Introduction

According to the WHO, inadequate social support is associated not only with increased mortality, morbidity and psychological distress, but also, in a general way, with poorer health and decreased well-being (WHO Madrid 2002). Elderly persons are more likely to lose loved ones and friends and so are more vulnerable to loneliness. The number of elderly is constantly increasing in France, as in all developed countries. This increase is accompanied by:

- multiplication of the number of pathologies per patient: 85% of those aged over 75 years have at least one chronic disorder.
- an estimated increase of 14 to 33% of the number of dependent persons between 2000 and 2020.

Inequalities exist, and the heatwave in the summer of 2003 revealed the shortcomings of the ability of our society and our health system to protect the most isolated persons. A study carried out by the CREDOC (1) in 1998 on the living conditions and aspirations of the French showed that 35% of persons aged 60 to 69 years and 57% of those aged over 70 lived alone.

The main reasons persons aged over 60 gave for their loneliness were:
- illness 30.7%
- isolation from their family 49.6%
- loss of a loved one 45.6%.

Women are more likely to be alone because they live longer and are often younger than their spouse. The consequences of loneliness are fewer social relationships and opportunities for meeting people, and greater confinement to the home with its associated risks (a fall which goes unnoticed, impossibility of obtaining food supplies).

Besides physiological factors (loss of appetite, impaired sense of taste), social factors have considerable impact on the amount and variety of food consumed. A study carried out by the INRA on the diet of elderly persons (2) pinpointed changes in household composition and delegation of shopping to others as key elements in dietary modifications. "Moments of breakdown", such as retirement, bereavement, illness or moving house, are decisive factors in changes in eating habits.

Nevertheless, feeding oneself is an act essential to life and is now known to be a key element in successful aging. Nutrition and health status are closely linked, even more so in the case of acute diseases which restrict spontaneous eating. In the elderly subject, the risk is no longer obesity or all the so-called overload diseases, but protein-energy malnutrition (PEM) or undernutrition.

The national programme for nutrition and health (Programme National Nutrition Santé, PNNS) was launched in...
2001 (3). Its overall objective is to improve the state of health of the population by acting on one of its major factors: nutrition. One of the nutritional aims of the PNNS concerns the prevention, identification and reduction of undernutrition in the elderly. In France undernutrition is observed in 350 000 to 500 000 elderly persons living at home, depending on the studies and the parameters used (EURONUT-SENECA) (4, 5) and it affects 50% of elderly hospitalized patients (6). It may in itself be the cause of hospitalization, as it contributes to lung diseases, urinary infections and femoral neck fractures. It also always accompanies an acute disease requiring hospitalization (7). In home-dwellers, 5-year survival is inversely proportionate to serum albumin levels, which reflect nutritional status (8). For persons in hospital, undernutrition leads to increased morbidity and mortality (9, 10) The repercussions of undernutrition are serious: infectious diseases, weight loss, increase in global morbidity and mortality (11, 12), even in healthy people at home (13).

Aging in itself brings with it various sensory, functional, metabolic and also immune disorders (14). In addition, profound changes in the way of life occur against a background of progressive or sudden isolation, material, financial or psychological difficulties, leading to increased frequency of depressive states (14). Nearly 50% of isolated elderly persons who previously lived independently at home and who are admitted to short-stay hospital facilities have an increased risk of secondary institutionalization (> 30%) compared with the dependent elderly (1.4%) who often already have organized help at home (15).

The SENeca project was inspired in particular by the report of the Haut Comité de la Santé Publique "For a nutritional public health policy in France" of June 2000 (3) which drew up an inventory of changes in the dietary habits of the French and their impact on health. This report on elderly persons made the following observations:
- A demographic increase in the number of persons aged over 75 can be expected in the next ten years,
- A large proportion of persons aged over 75 live alone at home,
- The nutritional status of this population shows wide variations.

The global objectives of SOLINUT were:
- To evaluate the nutritional status of persons living alone at home in the populated area of Valence which includes urban, suburban and rural sectors.
- To assess their dietary status while taking into account the specific nutritional needs of the elderly, and their situation with regard to obtaining food, preparing and eating it, voluntary exclusion of certain foods or food restrictions.
- To analyse the social, psychological, physiological and health factors underlying the diverse conditions encountered.

