International Journal of Medical Science and Health Research

Vol.9, No. 03; 2025

ISSN: 2581-3366

Dynamics of Transmission of Anti-measles Antibodies Mother-infant in the City of Douala, Cameroon

Abdou Aziz PETOUONCHI NJOYA[1,3*], Jean Pierre NDA MEFO'O[1,2], Grace NGONDI[1,3], Josiane ESSOLA[1,3], Christiane MEDI SIKE[3,4], Gabin SIMO[1,3], Achille CHUENGOUE[2], MBONO Ritha[5], Patrick ELOUNOU[6], Dieudonné ADIOGO[1]

[1]Faculty of Medicine and Pharmaceutical Sciences of the University of Douala

[2]Clinical Biology Laboratory of the Douala General Hospital

[3]Clinical Biology Laboratory of Laquintinie Douala Hospital

[4]Faculty of Medicine and Biomedical Sciences of the University of Yaounde I

[5] Mother-Child Department of Laquintinie Douala Hospital

[6]Mother-Child Department of the Douala General Hospital

*Correspondence author:

Abdou Aziz PETOUONCHI NJOYA

Address: Laquintie Douala Hospital – PO Box: 4035 Douala, Cameroon

Phone contact: + (237) 699 972 620

doi: 10.51505/ijmshr.2025.9306 URL: http://dx.doi.org/10.51505/ijmshr.2025.9306

Received: May 13, 2025 Accepted: May 24, 2025 Online Published: Jun 09, 2025

Abstract

Introduction: Measles is a childhood disease that causes significant morbidity and mortality in low-income countries. Mortality reduction depends on the level of immunization of the infant and therefore that of the mother. The period from birth to the 9th month of life could be a high-risk area for morbidity and mortality. Therefore, we proposed to assess the immune status of infants in respect to measles as well as the associated factors.

Methodology: We conducted an analytical cross-sectional study, from January 2023 to January 2025 at the General and Laquintinie Hospital of Douala. All mothers and their infants who were treated in these two hospitals were included in this study. The sampling type was consecutive and a technical sheet was used to collect sociodemographic data and vaccination history of the mother-infant. For the search for the protective titer, a sample of 5ml of venous blood was taken from adults and 1.1ml from infants; anti-measles IgG quantification was done using a sandwich Elisa technique. The protective antibody titer was ≥200 mIU/ml and the collected data were analyzed on Excel 2013, epi info 7.3, Studio R and SSPS 20 software, then the search for associated factors was done by logistic regression and also presented in the form of odds ratio; the significance threshold was set at 5%.

Vol.9, No. 03; 2025

ISSN: 2581-3366

Results: A total of 200 infants aged 1 to 6 months and their mothers were recruited. The prevalence of a protective level (≥ 200 mIU/ml) was 16% among infants and 49% among their mothers. Breastfeeding and weight of the infant were correlated with maternal antibody levels. This was also the seen between infant age range and the dynamics of maternal antibody transmission. Among the infants' mothers, educational level, professional status as a trader and housewife, community lifestyle, occupation in contact with children under 5 years of age, history of illness, vaccination booster, and HIV status were protective factors ($P < 0.005$).

Conclusion: A significant proportion of infants and their mothers had antibody titers below the protective level, hence the risk of measles virus infection in the pre-vaccination period.

Keywords: Dynamics transmission, measles antibodies, protection rate, Douala

Introduction

Measles is a highly contagious childhood infectious disease **[1].** It is generally known as a mild viral illness and is one of the most contagious infections worldwide **[2]**. Transmission occurs through the air, directly from an infected individual via airborne droplets, or indirectly due to the persistence of the virus in the air or on a surface contaminated by nasopharyngeal secretions **[1].** It is endemic and epidemic in developing countries, where it is responsible for significant infant morbidity and mortality despite the existence of an effective vaccine **[3]**. Women of childbearing age who have already developed the disease or have been vaccinated against measles nevertheless benefit from immunity that can be transmitted to the fetus during gestation [2; 4]. The concentration of antibodies in newborns at birth is proportional to the levels of maternal antibodies acquired during pregnancy and decreases steadily during the first months of life to disappear around the sixth month **[5, 6]**.

Worldwide, WHO estimates that 10.3 million measles cases were reported in 2023, an increase of 20% compared to 2022 **[11]**. France is the most affected European country by measles epidemic. Between January 1 and March 14, 2025, 180 cases of measles were reported; these cases particularly affected children aged 1-4 years (21.1%) and infants under one year old (14.4%) **[12]**. The African region recorded a drop in the measles vaccination coverage rate of 72% compared to 74% in 2017 **[13]**. In Congo in 2012, the incidence rate of measles was 100 cases per 1000 inhabitants [14]. In Nigeria, in 2005, Oluseyi et al carried out a study in pediatrics and the frequency of measles immunity was 42% **[15]**. Between 2008 and 2014, a prevalence of 24.41% of measles cases in children with fever and skin rash was reported in Cameroon [16]. In 2020, there was a resurgence in 78 health districts in the ten regions of Cameroon causing 11 deaths and in the same year, Okalla et al. conducted a study in infants aged 0-9 months in the city of Douala which revealed a low seroprevalence (39%) of anti-measles antibodies **[17,18]**. In 2023 a persistent measles epidemic affecting more than 3,000 Cameroonian children, Petouonchi et al in 2024 had found a low frequency of anti-measles IgG (78.13%) in pregnant women in the city of Douala **[19, 20].**

Vol.9, No. 03; 2025

ISSN: 2581-3366

However, pregnant women who had received the measles vaccine in their childhood and others took the booster dose but do not produce antibodies, and others lose their immunity over time, hence the low transmission during gestation to their fetuses, which could be the cause of measles in the neonatal period. Data on the proportion of subjects with a protective anti-measles antibody level are scarce, mainly in our environment. In order to study the risk of neonatal measles, we proposed to evaluate the level of protective immunization in infants while looking for the factors associated with this immunization.

