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ORIGINAL COMMUNICATION

Dietary intakes and vitamin status of a sample of homeless people in Paris

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OBJECTIVE: To determine nutritional intake and vitamin status in a sample of homeless people who had been on the streets of Paris for more than 2 y.
DESIGN: The nutritional status was evaluated by a 24 h recall questionnaire and by assay of circulating levels of vitamins A, B_1, B_6, B_{12}, C and E.
SETTING: The study was conducted in four accommodation centres of the SAMU Social of Paris (CHUSI units) from July 1999 to May 2000.
SUBJECTS: A total of 329 homeless people were interviewed. Only 87 subjects, aged 26–76 y, were recruited based on seven selection criteria (over 18 y old, being homeless for more than 2 y, interviewed before taking a meal in the CHUSI units, good understanding of French, in a calm state, not coming from hospital or another CHUSI units, without any acute condition that might affect usual dietary habits), and completed the dietary questionnaire. Out of these 87, 71 agreed to blood sampling.
RESULTS: In all 84% of the subjects declared that they drank alcoholic beverages regularly (175 ± 167 g/day of alcohol), and 75.5% of the subjects also declared that they smoked. The mean total energy intake was 2111 ± 1482 kcal/day for the men (8823.98 ± 6194.76 kJ/day) and 1523 ± 531 kcal/day for the women (6366.14 ± 2219.58 kJ/day). Alcohol accounted for $44 \pm 30\%$ and $19 \pm 17\%$ of the total energy intakes (TEI) for the men and women, respectively. Proteins, lipids and carbohydrates accounted for 21 ± 9, 23 ± 14 and $57 \pm 16\%$, respectively, of the energy intake without alcohol for men, and 15 ± 5, 22 ± 11 and $62 \pm 14\%$ EIWA for women. For all micronutrients, except for iron in the men, more than 50% of the population studied had intakes below the French recommendations for the adult population. All the women had calcium, vitamin E and vitamin B_1 intakes below the recommendations for French women (900, 12 and 1.3 mg/day, respectively) in the general population. For the men, 98.7, 96.1 and 93.5% of the subjects had vitamin E, B_1 and C intakes below the recommendations for French males in the general population (12, 1.5 and 80 mg/day, respectively). It is of note that subjects who ate in the CHUSI units more than once a day per week had significantly ($P = 0.018$) higher intakes of vitamin C (27 ± 38 mg/day) than did the subjects who ate in the CHUSI units less than once a day (8 ± 12 mg/day). Measurement of serum vitamin levels demonstrated a deficiency in 95% of the subjects, mainly for vitamin C. The mean concentration in serum was 16 ± 8 μmol/l, although 72% of the subjects had levels of 6 μmol/l. In contrast, 50.7, 42.2 and 35.2% of the subjects had high levels of vitamin B_6, B_{12} and B_1, respectively (100 nmol/l, 420 pmol/l and 40 μmol/l).
CONCLUSION: Alcohol takes a high place in the diet of these homeless people. Although the total energy intake was too low, macronutrient intakes seem to be satisfactory in quality (well-balanced). However, calcium and vitamin C intakes were too low, and these deficiencies favour the development of disease (scurvy, asthenia, ecchymosis), in addition to alcohol-linked disease. Furthermore, the overexposure to vitamin B_6, among the other B vitamins, is a matter of concern since it has been shown to be toxic in high doses.
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Introduction

Homelessness is a growing issue in much of the world, including France. The size of this population is difficult to measure accurately, but can be estimated, for example, from the number of people telephoning 115, an emergency phone number for the homeless in France. Numbers are rising dramatically and the population is now estimated at around 28 000 persons (Observatoire du Samu Social, 1999). In France, homeless people can claim a national financial allowance (Revenu Minimum d'Insertion, about 2500 FF/month), but they are often confronted with administrative barriers that prevent them obtaining these funds. As they have little money, homeless people are usually willing to take advantage of night shelters and food distributions, or free meals provided by relief organisations. Among these emergency centres, the CHUSI units (Centre d'Hébergement d'Urgence avec Soins Infirmiers) provide shelter and medical care and are part of the SAMU (Service d'Aide Médicale d'Urgence). These units were set up in 1993 by the government in face of the growing number of homeless people. Homeless individuals can only stay for one night in these units.

