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Phytomedicines of Sickle Cell Crisis in Mezam Division, Cameroon: Preventive and Curative Cares

NOUMI Emmanuel^{1*} and NFORBI Akonwi Ngwa Nebane¹

¹Laboratory of Plant Biology, Higher Teachers' Training College, University of Yaoundé I, P.O. Box 47, Yaoundé, Cameroon.

Authors' contributions

This work was carried out in collaboration between all authors. Author NE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript and answered the reviewer's comments, and author NANN participated to the field work (with NE) in gathering data and collecting plants specimens in the goal to write her dissertation submitted in partial fulfillment of the requirements for the award of the Post Graduate Teachers' Diploma (DIPES II). All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Background: The aim of this study was to survey the Mezam Division of Cameroon, with a view to documenting how the population of that area treat sickle cells disease using medicinal plants, and to determine the need for further information on sickle cell disease or sickle cell anaemia in that division.

Method: Two questionnaires (one to patients and the other to traditional healers) were designed to gather information on every day life of patients and their parents, and medicinal plants were collected during the field trips.

Results: Seventeen plants species belonging to 16 genera and 13 families were collected. They formed 12 recipes used to treat sickle cell by 5 traditional healers. With the help of these phytotherapists, we meet 92 former and new patients aged from 1 to 35 years old. The current symptoms of the disease were anaemia, hand and foot syndrome, splenomegaly and rheumatic pains. A rate of 52.2% of patients felt better after the treatment; 19.5% of patients with ongoing treatment, felt persistent symptoms; and 28.3% abandoned the treatment.

Conclusion: Two haemoglobin diseases rage in Mezam Division and present some

*Corresponding author: Email: noumikap@yahoo.fr;

standard clinic demonstrations of anaemia hemolytic: HbS/S and HbS/C. The therapeutic preparations with *Zanthoxylum zanthoxyloides* exert an influence over haematopoietic organs like the spleen, by a dedifferentiation of its cells, and the production of Hb($\alpha 2, \gamma 2$) which is the foetal haemoglobin. Thus the patient haemoglobins are S/S and F. This was observed in a patient aged 26 years old in 1999. Since that year, she is still symptom-free up to 2011. The main limitation of this research, however, may be used as a direction for future research, which is, assessing the results from the field at the chemical level in laboratories.

Keywords: Hereditary disease, sickle cell disease, Phytomedicines, Mezam Division, Cameroon.

1. INTRODUCTION

Haemoglobins (Hb) are normally presented in the blood cells in all human beings. They are formed by two unlike pairs: an α pair and a non α pair, variable with the age of the individual [1]. The molecule of hemoglobin has a genetic conditioning. The blood disease due to an anomaly of haemoglobin is haemoglobinopathy. - 1° It can be one hand, about a different distribution, in the molecule of haemoglobin, of the polypeptidic chains that constitute it and that have a normal structure. Haemoglobinopathy is thus quantitative, as thalassaemia. - 2° Haemoglobinopathy can result, on the other hand, of an anomaly of structure of one of the hemoglobin polypeptidic chains. Thus, haemoglobinopathy is qualitative; it is haemoglobin disease [2,3].

- haemoglobin disease can remain latent. in the heterozygote forms; defect existing only at one parent. The homozygote forms (the defect being present to the two parents) give some standard clinic demonstrations of haemolytic anemia type. Among this homozygote forms, most serious is haemoglobin disease S or drepanocytosis or sickle-cell anaemia, having for symbol HbS ($\beta 6^{\text{glu-val}}$). In this later, the 6th aminoacid (glutamic acid) of chain β is replaced by the valine, with the risk of these molecules crystallizing in length, in anoxia. The other shapes are rare.

*HbC ($\beta 6^{\text{glu-lys}}$). Replacement in the chain β of the hemoglobin of the 6th aminoacid, the glutamic acid by the lysine. This substitution entails an anemia analogous to the one of the less serious drepanocytosis, in which the red blood cell has a shape of target.

*HbD. All hemoglobin which migrates like HbS in electrophoresis at an alkali pH, but provoking no malformation.

* HbE ($\beta 26^{\text{glu-lys}}$) in which the 26th acidic amine (glutamic acid of the chain β) is replaced by the lysine. It provokes a light hemolytic and microcytic anemia with cells-targets.

- In thalassaemia, chain β is the most often in insufficient quantity, from where the name of β thalassaemia given to this anemia in which does exist an excessive quantity of hemoglobin F (or fetal) [2,4].