Materials and Methods:

This was a cross-sectional analytical study. It took place from November 5, 2023, to January 30, 2025, at Laquintinie Hospital and Douala General Hospital (Cameroon). Participant recruitment and sample collection took place in the maternal and child ward of the neonatology, pediatrics, and vaccination units of the two hospitals, and analyses were performed in the clinical biology laboratory of Douala General Hospital in the serology unit.

The study population consisted solely of mothers and their infants aged 0-6 months who freely consented to participate in the study. The minimum sample size, calculated using the Lorentz formula, was 200 mother-infant. A survey form provided us with: identification and sociodemographic data, knowledge of measles, history of the disease, and paraclinical information from the mothers. For the infants: demographic data (age, sex, mode of delivery, gestational age, type of breastfeeding, and weight). Blood samples were then drawn from the participants; for each woman, 5 ml of blood was collected in a tube without anticoagulant and 1.1 ml for each infant.

The samples were sent to the serology unit of the clinical biology laboratory of the Douala General Hospital where centrifugation was done at 3.000 rpm for 5 minutes; the serum was collected and stored at -80°C. The quantitative search for anti-measles type G immunoglobulins in the serum was carried out by enzyme-linked immunosorbent assay (ELISA) using the EUROIMMUN Kit (Medizinische Labordiagnostika AG: ELISA Anti-Measles Virus (IgG) reference: EI 2610-9601G, Germany) with 100% sensitivity and accuracy. This involves the detection of antibodies presumed to be present in the serum using measles virus antigens fixed on a plastic support, followed by a colorimetric reading (STAT FAX 4200, AWARENESS TECHNOLOGY) at a wavelength of 450 to 630 nm. For the quantitative IgG values, the results were measured in mIU/ml and the positivity threshold (protective titer) was set at an antibody titer greater than or equal to 200 mIU/ml.

Statistical analyses

Data were analyzed using Excel 2013, Epi info 7.3, Studio R, and SSPS 20. Qualitative sociodemographic data and protected status were presented as counts and percentages; quantitative data were presented as means and standard deviations. Associated factors for comparing protected and unprotected mothers and infants were identified using logistic

Vol.9, No. 03; 2025

ISSN: 2581-3366

regression and presented as odds ratios and confidence intervals with a statistical significance level of p less than 0.05.

Results:

Sociodemographic Characteristics of Infants and Their Mothers

A total of 200 infants aged between 1 and 6 months, with an average age of 2.89 ± 1.78. The majority of the age range was between 1 and 2 months, with a frequency of 33.13%. Males were the dominant sex, with a frequency of 59%, a sex ratio of 1.43, and full-term infants predominated at 88%. First-borns were the most common, with 39.5%. Fifty one point five percent of the infants were breastfed and their weight ranged from 1.6 to 10.2 kg, with an average of 5.38 ± 4.51 kg, with the most common being between 4 and 6 kg **(Table I)**. Concerning the mothers of the infants, 200 were sampled, their ages were between 13 and 45 years with an average age of 29.66 ± 6.01 and the dominant age range was [28-33[years with 30%. The most represented level of education was higher education (48.5%) and the majority of mothers lived in the community (60.5%). Regarding profession, those in contact with children under 5 years, only 01 woman worked in a nursery, 05 taught nursery and primary schools (Class one / Class two) and 08 were health personnel. Their history of measles makes us understand that 13.5% had had measles in the past and only 4.0% had taken the booster dose apart from the childhood vaccine. **(Table I).**

Laboratory Analysis

IgG levels in infants ranged from 0 to 7,011 mIU/ml, with an average of 339.60 mIU/ml. Infants who acquired protective maternal anti-measles antibodies had a low frequency of 16%, compared to 84.0% who had a level below the protective threshold (200 mIU/ml). The majority of unprotected infants, 78%, had a level below 50 mIU/ml. Among the protected infants, 1 infant had a level above 5,000 IU/ml, or 0.5%. Depending on the age range, those aged 1-2 months, 68.9% were unprotected, and infants aged 4-5 months had a non-protective measles antibody level of 100% **(Table II).** Distribution of geometric average concentration of measles neutralizing antibodies in infants showed that the maximum average geographic concentration level was 817.12 mIU/ml in those aged [1-2[months and decreased with age. It decreased rapidly until it tended to zero at [4-5[and [5-6[months with concentrations of 1.94mIU/ml and 9.93mIU/ml respectively ***(Figure 1).***

Of the 200 mothers of the infants sample, only 98 (49%) had levels of IgG anti-measles antibodies that were protective against the measles virus. Their antibody titer varied from 0 to 6676 mIU/ml with an average level of 1,001.37 mIU/ml. The number of participants unprotected against the measles virus predominated in the age group [18-23 years] with a frequency of 70.8% or 16/24. And the majority of unprotected participants had an antibody titer below 50 mIU/ml (36%). Those immunized against the measles virus (protected) were more represented by a low

Vol.9, No. 03; 2025

ISSN: 2581-3366

titer of protective anti-measles antibodies (200-1,000 mIU/ml) therefore approximately 43 **(Table III).**

The average geographic concentration of protective measles antibodies in infants' mothers peaked in the 13-18 age group at 3,816 mIU/ml. This mean geographic concentration decreased significantly in the 13-23 age group (3,816 to 557.41 mIU/ml). We observed a gradual increase in the mean geographic concentration, reaching its peak in women aged 38 to 45 years (557.47 to 1,543.36 mIU/ml) ***(Figure 2)***.