This homeless population has a high mortality (Hwang *et al*, 1998; Hwang, 2000; Barrow *et al*, 1999) and high morbidity, with a high incidence of mental disorders (Kovess *et al*, 1999), lung infections (Rendleman, 1999; Kashiyama *et al*, 1999) and skin conditions (Stratigos *et al*, 1999). In addition, in Paris, 12 cases of scurvy have been identified among people from disadvantaged backgrounds (Fain & Thomas, 1997), while more than 100 000 cases have been detected in recent years among refugees from the Horn of Africa (Desenclos *et al*; 1989). Scurvy is due to a deficiency in vitamin C. Indeed, in 1912, Funk suggested that vitamin C was an anti-scurvy vitamin, and in 1933, vitamin C was synthesised and prescribed. The homeless were thus assumed to have an insufficient intake of this vitamin. However, there are few data supporting this hypothesis, and the clinical symptoms of vitamin deficiency are difficult to observe in this population as they are often confounded by high alcohol consumption.

As there have been few studies on the nutritional status of the homeless, especially in France, we determined nutritional intakes and vitamin status of a sample of homeless persons residing in Paris for more than 2 y. We attempted to link these findings to their overall vital prognosis.

Subjects and methods

The study was conducted from July 1999 to May 2000 in four CHUSI units (Corentin Celton, Colonie, Cochin, Saint Michel). In the absence of a better alternative, the homeless people presenting themselves at these shelters were assumed to be representative of the homeless population. This study was approved by the CCPPRB (Comité Consultatif de Protection des Personnes dans la Recherche Biomédicale).

Sample

Each time a homeless person was received in of the four CHUSI units, he was asked to participate in the study. The volunteers were taken individually to a separate interview room where a nurse asked them a few questions to determine whether they could be recruited for the study or not. Volunteers had to be (i) more than 18 y old; (ii) homeless for at least 2 y and habitually sleeping rough; (iii) interviewed before taking a meal in the CHUSI units and not having had meal in another emergency centre on the previous day; and (iv) good understanding of French. Exclusion criteria were (i) state of excitation (eg under the influence of alcohol or drugs at the time of the survey); (ii) having come from a hospital or another CHUSI unit; and (iii) having a disease that might affect dietary habits and vitamin absorption. These criteria were designed to ensure that volunteers were only surveyed on their usual dietary habits in the street. The recruited volunteers were then given a 24 h recall dietary questionnaire to evaluate their nutritional intakes. A venous blood sample was also taken for assay of vitamins A_1, B_1, B_6, B_{12}, C and E. The average time spent with each subject was 40 min.

Questionnaire: dietary data

The dietary questionnaire was filled in by the nurses of the CHUSI units, who are specialised in medico-social relationships, so that the subjects felt confidence. In order to standardise the collection of the dietary data, the nurses (one or two in each CHUSI unit) all received training from our dietician, and on how to fill in the dietary questionnaires. A standard explanation of the purposes of the survey was given to each subject before the interview.

A pilot study was carried out and our dietician monitored the nurses interviewing 20 homeless persons (five in each CHUSI unit) to ensure that the 24 h dietary recall was well understood by the subjects and that the interviews were conducted properly by the nurses (they had to get as accurate an account of the dietary intake as possible by asking check questions, prompting the subject throughout the recall and helping them remember their whereabouts in order to recall intake).

The interview, in two parts, consisted of a brief personal history, general questions about smoking, drinking and dietary habits, followed by a 24 h dietary recall.

The brief personal history included gender, age and duration of homelessness. Volunteers were then asked some general questions concerning food behaviour, especially on alcohol intake, including frequency of drinking alcohol, estimated intake and type of beverage. They were also asked about smoking habits (estimated number of cigarettes smoked in a day) and drug consumption (frequency of consumption and type of drug).

Dietary information was then elicited from a 24 h recall questionnaire, which included place of eating. Subjects assessed food portion sizes from household measures, such as cups, dishes and spoons. More time tended to be spent

prompting the subjects if they had consumed alcohol during the 24 h recall period. However, subjects may have felt ashamed of their consumption and tried to dissimulate it. The alcohol consumption recorded in the 24 h recall was therefore compared with that recorded in the general questions section, and corrected if necessary.

