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Seroprevalence of Anti-Measles Immunoglobulin G in Pregnant Women Followed at Laquintinie Hospital and General Hospital of Douala

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Abstract

Introduction: Pregnant women who have been in contact with the measles virus or vaccinated against this virus produce anti-measles antibodies of the IgG type. These will be transferred to the fetus via the placenta to protect it at birth before the vaccination age of 9 months. To this end, we set out to research the titer of anti-measles antibodies and the factors associated with this titer in pregnant women.

Methodology: We conducted a cross-sectional study with analytical purposes, from June 2021 to February 2022(9 mois). The recruitment of participants took place in the maternity departments of Laquintinie Hospital and the General Hospital of Douala. Any pregnant woman consultant who had consulted in one of these two hospitals was included in this study. Consecutive sampling was adopted and a technical sheet was used to collect socio-demographic data and obstetric history of the participants. To study the antibody titer, a 5ml sample of venous

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blood was taken. The qualitative and quantitative investigation of immunoglobulin G in serum was carried out using the "Measles Virus IgG ™ " ELISA (IBM international). The protection titer was considered based on values ≥ 200 mIU/ml. The data collected were analyzed using Excel 2013 and SPSS 20 software and then the associated factors were searched using the odds ratio and the p-value.

Results: A total of 160 pregnant women were recruited, the majority age group was 25-30 years old. The participants' histories showed that 16.85% had "had measles" and 1.25% had been in contact with infected children. The biological analysis showed that the titer of anti-measles antibodies was between 40 and 5,000 mIU/ml with a predominance of titer between 200 and 1000 mIU/ml. The status between the neutralizing antibody titer and the protective situation presented 78.13% of women who had a protective level (values ≥ 200 mIU/ml). We observed no significant association between protection status and any factors.

Conclusion: A significant fraction of our study population presented an antibody titer lower than the protective level and could therefore not promote sufficient newborn birth in the pre-vaccination period, thus leaving a possibility of risk of neonatal measles.

Keywords: pregnant women, anti-measles antibodies, immunoglobulin G, protection rate, Douala

Introduction

Measles is a highly contagious infection caused by an RNA virus of the Paramyxoviridae family [1]. It is generally known as a benign viral illness of childhood. However; many people can be infected regardless of age, including pregnant women [2]. Measles is one of the most contagious infections worldwide [3]. Transmission occurs through the air, directly to an infected person via flu droplets, or indirectly due to the persistence of the virus in the air or on a surface contaminated by nasopharyngeal secretions [1].

Measles occurs in an endemic-epidemic state in developing countries, where it is responsible for significant infant morbidity and mortality despite the existence of a safe and effective vaccine [4]. If signs appear near term in pregnant women, the consequences of congenital measles can be serious in the newborn [2]. Pregnant women who have already developed the disease or who have been vaccinated against measles, nevertheless benefit from humoral mediated immunity which will remember the anti-measles immunoglobulin G. These monoclonal antibodies during gestation are transferred to the fetus via the placenta [2]. Placental transfer of IgG begins around the 13th week of amenorrhea and progresses linearly during pregnancy [5]. This transport is an active process and intensifies in the last trimester. The transmission of anti-measles antibodies from mother to fetus and the duration of their persistence at protective levels is variable. The concentration of antibodies in the newborn at birth is proportional to the levels of maternal antibodies acquired during pregnancy and decreases regularly during the first months of life [6;7].

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In the majority of cases, some pregnant women have never been in contact with the virus to be naturally immunized, or have never been vaccinated, which is often the cause of the occurrence of measles in the neonatal period. in infants [8].

In Asia, a study conducted by Eriko Kanda et al. in Japan in 2010 among 10,349 pregnant women presented a seroprevalence of immunity to measles of 71.6% [9]. Between 2016 and 2017 a similar study was carried out in Europe (southern region of Italy) by Serena et al, who found a prevalence of 96.9% [10]. In Africa, respective prevalence of 76.8%, 86.7% were found in South Africa by Gisel et al in 2019 among pregnant women living with HIV and in Zimbabwe by Obi et al [11,12].

In Cameroon, work carried out by Okalla et al in 2020 in infants revealed a low seroprevalence (39%) of maternal anti-measles antibodies [13]. However, very few studies have been done among pregnant women in Cameroon. Hence the interest in work on the search for maternal antibodies for the evaluation of the protection of newborns in the pre-vaccination period against the measles virus.