This cross-sectional study, which was both epidemiological and anthropological, based on quantitative and qualitative nutritional and sociological investigation, is a logical continuation of the EURONUT-SENECA study (5), which showed that social isolation already seemed to be a significant factor of undernutrition.

**Subjects and Method**

One hundred and fifty subjects were selected on the following criteria: aged over 70, living alone [not more than 5 "emotionally meaningful" contacts per month (closest person), not more than 2 hours of professional assistance per week], living at home, in an urban or semi-urban environment and not cared for by any health facility.

The study was carried out in the patients’ homes, through contacts with the town councils of Valence and the neighboring communes, the social services, associations, general practitioners, pharmacists, and the media (press, local radio stations) in order to carry out a pre-selection by telephone. Subjects who fulfilled the inclusion criteria were enrolled and data were then collected. The questionnaires were developed with the help of the epidemiology team of INSERM U593 in Bordeaux (Dr. Barberger-Gateau).

Subjects were recruited between March 2002 and May 2003.

In November 2002, because women were a large majority (113 women versus 17 men), it was admitted that the INSEE census did not correspond to the actual distribution of our subjects. In order to correspond more closely to the census figures without being contrary to the findings in the field, we decided to include only a maximum of 40 men for 130 women, in conformity with the most recent census.

The investigators visited each person twice so that all social, dietary and psychological data could be collected. Only persons with complete questionnaires were retained, and 37 subjects with incomplete data were excluded.

The sociological investigation attempted to determine the feelings of the subjects in relation to their social isolation. The investigators were instructed to allow the persons to express themselves freely, while providing a framework to guide the
conversation in the required direction. The order of the questions was thus not necessarily strictly respected and the speaker was not interrupted, while their answers were recorded.

Psychological status was assessed through a questionnaire including a depression scale [the Geriatric Depression Scale of Yesavage (17)], restricted to the mini-GDS with 4 items (18), which is sufficiently sensitive to detect persons with a depressive habitus or those who had recently undergone a stressful event (bereavement and/or illness). The shorter scale was chosen by the psychologist to avoid upsetting the participant with difficult questions and then leaving them alone to cope with their reactions. The psychologists also asked questions on visits received, their frequency and emotional significance, with the feeling of loneliness as a corollary.

Fear of falling, number of recent falls and ability to perform the chair rise test were also assessed. This test, which consists of five consecutive chair rises in the shortest possible time without using the chair arms for support, was validated in the SENECA study, where it was found to predict the need for assistance in women at 5 years (20). It has just been recognized by the Task Force Consensus as a functional criterion in the minimum data set for detection of undernutrition (21).

Statistical analysis of the data was carried out with EPINFO6 software.

Results

Description of the sample
The sociodemographic characteristics of the participants are summarized in table 1.

Table 1
Sociodemographic characteristics of participants, SOLINUT study, 2002-2003.

