Diet, Alcohol Consumption and Cognitive Disorders in Central Africa: A Study from the EPIDEMCA Program

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DIET, ALCOHOL CONSUMPTION AND COGNITIVE DISORDERS IN CENTRAL AFRICA: A STUDY FROM THE EPIDEMCA PROGRAM

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Abstract: Western research into dementia has focused on finding effective means of prevention, particularly through nutrition. To date, however, little is known about the relationship between diet and cognitive disorders in Africa, where the number of people with dementia is expected to increase most over the coming decades. The objective of the study was to investigate the relationship between diet and alcohol intake and cognitive disorders among elderly people in Central Africa. Between 2011 and 2012, a cross-sectional multicentre population-based study was carried out in rural and urban areas of the Central African Republic (CAR) and the Republic of Congo (ROC). Participants aged ≥65 years were interviewed using the Community Screening Interview for Dementia (CSI-D). Elderly people who performed poorly (COGSCORE≤24.5/30) were clinically assessed by neurologists and underwent further psychometric testing. DSM-IV and Petersen criteria were required for a diagnosis of dementia or mild cognitive impairment (MCI), respectively. A food frequency questionnaire assessed the intakes of dairy products, fruit, vegetables, starches, legumes, oleaginous foods, meat or fish, eggs and sweet foods over the previous three days. We also collected data on alcohol intake. Sociodemographic, vascular, and psychological factors were documented. Multivariate multinomial logistic regression models were used to estimate the associations. In fully adjusted models, a lower consumption of oleaginous foods was associated with MCI (OR=3.7 [1.4-9.9]) and dementia (OR=2.8 [1.0-7.7]) in a rural area of CAR. Alcohol consumption was associated with reduced probability of dementia in CAR (OR=0.3 [0.1-0.8]). In ROC, food groups and alcohol intake were not associated with MCI or dementia. In conclusion, our study provides new data about the association between diet and cognitive disorders in Africa. Further studies should investigate the relationship between diet and cognitive disorders at the level of specific foods rather than food groups.

Key words: Dementia, mild cognitive impairment, diet, alcohol consumption, Central Africa.

Abbreviations: ANR: Agence nationale de la recherche; CAR: Central African Republic; CI: Confidence Interval; CN: Cognitively normal; CSI-D: Community Screening Interview for Dementia; DSM-IV: Diagnostic and Statistical Manual; EDAC: Etude des démences en Afrique Centrale (Study of dementia in Central Africa); EPIDEMCA: Epidemiology of Dementia in Central Africa; MCI: Mild Cognitive Impairment; OR: Odds ratio; RGPH: Recensement général de la population et de l'habitat; ROC: Republic of Congo; UA: Unit of alcohol.

Introduction

Dementia is growing in prevalence worldwide. The number of cases was estimated at 44.4 million in 2013 and it is expected to reach 135.5 million by 2050 (1). The African continent is no less affected than elsewhere. In 2013, there were an estimated 2.78 million cases, rising to an expected 12.35 million by 2050, i.e. an increase of 344% (1). Although some studies have suggested that dementia is less prevalent in Africa than in Western countries (2), suggesting that environmental factors may play a role, others have found comparable figures, particularly in urban areas (3). Data on the prevalence of mild cognitive impairment (MCI) in Africa are very scarce as only one study provides figures, for South Africa. Ramlall et al. reported a prevalence of 27.1% among participants aged 60 and over and living in residential homes for elderly people administered by a non-governmental organization (4). Little work on MCI and dementia has so far been conducted in this part of the world, despite the fact that dementia is likely to represent a heavy burden for these countries in very few decades.

In the absence of curative treatment, Western research has focused on finding ways to prevent or delay dementia, particularly through nutrition. Nutritional factors identified as potentially protective include: antioxidants, found mainly in fruits and vegetables (vitamins E, C, β-carotene and flavonoids); mono-unsaturated fatty acids, mainly found in vegetable oils; and poly-unsaturated fatty acids n-3 mostly found in fish (5, 6). Moderate alcohol consumption could also protect individuals against the risk of dementia (7). In contrast, high intakes of saturated fatty acids and polyunsaturated fatty acids n-6 could be risk factors (8).

African countries are experiencing a nutritional transition,

particularly in urban areas where diets are becoming more western and therefore richer in sugars and animal products, particularly saturated fats. Such changes are often associated with reduced physical activity, thereby increasing the risk and prevalence of obesity and other chronic diseases such as diabetes, hypertension and cardiovascular disorders (9). As these conditions are risk factors for cognitive disorders in elderly people (10), it is imperative that we understand the role of nutritional factors in the development of cognitive disorders in Africa.

To date, only the Epidémiologie des Démences en Afrique Centrale (EDAC) study investigated the association between diet and dementia in Africa, finding that lower consumptions of fruit and of meat/fish were associated with dementia (11). To date, no studies have investigated the association between diet and MCI in Africa.

