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Abbreviation list:

BMI body mass index

BP blood pressure

CVD cardiovascular disease

HTN hypertension

INTERMAP International Study of Macro- and Micro-Nutrients and Blood Pressure

NRF nutrient-rich food

SD standard deviation

UK United Kingdom

US United States

Clinical Trial Registry: The observational INTERMAP study was registered at www.clinicaltrials.gov as NCT00005271.

ABSTRACT

Background and Aims: Previous studies have reported associations between higher potato intake and higher blood pressure (BP) and/or risk of hypertension and obesity. These studies rarely considered preparation methods of potatoes, overall dietary pattern or the nutrient quality of the meals. These factors may affect the association of potato intake with BP and body mass index (BMI). This study investigated potato consumption by amount, type of processing, overall dietary pattern, and nutrient quality of the meals in relation to BP and BMI.

Methods: Cross-sectional analyses were conducted among 2,696 participants aged 40–59 y in the US and UK samples of the International Study of Macro- and Micro-Nutrients and Blood Pressure (INTERMAP). Nutrient quality of individual food items and the overall diet was assessed with the Nutrient-Rich Foods (NRF) index.

Results: No associations with BP or BMI were found for total potato intake nor for boiled, mashed, or baked potatoes or potato-based mixed dishes. In US women, higher intake of fried potato was associated with 2.29 mmHg (95% CI: 0.55, 3.83) higher systolic BP and with 1.14 mmHg (95% CI: 0.10, 2.17) higher diastolic BP, independent of BMI. Higher fried potato consumption was directly associated with a +0.86 kg/m^2 difference in BMI (95% CI: 0.24, 1.58) in US women. These associations were not found in men. Higher intakes of fried potato meals with a lower nutritional quality (NRF index≤ 2) were positively associated with systolic (3.88 mmHg; 95% CI: 2.63, 5.53) and diastolic BP (1.62 mmHg; 95% CI: 0.48, 2.95) in US women. No associations with BP were observed for fried potato meals with a higher nutritional quality (NRF index> 2).

Conclusions: Fried potato was directly related to BP and BMI in women, but non-fried potato was not. Poor-nutrient quality meals were associated with intake of fried potatoes and higher BP, suggesting that accompanied dietary choices are key mediators of these associations.

INTRODUCTION

White potatoes are a traditional staple food in many Western countries. Since the 1960s, potato consumption (including fresh and processed) has remained stable in the US (~28 g/capita/1000 kcal)(1) and the UK (~40 g/capita/1000 kcal)(2). The 2015 Dietary Guidelines for Americans recommend adults to eat 2.5 to 3 cups of vegetables daily, where a medium-sized boiled or baked white potato is equivalent to 1 cup(3), while in the UK, national food guides recommend that starchy foods, including potatoes, should comprise a third of food intake(4) Potatoes, boiled, mashed or baked, are low in energy density and are good sources of key nutrients, including starch, dietary fiber, potassium, and vitamin C(5), that have established beneficial effects on blood pressure (BP)(6–8). Though meta-analysis of 5 prospective cohort studies showed inverse associations of total potato consumption with all-cause mortality, no significant associations with cardiovascular disease (CVD) were observed(9). The few cohort studies that investigated total potato consumption for risk of hypertension (HTN)(10,11), high BP(11,12), increased waist circumference(13), and long-term weight gain(14) reported inconsistent findings. This has led to confusion about the role of potatoes in a healthy diet, which may be due to potential unfavorable influences of preparation methods, related overall dietary choices, and nutritional quality of potato-containing meals(15).

Potential unfavorable influences of various preparation methods on the nutritional composition of potatoes include loss of nutrients through leaching with boiling(16) and addition of fat and salt with boiling and frying(17). Findings of emerging, but still limited, research on the consumption of non-fried and fried potatoes and the risk of hypertension(10,11) and high BP(11) have so far been inconsistent; however, consistent direct associations between consumption of French fries with long-term weight gain have been reported(14,18). Potato-containing meals may differ largely in nutritional quality thereby influencing associations with CVD and its risk factors. Most food frequency questionnaires lack sufficient detail to investigate these potential associations; detailed 24-hr dietary recall data can shed light on these research questions.

Hence, cross-sectional associations of potato consumption with BP and body mass index (BMI) were investigated in the US and UK cohorts of the International Study of Macro- and Micro-Nutrients and Blood Pressure (INTERMAP). Specifically, whether preparation method (non-fried or fried), and nutritional quality of the overall diet and potato-containing meal modulated associations was investigated using detailed nutritional data from four multipass 24-hr dietary recalls.

MATERIALS AND METHODS

Population samples

INTERMAP is a cross-sectional study investigating influence of dietary factors on BP. Between 1996 and 1999, researchers surveyed 4,680 men and women aged 40–59 y from 17 population samples in Japan, the People's Republic of China, the United Kingdom (UK), and the United States of America (US). Participants were randomly selected from community or workplace population lists, stratified by age and gender(19). Participants visited their local research centers four times: twice on 2 consecutive days, and 2 further consecutive visits on average 3 weeks later. Of 4,895 participants initially surveyed, we excluded individuals if they did not attend all 4 visits (n=110), dietary data were considered unreliable (n=7), energy intake from any 24-hr recall was <500 or >5000 kcal/d for women and <500 or >8000 kcal/d for men (n=37), other data were incomplete or missing, or there were indications of protocol violation (n=61). The present study used data from 2,696 participants in the US (N=2,195) and UK (N=501). Institutional ethics committee approval was obtained for each site; all participants provided written informed consent.

Dietary assessment

At each visit, a trained interviewer conducted an in-depth, multipass 24-hr dietary recall with extensive quality control(20). Consumption of all foods, beverages, and supplements in the prior 24 hours was ascertained including preparation methods. In the US, dietary data were entered directly into the Nutrition Data System for Research (NDSR, version 2.91; University of Minnesota, Minneapolis, Minnesota, US). In the UK, data were entered on standardized paper forms, then transferred onto the FoodBase computer program (version 1.3, 1993)(21). Country-specific food composition tables were used to calculate nutrient intakes with details published previously(20). Briefly, food composition data were obtained in the UK from the McCance and Widdowson's national food tables, including all published subsequent supplements up to 1998 (22–28) and in the USA from the Nutrition Coordinating Centre database on nutrient composition (29). Pearson partial correlation coefficients, adjusted for sample and sex, compared consumption recorded in the 24-hr recall and 24-hr urinary excretion data for the US/UK samples; these were respectively 0.46/0.36 for sodium, 0.58/0.51 for potassium, and 0.52/0.48 for total protein intake and urinary urea(20).

Total potato consumption comprised all reported non-fried and fried potato products and potato-based mixed dishes(30). Weighted average nutritional composition (per 100 g) by type of potatoes as reported by participants is shown in **(Table S1).** Non-fried potatoes included (1) boiled potatoes, (2) mashed potatoes including mashed and creamed potatoes and (3) baked potatoes including oven-baked and canned potatoes. Fried potatoes included French fries, potato chips, and sticks. Mixed dishes containing potatoes, e.g., curries were categorized as potato-based mixed-dishes. A meal was defined as any eating occasion containing potatoes (non-fried or fried potato meals), whether it was a main meal or a snack. Non-white/sweet potatoes were excluded as their nutritional value differs from white potatoes.

