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Diet in residents of East and West Germany in 1991–1992 as ascertained by a retrospective food frequency questionnaire

Summary

In this study, we compared dietary habits of residents in East (N = 76) and West Germany (N = 266) using results obtained in 1992–1993 from a retrospective semi-quantitative food frequency questionnaire referring to 1991–1992. Nutrient intakes were calculated based on the German Federal Food Code. Univariate and multivariate logistic regression was used to determine whether dietary intakes varied according to residence in East and West Germany. At the food level, East German subjects reported a higher consumption of bread, spreadable fat, and sausage, whereas West German participants reported a higher intake of fruit, vegetables, and pasta and rice. At the macronutrient level, energy intake did not differ significantly between groups, nor did the percent contribution of protein, carbohydrate, fat, and alcohol to total energy intake. East German participants had a lower total water and fibre intake, the latter significant only after adjustment for confounders. At the micronutrient level, East German participants had a higher intake of cobalamin, retinol and retinol-equivalents (but not of beta-carotene). There were no differences in the intake of vitamins C, D, and E between groups. Less salt and more potassium, calcium, magnesium and zinc were consumed by West than by East German subjects. Overall, both groups showed disadvantageous dietary patterns. The results are discussed in the context of an overview of other dietary surveys performed in the two parts of Germany before and after reunification. In general our results are consistent with other observations showing that dietary habits in East Germany rapidly approached those in West Germany after reunification, although some residual differences seemed to persist.

The availability of foods in the former German Democratic Republic (GDR) differed markedly from that in the West German market economy[1, 2]. The GDR gave priority to the provision of generally heavily subsidized basic food items (particularly bread, potatoes, legumes, rice, pasta, but also sugar, fish and cheese). The variety of available foods was limited and subject to regional and seasonal fluctuations[3]. Losses (such as due to spoilage and feeding of foodstuffs to animals) were high[4]. Participation in canteen feeding was very common in the GDR[2, 5].

A description of the quasi-experimental dietary situation in the separate German states and its development after reunification is warranted in its own right, but also because of the manifold associations between diet and health. Here we describe the dietary intake in two groups of individuals from the former GDR and West Germany shortly after reunification. These results are then compared to existing data on differences in dietary habits between East and West Germany before and after German reunification.

Methods

Dietary habits were assessed and compared in East and West German residents who participated in the German Parkinson's Disease Study as controls[6–8]. One of the aims of this hospital-based case-control study was to compare dietary habits of patients with Parkinson's disease (PD) with those of age- (± 3 years) and sex-matched controls. The patients were recruited from seven clinics in

West Germany serving PD patients from Northern Germany (Lübeck, Hamburg and Hannover), Western Germany (Düsseldorf) and Southern Germany (Karlsruhe and Munich), as well as a large speciality clinic in Kassel, Hesse that served PD patients from all parts of Germany in addition to those from the surrounding area. The two participating clinics in the former GDR served large areas of Mecklenburg-Vorpommern and Saxony Anhalt.
A random route process[9] was used to recruit one control from the same neighbourhood (N = 379) and a second control from the same urban or rural region (N = 376) as each patient (N = 382).
Experienced interviewers were contracted with Infratest/Epidemiologische Forschung Berlin, a sociologic and health research institute, to carry out a detailed structured interview regarding environmental exposures and dietary habits. Controls were asked to participate in a health survey; they were unaware that the study dealt with risk factors for PD. A self-administered food frequency questionnaire (FFQ) was implemented for the documentation of dietary habits[10–12]. This FFQ contains 148 food items with pictures of portion sizes. Correlation coefficients comparing dietary intakes from the FFQ with those from 24-hour dietary recalls compare favourably with those reported for other FFQs in the literature. The interviewers gave participants detailed instructions on filling out the FFQ and returned personally to pick up the questionnaire and to help the subjects with any problems they may have had. The data collection took place between December 1992 and August 1993. Controls were asked to recall their dietary habits as they had been one year prior to the interview, which thus corresponds to the period December 1991 – August 1992. Responses on the FFQ were linked with the latest version of the German Federal Food Code II.2[13], revised after German reunification, to estimate the nutrient composition of the diet.
For financial reasons, the FFQ was only administered to the neighbourhood controls. If that person declined to fill out the questionnaire, the regional control was asked (53 cases). In total, data from 342 of the participating controls were available for analysis. Neither patients or controls who declined to fill out the FFQ differed from participating cases or controls in terms of age, sex, body mass index (BMI; weight/height^2) or smoking habits. The analysis presented here is confined to data obtained from controls, since the diet of PD patients differed from that of the controls[6,7] and may thus not accurately reflect differences between East and West German participants.
Data were compiled in a relational databank using the SIR 3.1 Database System. Data analysis was carried out using SPSS 8.0 for Windows. To determine whether food and nutrient intakes differed according to residence in East or West Germany, univariate logistic regression analysis was performed using "East/West status" as the dependent variable and the intake variable as the independent variable. The p-values for the significance of the intake variables (regressands) are reported as an indication of whether food intake was statistically significantly associated with residence in either East or West Germany. A multivariate analysis was additionally performed in order to adjust for energy intake by including it as a covariate in the regression equation[14], as well as to adjust for potential confounders. As subjects from East Germany were on average two years older and had a higher BMI than those from West Germany, and as smoking was more common among subjects from West Germany, age, BMI and smoking were included as covariates in each logistic regression equation in addition to energy intake. There was no evidence for confounding related to the sex or educational status of the participants. No adjustment was made for multiple comparisons.

