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## Malnutrition and its determinants among older adults living in foster families in Guadeloupe (French West Indies). A cross-sectional study

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<b>Keywords</b>	Foster families; older adults; malnutrition; Caribbean.

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**Malnutrition and its determinants among older adults living in foster families in Guadeloupe (French West Indies). A cross-sectional study.**

**Abstract**

**Background:** Foster families may represent an alternative model for dependent older adults in many countries where nursing homes are insufficiently developed. This study aimed to assess the prevalence of malnutrition and its determinants in older adults living in foster families in Guadeloupe (French West Indies).

**Methods:** This cross-sectional study was gathered from the KASAF (Karukera Study of Ageing in Foster families) study (n=107, 41M/66F, Mdn 81.8 years). Nutritional status was assessed with the Mini Nutritional Assessment Short- Form (MNA- SF). Clinical characteristics and scores on geriatric scales (Mini-Mental State Examination (MMSE), Activities of Daily Living (ADL), Short Physical Performance Battery (SPPB), Center for Epidemiologic Studies- Depression (CESD) and Questionnaire Quality of Life Alzheimer’s Disease (QoL-AD)) were extracted. Bivariate analysis and logistic models adjusted for age and gender were performed to test the association of nutritional status with socio-demographic variables and geriatric scales.

**Results:** Thirty (28.0%) older adults were malnourished (MNA-SF score  $\leq 7$ ). In bivariate analysis, malnutrition was associated with an increased prevalence of cardiovascular diseases (46.7% versus 19.5%,  $p=0.004$ ), the presence of hemiplegia (30.0% versus 6.5%,  $p=0.003$ ), a poorer cognitive status (MMSE score  $4.7 \pm 7.1$  versus  $9.7 \pm 10.7$ ;  $p=0.031$ ), higher risk of depression (CESD score  $27.3 \pm 23.0$  versus  $13.5 \pm 14.4$ ;  $p=0.035$ ) and dependency (ADL score  $1.9 \pm 1.9$  versus  $2.3 \pm 2.1$ ;  $p<0.001$ ). Malnutrition was also associated with lower caregivers’ rating of QoL (QoL-AD score  $21.8 \pm 6.4$  versus  $26.0 \pm 5.7$ ;  $p=0.001$ ) but not by older adult’s rating ( $24.1 \pm 11.2$  versus  $28.3 \pm 7.7$ ;  $p=0.156$ ). Similar associations were observed in logistic models adjusted for age and gender.

**Conclusion:** Malnutrition was common among foster families for older adults. Special attention towards the prevention and treatment of malnutrition in older adults from cardiovascular diseases, cognitive impairment, dependency and depression is necessary in this model of dependency support.

**Keywords:** Foster families; older adults; malnutrition; Caribbean

## 36 **Introduction**

37 Although foster families exist in many countries, this model is not widespread (1).  
38 Consequently, very few studies have described and assessed the effectiveness of this model  
39 on potential adverse health outcomes (2). In Guadeloupe (French West Indies, Caribbean  
40 Island), the number of foster families has increased over the past three decades, due to the  
41 aging of the population and the limited availability of nursing home placements. Cultural  
42 factors may also contribute to this phenomenon. For instance, the importance of the family in  
43 Caribbean culture and the public's reticence towards nursing homes may contribute to this  
44 phenomenon. Foster families assume responsibility for the care of one to three residents in  
45 their home, while a nurse, who visits the older adults on a daily basis, assumes paramedical  
46 care. Foster families are remunerated directly by the relevant public authorities. In a  
47 prospective observational study (KArukera Study of Ageing in Foster Families, KASAF), we  
48 observed that the profile of older adults in foster families was similar to that for older adults  
49 living in nursing homes in terms of co-morbidities, dementia and dependence (3). Foster  
50 caregivers are responsible for the daily activities, including shopping, food preparation and  
51 the provision of meals. It is essential that these meals meet the nutritional needs of older  
52 adults.

53 Indeed, ensuring nutritional needs is fundamental to the care of older adults, particularly those  
54 who are dependent (4). Ageing is associated with a change in body composition, a decrease in  
55 lean body mass and an increase in fat mass. Malnutrition predisposes older adults to an  
56 increased risk of adverse health outcomes such as frailty, osteoporosis, muscle wastage,  
57 mortality (4), a lack of energy (5), a decline in health and physical functions (6) or falls (7).  
58 Malnutrition is frequently underestimated and neglected, as its manifestations are non-  
59 specific, particularly in the early stages. The following factors have been identified as  
60 increasing the risk of malnutrition:-age over 85, low nutrient intake due to a loss of the ability  
61 to eat independently, difficulty swallowing, becoming bedridden, pressure ulcers, a history of  
62 hip fracture, dementia, depressive symptoms, and suffering from two or more chronic  
63 illnesses (8).

