

## NOTE

# Sodium in Commercially Produced Frozen Pizzas

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The possible role of sodium in the etiology of hypertension and disorders of the heart, liver, and kidney has prompted studies to identify and modify foods high in sodium for labeling and other purposes (SCOGS Report 1979; Federal Register 1982). Pizza is one such food, because several sodium-containing ingredients, particularly salt, are used in its preparation. Frozen pizzas are becoming increasingly popular as snacks or meal items. Although several kinds are produced commercially, those containing cheese, hamburger, Canadian bacon, pepperoni, and any combination of these are most popular. This study was designed to determine the content of sodium in frozen pizzas and to identify their major sources of sodium.

### MATERIALS AND METHODS

Three different brands of five types of frozen pizzas were purchased locally (Table I). All represented popular national brands. After thawing, the pizzas were separated manually into three components: crust, cheese/sauce, and toppings. Care was taken during separation to avoid sodium contamination. The separation of cheese and sauce components did not appear feasible. After the components were weighed, the crust and cheese/sauce were freeze-dried and finely ground, and the toppings were minced.

Samples of the separate pizza components were wet-ashed ( $\text{HNO}_3$  and  $\text{HClO}_4$  digestion). An IL (Instrumentation Laboratories, Inc., Lexington, MA) model 251 flame spectrophotometer was used to determine sodium content (Instrumentation Laboratories 1974). The National Bureau of Standards wheat flour was analyzed for sodium to verify the validity of the analytical procedure. Sodium content was calculated as total content in pizza as purchased, and per 100 g of each component.

### RESULTS AND DISCUSSION

Product information for the pizzas sampled is shown in Table I. With few exceptions, product label weights differed less than 15 g from the measured weights shown. The percents of pizza components varied among manufacturers and types of pizzas tested. Crust was the major component of all pizzas examined, averaging more than 50% of total weight for all types. The next highest component was cheese/sauce, with average percentages of 27–37. Toppings constituted about one tenth of bacon and pepperoni pizzas and about two tenths of hamburger and combination types.

In all pizza types, crust is the major contributor of sodium (Table II). This contribution however, is proportional to the percent crust weights. Average weights of the crust ranged from 52 to 63% of the total pizza weight (Table I), and its sodium contribution from 46 to 58% (Table II). In proportion to their percent weight, about one third of the total sodium in pizza is contributed by the cheese/sauce component; this contribution in cheese pizza is obviously higher. Bacon and pepperoni toppings contribute sodium in excess of their proportional weights in the single-ingredient and combination pizzas. Contribution by these toppings is less when they are used sparingly, as seems to be the case for bacon pizza B and combination pizza E (Table I).

Based on the information presented in Table II, frozen pizzas

cannot be considered moderately low or even moderate in sodium content, in spite of sizable variations between types and brands sampled. On an as-purchased basis, a 100-g (3.5 oz) portion of pizza contains an average of 524 mg (cheese type) to 742 mg (pepperoni type) sodium (Table II). Appledorf and Kelly (1979) reported values of 462–628 mg sodium in a 100-g portion of freshly baked cheese pizza. For a similar portion, Watt and Merrill (1963), reported values of 702 mg for cheese pizza and 729 mg for sausage pizza.

In present studies, a 7-oz unbaked portion (same as a 6-oz baked portion) considered as one serving would supply 1,048–1,484 mg sodium. This means that one serving provides from one third to the full amount of the proposed (Food and Nutrition Board 1980) daily intake of sodium, depending on whether upper or lower limits of intakes are considered (Fig. 1). For individuals on sodium-restricted diets, awareness of the sodium content of pizza products is important in meal planning. One serving of pizza would fall within the limits of mild (2,000–3,000 mg per day) and moderate (1,000–1,500 mg per day) sodium restrictions (Federal Register 1982) if other high-sodium foods were avoided on the day of pizza consumption. For those on severe and extreme sodium-restricted diets, frequent inclusion of pizza in the diet might be harmful. For these individuals, pizza products can be acceptable only if their sodium content can be reduced. Some reduction in sodium may be technologically feasible without compromising consumer acceptance, but substantial reduction may pose many problems.

Added sodium chloride is the major contributor of sodium in pizza. Other sources are sodium stearoyl lactylate, sodium sulfite, baking soda, baking powder, sodium citrate, sodium phosphate, sodium aluminium phosphate, sodium nitrite, sodium ascorbate, and monosodium glutamate. Because of their modest use, these

**TABLE I**  
Product Description of Test Pizzas

Type	Pizza		Percent of Components		
	Brand <sup>a</sup>	Weight <sup>b</sup> (g)	Crust	Cheese/Sauce	Toppings
Cheese	A	362	61	39	...
	B	360	69	31	...
	C	338	58	42	...
	Average		63 ± 6	37 ± 6	
Hamburger	D	643	52	30	18
	A	416	61	22	17
	C	346	44	36	20
	Average		52 ± 9	29 ± 7	18 ± 2
Bacon	A	325	53	35	12
	B	369	68	26	6
	C	379	56	31	13
	Average		59 ± 8	31 ± 5	10 ± 4
Pepperoni	A	419	59	29	12
	C	346	63	27	10
	E	350	57	33	10
	Average		60 ± 3	30 ± 3	11 ± 1
Combination	A	465	45	26	29
	B	389	70	16	14
	E	394	49	40	11
	Average		55 ± 13	27 ± 12	18 ± 10

<sup>a</sup>Nationally popular brands, as purchased. One sample per brand was obtained.

