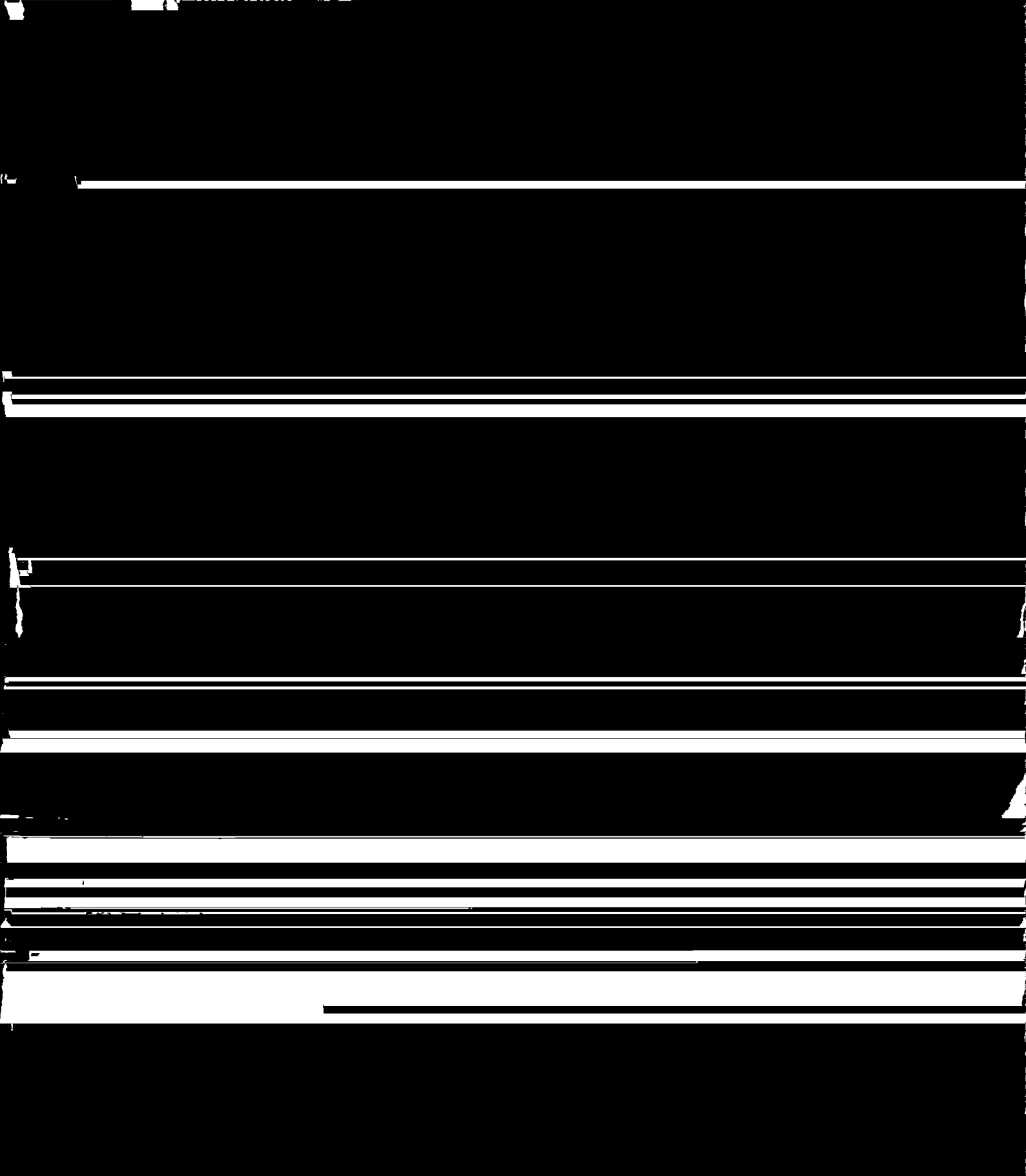


Economic crisis and malnutrition: socioeconomic determinants of anthropometric status of preschool children and their mothers in



influence of socioeconomic characteristics on the nutritional status of children and mothers. A general linear model¹⁰ was used for continuous nutritional indices (height-for-age and weight-for-height expressed in z-scores for children, BMI in kg m^{-2} for mothers) and, in parallel, a generalized linear model (logistic regression¹¹) was used for discrete indices (prevalence of stunting and of low weight-for-height indices in children, prevalence of thinness and of overweight in mothers). In these models the response variable was the nutritional index and all the socioeconomic variables were included as explanatory variables. Other explanatory variables were also entered for adjustment purpose. For the mothers, the only adjustment variable was age. For the children two types of models were used: model I was adjusted for the mother's age and the child's age and sex. In addition, model II was

(mainly recent settlers). The average age of the mothers was 28.8 years (SD=0.3) and 10.1% of them were less than 20 years old. Among the children there were 50.1% boys and 49.9% girls. Most of them had direct family ties with the head of household.