The present study investigated the relationship between dietary consumption and alcohol consumption and cognitive disorders among elderly people from rural and urban areas in two Central Africa countries, namely the Central African Republic (CAR) and the Republic of Congo (ROC). The results from the EDAC study, previously conducted in the capitals of CAR and ROC, showed that the frequencies of consumption of the main food groups differed significantly between countries. We therefore postulated that the same would be true in the present investigation. This may be explained by differences in access to food related to variations in socioeconomic profiles and food availability. This study is part of the Epidemiology of Dementia in Central Africa (EPIDEMCA) program, the main objectives of which were to estimate the prevalences of dementia and cognitive disorders in elderly people from rural and urban areas of Central Africa (ROC and CAR) and to evaluate associated factors.

Method

Study Design

The EPIDEMCA survey was a multicenter community-based study conducted in rural and urban areas in CAR and ROC between November 2011 and December 2012 using a cross-sectional two-phase design.

Study areas

Urban areas studied were the capitals of the two countries, namely Bangui in CAR and Brazzaville in ROC. The population of Bangui was estimated at 622,771 inhabitants in 2003 (RGPH 2003), with 1.4% of people aged 65 and above. Brazzaville counted 1,373,382 inhabitants in 2007, representing 37.1% of the total ROC population. People aged 65 and above accounted for 2.3% of Brazzaville's population (RGPH 2007). Rural areas in each country were selected for security and feasibility reasons. In CAR, Nola and villages within a 10-km radius in the prefecture of Sangha-Mbaéré at the southwestern tip of the country were selected. In ROC, Gamboma located in the Gamboma district, Plateaux Region, was selected.

Sample

Inclusion criteria

Subjects aged 65 years and above and currently living in the study area were included unless they declined to participate or presented severe comorbidities precluding cognitive testing - particularly deaf-mute people and bedridden people too frail to be interviewed.

Sample size and selection

The primary objective of the EPIDEMCA program being to estimate dementia prevalence, we aimed to include a minimum of 456 participants from each site in order to detect a prevalence of 5% with a precision of 2% (EpiInfo 6.04, Epiconcept). We rounded up to 500 subjects. In urban areas, the sample was selected using a random sampling proportional to the main city subdivision size. In rural areas, exhaustive sampling using a door-to-door approach was preferred due to logistic and financial constraints.

Ethics

Town halls were informed of the study and neighborhood leaders were visited prior to starting the survey in order to increase awareness. Moreover, information was broadcast on the local radio. Participants were not remunerated, but a few basic drugs (such as analgesics and vermifuges) were distributed after physical examination if necessary, and a more thorough medical examination by a doctor could be proposed.

Approvals were obtained from the Ministry of Public Health in CAR, the CERSSA (Comité d'Ethique de la Recherche en Sciences de Santé) in ROC and Comité de Protection des Personnes du Sud-Ouest et d'Outre-Mer 4 in France. All participants and/or their families gave informed consent before being included in the study.

Assessment of cognitive disorders

During the first phase, cognitive testing was performed using the Community Screening Interview for Dementia (CSI-D) (12) adapted, back-translated and pretested in the local languages (Sango in CAR, Lari, Lingala, and Kituba in ROC). A relative of each elderly person included was interviewed at the same time using the CSI-D informant section to assess daily activities and any personality changes. Every subject with a poor performance in the CSI-D cognitive tests (COGSCORE≤24.5) was recorded as having suspected cognitive impairment and invited for further clinical assessment.

The second phase took place at the hospital 3 to 14 weeks later. Further psychometric tests were conducted, including the Free and Cued Selective Reminding Test (13), Zazzo's cancellation task (14) and Isaac's Set Test of verbal fluency (15). Neurologists performed specialist examinations during which histories of stroke and depressive disorders were sought.

Orientation skills and daily activities were also investigated in order to evaluate the level of dependence.

The diagnosis of dementia was made according to DSM-IV criteria (16) based on, firstly, the development of multiple cognitive deficits manifested by memory impairment plus one of four cognitive disturbances (aphasia, apraxia, agnosia, disordered executive functioning); secondly, these cognitive deficits were required to cause significant impairment in social or occupational functioning (15). The diagnosis of MCI was based on Petersen criteria (17) that include memory complaint, normal activities of daily living, normal general cognitive function, abnormal memory for age and no dementia (16). An experienced neurologist reviewed all medical records and test performances in order to reach a consensus on uncertain cases.

Dietary assessment

During the first phase, a 8-item food frequency questionnaire (FFQ) was administered by interviewers to each individual to assess the frequency of intakes of broad categories of food over the previous three days: dairy products (milk, cheese, yogurt…), fruits, vegetables (tomatoes, carrots, gumbo, avocado, eggplant…), starches (corn, millet, sorghum, rice, wheat, sweet potato, yam, plantain, potato…), legumes (dry bean, chick pea, lentil…), oleaginous foods (peanut, sesame...), meats or fishes, eggs and sweet foods (soda, sugar, honey…). This FFQ was previously used in the EDAC study (11) but also in another study about nutrition and epilepsy (18). In cases where the elderly person was unable to respond, an informant - generally a close relative or someone living with the subject - answered on his or her behalf.