Material and Method:

This was a cross-sectional analytical study. It took place from June 1, 2021 to December 31, 2021 at the Laquintinie Hospital and the General Hospital of Douala (Cameroon), the recruitment of participants and the collection of samples took place in the Gyneco-obstetrics departments (unit prenatal) and the analyzes were carried out in the clinical biology laboratory department of the Douala General Hospital in the serology unit.

The study population consisted solely of pregnant women followed in the Gynecology department of the two hospitals without distinction of age and who had freely and deliberately given their written and signed consent to participate in the study. Any pregnant woman followed in the gynecology department of one of the hospitals was included in this study, regardless of age, and those who refused to participate were excluded.

The minimum sample size calculated using the Lorentz formula was 160 participants. A survey sheet allowed us to have: identification and sociodemographic data, knowledge of measles, obstetric history, clinical and paraclinical status of the study population during the study. Then the participants were sampled, for each woman, approximately 05 ml of blood was collected in a tube without anticoagulant.

The samples were sent to the serology unit of the clinical biology laboratory of the Douala General Hospital where centrifugation was at 3,000 rpm for 15 minutes, the serum was collected and stored at -80°C when the analysis was deferred. The qualitative and quantitative research of immunoglobulin G in serum was carried out using the "Measles Virus IgG^{TM}" kits from the IBM international brand (Hambunrg, Germany, Reference: RE57141) via the ELISA technique. the detection of antibodies supposed to be present in the serum using measles virus antigens fixed on a plastic support, then followed by a colorimetric reading (STAT FAX 4200, AWARENESS

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TECHNOLOGY) at a wavelength of 450 to 630 nm. For the quantitative values of IgG, the results were measured in IU/ml and the protection threshold was set at an antibody level greater than or equal to 200 mIU/ml.

Statistical Analyzes

The data were analyzed using the software: Excel 2013 and SSPS 20. The measurement of the association between protection status with associated factors was assessed using a regression model logistics for univariate analyses. If the covariates were not normally distributed, a ki2 test was used to check the association. P values less than 0.05 were considered statistically significant for univariate analysis. The strength of association was delivered in the form of an odds ratio with a Confidence Index of 95%.

Result:

Sociodemographic, clinical and paraclinical characteristics

A total of 160 pregnant women aged between 15 and 45 years from all three gestational trimesters participated in this study. Whose majority age group was 25-30 years old with a frequency of 33.13%. The majority of participants had university level 54.37% and then, 52% of them were single. According to professional status, 40% of women were employees and 78% of these women came from rural neighbour hoods (Table I). The participants' histories showed that 5% had had measles and 1.25% had been in contact with infected children. Among the recruits, 35% were paupiparous and the second gestational trimester predominated at 42.50%. The HIV serological status showed that 6.25% were seropositive (Table I).

Biological characteristics

Biological analyzes using the ELISA technique showed that the level of anti-measles antibodies was between 40 and 5,000 mIU/ml with a predominance of titers of 200 - 1000 mIU/ml (48.75%) Figure 1. The variation geographical average concentrations of IgG antibodies according to the age groups of the study population showed that the age groups with the highest peaks were]15-20 years] and]30-35 years] (1296, 56 and 1243.27 mIU/ml) Figure 2. The overall seroprevalence showed that 78.13% of women had a protective rate, i.e. having a value above the threshold (200 mIU/ml); 21.87 had a non-protective titer and in the latter, the antibody concentrations were between 100-200 mIU/ml. Among the protected subjects, those aged between 25-30 years predominated with a frequency of 26.25% (Table II). The observation of a statistically significant relationship between unemployed professional status and employees with protective antibody titers with a P = 0.01 (Table II).

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Table I: Factors associated with IgG protection status

Factors	Variables	Participants (n/%)	Number of immunized (n/%)	OR	CI	P value
Ages rang (years)	]15 - 20]		8(88.9)	1		
	]20 - 25]		20 (64.51)	1. 60	0.08 – 31.77	0.75
	]25 - 30]		42(79.24)	0.36	0.03 – 0.51	0.38
	]30 - 35]	9(100) 31 (100)	32(86.50)	0.76	0.08-7.22	0.81
	]35 - 40]	53(100) 37(100)	19(79.20)	1.28	0.12 - 13.35	0.83
	]40 - 45]	24(100) 6(100)	6(83.10)	0.76	0.07-8.06	0.82
Educational level	University	87(100)	68(78.20)	1		
	Secondary	65(100)	51(78.20)	0.98	0.45-4.41	0.96
	Primary	8(100)	7(87.50)	0.51	0.05-4.41	0.54
Marital status	Single	83(100)	62(74.70)	1		
	Mariage	77(100)	64(83.10)	0.6	[0.27-1.30]	0.19
Professional Status	other occupations	6(100)	2(33.30)	1		
	No employment	38(100)	32(84.20)	0.09	[0.01-0.63]	**0.01***
	Pupil/Student	26 (100)	18(69.20)	0,22	[0.03-1.47]	0.11
	Business	26(100)	20(76.90)	0,15	[0.02-1.03]	0.05
	Cival servant	64(100)	54(84.40)	0,09	[0.01-1.57]	**0.01***
Place of residence	Urban	36(100)	27(75.00)	1		
	Rural	124(100)	99(79.83)	1.32	[0.53-13.15]	0.53

