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An analysis of potato consumption habits and diet quality among adults and children in the UK

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Abstract

Many people are confused about the nutritional role of potatoes in a healthy, balanced diet. Starchy foods are often under-regarded by the public and maligned by proponents of low carbohydrate diets, yet carbohydrate should supply around 50% of dietary energy, preferably from sources such as potatoes, pulses and wholegrains. Potatoes provide significant quantities of shortfall micronutrients, yet they do not count as vegetables in 5 A DAY targets. To provide balanced advice, research is needed on potato consumption and its possible nutritional consequences. Therefore we analysed individual dietary records from the *National Diet and Nutrition Survey* 2008–2012 to investigate potato consumption patterns and associations with nutrient intakes. We hypothesised that high consumption of potatoes would be associated with higher total intakes of potassium, B vitamins and fibre. Across the whole population, potatoes provided 7% of energy, 15% of potassium, 13% of dietary fibre (non-starch polysaccharide) and vitamin C, 14% of vitamin B_6, 10% of folate, 8% of magnesium and 6% of iron. Both very low and very high consumption of potatoes (Q1 and Q5) was associated with lower energy and nutrient intakes, compared with average consumers. Lower micronutrient intakes were most pronounced in Q5 (mean 14.8% energy from potatoes), although Q1 had lowest intakes of potassium, vitamin B_6 and thiamin. Food intakes suggest a less healthy, varied dietary pattern among high potato consumers. Conversely, low consumers of potatoes had lower intakes of potassium, thiamin and vitamin B_6 (all found in potatoes) despite an apparently health-conscious dietary pattern that included higher consumption of fruit, vegetables and fish. Our study suggests that based on current habits, a broad range of potato consumption is compatible with good nutrition, while high reliance on potatoes may be associated with an unbalanced diet. To help raise intakes of shortfall nutrients such as potassium and fibre, consumption of potatoes could be encouraged alongside existing healthy eating messages relating to vegetables, fruit and wholegrain foods.

Keywords: consumption, dietary, food, intake, nutrient, potato

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Introduction

Perhaps as a consequence of their value as a 'poor man's food' potatoes have long been under-regarded for their nutritional contribution. In modern times they have been maligned for their suspected link to high-carbohydrate, high-fat, or high-energy diets, and by extension to obesity (Weaver & Marr 2013). Compositionally, they are high in carbohydrate, but are less energy dense than pasta or rice, and low in fat depending on the amount added in cooking or serving (Camire *et al*. 2009). In food-based dietary guidelines for the UK, white potatoes are classified as a starchy food rather than as a vegetable (NHS UK 2015), in contrast to the US where they are regarded as vegetables in the Dietary Guidelines for Americans (USDA & HHSC 2010).

Potatoes make a significant contribution to intake of fibre, which is typically low in Western diets (Storey & Anderson 2013). They also provide key micronutrients such as potassium, magnesium and folate (Weichselbaum 2010), intakes of which are marginally inadequate, especially among teenage girls and young women (SACN 2008; Mensink *et al*. 2013). For example, mean intakes of potassium among teenagers and adults in the *National Diet and Nutrition Survey* (*NDNS*) were only 70–80% of the reference nutrient intake (RNI) (Bates *et al*. 2014). Potassium has received much less attention than sodium, but adequate potassium intake may be just as important for regulating blood pressure as low sodium intake (Perez & Chang 2014), and evidence from both prospective cohort studies and intervention trials shows that potassium lowers risk of stroke and cardiovascular disease (Houston 2011; Aburto *et al*. 2013). In 2012 the World Health Organization (WHO) issued recommendations for an increase in potassium intakes (WHO 2012). Fruit and vegetables, including potatoes, are good sources of potassium while being naturally low in sodium, hence increased consumption could reduce the dietary ratio of sodium to potassium towards the optimal value of 1:1. Magnesium and folate are also marginal in the UK diet (Mensink *et al*. 2013) and could be increased by increasing potato intake. Low iron intake and status is also common among teenage girls and women (Bates *et al*. 2014) and although potatoes are not a rich source of iron, bioavailability may be enhanced owing to their high vitamin C and low phytate content (Kondo *et al*. 2012).