Alcohol consumption assessment

Alcohol consumption was assessed during the first phase using the following question: "How many doses of alcohol do you drink in a normal week?" We considered that one dose of beer was 33 cl; liquor 25 ml and local drinks 500 ml. From these data, we generated the number of units of alcohol (UA) consumed in a normal week (1 UA=10 g).

Other data collected

All covariates were collected during the first phase. Sociodemographic data included age, gender, marital status, formal education and area (urban; rural). Age was ascertained from official documents, or using historical events (19,20) or from an informant if previous methods were unsuccessful. Vascular covariates included smoking status (current non-smoker [including former smoker]; current smoker), body mass index (BMI) (in three categories: <18.50 kg/m^2 for undernutrition; 18.50-24.99 kg/m^2 for normal nutritional status; ≥ 25.00 kg/m^2 for overweight) (21), hypertension (defined as having systolic blood pressure ≥140 mmHg and/ or diastolic blood pressure ≥90 mmHg or currently taking antihypertensive drugs) (22), diabetes (defined as currently taking antidiabetic drugs or having glycaemia greater than 126 mg/dl for more than 2 hours or greater than 200 mg/dl in non-fasting participants), history of stroke, physical activity (defined as having walked or cycled at least 150 min in the previous week) (23). Depressive and anxiety symptoms were assessed with the Geriatric Mental State version B3 (24). Dependent personality disorder (DPD) was assessed using the DPD domain of the Personality Diagnostic Questionnaire – 4+ (25). The DPD domain contains eight true-false items corresponding to the DSM-IV diagnostic criteria. A person was considered as having DPD if the "True" option was selected for at least five items.

Data management and analysis

All data collected were computerized directly in the field using an interface especially created with Epidata version 3.1 (EpiData Association, Odense, Denmark). Cognitive disorders used as categorical variables were our dependent variable consisting of three categories: cognitively normal (CN), MCI and dementia.

From the intake over the previous three days, the mean number of intakes per day was calculated for each food group. We then categorized the variable into two (<1 per day; 1 or more per day) or three classes (<1 per day; 1-2 per day; 2 or more per day) depending on the distribution of the responses.

For descriptive purposes, we divided the quantity of alcohol into three categories: abstainers (0 UA consumed in a normal week); light consumers (>0-6 UA consumed in a normal week) and moderate-to-heavy consumers (7 or more UA consumed in a normal week). For multivariate analyses, we dichotomized the quantity of alcohol consumed to create the variable "alcohol consumer" (yes/no) as the number of cases was not sufficient to run fully adjusted models.

All covariates were used as categorical variables, except for age, which was used as a continuous variable because the linearity hypothesis could not be rejected.

As we postulated that dietary habits are different between countries, we performed separate analyses for each country. Means with their standard deviations were used as summary statistics for age. Percentages were calculated for all categorical variables. Univariate analyses were carried out between our dependent variable and our independent variables on one hand, and all potential covariates on the other using Chi^2 test, Fisher exact test or t-test when appropriate. Unadjusted analysis using multinomial logistic regression models was used to test the relationship of cognitive disorders with each food group and alcohol intake. Each independent variable and covariate associated with cognitive disorders at $p<0.20$ in univariate analysis was entered into a multivariate multinomial logistic regression model. A backward stepwise selection procedure was used to retain covariates with $p<0.10$, and all sociodemographic variables were forced into models. In the final models, we tested for interaction between each food group that remained in the model and gender on one hand and living area (rural/urban) on the other. The level of significance was

Table 1
Comparison of main characteristics between excluded and included participants, EPIDEMCA, 2011-2012

	Excluded (n=229)			Included (n=1772)			
	n	**% or mean, sd**	**md**	**n**	**% or mean, sd**	**md**	**p**
Area, %			0			0	<0.001
Nola	65	28.38		408	23.02		
Bangui	48	20.96		452	25.51		
Gamboma	95	41.48		433	24.44		
Brazzaville	21	9.17		479	27.03		
Age (mean, SD)	229	73.10, 6.67	0	1772	74.75, 6.69	0	<0.001
Female, %	182	79.48	0	1047	59.09	0	<0.001
In couple, %	44	19.21	0	687	38.88	5	<0.001
No formal education, %	200	87.34	0	1173	66.38	5	<0.001
History of stroke, %	14	6.11	0	118	6.68	5	0.746
BMI, %			22			91	<0.001
<18.5 kg/m^2	88	42.51		556	33.08		
18.5-24.9 kg/m^2	107	51.69		832	49.49		
≥ 25.0 kg/m^2	12	5.80		293	17.43		
Hypertension, %	139	61.23	2	1075	61.01	10	0.948
Diabetes, %	16	7.08	3	142	8.21	42	0.558
Current smoker, %	58	25.66	3	382	21.66	8	0.172
Physical activity, %	50	22.03	2	504	28.70	16	0.035
Depressive symptoms, %	113	49.34	0	649	36.63	0	<0.001
Anxiety symptoms, %	22	9.61	0	133	7.51	0	0.263
Dependent personality disorder, %	45	20.55	10	255	14.53	17	0.019
Dairy products, %			3			9	<0.001
<1/d	212	93.81		1488	84.40		
1+/d	14	6.19		275	15.60		
Fruits, %			3			12	0.037
<1/d	203	89.82		1489	84.60		
1+/d	23	10.18		271	15.40		
Vegetables, %			3			10	0.051
<1/d	114	50.44		744	42.22		
1-2/d	74	32.74		638	36.21		
2+/d	38	16.81		380	21.57		
Starches, %			3			11	0.024
<1/d	52	23.01		279	15.84		
1-2/d	86	38.05		745	42.31		
2+/d	88	38.94		737	41.85		
Legumes, %			3			11	0.070
<1/d	57	25.22		353	20.05		
1+/d	169	74.78		1408	79.95		
Oleaginous food, %			3			16	0.657
<1/d	167	73.89		1273	72.49		
1+/d	59	26.11		483	27.51		