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>%</th>
<th>Women</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>40</td>
<td></td>
<td>120</td>
<td></td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country of birth (%)</td>
<td>France</td>
<td>32</td>
<td>80%</td>
<td>97</td>
<td>88.2%</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>8</td>
<td>20%</td>
<td>13</td>
<td>11.8%</td>
<td>21</td>
</tr>
<tr>
<td>Mother tongue (%)</td>
<td>French</td>
<td>36</td>
<td>90%</td>
<td>103</td>
<td>94%</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4</td>
<td>10%</td>
<td>7</td>
<td>6%</td>
<td>11</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td>Single</td>
<td>6</td>
<td>15%</td>
<td>11</td>
<td>10%</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>2</td>
<td>5%</td>
<td>1</td>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Separated or divorced</td>
<td>3</td>
<td>2.5%</td>
<td>13</td>
<td>12%</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>28</td>
<td>7%</td>
<td>85</td>
<td>77%</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1</td>
<td>2.5%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
</tr>
<tr>
<td>Habitat (%)</td>
<td>Town centre</td>
<td>12</td>
<td>30%</td>
<td>27</td>
<td>24.5%</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Suburb</td>
<td>20</td>
<td>52%</td>
<td>46</td>
<td>43%</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Urban periphery</td>
<td>6</td>
<td>15%</td>
<td>28</td>
<td>25.5%</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>2</td>
<td>5%</td>
<td>8</td>
<td>7%</td>
<td>10</td>
</tr>
<tr>
<td>Past professional activity</td>
<td>yes</td>
<td>40</td>
<td>100%</td>
<td>96</td>
<td>87%</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>0</td>
<td>0%</td>
<td>14</td>
<td>13%</td>
<td>4</td>
</tr>
<tr>
<td>Taxpayer (%)</td>
<td>yes</td>
<td>22</td>
<td>55%</td>
<td>49</td>
<td>44.5%</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>18</td>
<td>45%</td>
<td>61</td>
<td>55.5%</td>
<td>79</td>
</tr>
<tr>
<td>Income:</td>
<td>Adequate</td>
<td>20</td>
<td>52%</td>
<td>60</td>
<td>54.5%</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Somewhat inadequate</td>
<td>18</td>
<td>45%</td>
<td>42</td>
<td>38%</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Very inadequate</td>
<td>2</td>
<td>5%</td>
<td>8</td>
<td>7.5%</td>
<td>10</td>
</tr>
</tbody>
</table>

Sex ratio
The 150 participants were composed of 40 men and 110 women, which corresponded to the distribution of their age group in this geographical area according to the INSEE figures.

Age
The mean age of the whole group was 80.8 +/- 5.15 years, 81.5 +/- 4.87 years for women and 79.8 +/- 5.73 years for men. The oldest subject was aged 99.

Nationality
129 (86%) of subjects questioned were born in France, but French was the native tongue of 139 participants (92.7%). 71.3% originated from the Rhône-Alpes region and 60.5% from the two administrative areas (départements) of the Drôme and the Ardèche.

Marital status
113 subjects were widowed (75.3%), 17 (11.3%) single, 16 (10, 7%) divorced or separated and only 3 (2%) were married but alone since their spouse had been admitted to a distant institution because of severe cognitive impairment. In one case marital status could not be determined.

Habitat
39 subjects (26%) lived in a town or city center, 67 (44.6%) in a suburb, 34 (22.7%) in the urban periphery and 10 (6.7%) in a rural area. 92 (61.3%) lived in an apartment block, 46 (30.7%) in a house in the vicinity of other houses and 12 (8%) in an isolated house. Those questioned had lived on average 27.6 years in the same accommodation (range 1 - 88 years). The heating system required repair in 6.7% of cases, 5.3% of accommodation had no bathroom and in 3 cases the toilet was upstairs or outside.

Professional occupation
Only 14 subjects (9.3%), all women, had never had a professional occupation. The main occupation had been followed from a mean age of 21 years.

Income level
Less than half the subjects (47.3%) were eligible to pay tax. Nevertheless, 53.3% considered their income was sufficient and only 6.7% found it very inadequate. At the time of the study, only 11 persons (7.3%) received the personal independence allocation and none received benefit from the Fonds National de Solidarité.

Characteristics of the sample

Psychological status
Eighty-seven of the 150 subjects complained of feeling lonely, in particular in the evenings. This feeling was much more marked if isolation was associated with reduced mobility which made activities difficult. It was not correlated with the depression scale, nor with the number of visits received each
week. It was, however, inversely correlated with the person’s ability to make contact with the outside world, in particular physically (taking part in trips and excursions, membership of an association…).

**Social and family environment**

The persons questioned had a mean of 2 children (range 0 - 10) and the majority of children were living. 8% had family members living near (less than 50 km and less than 15 min on foot for 38.6%) but were nevertheless alone, while only 20% received a visit from someone every day, and 21.3% had a pet. The family sometimes and neighbours often helped these elderly persons with everyday activities.

**Nutritional status**

*Anthropometric measurements*

- **Weight**
  
  The mean weight of the whole group was 64.9 kg (range 37 - 130 kg). In men it was 77.6 kg (range 55 - 130 kg) and in women 60.4 kg (range 37 - 91 kg). 26% of persons questioned considered they had lost weight during the last three months (table 2).