More than 600 abnormal hemoglobins exist; the HbS (hemoglobin S) is the most serious among them; the other frequently encountered haemoglobinopathies are the HbC (hemoglobin C) and the β thalassaemia (βthal)⁵. These two last can be associated to HbS,

giving HbS/C (sickle cell S/C), and the *HbS/βthal* (sickle cell S/βthal), that are major genotypes of sickle cell disease. The people who present those syndromes (sickle cell S/S, S/C or S/βthal) are sick. People who have a hemoglobin A/S, A/C or A/βthal are not sick but can transmit the abnormal gene to their progenies and give some clinical manifestations associated to a type of hemolytic anaemia [6].

The patients' life expectancy is shortened by diseases, to 42 years for males and to 48 years for females. Hemoglobin S begins to crystallize when the oxygen concentration falls as it does in the capillaries of tissues. This causes the red blood cells normally biconcave disc-shaped, to assume the shape of a crescent or sickle. The severe anemia which results is generally fatal [7].

About 20% of the Cameroon's population is heterozygote and 2.8% homozygote.

About 28.6% of children have sickle cell [8]. Increased efforts have been made to provide modern treatment for sickle cell anemia, to prevent morbidity associated with stroke, in the Government hospitals, dispensaries and health centers, in Cameroon and in the other African countries [9]. But the treatment is long, expensive and the disease is not cured. Thus, the parents contact traditional healers to treat their children. Given that sickle cell is a genetic disease; did folk medicine succeed to treat it?

The aims of this study are: i) to document the treatment of sickle cell disease as it is practiced by traditional healers of the Mezam Division; ii) to appreciate its effectiveness through interviews of former and current patients vis-à-vis scientific literature; and iii) to determine the information requirement of the population as far as sickle cell disease is concerned.

2. STUDY AREA

Mezam Division (5°36'-5°56' N latitude, 10°10'-10°45' E longitude) is one of the seven divisions of the North-West Region of Cameroon. Bamenda, also known as Abakwa and Mankon town, is a city in North Western Cameroon and capital of the North West Region (Fig. 1). The population of the Mezam Division is estimated at 322,889 inhabitants in 2010, representing 18.67% of the population of the North-West Region and 1.66% of the population of Cameroon [10]. The native population is of the Bamileke tribe. The study area is situated on the Western highlands of Cameroon (1,200 m to 2,500 meters in height), characterized by rugged relief and high accident rates. On the plateau, volcanic rocks have created fertile black or brown ferralitic soils [11]. That plateau is submitted to the humid wind coming from the Atlantic Ocean (monsoon), and to the incursions of the tropical air of the Sahara (harmattan). The meeting of these two masses of air forms the intertropical forehead (ITF) whose swing determines the cycle of the seasons. The area experiences an equatorial climate of the highlander's type with 2 seasons: a short dry season of November-February and along wet season of March-October. Average rainfalls per year ranges from 1,000 mm to 2,000 mm [12]. High elevations give the region a cooler climate. The vegetation, originally made of forest, is nowadays disrupted by man's activities leading to a bocage landscape. Sudan savanna forms the dominant vegetation. This consists of grass fields [13].