Nutritional situation

The nutritional status of the children and mothers has already been detailed⁴. Among the children ($n=2334$), the main figures were as follow: the overall prevalence of wasting was 4.2% (a prevalence of a weight-for-height of less than -1 z-score was 25.2%) with an average weight-for-height index of -0.39 z-score (SEM=0.02). As expected, the wasting was more pronounced in the youngest categories (especially 12–23 months). The overall prevalence of stunting was 11.0% with a

Table 1 General features of the variables used in the models

Variables at the household level (<i>n</i> =1368)	%	Additional variables for mothers (<i>n</i> =1512)	%	Additional variables for children (<i>n</i> =2373)	%
Dwelling district		Matrimonial status		Ties with the head of household	
Centre	20.8	Married	66.2	Son/daughter	73.5
Intermediate	50.4	Single	33.8	Grandson/granddaughter	18.9
Peripheral	28.7			Other	7.6
Number of persons in the household		Head of household		Person caring for	
1-4	37.9	Yes	11.6	Mother	91.7
5-9	48.2	No	88.4	Other	8.3
10-14	11.3	Wife of head of household			
15+	2.6	Yes	66.7		
		No	33.3		
Number of preschool children		Occupation			
1	48.2	Salaried	9.3		
2	36.7	Shopkeeper, artisan	2.7		
3+	15.1	Street seller	15.9		
Sex of the head of household		No occupation	66.4		
Male	78.4	Pupil	5.7		
Female	21.6	Education			
Time in Brazzaville		No schooling	15.1		
0-4 years	4.6	Primary school	18.5		
5-9 years	8.4	Secondary school	51.3		
10-19 years	21.1	Higher	15.1		
20+ years	65.9				
Time in the present home					
0-4 years	28.0				
5-9 years	19.6				
10+ years	52.4				
Lodging status					
House owner	35.5				
Lease holder	39.2				
Free lodging	25.3				
Economic level					
Low	30.4				
Medium	34.2				
High	35.4				
Occupation of the head of household					
Middle management	25.1				
Worker	19.4				
Office worker	12.9				
Shopkeeper, artisan	13.5				
No occupation	29.0				
Education of the head of household					
No schooling	14.3				
Primary school	21.8				
Secondary school	29.7				
Higher	34.2				

Adjustment variables for type I models			
Age		Sex	
<20 years	10.1	Male	50.1
20-29 years	56.2	Female	49.9
30+ years	33.7	Age	
		0-11 months	20.0
		12-23 months	17.8
		24-72 months	62.2

Additional adjustment variables for type II model			
Height		Birth weight	
Mean=1.60 m (SD=0.06)		Mean=3053 g (SD=525)	
BMI			
Mean=23.1 kg m ⁻² (SD=4.3)			

The child's birth weight ($P < 0.0001$) and the mother's height ($P < 0.0001$) are significantly linked to the height-for-age index and stunting, reflecting the strong influence of maternal and prenatal status. Taking these variables into account does not alter the conclusions about the estimated effects of the economic level of the household, of the schooling of the mother and of the dwelling district on the mean height-for-age index (Table 4, model II). However, while adjusting for maternal and prenatal status, the effects of the socioeconomic factors and dwelling district on

stunting are modified (Table 5, model II). The effect of the dwelling district remains significant, whereas that of economic level of the household is not any more and the mother's education significance is greatly reduced. This suggests that at least part of the effect of these two variables on the height of children is explained by the prenatal or maternal influence.