Sweet food, %			3			11	0.002
<1/d	185	81.86		1270	72.12		
1+/d	41	18.14		491	27.88		
Meat, fish, egg, %			10			34	0.010
<1/d	97	44.29		589	33.89		
1-2/d	73	33.33		698	40.16		
2+/d	49	22.37		451	25.95		
Alcohol consumers, %	40	17.78	4	566	32.20	14	<0.001

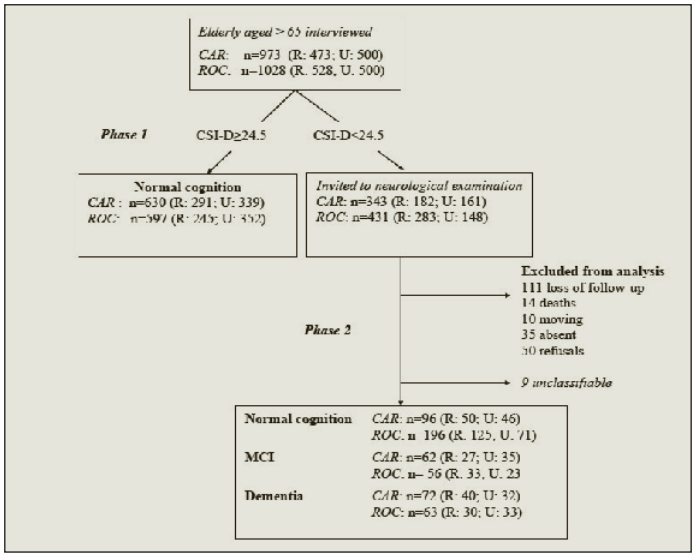
d: day; md: Missing data; SD: Standard deviation

fixed at 0.05 for all analyses, except for interaction tests for which Bonferroni correction was used to control for overall Type I error rate over the multiple tests ($\alpha_{Bonferroni}$<0.05/ number of tests). The statistical analysis was carried-out using Stata version 10.1 for Windows (StataCorp, College Station, TX).

Results

During the first phase in the general population, 2113 people aged 65 and above were approached; 111 declined to participate in the survey. Of the remaining 2002 participants, 775 were invited to clinical interview and 555 actually came. At the end of the second phase, 118 had MCI, 135 had dementia and 1519 had normal cognition. We did not have neurological data for 229 subjects, who were therefore excluded from our analysis. One participant was excluded because of missing age, leaving 1772 participants for analysis. The detailed flow chart is presented in Figure 1.

Figure 1
Flow chart of the EPIDEMCA study in CAR and ROC, 2011-2012



CAR: Central African Republic; CSI-D: Community Screening for Dementia; MCI: Mild Cognitive Impairment; R: Rural area; ROC: Republic of Congo; U: Urban area

Table 1 shows the characteristics of the 1772 included participants compared to the 229 excluded ones. Subjects excluded differed significantly from those included regarding residence area (p<0.001). They were younger (p<0.001), mainly female (p<0.001), less likely to be in a couple (p<0.001), less educated (p<0.001), less corpulent (p<0.001), and more depressed (p<0.001). Regarding their dietary consumption, participants excluded were less likely to consume dairy products (p<0.001), fruits (p=0.037), starches (p=0.024), meat/fish/egg (p=0.010), sweet foods (p=0.002) and alcohol (p<0.001).

Table 2 presents the general characteristics of the 1772 EPIDEMCA participants included according to their country of residence. CAR participants were younger than ROC ones (p<0.001). They were less hypertensive (p<0.001), diabetic (p<0.001), depressed (p<0.001), and anxious (p<0.001). However, they were more likely to be smokers (p<0.001), to be physically active (p<0.001), and to have a dependent personality disorder. Our postulate is confirmed by our results. Indeed, CAR participants were more likely than ROC ones to eat fruits (p<0.001), vegetables (p<0.001), oleaginous foods (p<0.001), and sweet foods (p<0.001). However, the latter were more likely to eat starches (p<0.001) and meat/fish/egg (p<0.001). In both countries, most participants did not drink alcohol. Among those who did, most were light consumers. In CAR, among alcohol consumers, the median number of UA consumed in a typical week was 2.0 ± 3.6 UA with a maximum of 46 UA. In ROC, the median was 3.5 ± 9.1 UA with a maximum of 191.5 UA. The two distributions did not differ significantly (p=0.264).