Using *NDNS* data from 2008–2010 we have shown that potatoes in forms currently consumed enrich the diet in respect of several nutrients including potassium, magnesium, folate, vitamin C, vitamin B_6, dietary fibre and unsaturated fatty acids. For every 1% of energy they contribute, potatoes provide more than 1% of these micronutrients, and less than 1% of saturated fatty acids (Gibson & Kurilich 2013). In the present study, we evaluated nutritional differences between consumers according to the relative amount of potatoes consumed, hypothesising that high consumption of potatoes would be associated with higher total intakes of potassium, B vitamins and fibre. The analysis is based on original raw data from 4 years of the *NDNS* rolling programme (2008–2012) (NatCen Social Research *et al*. 2014).

Method

The *NDNS* provides the only source of high quality nationally representative data on the types and quantities of foods consumed by UK individuals, from which estimates of nutrient intakes are derived (Bates *et al*. 2014). Results are used by government to develop policy and monitor diet and nutrient intakes. Computerised data files comprising individual dietary records from 4 years of the *NDNS* rolling programme (2008–2012) (NatCen Social Research *et al*. 2014) were obtained under license from the UK Data Archive. The sample analysed consisted of 4156 children and adults aged 1.5–99 years.

Food diaries (4 days for 98% of respondents) were examined to identify all codes for potatoes from food groups 'chips and fried/roast potatoes' (group 38) and 'other potatoes, products and dishes' (group 39). This included potatoes used in homemade recipe dishes such as cottage pie, where the amount of mashed potato was recorded separately. However, potatoes in ready-made meat-based composite dishes were classified as meat dishes. However, less than 5% of meat and fish dishes appeared to contain potatoes and mean intake of these dishes was about 5 g/day, so of the contribution of composite dishes to potato intake is likely to be very small. Potato codes include added fat and/or milk.

We combined the 129 different potato codes into seven categories ('boiled', 'baked', 'mashed', 'roast', 'fried chips', 'oven chips' and 'other potato dishes') for comparison of consumption patterns by age groups (<4 years, 4–10 years, 11–18 years, 19–64 years, 65 + years). The average daily amount consumed by each individual was computed taking into account the number of diary days completed (3 or 4 days). Mean intakes of energy, nutrients and food groups were

compared across quintiles of potato consumption (as % of energy in the diet) from Q1 (low) to Q5 (high). The proportion of individuals with intakes of micronutrients below the lower reference nutrient intake (LRNI) (DH 1991) was also used to evaluate the relevance of findings. Assessment of the benefits (or otherwise) of high consumption of potatoes was made by comparing the diets of consumers across the quintiles of potato consumption.

Food and nutrient intakes were compared between quintiles of potato consumption using analysis of variance (ANOVA). Planned contrasts (Q1 vs. Q3, Q1 vs. Q5, Q5 vs. Q3) were used to test the hypothesis that high or low consumption of potatoes was associated with poorer dietary quality compared with the other or with average consumption. Chi-square test and Z-test of column proportions was used for categorical variables (background factors, classification based on LRNI). Bonferroni correction was applied to *p* values for multiple comparisons. Analyses used a weighting factor to adjust for sampling and non-response bias and to give results representative of the total UK population. *P* values less than 0.05 were taken as statistically significant. All analyses were conducted using IBM SPSS statistics version 22 (IBM Corp).

Results

Consumption of potatoes and nutrient adequacy according to age group

Mean consumption of potatoes across the total population was 90 g/day contributing 7% of total energy (Table 1). Boiled potatoes were the most popular form in which potatoes were consumed (33%) followed by fried chips (21%), oven chips (11%), baked (13%), roast (13%) and mashed potatoes (8%). Boiled potatoes were the most popular form consumed among all age groups, except 11–18 year-olds (Fig. 1) who consumed more fried chips (28%). Across the total population potatoes provided 7% of total energy, 6% of fat intake and 3% of saturated fatty acid intake, 15% of potassium, 13% of dietary fibre (non-starch polysaccharide), 14% of vitamin B_6 and vitamin C, 10% of folate, 8% of magnesium and 6% of iron. Teenagers (11–18 years) had the highest energy contribution from potatoes and derived more protein, fat, fibre, potassium, magnesium, iron and folate from potatoes than other age groups (Figs 2,3).