Calculation of nutrient quality

The nutrient quality of individual food items and the overall diet was assessed with the Nutrient-Rich Foods 9.3 (NRF) index(31). The NRF index scores the sum of the percentage of daily values for 9 nutrients to encourage (protein, dietary fiber, vitamins

A, C and E, calcium, iron, potassium, and magnesium) minus the sum of the percentage of maximum recommended values for 3 nutrients to limit (saturated fat, added sugar, and sodium) per 100 kcal. The NRF index was calculated for total diet, and for each meal (with and without potatoes). A high NRF index indicates a high-nutrient quality per 100 kcal of a food, meal, or dietary pattern. The NRF index was found highly correlated with the Healthy Eating Index score(32), established by the US Dietary Guidelines as a measure of diet quality.

Outcome measurements

Trained staff used a random zero sphygmomanometer to measure systolic and diastolic BP twice at each visit, 8 measurements in total. Participants were asked to refrain from physical activity, eating or drinking, and smoking during the preceding 30 minutes. After sitting for at least 5 minutes in a quiet room, with bladder emptied, participants had BP measurements taken on the right arm(19). Weight and height without shoes and heavy clothing were measured four times in total, twice each at the first and third visits, in order to determine BMI (kg/m^2). BP was determined as the average of 8 measurements, and BMI as the average of 4 measurements.

Other lifestyle factors

Data on demographics, lifestyle factors, and disease history were obtained on two visits using interviewer-assisted questionnaires including daily alcohol intake in the last 7 d, cigarette smoking, attained educational level, physical activity, adherence to a special diet, dietary supplement use, and medication use. Each participant provided two borate-preserved timed 24-hr urine collections; aliquots were sent to the Central Laboratory, Leuven, Belgium, for electrolyte analysis.

Statistical methods

Individual measurements of dietary variables and of BP and BMI were averaged across the 4 visits and across the 2 visits for 24-hr urinary variables. For boiled, mashed, baked, and fried potatoes separately, weighted average nutritional compositions (per 100 g) by country were calculated using country-specific food composition tables. The average sum of nutrients from included food items per potato category was divided by total amount consumed and converted into amount/100g.

Associations of non-fried and fried potato consumption with other variables were explored using the partial Pearson correlation, adjusted for age, sex, and sample, pooled and weighted by country. From the means of the first and second pairs of visits, we estimated reliability – a measure of possible regression dilution bias – of potato consumption for individuals using the following formula: 1/[1+(ratio/2)]x100, in which the ratio of intra-individual variance is divided by inter-participant variance(33,34). This gives an indication of the effect of the day-to-day variability in potato consumption on the associations with BP and BMI.

Multiple regression analyses assessed associations of BP and BMI with 2 standard deviations (SD) higher potato consumption by preparation method: total, non-fried, and fried, and their individual components; that is, baked, boiled, and mashed, and potato-based mixed dishes, and stratified by nutrient quality of the non-fried or fried potato meals (below or above median NRF index). Models were fitted by country and coefficients were pooled, weighted by the inverse of their variance(34,35). Six models were used, each adjusted for possible nondietary and dietary confounders. Potential confounders were chosen based on *a priori* knowledge of known or possible associations of those variables with BP or potato consumption. Cross-country heterogeneity of regression coefficients was assessed with the chi-square test. Sensitivity analyses were done, repeating all analyses for three subcohorts according to various exclusions for participants with medical conditions who might bias the potato–BP/BMI associations. Effects of age, sex, ethnicity, BMI, 24-hr urinary sodium, and nutritional quality of the total diet on BP were assessed using interaction terms in regression models and stratified analyses.

Analyses were performed with SAS version 9.3 (SAS Institute Inc., Cary, North Carolina, US). Two-sided $P<0.05$ was considered statistically significant.

RESULTS

Descriptive statistics

Table S2 presents descriptive data, including urinary and dietary data, on the US and UK INTERMAP participants by non-fried and fried potato consumption. All US and UK participants reported potato consumption on one or more recall days. The average (±SD) daily total potato consumption (g/1000 kcal) was 22±24 in the US and 77±46 in the UK. Total potato consumption comprised predominantly non-fried potatoes in both the US (54%) and the UK (81%); fried potatoes comprised 22% of potato intake for US, 19% for UK.

The partial correlation between non-fried and fried potato consumption was (-0.16). Non-fried potato consumption was associated with higher intakes of vegetables (0.22; **Table S3**), vitamin B6 (0.18), dietary fiber (0.12), vitamin C (0.12), and urinary potassium excretion (0.12) and with lower intakes of refined grain intake (-0.11). Fried potato consumption was inversely related with the NRF index (-0.19) and intake of fruit (-0.16), magnesium (-0.16), dietary fiber (-0.14), vitamin C (-0.14), vegetable protein (-0.13), calcium (-0.13), iron (-0.13), and β-carotene (-0.12) and with higher intakes of total fat (0.18), polyunsaturated fatty acids (0.20), monounsaturated fatty acids (0.14), and saturated fatty acids (0.12). Non-fried potato consumption was not correlated with dietary and 24-hr urinary sodium excretion (r=0.02 and 0.01, respectively). Fried potato consumption was significantly associated with 24-hr urinary sodium excretion (r=0.05), but not with dietary sodium intake (r=0.02).

Univariate estimates of reliability of the average of two assessments of total potato consumption were 54% for the US participants and 35% for the UK. Reliability estimates for non-fried and fried potatoes for the US and UK participants ranged from 30% to 48%; and for BP and BMI, ≥ 90%.

Associations of potato consumption, total and by preparation method, with BP

No significant associations with systolic and diastolic BP were found for total or non-fried potato consumption (**Table 1**), nor for boiled, mashed, baked, or potato-based mixed dishes (**Table S4**). Associations of fried potato consumption with BP were heterogeneous by country (P<0.05); specifically, we only observed significant fried potato-sex interactions in the US population (P<0.05). No significant associations of fried potato consumption with systolic or diastolic BP were observed in US men (**Table 2**). In contrast, higher fried potato intake of +13 g/1000 kcal (2SD) was directly associated with systolic (model 3a: 2.29 mmHg; 95% CI: 0.55, 3.83) and diastolic (1.14 mmHg; 95% CI: 0.10, 2.17) BP in US women. These significant fried potato–BP associations in US women persisted with additional adjustments for total diet quality, urinary sodium or potassium excretion, and BMI. No significant interactions were observed between fried potato consumption and age, ethnicity, BMI, 24-hr urinary sodium, or overall diet quality. Compared to US women with higher non-fried potato intake (above median), US women with higher fried potato intake (above median), had higher systolic BP, diastolic BP, and BMI; consumed more total energy and more sugar-sweetened beverages; had higher urinary sodium excretion and lower whole grain intake; ate less fruit and fewer dairy products; and consumed meals with lower NRF index scores **(Table S5).** US women generally consumed meals of higher nutritional quality in comparison to men (data not shown).

Sensitivity analyses for the three subcohorts excluding participants with medical conditions that might bias associations showed similar non-significant associations for non-fried potatoes in the total population and fried potatoes in US men (**Table S6**). In US women, similar strong significant fried potato–systolic BP associations remained, while associations with diastolic BP attenuated.

Associations of potato consumption, total and by preparation method, with BMI

Higher intakes of total and non-fried potatoes were not associated with BMI (**Table 1**); comparable findings were observed for boiled, mashed, and potato-based mixed dishes (**Table S4**). In US women, higher fried potato consumption of +13 g/1000 kcal was directly associated with a +0.86 kg/m^2 difference in BMI (model 3a: 95% CI: 0.24, 1.58; **Table 1**). This significant association prevailed with additional adjustment for overall diet quality and urinary sodium and potassium excretion. No significant interactions between fried potato and age, ethnicity, BMI, 24-hr urinary sodium, and diet quality were observed. Comparable findings were observed in sensitivity analyses when participants with medical conditions that might bias associations were excluded (**Table S6**).