Table 3 and Table 4 display the results of univariate and multivariate analyses of the association between cognitive disorders and food groups and alcohol consumption in CAR and ROC, respectively. In CAR, a significant interaction was found between oleaginous food and area (urban/rural) in multivariate analysis (p=0.004). This interaction remained significant even after application of the threshold corrected according to Bonferroni procedure ($\alpha_{Bonferroni}$<0.05/12 tests=0.004). Lower intake of oleaginous food was associated with a higher probability of MCI and dementia in rural areas while no association was observed in urban areas (Table 3). Alcohol intake was associated with a reduced probability of dementia. In ROC, in multivariate analysis, food groups were

Table 2

Comparison of characteristics of included participants between CAR and ROC, EPIDEMCA, 2011-2012

	CAR (n=860)			ROC (n=912)			
	n	**% or mean, sd**	**md**	**n**	**% or mean, sd**	**md**	**p**
Age (mean, SD)	841	72.41, 6.41	0	931	73.74,6.84	0	<0.001
Living in rural area, %	408	47.44	0	433	47.48	0	0.988
Female, %	513	59.65	0	534	58.55	0	0.638
In couple, %	318	37.06	2	369	40.59	3	0.128
No formal education, %	570	66.43	2	603	66.34	3	0.966
History of stroke, %	72	8.39	2	46	5.06	3	0.005
Hypertension, %	458	53.50	4	617	68.10	6	<0.001
Diabetes, %	39	4.67	24	103	11.52	18	<0.001
Current smokers, %	266	31.04	3	116	12.79	5	<0.001
Physical activity, %	337	39.65	10	167	18.43	6	<0.001
Depressive symptoms, %	274	31.86	0	375	41.12	0	<0.001
Anxiety symptoms, %	31	3.60	0	102	11.18	0	<0.001
Dependent personality disorders, %	149	17.51	9	106	11.73	8	0.001
Dairy products, %			6			3	0.141
<1/d	732	85.71		756	83.17		
1+/d	122	14.29		153	16.83		
Fruits, %			7			5	<0.001
<1/d	659	77.26		830	91.51		
1+/d	194	22.74		77	8.49		
Vegetables, %			7			3	<0.001
<1/d	252	29.54		492	54.13		
1-2/d	364	42.67		274	30.14		
2+/d	237	27.78		143	15.73		
Starches, %			7			4	<0.001
<1/d	194	22.74		85	9.36		
1-2/d	342	40.09		403	44.38		
2+/d	317	37.16		420	46.26		
Legumes, %			8			3	<0.001
<1/d	253	29.69		100	11.00		
1+/d	599	70.31		809	89.00		
Oleaginous food, %			11			5	<0.001
<1/d	457	53.83		816	89.97		
1+/d	392	46.17		91	10.03		
Sweet food, %			7			4	<0.001
<1/d	487	57.09		783	86.23		
1+/d	366	42.91		125	13.77		
Meat, fish, egg, %			8			26	<0.001
<1/d	463	54.34		126	14.22		
1-2/d	255	29.93		443	50.00		
2+/d	134	15.73		317	35.78		
							<0.001

Alcohol consumers, %			9		5
Abstainers	577	67.80	615	67.81	
Light	240	28.20	214	23.59	
Moderate-to-heavy	34	4.00	78	8.60	

CAR: Central African Republic; d: day; md: Missing data; ROC: Republic of Congo; SD: Standard deviation

associated with neither MCI nor dementia (Table 4). The same was observed for alcohol intake.

Discussion

The present study aimed to study the association between dietary intake, including alcohol, and cognitive disorders, namely MCI and dementia, in a sample of elderly people from rural and urban areas of Central Africa. To our knowledge, it is the first population-based study to specifically investigate this relationship in Africa.

In CAR, a significant inverse association was observed between intake of oleaginous foods and MCI and dementia in the rural area, and the magnitude of the association in the urban area suggested a positive association. Oleaginous foods are the main dietary source of monounsaturated fatty acids (MUFA), which have been associated with a decreased risk of cognitive disorders (26–29). This is congruent with our result in rural areas but not in urban areas. The difference may be explained by the different types of oleaginous foods consumed between rural and urban areas. In rural CAR, the main type is groundnut oil and in urban CAR we found pumpkin seed oil, sheanut oil, and sesame oil. As we worked at the level of food groups level and not individual foods, our analysis did not distinguish between the kinds of oil consumed. The different oils vary in the fatty acids they contain. Groundnut oil is mainly composed of unsaturated fatty acid (78.2%) including 46.2% MUFA and 32.0% polyunsaturated fatty acids (PUFA) (30). Sesame oil is similar (72.4% unsaturated with 39.7% and 41.7% MUFA and PUFA, respectively) (30) as is pumpkin seed oil (78-79% with 28.2-34.0% MUFA and 43.0-53.0% PUFA) (31). However, sheanut oil contains lower levels of unsaturated fatty acids (49.2%) mainly represented by MUFA (44.0%) and thus higher levels of saturated fatty acids (46.6%) (30), which have been associated with increased risk of cognitive disorders (26, 27).