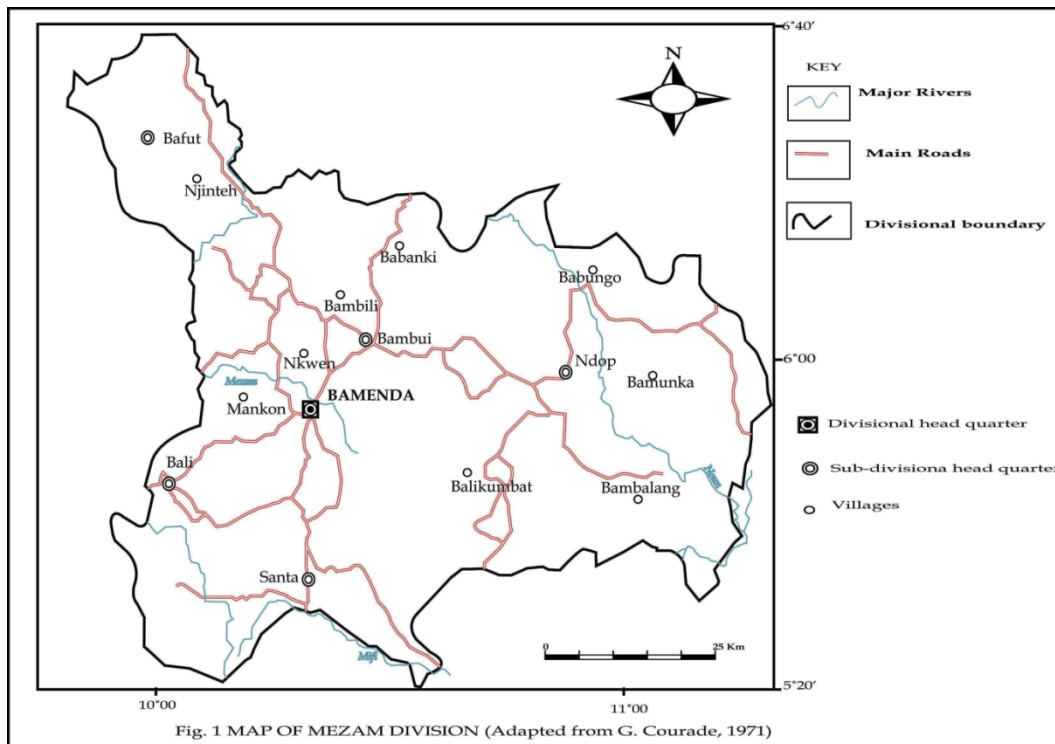


Fig. 1. Map of Mezam Division in the North-West Region of Cameroon.

3. METHODOLOGY

The work was carried out between December, 2008 and December, 2011. There, we met the chiefs of many villages and presented ourselves as lecturers of the university, to have any time, an agreement for this investigation. Five fieldworks were done. The target population in this study consisted of herbalists who treat the said diseases and the family that carries that sickness. The data were obtained through two multiple choice questionnaires, one to the patients and the other to the traditional healer. The questions to the patients were on: i) awareness of sickle cell disease and associated diseases; ii) the treatments followed; and iii) the effectiveness of the treatment. To the traditional healers the questions were on: i) the plants and therapeutic preparations used and ii) the method of administration of the phytomedicines.

After obtaining the consent of the persons who accept to collaborate to the research, proper clarifications were made and the anonymous questionnaire was distributed to respondents able to complete them. Each time, the questionnaires were collected the same day. To those who could not read or write, information was obtained through casual conversation. No direct questions were asked in order to prevent biasing the answers and compromising spontaneity. Everything that came out during the interview was subsequently transferred to the structured form. The method adopted followed the criteria outlined by some authors in conducting interviews [14,15].

The traditional healers, who cooperated with this work, showed the plants used to treat the sickle cell illnesses and indicated the various recipes as well as showed some patients treated or ongoing treatment. A digital camera was used to fix the pictures of the plants whose parts had been harvested like voucher specimen. Plant classification and nomenclature follow those of some systematic works [16,17]. The plants listed as treating sickle cell were collected, pressed and dried, and identified by the authors. All identifications were confirmed by the personnel of the Cameroon National Herbarium (HNC) (YA) of the Cameroon Ministry of Scientific and Technical Research. Data collected were compared with data from Cameroon ethnobotany as well as from other countries, and analyzed against scientific literature [18,19].

The chemical and biochemical data of plants were searched in scientific literature. The goal was to determine the effectiveness of their extracts on the treatment of sickle cell disease. The results were treated and analyzed using MS Word 97 and MS Excel programs. In 2010, separate structured interviews consisting of multiple choice questions were held individually with five healers (five men) about the cost of sickle cell treatment with traditional medicine. Each healer was asked the following questions: (A) What kind of sickle cell do you treat (only curse or witchcraft form, only physical, or both spiritual and physical forms)?; (B) Do patients have to pay for treatment (yes or no)?; (C) How do patients pay (labor exchange, animals, crops, or money)?; (D) How much is payment (less than 5,000CFA for some, between 5,000 and 10,000 for others, depending on some other parameters or duration of treatment)?; (E) When is payment due (immediately after consultation, or later when the patient has regained health)? All patient names used in this study are imaginary.

4. RESULTS

4.1 Field Trips Data

Many problems were encountered. Many of the sickle cell disease patients were not open from the start, thinking that the authors were going to make public the fact that they were suffering from sickle cell disease. Thus the parents disallowed their children to remove their clothes for photographing the affected parts of body. Nevertheless, some patients allowed the researchers to take photograph and to publish it, if necessary. The five traditional healers, who accepted to cooperate, did so because one of the authors of this work is the sister of their 2 sickle cell disease patients. A total of 102 former and new patients were encountered with the help of traditional healers and accepted to collaborate. The patients presented two major syndromes of sickle cell diseases: S/S and S/C (Fig. 2).

