

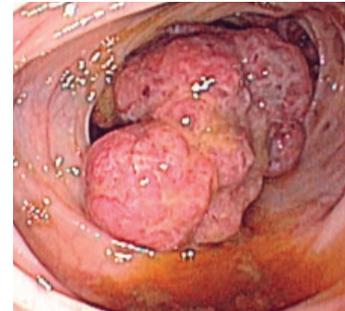
# research



Tobacco use in low and middle income countries p 313



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## ORIGINAL RESEARCH Nationally representative survey data from 82 countries

### Patterns of tobacco use in low and middle income countries by tobacco product and sociodemographic characteristics

Theilmann M, Lemp JM, Winkler V, et al

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**Study question** How does use of smoked and smokeless tobacco and frequencies of use in low and middle income countries vary across tobacco products and sociodemographic characteristics?

**Methods** Individual level data from nationally representative surveys conducted between 1 January 2015 and 31 December 2020 in 82 low and middle income countries were harmonised. Prevalence and frequency of use were estimated for smoked and smokeless tobacco (eg, chewing tobacco, snuff) overall and for commonly used tobacco products at global, world region, and country levels. Weighted logistic and ordinary least squares regressions were fitted to determine variation by rural versus urban residency, sex, age, education, and household wealth.

**Study answer and limitations** 1 231 068 individuals aged 15 years and older were included. Prevalence of smoked tobacco use was 16.5% (95% confidence interval 16.1% to 16.9%) and of smokeless tobacco use was 7.7% (7.5% to 8.0%). Prevalence of smoked tobacco ranged from 1.1% (0.9% to 1.3%) in Ghana to 50.6% (45.2% to 56.1%) in Kiribati. Prevalence of smokeless tobacco use was highest in Papua New Guinea (daily use prevalence of 65.4% (63.3% to 67.5%)). Although variation was wide between countries and by tobacco product, for many low and middle income countries, the

highest prevalence and cigarette smoking frequency was reported in men, older age groups, and those with lower education, less household wealth, and residency in rural areas. Limitations include self-report of tobacco use and differences in how information on pack years was collected across the surveys.

**What this study adds** Both smoked and smokeless tobacco use and frequency of use vary widely across tobacco products in low and middle income countries. Examining smoked or smokeless tobacco use as overall categories masks important differences in use across tobacco products both between and within countries.

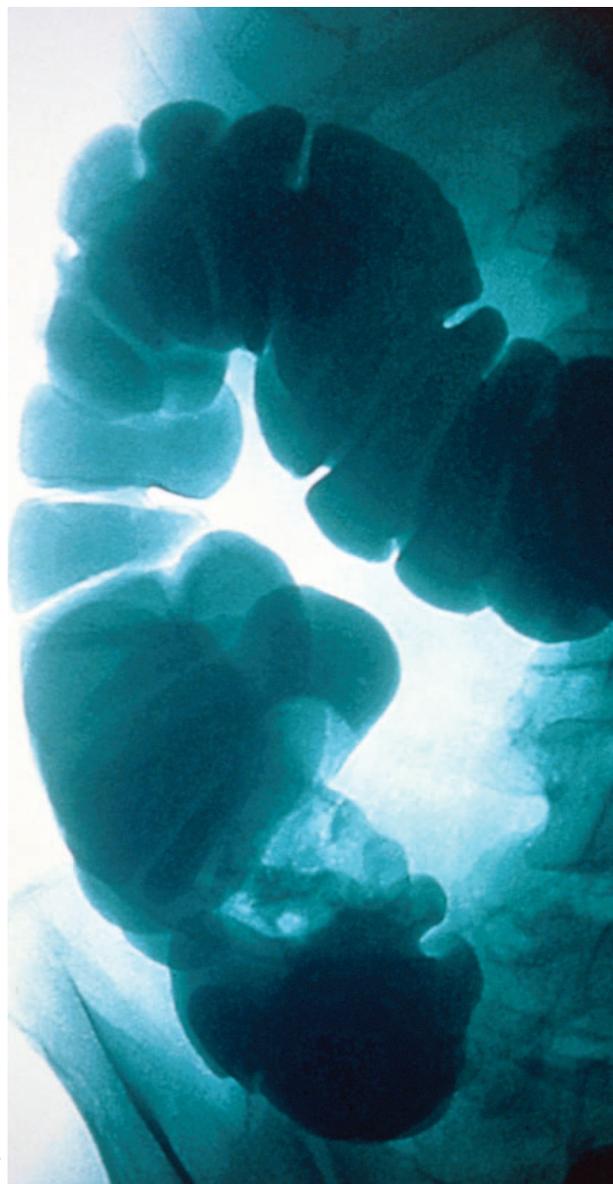
**Funding, competing interests, and data sharing** No specific funding received. No competing interests declared. Most survey data are publicly available.