Analysis of the dynamics of mother-to-infant measles antibody transmission revealed that only 16% of infants received protective measles antibody levels from their mothers and 32.5% received unprotected measles antibodies, but their mothers had satisfactory protective antibody levels.

Associated Factors

In infants, there was a statistically significant association between breastfeeding and infant weight between 7 and 9 kg (P= 0.001 and 0.003) with the level of protective measles antibodies **(Table IV).** This was also the case between infant age groups: [1-2[, [2-3[and [3-4[months with the dynamics of antibody transmission from their mothers (P = 0.0001, 0.0001 and 0.00006 respectively) **(Table V).**

Regarding mothers of infants, statistically significant relationships were observed between secondary education level (P = 0.003); professional status (students, shopkeepers, and housewives) (P = 0.00001; 0.0001 and 0.0001 respectively); Community lifestyle (0.0004) and occupation in contact with children under 5 years old such as nursery/daycare and nursery and primary school –Class one and two- (P = 0.001 and 0.001) and the rate of protective antibodies in the mothers of the infants **(Table VI).** And this was also a relationship between the history of the disease and the vaccination booster of the mothers of the infants: having knowledge of the mode of transmission, taking booster vaccine and HIV status (P = 0.002; 0.0004 and 0.002 respectively) and the rate of protective antibodies **(Table VI).**

Table I: Sociodemographic characteristics and history of the infants and their mothers

parameters	Variables	Effective (n)	Frequency (%)
Ages ranges (months)	[1 - 2[	58	29
	[2 - 3[	44	22
	[3 - 4[	36	18
	[4 - 5[	17	8.5
	[5 - 6]	45	22.5
Sex	Female	81	41
	Male	119	59

Vol.9, No. 03; 2025

ISSN: 2581-3366

Birth term	Premature	24	12
	In term	176	88
Type of delivery	Caesarean	96	62
	Normal delivery	124	38
Type of breastfeeding	Maternal	103	51.5
	Formula fed	16	8
	Mixed	81	40.5
Birth order	1	79	39.5
	2	50	25.0
	3	41	20.5
	4	13	6.5
	>5	17	8.5
Infant weight (Kg)	1 à 3	30	15.0
	4 à 6	108	54.0
	7 à 9	59	29.5
	≥10	3	1.5
Average age of mothers (years)	29.66±6.01		
Education level	Primary	19	9.5
	Secondary	84	42.0
	University	97	48.5
Community lifestyle	Yes	121	60.5
	No	79	39.5
Profession in contact with children under 5 years	Daycare	1	0.5
	Nursery and primary school(class 1 and 2)	5	2.5
	Health personnel	8	4.0
	None of the professions	186	93.0
History of measles	Yes	27	13.5
	No	173	86.5
Vaccination booster	Yes	8	4.0
	No	192	96.0

Vol.9, No. 03; 2025

ISSN: 2581-3366

Table II: Distribution of anti-measles IgG levels according to age

Protection status	IgG titer in mUI/ml	Ages ranges (months) [1-2[	[2-3[	[3-4[	[4-5[	[5-6]	Frequency(%)
Unprotected (n=168)	<50	35	31	30	17	43	**156(78.00)**
	]50-100]	2	1	0	0	0	**3(1.50)**
	]100-200]	3	4	1	0	1	**9(4.50)**
Protected (n=32)	]]200-1000]	5	1	4	0	1	**11(5.50)**
	]1000-2000]	1	4	0	0	0	**5(2.50)**
	]2000-3000]	4	2	1	0	0	**7(3.50)**
	]3000-5000]	7	1	0	0	0	**8(4.00)**
	>=5000	1	0	0	0	0	**1(0.50)**
	unprotected Frequency	**68.9**	**81.8**	**86.1**	**100**	**97.7**	
	Total	**58**	**44**	**36**	**17**	**45**	**200(100)**