Associations of potato consumption by nutritional quality of potato meals with BP and BMI

Non-fried potato meals with a higher nutritional quality (NRF index>2) comprised slightly more vegetables and dairy products, but less refined grains than non-fried potato meals with a lower nutritional quality (NRF index≤ 2; **Table S7)**. Non-fried potato meals with lower nutritional quality were most frequently eaten as a side dish with meat/chicken or casserole, with grilled steak and mixed vegetables (mashed potatoes &

gravy), and with fried chicken (mashed potatoes & gravy; **Table S8**). Fried potato meals with a higher nutritional quality (NRF index>2) comprised more fruit, vegetables and dairy products compared to fried potato meals with a lower nutritional quality (NRF index≤ 2), while the latter contained more refined grains, sugar-sweetened beverages, and red and processed meat **(Table S7).** More specifically, in the US, fried potato meals with lower nutritional quality were most frequently eaten as burgers (added mayonnaise/ketchup) with French fries and sugar-sweetened beverages, chips/crisps with sugar sweetened beverages, and hash browns with sausages/bacon and eggs. Compared to fried potato meals with lower nutritional quality, fried potato meals with higher nutritional quality contained similar types of foods, but in lower amounts **(Table S8).**

No significant associations with BP were observed for non-fried potato meals with a lower or higher nutritional quality **(Table 3).** In US women, but not in US men, higher intake of fried potato meals with a lower nutritional quality was directly associated with systolic (model 2: 3.88 mmHg; 95% CI: 2.63, 5.53) and diastolic BP (1.62 mmHg; 95% CI: 0.48, 2.95). Fried potato meals with a higher nutritional quality were not significantly associated with BP in US men and women. In the UK, no significant associations with systolic or diastolic BP were observed for fried potato meals with a low or high nutritional quality.

Non-fried potato meals with a lower or higher nutritional quality were not associated with BMI **(Table 3).** In US women but not men, 4 g/1000 kcal higher intakes of fried potato meals with a lower nutritional quality were directly associated with BMI (model 2: 0.96 kg/m^2; 95% CI: 0.39, 1.20), as were fried potato meals with a higher nutritional quality (0.90 kg/m^2; 95% CI: 0.20, 1.32).

DISCUSSION

In this population of US and UK participants, neither total potato nor non-fried potato consumption were associated with BP or BMI. Higher consumption of fried potato, however, was associated with higher systolic and diastolic BP in US women (not in men) independent of BMI and overall diet quality. Consumption of fried potato meals with lower-nutrient quality was directly associated with BP in US women, while those with higher nutrient quality were not associated with BP. With regard to BMI, direct associations were found with fried potato consumption in both countries independent of overall diet quality. Consumption of fried potato meals of both lower and higher nutrient quality was directly associated with BMI in US women.

Our null findings of total potato and non-fried potato consumption with BP are in line with previously published associations relative to 4 year BP changes or risk of HTN from the prospective Prevención con Dieta Mediterránea (PREDIMED) Study(11), while other cohort studies reported direct associations of total and/or non-fried potato intake with BP(12) and risk of HTN(10,36). Overall diet quality did not influence associations between non-fried potato consumption and BP although direct correlations with higher intakes of vegetables, dietary fiber, vitamin B6 and C, and urinary potassium excretion were found. Although methodological issues such as use of food frequency questionnaires or the limited sample size in the INTERMAP study may explain discrepancies in findings, this may also suggest that associations with BP depend on amount of non-fried potatoes eaten or the nutritional composition of the meal.

Our findings of a direct association of fried potato intake with BP in US women is in agreement with results of the PREDIMED study, where higher intake of homemade fries was associated with higher SBP in those not treated for HTN(11) and with findings of the Chinese cohort where stir-fried potato intake was directly related to risk of HTN(36). The heterogeneity by country for associations of fried potato consumption with BP in our study might be explained by the small sample size in the INTERMAP-UK cohort. Moreover, the direct fried potato-BP association we observed in US women may be explained by their overall dietary patterns; women with higher fried potato intake consumed more sugar-sweetened beverages and less whole grains, fruit, dairy products, and had lower overall diet quality in comparison to women with higher non-fried potato intake. However, no interaction by overall dietary pattern was detected.

As our study design is cross-sectional, it may be that women who have adopted an unhealthier lifestyle had higher BP and may consume more fried potatoes. Our findings occurred only in women and not in men. This might be related to different dietary choices; the diet quality of men was generally poor compared to women, which might mask any association of fried potato with BP. In addition, research shows that women usually recall their diets more accurately than men, which may have limited the findings to women(37). However, these suggestions need to be confirmed in future studies.

Furthermore, to our knowledge, this is the first study that showed that the nutritional quality of the potato meal influences associations with BP. The high-quality and detailed 24-hr dietary recall data enabled us to show that meals containing fried potatoes of US women was accompanied with poorer dietary choices, e.g. processed meat (burgers), sugar-sweetened beverages, sausages/bacon with fried eggs. These lower nutritional quality fried potato meals contained less dietary fiber, whole grains, fruits, and vegetables compared to fried potato meals of higher nutritional quality.

Previous investigations on the association of potato with BP did not report descriptions of the potato meal or of the other foods that accompanied the potato meal, nor were adjustments for other component of the meals made(10–12).

Our findings of a positive association between fried potato consumption and BMI in US women are in agreement with a previous cross-sectional investigation in the US where, for women, French fry intake was directly associated with BMI(38). We also found that low- and high-nutrient quality fried potato meals were directly associated with BMI, suggesting that overall dietary choices are key mediators of the association. Previous studies have related higher potato consumption with higher BMI or other measures of obesity, but without referring to the nutrient quality of the meal(14,15). Our models were extensively adjusted for lifestyle factors, but a recent systematic review concluded that though fried potato intake may be associated with higher risk of obesity, other unmeasured foods and unhealthy lifestyle behaviors may confound the association(15).

This study has several strengths. BP was a primary outcome in the INTERMAP, and standardized BP measurements were repeated during data collection. Sodium and potassium excretion data from two 24-hr urine collections were available, thus enabling us to better adjust for potential confounding. We also applied a nutrient density method for energy adjustment to account for differences in intake due to body size and physical activity level. The use of multiple 24-hr dietary recalls allowed us to better estimate intake compared to a single dietary recall. Furthermore, using detailed 24-hr dietary recalls enabled us to separate potato meals from other meals and to identify the nutrient quality of the diet and individual meals.

This study was however limited by its cross-sectional design; thus, we cannot establish a causal relationship. Although we have included many important confounding factors in our analyses, residual confounding, for example inaccurate measurement of physical activity, is still possible. Absence of 24h ambulatory BP monitoring recordings is also a limitation, though we used the average of eight BP measurements to ensure precision. Additionally, we applied extensive measures to ensure accuracy of dietary data collection; however, dietary assessment measures are subject to recall and reporting bias such as possible over-reporting of healthy food.

In conclusion, this cross-sectional study showed that total potato as well as non-fried potato consumption was not associated with BP and BMI. Higher consumption of fried potatoes was associated with higher BP in US women, but not in men, and higher BMI. Our findings suggests that dietary choices related to fried potato intake is important to consider; fried potatoes may be part of a healthy diet, but not if accompanied by unhealthy dietary choices. Considering the current guidelines recommending potatoes as part of a healthy dietary pattern, it may be important to further research and address potential unfavorable relations by preparation methods and accompanied dietary choices on health outcomes.