BERT DE RUITER/ALAMY

# The trouble with ultra-processed foods

**ORIGINAL RESEARCH** Results from three prospective US cohort studies



## Association of ultra-processed food consumption with colorectal cancer risk among men and women

Wang L, Du M, Wang K, et al

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**Study question** What is the association between ultra-processed food intake and risk of colorectal cancer among men and women in three large prospective US cohorts?

**Methods** This study used data from the Nurses' Health Study (n=67 425 women; follow-up 28 years), Nurses' Health Study II (92 482 women; 24 years), and Health Professionals Follow-up Study (46 341 men; 28 years). Dietary intakes were collected every four years using food frequency questionnaires. Association between ultra-processed food consumption and risk of colorectal cancer was estimated using time varying Cox proportional hazards regression models adjusted for potential confounder factors.

**Study answer and limitations** In the three cohorts, 3216 cases of colorectal cancer (men, n=1294; women, n=1922) were documented during the 24-28 years of follow-up. Higher consumption of ultra-processed foods was associated with increased risk of colorectal cancer among men (hazard ratio for highest versus lowest fifth 1.29, 95%

confidence interval 1.08 to 1.53; P for trend=0.01), and the association was limited to distal colon cancer (hazard ratio 1.72, 1.24 to 2.37; P for trend <0.001). The associations were largely independent of body mass index or dietary quality. Associations of certain subgroups of ultra-processed foods with risk of colorectal cancer among men and women were also observed. Limitations of the study include the observational nature, the inability to rule out residual confounding, and the self-reporting of dietary intake and lifestyles, which may result in measurement errors.

**What this study adds** Findings of this study indicate that high consumption of total ultra-processed foods in men, and certain subgroups of ultra-processed foods in men and women was associated with an increased risk of colorectal cancer. Further studies are needed to better understand the exact mechanisms of ultra-processed foods that contribute to colorectal carcinogenesis.

**Funding, competing interests, and data sharing** This work was supported by National Institutes of Health/National Institute on Minority Health and Health Disparities 1R01MD011501 (FFZ).

No competing interests declared. No additional data available.

Colorectal cancer risk by fifths of ultra-processed food consumption among men and women. Values are hazard ratios (95% confidence intervals) unless stated otherwise

	Energy adjusted servings per day of ultra-processed food intake					P for trend	Continuous
	Fifths						
	1	2	3	4	5		
<b>Men (HPFS):</b>							
Cases/person years	234/205 781	276/219 114	235/221 181	263/218 770	286/209 632	-	-
Age adjusted model	Reference	1.19 (1.00 to 1.42)	1.00 (0.83 to 1.19)	1.13 (0.95 to 1.35)	1.24 (1.04 to 1.47)	0.04	1.03 (1.00 to 1.06)
Multivariable adjusted model	Reference	1.22 (1.02 to 1.45)	1.04 (0.86 to 1.25)	1.17 (0.98 to 1.40)	1.29 (1.08 to 1.53)	0.01	1.04 (1.01 to 1.06)
<b>Women (NHS+NHS II):</b>							
Cases/person years	379/823 070	360/869 668	385/873 557	396/861 866	402/824 317	-	-
Age adjusted model	Reference	0.91 (0.78 to 1.05)	0.96 (0.84 to 1.11)	1.01 (0.87 to 1.16)	1.08 (0.94 to 1.24)	0.08	1.02 (1.00 to 1.05)
Multivariable adjusted model	Reference	0.90 (0.78 to 1.04)	0.95 (0.83 to 1.10)	0.99 (0.85 to 1.14)	1.04 (0.90 to 1.20)	0.29	1.01 (0.98 to 1.04)

HPFS=Health Professionals Follow-up Study; NHS=Nurses' Health Study.  
P=0.045 for heterogeneity between sexes.