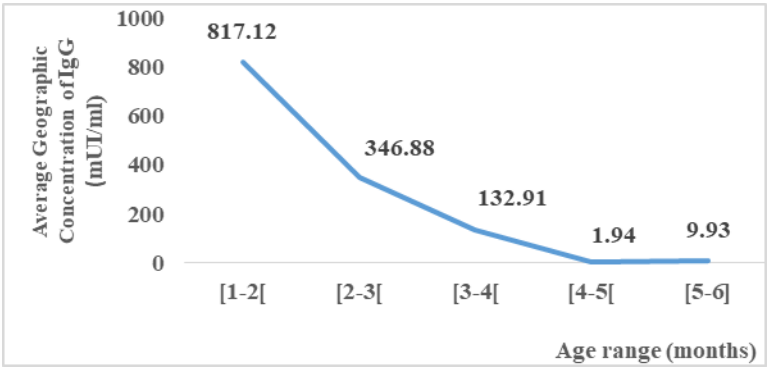

***Figure 1*:** Distribution of average geometric concentration of measles-neutralizing antibodies in infants.

Vol.9, No. 03; 2025

ISSN: 2581-3366

Table III: Measles IgG titers of infant's mothers

Protection status	IgG titer in mUI/ml	Ages ranges (years) [13-18[	[18-23[	[23-28[	[28-33[	[33-38[	[38-45]	Frequency(%)
unprotected (n=102)	<50	0	13	25	20	11	3	**72(36.00)**
	] 50-100]	0	1	1	2	1	2	**7(3.5)**
	]100-200]	0	3	7	6	4	3	**23(11.5)**
Protected (n=98)	]200-1000]	0	5	11	14	8	5	**43(21.5)**
	]1000-2000]	0	0	1	9	2	4	**16(8.00)**
	]2000-3000]	0	0	0	0	7	1	**8(4.00)**
	]3000-5000]	1	1	5	9	6	6	**28(14.00)**
	>=5000	0	1	0	0	1	1	**3(1.5)**
	Unprotected Frequency	**0**	**70.8**	**55.4**	**46.6**	**40**	**32**	
	Total	**1**	**24**	**110**	**60**	**40**	**25**	**200(100)**

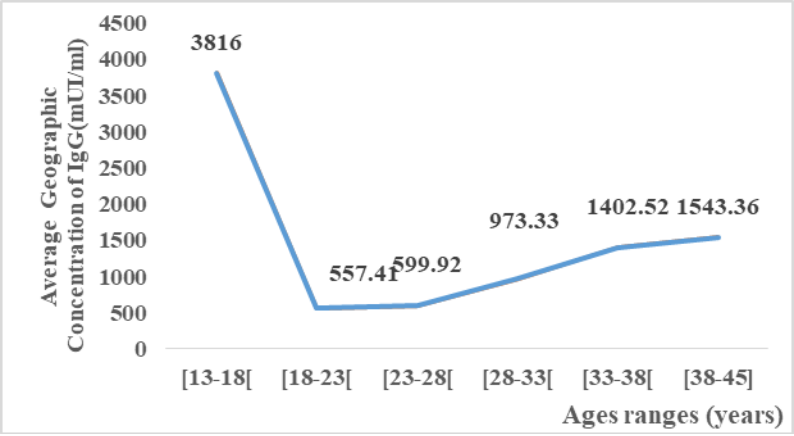

***Figure 2*:** Distribution of average geographic concentration of measles-neutralizing antibodies in mothers of infants

Vol.9, No. 03; 2025

ISSN: 2581-3366

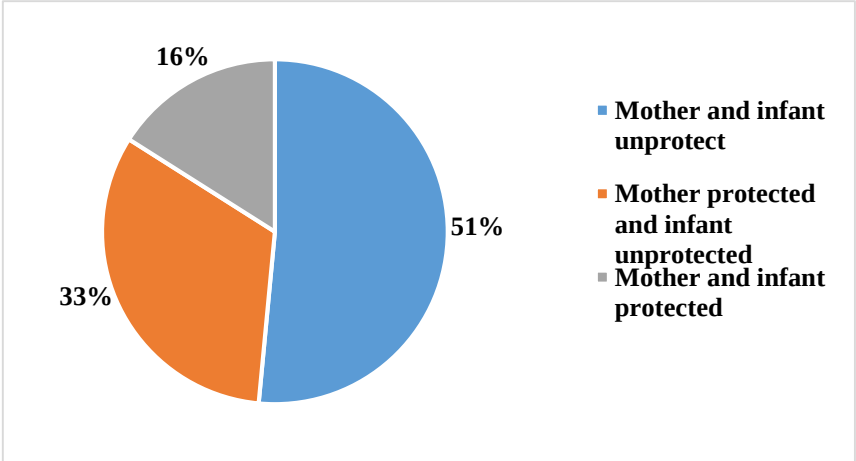

Figure 3: Frequency of transmission of maternal antibodies to infants

Table IV: Demographic factors associated with IgG protection status in infants

Parameters	Variables	Participants (n/%)	Nomber of immunized (n/%)	OR(CI at 95%)	P Value
Age ranges (months)	[1 - 2[	58(100)	18(31.0)	1	
	[2 - 3[	44(100)	8(18.1)	1.3[0.02-2.04]	0.42
	[3 - 4[	36(100)	5(13.8)	1.02[0.01-1.92]	0.73
	[4 - 5[	17(100)	0(0.0)	2.2[1.31-4.11]	0.085
	[5 - 6]	45(100)	1(2.2)	4.2[1.09-6.18]	0.055
Sex	Female	81(100)	13(16.0)	1	
	Male	119(100)	19(15.9)	2.4[1.03-4.20]	0.088
Type of delivery	Caesarean	96(100)	16(21.0)	1	
	Normal delivery	124(100)	16(12.9)	2.4 [0.31-4.16]	0.071
Type of breastfeeding	Mixed	81(100)	10(12.3)	1	
	Maternal	103(100)	17(16.5)	5.2[1.72-12.23]	**0.001***
	Formula fed	16(100)	5(31.2)	3.4 [1.20-5.08]	0.053
Infant weight (Kg)	≥10	3(100)	0(0.0)	1	
	7 à 9	59(100)	3(5.0)	5.3[1,36-14.42]	**0.003***
	4 à 6	108(100)	18(16.6)	1.8[0.72-69.15]	0.069
	1 à 3	30(100)	11(36.6)	2.8[1.30-8.43]	0.07

(*) Significant P value: < 0.05 ; OR=odds-ratio ; CI= Comfidence Interval

Vol.9, No. 03; 2025

ISSN: 2581-3366

Table V: Protection status according to the age range of infants and their mothers