Results

The characteristics of the study population are shown in Table 1. At the food groups level, subjects from West Germany reported a significantly higher intake of rice and pasta and salty snacks; their counterparts from East Germany reported a higher intake of bread (Table 2). Subjects from West Germany ate significantly more raw as well as cooked vegetables and more fruit than those from former East Germany, although the latter was not statistically significant (p = 0.06 in the multivariate analysis). Less meat, but more meat products were consumed by East German participants, although these differences failed to reach statistical significance. East Germans consumed significantly more spreadable fat than West Germans. The intake of sweets, eggs, potatoes, legumes, milk and milk products, nuts, coffee, tea, or alcoholic beverages was not found to be predictive of residence in either East or West Germany. However, in the univariate analysis, the higher coffee intake among West German subjects approached statistical significance (p = 0.08).
At the macronutrient level (Table 3) subjects from East and West Germany did not differ in terms of their energy, carbohydrate or fat intake. The energy composition of the diet did not differ significantly between the West and East German participants. After adjustment for total energy intake, age, BMI, and smoking, the intake of protein and fibre was significantly lower in East German than West German subjects. Subjects from East Germany had a significantly lower total water intake. There was no dif-

Characteristic	West Germany	East Germany	
Age			
mean ± SD	55.6 ± 7.2	57.6 ± 5.7	p = 0.01†
min – max; median	29–69; 56	36–69; 58	
Sex	*N (%)*	*N (%)*	
Male	175 (65.8)	49 (64.5)	
Female	91 (34.2)	27 (35.5)	p = 0.94*
Education	*N (%)*	*N (%)*	
< 10 years of schooling	180 (67.7)	53 (69.7)	
> 10 years of schooling	53 (19.9)	12 (15.8)	
High school education	33 (12.4)	11 (14.5)	
Total	266 (100)	76 (100)	p = 0.68*
Family status	*N (%)*	*N (%)*	
Single	7 (2.6)	2 (2.6)	
Married	230 (86.5)	69 (90.8)	
Divorced	11 (4.1)	1 (1.3)	
Widowed	18 (6.8)	4 (5.3)	
Total	266 (100)	76 (100)	p = 0.64*
Smoking			
Pack-years (mean ± SD)	19.1 ± 63.5	10.7 ± 13.0	p = 0.25†
Smoking	*N (%)*	*N (%)*	
Never	101 (38.0)	36 (47.4)	
Ever	165 (62.0)	40 (52.6)	p = 0.18*
BMI			
mean ± SD	26.2 ± 3.6	27.3 ± 3.8	p = 0.03†
Overweight	*N (%)*	*N (%)*	
Men	21 (12.0)	11 (22.4)	
Women	21 (23.1)	10 (37.0)	p = 0.03*

† Student's t-test.
* Chi-Square.
BMI = body mass index (weight / height^2); overweight: BMI > 30 kg/m^2 in men and BMI > 29 kg/m^2 in women.

Table 1. *Characteristics of the study population.*

ference in alcohol intake between groups. The intake of mono-, di-, or polysaccharides was also similar among West and East German subjects. The fat composition of the diet and cholesterol intake were also comparable. The P/S-ratio (ratio of polysaturated fat to saturated fat intake) was on average 0.31 among the subjects from West Germany and 0.33 among those from the former GDR. At the micronutrient level (Table 3), the higher intake of retinol equivalents among East German subjects was due to their higher retinol (but not beta-carotene) intake. They also had a higher intake of vitamin B-12 than their West German counterparts. No differences were observed in the intake of other B vitamins, or in vitamins C, D, and E. The subjects from West Germany had a higher vitamin K intake than those from the former GDR. East German subjects consumed more sodium and chloride, but less potassium, calcium and magnesium than West German participants. There was no difference in iron intake between groups. Iodine intake derived from diet alone was higher among West German participants. This is largely due to their higher intake of milk and milk products, vegetables and fruit. However, as the intake of iodinised salt was not obtained, it is not possible to compare the intake of total iodine between East and West German participants. Vitamin or mineral supplement intake was reported by 9.2% of East German and 13.2% of West German participants. The difference was not statistically significant.

