

Supplemental table 1. Age-adjusted Pearson partial correlation coefficients matrix for individual whole grain foods.

	Whole grain breakfast cereal	Oatmeal	Dark bread	Brown rice	Popcorn	Added bran	Wheat germ
Whole grain breakfast cereal	1	0.07	0.14	0.05	0.03	0.11	0.07
P value		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Oatmeal	-	1	0.12	0.14	0.03	0.11	0.11
P value	-		<.0001	<.0001	<.0001	<.0001	<.0001
Dark bread	-	-	1	0.13	0.03	0.07	0.07
P value	-	-		<.0001	<.0001	<.0001	<.0001
Brown rice	-	-	-	1	0.06	0.10	0.11
P value	-	-	-		<.0001	<.0001	<.0001
Popcorn	-	-	-	-	1	0.03	0.01
P value	-	-	-	-		<.0001	<.0001
Added bran	-	-	-	-	-	1	0.28
P value	-	-	-	-	-		<.0001
Wheat germ	-	-	-	-	-	-	1
P value	-	-	-	-	-	-	

Supplemental table 2. Multivariable-adjusted pooled HRs (95% confidence intervals) of type 2 diabetes for individual whole grain food consumption in Nurses' Health Study (1984-2014), Nurses' Health Study II (1991-2017), Health Professionals Follow-up Study (1986-2016)

	Consumption levels				P for trend†	Per serving daily
	Never or < 1 serving/month	1 serving/month - 1 serving/week	1 serving/week – 4-6 servings/week	≥1 servings/d		
Cold breakfast cereal						
NHS*						
Cases/person-time	3,474/619,365	1,777/344,185	2,343/591,499	576/168,484		
Multivariable adjusted model*	1.00	0.92(0.87 to 0.97)	0.74(0.70 to 0.79)	0.74(0.68 to 0.81)	<.0001	0.69(0.63 to 0.75)
NHSII*						
Cases/person-time	2,215/516,774	1,680/430,687	2,314/818,940	863/313,137		
Multivariable adjusted model*	1.00	0.95(0.89 to 1.02)	0.76(0.72 to 0.81)	0.87(0.80 to 0.95)	<.0001	0.84(0.77 to 0.90)
HPFS*						
Cases/person-time	1,259/249,423	656/144,508	914/253,885	558/167,910		
Multivariable adjusted model*	1.00	0.90(0.82 to 0.99)	0.76(0.69 to 0.83)	0.82(0.74 to 0.90)	<.0001	0.81(0.73 to 0.89)
Dark bread						
NHS*						
Cases/person-time	1,007/168,756	1,739/336,210	2,856/648,800	2,568/569,767		
Multivariable adjusted model*	1.00	0.91(0.84 to 0.99)	0.81(0.76 to 0.88)	0.81(0.75 to 0.87)	<0.001	0.94(0.91 to 0.98)
NHSII*						
Cases/person-time	1,081/235,814	1,603/417,999	2,532/821,312	1,856/604,413		
Multivariable adjusted model*	1.00	0.91(0.84 to 0.98)	0.78(0.72 to 0.84)	0.78(0.73 to 0.85)	<0.001	0.94(0.90 to 0.97)
HPFS*						
Cases/person-time	471/86,097	775/162,742	988/258,516	1,153/308,371		
Multivariable adjusted model*	1.00	0.92(0.82 to 1.03)	0.73(0.66 to 0.82)	0.76(0.68 to 0.85)	<.0001	0.90(0.86 to 0.94)
Popcorn						
NHS*						
Cases/person-time	2,664/580,505	3,887/810,792	1,399/292,278	220/39,957		
Multivariable adjusted model*	1.00	0.98(0.93 to 1.04)	0.90(0.84 to 0.97)	1.04(0.91 to 1.20)	0.55	0.97(0.88 to 1.06)
NHSII*						
Cases/person-time	865/278,229	3,511/1,121,424	2,166/578,081	530/101,804		
Multivariable adjusted model*	1.00	0.91(0.85 to 0.98)	0.91(0.84 to 0.99)	1.07(0.95 to 1.19)	0.02	1.08(1.01 to 1.15)
HPFS*						
Cases/person-time	958/234,309	1,581/391,612	656/155,283	192/34,522		
Multivariable adjusted model*	1.00	0.96(0.88 to 1.04)	0.95(0.86 to 1.05)	1.15(0.98 to 1.35)	<0.001	1.16(1.06 to 1.26)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	≥2 servings/week			