64 Malnutrition has been the subject of investigation in both nursing homes and the community.  
65 However, it has never been the subject of study in the context of foster families for older  
66 adults. The aim of this study was to estimate the prevalence of malnutrition among older

67 adults receiving caregiving in foster families and to investigate the factors associated with  
68 malnutrition using the baseline data of the KASAF cohort.

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70

## 71 **Methods**

### 72 Study design

73 KASAF cohort is a prospective observational study of older adults ( $\geq 60$  years old) living in  
74 foster families in Guadeloupe. The study protocol (9) and inclusion data has been published  
75 (3). At inclusion, 6 months and 12 months, healthcare professionals (geriatricians or clinical  
76 research nurses) interviewed the participants and their professional caregivers. For this study,  
77 we performed a cross-sectional analysis of the baseline's characteristics of participants. The  
78 KASAF study and was approved by the Sud Méditerranée III Ethics Committee on July 1,  
79 2020 (number 2020.05.03 bis\_ 20.04.01.59610).

### 80 Outcome measure

81 The nutritional status was evaluated using the Mini Nutritional Assessment Short- Form  
82 (MNA- SF) (Rubenstein) (9). 15 The MNA- SF comprises six items: reduced food intake,  
83 non- volitional weight loss in the past 3 months, mobility, psychological stress or acute  
84 disease during the past 3 months, neuropsychological problems, and low body mass index  
85 (BMI). For adults whose BMI was missing, it was replaced by low calf circumference, as  
86 recommended in the MNA- SF guidance (9). The total MNA- SF score ranges from 0  
87 (indicating the most severe form of malnutrition) to 14 (indicating no sign of malnutrition).In  
88 particular, a score of 12–14 is indicative of a normal nutritional status, while a score of 0–7  
89 and 8–11 identifies malnutrition or risk of malnutrition respectively.

### 90 Other measurements

91 The sociodemographic data and comorbidities were collected from the foster caregiver. The  
92 cognitive status was assessed using the Mini-Mental State Examination (MMSE) (10). A  
93 score below 18 indicated the presence of major cognitive impairment. Functional status was  
94 evaluated using the Activities of Daily Living (ADL) scale (11) and the instrumental ADL  
95 scale (IADL) (12). Physical function was assessed using the Short Physical Performance  
96 Battery (SPPB) (13) and depression with the Center for Epidemiologic Studies Depression  
97 (CESD) scale (14). Quality of life of the participant was assessed using the QoL-AD  
98 (Questionnaire Quality of Life - Alzheimer's Disease) (15), which was administered to the

99 participant and the caregiver.-Pain was quantified using a visual analogue scale (VAS), with  
100 scores ranging from 0 to 100.

### 101 Statistical analysis

102 Quantitative variables were expressed as mean  $\pm$  standard deviation, median and minimum  
103 and –maximum values. The qualitative variables were expressed as percentages. Chi- square  
104 or Fisher test and t- tests were used to describe the population according to their nutritional  
105 status. A Pearson correlation test was used to assess the correlation between the QOL-AD  
106 scores of patient and their respective caregiver. Logistic regression models, which were  
107 adjusted for age and gender, were conducted to examine the association between nutritional  
108 status (the independent variable) and each comorbidity and each geriatric scale. We reported  
109 odds ratios (ORs) and 95% confidence intervals (95% CIs). No imputation method was  
110 performed for missing data- Statistical significance was set at  $P < 0.05$ . All analyses were  
111 performed with R. 4.2.1.

112

## 113 Results

### 114 1. Frequency of malnutrition

115 A total of 107 older adults were included in the study. The mean age was  $82.2 \pm 11.6$  years,  
116 and 38.3% of the participants were men. They had been living in foster care for  $4.6 \pm 4.8$   
117 years. The frequency of malnutrition ( $MNA-SF \leq 7$ ) was 28.0% (95% confidence interval  
118 (CI): 20.9-39.1) (n=30). Furthermore, 52 (48.6%, IC95%: 39.1-58.1) older adults were at risk  
119 of malnutrition (MNA-SF between 8 and 11 points). The prevalence of older adults with  
120 malnutrition or at risk of malnutrition was 76.6% (IC95%: 68.6-84.6).