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History of Measles	Not reached	152(100)	118(77.60)	1		
	Reached	8(100)	8(100)	0.2	ND	0.14
Parity	Primiparous	56(100)	40(71.40)	1		
	Pauci parries	69(100)	54(78.30)	0,35	[0.31-24.62]	0.54
	Multiparous	27(100)	25(92.60)	0,54	[0.22-17.06]	0.65
	Large multiparous	8(100)	7(87.50)	0,65	[0.31-24.62]	0.35
Contact with an affected child	No	158(100)	124(78.5)	1		
	Yes	2 (100)	2 (100)	0	ND	0.61

ND: Non Detectable, *:Significant

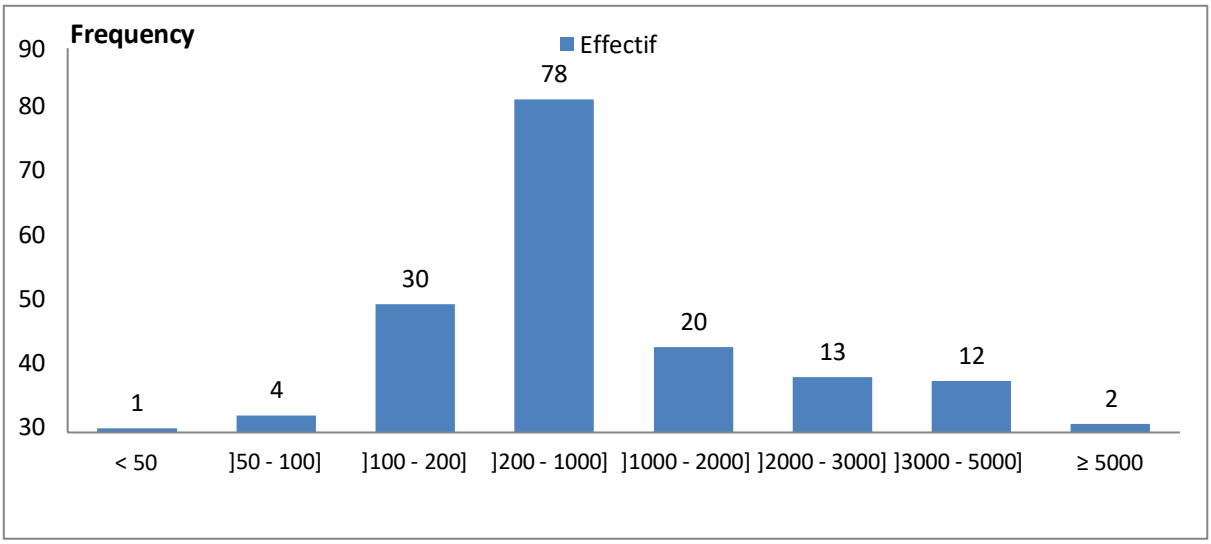

Figure 1: Variation in IgG titer of the study population

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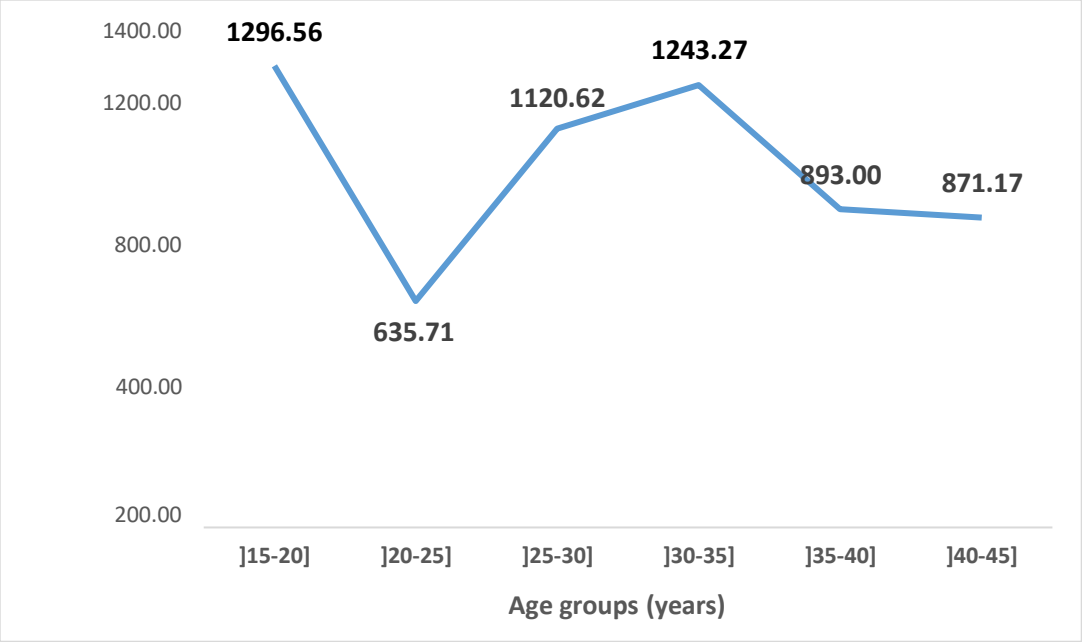

Figure 2: Variation in the geographic average concentration of IgG antibodies depending on the age groups of the study population

Table II: Anti-measles IgG antibody titer and protection situation

Protection Status	IgG titer in mUI/ml	Age groups (years)]15-20]	]20 - 25]	]25 - 30]	]30 - 35]	]35 - 40]	]40 - 45]	Frequency n(%)
Unprotected n=35(21.87)	< 50	0	0	1	0	0	0	1(0.6)
	]50 - 100]	0	3	1	0	0	0	4(2.5)
	]100 - 200]	1	9	9	5	5	1	30(18.7)
Protected n=125 (78.13)	]200 - 1000]	4	14	25	17	14	4	78(48.7)
	]1000 - 2000]	2	2	6	7	3	0	20(1.3)
	]2000 - 3000]	0	3	5	4	0	1	13(8.1)
	]3000 - 5000]	2	0	5	4	1	0	12(7.5)
	≥ 5000	0	0	1	0	1	0	2(1.3)

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Unprotected frequency	**11.11**	**38.7**	**20.75**	**13.51**	**20.83**	**16.66**	
Total	**9**	**31**	**53**	**37**	**24**	**6**	**160(100)**

Discussion

We carried out a cross-sectional analytical study among pregnant women followed in the two hospitals of the city of Douala-Cameroon, the aim of which was to research the anti-measles protection rate and associated factors.