Oatmeal						
NHS*						
Cases/person-time	4,555/925,185	2,847/584,793	768/213,554	-		
Multivariable adjusted model*	1.00	0.93(0.89 to 0.98)	0.79(0.73 to 0.85)	-	0.005	0.76(0.63 to 0.92)
NHSII*						
Cases/person-time	3,166/891,177	2,961/844,732	945/343,630	-		
Multivariable adjusted model*	1.00	1.00(0.95 to 1.05)	0.83(0.77 to 0.89)	-	0.27	0.90(0.74 to 1.09)
HPFS*						
Cases/person-time	2,002/432,537	1,013/255,974	372/127,214	-		
Multivariable adjusted model*	1.00	0.89(0.83 to 0.96)	0.71(0.63 to 0.79)	-	<.0001	0.54(0.42 to 0.69)
Brown rice						
NHS*						
Cases/person-time	5,914/1,153,358	2,029/495,787	227/74,387	-		
Multivariable adjusted model*	1.00	0.95(0.91 to 1.01)	0.79(0.69 to 0.91)	-	0.006	0.61(0.43 to 0.87)
NHSII*						
Cases/person-time	4,133/1,068,432	2,468/828,122	471/182,984	-		
Multivariable adjusted model*	1.00	0.97(0.92 to 1.03)	0.92(0.83 to 1.01)	-	0.88	1.02(0.80 to 1.30)
HPFS*						
Cases/person-time	1,814/388,547	1,358/360,879	215/66,300	-		
Multivariable adjusted model†	1.00	0.95(0.89 to 1.02)	0.91(0.79 to 1.05)	-	0.48	0.89(0.66 to 1.22)
Added bran						
NHS*						
Cases/person-time	6,688/1,304,971	862/219,812	620/198,750	-		
Multivariable adjusted model*	1.00	0.87(0.81 to 0.94)	0.81(0.74 to 0.88)	-	0.002	0.83(0.74 to 0.93)
NHSII*						
Cases/person-time	6,096/1,729,096	689/236,455	287/113,987	-		
Multivariable adjusted model*	1.00	0.99(0.92 to 1.08)	0.94(0.84 to 1.06)	-	0.97	1.00(0.86 to 1.15)
HPFS*						
Cases/person-time	2,635/600,893	438/110,282	314/104,551	-		
Multivariable adjusted model*	1.00	0.95(0.85 to 1.05)	0.84(0.74 to 0.94)	-	0.08	0.91(0.82 to 1.01)
Wheat germ						
NHS*						
Cases/person-time	7,551/1,540,820	450/123,833	169/58,880	-		
Multivariable adjusted model*	1.00	0.96(0.87 to 1.05)	0.90(0.77 to 1.05)	-	0.57	0.93(0.74 to 1.18)
NHSII*						
Cases/person-time	6,718/1,919,927	295/126,254	59/33,356	-		
Multivariable adjusted model*	1.00	0.91(0.81 to 1.02)	0.84(0.65 to 1.08)	-	0.19	0.71(0.43 to 1.18)
HPFS*						
Cases/person-time	3,130/728,505	169/53,822	88/33,398	-		

Multivariable adjusted model*	1.00	0.85(0.73 to 1.00)	0.87(0.70 to 1.08)	-	0.32	0.87(0.66 to 1.14)
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*Adjusted for age (years), ethnicity (white, African American, Asian, others), body mass index (calculated as weight in kilograms divided by height in meters squared) (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥ 35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or ≥ 25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and ≥ 30.0 g/d), multivitamin use (yes, no), physical activity (quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. For women, postmenopausal hormone use (never, former, or current hormone use, or missing), and oral contraceptive use were further adjusted.