Discussion

This comparison of dietary habits in West Germany and the former GDR was made possible by analysis of data obtained from control subjects participating in a study investigating risk factors for PD. This ensured that the data collection occurred simultaneously in the two parts of Germany using identical methodology. Although control subjects were not selected randomly, as they were matched to PD patients with respect to place of residence, age and sex, they were independently living persons recruited according to a uniform method in both study regions. They ranged in age from 36 to 69 years in

Food intake (g/day)	West (N = 266)		East (N = 76)		Logistic regression analysis; p-value for intake variable	
	Mean ± SD	Median	Mean ± SD	Median	Crude	Adjusted*
Bread	174.0 ± 78.6	171.4	196.6 ± 63.5	185.5	0.02	0.006
Rice and pasta	45.3 ± 37.7	36.7	26.5 ± 25.9	20.2	0.0001	< 0.00005
Salty snacks	15.4 ± 19.4	8.8	6.75 ± 9.78	2.7	0.0003	0.001
Sweet baked goods	63.9 ± 53.1	49.6	57.4 ± 55.8	39.1	0.35	0.29
Sweets	22.4 ± 22.2	15.2	17.9 ± 16.3	11.4	0.10	0.28
Eggs	19.6 ± 19.6	14.7	17.8 ± 15.7	14.4	0.49	0.53
Fruit	141.2 ± 129.5	115.4	117.1 ± 83.0	94.0	0.12	0.06
Raw vegetables	82.3 ± 62.5	67.4	58.4 ± 49.5	45.9	0.003	0.003
Cooked vegetables	96.7 ± 69.6	79.4	77.0 ± 55.9	58.1	0.03	0.03
Legumes	23.1 ± 23.8	16.1	24.7 ± 19.3	19.9	0.61	0.43
Potatoes	116.8 ± 60.0	113.7	123.4 ± 56.8	113.0	0.39	0.40
Nuts	3.44 ± 7.17	0.82	2.66 ± 6.31	0.14	0.40	0.46
Milk and milk products	183.1 ± 167.2	137.6	173.6 ± 168.0	113.2	0.66	0.84
Cheese/Quark	37.2 ± 26.6	32.7	37.2 ± 30.5	24.5	0.99	0.93
Coffee	416.6 ± 289.5	450.0	351.8 ± 234.7	300.0	0.08	0.19
Tea	73.5 ± 132.1	9.9	57.8 ± 121.2	4.9	0.35	0.27
Beer	253.9 ± 338.8	82.2	275.9 ± 348.6	142.5	0.62	0.14
Wine	33.0 ± 55.1	8.2	22.9 ± 37.8	4.1	0.14	0.24
Spirits	2.65 ± 5.32	0.22	2.58 ± 4.93	0.0	0.92	0.68
Spreadable fat	29.1 ± 19.3	23.6	34.3 ± 19.3	31.2	0.04	0.01
Sauces	10.8 ± 8.7	8.6	9.48 ± 8.78	6.0	0.24	0.29
Desserts	32.7 ± 36.9	20.0	37.1 ± 41.0	23.6	0.37	0.40
Fish	18.6 ± 18.1	13.9	21.3 ± 19.4	14.3	0.25	0.34
Meat	65.6 ± 42.4	58.8	57.8 ± 27.8	56.0	0.13	0.13
Meat products	80.9 ± 62.3	66.0	92.3 ± 64.1	71.8	0.17	0.07
Soups	73.5 ± 71.3	53.1	67.6 ± 62.7	49.8	0.52	0.71

* for energy intake, smoking in pack-years, age and BMI.

Table 2. *Food intake among West and East German participants.*

the former GDR and from 29 to 69 years in West Germany. Therefore, the comparison of dietary habits between these groups is a methodically valuable contribution to the description of dietary differences in the two parts of Germany, even though the participants may not be entirely representative of the East and West German populations.

The magnitude of the food and nutrient intakes in our study are generally comparable with the dietary surveys carried out in Erfurt in 1991[15,16] and Augsburg in 1994–1995[17] respectively. Our intake values tended to be slightly higher, which is likely related to differences in the methodology of dietary assessment – an FFQ eliciting information on a large number of foods tends to yield higher intake estimates[18]. However, a scaling bias within the dietary assessment instrument has no drawbacks for the comparison between two groups. In addition, one must note that our analysis was performed using a later version of the German Federal Food Code.

We would like to place these results in the context of other dietary surveys performed in East and West Germany before and after reunification. Data on dietary habits were collected from subjects in the former GDR and West Germany before and after reunification in a number of studies (Table 4 a and b). Some authors based comparisons of dietary habits in the two parts of Germany at various points in time on these data[17,19–23]; others have attempted to show changes over time[24–27]. Usual regional dietary heterogeneity and methodical differences in the collection, analysis and presentation of these data (see Table 4) must be considered in the interpretation of the results.