The completed dietary records were analysed by a dietician who converted the evaluation of quantity of ingested food units into weights. Then ingested nutrient values were calculated using the food composition database of Ciqual (Feinberg *et al*, 1991).

Vitamin status

After sampling, blood was immediately centrifuged on site and plasma separated to avoid haemolysis. Plasma was rapidly frozen (within 30 min) in several aliquots. To avoid photodegradation they were kept in the dark and samples for vitamin C were covered with neutral oil to avoid oxidation. They were then transported to the laboratory and assayed within the next 2 days.

Concentrations of vitamins A_1, B_1, B_6, E and C were all assessed by high performance liquid chromatography (HPLC). Serum concentrations of vitamins B_9 and B_{12} were determined by radioimmunoassay.

Statistical analysis

Data in the text and tables are expressed as means ± s.d. and were compared using the non-parametric Mann–Whitney *U*-test.

Results

Questionnaire: general questions

Three-hundred and twenty-nine homeless people were interviewed, but only 87 subjects fulfilled the criteria for the study and replied to the dietary questionnaire and, among them, only 71 agreed to the blood sampling. The sociodemographic details of the population are summarised in Table 1. They comprised 88.5% men and 11.5% women, with a mean age of 47.8 ± 10.7 y (range 26–76 y). The mean duration of homelessness was 11.2 ± 11.5 y (range 2–55 y).

More than half (59.5%) of the volunteers declared that, in general, they were not getting enough to eat. The causes were various (Figure 1), but the most important was lack of money. As a consequence, 57.1% of the subjects thought that they had lost weight during their period of homelessness. From their declarations, most of the volunteers ate two meals a day (Figure 2).

Our population had a high alcohol consumption and the main alcoholic drinks consumed were wine and beer (Table 1). They were also tobacco-addicted (Table 1), while 90.5% of the subjects declared that they did not consume drugs other than alcohol and tobacco.

Table 1 Sociodemographic characteristics of the population studied ($n = 87$)

	Men	*Women*	*Total*
Number of subjects	77 (88.5%)	10 (11.5%)	87 (100%)
Age			
Mean ± s.d. (y)	48.0 ± 10.6	49.1 ± 13.8	47.8 ± 10.7
Range (y)	26–76	28–65	26–76
Duration of homelessness			
Mean ± s.d. (y)	10.1 ± 9.0	20.3 ± 22.8	11.2 ± 11.5
Range	2–52	2–55	2–55
Smokers (%)			
No	50	21	24.5
< 10 cigarettes per day	0	5.5	5
10 cigarettes per day	40	20	22
20 cigarettes per day	10	31	28.5
40 cigarettes per day	0	22.5	20
Alcohol consumption (%)			
No	30	14.5	16
Wine	50	46	46.5
Beer	10	25	23.5
Wine and beer	10	14.5	14

Questionnaire: dietary data

Mean dietary daily intakes in macro- and micronutrients are listed in Tables 2 and 3, respectively. Mean total energy intake was 2111 ± 1482 kcal/day for the men (8823.98 ± 6194.76 kJ/day) and 1523 ± 531 kcal/day for the women (6366.14 ± 2219.58 kJ/day). This is less than the recommendations for French adults of the general population (Dupin *et al*, 1992) and 44 ± 30 and 19 ± 17% of these intakes for men and women, respectively, were provided by alcohol. When alcoholic drinks were removed from the analysis, the contribution of macronutrients to energy intake was well balanced according to French recommendations (Dupin *et al*, 1992), with respectively for men and women, 21 ± 9 and 15 ± 5% of energy intake without alcohol (EIWA) of protein *vs* 12% recommended, 57 ± 16 and 62 ± 14% EIWA of carbohydrates *vs* more than 55% recommended, and 23 ± 14 and 22 ± 11 EIWA of lipids *vs* less than 35% recommended.