<table>
<thead>
<tr>
<th>Number</th>
<th>Mean weight (kg)</th>
<th>Minimum weight (kg)</th>
<th>Maximum weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>global</td>
<td>64.9</td>
<td>37</td>
<td>130</td>
</tr>
<tr>
<td>men</td>
<td>77.6</td>
<td>55</td>
<td>130</td>
</tr>
<tr>
<td>women</td>
<td>60.4</td>
<td>37</td>
<td>91</td>
</tr>
</tbody>
</table>

- **Height**
  
  The mean height of the whole group was 160.4 +/- 8.15 cm (range 140 - 179 cm). In men it was 169.9 cm (range 160 - 179 cm) and in women 157.1 cm (range 140 - 170 cm).

- **Body mass index**
  
  Body mass index (BMI) was calculated using the formula BMI = weight (kg) / height 2 (m).

  For a person aged over 70, optimal BMI is around 24 or 25, which is the threshold considered as overweight in a younger subject (22) (table 3).

  Mean BMI was 24.4 but the range was considerable (15.6 – 35.4).

<table>
<thead>
<tr>
<th>Men (n)</th>
<th>Men (%)</th>
<th>Women (n)</th>
<th>Women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18.5 (underweight)</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>18.5 – 24.9</td>
<td>18</td>
<td>48.64</td>
<td>51</td>
</tr>
<tr>
<td>25 – 29.9</td>
<td>14</td>
<td>37.83</td>
<td>32</td>
</tr>
<tr>
<td>&gt; 30 (obesity)</td>
<td>5</td>
<td>13.51</td>
<td>14</td>
</tr>
<tr>
<td>&gt; 40 (massive obesity)</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100</td>
<td>110</td>
</tr>
</tbody>
</table>

Three men who weighed over 100 kg were excluded from the population in order to obtain a BMI closer to reality (total number 147 subjects).

**Eating habits**

More than 80% of participants considered that their diet was important. Two-thirds thought they had a balanced diet, but 14% did not give an opinion (due no doubt to lack of information on the subject).

90% were of the opinion that their intake was sufficient, but 19% admitted to feeling hungry between meals, 11% during the evening and 5% at night. This resulted in the desire to "nibble" between meals for 15% of subjects, during the evening for 15% and during the night for 7%. Age did not exclude interest in food: 43% of subjects said they enjoyed eating, and 50% considered themselves as interested in fine food.

However, 30% of participants reported a loss of appetite during the last three months and only 70% were able to prepare their own meals, while the remaining 30% needed varying degrees of assistance. These figures are in relation with the social isolation of this population and confirm the fragility of their dietary equilibrium.

Most subjects (85%) ate three meals a day, and 6.7% had a snack as well, but 8% made do with two meals.

Various diets were followed regularly: low-cholesterol (14%), diabetic (8.7%), salt-free (6%), slimming (2.7%), other (20%), more or less irrational and sometimes self-prescribed (among them 4 "fat-free" diets). Much still needs to be done in diffusing information on the harmful effects of restrictive diets after the age of 70.

Fluid intake: 70% bought bottled water, which often restricted their fluid intake because of the difficulty of carrying the packs; 48.7% drank wine every day (between 0.5 and 7 glasses a day, but 84% of those who drank daily consumed 2 glasses or less). 6% had a before-dinner drink, 4% drank beer and a single subject consumed 2 glasses of after-dinner liqueur a day, 56% usually drank soup in the evening.

32% of persons never shared a meal with a family member or with friends, which confirms their extreme isolation. 31% had no local baker’s shop and 40.7% no nearby grocer.

**Nutrient intake**

Intake as compared with the recommended daily allowances (23) is detailed in table 4. This table confirms the marked deficiency in micronutrients, in particular in vitamin C and
folates, which are supplied above all by fresh food. There was also a deficiency in anti-oxidants (beta-carotene and selenium, and a more marked deficiency in zinc and vitamins E and C).