The age of the participants was between 15 and 45 years old with an average age of 29.66±5.77. The most represented age group was [25-30[years or 33.13%. This could be justified by the fact that at this age group, women have reached physiological and social maturity. This differs from the results obtained by Serena et al in Italy in 2017 where the age group was rather [34-39[years old who repented 89.7% [10]. Sociocultural factors could be at the origin of this discordance.
According to the biological analysis, the measles IgG antibody titers ranged from 40-5000 mIU/ml with an average level of 511.39 mIU/ml. The level of protective antibodies varied from 200 to > 5000 mIU/ml. This is in agreement with the results of Gieles et al in 2019 in Soweto, the protective titers ranged from 275 - 905.8 mIU/ml [11]. This similarity could be explained by the use of the same ELISA immunoenzymatic biological analysis technique which had similar specificity and sensitivity.

Concerning the seroprevalence of anti-measles antibodies, we found that 78.13% had a sufficient level of anti-measles antibodies, i.e. an IgG titer >200 mIU/ml. This result is close to those obtained by Eriko et al in 2020 in Japan (71.6%) who worked on pregnant women born in the pre-vaccine era [9]. Plans P. et al in 2013 in Spain and Gieles et al in 2019 in South Africa also agree with the result (89%; 76.8%) [12,11]. This low IgG prevalence would be linked to either a reduction in the circulation of the virus in the population, a loss of vaccine immunity or a poor performance of the vaccination system with many subjects escaping vaccination. We observe a slight discrepancy with the results of Gieles et al in 2009 who obtained 55.9% among women born in the vaccination era [11].

