

Full Length Research Paper

Community knowledge perceptions and practices regarding malaria prevention and physical environment aspect: A prelude to indoor residual spraying (IRS) implementation in Atacora region, Benin

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The implementation of a vector control strategy needs to be adapted to both sociocultural and environmental contexts. The determination of National Malaria Control Program (NMCP) to fight effectively against malaria resulted in their decision to implement indoor residual spraying (IRS) in the department of Atacora in the Northwest of Benin. This study assessed community knowledge, perceptions and practices about malaria prevention especially about Indoor Residual Spraying (IRS), as well as data related to the type of human dwellings. Cross-sectional study was conducted between September and October, 2010. The results of a total of 7,878 respondents show little knowledge of populations about malaria. There was however a variety of protective measures against mosquito bites including bednets which are the most used. Moreover, IRS was accepted by 98.74% of respondents. Most (79.84%) of the walls were smooth and lend themselves well to the insecticide treatment.

Key words: Malaria prevention, community, knowledge, perceptions, practices, physical environment aspect, indoor residual spraying (IRS), Benin.

INTRODUCTION

Malaria remains a major cause of morbidity and mortality in sub-Saharan Africa and represents one of the most critical public health challenges for Africa. More than two billion people around the world, particularly people living in South America, South-Eastern Asia and sub-Saharan Africa, are at risk of contracting malaria. Besides, one million deaths are recorded yearly of which, 91% occur in sub-Saharan Africa (WHO, 2011).

In Benin, in 2010, malaria was responsible for more than 1,410 deaths (Ministère de la santé, 2011). However, its incidence in Atacora in 2009 was 16.2%, which is higher than the national average (15.2%).

The fight against malaria aims to significantly reduce the mortality and morbidity linked to it as well as the economic losses it causes. Among the various methods used in the fight against malaria, vector control occupies a prominent place. The use of Insecticide Treated Nets (ITNs) as a method of preventing malaria is widely adopted in most of the strategies already implemented by the national control programs against malaria. Several studies conducted since 1988 so far have demonstrated the effectiveness of ITNs in the fight against malaria, particularly in Burkina Faso (Carnevale et al., 1988; Robert and Carnevale, 1991), Cameroon (Desfontaine et

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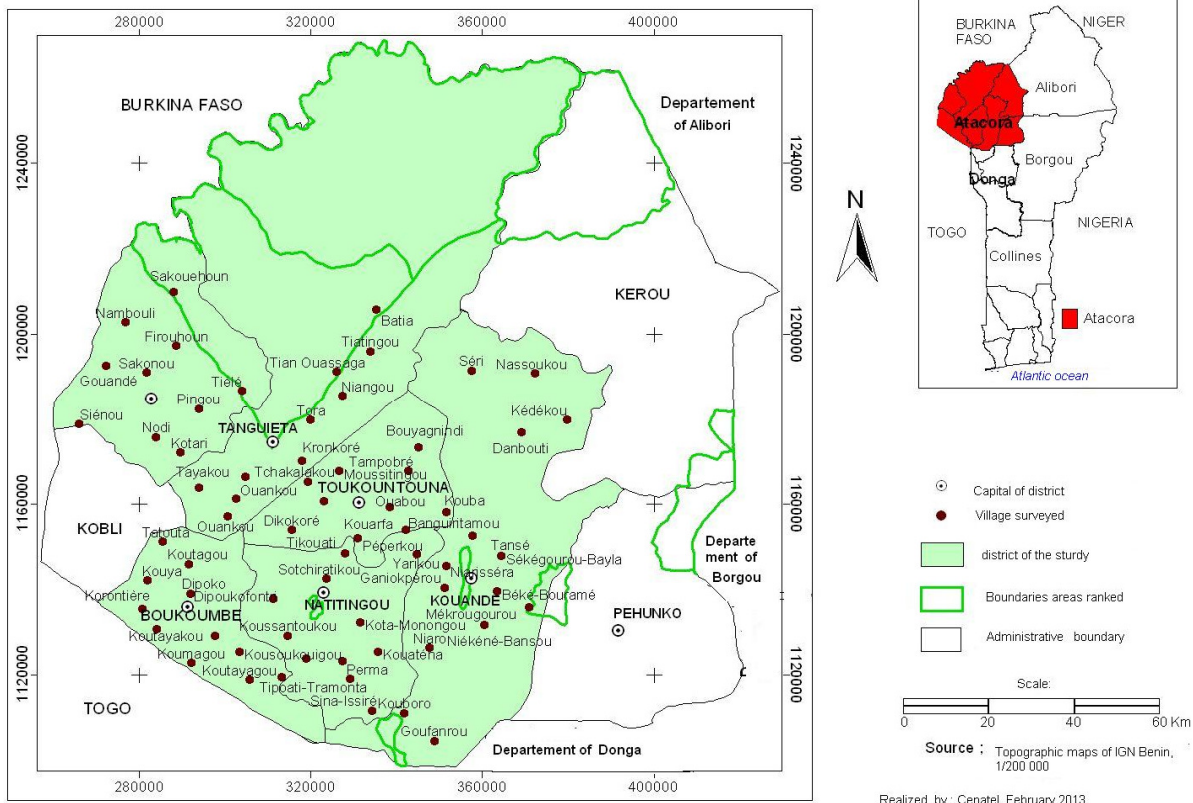