## COMMENTARY

# People need nourishing food that promotes health, not the opposite

The two papers linked to this editorial report associations between poor health outcomes and ultra-processed food and drinks.<sup>1,2</sup> Both papers use the Nova food classification, which divides all foods into four groups according to the extent and purpose of their processing.<sup>3</sup>

Ultra-processed foods (Nova group 4) are industrial formulations made by deconstructing whole foods into chemical constituents, altering them, and recombining them with additives into products that are alternatives to fresh and minimally processed foods and freshly prepared meals.<sup>4</sup> Most ultra-processed foods are made, sold, and promoted by corporations, typically transnational, that formulate them to be convenient (ready to consume), affordable (low cost ingredients), and hyper-palatable, and thus liable to displace other foods and also to be over-consumed.<sup>5</sup> This food group includes soft drinks; packaged snacks; commercial breads, cakes, and biscuits; confectionery; sweetened breakfast “cereals”; sugared milk based and “fruit” drinks; margarine; and pre-processed ready-to-eat or heat products such as burgers, pastas, and pizzas.

### Risks to health

Systematic reviews and meta-analyses of large, well designed, long duration cohort studies carried out all over the world show that consumption of ultra-processed foods increases the risk of obesity, type 2 diabetes, hypertension, cardiovascular and cerebrovascular

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## ORIGINAL RESEARCH Moli-sani prospective cohort study

### Joint association of food nutritional profile by Nutri-Score front-of-pack label and ultra-processed food intake with mortality

Bonaccio M, Di Castelnuovo A, Ruggiero E, et al; Moli-sani Study Investigators

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**Study question** Does only the nutritional composition of a diet matter in relation to mortality?

**Methods** This cohort study included longitudinal data on 22 895 Italian men and women from the Moli-sani Study who were followed-up for 12.2 years. Adherence to a nutritionally adequate diet was evaluated through the Food Standards Agency Nutrient Profiling System (FSAm-NPS) dietary index, used to derive the Nutri-Score front-of-pack label, and was calculated for each food based on its amount of energy, saturated fat, sugar, sodium, fibre, protein, fruit, vegetables, legumes, and nuts. Ultra-processed food intake according to the Nova classification was calculated as the ratio (%) between ultra-processed food (g/d) and total food (g/d) consumed, with increased values indicating a larger proportion of ultra-processed foods in the diet. The outcomes investigated were all cause and cause specific mortality.

**Study answer and limitations** A total of 2205 deaths occurred during 272 960 person years of follow-up. Both the FSAm-NPS dietary index and ultra-processed food consumption were separately associated with all cause and cardiovascular disease mortality. However, when these two indices were jointly analysed, the magnitude of the association of the FSAm-NPS index with all cause and cardiovascular mortality was attenuated by 22.3% and 15.4%, respectively. By contrast, the relation between high intake of ultra-processed foods and mortality was not explained by their poor nutritional quality. Weaknesses of this study include the observational design.

**What this study adds** Nutritional quality alone is unlikely to reflect the overall mortality risk associated with a diet, which is also determined by the degree of food processing.

**Funding, competing interests, and data sharing** Supported by research grants from the Pfizer Foundation, Italian Ministry of University and Research, Instrumentation Laboratory, and Italian Ministry of Health.

No competing interests declared. The underlying data will be shared on reasonable request to the corresponding author.

#### Ultra-processed food (weight ratio) and Food Standards Agency Nutrient Profiling System (FSAm-NPS) dietary index as explanatory factors of their respective association with all cause and cardiovascular disease mortality

Outcome	FSAm-NPS dietary index (Q4 v Q1)	FSAm-NPS dietary index (Q4 v Q1)+UPF (continuous)		UPF (Q4 v Q1)	UPF (Q4 v Q1)+FSAm-NPS dietary index (continuous)	
	HR (95% CI)	HR (95% CI)	Attenuation, % (95% CI)	HR (95% CI)	HR (95% CI)	Attenuation, % (95% CI)
All cause mortality	1.19 (1.04 to 1.35)	1.14 (1.00 to 1.31)	22.3 (16.4 to 30.2)	1.19 (1.05 to 1.36)	1.20 (1.05 to 1.37)	-3.3 (-7.3 to 0.3)
Cardiovascular disease mortality	1.32 (1.06 to 1.64)	1.26 (1.01 to 1.58)	15.4 (10.5 to 22.6)	1.27 (1.02 to 1.58)	1.27 (1.02 to 1.59)	0.0 (-5.0 to 4.9)

CI=confidence interval; HR=hazard ratio; Q1=quarter 1; Q4=quarter 4; UPF=ultra-processed food.