### Table 4

<table>
<thead>
<tr>
<th>Nutrient in relation to Recommended Daily Allowances. (23)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Protein (g/day)*</td>
</tr>
<tr>
<td>Fat (g/day)*</td>
</tr>
<tr>
<td>Carbohydrate (g/d)*</td>
</tr>
<tr>
<td>Alcohol (g/day)*</td>
</tr>
<tr>
<td>Kcal/day**</td>
</tr>
<tr>
<td>Prot/kg</td>
</tr>
<tr>
<td>Kcal/kg</td>
</tr>
<tr>
<td>Water (ml)</td>
</tr>
<tr>
<td>Mg (mg)</td>
</tr>
<tr>
<td>Ca (mg)</td>
</tr>
<tr>
<td>Iron (mg)</td>
</tr>
<tr>
<td>Zn (mg)</td>
</tr>
<tr>
<td>Vit B1 (mg)</td>
</tr>
<tr>
<td>Vit B2 (mg)</td>
</tr>
<tr>
<td>Vit B5 (mg)</td>
</tr>
<tr>
<td>Vit B6 (mg)</td>
</tr>
<tr>
<td>Vit B9 (mg)</td>
</tr>
<tr>
<td>Vit B12 (mcg)</td>
</tr>
<tr>
<td>Vit C (mg)</td>
</tr>
<tr>
<td>Vit E (mg)</td>
</tr>
</tbody>
</table>

* Macronutrients intake is correlated with BMI, physical activity and global needs; ** Dietary intake less than 1500kcal/day is a large risk of deficiency in micronutrients

### Energy intake (kcal/kg/day)

The number of kcal/kg/day ranged from 9.66 to 58.3 (mean 26.3): from 9.66 to 54 for women (mean 25.9) and 13.5 to 58.3 for men (mean 26.5). The proportions of the various macronutrients in the daily food intake is given in table 5.

### Table 5

<table>
<thead>
<tr>
<th>Percentage of daily energy intake supplied by carbohydrate, fat, protein and alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (%)</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Carbohydrate</td>
</tr>
<tr>
<td>Fat</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Alcohol</td>
</tr>
</tbody>
</table>

Energy intake ranged from 9.66 to 58.3 kcal/kg/day with a mean of 26.3 kcal/kg/day.

### Risk of undernutrition

- (42.7%), including 76.5% of women and 23.5% of men, had an energy intake of less than 25 kcal/kg/day, which is the threshold for risk of undernutrition.
- and 22.7% had an intake between 20 and 25 kcal/kg/day.
- 21.3%, (of whom nearly three-quarters were women) had an energy intake of less than 20 kcal/kg/day, which is established undernutrition.
- 28% had an intake between 25 and 30 kcal/kg/day
- and only 28% had a intake of 30 kcal/kg/day or more, which is the normal threshold for elderly persons.

The 62 subjects who consumed less than 1 500 kcal/day, 55 women and 7 men, mean age 81.9 years (range 74 - 95 years), were clearly at risk of micronutrient deficiency.

### Food intake and medication

The 83 subjects who took 4 or more medications a day consumed about the same number of calories (mean 1 663 kcal/day) as the others, but 35 subjects (23%) both took several medications and also consumed less than 1 500 kcal/day. These statistics are in conformity with those of the literature. The PAQUID and CREDES studies have shown that patients aged over 70 years took a mean of 4 to 5 different medications per day. It does not therefore seem from our study that social isolation is a factor of excessive consumption of medications.

### Food intake and mobility

Decreased food intake was correlated with decreased physical ability. Some elderly persons had difficulty in moving around, in carrying even light weights, and were afraid of falling, which limited their ability to do their own shopping. In the SENIKA study, in elderly Europeans, physical performance declined significantly as they aged from 75-80 years (19) to 81-86 years of age, second part of the longitudinal survey (20). This finding was clear both by subjective and objective measures of functioning. Between the two surveys participants declined in their global physical performance of the P (p < 0.0001) . This finding was significant for the chair stand in women (p < 0.04).The ability to rise to a standing position from a chair with or without support using the chair arms predicted the need for assistance at 5 years (20). In this study, the frequency of needing to use the chair arms to stand up was correlated with food intake: it was 44% in subjects who consumed less than 25 kcal/day and only 38% in those whose intake was greater than 30 kcal/day.