The linear model for the mother's BMI and the logistic regression models for thinness and overweight are shown in Table 6. All these models are adjusted for age. The mean

Table 2 General linear model: weight-for-height index in children aged < 6 years ($n=1163$)

Socioeconomic variables with significant effect	Model I* adjusted means	Model II† adjusted means
Number of preschool children in the household		
1	-0.21 ^a	-0.17 ^a
2	-0.45 ^b	-0.39 ^b
3 or more	-0.43 ^b	-0.37 ^b
	($P=0.007$)	($P=0.015$)
Adjustment variables	<i>P</i> value	<i>P</i> value
Child's sex	0.20	0.04
Child's age	2.10^{-7}	2.10^{-8}
Mother's age	0.16	0.48
Birth weight	-	1.10^{-10}
Mother's height	-	0.96
Mother's BMI	-	8.10^{-5}

*Adjusted for the child's sex and age and the mother's age.

†Adjusted for the child's sex, age, birth weight and the mother's age, height and BMI.

^{a,b}Means with no common letter are significantly different at the 0.05 level.

BMI increases with the economic level of the household and when the mother is married, and varies with her occupation. The highest index is observed among salaried

occupation (except for rare shopkeepers or artisans). The occupation of the head of the household also appears to be linked to levels of overweight in mothers but office

Table 4 General linear model: height-for-age index in children aged < 6 years ($n=1163$)

Socioeconomic variables with significant effect	Model I* adjusted means	Model II† adjusted means
Dwelling district		
Peripheral	-0.88 ^a	-0.79 ^a
Intermediate	-0.70 ^b	-0.64 ^b
Central	-0.40 ^c	-0.48 ^b
	($P=0.0006$)	($P=0.030$)
Economic level of the household		
Low	-0.85 ^a	-0.80 ^a
Medium	-0.63 ^b	-0.57 ^b
High	-0.50 ^b	-0.53 ^b
	($P=0.004$)	($P=0.017$)
Mother's education		
No schooling	-0.92 ^a	-0.78 ^a
Primary school	-0.91 ^a	-0.86 ^a
Secondary school	-0.59 ^b	-0.57 ^b
Higher	-0.22 ^c	-0.33 ^c
	($P=0.00001$)	($P=0.002$)
Adjustment variables	<i>P</i> value	<i>P</i> value
Child's sex	0.11	0.016
Child's age	2.10^{-7}	9.10^{-10}
Mother's age	0.035	0.13
Birth weight	-	2.10^{-2}
Mother's height	-	3.10^{-16}
Mother's BMI	-	0.006

*Adjusted for the child's sex and age and the mother's age.

†Adjusted for the child's sex, age, birth weight and the mother's age, height and BMI.

^{a,b,c}Means with no common letter are significantly different at the 0.05 level.**Table 5** Logistic regression models for stunting (height-for-age index < -2 z-score) in children aged < 6 years ($n=1163$)

Socioeconomic variables with significant effect	Model I*		Model II†	
	Adjusted odds ratios	Confidence interval (0.95)	Adjusted odds ratios	Confidence interval (0.95)
Dwelling district				
Peripheral	3.8	1.8-7.8	3.0	1.4-6.4
Intermediate	2.1	1.1-4.2	1.6	0.8-3.3
Central	1.0		1.0	
	($P=0.0005$)		($P=0.005$)	
Economic level of the household				
Low	2.0	1.1-3.6	1.9	1.0-3.5
Medium	1.7	1.0-2.9	1.5	0.8-2.6
High	1.0		1.0	
	($P=0.048$)		($P=0.11$)	
Mother's education				
No schooling	2.9	1.2-7.2	2.1	0.8-5.3
Primary school	2.9	1.3-6.7	2.6	1.1-6.1
Secondary school	1.4	0.6-2.9	1.3	0.6-2.8
Higher	1.0		1.0	
	($P=0.004$)		($P=0.047$)	
Adjustment variables	<i>P</i> value		<i>P</i> value	
Child's sex	0.0053		0.0009	
Child's age	0.0042		0.0015	
Mother's age	0.098		0.27	
Birth weight	-		<0.0001	
Mother's height	-		<0.0001	
Mother's BMI	-		0.09	

*Adjusted for the child's sex and age and the mother's age.

†Adjusted for the child's sex, age, birth weight and the mother's age, height and BMI.

