.00 (0.91 - 1.10)	**0.90 (0.81 - 0.99)**	1.05 (0.96 - 1.14)
		2	0.95 (0.86 - 1.06)	0.99 (0.89 - 1.10)	1.08 (0.93 - 1.26)	1.03 (0.93 - 1.12)
Multiple myeloma	588	1	0.95 (0.86 - 1.05)	1.10 (1.00 - 1.22)	1.01 (0.93 - 1.10)	1.04 (0.95 - 1.15)
		2	0.94 (0.84 - 1.05)	1.10 (0.99 - 1.22)	1.09 (0.94 - 1.26)	1.02 (0.92 - 1.13)
NHL[5]	2356	1	0.99 (0.94 - 1.04)	1.04 (0.99 - 1.10)	1.02 (0.97 - 1.06)	1.00 (0.95 - 1.04)
		2	0.99 (0.94 - 1.05)	1.05 (0.99 - 1.11)	1.07 (0.99 - 1.15)	0.98 (0.93 - 1.03)
Leukemia	503	1	0.96 (0.86 - 1.07)	1.04 (0.93 - 1.17)	0.98 (0.89 - 1.08)	1.07 (0.97 - 1.18)
		2	1.00 (0.88 - 1.13)	1.05 (0.93 - 1.19)	0.93 (0.79 - 1.09)	1.03 (0.93 - 1.16)
Melanoma	2312	1	1.00 (0.95 - 1.05)	0.95 (0.90 - 1.02)	0.97 (0.93 - 1.02)	1.03 (0.98 - 1.08)
		2	0.98 (0.93 - 1.04)	0.98 (0.91 - 1.04)	0.95 (0.87 - 1.03)	1.04 (0.99 - 1.10)
Breast (pre)[6]	2223	1	1.00 (0.94 - 1.07)	1.01 (0.94 - 1.09)	**1.11 (1.03 - 1.19)**	0.95 (0.89 - 1.00)
		2	1.02 (0.95 - 1.09)	1.01 (0.94 - 1.09)	1.06 (0.95 - 1.19)	0.97 (0.91 - 1.03)
Breast (post)[7]	7724	1	**0.96 (0.93 - 0.99)**	1.00 (0.96 - 1.04)	**1.07 (1.03 - 1.11)***	1.00 (0.97 - 1.04)
		2	0.99 (0.95 - 1.03)	1.01 (0.97 - 1.06)	1.04 (0.98 - 1.10)	1.00 (0.97 - 1.03)
Cervical	354	1	0.96 (0.83 - 1.12)	1.05 (0.88 - 1.25)	1.00 (0.83 - 1.20)	1.04 (0.91 - 1.19)
		2	0.93 (0.79 - 1.10)	1.10 (0.92 - 1.32)	1.14 (0.87 - 1.50)	1.03 (0.89 - 1.19)
Endometrial	1932	1	1.02 (0.95 - 1.09)	1.03 (0.95 - 1.12)	0.95 (0.87 - 1.03)	1.00 (0.94 - 1.07)
		2	1.00 (0.93 - 1.08)	**1.10 (1.01 - 1.19)**	1.06 (0.93 - 1.20)	0.98 (0.92 - 1.05)
Ovarian	1415	1	1.01 (0.93 - 1.09)	0.99 (0.90 - 1.08)	0.93 (0.84 - 1.03)	1.03 (0.96 - 1.10)
		2	0.99 (0.90 - 1.08)	0.96 (0.87 - 1.06)	0.94 (0.81 - 1.09)	1.03 (0.95 - 1.11)
Prostate	6926	1	1.02 (0.99 - 1.05)	1.01 (0.98 - 1.04)	0.98 (0.96 - 1.00)	1.00 (0.97 - 1.03)

	2	1.03 (1.00 - 1.06)	1.01 (0.97 - 1.04)	**0.96 (0.92 - 0.99)**	0.99 (0.96 - 1.03)

Note. HR (95%CI)=Hazard ratio (95% Confidence Interval). NOVA group intake in %g/d (1-sd increment). NOVA 1=minimally processed foods; NOVA 2=processed culinary ingredients; NOVA 3=processed foods; NOVA 4=ultra-processed foods. . [1]Oesophagus Adenocarcinoma. [2]Oesophagus Squamous Cell Carcinoma.[3]Hepatocellular Carcinoma. [4]Renal Cell Carcinoma. [5]Non-Hodgkin Lymphoma. [6]Premenopausal Breast cancer. [7]Postmenopausal Breast cancer. Model 1 was stratified by age and centre and adjusted for sex, smoking, education, physical activity, height and diabetes. Model 2 was further adjusted for body mass index, Mediterranean diet and alcohol, total energy, lipid, sodium and carbohydrate intakes. Colorectal cancers were also further adjusted for fibre and calcium intake in model 2, while Renal Cell Carcinoma hypertension and female-specific cancer sites for menopausal status, hormone therapy, oral contraceptive use, age at menarche and age at first full-term pregnancy in models 1 and 2. P-value≤0.05 in bold. *Significant after Bonferroni correction, which considered analysis for all cancers and 25 cancer-specific sites and p value of ≤0·002.