#### a) Functional ability

Functional ability was calculated using the scale of Katz (24) for activities of daily living and Lawton’s scale for instrumental activities of daily living (IADL) (25). We paid particular attention to the four IADL correlated with cognitive function in the PAQUID study: use of the telephone, managing medication, handling money and the ability to use transportation (26). This fourth function is particularly dependent on physical and sensory capacities as well as on cognitive function. Lastly, the AGGIR assessment was used to classify subjects in groups with the same level of ability, with GIR scores of 1 to 6 ranging from total dependence to independence. All the subjects living alone, except one, were independent with a GIR score of
between 4 and 6. Nevertheless, (45.3%) were afraid of falling and 34% had in fact had a recent fall, compared with the 20% classically accepted in the literature. This study reveals the importance of falls and fear of falling in a population living alone at home who were a priori capable of managing on their own. In Suzuki’s study (27) of 135 subjects living at home with assistance, only 16% were very afraid of falling especially while walking or having a bath. In our study, the circumstances in which the individuals were afraid of falling were not specified.

In the present circumstances of social isolation, a fall can also have a symbolic value. Our study thus tends to agree with that of Faulkner (28) of women living in retirement homes, which indicated that the quality of the family network influenced the risk of falls: the stronger the presence of the family, the lower the risk of falls.

In another respect, it is regrettable that in the SOLINUT study one-leg balance was not taken into account, as this is a good marker of the risk of falls and could have detected the possible fragility of this population (29). However, we considered it too risky to carry out this test with unqualified investigators, alone in the home with the participant. -24.7% had difficulty rising from a chair and 41.3% needed to use the chair arms in order to rise to a standing position. The chair rise test was validated in the EURONUT-SENECA study for persons aged over 70 years (20).
-34.7% had problems with balance when walking.
-Only 58% of subjects were fully mobile.
-Ninety-three of the 150 subjects were able to carry a 5 kg weight for a distance of 10 meters, 41 of these with difficulty.
-44% could not cut their own toenails and 46% had difficulty in picking up an object on the ground.

b) Health status
52.7% of persons rated their health as good or very good, 14% as average and 33.3% as poor or very poor. This average is part of the range of undernourished subjects who are at risk of poor health status (30). The 30 subjects who rated their health as not very good were generally confined to their home (30%) and 13 of them were very afraid of falls. Nearly all participants (95%) had a treating physician, whom the great majority (81%) consulted at least once every three months. They presented a variety of disorders, predominantly joint pain (75%), sensory or sight problems (62%), hearing problems (42%) and dyspnea (32%), while 11% had had a heart attack, 9% neurological problems and only 8.7% had diabetes. The mean number of medications taken was 4.4 per subject and per day (range 0 – 14).

Discussion
This study clearly shows the impact of loneliness on nutritional status. The prevalence of undernutrition in elderly home-dwelling populations is 1.6% to 7.4% depending on the studies and the methodology used (collective investigation, INSERM 1999). In the EURONUT-SENECA study, 4% of persons living at home with a spouse, and aged 70 to 75 years on inclusion, were undernourished. In the SOLINUT study, 76.5% of women and 23.5% of men had an energy intake of less than 25 kcal/kg/day, the threshold for undernutrition. But above all, 21.3% of subjects, of whom 72% were women, had an energy intake of less than 20 kcal/kg/day, which is the established undernutrition. This decrease in nutritional status influences their functional capacity and their health status.

This study also confirms that elderly men are much less isolated, since women, whether family members or professional healthcare workers, look after them and often prepare the meals.