Nutrient intake per day	West (N = 266)		East (N = 76)		Logistic regression analysis; p-value for intake variable	
	Mean ± SD	Median	Mean ± SD	Median	Crude	Adjusted*
Energy (kjoule)	9629 ± 3346	8997	9412 ± 3445	8734	0.62	–
Energy (kcal)	2298 ± 799	2147	2246 ± 822	2084	–	–
Energy from protein (%)	*15.2 ± 2.7*	*14.7*	*14.6 ± 1.9*	*14.6*	*0.21*	–
Energy from carbohydrate (%)	*41.5 ± 6.7*	*41.6*	*41.9 ± 6.6*	*43.0*	*0.53*	–
Energy from fat (%)	*38.5 ± 6.0*	*38.9*	*38.7 ± 6.3*	*39.2*	*0.95*	–
Energy from alcohol (%)	*4.8 ± 4.5*	*3.5*	*4.8 ± 4.7*	*3.9*	*0.96*	–
Protein (g)	86.2 ± 29.6	82.1	81.4 ± 28.2	78.3	0.21	0.04
Fat (g)	97.2 ± 39.6	89.4	96.8 ± 44.7	82.1	0.95	0.51
Carbohydrate (g)	237.7 ± 87.3	223.0	230.8 ± 79.8	213.0	0.53	0.70
Fiber (g)	24.7 ± 9.1	23.5	22.9 ± 7.7	22.8	0.12	0.04
Total water (l)	2.31 ± 0.69	2.20	2.04 ± 0.63	1.99	0.004	0.0005
Ethanol (g)	15.7 ± 15.8	10.9	15.8 ± 15.7	12.1	0.96	0.29
Retinol equivalents (mg)	1.79 ± 0.99	1.60	2.11 ± 1.28	1.87	0.02	0.0009
Retinol (mg)	1.18 ± 0.81	0.960	1.69 ± 1.16	1.55	0.0001	< 0.00005
Beta-carotene (mg)	3.88 ± 2.42	3.12	3.42 ± 2.42	2.75	0.15	0.11
Vitamin D (µg)	4.33 ± 2.54	3.72	4.44 ± 2.71	4.09	0.76	0.71
Tocopherol equivalents (mg)	12.6 ± 6.03	11.2	12.8 ± 7.18	11.0	0.80	0.59
Alpha-Tocopherol (mg)	10.2 ± 5.24	8.87	10.2 ± 6.46	8.11	0.98	0.87
Vitamin K (µg)	415.3 ± 173.5	387.0	355.7 ± 167.2	315.5	0.009	0.011
Thiamine (mg)	1.52 ± 0.62	1.36	1.59 ± 0.67	1.54	0.39	0.10
Riboflavin (mg)	1.85 ± 0.69	1.73	1.91 ± 0.81	1.74	0.48	0.07
Niacin (mg)	18.5 ± 6.68	17.2	18.8 ± 6.56	17.6	0.79	0.17
Niacin equivalents (mg)	34.7 ± 11.6	32.6	34.0 ± 11.2	31.9	0.66	0.999
Pantothenic acid (mg)	5.83 ± 2.20	5.43	6.04 ± 2.61	5.42	0.48	0.08
Pyridoxine (mg)	1.93 ± 0.71	1.79	1.96 ± 0.77	1.84	0.80	0.37
Biotin (µg)	54.5 ± 24.7	49.6	56.1 ± 31.1	45.7	0.64	0.32
Free folic acid equiv. (µg)	177.3 ± 100.3	152.0	189.5 ± 127.1	146.5	0.38	0.21
Total folic acid (µg)	387.3 ± 183.8	341.0	392.9 ± 195.2	350.0	0.82	0.44
Free folic acid (µg)	126.6 ± 87.7	99	140.0 ± 118.4	98.5	0.28	0.19
Cobalamin (µg)	6.87 ± 3.38	6.35	7.86 ± 4.01	7.4	0.04	0.002
Vitamin C (mg)	132.2 ± 69.9	115.9	126.4 ± 67.9	120.2	0.52	0.39
Sodium (g)	2.68 ± 1.00	2.47	2.82 ± 1.12	2.56	0.32	0.009
Chloride	4.47 ± 1.53	4.04	4.90 ± 1.51	4.15	0.38	0.01
Potassium (g)	3.28 ± 1.05	3.12	3.08 ± 0.98	2.94	0.15	0.03
Calcium (mg)	840 ± 320	820	760 ± 330	710	0.048	0.02
Magnesium (g)	0.38 ± 0.12	0.36	0.35 ± 0.11	0.35	0.10	0.008
Phosphorus (g)	1.45 ± 0.48	1.38	1.38 ± 0.48	1.32	0.23	0.08
Zinc	12.8 ± 4.2	12.4	11.8 ± 3.9	11.1	0.06	0.002
Iron (g)	15.4 ± 5.22	14.7	14.7 ± 4.97	13.9	0.34	0.18
Iodine (µg)	102.5 ± 32.6	101.4	92.3 ± 35.8	86.6	0.02	0.001
Monosaccharides (g)	37.5 ± 21.5	33.1	34.0 ± 18.5	27.7	0.20	0.10
Disaccharides (g)	67.8 ± 33.9	60.2	62.7 ± 37.0	50.6	0.26	0.26
Polysaccharides (g)	122.4 ± 45.5	115.5	123.1 ± 34.4	125.0	0.90	0.52
Saturated fatty acids (g)	42.5 ± 17.7	39.0	41.7 ± 20.49	35.4	0.76	0.95
Monounsaturated fatty acids (g)	35.4 ± 15.0	32.1	35.7 ± 16.8	31.9	0.86	0.25
Linoleic acid (g)	10.58 ± 4.98	9.17	10.75 ± 4.97	10.2	0.80	0.37
Linolenic acid (g)	1.67 ± 0.67	1.53	1.60 ± 0.68	1.50	0.45	0.24
Polyunsaturated fatty acids (g)	12.8 ± 5.81	11.3	13.0 ± 5.94	12.3	0.61	0.24
P/S-Quotient	0.31 ± 0.10	0.30	0.33 ± 0.12	0.31	0.32	–
Cholesterol (mg)	381.5 ± 163.4	0.35	365.3 ± 187.2	0.29	0.46	0.32

* for energy intake, smoking in pack-years, age and BMI.