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Statement of Authorship

GA, KP and LOG analyzed the data. GA and LOG interpreted the results and drafted the paper. JS, QC, JMG, LVH, MLD, and PE interpreted results and helped in preparation and editing of the manuscript. JS and PE designed the INTERMAP Study. All authors were involved in writing the manuscript and had final approval of the submitted and published versions.

Conflicts of interest

The authors declare no competing interests.

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Table 1. Estimated mean differences in BP and BMI associated with 2SD higher intakes of total, non-fried, and fried potato consumption in US and UK INTERMAP participants, N=2,696 [1,2,3]

	Total potato Difference (95% CI)	Non-fried potato Difference (95% CI)	Fried potato Difference (95% CI)
SBP (mmHg)			
Model 1	0.80 (-1.15, 2.74)	-0.15 (-2.05, 1.76)	1.67 (-0.26, 3.59)
Model 2	0.74 (-1.12, 2.61)	0.13 (-1.69, 1.95)	1.31 (-0.53, 3.16)
Model 3a	1.17 (-0.57, 2.92)	1.03 (-0.90, 2.96)	0.53 (-1.41, 2.47)
Model 3b	0.69 (-1.01, 2.38)	0.35 (-1.49, 2.19)	0.84 (-1.03, 2.72)
Model 4	1.16 (-0.59, 2.90)	1.00 (-0.92, 2.93)	0.51 (-1.42, 2.45)
Model 5	1.29 (-0.47, 3.06)	1.15 (-0.81, 3.11)	0.62 (-1.33, 2.57)
Model 6	1.06 (-0.62, 2.74)	1.00 (-0.87, 2.84)	-0.23 (-2.10, 1.64)
DBP (mmHg)			
Model 1	-0.05 (-0.36, 1.26)	-0.21 (-1.49, 1.07)	0.34 (-0.95, 1.63)
Model 2	-0.31 (-1.41, 1.15)	-0.19 (-1.44, 1.05)	0.41 (-0.85, 1.67)
Model 3a	0.06 (-1.13, 1.26)	0.06 (-1.26, 1.38)	0.12 (-1.21, 1.45)

Model 3b	-0.13 (-1.29, 1.04)	-0.11 (-1.38, 1.15)	0.20 (-1.09, 1.48)
Model 4	0.11 (-1.10, 1.32)	0.09 (-1.25, 1.43)	0.15 (-1.19, 1.48)
Model 5	0.02 (-1.16, 1.19)	0.05 (-1.25, 1.34)	-0.26 (-1.56, 1.05)
Model 6	0.06 (-1.14, 1.26)	0.05 (-1.27, 1.37)	0.11 (-1.22, 1.44)
BMI (kg/m^2)			
Model 1	0.28 (-0.46, 1.02)	-0.30 (-0.99, 0.40)	1.34 (0.63, 2.05) ***
Model 2	0.14 (-0.54, 0.81)	-0.30 (-1.00, 0.35)	1.19 (0.49, 1.89) ***
Model 3a	0.14 (-0.82, 0.86)	0.03 (-0.70, 0.75)	1.00 (0.26, 1.73) **
Model 3b	0.14 (-0.52, 0.80)	-0.22 (-0.91, 0.48)	1.01 (0.31, 1.72) **
Model 4	0.11 (-0.55, 0.76)	-0.01 (-0.71, 0.70)	1.00 (0.25, 1.69) **
Model 5	-0.15 (-0.83, 0.53)	-0.29 (-1.03, 0.43)	0.83 (0.10, 1.56) **

Values are presented as mean (95%CI); *P-value < 0.05; **P-value < 0.01; ***P-value <0.0001

[1] Model 1 is a crude model adjusted for sample, age, and sex; model 2 is model 1 adjusted for moderate or heavy physical activity, dietary supplement intake, 7-day alcohol intake, smoking status, total calorie intake, history of cardiovascular disease or diabetes mellitus, family history of hypertension, education level, use of antihypertensive, cardiovascular disease or diabetes medication, and adherence to special diet; model 3a is model 2 adjusted for intakes of other dietary factors (g/1000 kcal): red and processed meat, sugar-sweetened beverages, fish and shellfish, fruits,

vegetables, low fat dairy products, and mutually for the sum of intakes of ‘other’ potatoes; model 3b is model 2 additionally adjusted for NRF index; model 4 is model 3a additionally adjusted for urinary sodium; model 5 is model 3a additionally adjusted for urinary potassium; model 6 is model 3a additionally adjusted for BMI

[2] Two standard deviations are 100 g/1000 kcal for total potato, 94 g/1000 kcal for non-fried potato, and 39 g/1000 kcal for fried potato

[3] Associations of fried potato consumption with BP were heterogeneous by country ($P > 0.05$)

Table 2. Estimated mean differences in BP associated with 2SD higher intakes of fried potato consumption separately for US and UK INTERMAP participants [1,2,3]

	Fried potato Difference (95% CI)		Fried potato Difference (95% CI)
	US Men	US Women	UK
N	1,103	1,092	501
SBP (mmHg)			
Model 1	1.51 (0.01, 3.02)*	3.17 (1.47, 4.87)***	0.57 (3.86, 2.72)
Model 2	1.04 (-0.27, 2.35)	2.50 (0.89, 4.12)**	-0.54 (-2.94, 1.85)
Model 3a	0.59 (-0.72, 1.91)	2.29 (0.55, 3.83)**	-1.39 (-2.98,1.20)
Model 3b	0.63 (-0.69, 1.95)	2.10 (0.46, 3.73)**	-0.63 (-2.07, 1.82)
Model 4	0.60 (-0.72, 1.91)	2.21 (0.57, 3.86)**	-1.53 (-3.12, 1.06)
Model 5	0.36 (-0.91, 1.64)	1.70 (0.10, 3.29)*	-1.44 (-3.07, 1.18)
Model 6	0.63 (-0.69, 1.94)	2.15 (0.52, 3.79)**	-1.95 (-3.43, 0.53)
DBP (mmHg)			
Model 1	0.88 (-0.24, 2.00)	1.56 (0.49, 2.63)**	-1.13 (-1.87, 0.60)

Model 2	0.84 (-0.26, 1.94)	1.25 (0.22, 2.29)**	-0.71 (-1.38, 0.96)
Model 3a	0.68 (-0.43, 1.79)	1.14 (0.10, 2.17)*	-1.06 (-1.88, 0.73)
Model 3b	0.59 (-0.40, 1.58)	1.05 (0.01, 2.10)*	-0.76 (-1.46, 0.95)
Model 4	0.61 (-0.38, 1.61)	1.11 (0.05, 2.17)*	-1.18 (-1.98, 0.62)
Model 5	0.44 (-0.53, 1.40)	0.89 (-0.15, 1.93)	-1.32 (-2.14, 0.50)
Model 6	0.62 (-0.37, 1.62)	1.11 (0.05, 2.17)*	-1.32 (-2.10, 0.46)
BMI (kg/m^2)			
Model 1	0.77 (0.15, 1.39)*	1.42 (0.65, 2.19)***	0.72 (-0.09, 1.53)
Model 2	0.55 (-0.02, 1.13)	0.97 (0.25,1.69)**	0.80 (-0.02, 1.61)
Model 3a	0.41 (-0.17, 0.99)	0.86 (0.24,1.58)**	0.64 (-0.24, 1.53)
Model 3b	0.43 (-0.16, 1.01)	0.71 (-0.06, 1.44)	0.77 (-0.06, 1.60)
Model 4	0.48 (-0.08, 1.04)	0.81 (0.21, 1.50)**	0.53 (-0.34, 1.40)
Model 5	0.39 (-0.18, 0.95)	0.77 (0.22, 1.49)**	0.53 (-0.34, 1.40)