Possibly, the origin of the elderly person’s feeling of loneliness should not be sought in the reality of their present daily life, but rather in their past life, in the way they have coped with successive bereavements (as well as the progressive loss of physical capacity and mobility) and in their aptitude to become involved again with the outside world. In order to alleviate their loneliness, elderly persons appear to seek above all involvement in activities outside their home. When social participation is no longer possible, they are at risk of depression, a state which increases the likelihood of dependence, both physical and psychological (decreased mobility, no outings or excursions, loss of familiar landmarks, of interest in the outside world and of any initiative or vital energy). Heikkinen (31), who evaluated symptoms of depression in a 10-year follow-up of a cohort of persons aged over 75, showed that loneliness is an important factor, and even more so if it is associated with decreased functional ability or a large number of chronic diseases. This was confirmed by the study of Jylha (32), which examined whether older age is associated with increasing loneliness in people aged 60 and over (TamELSA), a population-based prospective longitudinal study in Tampere, Finland. The follow-up time was 20 years. Loneliness was measured by a single question:"Do you feel lonely?" with the possible answers often, sometimes, or never. Cross-sectional analysis showed that the percentage of subjects feeling lonely increased toward older age groups, but in a multivariate analysis, only household composition and social participation were independently associated with loneliness. Longitudinal analysis showed that loneliness increased with higher age. Over a 10-year period, loneliness increased most in those who, at baseline, were married and living alone with their spouse. We agree with their conclusion: loneliness does increase with age, not because of age per se, but because of increasing disability and decreasing social integration.

But it must be emphasized that many elderly subjects do not benefit from the services to which they could have access, because of a lack of coordination between the various providers. It thus seems desirable that elderly persons should be integrated in a support network, which helps them to feed
themsevles better and to increase their mobility.

This proposal is even more important if a sudden, unforeseen climatic event occurs. Study of the Chicago heatwave in July 1995 clearly showed the value of "social capital" since deaths of isolated persons were the most numerous (33). During the heatwave which marked the summer of 2003 in France, isolated subjects were exposed to a much higher risk. After that episode, we noted the deaths which had occurred in our population and observed that preventive action had been effective (visits ended in May 2003), as only two deaths were recorded.

Proposals

It is indispensable to screen for those persons who are at risk of undernutrition and dehydration. In the SENECA study, we defined the profile of subjects at risk (5). They are elderly persons, living at home, who:

- do not eat enough protein
- tend to consume simple carbohydrates
- consume few foods rich in vitamins and minerals (fruit and vegetables)
- who lack exercise
- who undergo an intercurrent event, in particular an acute illness or a psychological stress
- and to these factors we must now add loneliness and social isolation, already cited in a consensus conference (34).

1) Persons exposed to the risk of undernutrition can thus be detected by identifying those who are socially isolated. The Mini-Nutritional Assessment"Short Form" (MNA) should be used as a screening tool by all those in contact with elderly persons living at home (35). This tool assesses appetite, weight (in particular weight loss), mobility and physical and/or emotional disorders. Information should also be given on harmful diets and on the suitability of tap water for drinking, to avoid dehydration particularly in summer time.

2) It is also important to maintain the presence of small local shops, make the goods on the shelves easier to reach, supply smaller packs and clearer labelling, and lastly to provide help with carrying the shopping and/or home delivery.

3) Any necessary services should be provided even if the need is only temporary.

4) Contacts could be established between elderly persons by encouraging them to meet in small facilities open to the life of the community or in meetings of the residents of a street or an apartment block around a given topic, for example a simple meal.

5) Lastly, fear of insecurity increases isolation, incites people to stay at home, reduces physical activity and helps to turn elderly people into "excluded recluses ".

Conclusion

Regarding diet, our study confirms that loneliness has an impact on nutritional status in a variety of areas, from appetite to the ability to do the shopping. The fact that local shops have almost disappeared and that where they still exist their higher prices are less compatible with a reduced income contributes to decrease food consumption and promotes the onset of various disorders which are the consequence of an inadequate intake, among them fractures of the femoral neck and their repercussions.

After a certain age, successful aging is not related to isolation in itself, nor to absence of financial worries, since a large number of persons with a low income nevertheless consider it as adequate. It stems rather from appreciating the value of this period of life by sustaining a positive outlook, maintaining social contacts and the desire to live well, by eating sufficiently and taking regular, moderate physical exercise.

Effective prevention of undernutrition and the provision of simple aids and assistance, together with application of the PNNS recommendations, should enable us to improve the quality of life of elderly persons.

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