†P for trend was calculated using continuous exposure variables.

Supplemental table 3. Association between regular and light/fat free popcorn intake and risk of type 2 diabetes in Nurses' Health Study (2002-2012), Nurses' Health Study II (2003-2013) and Health Professionals Follow-up study (2002-2012)

	Regular popcorn				Light, fat free popcorn			
	<1 serving/mo	1 serving/mo – 1 serving/wk	> 2 servings/wk	P for trend†	<1 serving/mo	1 serving/mo – 1 serving/wk	> 2 servings/wk	P for trend†
NHS								
Cases/person-years	1,460/331,778	517/94,501	63/11,404		1,267/292,921	620/118,883	153/25,879	
Multivariable-adjusted model*	1.00	1.03 (0.93 to 1.15)	0.99 (0.76 to 1.28)	0.96	1.00	1.11 (1.01 to 1.23)	1.23 (1.03 to 1.46)	0.02
NHSII								
Cases/person-years	1,801/429,260	1,374/299,875	230/41,246		1,709/385,037	1,329/311,713	367/73,631	
Multivariable-adjusted model*	1.00	0.94 (0.87 to 1.01)	1.00 (0.87 to 1.15)	0.98	1.00	0.96 (0.89 to 1.03)	1.02 (0.91 to 1.15)	0.59
HPFS								
Cases/person-years	385/104,765	288/64,812	45/8,759		486/121,973	192/47,790	40/8,573	
Multivariable-adjusted model*	1.00	1.06 (0.90 to 1.24)	1.22 (0.88 to 1.67)	0.21	1.00	0.99 (0.83 to 1.17)	1.14 (0.82 to 1.59)	0.47
Pooled†								
Multivariable-adjusted model*	1.00	0.98 (0.93 to 1.04)	1.02 (0.91 to 1.15)	0.65	1.00	1.01 (0.95 to 1.06)	1.09 (0.99 to 1.19)	0.06

*Multivariable-adjusted model 1 adjusted for age (years), ethnicity (white, African American, Asian, others), body mass index (calculated as weight in kilograms divided by height in meters squared) (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or ≥25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and ≥30.0 g/d), multivitamin use (yes, no), physical activity (quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. For women, postmenopausal hormone use (never, former, or current hormone use, or missing), and oral contraceptive use were further adjusted.

Regular popcorn and light/fat free popcorn were mutually adjusted.

†Study estimates from three cohorts were pooled using a fixed effects model.

††P for trend was calculated using continuous exposure variables.

Supplemental table 4. Multivariable-adjusted pooled HRs (95% confidence intervals) of type 2 diabetes for individual whole grain food consumption in Nurses' Health Study (1984-2014), Nurses' Health Study II (1991-2017), Health Professionals Follow-up Study (1986-2016) mutually adjusting for each whole grain foods

