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Protection Potentials of Impregnated Mosquito Net Against Malaria in Pregnant Women in Ngaoundere-Cameroon

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Abstract: Very few studies have been affected on the relation ships between malaria and pregnancy in developing country in general and in Cameroon in particular. This study was conducted in the provincial and protestant hospital of Ngaoundere-Cameroon by consultation or examination of patients and sampling of blood to evidence the presence of *Plasmodium*, the parasitemia in patients, the parasitic density and the hematocrite content. The analysis of data from the examination of 170 pregnant women parasited by *Plasmodium falciparum* indicated very few patients use mosquito nets to prevent malaria. Most of the patients who are generally married (86.5%). The pregnant women make the first examination after the second term of the pregnancy (12-24 months). About 61.9% of pregnant women do not use a single method for protection against malaria. Among women using preventive methods chemoprevention is the most used method in the town. Amodiaquine is the mostly used drug by these patients. Despite the lack of protection the parasitic density of infected women is low with 73.5% of individuals presenting a parasitemia ranging between 0-100% parasites/μL of blood. These suggest that a hematocrite rate lower than the normal. These results show that it is important to vulgarize the different methods of prevention against malaria in endemic zones.

Key words: Malaria, pregnancy, *Plasmodium falciparum*, hematocrite

INTRODUCTION

Malaria is very important parasitic endemic and problem shooting to the health of public in tropical areas, despite the therapeutic progress and efforts realized to eradicate it (Patrice, 1997). Among the 4 species infesting human, *P. falciparum* show a real capacity to acquire resistance against schizoncides (Le Bras and Basco, 1991). In regions where malaria is endemic there are groups of people more vulnerable than others due to factors linked to the physiologic status and then development of organism. Pregnancy is status of complex physiologic development involving a certain degree of immuno-suppression that lead to enhancing the susceptibility to several pathologies. Malaria is probably the parasitosis for which the increased risk is the most evident (Deleron and Mauber, 1994). Whenever, this pathology is detected in an individual it is generally accompanied by numerous lesions located in the blood. These consequences increase during pregnancy because in women (aggravation of clinical sign, anaemia) in foetus (absorption, reduction of weight at bird, prematuration, low intra-uterine development) and to new born (increasing mortality). The placental infections are several and frequently associated to foetal and newborn consequences (Deleron and Mauber, 1994).

Malaria is manifested differently according to the physiologic status of individuals (Ekobo, 1997) and the infesting capacity of the parasite. When an organism has developed efficient mechanism against the parasites invasion. The parasites have also found means of escaping the host immuno-response.

Plasmodium falciparum is the parasite species responsible for the acute malaria and is the most concerned with chemo-resistance (Le Bras and Basco, 1991). This species is frequent in children of less than 5 years old and pregnant women. The chemo-resistance corresponds to adaptation of plasmodia to drug such as chloroquine and can result to uncontrolled administration of drugs, as excess auto-medication, or a non-respect of treatment requested. In this riskily population, it is necessary to seek for the most adapted

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method appropriated to their weakly health. This methodology requests a best knowledge of infestation conditions and means used to control this parasitosis. This study will enable to evaluation of all the infestation parameters related to living conditions of pregnant women.

MATERIALS AND METHODS

Study area: The study was conducted in Ngaoundere, located in the Adamawa province of Cameroon. The town is at 1200 m altitude and represents a transition point the Northern (war) and Southern (cold) region that confer to it a good weather. The vegetation is essentially a savannah with shrubs or trees such as *Daniella oliveri* or *Lophira lanceolata* (Isaka, 2002).

The annual rainfalls are 1400 mm on average, with the rainy season extending over 7-8 months and generally located in time and space. They appear in the form of downpours or from storms as in the case of equatorial climate (Mapongmetsem, 1995). The provincial and protestant hospitals of Ngaoundere are 2 sanitary structures in which patients from any location in the town are oriented daily.

Sampling: Pregnant women were samples in the Prenatal Consultation Services (CPN). Any patient receives a series of questionnaire elaborated for the study. A thick drop, a blood smear and a hematocrite are made for each patient.