Parameters		Immunized mothers n(%)	Immunized infants n(%)	P-value
Age range of infants (months)	[1-2[	30(62.5)	18(37.5)	**0.0001***
	[2-3[	22(73.3)	8(26.6)	**0.0001***
	[3-4[	20(80)	5(20)	**0.00006***
	[4-5[	3(100)	0(0.0)	0.082
	[5-6]	23(95.8)	1(4.1)	1

(*) Significant P value: < 0.05 ; OR=odds-ratio ; CI= Comfidence Interval

Table VI: Socio-professional factors associated with IgG protection status in mothers of infants

Parameters	Variables	Participantes (n/%)	Nombre of immunized (n/%)	OR (C I à 95%)	P-value
Age ranges (years)	[13-18[	1(100)	1(100)	1	
	[18-23[	24(100)	7(29.1)	1.4[0.30-2.16]	0.062
	[23-33[	110(100)	49(44.5)	4.3[1.22-8.02]	0.004
	[33-38[	40(100)	24(60.0)	1.1[0.04-1.78]	0.55
	[38-45]	25(100)	17(68.0)	2.4[1.17-3.16]	0.52
Education level	Primary	19(100)	11(57.8)	1	
	Secondary	84(100)	39(48.4)	5.1[2.20-8.07]	**0.0003***
	University	97(100)	48(49.4)	1.1[0.11-3.31]	0.47
Marital status	Single	99(100)	37(37.3)	1	
	Maried	101(100)	61(60.4)	1.5[0.12-4.81]	0.62
Professional status	Others occupation	15(100)	9(60,0)	1	
	Student	35(100)	16(45.7)	5.4[1.38-11.26]	**0.00001***
	Employee	49(100)	29(59.1)	1.4[0.02-2.16]	0.34
	Buisiness owner	30(100)	14(46.6)	4.1[2.33-7.22]	**0.0001***
	Housewife	60(100)	27(45.0)	8.2[3.13-16.05]	**0.0001***
	unmployed	11(100)	3(27.2)	2.2[1.34-4.11]	0.072
Community lifestyle	No	79(100)	34(43.0)	1	

Vol.9, No. 03; 2025

ISSN: 2581-3366

	Yes	121(100)	64(52.8)	5.6[1.42-10.33]	**0.00041***
Cohabits with les children under 5 years old	No	88(100)	38(43.1)	1	
	Yes	112(100)	60(53.5)	4.1[1.11-8,45]	**0.0005***
	None	186(100)	93(50.0)	1	
	Daycare	1(100)	1(100)	4.3[1.05-7.30]	**0.001***
Profession in contact with children under 5 years	Nursery school And primary (Class 1/2)	5(100)	2(40.0)	5.7[2.09-10.04]	**0.001***
	Health personnel	8(100)	2(25.0)	1.5[0.03-2.03]	0.085
Knowledge on the transmission mode	No	161(100)	78(48.4)	1	
	Yes	39(100)	20(51.2)	3.6[1.32-4.12]	**0.002***
History of measles	Yes	173(100)	81(46.8)	1	
	No	27(100)	17(62.9)	1.4[0.17-2.32]	0.49
Infants who have had measles in the pass	Non	171(100)	83(48.5)	1	
	Oui	29(100)	15(51.7)	1.1[0.62-3.17]	0.36
Vaccine booster dose	No	192(100)	93(48.4)	1	
	Yes	8(100)	5(62.5)	5,3[1.27-11.45]	**0.0004***
HIV Status	Negatif	190(100)	92(48.4)	1	
	Positif	10(100)	6(60.0)	3.1[1.34-6.22]	**0.002***

(*) Significant P value: < 0.05 ; OR=odds-ratio ; CI= Comfidence Interval

Discussion

We included 200 infants in this study which had a male sex predominance with a frequency of 59% and a sex ratio of 1.43; this observation is close to that of Diaby et al in Bamako in 2008 and Okalla et *al* in Cameroon 2021 which were 52% and 54.49% **[21, 18].** The ages of the infants were between 1 and 6 months with an average age of 2.89±1.78 months. The most represented age group was between **[**1-2**[** months with a frequency of 29%, this result is in agreement with that reported by Hartter et *al* in Ibadan in Nigeria in 2000 (29.8%), but with a different mean age (3.59 months) **[22].** These similarities of results can be explained by the fact that these countries are developing countries.

Vol.9, No. 03; 2025

ISSN: 2581-3366

The majority of infants (53.5%) were collected from the vaccination unit; this is supported by the dominance of the age group of **[**1-2**[**months (29%) because the first vaccines are of great importance for the protection of children. But Okalla in 2021, in the same town had observed the large numbers rather with the children who came for consultation **[18].** And 176/200 were delivered at gestational term. Then the dominant type of delivery was the delivery by vaginal canal, i.e. 62% and 51.5% were breastfeeding. These observations were recorded in 2014 in Yaoundé by Foumane P. et al in 2014 with Sathiyanarayanan et al in India in 2020 **[23, 24]**. The prevalence of breastfeeding could be explained by the marital status married (50.5%) and predominantly of higher level of education, which makes mothers responsible for infants and the recognition of the value of breast milk as the first protective food for infants. But OKalla et al had found a dominance rather with mixed breastfeeding which could be due to the professional status of mothers of infants who were mainly pupils/students **[18].**