	Never or < 1 serving/month	1 serving/month - 1 serving/week	1 serving/week – 4-6 servings/week	≥1 servings/d
Whole grain breakfast cereal				
Cases/person-time	6,948/1,385,562	4,113/919,380	5,571/1,664,324	1,997/649,531
Multivariable adjusted model*	1.00	0.95 (0.91 to 0.99)	0.79 (0.76 to 0.82)	0.83 (0.79 to 0.88)
Dark bread				
Cases/person-time	2,559/490,667	4,117/916,951	6,376/1,728,628	5,577/1,482,551
Multivariable adjusted model*	1.00	0.92 (0.88 to 0.97)	0.83 (0.79 to 0.87)	0.84 (0.79 to 0.88)
Popcorn				
Cases/person-time	4,487/1,093,043	8,979/2,323,828	4,221/1,025,642	942/176,283
Multivariable adjusted model*	1.00	0.98 (0.94 to 1.02)	0.96 (0.92 to 1.01)	1.09 (1.01 to 1.18)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	≥2 servings/week	
Oatmeal				
Cases/person-time	9,723/2,248,899	6,821/1,685,499	2,085/684,398	-
Multivariable adjusted model*	1.00	1.00 (0.97 to 1.04)	0.86 (0.82 to 0.90)	-
Brown rice				
Cases/person-time	11,861/2,610,337	5,855/1,684,788	913/323,671	-
Multivariable adjusted model*	1.00	1.00 (0.97 to 1.04)	0.95 (0.88 to 1.02)	-
Added bran				
Cases/person-time	15,419/3,634,960	1,989/566,549	1,221/417,288	-
Multivariable adjusted model*	1.00	0.97 (0.93 to 1.02)	0.93 (0.87 to 0.99)	-
Wheat germ				
Cases/person-time	17,399/4,189,252	914/303,909	316/125,634	-
Multivariable adjusted model*	1.00	0.98 (0.91 to 1.05)	1.00 (0.89 to 1.13)	-

*Adjusted for age (years), ethnicity (white, African American, Asian, others), body mass index (calculated as weight in kilograms divided by height in meters squared) (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or ≥25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and ≥30.0 g/d), multivitamin use (yes, no), physical activity (quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. Study estimates from three cohorts were pooled using a fixed effects model.

Supplemental table 5. Multivariable-adjusted pooled HRs (95% confidence intervals) of type 2 diabetes for individual whole grain food consumption in Nurses' Health Study (1984-2014), Nurses' Health Study II (1991-2017), Health Professionals Follow-up Study (1986-2016) using baseline intake, simple updated intake, latency analysis, and adjustment for baseline BMI.

	Consumption levels				P for trend‡	Per serving daily
	Never or < 1 serving/month	1 serving/month - 1 serving/week	1 serving/week – 4-6 servings/week	≥1 servings/d		
Whole grain cold breakfast cereal						
Baseline intake						
Cases/person-time	8,743/1,917,175	4,286/1,018,276	3,160/869,328	2,440/814,017		
Multivariable adjusted model*	1.00	0.97 (0.94 to 1.01)	0.89 (0.85 to 0.93)	0.84 (0.80 to 0.88)	<.0001	0.84 (0.80 to 0.88)
Simple updated intake						
Cases/person-time	7,369/1,558,846	3,759/891,706	3,185/855,410	2,463/811,327		
Multivariable adjusted model*	1.00	0.93 (0.89 to 0.97)	0.86 (0.82 to 0.90)	0.80 (0.76 to 0.83)	<.0001	0.80 (0.76 to 0.84)
Lag 4 years						
Cases/person-time	5,979/1,410,131	3,647/934,115	5,094/1,696,564	1,778/657,371		
Multivariable adjusted model*	1.00	0.93 (0.90 to 0.97)	0.75 (0.72 to 0.78)	0.82 (0.77 to 0.86)	<.0001	0.78 (0.74 to 0.82)
Adjusting for baseline BMI						
Cases/person-time	6,916/1,378,969	4,111/918,809	5,614/1,673,776	1,988/647,243		
Multivariable adjusted model†	1.00	0.93 (0.90 to 0.97)	0.76 (0.73 to 0.78)	0.80 (0.76 to 0.84)	<.0001	0.76 (0.73 to 0.80)
Dark bread						
Baseline intake						
Cases/person-time	3,375/713,847	4,998/1,207,153	4,381/1,113,311	5,875/1,584,484		
Multivariable adjusted model*	1.00	0.91 (0.87 to 0.95)	0.90 (0.86 to 0.94)	0.84 (0.81 to 0.88)	<.0001	0.93 (0.91 to 0.95)
Simple updated intake						
Cases/person-time	2,914/618,411	4,603/1,116,549	4,166/1,048,825	5,219/1,370,886		
Multivariable adjusted model*	1.00	0.93 (0.88 to 0.97)	0.92 (0.87 to 0.96)	0.87 (0.83 to 0.92)	<.0001	0.95 (0.93 to 0.97)
Lag 4 years						
Cases/person-time	2,230/501,263	3,612/931,461	5,778/1,760,330	4,878/1,505,127		
Multivariable adjusted model*	1.00	0.91 (0.87 to 0.96)	0.78 (0.74 to 0.82)	0.78 (0.74 to 0.82)	<.0001	0.92 (0.90 to 0.94)