Values presented as mean (95%CI); *P-value < 0.05; **P-value < 0.01; ***P-value <0.0001

[1] Model 1 is a crude model adjusted for sample and age; model 2 is model 1 adjusted for moderate or heavy physical activity, dietary supplement intake, 7-day alcohol intake, smoking status, total calorie intake, history of cardiovascular disease or diabetes mellitus, family history of hypertension, education level, use of antihypertensive, cardiovascular

disease or diabetes medication, and adherence to special diet ; model 3a is model 2 adjusted for intakes of other dietary factors (g/1000 kcal): red and processed meat, sugar-sweetened beverages, fish and shellfish, fruits, vegetables, low fat dairy products, and mutually for the sum of intakes of 'other' potatoes; model 3b is model 2 additionally adjusted for NRF index; model 4 is model 3a additionally adjusted for urinary sodium; model 5 is model 3a additionally adjusted for urinary potassium; model 6 is model 3a additionally adjusted for BMI. Significant interaction found for fried potato consumption with BP (P=0.06)

[2] Two standard deviations are 17 g/1000 kcal for fried potato (US men), 13 g/1000 kcal for fried potato (US women), 38 g/1000 kcal for fried potato (UK)

[3] Associations of fried potato consumption with BP were heterogeneous by country ($P > 0.05$)

Table 3. Estimated mean differences in BP and BMI associated with 2SD higher consumption of non-fried and fried potato meals with lower and higher nutritional quality in US and UK INTERMAP participants, N=2,195 [1,2,3]

	Non-fried potato meal	Fried potato meal		
	Difference (95% CI)	Difference (95% CI)		Difference (95% CI)
	US + UK population	US men	US women	UK
N	2,195	1,103	1,092	501
SBP (mmHg), model 2				
Low nutrient quality	-0.55 (-1.61, 0.51)	0.54 (-0.16, 0.82)	3.88 (2.63, 5.53)**	1.71 (-0.96, 2.04)
High nutrient quality	0.49 (-0.10, 1.08)	0.30 (-2.64, 3.07)	1.61 (-0.20, 3.42)	-0.48 (-1.16, 1.67)
DBP (mmHg), model 2				
Low nutrient quality	-0.47 (-1.20, 0.28)	0.65 (-0.38, 1.69)	1.62 (0.48, 2.95)*	-0.77 (-1.17, 1.21)
High nutrient quality	0.30 (-0.12, 0.71)	0.40 (-0.12, 2.08)	0.65 (-0.38, 1.69)	-1.62 (-2.84, 0.79)
BMI (kg/m^2), model 2				
Low nutrient quality	0.15 (-0.32, 0.62)	0.54 (0.26, 0.83)**	0.96 (0.39, 1.20)***	0.58 (-0.65, 1.11)
High nutrient quality	-0.11 (-0.37, 0.15)	0.81 (-0.09, 1.66)	0.90 (0.20, 1.32)*	0.98 (-0.19, 1.67)

Values are presented as mean (95%CI); *P-value < 0.05; **P-value < 0.01; ***P-value <0.0001

[1] Model 1 is a crude model adjusted for sample, age, and sex; model 2 is model 1 adjusted for moderate or heavy

physical activity, dietary supplement intake, 7-day alcohol intake, smoking status, total calorie intake, history of cardiovascular disease or diabetes mellitus, family history of hypertension, education level, use of antihypertensive, cardiovascular disease or diabetes medication, and adherence to special diet ; model 3a is model 2 adjusted for intakes of other dietary factors (g/1000 kcal): red and processed meat, sugar-sweetened beverages, fish and shellfish, fruits, vegetables, low fat dairy products, mutually for the sum of intakes of ‘other’ potatoes, and the NRF index of all other meals

[2] Two standard deviations 10 g/1000 kcal for non-fried potato meals, and 4 g/1000 kcal for fried potato meals

[3] Potato meals were classified according to lower or higher nutritional quality using the median NRF index of the meal; 3 for non-fried and 2 for fried potatoes

Supplementary materials

Associations of potato consumption, by preparation method and meal quality, with blood pressure and body mass index: the INTERMAP Study

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Table S1. Weighted average nutritional composition (per 100 g) by type of potatoes as reported in US and UK INTERMAP

	Boiled		Mashed		Baked		Fried	
	US	UK	US	UK	US	UK	US	UK
Energy, kcal	87	70	107	63	96	112	228	134
Total carbohydrates, g	15	15	14	14	17	25	25	27
Total sugar, g	1	1	2	1	2	1	3	1
Starch, g	13	15	11	13	14	24	21	26
Dietary fiber, g	2	1	1	2	2	3	2	3
Total fat, g	1	1	6	4	2	1	12	13
Mononunsaturated fatty acids, g	1	0	2	0	1	0	4	6
Polyunsaturated fatty acids, g	0	1	1	1	0	1	5	4
Saturated fatty acids, g	0	0	2	2	1	0	2	3
Trans fatty acids, total, g	0	0	1	1	0	0	1	0
Total protein, g	2	2	2	2	3	3	3	3
Vegetable protein, g	2	2	1	1	2	3	3	3
Potassium, mg	313	291	222	260	369	564	442	603

Sodium, mg	139	43	158	78	115	21	198	105
Calcium, mg	13	6	29	12	18	10	24	15
Vitamin C, mg	7	8	5	8	8	10	10	10
Niacin (Vitamin B3), mg	1	0	1	1	1	1	2	1
Vitamin B6, mg	0.2	0.3	0.2	0.3	0.2	0.4	0.3	0.3
Beta-carotene, ug	40	0	27	1	24	0	48	0

Table S2. Characteristics stratified by lower and higher non-fried and fried potato consumption of US and UK INTERMAP participants, N=2,696 [1,2]

	Non-fried potatoes		Fried potatoes	
Variable	**Lower**	**Higher**	**Lower**	**Higher**
N	1,356	1,340	1,486	1,210
Men, %	54	48	49	53
Age, y	49.0 (5.4)	49.3 (5.5)	49.7 (5.3)	48.5 (5.5)
Education, y	14.8 (3.1)	14.2 (3.2)	14.8 (3.2)	14.2 (3.1)
Current smokers, %	17	17	15	19
Engagement in moderate and heavy physical activity during work and leisure time, hours/d	3.1 (3.2)	2.9 (2.9)	3.0 (3.0)	3.1 (3.1)
Taking dietary supplements, %	52	46	53	44
Systolic blood pressure, mm Hg	118.8 (13.9)	119.1 (14.2)	118.3 (14.1)	119.7 (13.9)
Diastolic blood pressure, mm Hg	73.7 (9.8)	74.6 (9.9)	73.6 (9.6)	74.8 (10.0)
Body mass index, kg/m^2	28.9 (5.7)	28.4 (5.7)	28.4 (5.6)	29.0 (5.8)
History of cardiovascular disease or diabetes mellitus, %	15	14	15	15