The analysis at food group level and not individual food level may also explain why no other food groups were associated with MCI or dementia in CAR or ROC. The EDAC study showed that people with dementia consumed less fruit and meat/fish than did controls (11). However, the objective, the sampling method and the analysis strategy were different from our study.

Seventy-five percent of our sample lived with their adult children, who usually prepared the same meal for all members of the household, meaning that only the quantity could differ. Food intake decreases with increasing severity of dementia pathology due to brain damage, psychological, behavioral and sensory symptoms, social factors, oral and dental health and motor disturbances (for review, see (32)). This may partially explain the lack of association with most food groups in our study because we assessed the frequency of consumption and not the quantity.

In the literature, some food groups are reported to be protective against or risk factors for cognitive disorders. Frequent consumption of fruits and vegetables has been associated with a decreased risk of Alzheimer's disease, dementia and cognitive decline (5, 33–35). Fish has been associated with a reduced risk of dementia mainly due to its omega 3 fatty acid content whereas meat was associated with a higher risk in western countries as well as in low and middle income parts of the world (5,36). However, few western studies analyzed the relationship between MCI and dietary consumption and most that did were specifically interested in the Mediterranean diet (37, 38), which is not relevant to our context.

In the present study, alcohol intake was associated with a lower probability of MCI and dementia in CAR. Most alcohol consumers had a low intake, with around 88% of respondents in CAR and 73% in ROC declaring drinking less than seven UA in a typical week. These results are consistent with several western studies (39,40) even if some others are contradictory (7, 41). Moderate intake of alcohol would be associated with reduced risk of dementia through the reduction of vascular risk factors (for review, see (39)).

Some limitations are described above. In addition, because our study is cross-sectional in design, it tells us nothing about the temporality of the associations observed. The low numbers of prevalent cases of MCI and dementia by country could affect the precision of estimates and lead to non-significant associations. This also led us to group together meats, fishes and eggs, and thereby obscure possible associations. Some studies have suggested that ApoE genotype could modify the relationship between some foods and alcohol consumption and cognitive disorders (5, 42) but the ApoE genotype was not available here. We cannot exclude the existence of recall bias but we believe it is limited as in our study areas meals are prepared for the whole household and generally by children or grandchildren who were also our informants. Moreover, unlike in western countries, meals are very similar from one day to another. Finally, because we worked at food group level we did not expect details of all foods consumed over the previous three days.

Table 3

Univariate and multivariate analysis of the association between cognitive disorders and food groups and alcohol consumption in CAR, EPIDEMCA, 2011-2012

				Univariate analysis				Multivariate analysis*			
	CN (N=726)	**MCI (N=62)**	**Dementia (N=72)**	**MCI vs CN**		**Dementia vs CN**		**MCI vs CN**		**Dementia vs CN**	
	n (%)	**n (%)**	**n (%)**	**p**	**OR** (95%CI)	**p**	**OR** (95%CI)	**p**	**OR** (95%CI)	**p**	**OR** (95%CI)	**p**
Dairy products				0.112								
<1/d	612 (84.65)	56 (91.80)	64 (91.43)		2.03 (0.80-5.18)	0.138	1.93 (0.82-4.58)	0.133	1.37 (0.47-4.03)	0.568	2.36 (0.58-9.57)	0.230
1+/d	111 (15.35)	5 (8.20)	6 (8.57)		1.00	-	1.00	-	1.00	-	1.00	-
md	*3*	*1*	*2*									
Fruits				0.130								
<1/d	549 (76.04)	52 (85.25)	58 (82.86)		1.82 (0.88-3.77)	0.107	1.52 (0.80-2.90)	0.201	1.10 (0.47-2.55)	0.829	1.05 (0.43-2.57)	0.915
1+/d	173 (23.96)	9 (14.75)	12 (17.14)		1.00	-	1.00	-	1.00	-	1.00	-
md	*3*	*1*	*2*									
Vegetables				0.028								
<1/d	199 (29.36)	26 (42.62)	27 (38.57)		2.52 (1.21-5.23)	0.013	2.05 (1.04-4.04)	0.036	1.48 (0.57-3.84)	0.421	1.64 (0.58-4.62	0.352
1-2/d	311 (43.07)	24 (39.34)	29 (41.43)		1.49 (0.71-3.10)	0.290	1.41 (0.73-2.74)	0.306	1.22 (0.52-2.85)	0.648	1.91 (0.74-4.89)	0.179
2+/d	212 (29.36)	11 (18.03)	14 (20.00)		1.00	-	1.00	-	1.00	-	1.00	-
md	*4*	*1*	*2*									
Starches				0.586								
<1/d	161 (22.30)	17 (27.87)	16 (31.43)		1.53 (0.78-3.03)	0.219	1.25 (0.64-2.44)	0.520				
1-2/d	285 (39.47)	25 (40.98)	32 (45.71)		1.27 (0.69-2.37)	0.443	1.41 (0.80-2.48)	0.237				
2+/d	276 (38.23)	19 (31.15)	22 (22.86)		1.00	-	1.00	-				
Legumes				0.976								
<1/d	215 (29.82)	18 (29.51)	20 (28.57)		0.99 (0.56-1.75)	0.959	0.94 (0.55-1.62)	0.827				
1+/d	506 (70.18)	43 (70.49)	50 (71.43)		1.00	-	1.00	-				
md	*5*	*1*	*2*									
Oleaginous food				0.024								
<1/d	373 (51.88)	38 (62.30)	46 (66.67)		-		-					
1+/d	346 (48.12)	23 (37.70)	23 (33.33)		-		-					
md	*7*	*1*	*3*									
In rural area				0.001								
<1/d	152 (45.51)	20 (74.07)	26 (70.27)		3.42 (1.41-8.31)	0.007	2.83 (1.35-5.91)	0.006	3.67 (1.37-9.85)	0.010	2.80 (1.02-7.70)	0.046
1+/d	182 (54.49)	7 (25.93)	11 (29.73)		1.00	-	1.00	-	1.00	-	1.00	-
In urban area				0.735								
<1/d	221 (57.40)	18 (52.94)	20 (62.50)		0.83 (0.41-1.69)	0.615	1.24 (0.59-2.60)	0.575	0.53 (0.23-1.23)	0.139	0.37 (0.13-1.05)	0.061
1+/d	164 (42.60)	16 (47.06)	12 (37.50)		1.00	-	1.00	-	1.00	-	1.00	-