Adjusting for baseline BMI						
Cases/person-time	2,541/487,803	4,113/914,337	6,410/1,735,940	5,565/1,480,717		
Multivariable adjusted model [†]	1.00	0.91 (0.87, 0.96)	0.79 (0.75, 0.83)	0.78 (0.75, 0.82)	<.0001	0.93 (0.91, 0.95)
Popcorn						
Baseline intake						
Cases/person-time	5,455/1,354,751	9,402/2,429,419	2,558/580,447	1,214/254,181		
Multivariable adjusted model*	1.00	1.00 (0.97 to 1.04)	1.07 (1.02 to 1.13)	1.09 (1.02 to 1.17)	0.001	1.07 (1.03 to 1.11)
Simple updated intake						
Cases/person-time	4,913/1,290,342	8,607/2,173,814	2,434/515,576	1,056/202,581		
Multivariable adjusted model*	1.00	1.01 (0.98 to 1.05)	1.12 (1.06 to 1.18)	1.13 (1.05 to 1.21)	0.0002	1.08 (1.04 to 1.13)
Lag 4 years						
Cases/person-time	3,802/1,112,731	7,961/2,361,521	3,907/1,045,241	828/178,689		
Multivariable adjusted model*	1.00	0.98 (0.94 to 1.02)	0.93 (0.89 to 0.98)	1.10 (1.01 to 1.19)	0.0002	1.09 (1.04 to 1.15)
Adjusting for baseline BMI						
Cases/person-time	4,475/1,091,138	8,972/2,321,695	4,254/1,031,380	928/174,583		
Multivariable adjusted model [†]	1.00	0.98 (0.94 to 1.02)	0.96 (0.91 to 1.00)	1.13 (1.05 to 1.22)	<.0001	1.11 (1.06 to 1.16)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	≥2 servings/week			
Oatmeal						
Cases/person-time						
Baseline intake						
Cases/person-time	11,026/2,663,095	6,459/1,615,741	1,144/339,961	-		
Multivariable adjusted model*	1.00	0.99 (0.96 to 1.02)	0.91 (0.85 to 0.97)	-	0.001	0.84 (0.75 to 0.93)
Simple updated intake						
Cases/person-time	9,341/2,196,788	6,186/1,521,201	1,475/457,224	-		
Multivariable adjusted model*	1.00	0.98 (0.95 to 1.02)	0.84 (0.79 to 0.89)	-	<.0001	0.73 (0.66 to 0.81)
Lag 4 years						
Cases/person-time	8,552/2,285,824	6,033/1,711,257	1,913/701,098	-		
Multivariable adjusted model*	1.00	0.94 (0.91 to 0.97)	0.77 (0.73 to 0.81)	-	<.0001	0.70 (0.62 to 0.80)
Adjusting for baseline BMI						
Cases/person-time	9,693/2,243,677	6,837/1,686,000	2,099/689,118	-		