Hazard ratios with 95% CIs obtained from multivariable cause specific Cox proportional hazards regression models, using data obtained from multiple imputation.

diseases, depression, and all cause mortality.<sup>6-9</sup> Other prospectively associated conditions include dyslipidaemias, hyperuricaemia, renal function decline, non-alcoholic liver disease, Crohn's disease, and breast cancer.<sup>10</sup>

Most ultra-processed foods are energy dense products, high in fat, sugar, and salt, and poor in fibre and micronutrients,<sup>4</sup> and, as shown by a meta-analysis of national dietary surveys in 13 countries,<sup>11</sup> a high intake of ultra-processed foods is associated with multiple nutrient imbalances. So the problem with ultra-processed products has been suggested to be simply their poor nutrient profiles. However, a review of 37 cohort studies shows that the association between increased ultra-processed food consumption and various chronic disorders and diseases persists after control for dietary nutrient profiles.<sup>10</sup> Furthermore, a randomised controlled trial has shown that diets based on ultra-processed foods, matched for macronutrients, sugar, sodium, and fibre with diets containing no ultra-processed foods, caused substantial increases in freely consumed daily calorie intake (almost 500 kcal (1 kcal=4.18 kJ)) and consequent body fat accumulation.<sup>12</sup>

These findings are in line with the important papers introduced here. One, reporting on a large prospective investigation in Italy, shows that increased ultra-processed food consumption is associated with higher cardiovascular and all cause mortality and states that: "Ultra-processed food intake... remained associated with mortality even after the poor nutritional quality of the diet was accounted for."<sup>1</sup> The other, reporting on a very large prospective investigation in the US, shows that increased ultra-processed food is associated with higher colorectal



**The solution includes making fresh and minimally processed foods available, attractive, and affordable**

cancer deaths in men and states that: "These associations remained significant after further adjustment for body mass index or indicators of nutritional quality of the diet."<sup>2</sup>

Furthermore, as stated by the authors of the Italian study, the ill effects of ultra-processed foods may be caused by "a variety of mechanisms triggered by non-nutritional components, such as cosmetic additives, food contact materials, neo-formed compounds, and degradation of the food matrix." The US investigators state that: "Beyond poor nutrition profiles, ultra-processed foods commonly contain food additives such as dietary emulsifiers and artificial sweeteners, some types of which have been suggested to increase the pro-inflammatory potential of the gut microbiome, promoting colon carcinogenesis."<sup>2</sup> Ultra-processed foods have many other potentially pathogenic qualities. Examples are lack of protective phytochemicals found in whole plant foods and their often addictive potential.<sup>13 14</sup>

Therefore, to reformulate ultra-processed foods by methods such as replacing sugar with artificial sweeteners or fat with modified starches, and adding extrinsic fibre, vitamins, and minerals, is not a solution. Reformulated ultra-processed foods would be especially troublesome if promoted as "premier" or "healthy" products. They would remain partly, mainly, or solely formulations of chemicals.<sup>15</sup>

### Rational solution

What is to be done? Everybody needs food, but nobody needs ultra-processed foods (with the exception of infant formula, in the rare cases in which infants do not have access to breast milk). The analogy is tobacco. The rational solution is official public policies, including guidelines and publicity advising avoidance, and actions, including statutes, designed to reduce production and consumption of ultra-processed foods and to restrict or preferably prohibit their promotion.<sup>16</sup>

In the UK, a version of such policies commissioned by government has recently been rejected,<sup>17 18</sup> apparently on the grounds that populations need cheap foods, especially in hard times. But nobody sensible wants foods that cause illness. The overall positive solution includes making supplies of fresh and minimally processed foods (Nova group 1) available, attractive, and affordable. And sustaining national initiatives to promote and support freshly prepared meals made with fresh and minimally processed foods, using small amounts of processed culinary ingredients (group 2) and processed foods (group 3).<sup>5 19</sup> Enacted, this will promote public health. It will also nourish families, society, economies, and the environment.<sup>19</sup>

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