The first-borns were in the chain line with 39.5%. A study conducted by Francisco in Bangladesh, reported similar results, which could be explained by the young age of the mothers in the study population **[25]**. The weights of infants were between 1.6 and 10.2 kg with a mean weight of 5.38 ± 4.51, the most represented was that between 4 and 6 kg. Similar results were reported in 2004 by Nehama L. et al in Israel **[26]**. Because infants of mothers over 20 years old and also primiparous take care and maintain children well. A total of 200 mothers of infants were included with the age between 17 and 45 years with a mean age of 29.66 ± 6.01. The majority age group was [28-33[years with respectively 30% which is almost similar to the age group observed by Okalla et al in 2021 in Cameroon (26%)**[18].**

Among these mothers of children, 60.5% lived in the same house with small children aged under 5 years. Community life was observed among 60.5% of these women. Few mothers of children had a profession that did not put them in contact with small children aged under 5 years such as nursery/daycare, nursery and primary school (Class 1 and 2) and health personnel (0.5%; 2.5% and 4%). This is of a sociocultural nature because in Africa we live in communities and professions that allow contact with the youngest, such as the nursery who are not valued.

The biological analysis of the infants showed an anti-measles antibody titer that varied between 0-7011 mIU/ml with a mean level of 339.60 mIU/ml. Result almost similar to that of OKalla in the infants in 2021 or IgG levels in the ranged from 8 to 5700 mIU/ml **[18]**. This concordance could be explained by the use of the same analysis technique (ELISA) which had high specificity and sensitivity. The protective titer of anti-measles antibodies in infants was more observable with the concentration between 200-1000 mIU/ml which was 5.50%, Okalla et al in 2021 had rather found the result different from ours, its interval was 1000-2000 mIU/ml or 45.07%, this low titer can be explained by the level of IgG of their mothers which was also low **[18].**
The seroprevalence of protective IgG antibodies against measles in infants was low (16%): not immunized. This result is similar to that reported by Diaby in 2008 in Mali, Sathiyanarayanan in India in 2020 and Mathew in 2023 in the same country which were 12%, 10% and 10% **[21, 24,**

Vol.9, No. 03; 2025

ISSN: 2581-3366

27]. But differs from that of Hartter H et al. in 2000 in Nigeria and Okalla et al in Douala in 2021 which were 42% and 39.88% **[22,18]**. This discordance in results can be explained by the size of the study populations.

The average geographic concentration of anti-measles antibodies peaked in the first age group of **[**1-2**[** months (817.12 mIU/ml) and then gradually decreased and reached zero in the age group of **[**4-6**[** months (1.94 mIU/ml and 9.93 mIU/ml). This result is consistent with that found by Mathew et al in 2023 in India who also observed the decrease in average geographic concentration depending on the age group (64 IU/ml, 8 IU/ml, 2 IU/ml and 1 IU/ml respectively) **[27].** This result can be explained by the fact that in the first months of birth, infants have a high level of maternal antibodies acquired via the placenta during gestation and that they will gradually lose them until the age of 6 to 7 months **[28].**

Regarding the dynamics of transmission of anti-measles antibodies from mothers to their infants, out of 200 infants collected simultaneously with their mothers, only 16% (32/200) of infants had received a protective maternal anti-measles antibody level from their mothers. And on the other hand, 32.5% had the antibodies and did not transmit to their infants. The study conducted by Leuridan in 2010 by comparing the maternal antibody level of infants and their mothers showed that 29% of 3-month-old infants born to vaccinated mothers were positive, compared to 60% of infants born to naturally immunized mothers **[28]**. We justify this low number of transmission of antibodies from vaccinated mothers to their infants by the fact that vaccine immunization is at a low antibody level which is associated with fetal transmission which is a function of maternal antibody concentration.

However, biological analysis of infant mothers showed us that measles IgG antibody titers ranged from 0 - 6676 mIU/ml with a mean level of 1001.37 mIU/ml. The protective antibody level ranged from 200 to 6676 mIU/ml. This is in agreement with the results of Petouonchi et al in the city of Douala in 2024 and Gieles et al in 2019 in Soweto, the protective titers ranged from 200-6000 mIU/ml and 275 - 905.8 mIU/ml **[20,29].** Hence the use of similar tests could be at the origin

Regarding the protective titer of anti-measles antibodies, we observed that the concentration between 200-1000 mIU/ml was the most represented, i.e. 43/200 (21.5%), Petouonchi et al in 2022 found the result almost similar with this range of titers, this low titer could be explained by a very old infection associated with a low rate of viral reactivation or the genetic factor of low-level production of IgG **[20].** The total prevalence of protective anti-measles IgG in the mother of infants was 49%. This result is close to those obtained by Gieles et al in 2019 who obtained 55.9% in women born in the vaccine era **[29].**

But being in disagreement with the result Eriko et al in 2020 in Japan (71.6%) having worked on pregnant women born in the pre-vaccination era **[30].** Petouonchi et al in 2024 in Cameroon among pregnant women are also in agreement with the result (78.13%) **[20].** This prevalence of IgG below 50% could be due to either a loss of vaccine immunity or a poor performance of the

Vol.9, No. 03; 2025

ISSN: 2581-3366

vaccination system with many subjects escaping vaccination or the majority of the population did not take the measles booster vaccine around 96%.