### 121 2. Factors associated with sociodemographic status and comorbidities

122 In bivariate analysis, malnutrition (compared to normal nutritional status or at risk of  
123 malnutrition) was associated with cardiovascular diseases (46.7% versus 19.5%,  $p=0.004$ ) and  
124 hemiplegia (30.0% versus 6.5%,  $p=0.003$ ). Malnutrition was not associated with age, gender,  
125 length of stay in foster families, hypertension, diabetes, dementia and Parkinson’s disease  
126 listed by the caregiver (table 1). In a model adjusted for age and gender, the OR were 3.94  
127 (CI95%: 1.52-10.62) for cardiovascular disease and 11.36 (CI95%: 3.00-53.29) for  
128 hemiplegia.

		<b>Bivariate analysis</b>	<b>Model adjusted on age and gender</b>
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Characteristics	All (n=107)	Malnutrition yes (n=30)	Malnutrition no (n=77)	p	OR (CI95%)	p
Age	82.2 ± 11.6	84.7 ± 11.3	81.2 ± 11.2	0.156		
<80 years old	44 (41.1%)	8 (18.2%)	36 (81.8%)			
≥ 80 years	63 (58.9%)	22 (34.9%)	41 (65.1%)	0.057		
Gender (men)	41 (38.3%)	8 (26.7%)	33 (42.9%)	0.122		
Length of stay in foster families	4.6 ± 4.8	4.2 ± 3.7	4.8 ± 5.2	0.576	0.98 (0.88-1.07)	0.647
Hypertension	49 (45.8%)	14 (46.7%)	35 (45.4%)	0.910	1.02 (0.42-2.42)	0.959
Diabetes	26 (24.3%)	7 (23.3%)	19 (24.7%)	0.884	0.93 (0.32-2.51)	0.903
Hypercholesterolemia	11 (10.3%)	4 (13.3%)	7 (9.1%)	0.498	2.86 (0.59-13.63)	0.178
Cardiovascular diseases (cardiac failure, myocardial infarction, stroke)	29 (27.1%)	14 (46.7%)	15 (19.5%)	0.004	3.94 (1.52-10.62)	0.005 <sup>i</sup>
Dementia	53 (49.5%)	19 (63.3%)	34 (44.2%)	0.075	1.75 (0.70-4.52)	0.237
Parkinson's disease	13 (12.2%)	6 (20.0%)	7 (9.1%)	0.184	2.58 (0.75-8.80)	0.124
Hemiplegia	14 (13.1%)	9 (30.0%)	5 (6.5%)	0.003	11.36 (3.00-53.29)	<0.001 <sup>ii</sup>
Kidney disease	4 (3.7%)	3 (10.0%)	1 (1.3%)	0.066	6.84 (0.81-144.09)	0.107
Cancer	1 (0.9%)	0 (0.0%)	1 (1.3%)	-		

129 *Table 1: Sociodemographic factors and comorbidities associated with nutritional status in KASAF study*

130 <sup>i</sup>: McFadden's Pseudo R2: 0.090

131 <sup>ii</sup>: McFadden's Pseudo R2: 0.133

132

### 133 3. Association between MNA-SF score and geriatric scales

134 Malnutrition (compared to normal nutritional status or at risk of malnutrition) was associated  
135 with poorer cognitive status assessed by the MMSE score ( $4.7 \pm 7.1$  versus  $9.7 \pm 10.7$ ,  
136  $p=0.031$ ), especially among older adults with major cognitive disorders (MMSE score < 18)  
137 ( $92.3\%$  versus  $30.0\%$ ,  $p=0.023$ ). Among the 28 older adults with a MMSE score <18 who  
138 were not diagnosed with dementia by the caregiver, six were malnourished ( $21.4\%$ ).  
139 Malnutrition was also associated with a lower ADL score ( $1.9 \pm 1.9$  versus  $2.3 \pm 2.1$ ,  
140  $p<0.001$ ). Malnutrition was highly associated with bedridden older adults ( $96.7\%$  versus  
141  $67.5\%$ ,  $p=0.001$ ) and older adults totally dependent at meals ( $80.0\%$  versus  $42.9\%$ ,  $p<0.001$ )  
142 in terms of activities of daily living. Malnutrition was associated with the caregivers

143 'estimation of QoL score (QoL-AD score  $21.8 \pm 6.4$  versus  $26.0 \pm 5.7$ ;  $p=0.001$ ) but not by  
 144 the self-reported QoL score ( $24.1 \pm 11.2$  versus  $28.3 \pm 7.7$ ;  $p=0.156$ ). The correlation  
 145 coefficient between the QoL-AD score for older adult and their respective caregivers was 0.60  
 146 ( $p<0.001$ ). Finally, the CESD score for depression was associated with malnutrition ( $27.3 \pm$   
 147  $23.0$  versus  $13.5 \pm 14.4$ ;  $p=0.035$ ) (Table 2). The SPPB score ( $0.4 \pm 1.3$  versus  $1.2 \pm 2.2$ ;  
 148  $p=0.07$ ) and VAS pain score ( $63.3 \pm 2.6$  versus  $41.3 \pm 36.4$ ,  $p=0.169$ ) were not statistically  
 149 associated with the MNA-SF score (table 2).