For all micronutrients, except for iron for men, more than 50% of the population studied had intakes below the French recommendations for the adult population. For iron, 42.8% of the male subjects had intakes below the 10 mg/day recommended for general French male, *vs* 90% for the women. All the women had intakes in calcium, vitamins E and B_1 below the French recommendations (Dupin *et al*, 1992), 90% of them had magnesium, iron, vitamins B_6, B_9 and B_{12} intakes below recommendations, and 80% of them had intakes of vitamin C below recommendations.

More than 90% of the men had intakes of vitamins E, C and B_1 below the French recommendations (Dupin *et al*, 1992), more than 80% had calcium intakes below recommendations, and more than 70% had magnesium, vitamins B_1, B_{12} and B_9 intakes below recommendations.

With respect to the frequency of meals taken in the CHUSI units, the subjects who ate more than once a day per week in the CHUSI units had equal or higher vitamin

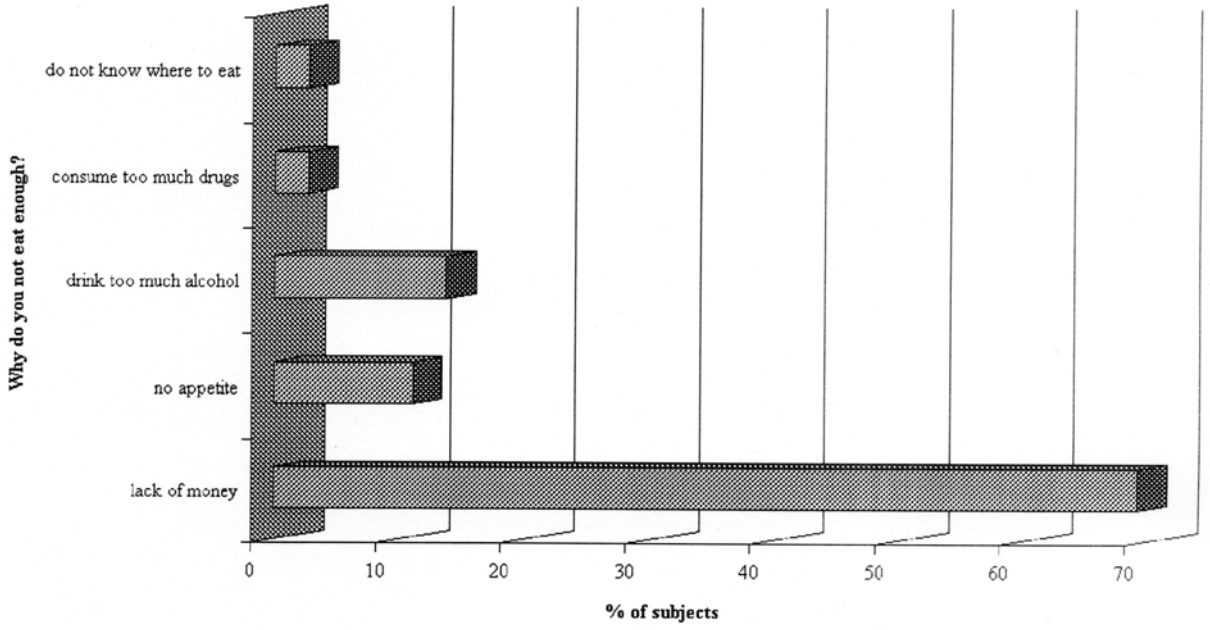

Figure 1 Replies to the open question 'Why do you not eat enough?' ($n=87$).