High potato consumers (quintile analysis)

The mean percentage energy from potatoes was 0.9%, 3.7%, 6.2%, 8.9% and 14.8% in Q1 through Q5, respectively. There were no significant differences in age and sex distribution across quintiles of potato consumption (mean age 39–41 years across quintiles; 49% males, 51% females). Associations with energy intake were 'n-shaped', *i.e.* high potato consumers (Q5) and low/non potato consumers (Q1) had energy intakes lower than 'average' potato consumers (Q3) ($P < 0.001$, Table 2). Mean intakes of micro and macronutrients also tended to be highest among average potato consumers (Tables 2,3), consistent with higher energy intakes. Compared with low/non potato consumers (Q1), high potato consumers (Q5) had lower mean intakes of protein and several micronutrients, including iron, zinc, magnesium, vitamin A, riboflavin, vitamin B_{12} and vitamin C, but higher mean intakes of potassium, vitamin B_6 and thiamin; intakes of folate and fibre were not significantly different between Q1 and Q5 (Table 3). The proportion of individuals with very low intakes (below the LRNI) was highest in Q5 for vitamin A (14%), riboflavin (13%), zinc (11%), calcium (12%), magnesium (23%) and iron (17%) (Table 4). On the other hand, Q1 had the highest prevalence of inadequate intake of vitamin C (3%), folate (5%) and potassium (25%).

Table 1 Mean potato consumption (g/day) by type and age group

	Boiled (g/day)	Mashed (g/day)	Baked (g/day)	Roast (g/day)	Fried chips (g/day)	Oven chips (g/day)	Other potatoes (g/day)	Total (g/day)
1.5–3 years	13	6	5	2	8	9	0.1	43
4–10 years	17	6	7	7	15	14	0.4	68
11–18 years	18	7	11	12	28	15	1	92
19–64 years	29	6	13	12	20	10	1	91
65+ years	48	9	12	13	13	7	1	103
Total	30	7	12	11	19	10	1	90

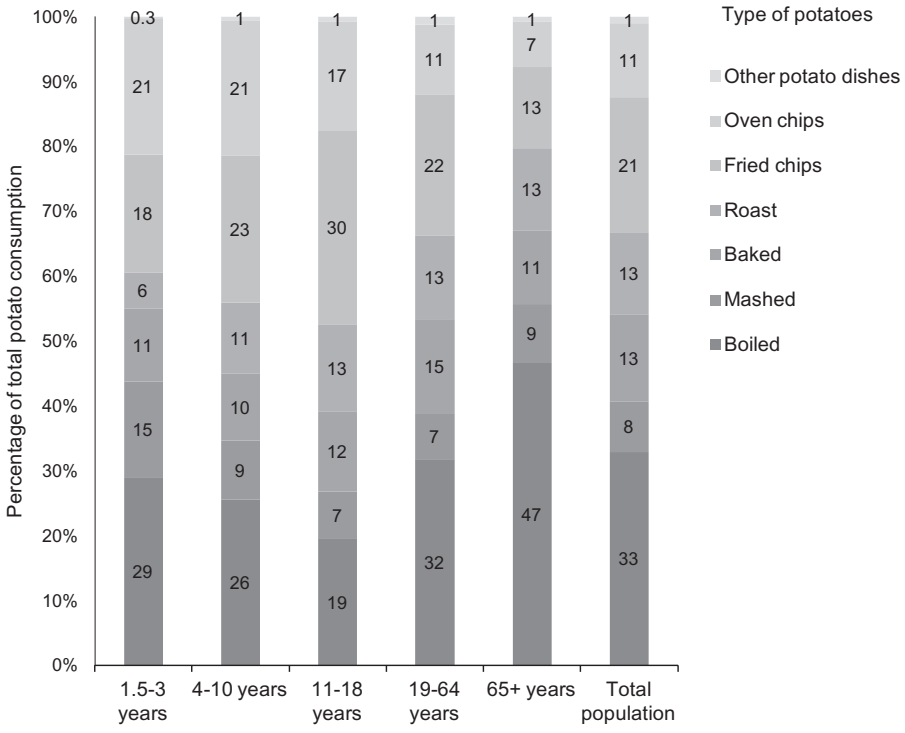

Figure 1 Potato consumption by type according to age group.