150 In model adjusted for age and gender, the OR for malnutrition was 4.92 (1.27-32.69) for a  
 151 MMSE score of  $\leq 18$ , 0.51 (0.31-0.76) for the ADL score, 0.87 (0.79-0.95) for QoL-AD caregivers  
 152 'estimation and 1.05 (1.00-1.11) for the CESD score.

153

Scale	All (n=107)	Bivariate analysis			Model adjusted on age and gender	
		Malnutrition yes (n=30)	Malnutrition no (n=77)	p	OR	p
MMSE (n=96)	$8.3 \pm 10.1$	$4.7 \pm 7.1$	$9.7 \pm 10.7$	0.031	0.94 (0.89-0.99)	0.045 <sup>1</sup>
MMSE $\leq 18$ (n=96)	73 (76.0%)	24 (92.3%)	21 (30.0%)	0.023	4.92 (1.27-32.69)	0.043
ADL (n=107)	$1.5 \pm 1.8$	$1.9 \pm 1.9$	$2.3 \pm 2.1$	<0.001	0.51 (0.31-0.76)	0.004 <sup>2</sup>
Full assistance for bathing	84 (78.5%)	28 (93.3%)	56 (72.7%)	0.020		
Full assistance of dressing	88 (82.2%)	29 (96.7%)	59 (76.6%)	0.015		
Full assistance for toileting	90 (84.1%)	29 (96.7%)	61 (79.2%)	0.015		
Bedridden	81 (75.7%)	29 (96.7%)	52 (67.5%)	0.001		
Incontinence	91 (85.0%)	29 (96.7%)	62 (80.5%)	0.035		
Totally dependent at meals	57 (53.3%)	24 (80.0%)	33 (42.9%)	<0.001		
QOL-AD (n=47) residents	$27.2 \pm 8.8$	$24.1 \pm 11.2$	$28.3 \pm 7.7$	0.156	0.93 (0.83-1.01)	0.104
QOL-AD caregivers' estimation (n=47)	$24.8 \pm 6.2$	$21.8 \pm 6.4$	$26.0 \pm 5.7$	0.001	0.87 (0.79-0.95)	0.003 <sup>3</sup>
VAS pain (n=37)	$44.9 \pm 35.6$	$63.3 \pm 2.6$	$41.3 \pm 36.4$	0.169	1.01 (0.99-1.04)	0.322
SPPB (n=105)	$1.0 \pm 2.0$	$0.4 \pm 1.3$	$1.2 \pm 2.2$	0.07	0.78 (0.52-1.03)	0.147
CESD (n=39)	$16.7 \pm 17.4$	$27.3 \pm 23.0$	$13.5 \pm 14.4$	0.035	1.05 (1.00-1.11)	0.031 <sup>4</sup>

154 Table 2: Associations between MNA-SF score and geriatric scales

155 <sup>1</sup>: McFadden's Pseudo R2: 0.178



156 <sup>2</sup>: McFadden's Pseudo R2: 0.133  
157 <sup>3</sup>: McFadden's Pseudo R2: 0.110  
158 <sup>4</sup>: McFadden's Pseudo R2: 0.724  
159

## 160 **Discussion**

161 This is the first study to assess malnutrition in foster families for dependent older adults. The  
162 results highlighted the high prevalence of malnutrition in this setting (28.0%). In community-  
163 dwelling older adults, the prevalence of malnutrition is between 3 to 6%,—depending on the  
164 setting and assessment method (4, 17, 21). In Guadeloupe, the prevalence of malnutrition or  
165 at-risk of malnutrition in older adults is 21.7% at home (18), which is a significantly lower  
166 than observed in our study (i.e. 76.6%). Foster families in Guadeloupe are considered an  
167 alternative to nursing homes. In the literature, the frequency of malnutrition in nursing homes,  
168 based on the MNA scale, is estimated at 13.8% (17). In France, a study carried out in nursing  
169 homes found a frequency of 15.7% (19). We observed a frequency of malnutrition of 92.3%  
170 in older adults with severe cognitive impairment, which appears to be higher than that  
171 reported in the literature. The estimated range is 6.8% to 75.6% (20) or 28.7% in another  
172 systematic review using only the MNA score (21). In the model adjusted for age and gender, a  
173 MMSE score  $\leq 18$  was associated with malnutrition (OR: 4.92 (CI95%: 1.27-32.69)). The  
174 finding of the study indicated that dementia, as reported by the foster caregiver, was not  
175 associated with malnutrition. However, the MMSE score suggested that almost 20% of the  
176 older adults suffered from undetected severe cognitive impairment. Dementia, as well as  
177 undernutrition, seems to be underestimated by foster caregivers.