Multivariable adjusted model [†]	1.00	0.95 (0.92 to 0.98)	0.78 (0.75 to 0.82)	-	<.0001	0.73 (0.65 to 0.83)
Brown rice						
Baseline intake						
Cases/person-time	12,806/2,910,472	5,232/1,514,576	591/193,748	-		
Multivariable adjusted model*	1.00	0.98 (0.94 to 1.01)	0.94 (0.86 to 1.03)	-	0.06	0.86 (0.74 to 1.01)
Simple updated intake						
Cases/person-time	11,249/2,518,460	5,131/1,465,643	573/184,759	-		
Multivariable adjusted model*	1.00	0.98 (0.94 to 1.01)	0.95 (0.86 to 1.04)	-	0.13	0.88 (0.75 to 1.04)
Lag 4 years						
Cases/person-time	10,377/2,650,110	5,284/1,717,342	837/330,729	-		
Multivariable adjusted model*	1.00	0.96 (0.93 to 0.99)	0.87 (0.81 to 0.94)	-	0.10	0.86 (0.72 to 1.03)
Adjusting for baseline BMI						
Cases/person-time	11,842/2,605,795	5,867/1,687,506	920/325,495	-		
Multivariable adjusted model [†]	1.00	0.97 (0.94 to 1.01)	0.89 (0.83 to 0.95)	-	0.20	0.90 (0.76 to 1.06)
Added bran						
Baseline intake						
Cases/person-time	15,947/3,812,498	1,739/492,196	943/314,102	-		
Multivariable adjusted model*	1.00	0.94 (0.89 to 0.99)	0.86 (0.81 to 0.92)	-	<.0001	0.88 (0.83 to 0.94)
Simple updated intake						
Cases/person-time	14,718/3,547,284	1,476/382,707	796/245,954	-		
Multivariable adjusted model*	1.00	1.04 (0.98 to 1.10)	0.94 (0.87 to 1.01)	-	0.03	0.93 (0.87 to 0.99)
Lag 4 years						
Cases/person-time	13,652/3,696,087	1,762/576,396	1,084/425,698	-		
Multivariable adjusted model*	1.00	0.92 (0.87 to 0.97)	0.84 (0.79 to 0.89)	-	0.001	0.89 (0.82 to 0.95)
Adjusting for baseline BMI						
Cases/person-time	15,413/3,633,469	1,992/567,552	1,224/417,775	-		
Multivariable adjusted model [†]	1.00	0.93 (0.89 to 0.97)	0.84 (0.79 to 0.90)	-	0.003	0.90 (0.84 to 0.96)
Wheat germ						
Baseline intake						
Cases/person-time	17,534/4,231,388	846/297,630	249/89,777	-		

Multivariable adjusted model*	1.00	0.85 (0.79 to 0.91)	0.89 (0.78 to 1.01)	-	0.01	0.82 (0.71 to 0.95)
Simple updated intake						
Cases/person-time	16,050/3,872,101	718/228,377	209/71,566	-		
Multivariable adjusted model*	1.00	0.94 (0.87 to 1.02)	1.01 (0.88 to 1.17)	-	0.31	0.92 (0.78 to 1.08)
Lag 4 years						
Cases/person-time	15,425/4,262,243	805/307,751	268/128,186	-		
Multivariable adjusted model*	1.00	0.91 (0.85 to 0.98)	0.82 (0.72 to 0.92)	-	0.01	0.78 (0.64 to 0.95)
Adjusting for baseline BMI						
Cases/person-time	17,397/4,188,575	916/304,396	316/125,825	-		
Multivariable adjusted model†	1.00	0.91 (0.85 to 0.97)	0.85 (0.75 to 0.95)	-	0.05	0.84 (0.71 to 1.00)

*Adjusted for age (years), ethnicity (white, African American, Asian, others), time-varying BMI (calculated as weight in kilograms divided by height in meters squared) (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥ 35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or ≥ 25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and ≥ 30.0 g/d), multivitamin use (yes, no), physical activity (quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. For women, postmenopausal hormone use (never, former, or current hormone use, or missing), and oral contraceptive use were further adjusted.

Study estimates from three cohorts were pooled using a fixed effects model.