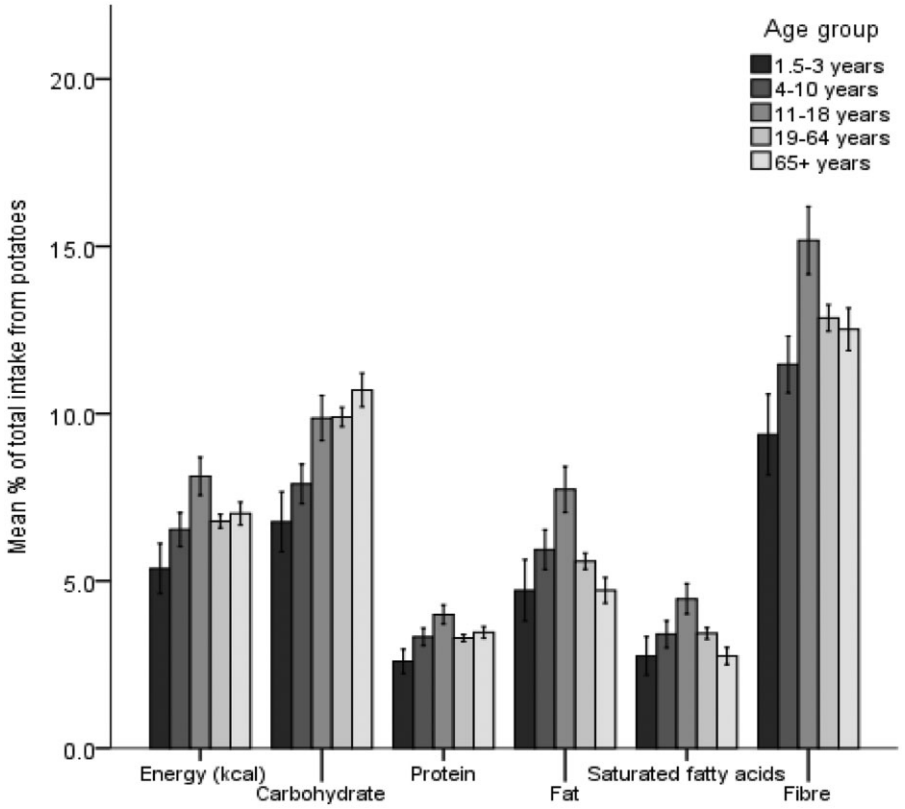

Figure 2 Macronutrient contribution from potatoes as a percentage of total intake by age group. Error bars represent 95% confidence limits.

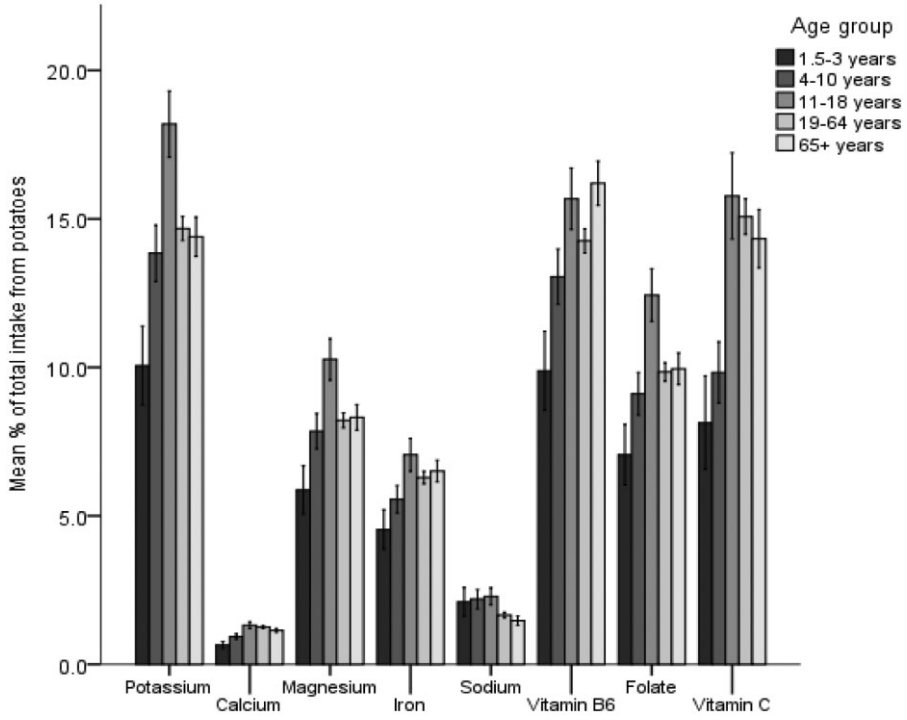

Figure 3 Percentage micronutrient contribution from potatoes by age group. Error bars represent 95% confidence limits.