Table 6 BMI in mothers: general linear model for continuous BMI and logistic regression models for thinness (BMI < 18.5 kg m⁻²) vs others and overweight (BMI ≥ 25 kg m⁻²) vs others

Socioeconomic variables with significant effect	BMI adjusted means	Underweight		Overweight	
		Adjusted odds ratios	Confidence interval (0.95)	Adjusted odds ratios	Confidence interval (0.95)
Economic level of the household					
Low	21.4 ^a	2.1	1.1–4.1	0.3	0.2–0.5
Medium	22.5 ^b	1.7	0.9–3.1	0.8	0.5–1.2
High	23.2 ^c	1.0		1.0	
	(<i>P</i> =3.10 ⁻⁵)	(<i>P</i> =0.06)		(<i>P</i> <0.0001)	
Mother's occupation					
No occupation	21.7 ^a			0.2	0.1–0.5
Pupil	21.3 ^a			0.2	0.1–0.5
Street seller	22.0 ^a			0.3	0.1–0.9
Shopkeeper/artisan	22.5 ^{ab}			0.7	0.1–2.9
Salaried	24.4 ^b			1.0	
	(<i>P</i> =0.0009)			(<i>P</i> =0.001)	
Marital status of the mother					
Single	21.6			0.2	0.1–0.5
Married	23.1			1.0	
	(<i>P</i> =0.01)			(<i>P</i> =0.0002)	
Education of the head of household					
No schooling		1.1	0.4–2.8		
Primary school		1.0	0.5–2.3		
Secondary school		2.6	1.4–4.9		
Higher		1.0			
		(<i>P</i> =0.006)			
Occupation of the head of household					
No occupation				1.0	0.5–1.7
Shopkeeper/artisan				1.0	0.5–2.0
Office worker				2.2	1.2–4.0
Worker				0.6	0.3–1.1
Middle management				1.0	
				(<i>P</i> =0.007)	
Effect of the age of the mother (adjustment variable)	<i>P</i> =4.10 ⁻⁵	<i>P</i> =0.003		<i>P</i> =0.007	

^{a,b,c}Means with no common letter are significantly different at the 0.05 level.

or marked obesity¹². Thus, even if the prevalence of thinness among mothers increased – and it is likely that the prevalence of overweight has also been limited by the crisis – the overall nutritional situation in Brazzaville was not so dire. This was probably due to the specificity of this urban area where, even though poverty increased, food supplies, access to safe water, electricity and to other facilities such as health care are usually better than in rural areas. Nevertheless, it is likely that the effects of the crisis were not distributed evenly in the population of Brazzaville. It was then important to determine which socioeconomic or dwelling district features were linked to the different types of malnutrition after several years of crisis. It was also of interest to assess whether the conceptual model of underlying causes of malnutrition adopted by the International Conference on Nutrition (ICN)¹³ is still valid in this context, and how the effects of the economic crisis were mediated by socioeconomic and prenatal factors.

Three factors have independent effects (i.e. adjusted for each other and for all the other variables) on the mean height-for-age index of children and on stunting: children

whose mothers have had only little schooling and children who live in the peripheral area are more at risk of stunting than others. As for the assessment of economic level of the household, it is important to notice that the variables used in computing the economic index reflect more the permanent living conditions of the households than current cash availability; a low economic level thus indicates medium to long-term poverty⁹. Although a low level of education is generally associated with poverty, the effect of the education of the mother on the height of children remains when adjusted for the economic level. This underlines a differential ability of the mothers to take care of their young children, according to their level of education, independently of the economic level of the household. Indeed, the results suggest the importance of a minimum level of education for mothers to adequately care for their children and thus ensure satisfactory growth¹⁴. The dwelling district variable takes into account access to health services, general infrastructure, hygiene and sewage facilities which are strongly contrasted between the three districts. The fact that, even when adjusted for economic level of the household, stunting is

not, confirms the hypothesis that the nutritional status of children is much more sensitive to environmental conditions than that of adults¹⁵.

When the three preceding characteristics are accounted for, none of the other variables actually provides further significant information on stunting. So, this combination of economic level of the household, mother's schooling and

higher when there is only one child aged < 6 years in the household. In the latter situation, it is likely that the mother has more time available for providing adequate caring to her child. But the feature that stands out is that few socioeconomic variables are shown to affect the weight-for-height index or wasting of the children¹⁹. Children aged 12–23 months remain the most at risk when all socioeconomic, maternal and areatal characteristics have

References

- 1 Thomas D, Lavy V, Strauss J. *Public Policy Anthropometric Outcomes in Côte d'Ivoire Living Standards Measurement*
- 13 transition nutritionnelle en Afrique Sub-Saharienne: les exemples du Congo et du Sénégal. *Rev. Epidemiol. Sante Publique* 1992; **40**: 252-8.
- 13 FAO/WHO. *Nutrition and Development – A Global Assessment International Conference on Nutrition*. Rome: Food

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