†Baseline BMI (calculated as weight in kilograms divided by height in meters squared) (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥ 35.0 kg/m²) was adjusted.

Study estimates from three cohorts were pooled using a fixed effects model.

‡P for trend was calculated using continuous exposure variables.

Supplemental table 6. Multivariable-adjusted pooled HRs (95% confidence intervals) of symptomatic type 2 diabetes for individual whole grain food consumption in Nurses' Health Study (1984-2014), Nurses' Health Study II (1991-2017), Health Professionals Follow-up Study (1986-2016)*

	Consumption levels				P for trend‡	Per serving daily
	Never or < 1 serving/month	1 serving/month - 1 serving/week	1 serving/week – 4-6 servings/week	≥1 servings/d		
Whole grain cold breakfast cereal						
Cases/person-time	3,265/1,388,973	1,914/921,355	2,395/1,667,250	877/650,542		
Multivariable adjusted model†	1.00	0.95 (0.89 to 1.00)	0.74 (0.70 to 0.78)	0.78 (0.72 to 0.84)	<.0001	0.73 (0.68 to 0.79)
Dark bread						
Cases/person-time	1,200/491,937	1,896/918,994	2,817/1,731,883	2,538/1,485,306		
Multivariable adjusted model†	1.00	0.92 (0.85 to 0.99)	0.80 (0.74 to 0.86)	0.79 (0.74 to 0.85)	<.0001	0.93 (0.90 to 0.96)
Popcorn						
Cases/person-time	2,027/1,095,307	4,105/2,328,288	1,880/1,027,801	439/176,724		
Multivariable adjusted model†	1.00	0.99 (0.93 to 1.05)	0.95 (0.89 to 1.02)	1.07 (0.96 to 1.20)	0.02	1.08 (1.01 to 1.15)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	≥2 servings/week			
Oatmeal						
Cases/person-time	4,344/2,253,847	3,178/1,688,813	929/685,461	-		
Multivariable adjusted model†	1.00	1.01 (0.96 to 1.05)	0.85 (0.79 to 0.91)	-	0.25	0.91 (0.77 to 1.07)
Brown rice						
Cases/person-time	5,396/2,616,256	2,620/1,687,756	435/324,109	-		
Multivariable adjusted model†	1.00	0.98 (0.94 to 1.03)	1.00 (0.90 to 1.11)	-	0.13	1.18 (0.95 to 1.48)
Added bran						
Cases/person-time	6,925/3,642,742	947/567,518	579/417,860	-		
Multivariable adjusted model†	1.00	1.01 (0.94 to 1.08)	0.94 (0.86 to 1.03)	-	0.05	0.90 (0.81 to 1.00)
Wheat germ						
Cases/person-time	7,877/4,197,973	439/304,357	135/125,790	-		
Multivariable adjusted model†	1.00	0.99 (0.90 to 1.09)	0.89 (0.75 to 1.06)	-	0.50	0.92 (0.72 to 1.17)

*Patients without reporting any diabetes-related symptoms were censored during follow-up.

†Adjusted for age (years), ethnicity (white, African American, Asian, others), BMI (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or \geq 35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or \geq 25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and \geq 30.0 g/d), multivitamin use (yes, no), physical activity (quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. For women, postmenopausal hormone use (never, former, or current hormone use, or missing), and oral contraceptive use were further adjusted.

Study estimates from three cohorts were pooled using a fixed effects model.

‡P for trend was calculated using continuous exposure variables.

Supplemental table 7. Multivariable-adjusted pooled HRs (95% confidence intervals) of type 2 diabetes for individual whole grain food consumption in Nurses' Health Study (1984-2014), Nurses' Health Study II (1991-2017), Health Professionals Follow-up Study (1986-2016) using multiple imputation for missing covariates.