Table 3. *Nutrient intake among West and East German participants.*

Studies (East Germany)	Subjects	Response rate (%)	Age distribution	Survey method	Data analysis	Key results (nutrient level) (Mean values are presented, as median values were not available in all studies)
GDR-MONICA-Survey 1984 [3, 28–30]	Representative sample of 434 M and 557 W from 11 districts in the GDR	82.5 [3]	25–64 years	3-day dietary records with weighing and use of household measures for 60 designated foods/ food groups [49]	Linkage with food composition tables appropriate to the food spectrum available in the GDR [50]	Energy intake (M/W): 3220/2260 kcal/day, with 43.0/44.9 en% from fat (P/S-quotient of 0.26); 38.3/40.0 en% from carbohydrate; 12.2/12.8 en% from protein; 6.5/2.2 en% from alcohol. Mean cholestrerol intake was 552/434 mg/d. The intake of vitamins C, B1, B2, A, calcium and potassium was below recommendations [1] among ca. 50% and more subjects; the majority of W had inadequate iron intake. Salt intake was excessive at a mean of 5.4/5.3 mg sodium/d.
GDR-MONICA-Survey 1988 [3, 21, 22, 29, 30]	Representative sample of 464 M and 641 W from 7 districts in the GDR	71	25–64 years	3-day dietary records with weighing and use of household measures for 60 designated foods/ food groups [49]	As above	Energy intake (M/W): 3230/2194 kcal/d, with 41.9/43.9 en% from fat (P/S-quotient 0.30/0.31); 38.5/39.7 en% from carbohydrate; 12.5/13.5 en% from protein; 7.1/2.9 en% from alcohol. Mean cholesterol intake was 533/415 mg/d. In spite of slight improvements (particularly better provision with calcium) the intake of vitamins and minerals remained below recommendations among 50% or more of the participants. Sodium intake decreased to 4.0 g/d (M + F)
Erfurt-MONICA-Survey 1991 [15, 16]	Representative sample of 469 M and 333 W from the city of Erfurt	41.9 (M) 28.2 (W)	20–64 years	Open 3-day dietary records with weighing and use of household measures	Linkage with the internally modified Version 2.1 of the Federal Food Code	Energy intake (M/W): 2624/1916 kcal/d, with 40.0/40.5 en% from fat (P/S-quotient 0.40/0.41); 38.5/41.5 en% from carbohydrate, 15.3/15.8 en% from protein; 6.0/2.1 en% from alcohol. Mean intake of cholesterol was 422/429 mg/d and of fiber, 23/30 g/d. Among M, the mean calcium intake and among W, the mean intake of vitamins E and B2, calcium, magnesium and iron were below recommendations.
Dresden Cardiovascular risk and nutrition study (DRECAN)-1990–1991 [38, 41]	Sample of 807 M; 1331 W employed in factories and institutions in the city of Dresden	50	16–65 years	Quantitative food frequency interview referring to the current diet and to the diet prior to reunification, taking into account differences in the food spectrum	Linkage with Version II of the Federal Food Code (current diet); with GDR food composition tables [50] (diet before reunification)	In the retrospective comparison of this study, the energy intake was (M/W) 3113/2332 kcal/d before and 3352/2594 kcal/d after reunification. Fat provided 39.8 en% before and 39.5 en% after; protein 13.8 en% before and 13.4 en% after; carbohydrate 42.6 en% before and 43.7 en% after; alcohol 3.8% before and 3.4 en% after reunification. The fat composition improved (P/S-quotient: 0.35 before and 0.49 after; cholesterol intake in mg/d: 363 before and 332 after). Fiber intake was 22.1 g/d before and 27.8 g/d after reunification.
Potsdam Nutrition Study (December 1990 to December 1991) [40, 44]	Non-representative sample of 64 M, 158 W participated in initial survey; of these, 47 M, 103 W participated in the final survey	–	89% of the subjects were aged 25–60 years	4 open 3-day dietary records with weighing and use of household measures at intervals of 3 months	Linkage with internally modified Version II.1 of the Federal Food Code	The macronutrient composition remained relatively constant during the study period. In December 1991 the mean energy intake was 2728/1967 (M/W) kcal/d, with 39.3/39.2 en% from fat; 14.4 en% (M + W) from protein; 40.5/43.7 en% from 40.5/43.7 en% from carbohydrate; 5.8/2.7 en% from alcohol. The mean intake of cholesterol was 419/324 mg/d and of fiber, 29.2/22.6 g/d. In M, alcohol intake increased by 19.6% and Vitamin A-intake by 13%, while beta-carotene intake decreased by 15.5% during the study period. In W, the intake of alcohol (17.2%), vitamin A (8.3%), and beta-carotene (20.3%) decreased. Among M, the mean intake of folic acid, and among W, the mean intake of calcium, Vitamins E, B1, B2, B6 and folic acid failed to reach recommended levels.