Figure 1. Map of study area.

al., 1990), Gambia (Alonso et al., 1991; D'Alessandro et al., 1995; Cham et al., 1996; Aikins et al., 1998; Snow et al., 1988), Democratic Republic of Congo (Karch et al., 1993), Kenya (Nevill et al., 1996), Ghana (Binka et al., 1996), Benin (Akogbeto et al., 1996) and Côte d'Ivoire (Doannio, 2003; Konan, 2003). Unfortunately, in recent years, the phenomenon of vector resistance to insecticides has been an obstacle to the use of ITNs. The first case of resistance to pyrethroids was highlighted in 1993 in Côte d'Ivoire in natural populations of *Anopheles gambiae* (Elissa et al., 1993). Chandre et al. (1999) confirmed this resistance and showed that it extended to other sub-Saharan countries including Benin. Nowadays, it is present in several countries in central Africa and east Africa (Vulule et al., 1999; Etang et al., 2006; Abdalla et al., 2008; Koekemoer et al., 2002; Nwane et al., 2009). In fact, in Benin, the resistance of malaria vectors to pyrethroids observed first in Cotonou spread not only to central and southern regions of the country, but also to the northern localities (Corbel et al., 2007; Yadouleton et al., 2010). One of the interventions chosen by the National Malaria Control Program (NMCP) to fight against malaria in the context of vector resistance to pyrethroids is a large-scale indoor residual spraying (IRS) using a non-pyrethroids. Then, since 2008, Benin has undertaken a fight against malaria vectors based on IRS like 14 other African countries. A study conducted in Ouémé, in Southern

Benin showed that the first and second rounds of IRS using bendiocarb were successful with a drastic decrease in malaria transmission in areas under IRS (Akogbéto et al., 2011). In view of these performances, the NMCP decided to continue the IRS implementation in other regions of Benin. The second region selected is Atacora.

Elsewhere, the vector control interventions should not only be adapted to the socio-cultural realities of the benefiting population (Kyawt-Kyawt-Swe and Alan, 2004), but also have their agreement. No information was available on communities' knowledge perceptions and practices about IRS. The purpose of this study was therefore to assess community knowledge, perceptions and practices about malaria prevention and especially about IRS. Furthermore, data related to the type of human dwellings were collected. The surveys were conducted between September and October, 2010 in the Department of Atacora before the implementation of the campaign.