Table 2 Macronutrient intake by potato consumption quintiles

		Percentage energy (kcal) from potatoes						Planned contrasts – *p* values		
		Q1	Q2	Q3	Q4	Q5	Total	Q1 vs. Q3	Q1 vs. Q5	Q3 vs. Q5
	n	830	833	829	833	830	4156			
	Base n	823	848	874	788	823	4156			
Percentage energy from potatoes	Mean	0.9	3.7	6.2	8.9	14.8	6.9			
Total energy (kcal)	Mean	1719	1899	1813	1820	1694	1789	0.001	0.368	<0.0001
	SE	22	22	19	19	19	9			
Protein (g)	Mean	70	74	72	73	66	71	0.037	0.002	<0.0001
	SE	1.2	0.8	0.8	0.8	0.7	0.4			
Fat (g)	Mean	63	72	67	68	64	67	0.001	0.395	0.016
	SE	1.0	1.0	0.8	0.8	0.8	0.4			
Saturated fatty acids (g)	Mean	24	28	25	25	23	25	0.003	0.095	<0.0001
	SE	0.4	0.4	0.3	0.4	0.3	0.2			
Carbohydrate (g)	Mean	209	235	223	224	211	220	<0.0001	0.658	0.001
	SE	2.7	2.7	2.3	2.3	2.4	1.1			
Total sugars (g)	Mean	95	109	97	94	84	96	0.242	<0.0001	<0.0001
	SE	1.6	1.6	1.4	1.5	1.4	0.7			
Non-milk extrinsic sugars (g)	Mean	56	66	59	58	55	59	0.116	0.509	0.026
	SE	1.4	1.4	1.3	1.3	1.3	0.6			
Fibre (NSP) (g)	Mean	12.7	14.1	13.5	13.3	12.5	13.2	0.001	0.337	<0.0001
	SE	0.2	0.2	0.2	0.2	0.15	0.08			

NSP, non-starch polysaccharides; SE, standard error.

Table 3 Micronutrient intake by potato consumption quintile

Micronutrient (unit/day)		Percentage energy from potatoes						Planned contrasts – *p* values		
		Q1	Q2	Q3	Q4	Q5	Total	Q1 vs. Q3	Q1 vs. Q5	Q3 vs. Q5
	n	830	833	829	833	830	4156			
	Base n	823	848	874	788	823	4156			
Percentage energy from potatoes	Mean	0.9	3.7	6.2	8.9	14.8	6.9			
Vitamin A (RE) (μg)	Mean	962	1014	1010	934	792	942	0.312	<0.0001	<0.0001
	SE	33.5	34.3	31.8	36.9	30.3	15.0			
Thiamin (mg)	Mean	1.3	1.5	1.4	1.5	1.4	1.4	<0.0001	<0.0001	0.036
	SE	0.02	0.02	0.02	0.02	0.02	0.01			
Riboflavin (mg)	Mean	1.6	1.7	1.6	1.6	1.4	1.6	0.095	<0.0001	<0.0001
	SE	0.03	0.02	0.02	0.02	0.02	0.01			
Niacin equivalent (mg)	Mean	34.1	35.5	35.4	35.4	32.2	34.5	0.065	0.009	<0.0001
	SE	0.7	0.5	0.4	0.5	0.4	0.2			
Vitamin B_6 (mg)	Mean	2.0	2.2	2.2	2.3	2.2	2.1	<0.0001	<0.0001	0.440
	SE	0.04	0.03	0.03	0.04	0.04	0.02			
Vitamin B_{12} (μg)	Mean	5.3	5.4	5.3	5.2	4.5	5.1	0.945	<0.0001	<0.0001
	SE	0.1	0.1	0.1	0.1	0.1	0.1			
Folate (μg)	Mean	235	258	255	252	235	247	<0.0001	0.980	<0.0001
	SE	3.8	3.5	3.7	3.7	3.7	1.6			
Vitamin C (mg)	Mean	82	96	83	83	70	83	0.656	<0.0001	<0.0001
	SE	1.9	2.2	2.0	2.4	1.8	0.9			
Vitamin D (mg)	Mean	3.0	2.8	2.9	2.7	2.4	2.8	0.516	<0.0001	<0.0001
	SE	0.1	0.1	0.1	0.1	0.1	0.0			
Vitamin E (mg)	Mean	8.7	9.3	8.8	8.8	8.1	8.7	0.699	0.002	0.001
	SE	0.2	0.1	0.1	0.1	0.1	0.1			
Iron (mg)	Mean	10.3	10.8	10.5	10.3	9.2	10.2	0.361	<0.0001	<0.0001
	SE	0.1	0.1	0.1	0.1	0.1	0.1			
Calcium (mg)	Mean	812	907	837	820	700	815	0.093	<0.0001	<0.0001
	SE	12	11	10	11	10	5			
Magnesium (mg)	Mean	240	258	249	243	217	241	0.038	<0.0001	<0.0001
	SE	3.4	3.0	2.9	2.9	2.4	1.3			
Potassium (mg)	Mean	2429	2778	2743	2786	2657	2679	<0.0001	<0.0001	0.046
	SE	31	31	30	31	28	14			
Zinc (mg)	Mean	8.3	8.7	8.3	8.3	7.5	8.2	0.708	<0.0001	<0.0001
	SE	0.1	0.1	0.1	0.1	0.1	0.1			
Sodium (mg)	Mean	2090	2332	2243	2263	2042	2194	<0.0001	0.236	<0.0001
	SE	30	32	28	28	26	13			