<sup>b</sup>Based on sum weights of separated components.

TABLE II  
Sodium Content of Pizzas and Pizza Components<sup>a</sup>

Pizza		Sodium (mg)									
Type	Brand	Per 100 g Pizza <sup>b</sup>						Per 100 g Components			
		Crust		Cheese/Sauce		Toppings		Total	Crust	Cheese/Sauce	Toppings
Cheese	A	328	(54)	279	(46)	...	...	607	541	709	...
	B	299	(63)	173	(37)	...	472	431	564	...	...
	C	279	(56)	215	(44)	...	494	479	515	...	...
	Average	302 ± 25	(58 ± 5)	222 ± 53	(42 ± 5)	...	...	524 ± 72	484 ± 55	596 ± 101	...
Hamburger	D	336	(54)	189	(30)	103	(16)	628	645	633	575
	A	276	(52)	158	(30)	100	(18)	534	450	717	603
	C	268	(40)	265	(40)	138	(20)	671	607	727	710
	Average	293 ± 37	(49 ± 8)	204 ± 55	(33 ± 6)	114 ± 21	(18 ± 2)	611 ± 70	567 ± 103	692 ± 52	629 ± 71
Bacon	A	334	(43)	316	(40)	131	(17)	781	629	901	1,101
	B	286	(50)	217	(38)	71	(12)	574	419	841	1,186
	C	304	(44)	252	(37)	127	(19)	683	539	811	1,015
	Average	308 ± 24	(46 ± 4)	262 ± 50	(38 ± 2)	110 ± 34	(16 ± 4)	679 ± 104	529 ± 105	851 ± 46	1,101 ± 86
Pepperoni	A	393	(49)	128	(26)	201	(25)	802	664	726	1,646
	C	348	(49)	241	(34)	124	(17)	713	549	874	1,282
	E	331	(46)	214	(30)	167	(24)	712	584	649	1,614
	Average	357 ± 32	(48 ± 2)	221 ± 18	(30 ± 4)	164 ± 39	(22 ± 4)	742 ± 52	599 ± 59	750 ± 114	1,514 ± 202
Combination	A	290	(45)	181	(28)	170	(27)	641	646	692	588
	B	317	(57)	115	(21)	123	(22)	555	454	732	853
	E	264	(42)	265	(42)	102	(16)	631	539	658	939
	Average	290 ± 27	(48 ± 8)	187 ± 75	(30 ± 11)	132 ± 35	(22 ± 6)	609 ± 47	546 ± 96	694 ± 37	793 ± 183

<sup>a</sup> As purchased.

<sup>b</sup> Values within parentheses represent percent total sodium.

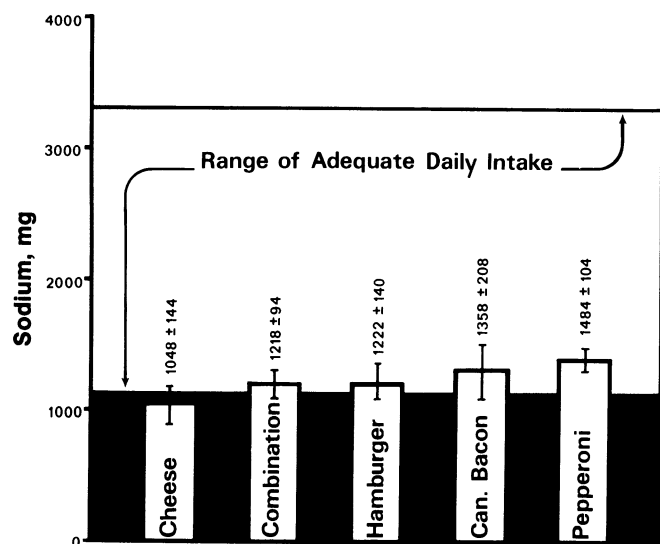


Fig. 1. The contribution of sodium in a 200-g serving (as-purchased basis) of various pizzas to meet adequate and safe daily sodium intakes. The values on bars indicate mean ± standard deviation of the three brands tested.

sources do not contribute substantially to the sodium content. Sodium contribution from these sources can be reduced, however, in conjunction with reduction of salt, by using alternative functional sources. For example, calcium stearoyl lactylate could be substituted for sodium analog, L-cysteine for sodium sulfite, potassium bicarbonate for sodium analog, and potassium chloride for salt.

## CONCLUSIONS

Frozen pizzas and their major components are relatively high in sodium. On the average, a 200-g portion contains 1,048 (cheese), 1,218 (combination), 1,222 (hamburger), 1,358 (bacon), and 1,484 (pepperoni) mg sodium. For the five types tested, the crust and cheese/sauce components contribute sodium proportional to their percent weights in the total pizza. In bacon and pepperoni pizzas, but not in other types, the toppings contribute sodium in excess of their proportional weights. Development of low-sodium pizza may be necessary for prudent consumption of this food by people on sodium-restricted diets.

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