METHODOLOGY

Study area

The study was carried out in Atacora, a department located in North-West of Benin (Figure 1). It includes nine districts (Boukoumbé, Kobli, Kérou, Kouandé, Matéri, Natitingou, Péhunco, Tanguiéta, Toukountouan) and covers an area of 31,665 km² with

Table 1. Rates (%) of education level and sex of the population according to districts.

Variable		Boukoumbé		Kouandé		Matéri		Natitingou		Tanguiéta		Toukountounan		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Sex	Male	601	45.77 ^a	597	45.47 ^a	633	48.21 ^a	692	52.70 ^a	652	49.66 ^a	647	49.28 ^a	3,822	48.51 ^a
	Female	712	54.23 ^b	716	54.53 ^b	680	51.79 ^a	621	47.30 ^a	661	50.34 ^a	666	50.72 ^a	4,056	51.48 ^b
Educational level	Can read and write	429	32.67 ^a	397	30.24 ^a	434	33.05 ^a	511	38.92 ^a	494	37.62 ^a	409	31.15 ^a	2,674	33.94 ^a
	Cannot read and write	884	67.33 ^b	916	69.76 ^b	879	66.94 ^b	802	61.08 ^b	819	62.38 ^b	904	68.85 ^b	5,204	66.05 ^b

N: Number of respondents; Percentage of respondents; Within rows, for a same variable, means followed by the same letter do not differ significantly ($p < 0.05$ chi-square test).

a total of 735,845 inhabitants including 146,309 children under 5 years old in 2011 (INSAE, 2009). This department is characterized by a sub-equatorial climate with only one dry season (December-May) and only one rainy season (July-November). The annual rainfall mean is 1,300 mm and the monthly mean temperatures vary between 23 and 33°C. The major economic activity is agriculture and it is characterized by the production of cotton and millet in areas where various classes of pesticides are used for pest control.

Survey

It is a cross-sectional study, descriptive and analytically based on cluster sampling, conducted between September and October, 2010. The survey consisted of 7,878 individuals including adult male and female heads of household (family unit). The respondent's consent was sought and gained by explaining the aims of the study. The questionnaire contained items on the educational level of the heads of household, their perception regarding mosquito discomfort (bite, malaria), common malaria prevention practices (ITN, IRS) and malaria treatment (traditional medicine and modern antimalarial drugs). During each interview, observations were focused on the type of habitat, wall nature (cement, mud) as well as wall surface (smooth, rough). Subjects who could not or read, write or speak French language were interviewed in their local language. As regards the qualitative interviews, a focus group of thirty people (Krueger, 1994), involving opinion leaders, was conducted in each district to have a better

understanding of people's attitudes, their perception of malaria and how they fight against it.

Sampling

The sampling method used is rational choice method. The sampling fraction was calculated on the basis of 10% of households in Atacora. This resulted in a total of 7,878 households or 7,878 respondents, at the rate of one respondent per household. We chose to conduct the surveys in 2/3 of all districts and that adds up to 6 districts out of 9 with 1313 households surveyed by district regardless of the number of households per district. Actually, these six districts were randomly selected. They include Boukoumbé, Kouandé, Matéri, Natitingou, Tanguiéta and Toukountounan. In each district, the survey was conducted in ten villages. The rational choice method was used in setting the selection criteria of the male or female head of household to be interviewed.

Statistical analysis

Responses and information obtained from the survey were entered in computers using Microsoft Office Excel 2010 of Windows. Then, simple descriptive statistics such as frequency and percentage of variables were computed and cross-tables were produced using SPSS software (16.0 version). A chi-square test for proportion comparison was performed to compare the proportions of each variable related to each region.