178 Malnutrition was particularly prevalent in older adults with a history of cardiovascular disease  
179 and hemiplegia. It is well established that malnutrition increases the risk of mortality and  
180 hospitalizations in patients with chronic heart failure (22). Our study is consistent with several  
181 other studies conducted ~~carried out~~ in nursing homes that have investigated the potential  
182 association between malnutrition and depression or poor physical function (23). Furthermore,  
183 we observed a strong association between dependency and malnutrition, particularly for in  
184 patients who are bedridden or have difficulty eating. With regard to quality of life, we noted  
185 that malnutrition was associated with QoL score as perceived by caregivers, but not with that  
186 rated by older adults themselves. In nursing homes, malnutrition impacts quality of life  
187 (24,25). This result may be due to the low number of older adults who were able to answer to  
188 the QoL-AD scale, excluding older adults with severe dementia. Impaired cognition has been  
189 associated with reduced quality of life when the caregiver is the assessor (26). Moreover,

190 quality of life perceived by the older adult is generally rated higher than that perceived by the  
191 proxies' rating (27,28). Higher prevalence of malnutrition have been observed in adults aged  
192 > 80 years and women (29). Although the association was not statistically significant, the  
193 frequency of malnutrition was higher in adults aged > 80 years (34.9% versus 18.2%,  
194  $p=0.057$ ) in our study.

195 Our study therefore provides important elements for the assessment of the foster family model  
196 for dependent older adults. One strength of our study is that it presents data from a population  
197 of Caribbean population, with a specific diet (especially in terms of fruit and vegetables) and  
198 probably specific dietary intake (30). Foster families for older adults could provide a solution  
199 to the challenge of dependency in many countries, particularly in the Caribbean and Africa.  
200 Improving nutritional care represents an essential lever for developing this model. In terms of  
201 nutrition, the foster family is presents both a strength and a weakness. It is easier to respect  
202 the food tastes and preferences of the older adult in a domestic setting than in a collective  
203 kitchen such as those found in nursing homes. Furthermore, the residents of nursing homes  
204 have less flexibility in their meal schedules. Nevertheless, the quantity and quality of home-  
205 cooked meals may not be optimal for malnourished older adults. Additional training and  
206 specialized dietetic care, including advice, food enrichment, anthropometric monitoring,  
207 consultations with nutritionists and dieticians and a food diary (4)), could be provided if  
208 malnutrition is detected. An alternative solution could be the implementation of meal delivery  
209 services. Currently, in Guadeloupe, the authorization to work as a foster caregiver requires 54  
210 hours of training, with only a few hours devoted to hygiene and nutrition. It is also  
211 noteworthy that weight was only available for 22 participants, despite the simplicity of the  
212 tool for detecting recent malnutrition. Paramedical staff could also provide training and  
213 screening for malnutrition, given that all foster care residents benefit from a daily visit from a  
214 nurse.

215 Our study has a number of limitations. Firstly, there were no data concerning the  
216 precariousness of family caregivers and the budget allocated to buying meals for the older  
217 people. This socio-economic data could have been interesting to explore. Secondly, due to the  
218 low sample size and the limit number of outcomes events for CESD scale or QOL-AD scale,  
219 no multivariate model taking into account all the covariates associated with malnutrition was  
220 performed. This is a cross-sectional study suggesting associations. The one-year longitudinal  
221 follow-up of our study will enable us to identify risk factors for nutritional deterioration,  
222 including hospitalizations and ADL.

223 **Conclusion:**

224 Malnutrition was common among older adults living in foster families. The prevalence of  
225 malnutrition was higher in older adults with dependency, depression, cardiovascular diseases,  
226 hemiplegia and cognitive impairment. The findings of this study indicate that there is a need  
227 for greater focus on the nutritional requirements of older adults and the training of foster  
228 caregivers in this area.

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236 Acquisition of data: Christine Rambohjan, Denis Boucaud-Maitre, Roxane Villeneuve, Leila  
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347 SUPPLEMENTARY MATERIAL

348 S1 : dataset