	Consumption levels					P for trend†	Per serving daily
	Q1	Q2	Q3	Q4	Q5		
Total whole grain							
Multivariable adjusted model*	1.00	0.87 (0.83 to 0.91)	0.81 (0.78 to 0.85)	0.73 (0.69 to 0.76)	0.70 (0.67 to 0.74)	<.0001	0.87 (0.85 to 0.89)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	1 serving/week - 4-6 servings/week	≥1 servings/d			
Whole grain cold breakfast cereal							
Multivariable adjusted model*	1.00	0.93 (0.89 to 0.96)	0.75 (0.72 to 0.78)	0.81 (0.77 to 0.85)		<.0001	0.78 (0.74 to 0.81)
Dark bread							
Multivariable adjusted model*	1.00	0.91 (0.87 to 0.96)	0.79 (0.75 to 0.82)	0.79 (0.76 to 0.83)		<.0001	0.93 (0.91 to 0.95)
Popcorn							
Multivariable adjusted model*	1.00	0.94 (0.92 to 0.97)	0.92 (0.88 to 0.97)	1.10 (1.02 to 1.19)		0.006	1.08 (1.03 to 1.13)
	Never or < 1 serving/month	1 serving/month - 1 serving/week	≥2 servings/week				
Oatmeal							
Multivariable adjusted model*	1.00	0.95 (0.92 to 0.98)	0.79 (0.75 to 0.83)	-		<.0001	0.75 (0.66 to 0.84)
Brown rice							
Multivariable adjusted model*	1.00	0.96 (0.93 to 0.99)	0.88 (0.82 to 0.94)	-		0.12	0.88 (0.74 to 1.04)
Added bran							
Multivariable adjusted model*	1.00	0.93 (0.89 to 0.98)	0.84 (0.79 to 0.90)	-		0.002	0.89 (0.83 to 0.96)
Wheat germ							
Multivariable adjusted model*	1.00	0.92 (0.86 to 0.98)	0.87 (0.78 to 0.97)	-		0.04	0.87 (0.76 to 0.99)

*Adjusted for age (years), ethnicity (white, African American, Asian, others), BMI (<21.0, 21.0-22.9, 23.0-24.9, 25.0-26.9, 27.0-29.9, 30.0-32.9, 33.0-34.9, or ≥35.0 kg/m²), smoking status (never smoked, past smoker, currently smoke 1-14 cigarettes per day, 15-24 cigarettes per day, or ≥25 cigarettes per day), alcohol intake (0, 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-29.9, and ≥30.0 g/d), multivitamin use (yes, no), physical activity

(quintiles), modified alternative healthy eating index (quintiles), and family history of diabetes. For women, postmenopausal hormone use (never, former, or current hormone use, or missing), and oral contraceptive use were further adjusted.

Study estimates from three cohorts were pooled using a fixed effects model.

†P for trend was calculated using continuous exposure variables.

Supplemental table 8. Distribution of types of popcorns consumed among 675 participants in Nurses' Health Study, Nurses' Health Study II, and Health Professionals Follow-Up Study, 2008.

	HPFS	NHS	NHSII	Average
Microwaved popcorn				
Butter flavor	46%	51%	47%	48%
Cheese flavor	11%	7%	3%	7%
Kettle Corn	14%	14%	19%	16%
Plain	29%	28%	30%	29%
Read-to-eat popcorn				
Cheese flavor	39%	40%	55%	45%
Butter flavor	61%	60%	45%	55%
Home popped popcorn				
Cheese flavored	4%	3%	6%	4%
Butter flavored oil	12%	10%	11%	11%
Dried butter flavored	7%	8%	8%	8%
Real butter melted	15%	20%	21%	19%
Real margarine melted	9%	8%	10%	9%
Cinnamon sugar	1%	0%	1%	1%
Air popped	24%	26%	25%	25%
Oil popped	28%	24%	19%	24%
Popcorn by Category				
Microwaved	53%	59%	61%	58%
RTE	8%	13%	9%	10%
Home Popped	39%	28%	30%	32%