RESULTS

Social representations of mosquito and malaria

Females constituted 51.50% ($n = 4,056$) of the 7,878 heads of households that were involved in the survey. Besides, 66.10% of respondents were illiterate (Table 1). The highest illiteracy rate (70.00%) was observed in Matéri. It was noticed that mosquito bite is the most feared mosquito nuisance (55.40%) (Table 2). And only 24.50% of respondents were able to establish the link between mosquitoes and malaria. Knowledge of the cause of malaria was relatively higher in Natitingou (35.11%). Actually, people connect the mosquito's ability to transmit malaria to the notion of dirt. For people, mosquito plays an indirect role in malaria transmission; it walks in wastewater, on rubbish heaps and can therefore transmit malaria by its bite. With regard to the symptoms of malaria, the most mentioned were fever (57.10%), headache (15.00%) and pain (12.60%) (Table 3). 22.70% of people recognized that malaria is a deadly disease. As for malaria treatment, traditional medicine practice (59.00%) was significantly higher than modern medicine practice (41.00%) (Table 3).

Table 2. Perception about mosquito nuisance.

Mosquito nuisance	Boukoubé		Kouandé		Matéri		Natitingou		Tanguiéta		Toukountouan		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Noise	76	5.79 ^a	92	7.01 ^a	81	6.17 ^a	60	4.57 ^a	40	3.05 ^a	101	7.69 ^{ad}	450	5.71 ^a
Bite	779	59.33 ^b	699	53.24 ^b	743	56.59 ^b	716	54.53 ^b	718	54.68 ^b	710	54.07 ^b	4,365	55.40 ^b
Malaria	242	18.43 ^c	276	21.02 ^c	281	21.40 ^c	461	35.11 ^c	369	28.10 ^c	299	22.77 ^c	1,928	24.47 ^c
Insomnia	80	6.09 ^d	96	7.31 ^a	30	2.28 ^d	37	2.82 ^a	83	6.32 ^d	79	6.01 ^d	405	5.14 ^a
Itch	136	10.36 ^e	147	11.19 ^d	176	13.40 ^e	39	2.97 ^a	103	7.84 ^d	124	9.44 ^a	725	9.20 ^d
Any	0	0 ^f	3	0.23 ^e	2	0.15 ^f	0	0 ^d	0	0 ^e	0	0 ^e	5	0.06 ^e

N: Number of respondents; Percentage of respondents; Within rows, means followed by the same letter do not differ significantly ($p < 0.05$ chi-square test).

Table 3. Perceptions and practices of the population related to malaria.

Variable	Boukoubé		Kouandé		Matéri		Natitingou		Tanguiéta		Toukountouan		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Symptom of malaria														
Fever	712	54.23 ^a	699	53.27 ^a	787	59.94 ^a	802	61.08 ^a	724	55.14 ^a	776	59.10 ^a	4,500	57.12 ^a
Pain	229	17.44 ^b	246	18.74 ^b	153	11.65 ^b	129	9.82 ^b	111	8.4 ^b	128	9.748 ^b	996	12.64 ^b
Nausea	80	6.09 ^c	33	2.51 ^c	47	3.58 ^c	51	3.88 ^c	49	3.73 ^c	31	2.36 ^c	291	3.69 ^c
Tiredness	56	4.27 ^{cd}	101	7.69 ^d	106	8.07 ^c	134	10.20 ^b	123	9.37 ^b	132	10.05 ^b	652	8.28 ^d
Headaches	201	15.31 ^b	206	15.69 ^b	199	15.16 ^d	136	10.35 ^b	233	17.74 ^d	206	15.69 ^d	1,181	14.99 ^b
Vomiting	35	2.67 ^d	28	2.13 ^c	21	1.60 ^c	61	4.64 ^c	73	5.56 ^c	40	3.04 ^c	258	3.275 ^c
Perception of the severity of malaria														
Serious	460	35.03 ^b	420	31.98 ^b	387	29.47 ^b	602	45.84 ^a	476	36.25 ^a	419	31.91 ^b	2764	35.08 ^c
Very serious	599	45.62 ^a	612	46.61 ^a	586	44.63 ^a	512	38.99 ^b	513	39.07 ^a	507	38.61 ^a	3329	42.269 ^a
Fatal	254	19.34 ^c	281	21.40 ^c	340	25.89 ^b	199	15.15 ^c	324	24.68 ^c	387	29.47 ^b	1785	22.66 ^b
Medicine used against malaria														
Modern medicine	525	39.98 ^a	501	38.16 ^a	537	40.90 ^a	625	47.60 ^a	510	38.84 ^a	534	40.67 ^a	3232	41.02 ^a
Traditionnal medicine	788	60.01 ^b	812	61.84 ^b	776	59.10 ^b	688	52.40 ^a	803	61.15 ^b	779	59.33 ^b	4646	58.97 ^b