Use of antihypertensive, cardiovascular disease or diabetes medication, %	22	19	21	19
Family history of hypertension, %	67	61	66	63
Adhering to special diet, %	18	19	22	16
Total energy, kcal	2,255 (701)	2,205 (672)	2150 (659)	2328 (708)
Food group intakes (g/1000 kcal)				
Total potatoes	12 (18)	52 (39)	24 (32)	41 (38)
Non-fried	1 (3)	42 (35)	20 (31)	23 (33)
Boiled	0 (2)	20 (32)	9 (24)	11 (26)
Baked	0 (3)	13 (19)	7 (16)	7 (14)
Mashed	0 (2)	9 (14)	4 (10)	5 (12)
Fried	11 (18)	10 (16)	1 (1)	15 (13)
Potato-based mixed dishes	5 (14)	3 (12)	4 (13)	4 (13)
Whole grains	29 (32)	25 (32)	35 (35)	24 (31)
Refined grains	174 (74)	142 (66)	164 (74)	143 (68)
Fruit	60 (51)	64 (54)	77 (57)	50 (60)

Vegetables (excluding potatoes)	59 (48)	71 (59)	74 (67)	56 (51)
Dairy products	127 (260)	133 (198)	132 (240)	129 (222)
Low fat dairy	93 (100)	102 (94)	106 (106)	89 (87)
Red and processed meat	25 (22)	27 (24)	21 (19)	24 (20)
Fish and shellfish	3 (2)	3 (2)	3 (2)	2 (2)
Sugar sweetened beverages	175 (95)	157 (87)	150 (99)	183 (96)
Alcohol intake, g/d	8 (15)	9 (16)	8 (15)	9 (16)
Urinary sodium, mmol/24-hour	161.8 (61.9)	156.8 (53.6)	158.6 (58.3)	160.3 (57.7)
Urinary potassium, mmol/24-hour	56.1 (20.2)	63.2 (21.5)	60.0 (21.9)	59.2 (20.3)
Nutrient-Rich Food index 9.3	38.2 (15.2)	38.8 (14.3)	41.7 (15.8)	34.7 (12.3)

[1] Participants were classified according to lower or higher non-fried and fried potato consumption by median intake; 10 g/1000 kcal for non-fried potatoes; 3 g/1000 kcal for fried potatoes

[2] Mean (SD) or percent

Table S3. Partial correlations of non-fried and fried potato consumption with food groups, nutrients, and urinary electrolytes, adjusted for age, sex and sample[1]

	Non-fried potatoes	Fried potatoes
Systolic blood pressure, mm Hg	0.01	0.08
Diastolic blood pressure, mm Hg	-0.01	0.06
Body mass index, kg/m^2	-0.03	0.09
Energy, kcal	-0.06	0.07
Food group, g/1000 kcal		
Whole grains	0.01	-0.09
Refined grains	-0.11	-0.08
Fruit	-0.03	-0.16
Vegetables (excluding potatoes)	0.22	-0.05
Dairy products	-0.02	-0.01
Low fat dairy	0.01	-0.10
Red and processed meat	-0.05	0.02
Fish and shellfish	0.01	-0.04

Sugar sweetened beverages	0.02	-0.01
Nutrients		
Total carbohydrates, %	-0.01	-0.10
Total sugar, %	-0.05	-0.09
Starch, %	0.07	-0.02
Dietary fiber, g/1000kcal	0.12	-0.14
Total fat, %	-0.03	0.18
Mononunsaturated fatty acids, %	-0.03	0.14
Polyunsaturated fatty acids, %	-0.05	0.20
Saturated fatty acids, %	-0.03	0.12
Trans fatty acids, %	0.05	0.09
Total protein, %	0.10	-0.10
Animal protein, %	**0.05**	**-0.10**
Vegetable protein, %	0.04	-0.13
Calcium, mg/1000kcal	-0.04	-0.13
Magnesium, mg/1000kcal	0.09	-0.16

Iron, mg/1000kcal	0.03	-0.13
Niacin (Vitamin B3), mg	0.07	-0.08
Vitamin B6, mg	0.18	-0.08
Vitamin C, mg/1000kcal	0.12	-0.14
Vitamin E, mg/1000kcal	-0.09	0.10
β-carotene, mcg/1000kcal	0.05	-0.12
Nutrient-Rich Food index 9.3	0.07	-0.19
Urinary markers, mmol/24-hr		
Urinary magnesium	0.05	-0.03
Urinary potassium	0.12	-0.04
Urinary sodium	0.01	0.03

[1] Correlation coefficients are statistically significant, except those ranging from -0.04 to 0.04

Table S4. Estimated mean differences in BP and BMI associated with 2SD higher intakes of boiled, baked, mashed, and mixed potato dishes in 2,696 US and UK INTERMAP participants [1,2]

	Boiled potato Difference (95% CI)	Baked potato Difference (95% CI)	Mashed potato Difference (95% CI)	Potato-based mixed dishes Difference (95% CI)
SBP (mmHg)				
Model 1	0.22 (-1.61, 2.07)	-2.28 (-4.22, -0.34)*	2.09 (0.14, 4.05)*	0.76 (-1.28, 2.79)
Model 2	0.59 (-1.16, 2.35)	-1.89 (-3.74, -0.10)*	1.56 (-0.29, 3.41)	0.33 (-1.59, 2.26)
Model 3a	0.87 (-0.98, 2.72)	-1.03 (-2.93, 0.87)	1.79 (-0.07, 3.65)	0.15 (-1.80, 2.10)
Model 3b	0.71 (-1.05, 2.49)	-1.58 (-3.44, 0.27)	1.42 (-0.42, 3.27)	0.33 (-1.59, 2.24)
Model 4	0.82 (-1.03, 2.67)	-1.00 (-2.89, 0.90)	1.80 (-0.07, 3.64)	0.16 (-1.78, 2.11)
Model 5	0.93 (-0.95, 2.80)	-0.96 (-2.87, 0.96)	1.81 (-0.06, 3.64)	0.15 (-1.80, 2.09)
Model 6	0.85 (-0.93, 2.62)	-1.11 (-2.94, 0.71)	1.85 (0.05, 3.64)*	0.40 (-1.49, 2.29)
DBP (mmHg)				
Model 1	-0.40 (-1.63, 0.84)	-0.51 (-1.82, 0.80)	0.92 (-0.40, 2.24)	0.03 (-1.30, 1.41)
Model 2	-0.23 (-1.44, 0.96)	-0.43 (-1.70, 0.83)	0.54 (-0.73, 1.81)	-0.23 (-1.56, 1.09)

Model 3a	-0.24 (-1.51, 1.03)	-0.09 (-1.39, 1.22)	0.59 (-0.69, 1.90)	-0.35 (-1.69, 1.00)
Model 3b	-0.20 (-1.41, 1.02)	-0.29 (-1.57, 0.98)	0.47 (-0.80, 1.75)	-0.24 (-1.56, 1.09)
Model 4	-0.06 (-1.53, 1.00)	-0.07 (-1.38, 1.24)	0.59 (-0.70, 1.87)	-0.34 (-1.69, 1.00)
Model 5	-0.26 (-1.54, 1.03)	-0.02 (-1.35, 1.29)	0.60 (-0.69, 1.89)	-0.35 (-1.70, 1.00)
Model 6	-0.24 (-1.49, 1.00)	-0.11 (-1.39, 1.17)	0.61 (-0.65, 1.86)	-0.21 (-1.52, 1.11)
BMI (kg/m^2)				
Model 1	-0.18 (-0.83, 0.46)	-0.36 (-1.10, 0.37)	0.13 (-0.64, 0.89)	0.16 (-0.72, 1.03)
Model 2	0.14 (-0.77, 0.50)	-0.27 (-1.00, 0.44)	-0.14 (-0.87, 0.60)	-0.05 (-0.87, 0.77)
Model 3a	0.01 (-0.66, 0.69)	0.07 (-0.66, 0.81)	-0.08 (-0.82, 0.66)	-0.41 (-1.23, 0.41)
Model 4	-0.06 (-0.72, 0.60)	0.13 (-0.58, 0.84)	-0.08 (-0.80, 0.64)	-0.39 (-1.18, 0.41)
Model 5	-0.14 (-0.82, 0.53)	-0.30 (-1.03, 0.44)	-0.14 (-0.88, 0.59)	-0.37 (-1.19, 0.44)