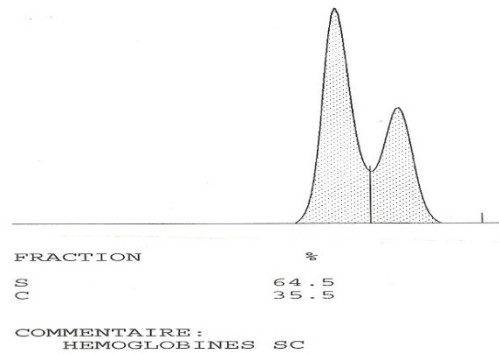


Fig. 2. Hemoglobin electrophoresis of a patient with hemoglobin S/C (Child 7 in the Table 6).

Source: Pasteur's Center of Cameroon, Laboratory of Biochemistry, Yaoundé; with the permission of the patient.

Since sickle cell disease is an illness with highly variable expressions, only the sharp symptoms common to all patients are indicated in (Table 1).

The first months of life are generally asymptomatic because fetal hemoglobin level is still high. At the basal state, anemia is variable from one sickle cell patient to another, the hemoglobin level being generally between 7 and 8 g/dL. Example: a child born the 10 October 1994, showed the hemoglobin concentration of 5.3 g/dL on 24 June 1997 (Source: Pasteur's Center, Yaoundé; File n° 97973).

In unaffected men, the level of normal hemoglobin is between 14 and 16 g/dL, while it is between 12 and 14 g/dL in woman. In Bamenda, as in other tropical zone, anemia is aggravated by malaria, or by digestive defects. Hepatomegalia (big liver) and splenomegaly (increase of the size of the spleen, provoked by the deformed red blood cell destruction) are present in all age groups [20-22] (Fig. 3).



Fig. 3. A sickle cell child (5years 2months) looking healthy but has a big belly (with splenomegaly) and yellow eyes (anemia). The parent refused photography bare-chested. (With the parents' permission).

Table 1. Pattern analysis of 102 sickle cell patients; the sharp symptoms of the illness pasted

Main symptom Age range (years)	sickle cell anemia	Hand and foot syndrome	Splenomegaly	Rheu matic pains	Growth Delay (size and weight), frequent pubertal delay	Aseptic osteo necrosis of the femoral head	sickle cell retinopathy	vaso - occlu sive crisis	Total number of patients
>4	7	9	4	6	5	0	0	0	31
5-14	6	8	4	8	3	0	0	1	30
15-24	4	2	5	8	2	0	0	0	21
25-34	2	4	2	3	0	2	1	0	14
>35	0	0	1	3	0	0	0	2	6
Total	19	23	16	28	10	2	1	3	102

The chronic demonstrations of sickle cell **disease** associated with a delay of growth (size and weight) [23] and a pubertal delay are frequent during childhood and in the beginning of puberty. This is due to the increasing elimination of the essential amino acids by urinary excretion [24] (Fig. 4).



Fig. 4. A sickle cell child (7years 1month) with the right leg bigger than the left leg [25]. (With the parents' premission).

Sickle cell osteopathy frequently presents an aseptic osteonecrosis of the femoral head [26-29] (Table 1). The deformed red blood cells are rigid: they hook up and obstruct the blood vessels. These accidents are called "vaso - occlusive crises". Preferential localizations of these vaso-occlusive crises exist at the level of the vessels of the limbs and extremities (feet, hands). Their closure sometimes causes severe pains; the concerned limb can be hot, swollen, with its mobilization can become very painful and necrotic [30] (Fig. 5).



Fig. 5. Leg of adult sickle cell patient showing lesions as a result of necrotic crisis (Photo Nforbi, Bamenda Regional Hospital, February 2001). Two sores due to the blockage of blood vessels which wear down the tissues of the affected area. Leg is swollen and the area around the sores is black due to shortage of blood causing the death of cells (photography and publication with the premission of the patient).

Ocular effects of sickle cell disease are frequent, especially in *S/C* and *S/βthalassaemia* patients [31]. Estimates show that these ocular effects appear in about 15 to 20% of SS sickle cell homozygote and 35 to 40% of the SC sickle cell homozygote adult patients. These manifestations lead to a more or less serious loss of vision [32] (Table 1).

4.2 Plants with Anti-sickle Cell Properties

The plants collected are presented in alphabetic order of the botanical names, in the column 1 (Table 2). The families are in column 2 and the current common names of plants in column 3. Seventeen plant species belonging to 16 genera and 13 families are listed. The important families are the *Liliaceae* (3 species).