N: Number of respondents; Percentage of respondents; Within rows, for a same variable, means followed by the same letter do not differ significantly ($p < 0.05$ chi-square test).

Experiences and practices of protection against mosquitoes

Among the means of protection, nets are most

commonly used. 34.10% of respondents reported sleeping under ITNs and 20.20%, under ordinary nets. Those possessing no mosquito nets use spirals (mosquito coils) (18.00%) and local plants

(7.24%). In addition, other methods such as the use of insecticide sprays, grids for windows, repellent ointments, cloth for cover, smoke, and fan were reported but in small proportions (Table 4).

Table 4. Measures used by people to fight against mosquitoes.

Measures used	Boukoubé		Kouandé		Matéri		Natitingou		Tanguiéta		Toukountounan		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Impregnated nets	446	33.97 ^a	453	34.50 ^a	402	30.62 ^a	512	38.99 ^a	472	35.94 ^a	399	30.38 ^a	2,684	34.07 ^a
Ordinary nets	299	22.77 ^b	254	19.34 ^b	273	20.795 ^b	246	18.73 ^b	226	17.21 ^b	296	22.54 ^b	1,594	20.23 ^b
Spiral	211	16.07 ^c	241	18.35 ^b	254	19.345 ^b	209	15.91 ^b	263	20.03 ^b	237	18.05 ^c	1,415	17.96 ^b
Spray	80	6.09 ^d	76	5.79 ^{cd}	57	4.3415 ^c	101	7.69 ^c	49	3.73 ^c	62	4.72 ^d	425	5.39 ^{cd}
Local plants	103	7.84 ^d	99	7.54 ^c	117	8.910 ^e	66	5.02 ^d	97	7.38 ^d	88	6.702 ^f	570	7.23 ^c
Smoke	49	3.73 ^e	57	4.34 ^d	76	5.79 ^c	28	2.13 ^e	46	3.50 ^c	61	4.65 ^d	317	4.02 ^d
Ointments	11	0.84 ^f	13	0.99 ^e	19	1.44 ^f	33	2.51 ^e	21	1.60 ^e	22	1.676 ^e	119	1.51 ^e
Window net	17	1.29 ^f	14	1.06 ^e	16	1.22 ^f	46	3.50 ^{ed}	13	0.99 ^e	20	1.52 ^e	126	1.60 ^e
Fan	28	2.13 ^g	19	1.44 ^e	21	1.60 ^f	38	2.89 ^e	15	1.14 ^e	17	1.29 ^e	138	1.75 ^e
Cover	69	5.25 ^d	87	6.63 ^{cd}	75	5.71 ^c	34	2.59 ^e	99	7.54 ^d	102	7.77 ^f	466	5.91 ^{cd}
Any	0	0 ^h	0	0 ^f	3	0.23 ^g	0	0 ^f	12	0.91 ^e	9	0.68 ^g	24	0.30 ^f

N: Number of respondents; Percentage of respondents; Within rows, means followed by the same letter do not differ significantly ($p < 0.05$ chi-square test).

Moreover, during the focus groups, some participants pointed out that they do not use nets because they do not have any, and make a call to the NMCP for free distribution of bed nets to the population.