The variations in IgG titers of the study population showed a predominance (48.75%) of concentrations of] 200-1000 [mIU/ml. This result is contrary to that of Obi et al (28.9%) in Zimbabwe, who used a less sensitive agglutination technique [13]. The geometric mean concentration (GMC) of antibodies decreased with management age. So the first trimester represented the majority with a CMG of 1080.24 mIU/ml. Those from the second trimester had a GMC of 988.04 mIU/ml and from the third trimester had a titer of 997.61 mIU/ml. Probably, in the second trimester a regulation of the immune system occurs with a view to establishing tolerance in the fetus, thus causing a transient immune deficiency in the pregnant woman. And the variation in geographical average concentrations of IgG antibodies depending on the age groups of the study population showed a value between [635.71-1296.56 mIU/ml] and that the

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age groups having the the highest peaks were] 15-20 years] and]30-35 years] (1296.56 and 1243.27 mIU/ml) which could be explained by the fact that these age groups would have been more in contact with children in our environment.

There is a statistically significant relationship between unemployed professional status and employees with the level of protective antibodies (P=0.01). This could be explained by the fact that employees could come from educated families who have respected the vaccination schedule for children. This result is different from that of Gieles et al in 2019 in South Africa and Obi in Zimbabwe ($p < 0.001$; $p < 0.01$) which was significant in women born in the pre-vaccination era whose antibody titers Anti-measles IgG were higher [11;13]. This discordance of associated factors could be explained by the widespread circulation of the more immunizing wild strain in the pre-vaccination era. Regarding clinical and paraclinical factors, the correlations with the presence of anti-measles IgG antibodies in the participants were not statistically significant. This is similar to the observation made by Gieles et al in 2019 who did not find a link in pregnant women living with or without HIV [11].

Limitations

We faced difficulties during the completion of this work which are as follows:
The very high cost of reagents which did not allow us to carry out more in-depth tests by comparing the level of anti-measles antibodies of mothers and their newborns.

Conclusion

A significant fraction of our study population presented an antibody titer lower than the protective level and could therefore not promote sufficient newborn in the pre-vaccination period, thus leaving a possibility of risk of neonatal measles.

Ethics

The study was conducted in accordance with ethical guidelines related to research in Cameroon. It was approved by the institutional ethics committee for human health research of the University of Douala (N°2932/CEI-UDo/10/2021/M) and the research authorizations of the Directors of the hospitals concerned: the Douala General Hospital (No. 173AR/MINSANTE/HGD/DM/10/21) and the Laquintinie Douala Hospital (No. 06192/AR/MINSANTE/HLD/SPER).

Author contributions

• AAPN, JPNM, GN, OEC, GS, CMS, AC, HE and CTN carried out the study and participated in the statistical analysis and procedures.
• AAPN, JPNM, GN, OEC, GS, CMS, AC, carried out the practical part of the study.
• JPNM and DA 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.

Guillet M, Vauloup-Fellous C, Cordier A.G et al. « Rougeole chez les femmes enceintes : mise au point » Journal de Gynécologie Obstétrique et Biologie de la Reproduction.2012. 41, 209-218

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.R, Faye P.M, 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

Olivia A, Vassilis T,Emmanuel L, Anne K, Camille L R, Pierre L, Daniel Floret, et *Al* « Rougeole et grossesse » Presse Med. 2011; 40: 1001–1007_ 2011 Elsevier Masson SAS. // www.em-consulte.com/revue/lpm ou www.sciencedirect.com

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

Serena M, Martina M, Simonetta V, Emanuele M et *al* "Measles in pregnancy: a threat for Italian women?" Human vaccine & immunotherapeutic, 2019, vol 15 (12) P 2851-2853

Gieles N.C., Mutsaerts E, Kwatra G, Bont L et *al.* ''Measles seroprevalence in pregnant women in Soweto, South Africa: a nested cohort study'' Clinical Microbiology and Infection 26, 2020, 515.e1e515.e

Plans P., De Ory F., Campins M., Álvarez E., Payà T. '' Prevalence of anti-rubella, anti-measles and anti-mumps IgG antibodies in neonates and pregnant women in Catalonia (Spain) in 2013: susceptibility to measles increased from 2003 to 2013'' European Journal of Clinical Microbiology & Infectious Diseases.2015.vol 34, pages 1161–1171

Obi C L, Tswana S A, Moyo S R, Berejena C "Measles virus haemagglutination-inhibition antibodies among pregnant and non-pregnant women in the vaccine era in Harare, Zimbabwe" Black FL. Prog Med Virol. Cent Afr j Med. 1996 May;42(5):135-8.