Values presented as mean (95%CI); *P-value < 0.05; **P-value < 0.01; ***P-value <0.0001

[1] Model 1 is a crude model adjusted for sample, age, and sex; model 2 is model 1 adjusted for moderate or heavy physical activity, dietary supplement intake, 7-day alcohol intake, smoking status, total calorie intake, history of cardiovascular disease or diabetes mellitus, family history of hypertension, education level, use of antihypertensive, cardiovascular disease or diabetes medication, and adherence to special diet ; model 3a is model 2 adjusted for intakes of other dietary factors (g/1000 kcal): red and processed

meat, sugar-sweetened beverages, fish and shellfish, fruits, vegetables, low fat dairy products, and mutually for the sum of intakes of 'other' potatoes; model 3b is model 2 additionally adjusted for the NRF index; model 4 is model 3 additionally adjusted for urinary sodium; model 5 is model 3 additionally adjusted for urinary potassium; model 6 is model 3 additionally adjusted for BMI.

[2] Two standard deviations are 72 g/1000 kcal for boiled potato, 53 g/1000 kcal for baked potato, 42 g/1000 kcal for mashed potato, and 53 g/1000 kcal for potato-based mixed dishes

Table S5. Characteristics of US women with high intake of non-fried potato vs US women with high intake of fried potatoes[1,2]

Variable	Non-fried potatoes Higher	Fried potatoes Higher
N	680	679
Age, y	49.5 (5.4)	48.7 (5.5)
Education, y	14.5 (3.4)	14.6 (3.2)
Current smokers, %	9	10
Engagement in moderate and heavy physical activity during work and leisure time, hours/d	3.1 (3.0)	3.4 (3.3)
Taking dietary supplements, %	25	19
Systolic blood pressure, mm Hg	121.5 (13.5)	122.8 (13.1)
Diastolic blood pressure, mm Hg	77.4 (9.7)	78.2 (9.9)
Body mass index, kg/m^2	28.3 (4.8)	29.0 (4.9)
History of cardiovascular disease or diabetes mellitus, %	8	8
Use of antihypertensive, cardiovascular disease or diabetes medication, %	11	9
Family history of hypertension, %	31	29

Adhering to special diet, %	8	7
Energy, kcal	2,493 (660)	2675 (697)
Food group intakes (g/1000 kcal)		
Total potatoes	52 (40)	40 (37)
Non-fried	41 (36)	22 (32)
Boiled	19 (33)	11 (24)
Baked	13 (18)	6 (14)
Mashed	9 (14)	5 (12)
Fried	8 (12)	15 (12)
Potato-based mixed dishes	3 (11)	3 (11)
Whole grains	26 (29)	23 (28)
Refined grains	144 (68)	148 (64)
Fruit	49 (58)	41 (50)
Vegetables (excluding potatoes)	72 (59)	64 (57)
Dairy products	142 (137)	135 (140)
Low fat dairy	92 (84)	81 (76)

Red and processed meat	64 (30)	62 (29)
Fish and shellfish	8 (13)	7 (12)
Sugar sweetened beverages	102 (139)	132 (156)
Alcohol intake, g/d	14 (19)	13 (19)
Urinary sodium, mmol/24-hour	170.5 (56.6)	178.1 (61.2)
Urinary potassium, mmol/24-hour	76.4 (22.2)	65.6 (21.0)
Nutrient-rich food score 9.3	36.1 (12.3)	30.8 (11.7)

[1] US women were classified according to higher non-fried and fried potato consumption by median intake; 9 g/1000 kcal for non-fried potatoes; 3 g/1000 kcal for fried potatoes

[2] Mean (SD) or percent

Table S6. Estimated mean difference in BP and BMI associated with 2SD higher intakes of non-fried and fried potato in subcohorts of US and UK INTERMAP participants [1,2,3]

	Non-fried potato	Fried potato		Fried potato	
	Difference (95% CI)	Difference (95% CI)	Difference (95% CI)	Difference (95% CI)	Difference (95% CI)
	US + UK	*US + UK*	*US Men*	*US Women*	*UK*
Excluding participants with a diagnosis of hypertension and users of antihypertensive drugs [b]					
N	1,842	1,842	732	745	365
SBP (mmHg)					
Model 1	-0.17 (-2.52, 1.18)	1.50 (-0.39, 3.38)	0.86 (-0.71, 2.44)	3.30 (1.60, 5.00)***	0.54 (-2.82, 1.75)
Model 2	0.16 (-2.23, 1.53)	1.41 (-0.47, 3.30)	0.06 (-0.94, 1.07)	2.95 (1.25, 4.65)**	-0.39 (-2.69, 1.90)
Model 3a	0.54 (-1.45, 2.54)	0.86 (-1.13, 2.86)	0.10 (-1.50, 1.69)	2.67 (0.94, 4.40)**	-1.01 (-3.50, 1.48)
DBP (mmHg)					
Model 1	-1.11 (-2.40, 0.18)	0.47 (-0.64, 1.99)	0.63 (-0.61, 1.87)	1.55 (0.41, 2.68)**	-0.39 (-1.96, 1.18)
Model 2	-1.13 (-2.45, 0.20)	0.55 (-0.58, 2.09)	0.60 (-0.65, 1.85)	1.38 (0.25, 2.51)*	-0.24 (-1.84, 1.37)
Model 3a	0.73 (-2.14, 0.67)	0.21 (-1.10, 1.72)	0.41 (-0.86, 1.68)	1.14 (-0.02, 2.30)*	-0.75 (-2.48, 0.97)

BMI (kg/m²)					
Model 1	-0.04 (-0.77, 0.69)	1.00 (0.60, 1.71)***	0.14 (-0.55, 0.83)	1.09 (0.24, 1.95)**	0.75 (-0.09, 1.59)
Model 2	-0.26 (-0.99, 0.52)	0.85 (0.46, 1.61)***	0.01 (-0.67, 0.69)	0.84 (0.20, 1.68)*	0.72 (-0.14, 1.59)
Model 3a	0.16 (-0.65, 0.96)	0.77 (0.23, 1.47)**	0.22 (-0.89, 0.46)	0.65 (0.18, 1.46)*	0.66 (-0.28, 1.60)
Nonhypertensive participants [2]					
N	1,761	1,761	694	727	340
SBP (mmHg)					
Model 1	-0.27 (-2.34, 0.82)	0.94 (-0.67, 2.56)	0.40 (-1.00, 1.81)	1.51 (0.94, 4.07)**	-0.21 (-2.15, 1.72)
Model 2	-0.21 (-2.11, 1.10)	0.84 (-0.76, 2.46)	0.16 (-1.26, 1.58)	2.19 (0.64, 3.75)*	-0.18 (-2.12, 1.76)
Model 3a	0.68 (-1.68, 1.77)	0.45 (-1.29, 2.19)	-0.24 (-1.66, 1.18)	2.08 (0.49, 3.67)*	-0.63 (-2.72, 1.51)
DBP (mmHg)					
Model 1	-.26 (-2.23, 0.12)	0.67 (-0.64, 2.00)	0.37 (-0.79, 1.53)	1.11 (0.02, 2.19)*	-0.06 (-0.89, 0.77)
Model 2	-.31 (-2.32, 0.15)	0.75 (-0.58, 2.09)	0.38 (-0.80, 1.56)	0.96 (-0.12, 2.05)	-0.07 (-0.92, 0.78)
Model 3a	-0.13 (-2.23, 0.38)	0.31 (-0.69, 1.72)	0.21 (-0.99, 1.40)	0.80 (-0.31, 1.91)	-0.28 (-1.21, 0.65)
BMI (kg/m²)					
Model 1	-0.33 (-0.76, 0.67)	1.03 (0.69, 1.73)***	0.35 (-0.35, 1.04)	0.66 (0.28,1.49)**	0.89 (0.06, 1.72)*