Sweet food				0.012							
<1/d	398 (55.12)	38 (62.30)	51 (72.86)		1.34 (0.79-2.30)	0.280	2.19 (1.26-3.78)	0.005	1.06 (0.56-2.03)	0.854	1.66 (0.77-3.60)	0.198
1+/d	324 (44.88)	23 (37.70)	19 (27.14)		1.00	-	1.00	-	1.00	-	1.00	-
md	*4*	*1*	*2*									
Meat, fish, egg				0.234								
<1/d	381 (52.84)	41 (67.21)	41 (58.57)		1.57 (0.72-3.45)	0.258	1.40 (0.66-2.96)	0.381	0.83 (0.33-2.12)	0.704	0.52 (0.19-1.44)	0.208
1-2/d	223 (30.93)	12 (19.67)	20 (28.57)		0.79 (0.31-1.98)	0.611	1.17 (0.51-2.64)	0.713	0.39 (0.14-1.10)	0.076	0.48 (0.16-1.39)	0.175
2+/d	117 (16.23)	8 (13.11)	9 (12.86)		1.00	-	1.00	-	1.00	-	1.00	-
md	*5*	*1*	*2*									
Alcohol consump-tion			0.003									
No	475 (65.97)	42 (68.85)	60 (85.71)		1.00	-	1.00	-	1.00	-	1.00	-
Yes	245 (34.03)	19 (31.15)	10 (14.29)		0.88 (0.50-1.54)	0.648	0.32 (0.16-0.64)	0.001	0.82 (0.43-1.57)	0.551	0.34 (0.14-0.83)	0.018
md	*6*	*1*	*2*									

* Adjusted for sociodemographic variables, BMI, physical activity, depressive symptoms and dependent personality disorder; CAR: Central African Republic; CI: Confidence Interval; CN: Cognitively normal; d: day; MCI: Mild Cognitive Impairment; OR: Odds ratio; vs: versus

Table 4

Unadjusted and adjusted analyses of the association between cognitive disorders and food groups and alcohol consumption in ROC, EPIDEMCA, 2011-2012

	Univariate analysis								**Multivariate analysis***			
	CN (N=793)	**MCI (N=56)**	**Dementia (N=63)**		**MCI vs CN**		**Dementia vs CN**		**MCI vs CN**		**Dementia vs CN**	
	n (%)	**n (%)**	**n (%)**	**p**	**OR (95%CI)**	**p**	**OR (95%CI)**	**p**	**OR (95%CI)**	**p**	**OR (95%CI)**	**p**
Dairy products				0.437								
<1/d	654 (82.68)	50 (89.29)	52 (83.87)		1.75 (0.73-4.15)	0.208	1.09 (0.54-2.20)	0.811				
1+/d	137 (17.32)	6 (10.71)	10 (16.13)		1.00	-	1.00	-				
md	*2*	*0*	*1*									
Fruits				0.863*								
<1/d	722 (91.51)	52 (92.86)	56 (90.32)		1.21 (0.42-3.44)	0.726	0.87 (0.36-2.08)	0.748				
1+/d	67 (8.49)	4 (7.14)	6 (9.68)		1.00	-	1.00	-				
md	*4*	*0*	*1*									
Vegetables				0.269		0.195		0.405				
<1/d	420 (16.18)	36 (64.29)	36 (58.06)		1.22 (0.57-2.60)	0.608	1.83 (0.75-4.44)	0.182	0.91 (0.35-2.37)	0.844	1.28 (0.37-4.41)	0.698
1-2/d	243 (30.72)	11 (19.64)	20 (32.26)		0.64 (0.26-1.59)	0.341	1.76 (0.69-4.48)	0.239	0.54 (0.18-1.58)	0.260	1.26 (0.35-4.57)	0.729
2+/d	128 (53.10)	9 (16.07)	6 (9.68)		1.00	-	1.00	-	1.00	-	1.00	-
md	*2*	*0*	*1*									