Experiences and practices regarding protection against mosquitoes

A total of 3,352 (42.50%) of respondents declared that they knew IRS (Table 5). The highest rate was observed in Toukountounan (46.40%) and the lowest in Kouandé (36.00%). 39.40% of the respondents agreed that IRS contributes to the reduction of mosquitoes (Table 5). But only 18.80% of them associated the reduction of malaria transmission to IRS. Although 68.40% of the respondents found no drawback to IRS, others fear odors (12.80%) that could be released by the pesticides and their toxicity (13.70%) (Table 5). As to the acceptability of IRS, there is a strong

adhesion of the populations. As a matter of fact, 98.70% gave their accession to the IRS campaign. And the same observation was made in focus groups. The populations also suggested that IRS campaign should be implemented during the rainy season when mosquitoes "disturb" a lot.

Physical nature of the various types of dwelling

In the 6 districts, it was noticed that human dwellings are mostly built with mud (Figure 2). And, out of the 6,600 dwellings surveyed, 87.66% were built with mud (Figure 3) and the majority of them (79.84%) had their walls plastered (Figure 4). In all districts, there was a very low number of cement walls (12.33%) (Figure 5). But Natitingou was characterized by the most modern habitat with the highest proportion of cement houses (33.00%). Most of the plastered cement walls and mud walls (82.33%) were smooth with surfaces

that lent themselves well to insecticide treatment. The walls with rough surfaces (17.66%) were essentially those that were not plastered.

DISCUSSION

The results of this study show that the majority of respondents have little knowledge about the cause of malaria. It was remarked that only 24.50% could relate malaria to mosquito bites. This low knowledge level regarding the cause of malaria confirms the results of previous works in Nigeria (Okeke and Okafor, 2008), Cameroon (Shey et al., 2011) and Benin (Padonou et al., 2011) in similar environments to Atacora. This could be explained by the culture of the communities who consider sun as a major cause of malaria. As a matter of fact, in the local language bariba, malaria is called "som Bararou" meaning "sun disease". However, in the same culture, there is a second name for malaria "bougain

Table 5. Perceptions and acceptability of populations for IRS.

Parameter		Boukoubé		Kouandé		Matéri		Natitingou		Tanguiéta		Toukountounan		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Knowledge of IRS	Know	525	39.99 ^a	472	35.95 ^a	576	43.87 ^a	601	45.77 ^a	569	43.34 ^a	609	46.39 ^a	3.352	42.55 ^a
	Do not Know	788	60.01 ^b	841	64.05 ^b	737	56.13 ^b	712	54.23 ^b	744	56.66 ^b	704	53.61 ^b	4.526	57.45 ^b
IRS disadvantage	Any	925	70.45 ^a	912	69.46 ^a	899	68.47 ^a	714	54.38 ^a	1021	77.76 ^a	916	69.76 ^a	5.387	68.38 ^a
	Bad odor	103	7.84 ^b	116	8.83 ^b	142	10.81 ^b	306	23.30 ^b	163	12.41 ^b	177	13.48 ^b	1.007	12.78 ^b
	Toxic	199	15.16 ^c	186	14.16 ^c	195	14.85 ^c	201	15.31 ^c	127	9.67 ^b	168	12.79 ^b	1.076	13.66 ^b
	Do not Know	86	6.55 ^b	99	7.54 ^b	77	5.86 ^d	92	7 ^d	2	0.15 ^c	52	3.96 ^c	408	5.18 ^c
IRS advantage	Reduction of disease	246	18.73 ^a	251	19.12 ^a	261	19.88 ^{ad}	271	20.64 ^a	128	9.75 ^a	273	20.79 ^a	1.430	18.15 ^a
	Reduction of malaria	236	17.97 ^a	222	16.91 ^a	231	17.59 ^a	256	19.49 ^a	273	20.79 ^b	265	20.18 ^a	1.483	18.82 ^a
	Réduction of mosquitoes	512	38.99 ^b	499	38 ^b	501	38.15 ^c	484	36.86 ^b	602	45.85 ^c	503	38.30 ^b	3.101	39.36 ^b
	Reduction of insects	316	24.07 ^a	335	25.51 ^c	304	23.15 ^d	299	22.77 ^a	310	23.61 ^b	269	20.48 ^a	1.833	23.27 ^c
	Don't know	3	0.23 ^c	6	0.45 ^d	11	0.84 ^e	3	0.23 ^c	0	0 ^d	2	0.15 ^c	25	0.37 ^d
	Others	0	0 ^c	0	0 ^d	5	0.38 ^e	0	0 ^c	0	0 ^d	1	0.078 ^c	6	0.08 ^e
IRS acceptance	Yes	1.299	98.93 ^a	1301	99.09 ^a	1.296	98.71 ^a	1.279	97.41 ^a	1.304	99.32 ^a	1.300	99.01 ^a	7.779	98.74 ^a
	NO	14	1.06 ^b	12	0.91 ^b	17	1.29 ^b	34	2.59 ^b	9	0.68 ^b	13	0.99 ^b	99	1.26 ^b