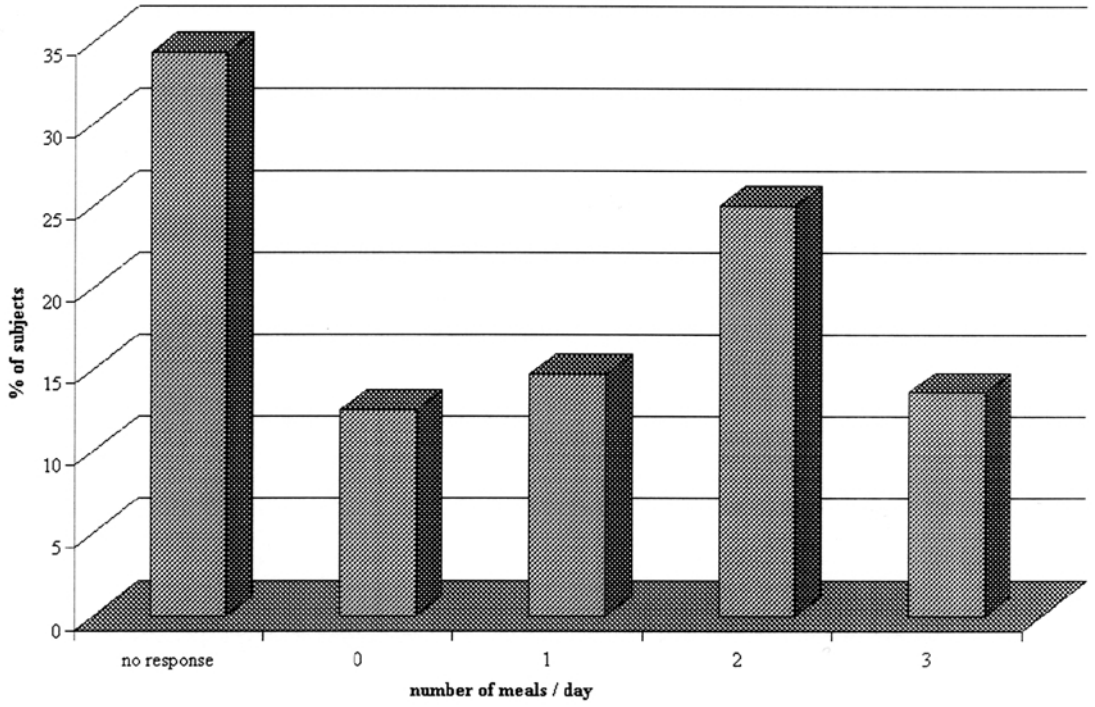

Figure 2 Replies to the open question 'How many meals do you have a day?' ($n=87$).

intakes than the subjects who ate less than once a day in the CHUSI units, and the difference was significant for vitamins C and E (respectively 27 ± 38 *vs* 8 ± 12 mg/day ($P=0.018$) and 2 ± 2 mg/day *vs* 1 ± 1 mg/day ($P=0.032$); Table 4).

Vitamin status

Blood concentrations of vitamins are listed in Table 5. The levels of vitamins in blood were within the normal range except for vitamin C for which 95% of the subjects had a

deficiency, with blood levels $< 45\,\mu mol/l$, and 72% of the subjects had levels below the detection threshold of the method ($< 6\,\mu mol/l$).

In contrast, 50.7, 42.2 and 35.2% of the subjects, respectively, had levels of vitamins B_6, B_{12} and B_1 above the normal range (100 nmol/l, 420 pmol/l and 40 μmol/l, respectively).

Discussion

Among the 87 volunteers who agreed to participate in the study, there were 88.5% men and 11.5% women (Table 2). This sex ratio is quite similar to that of the general population of homeless in Paris (79% men and 16% women; Observatoire du Samu Social, 1999). However, because of the recruitment criteria, the mean age of our sample was higher than that of the general homeless population (47.8 *vs* 39.7 y). Furthermore, our subjects had been homeless for an average of 11.2 y (Table 2), whereas only 9.6% of the general homeless population have been homeless for more than 2 y. Our series was thus not representative of the general homeless population, but represented rather a subgroup of homeless people who have been in this situation for more than 2 y, and so provides information on the chronic effects of the diet of the homeless.

The majority of our subjects were tobacco-addicts (75.5% smokers) in line with the observations of Luder *et al* (1989) with 79% of smokers in their sample.

The results of this study are also consistent with other studies, especially with respect to the high alcohol consumption. In this study, 84% of the volunteers declared that they drank regularly (175 ± 167 g/day of alcohol).

In Australia, 89% of the homeless sample of Darnton-Hill & Ash (1988) drank, with a mean daily intake of 231 g alcohol. In another study (Darnton-Hill & Truswell, 1990), he found that 30% of his sample had a daily intake ranging from 81 to 240 g alcohol, and 41% with daily intakes ranging from 241 to 900 g alcohol.