Starches				0.035		0.010		0.674				
<1/d	67 (8.48)	11 (19.64)	7 (11.29)		2.15 (1.02-4.52)	0.044	1.47 (0.61-3.53)	0.387				
1-2/d	357 (45.19)	17 (30.36)	29 (46.77)		0.62 (0.33-1.16)	0.134	1.14 (0.66-1.98)	0.632				
2+/d	366 (46.33)	28 (50.00)	26 (41.94)		1.00	-	1.00	-	1.00	-	1.00	-
md	*3*	*0*	*1*									
Legumes				0.083								
<1/d	81 (10.24)	11 (19.64)	8 (12.90)		2.14 (1.07-4.31)	0.032	1.30 (0.60-2.83)	0.510	1.43 (0.61-3.36)	0.415	1.52 (0.53-4.35)	0.434
1+/d	710 (89.76)	45 (80.36)	54 (87.10)		1.00	-	1.00	-	1.00	-	1.00	-
md	*2*	*0*	*1*									
Oleaginous food				0.277								
<1/d	705 (89.35)	53 (94.64)	58 (93.55)		2.10 (0.64-6.88)	0.218	1.73 (0.61-4.88)	0.302				
1+/d	84 (10.65)	3 (5.36)	4 (6.45)		1.00	-	1.00	-				
md	*4*	*0*	*1*									
Sweet food				0.233								
<1/d	680 (86.08)	52 (92.86)	51 (82.26)		2.10 (0.75-5.93)	0.160	0.75 (0.38-1.48)	0.408	1.12 (0.36-3.49)	0.841	1.29 (0.33-4.99)	0.711
1+/d	110 (13.92)	4 (7.14)	11 (17.74)		1.00	-	1.00	-	1.00	-	1.00	-
md	*3*	*0*	*1*									
Meat, fish, egg				0.028		0.015		0.250				
<1/d	99 (12.86)	15 (27.27)	12 (19.67)		2.47 (1.19-5.13)	0.015	1.46 (0.70-3.04)	0.313	1.88 (0.76-4.65)	0.170	0.65 (0.19-2.20)	0.494
1-2/d	394 (51.17)	23 (41.82)	26 (42.62)		0.95 (0.50-1.81)	0.879	0.79 (0.44-1.42)	0.439	0.98 (0.46-2.11)	0.962	0.89 (0.39-2.01)	0.778
2+/d	277 (35.97)	17 (30.91)	23 (37.70)		1.00	-	1.00	-	1.00	-	1.00	-
md	*23*	*1*	*2*									
Alcohol consumption				0.002								
No	518 (65.65)	46 (82.14)	51 (82.26)		1.00	-	1.00	-	1.00	-	1.00	-
Yes	271 (34.35)	10 (17.86)	11 (17.74)		0.42 (0.21-0.84)	0.014	0.41 (0.21-0.80)	0.009	0.63 (0.27-1.46)	0.281	1.06 (0.41-2.75)	0.902
md	*4*	*0*	*1*									

* Adjusted for sociodemographic variables, BMI, physical activity, smoking status and dependent personality disorder; CAR: Central African Republic; CI: Confidence Interval; CN: Cognitively normal; d: day; MCI: Mild Cognitive Impairment; OR: Odds ratio; ROC: Republic of Congo; vs: versus

In conclusion, this study provides a first insight into the association between diet and cognitive disorders in Africa. Future studies should be conducted in larger samples to further investigate the role of diet, at food level, in cognitive disorders in this context.

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Acknowledgments: The authors would like to thank the participants in the EPIDEMCA study as well as all the researchers and nurses involved in this project for their assistance. Thanks also to the town halls, mayors, and chiefs of districts for their collaboration, the Universities of Bangui (Central African Republic) and Marien Ngouabi in Brazzaville (Republic of Congo), the Health ministries of the Central African Republic and the Republic of Congo, for their support. We would like to thank Dr P. Nubukpo for proofreading this article and his valuable advice. The authors' responsibilities were as follows—All authors worked collectively to design the EPIDEMCA protocol; SP, MG, PM, BNB, JFD participated in data collection in the field; SP analyzed data and drafted the paper; other authors reviewed the manuscript, provided further contributions and suggestions; SP had primary responsibility for the final content. All authors read and approved the final manuscript. The authors reported no conflicts of interest. The sources of funding had no role in the design, implementation, analysis, or interpretation of the data.

Source of support: The French National Research Agency (ANR) funded this study through the ANR-09-MNPS-009-01 grant. The University of Limoges, Doctoral School 523 of Limoges University, the Limousin Regional Council and the French Ministry of Higher Education and Research funded the doctoral position of SP.

Conflict of interest: No conflicts of interest to declare.

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