The Mean Geographic Concentration of anti-measles antibodies had a peak in this age group of [13-18[years (3816 mIU/ml) and decreased in the age group of [13-23[years (3816 to 557 mIU/ml). But this concentration increased progressively to reach its maximum in this group between 38-45 years (3816.14 to 1716.77 mIU/ml). The reaching of the peak and the decrease in the first place could probably be explained by the fact that women in this age group still have a level of vaccine antibodies. The loss of vaccine immunity from childhood to the age of 15 to 16 years and the progressive increase from [23-45] years can be explained by the fact that in these age groups women are more in contact with small children and therefore contamination with the wild strain of the measles virus **[31].**

In infants, statistically significant associations were with breastfeeding and infant weight between 7 and 9 kg (P = 0.001 and 0.003) with the level of maternal protective antibodies in infants. The reason may be that breast milk contains maternal anti-measles antibodies and the weight presents a well-nourished infant hence the well-sophisticated immune system. This observation is in contrast to those of Leuridan et al in 2010 and Okalla et al in 2022 who found a link with the age groups of infants (P < 0.05) **[28,18].** This difference may be explained by an unequal distribution of the study population.

We also found a correlation of immunization between the age range of infants: [1-2[, [2-3[and [3-4[months with the dynamism of the transmission of antibodies from their mother (P = 0.0001, 0.0001 and 0.00006 respectively). And this association was effective in Leuridan et al in 2010 in Belgium **[28]**. Which could be explained by the fact that during gestation the transmission of neutralizing anti-measles antibodies had taken place and that the infants retained them during their first months of life.

In the mothers of infants, statistically significant relationships were observed between the level of secondary education (P = 0.0003); professional status of students, traders and housewife (P = 0.00001; 0.0001 and 0.0001 respectively); community lifestyle (0.0004) and profession in contact with children under 5 years old such as nursery/daycare and nursery and primary school –class 1and 2- (P = 0.001 and 0.001) with the level of protective antibodies in the mothers of infants. This is in contrast to the result of Okalla et al in 2022 in Cameroon and Mathew et al India (2023) which were rather with the age groups of mothers of infants (P <0.0001) **[18, 27].** These links can be explained by the fact that mothers with these parameters are exposed to the wild-type virus, which reactivates the immune system. We did not find a link between age groups, education level, or marital status. This difference between these studies can be explained by an unequal distribution of their study population.

Limitations

We encountered the following challenges during this study:

Vol.9, No. 03; 2025

ISSN: 2581-3366

• The scarcity and very high cost of reagents
• The difficulty of conducting a cohort study because the mothers refused to return for a second time to monitor the development of their infants' antibodies.

Conclusion

A significant proportion of infants and their mothers had antibody titers below the protective level, hence the risk of measles infection in the pre-vaccination period. We therefore believe that screening for measles immunity and increasing the level of protective measles antibodies through vaccination should be recommended for women of childbearing age. Then, if possible, infants should be protected through the anticipated vaccination schedule.

Ethics

The study was conducted in accordance with ethical guidelines for research in Cameroon.
It was approved by the Institutional Ethics Committee for Human Health Research of the University of Douala (No. 1105/CEI-UDo/10/2024/T) and received research authorizations from the Directors of the hospitals concerned: Douala General Hospital (No. 583AR/MINSANTE/HGD/DM/12/23) and Douala Laquintinie Hospital (No. 2143/AR/MINSANTE/HLD/SPER).

Author contributions

• AAPN, JPNM, GN, JE, CMS, GS, AC and PE carried out the study and participated in the statistical analysis and procedures.
• AAPN, JPNM, GN, JE, CMS, GS and AC carried out the practical part of the study.
• DA and JPNM coordinated and participated in study design, statistical analysis and writing of the manuscript.
• All authors have read and approved the final version.

Competing interests

The authors declare that they have no competing interests regarding the publication of this article.

References

Strebel PM, Cochi SL, Hoekstra E, Rota PA, Featherstone D, Bellini WJ et *al.* A World without Measles. J Infect Dis. 2011; 20: S1-3.

Lacroix L, Delaporte E, Siegrist C, Sudre P, Wyler C, et Gervaix A. Rougeole : diagnostic et prise en charge d'une maladie toujours d'actualité. Revue médicale suisse .2008 ;152 : 920-24.

Dao B, Koalaga A.P, Ki Zero G, Bambara M. Bazie A. J '' Rougeole et grossesse''J gynecol Obstet Biol Reprod .Masson 2016.26.606-609

Diagne-Guèye N. Faye P. Fall A., Diagne I, Camara B, Dramé M et autres. Rougeole néonatale: à propos d'un cas. Journal de pédiatrie et de puériculture,2012.25:155-7

Bansal J, Hameed a. '' Measles in pregnancy'' BMJ Case Rep 2019; 12:e228781. doi:10.1136/bcr-2018-228781

Leuridan E, VAN Damme P. passive transmission and persistence of naturally acquired or vaccine-induced maternal antibodies against measles in newborns. vaccine. 2007, 25: 6296-304

Malek A, Sager R., Kuhn P. et al. Evolution of materno fetal transport of immunoglobulins during human pregnancy. Am. J. Reprod. Immunol. 1996 ; 36 : 248-55.

World Health Organization. Measles mortality reduction in West Africa, 1996-2002 = Réduction de la mortalité rougeoleuse en Afrique de l'Ouest, 1996-2002. *Weekly Epidemiological Record = Relevé épidémiologique hebdomadaire,* 2003, *78* (45), 390 - 392. https://iris.who.int/handle/10665/232316

Waaijenborg S, Hahné S. J, Mollema L, Smits G. P, Berbers G, van der Klis et al. Waning of maternal antibodies against measles, mumps, rubella, and varicella in communities with contrasting vaccination coverage. The Journal of infectious diseases 2013; 208: 10-16.