N: Number of respondents; Percentage of respondents; Within rows, for a same variable, means followed by the same letter do not differ significantly ($p < 0.05$ chi-square test).

Bararou" which means "mosquito disease". This shows that within the same culture, the knowledge of the cause of malaria is heterogeneous. These results suggest then the need to develop an Information, Education and Communication (IEC) program on malaria to allow the populations to know this disease better so as to fight against it effectively. The poor knowledge of the causes of malaria is also linked to the illiteracy of a great deal of people in Atacora. In the present study, 55.40% of the respondents mentioned the bite as a main mosquito nuisance. The same thing was noticed during a survey conducted in Bouake where painful stings and noises preventing from sleeping well were reported as the major mosquito nuisances (Doannio et al., 2004).

There is a range of protective measures against mosquito bites. Although, nets are the most used means of protection (54.30%), the rate of net coverage remains low. And even within households where net use is reported, it is not available to all members. The populations pointed out that they got the majority of their nets from free distribution campaigns since their purchasing power is so limited that they cannot afford nets. This reminds earlier surveys carried out in Northern Ghana which showed that "cost" is one of the key factors that may influence the dissemination and effectiveness of bednets (Binka and Adongo, 1997). The second most commonly used means of protection against mosquitoes is the use of coils. This could be explained by the

availability of coils on all markets, their relatively low cost and the fact that they could be bought on retail basis. As for the repulsive gas plants, they are rarely used (7.24%) probably because of their short term effectiveness.

Indeed, the high rate of acceptability of IRS could be explained first, by the great experience the populations have in terms of home treatment, secondly, by the promotion of preventive measures against malaria and finally the comparison populations make between the effectiveness of phytosanitary treatments and IRS. However, some people distrust the toxicity of insecticides and their odors. But, a good sensitization will surely reduce this reluctance. As for the treatment of malaria, 59.00% of the respondents use traditional