Realization and colouring of blood: A drop of sampled blood was deposited in the middle of the slide. The edge of another slide was used to spread the blood sample. A drop of blood was deposited at one of the edge of the slide then, the slide was held with the left hand between the thumb and forefinger. With the right hand another slide was approached to the first at 45°C along which the two blood samples were fused. With a show, regular movement the fused blood was extended to the right several times to obtain the smear. The smear was set to dry on a flat surface and protected against dust of the flies. The dried smear was labelled with a pencil with the number affected to the patient. Then the smear was covered with a diluted solution of Giemsa dye (1/1: distilled water/dye). Five to ten minutes later the dye was washed with distilled water and the smear let to dry again.

Parasitic density: The parasite density was calculated by an approximate evaluation of the parasite and in comparison with leucocytes. A microscopic field of the 100×magnification was used to count 160 leucocytes. The reading of 50 fields was enough to observed 8000 leucocytes equivalent in 1 μL of blood. The number of parasite per microliter of blood was calculated based on the number of field observed.

Statistical analysis: The statistical comparison of parasite density of patients based on their age, activity and level of study was realized using an analysis of variance. The different prevalencies between parasite species were determined by the mean comparison test (Schwartz, 1996) at 5% level of significance.

RESULTS AND DISCUSSION

Frequencies and densities of parasites

Infestation according to the age: The data collected indicated that patient from 20-30 years old were more parasitized whether the impregnated mosquitoes net were used or not (Table 1). The average parasites frequencies were more elevated I pregnant women sleeping out of impregnated mosquitoes nets with a rate of 81.2% against 29.6% (Z = 4.69).

The parasite densities were more elevated in patient of more than 30 years old (Table 1). These results suggest that patients of between 20 and 30 years old are the most infested, in conformity with other results reported (Cot and Deleron, 2003; Cot *et al*., 2003), according to which pregnant women of between 15-25 years old were more infested. The use of mosquitoes net is not a prerequisite for the reduction of the parasite density (Nloga and Messi, 2005).

Infestation according to the activity of patients: The activity of pregnant women has an influence on the infestation rate (Table 2). Thus pregnant women working as secretaries and sleeping under impregnated mosquitoes nets were infested by *Plasmodium* at a rate of 50%. In contrast those who were householder or headers were more infested at 68.7 and 66.7%, respectively (Z = 0.074) for those sleeping out of the mosquitoes nets.

The parasite densities followed the parasite frequencies evolution with a higher density in the most infested patients.

These variations can be explained by the fact that many women in the region without experience have no activity. The infestation increased in according to the disponibility of women to get information. In addition the lack of engagement in public life is a factor to be taken into consideration that contributes to the non utilisation of mosquitoes nets (Habiba, 1997).

Table 1: Means frequencies and parasites densities of patients sample at the provincial and protestant hospitals of Ngaoundere from 14 August 2003 to 7 May 2004, in relation to age of pregnant women

	Women examined		Means frequences of parasites (%)		Means parasite densities (parasites μL^{-1} of blood)	
Age (years old)	Effective 1	Effective 2	Women 1	Women 2	Women 1	Women 2
[10-15]	0	10	0.0	60.0	0.0	18.2±16.5
[15-20]	33	63	18.2	69.8	2.18±4.8	7.6±5.5
[20-25]	71	54	29.6	72.2	4.5±7.9	6.7±5.3
[25-30]	62	16	29.03	81.2	4.1±6.9	5.2±3.4
[30-35]	31	15	19.3	33.3	1.5±3.5	1.9±2.9
[35-40]	6	6	16.7	33.3	1.3±3.3	1.0±1.7
[40-45]	0	6	0.0	16.7	0.0	0.7±1.6

1 = women under mosquitoes net; 2 = women sleeping out of mosquitoes net

Table 2: Means frequencies and parasites densities of patients sample at the provincial and protestant hospitals of Ngaoundere from 14 August 2003 to 7 May 2004, in relation to activity of pregnant women

	Women examined		Means frequences of parasites (%)		Means parasite densities (parasites μL^{-1} of blood)	
Activités des femmes	Effective 1	Effective 2	Women 1	Women 2	Women 1	Women 2
Householder	137	147	29.2	68.7	3.8±6.8	7.2±7.2
Student	7	3	0.0	0.0	0.0	0.0
School girl	13	7	23.1	57.1	0.6±2.2	4.6±5.5
Nurse	12	3	16.7	33.3	4.0±9.3	1.3±2.3
Teacher	11	3	18.2	0.0	2.2±5.2	0.0
Secretaries	6	4	50.0	50.0	6.0±7.0	4.5±5.2
Traders	17	3	11.8	66.7	1.6 ±4.7	9.0±7.8