Model 2	-0.19 (-1.03, 0.44)	0.98 (0.35, 1.63)**	0.13 (-0.56, 0.82)	0.40 (0.41, 1.22)**	0.88 (0.02, 1.73)*
Model 3a	-0.12 (-0.75, 0.83)	0.74 (0.32, 1.54)**	0.06 (-0.75, 0.62)	0.24 (0.57, 1.06)*	0.83 (-0.12, 1.77)*
Excluding participants with cardiovascular diseases or diabetes mellitus [3]					
N	1,576	1,576	617	646	313
SBP (mmHg)					
Model 1	-0.28 (-1.89, 1.34)	0.22 (-1.42, 1.87)	0.29 (-1.19, 1.76)	2.18 (0.51, 3.85)*	-0.88 (-2.84, 1.07)
Model 2	-0.11 (-1.68, 1.65)	0.36 (-1.30, 2.02)	0.13 (-1.36, 1.62)	1.89 (0.23, 3.55)*	-0.64 (-2.63, 1.35)
Model 3a	-0.35 (-1.33, 2.25)	0.14 (-1.76, 1.81)	-0.24 (-1.75, 1.24)	1.89 (0.10, 3.49)*	-1.01 (-3.20, 1.18)
DBP (mmHg)					
Model 1	-1.03 (-2.22, 0.16)	0.33 (-0.88, 1.55)	0.37 (-0.81, 1.54)	1.11 (-0.04, 2.27)	-0.26 (-1.71, 1.14)
Model 2	-0.12 (-2.29, 0.20)	0.41 (-0.84, 1.65)	0.36 (-0.82, 1.54)	0.97 (-0.18, 2.12)	-0.15 (-1.65, 1.36)
Model 3a	-0.17 (-2.09, 0.56)	0.13 (-1.12, 1.23)	0.14 (-1.05, 1.34)	0.83 (-0.35, 2.01)	-0.59 (-2.10, 0.93)
BMI (kg/m^2)					
Model 1	-0.13 (-0.75, 0.78)	0.88 (0.58, 1.64)***	0.24 (-0.49,0.97)	0.26 (0.61, 1.14)**	0.94 (0.07, 1.82)*
Model 2	-0.23 (-1.03, 0.56)	0.78 (0.30, 1.56)**	0.15 (-0.58, 0.88)	0.38 (0.45, 0.82)*	0.94 (0.05, 1.85)*
Model 3a	-0.17 (-0.73, 0.95)	0.61 (0.18, 1.44)*	0.01 (-0.75, 0.72)	0.13 (0.22, 0.73)*	0.86 (-0.12, 1.84)

Values presented as mean (95%CI); *P-value < 0.05; **P-value < 0.01; ***P-value <0.0001

[1] Model 1 is a crude model adjusted for sample, age, and sex; model 2 is model 1 adjusted for moderate or heavy physical activity, dietary supplement intake, 7-day alcohol intake, smoking status, total calorie intake, history of cardiovascular disease or diabetes mellitus, family history of hypertension, education level, use of antihypertensive, cardiovascular disease or diabetes medication, and adherence to special diet ; model 3a is model 2 adjusted for intakes of other dietary factors (g/1000 kcal): red and processed meat, sugar-sweetened beverages, fish and shellfish, fruits, vegetables, low fat dairy products, and mutually for the sum of intakes of 'other' potatoes. Significant interaction found for fried potato consumption with BP (P=0.06)

[2] Two standard deviations are 64 g/1000 kcal for non-fried potato, 23 g/1000 kcal for fried potato, 16 g/1000 kcal for fried potato (US men), 12 g/1000 kcal for fried potato (US women), 41 g/1000 kcal for fried potato (UK)

[3] Two standard deviations are 65 g/1000 kcal for non-fried potato, 24 g/1000 kcal for fried potato, 16 g/1000 kcal for fried potato (US men), 11 g/1000 kcal for fried potato (US women), 41 g/1000 kcal for fried potato (UK)

Table S7. Characteristics of non-fried and fried potato meals by low and high NRF index of the potato meal [1,2]

Variable	Non-fried potato meals		Fried potato meals	
	Lower NRF index	Higher NRF index	Lower NRF index	Higher NRF index
Carbohydrates, % kcal	17 (3)	17 (3)	16 (2)	17 (3)
Fiber, g/1000 kcal	3 (1)	3 (1)	2 (1)	3 (1)
Protein, % kcal	5 (1)	5 (1)	5 (1)	5 (1)
Total fat, % kcal	11 (2)	11 (2)	12 (2)	11 (2)
Saturated fatty acids, % kcal	4 (1)	4 (1)	5 (2)	4 (1)
Food group intakes (g/1000 kcal)				
Whole grains	10 (12)	10 (10)	7 (9)	9 (9)
Refined grains	55 (23)	52 (22)	55 (22)	53 (22)
Sugar sweetened beverages	49 (55)	40 (45)	54 (55)	49 (51)
Fruit	18 (21)	18 (19)	13 (16)	18 (19)
Vegetables (excluding potatoes)	59 (26)	66 (28)	46 (24)	56 (25)
Dairy products	37 (65)	51 (78)	40 (32)	45 (28)

Low fat dairy	30 (28)	34 (31)	27 (27)	30 (33)
Red and processed meat	21 (10)	20 (10)	24 (9)	20 (9)
Fish and shellfish	2 (4)	2 (4)	2 (4)	3 (5)

[1] Potato meals were classified according to lower or higher NRF index by median intake; 3 for non-fried and 2 for fried potatoes

[2] Mean (SD)

Table S8. Content of non-fried and fried potato meals by low/high NRF index [1,2]

Type of meal, % of intake	Non-fried potato		Fried potato	
	Lower NRF index	**Higher NRF index**	**Lower NRF index**	**Higher NRF index**
n	977	978	939	946
Baked/roasted potato as a side dish with meat/chicken or casserole	50	68	-	-
Grilled steak with mixed vegetables, mashed potatoes & gravy	42	32	-	-
Fried chicken with mashed potatoes & gravy	8	1	-	-
Beef burgers (added mayonnaise/ketchup) with French Fries and sugar-sweetened beverages	-	-	65	47
Chips/crisps with cheese/cream dip and sugar-sweetened beverages	-	-	20	27
Hash brown, sausages/bacon, and eggs	-	-	15	13
Fried potato pancakes with bacon	-	-	-	13

[1] Percent of intake (%)

[2] Potato meals were classified according to lower or higher NRF index by median intake; 3 for non-fried and 2 for fried potatoes

Exclusion flow chart INTERMAP Study