RE, retinol equivalents; SE, standard error.

Differences in food consumption across the quintiles help to explain some of these findings (Table 5). High potato consumers ate less of other major sources of carbohydrate (pasta, rice and other cereals) than low consumers (Q1) but the same amount of carbohydrate in total. Lower protein intakes in Q5 despite a slightly higher consumption of meat are consistent with lower intake of milk, cheese, eggs, fish and bread. High potato consumers drank 42% more soft drinks than low consumers (Q1) but ate less biscuits, cakes and confectionery with the result that non-milk extrinsic sugar (NMES) intake was the same in both groups. The lower intake of total sugars in Q5 vs. Q1 mainly reflects lower consumption of milk and fruit. By contrast, low consumers of potatoes (Q1) had a low potassium intake despite eating more fruit and vegetables than other groups.

Discussion

Starchy foods are under-regarded by the public and maligned by proponents of low carbohydrate diets, yet experts advising government have recently confirmed that carbohydrate should supply 50% of dietary

Table 4 Prevalence of micronutrient intakes below LRNI by quintile of potato consumption

		Percentage energy from potatoes					
		Q1	Q2	Q3	Q4	Q5	Total
	n	830	833	829	833	830	4156
	Base	823	848	874	788	823	4156
Percentage energy from potatoes	Mean	0.9	3.7	6.2	8.9	14.8	6.9
Vitamin A	Below LRNI	7%[2]	4%	5%	7%	14%[1,2,3,4]	8%
Thiamin	Below LRNI	0%	0%	0%	0%	0%	0%
Riboflavin	Below LRNI	8%[2,3]	3%	4%	7%	13%[1,2,3,4]	7%
Niacin equivalent	Below LRNI	0%	0%	0%	0%	0%	0%
Folate	Below LRNI	5%[2,4]	2%	2%	2%	3%	3%
Vitamin B_6	Below LRNI	1%	0%	0%	0%	0%	0%
Vitamin B_{12}	Below LRNI	3%[2,3]	0%	0%	1%	2%	1%
Vitamin C	Below LRNI	3%[2,4,5]	0%	1%	0%	0%	1%
Iron	Below LRNI	12%[2]	7%	9%	10%	17%[2,3,4]	11%
Calcium	Below LRNI	9%[2,3,4]	2%	4%	5%	12%[2,3,4]	6%
Magnesium	Below LRNI	17%[2,3]	8%	10%	14%	23%[1,2,3,4]	15%
Potassium	Below LRNI	25%[1,2,3,4]	10%	12%	12%	16%	15%
Zinc	Below LRNI	10%[2,3,4]	4%	5%	6%	11%[2,3,4]	7%

[1,2,3,4,5]Significantly higher prevalence than Q1, Q2, Q3, Q4, Q5 respectively (Z test for column proportions; $P < 0.05$).