Table 4a. *Dietary surveys in East Germany.*

Studies (East Germany)	Subjects	Response rate (%)	Age distribution	Survey method	Data analysis	Key results (nutrient level) (Mean values are presented, as median values were not available in all studies)
Dietary assessment as part of a health survey in the former GDR in 1991–1992[19,24,25]	Representative sample of 866 M and 950 W from former states of the GDR and East Berlin	Not stated	25–64 years	24 hours dietary recall	Linkage with GDR food composition tables[50]	Compared to results of 24-hour recalls performed as part of the GDR-MONICA Survey 1988/89, energy intake was unchanged in Men and significantly higher in W (quantitative values not given). The contribution of fat to total energy had decreased slightly in M + W, the contribution of protein increased in M and the contribution of carbohydrate increased among W. Although the mean intake of vitamins A, C, E, B1 (only in W) and B2 increased, between 39 and 77 % of the subjects (depending on sex and nutrient) failed to reach recommended intake levels.

M = Men; W = Women.

Table 4a *(continued).*

Surveys performed in the former GDR and in the FRG prior to reunification

Representative cross-sectional dietary surveys were carried out in the GDR as part of the MONICA-(MONItoring of trends and determinants in CArdiovascular Diseases) Project in 1984 and 1988[3,20,22,28–30]. The results of these surveys can be compared to those of the National Food Consumption Survey/Nutrition Survey and Risk Factor Analysis (NVS/VERA) in former West Germany[5,19,21,23,31–34] and to those of the dietary survey of a representative sample of men in Augsburg performed as part of the MONICA-Project in 1984/85[20,22,35,36]. In spite of some limitations in comparability, these data show that diet in the GDR was less favourable than in former West Germany in several respects. Energy intake was higher in the former GDR, with a less favourable fat composition due to the greater consumption of animal products, particularly sausage, and butter. A lower intake of fruit (particularly citrus), vegetables (especially raw), milk, and milk products led to a poorer supply of vitamins and minerals, in particular of vitamin C and calcium, in the GDR. Salt consumption was much higher in the GDR than in former West Germany and lay well above the upper recommended limit of 6 g/day[37] (Table 4).

Changes in dietary habits in the former GDR after reunification

Although the various individual-based surveys that allow a comparison of dietary habits in the former GDR before and after reunification[15,19,24–26,38–41] are heterogeneous with regard to their methodology and representativeness (Table 4a), they reveal the following dietary changes quite consistently: At the food level, the intake of plant derived foods in the form of (particularly raw) vegetables, fruit and whole grain products increased; the intake of meat and meat products decreased, with the exception of poultry consumption, which increased. The consumption of fish, milk products, and eggs also increased. In addition, more plant derived fats were consumed, mainly in the form of margarine. At the nutrient level, total energy intake decreased, but the macronutrient composition improved – if at all – only minimally. Fat composition did improve, however, and cholesterol intake decreased. Vitamin intake also improved, particularly that of vitamin C, as did calcium intake. Available publications do not permit insight into the development of salt intake. Our results suggest that salt consumption remained higher in East Germany than West Germany after reunification.

As summarised by Ulbricht[42] and Knötzsch[43], these changes are also reflected in less quantitative data collected by statistical offices and market-oriented surveys in the former GDR as early as 1990. As the food supply rapidly expanded, leading to comparable food choices in East and West Germany, the per capita consumption of butter, beef, and pork decreased and that of margarine, citrus fruits, vegetables, yoghurt, cheese, whole grain products, and poultry increased. According to surveys, the good taste and the now constant availability of these foods, but also an interest in good nutrition were mainly responsible for these developments. After an initial transitional phase of trying new products for their novelty, cost containment and health awareness played an increasing role in the choice of foods purchased. These aspects likely played an especially important role in the decrease in meat consumption[42–44]. Canteen feeding decreased markedly, while fast food restaurants and kiosks were increasingly frequented[5,44].