Table 2 Mean dietary daily intakes in macronutrients in the population studied ($n = 87$)

	Mean intake[a]		
	Men (n = 77)	*Women (n = 10)*	*Recommendations*
Energy (kcal)	2111 ± 1482	1523 ± 531	2700 (men); 2000 (women)
Protein (% TEI)[b]	11 ± 7	12 ± 5	—
Protein (% EIWA)[c]	21 ± 9	15 ± 5	12
Carbohydrates (% TEI)	31 ± 18	51 ± 20	—
Carbohydrates (% EIWA)	57 ± 16	62 ± 14	> 55
Lipid (% TEI)	14 ± 12	17 ± 9	—
Lipid (% EIWA)	23 ± 14	22 ± 11	< 35
Alcohol (% TEI)	44 ± 30	19 ± 17	0

[a]Recommendations for the general French population (Dupin *et al*, 1992).
[b]TEI, total energy intake.
[c]EIWA, energy intake without alcohol.

This alcohol consumption (mean daily intake of 175 g alcohol) is much higher than that of men in the general French population (mean daily intake about 40 g alcohol; Rigaud *et al*, 1997), and also with the homeless in London reported by Evans and Dowler (1999, 2.2 g/day for women and 9 g/day for men).

The mean total energy intake (2111 ± 1482 and 1523 ± 531 kcal/day for men and women, respectively) was less than that recommended for the French general population (2700 and 2000 kcal/day for men and women, respectively; Dupin *et al*, 1992). It should be noted that $44 \pm 30\%$ of this intake for men and $19 \pm 17\%$ for women was provided by alcohol (Table 2). This is a matter of concern as, although alcohol provides some energy, alcoholic beverages generally supply few nutrients (Auerhahn, 1992). The energy malnutrition may therefore be the consequence of ethanol intake or secondary to the alcohol-induced pathologies (Nicolas *et al*, 1993).

Although protein and fat intakes were adequate (proteins, 11 ± 7 and $12 \pm 5\%$ TEI for men and women respectively *vs* 12% recommended; fats, $14 \pm 12\%$ TEI and $17 \pm 9\%$ TEI for men and women, respectively), carbohydrate intakes were below recommended intakes, especially for the men (respectively 31 ± 18 and $51 \pm 20\%$ TEI for men and women *vs* more than 55% TEI recommended).

Surprisingly, when alcoholic drinks were taken out of the analysis, the contribution of macronutrients to energy intake was well balanced according to French recommendations (proteins, $21 \pm 9\%$ EIWA for men and $15 \pm 5\%$ EIWA for women *vs* 12% recommended; carbohydrates, $57 \pm 16\%$ EIWA for men and $62 \pm 14\%$ EIWA for women *vs* more than 55% recommended; lipids, $23 \pm 14\%$ EIWA for men and $22 \pm 11\%$ EIWA for women *vs* less than 35% recommended). It is now well documented that alcohol makes up too high a proportion of the diet of homeless at the expense of carbohydrates.

Micronutrient intakes were inadequate as more than 70% of the subjects had intakes below recommendations for the general population, except for iron in the men. The male subjects in this study even had iron intakes (17 *vs* 14 mg/day above that of the general population (Hercberg *et al*, 1991). Although our female subjects had iron intakes below recommendations, they were the same as the general population (Hercberg *et al*, 1991) (10 mg/day). In this respect, Herbeth *et al* (1988) have shown that moderate and heavy drinkers (88–200 g/day) consume more meat and meat products, and thus have higher intakes of iron than do controls. It is also in accordance with homeless in London whose iron intakes were lower than in our series, as were their alcohol intakes (Evans & Dowler, 1999). In contrast, for women the situation is particularly worrying with respect to calcium, vitamins E and B_1, and in the men for vitamins A, C and B_1 (Table 3). These vitamin deficiencies may stem from the alcohol misuse. Indeed, it is recognised that chronic alcoholics frequently suffer from specific micronutrient deficiencies,

Table 3 Mean dietary daily intake in micronutrients in the population studied ($n=87$)