Policy brief N°1-Avril 2019 « Hausse préoccupante des cas de rougeole au Cameroun en 2019 risque élevé de généralisation » www.onsp.minsante.cm

World Health Organization «measles-cases-surge-worldwide--infecting-10.3-million-people-in-2023» 14 November 2024, https://www.who.int/fr/about/policies/copyright, 19/04/2025

Santé publique France "Rougeole : appel à la vigilance renforcée face à la recrudescence des cas en France et en Europe » le 20 mars 2025 https://www.santepubliquefrance.fr/les-actualites19/04/2025

OMS. Couverture de la vaccination systématique dans le monde, 2016. REH 2017; 92: 701-707

Scobie H. M , Ilunga B , Mulumba A , Shidi, C , Coulibaly T , Obama R , Perry . Antecedent causes of a measles resurgence in the Democratic Republic of the Congo. Pan African Medical Journal. 2015; 21(1).

Oluseyi O, Odemuyiwa O, Ammerlaan W, Muller P, Adu D. Passive immunity to measles in the breastmilk and cord blood of some Nigerian subjects. Journal of tropical pediatrics**,** 2005; 5 : 44-48.

Mengouo M , Ndze V N , Baonga F , Kobela M , & Wiysonge, C. S. Epidemiology of rubella infection in Cameroon: a 7-year experience of measles and rubella case- based surveillance, 2008–2014. BMJ open. 2017; 7: e012959

Actucameroun « Cameroun: la résurgence de la rougeole a déjà causé 11 morts » https://actucameroun.com/2020/06/12:13 janvier 2025

Okalla C.O, Donfack D, Penda CI, Essome H et *al* "prevalence of anti-measles antibodies in infants from 0 to 9 months: case of three hospitals in the city of Douala (Cameroon)": Microbes and Infectious Dis 2021.2(4):682-689

vaccineswork « Une leçon de persévérance : le Cameroun lutte inlassablement contre la résurgence de la rougeole » Gavi, 17 Aout 2023 https://www.gavi.org/fr/vaccineswork/topics/recits, 19 avril 2025

Petouonchi N.A.., Nda Mefo'o, J., Ngondi, G.D., Simo, G.G., MEDI S. C, , Chuengue A, et *al*. Seroprevalence of Anti-Measles Immunoglobulin G in Pregnant Women Followed at Laquintinie Hospital and General Hospital of Douala. *International Journal of Medical Science and Health Research*, 2024, Vol.8, No. 05; ISSN: 2581-3366 https://www.ijmshr.com/uploads/pdf/archivepdf/2024/IJMSHR_399.pdf

Diaby. B. D. Mesure des Anticorps contre la rougeole dans le sérum et dans la salive chez les enfants âgés de 2 à 9 mois dans les villages de Kangaba et de Salamalé en Mars et Avril 2003.(thèse de doctorat en médecine). Université de Bamako,2008.

Hartter H, Heike K, Oyedele O, Dietz K, Kreis S, Hoffman J.P, and Muller C.P. placental transfer and decay of maternally acquired anti-measles antibodies in Nigerian children. the Pediatric infectious Disease journal. 2000; 19 : 7, 635-41

Foumane P, Mve K, Ze M, Njofang N, Dohbit J et al. Facteurs de risque et pronostic des césariennes d'urgence à l'hopital gynéco-obstétrique et pédiatrique de Yaoundé (Cameroun). Médecine et santé tropicale .2014 ; 24 : 89-93.

Sathiyanarayanan S, Kumar P, Rao CR, Kumar A, Kamath A, Kamath V. Prevalence of Maternal Measles Antibody and Its Associated Factors among Infants in Coastal Karnataka, India. Indian J Community Med. 2020 Jan-Mar; 45(1):83–88. https://doi.org/10.4103/ijcm.IJCM_259_19 PMID: 32029990

Francisco A, Hall J, Unicomb L, Chakraborty J, Yunus Md and Sack R.B. maternal measles antibody dacay in rural Bangladeshi infant- implications for vaccination schedules. Vaccine. 1998; 6 :564-568.

Nehama L, Esther T, Boris G, Poriya D, Asaf F and Lea S. placental transfer of measles antibodies: effect of gestational age and maternal vaccination status. Vaccine 22(2004); 1509-1514.

Mathew JL, Wagner AL, Ratho RK, Patel PN, Suri V, Bharti B, et al. Maternally transmitted anti-measles antibodies, and susceptibility to disease among infants in Chandigarh, India: A prospective birth cohort study. PLoS ONE 18(10): 2023, e0287110. https://doi.org/10.1371/journal.pone.0287110

Leuridan E, Hens N, Hutse V, Ieven M, Aerts M, Van Damme P. "Early waning of maternal measles antibodies in era of measles elimination: longitudinal study". BMJ. 2010 May 18;340:c1626. http://www.bmj.com

Gieles NC, Mutsaerts EAML, Kwatra G, Bont L, Cutland CL, Jones S, Moultrie A, Madhi SA, Nunes MC. Measles seroprevalence in pregnant women in Soweto, South Africa: a nested cohort study. Clin Microbiol Infect. 2020 Apr;26(4):515.e1-515.e4.

Vol.9, No. 03; 2025

ISSN: 2581-3366

Eriko K, Koushi Y, Masachi H, Hideo M. et *al.* "Low titers of measles antibodies in Japanese pregnant women: a single-center study" Journal of Obstetrics and Gynaecology Research © 2012 Japan Society of Obstetrics and Gynecology. vol 39; February 2013 P.500-503

Crotty S, Aubert RD, Glidewell J, Ahmed R. tracking human antigen-specific memory B cells : a sensitive and generalized ElISPOT system. Journal of immunological methods .2004; 286: 111-1