energy, which is slightly more than currently consumed (SACN 2014). Most of this should come from a diet based on wholegrains, pulses, potatoes, vegetables and fruit to supply the increased amount of fibre that is optimal for health. Potato consumption has been slowly falling in the UK by about 1% a year since 1942, as rice and pasta consumption has risen (Riley 2010). Fibre intakes (non-starch polysaccharide) currently average under 14 g/day among adults (Englyst method), falling short of current recommendations of 18 g/day. The proposed new guidelines would raise this by 25% to around 24 g/day (30 g/day based on the AOAC method) for adults, a mean increase of 70% over current intakes. Draft recommendations for fibre intake in children (by AOAC method) would be 20 g/day and 25 g/day for 5–11 year-olds and 11–16 year-olds, respectively. Overall, 40% of adults in the *NDNS* had fibre intakes below the recommended minimum of 12 g/day (data not shown). Potatoes in the amounts and types currently consumed bring twice as much fibre relative to their energy contribution, and this could be further enhanced by consuming potatoes unpeeled. However, wider changes in dietary habits and food composition will be necessary to achieve the ambitious fibre target. These will almost certainly entail a switch to wholegrain cereal foods and increased consumption of vegetables and fruit; there is also scope for products that incorporate non-digestible carbohydrates to enhance fibre intakes.

Public health concerns are currently dominated by obesity, and this is understandable considering its high prevalence and severe economic and social consequences. A reduction in energy intake through reduced consumption of energy-dense foods is a major policy objective, but the overall energy density of potatoes consumed in this study was the same as plain boiled rice (1.4 kcal/g). Secondly, if micronutrient intakes are to be maintained or increased on a diet supplying fewer calories, nutrient density needs to rise, especially for shortfall micronutrients. In addition, physical activity needs to increase to allow people to enjoy treat foods, such as sweet beverages, confectionery and alcohol in moderation.

Our results show that micronutrient intakes were highest among groups with an average intake of potatoes (Q2, Q3, Q4), while very high potato consumption (Q5) and to a lesser extent, very low consumption (Q1) was associated with slightly lower micronutrient intakes and a higher risk of inadequacy. The more adverse nutritional profile seen with high potato consumption could be attributed to a more restricted diet, or one containing less nutrient-dense foods. In support of this, compared to average potato consumers (Q3), very high potato consumers (Q5) reported consuming less fruit and vegetables, milk, cheese, fish, bread, cereals (and biscuits, cakes and confectionery) but more soft drinks. Conversely, low consumers of potatoes (Q1) consumed significantly less milk, meat, biscuits, cakes and confec-

Table 5 Food group consumption across quintiles

Food group (mean g)		Percentage energy from potatoes						Planned contrasts – *p* values		
		Q1	Q2	Q3	Q4	Q5	Total	Q1 vs. Q3	Q1 vs. Q5	Q3 vs. Q5
	n	830	833	829	833	830	4156			
	Base	823	848	874	788	823	4156			
Percentage energy from potatoes	Mean	0.9	3.7	6.2	8.9	14.8	6.9			
Potatoes	Mean	18	63	89	119	161	90	<0.0001	<0.0001	<0.0001
	SE	0.7	1.0	1.2	1.6	2.6	1.0			
Pasta, rice and other cereals	Mean	103	87	73	63	50	75	<0.0001	<0.0001	<0.0001
	SE	3.6	3.1	2.7	2.3	2.1	1.3			
Bread	Mean	84	87	85	86	69	82	0.733	<0.0001	<0.0001
	SE	2.0	1.8	1.7	1.7	1.5	0.8			
Total meat (including from composite dishes)	Mean	90	97	101	106	102	99	<0.0001	<0.0001	0.847
	SE	2.7	2.2	2.1	2.2	2.1	1.0			
Total red meat (including from composite dishes)	Mean	55	65	68	71	69	66	<0.0001	<0.0001	0.665
	SE	1.8	1.8	1.8	1.9	1.7	0.8			
Total fish (including from composite dishes)	Mean	24	23	23	21	17	22	0.401	<0.0001	<0.0001
	SE	1.2	1.0	1.0	0.9	0.8	0.4			
Oil-rich fish (including from composite dishes)	Mean	10	9	8	6	4	7	0.028	<0.0001	<0.0001
	SE	0.7	0.6	0.6	0.6	0.5	0.3			
Total milk and yogurt	Mean	178	209	197	184	154	184	0.014	0.002	<0.0001
	SE	5.4	5.8	5.4	5.5	4.9	2.4			
Eggs and egg dishes	Mean	21	17	18	18	16	18	0.024	0.001	0.31
	SE	1.9	0.9	0.9	0.9	0.8	0.5			
Cheese	Mean	14	17	14	13	10	14	0.652	<0.0001	<0.0001
	SE	0.7	0.7	0.6	0.6	0.5	0.3			
Biscuits, cakes and confectionery	Mean	43	55	49	44	34	45	0.004	<0.0001	<0.0001
	SE	1.5	1.6	1.5	1.4	1.2	0.7			
Breakfast cereals	Mean	28	33	30	27	24	28	0.552	0.076	0.018
	SE	1.7	2.0	1.6	1.4	1.4	0.7			
Tea, coffee and water	Mean	985	993	971	920	864	947	0.643	<0.0001	0.001
	SE	23	24	23	21	22	10			
Soft drinks low calorie	Mean	89	114	105	129	128	113	0.170	0.001	0.057
	SE	7.8	7.7	7.8	8.9	10.2	3.8			
Soft drinks not low calorie	Mean	115	134	120	133	162	133	0.677	<0.0001	<0.0001
	SE	7.8	7.6	7.0	7.3	8.8	3.5			
Total vegetables	Mean	187	180	167	158	135	166	<0.0001	<0.0001	<0.0001
	SE	4.2	3.8	3.4	3.1	3.0	1.6			
Fruit	Mean	105	122	95	88	61	94	0.049	<0.0001	<0.0001
	SE	3.7	4.1	3.2	3.3	2.7	1.6			
5 A DAY portions (portions/day)*	Mean	4.5	4.8	4.1	3.9	3.1	4.1	0.002	<0.0001	<0.0001
	SE	0.09	0.1	0.08	0.08	0.07	0.04			