Studies (West Germany)	Subjects	Response rate (%)	Age distribution	Survey method	Data analysis	Key results (nutrient level) (Mean values are presented, as median values were not available in all studies)
Heidelberg Health Survey of young men and women[51]	Representative sample of 564 M and 621 W	50 (M) 74 (W)	20–40 years	24-hour dietary recalls Open 7-day dietary records with weighing and use of household measures	Linkage with the German Federal Food Code Version I	Mean energy intake (M/W): 2544/1985 kcal/d, with 44,4/43,8 en % from fat; 12,8 en % from protein (M + F); 34,6/37,5 en % from carbohydrate; 8.7/5.3 en % from alcohol. Mean cholestrol intake was 483/348 mg/d. Salt intake was excessive. The intake of vitamins B1, B2, B6, C, iron (W) and calcium was below recommended levels in 40–89 % of subjects (depending on sex and nutrient)
National nutrition survey (NVS) 1985–1989[3,31,32,34]	Sample of 11'260 M and 12'817 W representative of the entire West German population	71.3	Children and adults of all age groups	Open 7-day dietary records with weighing and use of household measures Food frequency questionnaire	Linkage with the internally modified German Federal Food Code Version I	According to the most recent analysis of NVS-data, the mean energy intake was 2338/1821 kcal/d (M/W), with 39.2/40.0 en % from fat (P/S-quotient of 0.32/0.37; 14.2/14.4 en % from protein; 40.6/42.0 en % from carbohydrate; 5.2/2.7 en % from alcohol. The mean intake of cholesterol was 397/327 mg/d and of fiber, 20.2/17.3 g/d. Results of the VERA study show that for the majority of vitamins and minerals, recommended intake levels were not reached by at least 25 % and subjects (at least 75 % of subjects for calcium, magnesium and zinc). Sodium intake was excessive at 3.2/2.6 g/d.
Nutrition survey and risk factor analysis (VERA[3]) (substudy of the NVS) [31–33]	Representative subsample of the NVS with 854 M; 1134 F	72	18–88 years	In the VERA substudy, biochemical measurements were also performed		
MONICA-Survey Augsburg 1984 /85[35,36]	Representative sample of 899 M from the city of Augsburg *and 2 surrounding districts*	70	45–64 years	Open 7-day dietary records with weighing and use of household measures Food frequency questionnaire (24 items)	Linkage with the German Federal Food Code Version II.1	Mean energy intake: 2609 kcal/d, with 38.1 en % from fat (P/S quotient 0.38); 15.9 en % from protein; 36.6 en % from carbohydrate; 9.4 en % from alcohol. The mean intake of cholesterol was 507 mg/d and of fiber, 20.3 g/d. No data on *vitamin and mineral intake.*
MONICA-Survey Augsburg 1994–95[17,27]	Representative sample of 430 M from the city of Augsburg	71	45–64 years	Open 7-day dietary records with weighing and use of household measures	Linkage with the internally modified German Federal Food Code Version II.1	Mean energy intake: 2520 kcal/d, with 37.9 en % from fat (P/S-quotient 0.43); 16.4 en % from protein; 39 en % from carbohydrate; 6.5 en % from alcohol. The mean intake of cholesterol was 453 mg/d of fiber, 23 g/d. The intake of carotinoids, vitamin E, calcium and magnesium was improved compared to data from 1984/85[27].

[1] Refers to the recommendation of the German Society for Nutrition (Biesalski).
[2] Nationale Verzehrsstudie.
[3] Verbundstudie Ernährungserhebung und Risikofaktoren Analytik.

Table 4b. *Dietary surveys in West Germany.*

Dietary changes in West Germany after reunification

In former West Germany results of dietary surveys performed in 1989/90 and 1994/95 as part of the MONICA-Project in Augsburg also showed positive developments in comparison to results of the survey performed in 1984/85. The frequency of the intake of meat, sausage, eggs, and beer had decreased and that of whole grain products, cooked vegetables, and mineral water had increased by 1989/90[45]. In 1994/95[17,27] the macronutrient composition was more favourable (Table 4b), with a healthier fat composition and decreased alcohol intake. The intake of carotinoids, vitamin E, calcium, and magnesium increased.

Comparison of dietary habits in East and West Germany after reunification

In general, the results of our study are consistent with those of other dietary surveys carried out after German reunification, according to which dietary habits in the former GDR quickly approached those in West Germany following the rapid expansion of the food selection. Our results nonetheless show persistent "residual" differences, in particular with regard to the higher intake of bread, sausage (meat products), and spreadable fat and the lower vegetable and fruit consumption and lower total water intake among East German participants.
A direct comparison of the dietary surveys carried out in urban random samples of men aged 45–64 years in the cities of Erfurt (East Germany) in 1991/92 and in Augsburg (West Germany) in 1994/95 as part of the MONICA-Project[17] revealed an altered spectrum of dietary differences than earlier comparisons[20,22]. Consistent with our results are the higher intake of bread and sausage in Erfurt as compared to Augsburg. The higher consumption of potatoes in Erfurt and the higher intake of pasta and rice in Augsburg probably reflect regional custom. In contrast to our results, no differences were found in vegetable consumption between Erfurt and Augsburg. Similar to our findings, energy, carbohydrate, and fat intake were comparable in Erfurt and Augsburg, and protein intake was lower in Erfurt. At the micronutrient level, the men in Augsburg were better provided with carotinoids, vitamin E, and vitamin C. This can be at least partly explained by the fact that supplements were included in the calculation of nutrient intakes only in the later survey in Augsburg. The authors postulate that the altered spectrum of dietary differences in this latest comparison may reflect regional heterogeneity in eating customs to a greater extent than differences specific to residence in East or West Germany.

Health implications of dietary habits in East and West Germany

Consistent with other German surveys, subjects in our study exhibited a diet typical of western, industrialized societies, the contribution of consumed fat and protein to the total energy intake being too high and that of carbohydrate and fibre, too low. This was true for subjects from East as well as West Germany. In 57.9% of the West German and 50% (p = NS) of the East German participants the energy intake was higher than the age and sex specific recommendations for primarily sedentary activities of the German Nutritional Society[37]. However, a higher percentage of East German (M: 22.4%; W: 37.0%) than West German (M: 15.8%; W: 23.1%) subjects was overweight (BMI > 30 kg/m^2 in men and BMI > 29 kg/m^2 in women). The dietary fat composition with a P/S-ratio of 0.3 was more unfavourable than in other German studies from the same[15,38] or later[17,27] periods, although the cholesterol intake was lower.
In the years prior to reunification, life expectancy in the GDR developed less favourably than in the FRG. Mortality due to cardiovascular disease in particular was higher in the GDR[46,47]. Nutritional differences, but also differences in access to health care, may be explanations for this observation. If sustained, the favourable dietary changes in former East Germany following reunification could have a positive effect on the comparatively higher prevalence of cardiovascular risk factors such as hypertension, hypercholesterolemia, and overweight in the former GDR[47,48] and thereby reduce morbidity and mortality.