	Men (n=77)			*Women (n=10)*		
	Mean intake	*Recommendations*[a]	*Percentage of subjects with intake lower than recommendations*	*Mean intake*	*Recommendations*[a]	*Percentage of subjects with intake lower than recommendations*
Magnesium(mg/day)	374±287	420	71.4	192±100	330	90
Calcium (mg/day)	477±345	900	87.0	359±250	900	100
Iron (mg/day)	17±15	10	42.8	10±6	18	90
Vitamin E (mg/day)	1.08±1.76	12	98.7	1.01±0.81	12	100
Vitamin C (mg/day)	17±26	80	93.5	53±97	80	80
Vitamin B_1 (mg/day)	0.46±0.47	1.5	96.1	0.57±0.44	1.3	100
Vitamin B_6 (mg/day)	1.9±3.04	2.2	77.9	0.93±0.84	2.0	90
Vitamin B_{12} (μg/day)	2.85±7.03	3	77.9	0.79±1.04	3	90
Vitamin B_9 (μg/day)	202±306	300	77.2	139±105	300	90

[a]Recommendations for the general French population (Dupin *et al*, 1992).

Table 4 Meals taken in centres—frequency and vitamin intakes ($n=87$)

	Number of meals taken in the CHUSI	
Vitamin intakes	*Less than once a day*	*More than once a day*
Magnesium (mg/day)	309±204	354±266
Calcium (mg/day)	386±226	515±358
Iron (mg/day)	13±12	17±14
Vitamin E (mg/day)	1±1	2±2* ($P=0.032$)
Vitamin C (mg/day)	8±12	27±38* ($P=0.018$)
Vitamin B_1 (mg/day)	0±1	0±1
Vitamin B_6 (mg/day)	2±2	2±3
Vitamin B_{12} (μg/day)	2±2	2±6
Vitamin B_9 (μg/day)	176±187	189±270

*$P<0.05$, Mann–Whitney test.

including vitamins C and A (Herbeth *et al*, 1988), B_1 (Hope *et al*, 1999).

It should be noted that the estimations of vitamin intakes from the dietary data were not always confirmed by the results of the biochemical analyses (Table 5). In fact, real deficiencies were mainly observed for vitamin C (95% of the subjects were deficient). Only 9.3% of the general French population between 40 and 50 y old are deficient in vitamin C (Hercberg *et al*, 1994). The percentage of subjects deficient in vitamin B_6 and B_1 is higher in the French population between 40 and 50 y old than in the homeless population. Hercberg *et al* (1994) showed that, respectively, 6.9 and 11.2% of male subjects between 40 and 50 y old were deficient in vitamins B_6 and B_1 in the French population, whereas only 5.6% of the subjects in the present study were deficient in vitamins B_6 and B_1. The reverse was found for vitamins A and E. Hercberg *et al* (1994) reported that 1.3% of male subjects between 40 and 50 y old were deficient in vitamins A and E in the French population, whereas 43.6 and 19.7% of the subjects in the present study were deficient in vitamins A and E, respectively. Serum levels of vitamin B_9 in all our subjects were at the limit of the recommended range.

It should be borne in mind that the food composition table is not really exhaustive concerning vitamins, and so vitamin intakes may have been underestimated.

Nonetheless, there were three findings of interest:

1. The low intake of vitamin C was confirmed by a true deficiency: 95% of the subjects presented plasma levels below the acceptable value of 45 μmol/l, and 71.8% of the subjects had serum levels below 6 μmol/l (Tables 3 and 5).
2. As the food composition table is relatively complete with respect to calcium, the very low intake of calcium, especially in the women, is a matter of concern (Table 3).

Table 5 Blood levels of vitamins ($n=71$)

	Mean concentration	*Recommendations*	*Percentage of deficient subjects*	*Percentage of overexposed subjects*
Vitamin A (μmol/l)	1.88±0.95	1.55–3.30	43.6	11.2
Vitamin B_1 (μmol/l)	58±104	6–40	5.6	35.2
Vitamin E (μmol/l)	22±7	16–35	19.7	4.2
Vitamin C (μmol/l)	16±8[a]	45–90	95	0
Vitamin B_6 (nmol/l)	152±143	23–100	5.6	50.7
Vitamin B_{12} (pmol/l)	385±225	160–420	14.1	42.2
Vitamin B_9 (nmol/l)	12.7±7.3	<7.4	0	0

[a]This mean was calculated only with the positive samples, while 72% of the sample were below the detection limit of the method (6 μmol/l).