*Data for individuals aged 11+ years.

SE, standard error.

tionery but more fish, fruit and vegetables than Q3 potato consumers. Potato consumption has been associated with a Western dietary pattern in other epidemiological studies and with poorer diet quality (Piernas *et al*. 2014; Zazpe *et al*. 2014). Therefore the lower micronutrient intakes observed in Q5 might reflect the overall less healthy, varied dietary pattern of high potato consumers, rather than an effect of potato consumption *per se*. Conversely, low consumption of potatoes might have contributed directly to the lower intakes of some micronutrients (thiamine, potassium and vitamin B_6) observed in Q1 despite an apparently health-conscious dietary pattern (higher consumption of fruit and vegetables and oil-rich fish).

Clarifications are needed with regard to the interpretation of these results. As these data are cross-sectional, the associations between potato intake and food patterns cannot be assumed to be causal (*i.e.* consumption of potatoes does not necessarily lead to higher intake of soft drinks or meat or a lower intake of vegetables). Conclusions regarding the nutritional contribution of potatoes are only as robust as the intake assessment and compositional data allow. The estimates for fat contributed by potatoes include the fats and oils used in frying chips, roast and fried potatoes, butter/spread/milk in mashed potatoes, jacket potatoes *etc*. However, as shown in our previous paper, the *NDNS* may slightly overestimate the saturated and *trans* fatty acid content of some potato products by not capturing recent changes in formulation (Gibson & Kurilich 2013). The same applies to ongoing reductions in sodium content of potato products. On the other hand, total sodium intake is underestimated in *NDNS* diet records because discretionary use of salt is not quantified.

In the US, potatoes are seen as a white vegetable and a way to increase total vegetable intake (Weaver & Marr 2013). Although a similar case could be made in the UK, potatoes are currently excluded from the 5 A DAY target. To help raise intakes of shortfall nutrients such as potassium and fibre, consumption of potatoes could be encouraged alongside existing healthy eating messages relating to vegetables, fruit and wholegrain foods. Our study suggests that based on current habits, a broad range of potato consumption is compatible with good nutrition, while high reliance on potatoes may be associated with an unbalanced diet. Fibre intakes could be improved by consuming potatoes with their skin while high-fat and high-salt potato dishes should not be consumed too often. Given growing consumer interest in healthy eating and cooking from scratch, there may be opportunities to integrate more potatoes and vegetable dishes into the diet in ways that reduce dietary energy density and boost potassium and fibre intakes. Further analysis of dietary patterns may provide more insights into consumer behaviours that can help tailor solutions and target advice appropriately.

Conflict of interest

This further analysis of *NDNS* data (NatCen Social Research *et al*. 2014) was supported by the Potato Council. The data creators, depositors or copyright holder and the UK Data Archive bear no responsibility for their further analysis or interpretation. The Potato Council had no role in the analysis or interpretation of data or the drafting of this article. The authors take all responsibility for the work presented and have no conflict of interest to declare.

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