1 = women under mosquitoes net; 2 = women sleeping out of mosquitoes net

Table 3: Means frequencies and parasites densities of patients sample at the provincial and protestant hospitals of Ngaoundere from 14 August 2003 to 7 May 2004, in relation to instruction level of pregnant women

	Women examined		Means frequences of parasites (%)		Means parasite densities (parasites μL^{-1} of blood)	
Instruction level	Effective 1	Effective 2	Women 1	Women 2	Women 1	Women 2
No formal education	56	64	17.8	70.3	2.21±5.9	7.75±8.2
Primary school	36	53	38.9	66.0	5.33±7.5	6.7±6.9
Secondary school	97	50	27.8	60.0	3.6±6.9	5.5±5.1
University	14	3	7.1	0.0	2.5±5.8	0.0

1 = women under mosquitoes net; 2 = women sleeping out of mosquitoes net

Table 4: Variations of pregnant women coming to consultation at the provincial and protestant hospitals of Ngaoundere from 14 August 2003 to 7 May 2004, in relation to age of pregnant women

			Means frequences of parasites (%)	
Age (years old)	Effective A	Effective B	Women A	Women B
[15-20]	13	20	46.15	0
[20-25]	49	22	42.9	0
[25-30]	31	31	58.1	0
[30-35]	19	12	31.6	0
[35-40]	3	3	33.3	0

A = Women without chemotherapy; B = Women under chemotherapy

Table 5: Means frequencies and parasites densities of patients sample under chemotherapy, at the provincial and protestant hospitals of Ngaoundere from 14 August 2003 to 7 May 2004, in relation to activity and instruction level of pregnant women

Activity of women	Effective	Means frequences of parasites (%)	Formal level instruction	Effective	Means frequences of parasites (%)
Traders	8	25	No formal education	26	65.4
School girl	6	50	Primary school	21	47.6
Student	3	0	Secondary school	64	37.5
Nurse	5	40	University	6	16.7
Teacher	5	40	-	-	-
Householder	56	69.5	-	-	-
Secretary	4	75	-	-	-

Infestation according to the instruction level: The frequency of parasite infestation indicate that the rate was weak in pregnant women with university studies (17.8%) (Table 3). The infestation level of pregnant women who have only primary education and those sleeping under mosquitoes nets was significantly greater

than that of others (p = 0.0004). In contrast in women sleeping out of impregnated mosquitoes net, the higher infestation level was observed in those who have a low education level (70.3%). The parasite density due to Plasmodium followed the same trend as that of the parasite frequency. Here again, the infestation level was the highest in women sleeping out of mosquitoes nets. Mosquitoes nets impregnated with insecticide constitute a very good protection against human malaria in endemic zones as have been reported by several authors (Robert *et al*., 1990; Nloga and Messi, 2006).

Chemotherapy in women under mosquitoes impregnated nets with insecticide chemotherapy according to age: The chemotherapy in women under mosquitoes net avoids infestation by *Plasmodium*. Results show that 30% of pregnant women not submitted to chemotherapy are infested by malaria with a maximum between 25 and 30 years old (58.1%).

Thus mosquitoes net alone can not protect completely from parasite infestation. This infestation can be explained by the fact that pregnant women are under mosquitoes net only when they are sleeping. In their free time, they are exposed to the parasite. In addition all the neigh boring houses do not have mosquitoes net and can constitute the source of parasite. Studies conducted at Ebogo (Cameroon) have revealed that even under mosquitoes net pregnant women are infested by malaria (Nloga and Messi, 2006). Other authors have reported that the prevention of malaria in pregnant women is important because of the increased risks of infestation with consequences of child mortality (Cot *et al*., 2003; Coulaud, 1998).

Infestation related to the activity and of instruction level of women: Apart from students (ladies), all the pregnant women under mosquitoes net were infested by malaria but at different rates (Table 5). The most elevated infestation level was observed in secretary (75%) and householder (69.5%).

These infestations were confirmed by their instruction level with a low infestation level in women who have at least university education (16.7%). Women without formal education were significantly more infested at a rate of 65.4% ($p<0.05$).

This study confirm globally that pregnant women under mosquitoes net but not submitted to chemotherapy can be infested by malaria. The level of instruction strongly account for the protection against malaria. This can be attributed to the fact that women without or with very little instruction do not follow in general information on the different method of control against malaria.

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