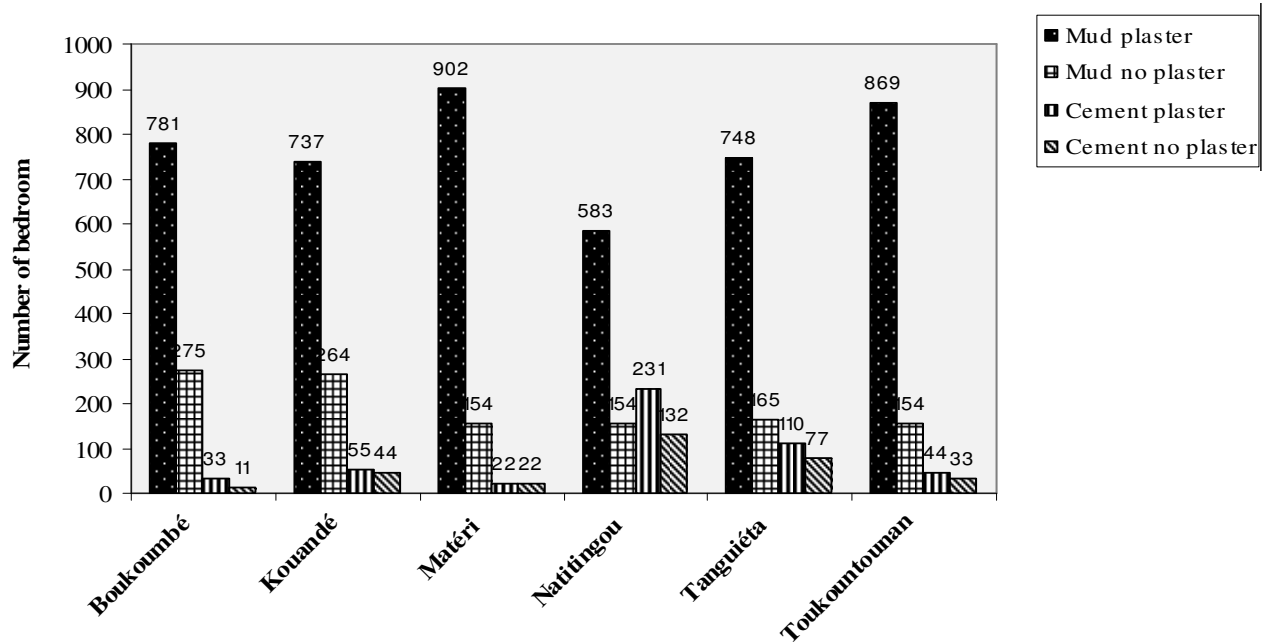


Figure 2. Numbers of habitat types noticed in each district.



Figure 3. Mud plaster habitat in Tanguiéta. Source: Aïkpon (2010).

traditional medicine. And, this could be explained not only by the low purchasing power of the population to afford drugs, but also by a lack of health facilities obliging patients to travel long distances before accessing the closer health center. The large number of houses built with mud (87.66%) is justified by the low standard of living. This type of wall could require the use of large quantities of insecticides during spraying due to its high porosity. There is, however, a high rate of plastering (79.84%),

often with a mixture of sand and/or debris of Néré (African tree from the family of *Mimosaceae*). This smooths the surface of the walls and may reduce the porosity so as to provide bioavailability of the insecticide on the surface of the walls. Indeed, a smooth surface is an advantage for the effectiveness of IRS (Najera and Zaim, 2004).

This survey was conducted in a community that had not yet been directly mobilized or educated about IRS, nor



Figure 4. Mud plaster habitat in Tanguiéta.
Source : Aikpon (2010).



Figure 5. Cement plaster habitat in Natitingou.
Source : Aikpon (2010).

did it explore actual experiences with use of IRS. Hence, this survey may not be able to differentiate between the real experiences and anticipated fears of IRS use. Nevertheless, the survey highlights significant community concerns about IRS that should be associated with sensitization to ensure success of such a programme.

Conclusion

The study of social representations and practices as far as malaria is concerned in the Department of Atacora shows that the respondents have little knowledge about the cause of malaria. There is, however, knowledge of preventive measures against mosquitoes. But, despite the diversity of prevention tools against mosquito bites,

bed nets are the most used. Although the majority of respondents had positive perceptions, a little proportion had negative perceptions towards the use of IRS. Therefore to ensure householders' cooperation and participation in the IRS processes in order to achieve a successful IRS programme, sensitization is needed, prior to introduction of IRS to address the identified knowledge gaps and poor perceptions about it.

Moreover, the majority of the walls are plastered with mud or cement, offering treatable smooth surfaces.

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