Conclusions

Our data are consistent with results from other surveys indicating that dietary habits in the former GDR rapidly approached those in West Germany after reunification. Nonetheless, there were differences in dietary intakes between West German and East German study participants that reflected differences observed in studies undertaken prior to reunification. In particular, East German participants had a higher intake of bread, sausage (meat products), and spreadable fat and a lower vegetable and fruit consumption and lower total water intake than their West German counterparts.

Zusammenfassung

Ernährungsgewohnheiten in einem Ost- und einem Westdeutschen Kollektiv 1991–1992: Erfassung mit einem retrospektiven Häufigkeitsfragebogen

In dieser Studie verglichen wir die Ernährungsgewohnheiten von ost- (N = 76) und westdeutschen Probanden (N = 266) anhand von Ergebnissen einer retrospektiven Ernährungsbefragung über den Zeitraum 1991–1992. Die Nährstoffzufuhr wurde anhand des Bundeslebensmittelschlüssels ermittelt. Der Vergleich wurde mittels einer univariaten und multivariaten Regressionsanalyse durchgeführt. Auf der Lebensmittelebene gaben ostdeutsche Teilnehmer an, mehr Brot, Streichfette und Wurst zu essen, während westdeutsche Teilnehmer einen höheren Verzehr von Obst, Gemüse und Nährmittel angaben. Auf der Makronährstoffebene unterschieden sich die Gruppen weder hinsichtlich der Gesamtenergiezufuhr noch hinsichtlich des prozentualen Energieanteils von Eiweiss, Kohlenhydrate, Fett und Alkohol. Ostdeutsche Teilnehmer nahmen weniger Gesamtwasser und Ballaststoffe zu sich, letzteres nur signifikant nach Adjustierung für Confounder. Auf der Mikronährstoffebene verzehrten ostdeutsche Teilnehmer mehr Kobalamin, Retinol und Retinoläquivalente (aber nicht Beta-Carotin). Es wurde kein Unterschied bei der Vitamin C-, D- und E-Zufuhr beobachtet. Westdeutsche Teilnehmer verzehrten weniger Salz und mehr Kalium, Kalzium, Magnesium und Zink im Vergleich zu ostdeutschen Teilnehmern. Insgesamt hatten beide Gruppen ein ungünstiges Ernährungsmuster. Die Ergebnisse werden diskutiert im Kontext der Ergebnisse anderer Ernährungssurveys aus Ost- und Westdeutschland vor und nach der Wiedervereinigung. Im Allgemeinen stimmen unsere Ergebnisse mit denen anderer Studien überein, nach denen die Ernährungsgewohnheiten in Ostdeutschland mit einigen wenigen Ausnahmen sich denen in Westdeutschland nach der Wiedervereinigung schnell anglichen.

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Résumé

Les habitudes alimentaires des habitants de l'Allemagne de l'ouest et de l'est 1991–1992 vérifié par un questionnaire rétrospective

Dans cette étude, on a comparé les habitudes alimentaires des résidents de l'Allemagne de l'ouest et de l'est en 1991–1992 en utilisant les résultats d'un questionnaire rétrospective. La consommation de nutriments étaient calculé selon le code fédéral alimentaire. La comparaison était faite en utilisant la régression univariate et multivariate. Au niveau des aliments, les résidents de l'Allemagne de l'est ont mangé plus de pain, de gras étendable et de saucisson, les résidents de l'Allemagne de l'ouest ont consommé plus de fruits, de légumes, de pâtes et de ris. Au niveau des macronutriments, la consommation de l'énergie était pareils dans les deux groupes comme aussi la contribution du protéine, des hydrates de carbone, du gras et de l'alcool à l'énergie totale. Les résidents de l'Allemagne de l'est ont consommé moins de l'eau total et moins de fibre. Au niveau des micronutriments, les participants de l'Allemagne de l'est ont consommé plus de cobalamin, rétinol, et l'équivalents de rétinol. Il n'y avait pas de différence entre les deux groupes en ce qui concerne la consommation des vitamines C, D, et E. Les habitants de l'Allemagne de l'ouest ont consommé moins de sel et plus de potassium, calcium, magnésium et zinc. En général, les deux groupes ont manifesté des habitudes alimentaires désavantageuses. Les résultats sont discutés dans le contexte d'autres enquêtes alimentaires exécutées dans les deux parties de l'Allemagne avant et après la réunification. En général, notres résultats sont en accord avec autres observations qui ont montré que, avec peu d'exceptions, les habitudes alimentaires en l'Allemagne de l'est ont rapidement approchées celles en l'Allemagne de l'ouest après la réunification.

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