3. Although intakes in vitamin B_1, B_6 and B_{12} may have been underestimated, it cannot explain why 35.2, 50.7 and 42.2% of the subjects had serum levels over the recommended values of 40 μmol/l, 100 nmol/l and 420 pmol/l, respectively (Tables 4 and 5).

The deficiency in vitamin C is a real problem since this vitamin is involved in a variety of cellular mechanisms, especially in the immune response (Anderson *et al*, 1980). Lack of vitamin C also causes scurvy.

In the general population, 10 mg/day are recommended for prevention of scurvy, while 60–100 mg/day are recommended for a good health and nutrition status (Dupin *et al*, 1992). However, alcohol enhances the requirement for vitamin C (Kallner *et al*, 1981), and smoking reduces its absorption and increases its catabolism. The daily turnover of vitamin C of heavy smokers (routinely more than 20 cigarettes per day, for 28% of the subjects) would be about 40% higher than that of non-smokers (Kallner *et al*, 1981).

On the basis of these findings, a target of 140 mg/day of vitamin C needs to be obtained in the homeless population, which points to the value of fresh fruit and vegetables in the diet of these individuals. It is noteworthy that the intakes in vitamins were higher in the subjects who took most meals in the CHUSI units, where an effort is made to improve food quality. This was particularly striking for vitamin C (Table 5). Indeed, subjects who ate less than once a day, compared to subjects who ate more than once a day, in the CHUSI units had significantly lower vitamin C intakes (8 ± 12 mg/day of vitamin C *vs* 27 ± 38 mg/day, $P = 0.018$; Table 5). Thus, improving the quality of food offered to homeless people leads to an improvement in nutritional intakes in vitamins, especially vitamin C.

The very low intake of calcium for 100% of the women and 87% of the men (Table 4) is also worrying since calcium deficiency can lead to muscular weakness, tetany, reduction in bone density, increased risk of fracture and contribute to osteoporosis (Commission of the European Communities, 1993).

An intake of 900 mg/day of calcium is recommended to avoid such pathologies (Dupin *et al*, 1992). This requirement could be met by favouring milk and dairy products in the diet of homeless people.

From the dietary data, intakes of vitamins B_1, B_6 and B_{12} were insufficient in our series (more than 75% of subjects had intakes below the French recommendations). However, 35.2, 50.7 and 42.2% of the subjects had blood levels up to 40 nmol/l in vitamin B_1, up to 100 nmol/l in vitamin B_6 and up to 420 pmol/l in vitamin B_{12}, respectively (Tables 3 and 5). The high level of vitamin B_{12} might stem from liver disease linked to the high alcohol consumption. In contrast, the high levels of vitamins B_1 and B_6 can be accounted for by supplementation in hospitals in an attempt to prevent neurological complications. It is known that alcoholism is associated with neuropsychiatric syndromes, and vitamin B deficiency contributes to the aetiology of a number of these syndromes. Supplementation with B vitamins plays a significant part in the prophylaxis and treatment of such disorders (Cook *et al*, 1998).

The toxicity of vitamin B_6 is no longer in doubt, and excessive intakes of vitamin B_6 can give rise to neuronal damage and sensory and motor effects (for review of animal studies see Snodgrass, 1992, and for human studies see Scaumburg *et al*, 1983).

An intake of 2.2 mg/day of vitamin B_6 is recommended for French males in the general population to maintain a good health status (Dupin *et al*, 1992), while intakes above 200 mg/day may give rise to neurotoxicity (Hathcock, 1997). Systematic supplementation may not be a solution since the half-life of vitamin B_6 is long, and serum levels may easily exceed the upper limit.

Taken together, our observations show that the quality of food offered by municipal and charitable shelters is of particular importance. The example of vitamin C intakes in the CHUSI units where meals are provided by a catering company is of note. Fresh fruit and vegetables should be supplied to improve vitamin C intake, along with milk and dairy products for calcium.

In view of the toxicity of vitamin B_6, systematic supplementation may not be appropriate in this population.

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