Table 2. Plants used to treat sickle cell diseases, in alphabetic order of botanical names

	Scientific name	Family	Common name
1	<i>Allium cepa</i> L.	Liliaceae	Onion
2	<i>Allium sativum</i> L.	Liliaceae	Garlic
3	<i>Aloe barteri</i> Bak.	Liliaceae	Aloe vera
4	<i>Bidens pilosa</i> L.	Asteraceae	Blackjack
5	<i>Cajanus cajan</i> (L.) Millspaugh	Fabaceae	Pigeon pea
6	<i>Carica papaya</i> L.	Caricaceae	Pawpaw
7	<i>Citrus limonum</i> Burm.f.	Rutaceae	Lemon
8	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Fever grass/Lemon grass
9	<i>Dacryodes edulis</i> (G.Don) Lam.	Burseraceae	African pear
10	<i>Eucalyptus saligna</i> Sm.	Myrtaceae	Eucalyptus
11	<i>Justicia hypocrateriformis</i> Vahl.	Acanthaceae	Humming bird bush
12	<i>Mangifera indica</i> L.	Anacardiaceae	Mango
13	<i>Phragmanthera capitata</i> (Spreng.) A. Balle	Loranthaceae	Panama parasite/Lighting matches/mistle toe
14	<i>Psidium guajava</i> L.	Myrtaceae	Guava
15	<i>Vernonia guineensis</i> Benth	Asteraceae	Guinean ginseng
16	<i>Zanthoxylum</i> <i>xanthoxyloides</i> (Lam) Waterman (or <i>Fagara xanthoxyloides</i> Lam)	Rutaceae	Nga'chou (or open mouthed) (Bamiléké)
17	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Ginger

The phytotherapy preparations are classified in alphabetical order of botanical names, and according to the number of species used (Table 3). Some non-botanical ingredients are also presented (*Gallus domesticus*, Gallinaceae), honey, milk and vaseline). Twelve plant recipes, of which 8 are monospecific, are used in the treatment of sickle cell trait. In the other 4 preparations, the number of species ranges from 3 to 9".

Table 3. Recipes gathered from 5 Traditional healers

N°	Ingredients	Recipes
1	- <i>Allium cepa</i> : 1kg of grated bulbs *Honey: 125mL *Palm wine: 1L	The ingredients are mixed in a large clay pot with a saucer or lid for 2 weeks, while stirring everyday. The liquid extract, strained and bottled, is drunk: 1 tablespoonful twice a day.
2	<i>Allium sativum</i> : 250g of cloves *Milk: 1L of unsweetened milk	Garlic is ground in paste and boiled in the milk for 5-10 min. The mixture is pressed in a clean tissue and the solution drunk: -Adult: 250mL 2 times a day; -Children from 8 months: 125mL 2 times a day. Remark: The recipe increases the rate of blood circulation.
3	- <i>Allium sativum</i> : 250g of cloves -Vaseline: 250 mL	The cloves are ground in paste mixed with the Vaseline. The mixture is kept in a jar with a tight-fitting lid, as a smoothed ointment to rub onto the area suffering from pains, especially joints.
4	<i>Aloe barteri</i> . leaf gel extract	A teaspoonful of aloe gel is mixed in 1 glassful of water every morning and the solution drunk. Fruit juice can be added.
5	<i>Carica papaya</i> : 1 kg of leaves	The leaves are boiled in 5L of water for 30 min and the cooled solution drunk: 1glassfl 3 times a day for 3 days to treat fever.
6	<i>Carica papaya</i> : 10g of fresh roots * <i>Gallus domesticus</i> (Gallinae): 1 middle chicken	10 g of the peel of pawpaw roots are boiled with a chicken and take as meal, for the treatment of jaundice. The yellowing of the eyes will disappear rapidly.
7	<i>Carica papaya</i> : 3-4 leaves	1 glassful of water is added to a paste of 3-4 fresh pawpaw leaves, and the mixture is boiled for 3min and allowed to cool for 10min. The mixture squeezed in a clean piece of cloth and the solution drunk. The process is done three times a day.
8	<i>Zingiber officinale</i> . 1 handful of ginger root	Ginger root are simmered in 1L of water. Soak folded clothe is soaked in the solution and applied to relieve pain or to bring blood to surface of congested area.
9	- <i>Zanthoxylum zanthoxyloides</i> : 150 mL of stem bark powdered - <i>Cajanus cajan</i> : 150 mL of leaves powdered - <i>Bidens pilosa</i> : 200 mL of leaves powdered	The ingredients are mixed and the powder is ingested: *1 to 6 years: 1 half a teaspoonful per day *7 to 12 years: 1 half a teaspoonful 2 times a day *over 12 years: 1 teaspoonful 2 times a day. The powder is introduced in the mouth and swallowed with water at mealtimes.
10	- <i>Allium cepa</i> : 2 bulbs - <i>Allium sativum</i> : 500g of cloves - <i>Citrus limonum</i> : 2 fruits - <i>Zingiber officinale</i> : 500g of ginger root *Honey: 200mL	The Ground ingredients are boiled in 5L of water for 10 min and the cooled solution is strained and stored and drunk: -Children 6-12 years: firstly use recipe 10: 1 tablespoonful 3 times a day for 3 months, then continue with the present recipe up till 9 months. The recipes 10 and 11 intervene during crises and serve as pain killer. They develop the system

		against infections. Side effects: heartburn, body weakness Special recommendations: Patients must drink a lot of water and rest well.
11	- <i>Aloe barteri</i> : 10 leaves - <i>Carica papaya</i> : 10 leaves - <i>Citrus limonum</i> : 2 fruits - <i>Dacryodes edulis</i> : 40 leaves - <i>Justicia sp.</i> : 20 leaves - <i>Phragmanthera capitata</i> : 20 leaves - <i>Vernonia guineensis</i> : 2 teaspoon fulls of leaf powder	All fresh leaves are pounded in a mortar and boiled in 10L of water for 20 min. The cooled solution is drunk: -Children 0-5 years: 1 teaspoonful morning and evening for 3 months; -Children 6-12 years: 1 tablespoonful 3 times a day for 3 months, then continue with recipe 11 up till 9 months.
12	- <i>Allium cepa</i> : 4 bulbs sliced - <i>Allium sativum</i> : 250g cloves sliced - <i>Aloe barteri</i> : 4 leaves chopped up - <i>Bidens pilosa</i> : 500g of fresh leaves - <i>Citrus limonum</i> : 4 fruits sliced - <i>Dacryodes edulis</i> : 1kg of leaves and 1kg of roots pounded - <i>Phragmanthera capitata</i> : 1kg of leaves pounded - <i>Vernonia guineensis</i> : 1kg of dried roots powdered - <i>Zingiber officinale</i> : 500g of fresh rhizome sliced *Honey: 0.5L	All the solid ingredients are boiled in 10L of water for 30 min and the preparation is strained. The honey is added to the solution bottled warm in a basin of cold water, and subsequently drunk: *5 months to 1 year: 2 tablespoonfuls each 3 or 4 times daily; *1 year to 3 years: 3 tablespoonfuls each 3 or 4 times daily; *7 years to 12 years: 250mL twice daily. This syrup is meant to protect and develop the immune system of the body. Recommendation: Patient must eat before taking syrup. If patient feels dizzy after taking medicine he must rest for at least 20 min.

4.3 Treatment of 102 Patients

4.3.1 Availability of medicines and enslavement

The fact that plant remedies are directly available from the surroundings might be a good strategy to avoid costly and long-lasting biomedical care, especially for chronic health conditions as sickle cell disease. But what a situation: The traditional healers of Mezam Division had been abused by the parents of sickle cell patients (refusal to pay for the lavished cares if the child dies, abandons the treatment, or even when he has been treated). Thus, they made a protocol of cares and payment (Table 4). The remedy conditioned by bottle of 1.5L, is sold cash at 5,000 FCFA. The traditional healers bear the responsibility on the efficiency of remedy but not on the obligation of the results if the protocol prescribed is not followed. According to Table 4, the Number of bottles per month and the subsequent cost and duration of treatment, vary according to the age of patient. The healers did not handle flexible payment modalities just like biomedical health care, where tablets were to be purchased with cash. The sum is not accessible to all parents. It is necessary to underline the fact that the number of patients constantly increases within the same family.

Table 4. Distribution of patients according to Age range; duration and costs of treatment

Age range (years)	Number of bottles per month	Cost of treatment per month (5000FCFA/bottle)	Duration of treatment	Total treatment cost
<15	1	5,000 FCFA	6 months	30,000 FCFA
15-24	2	10,000 FCFA	9 months	90,000 FCFA
25-34	2	10,000 FCFA	9 months	90,000 FCFA
>35	6	30,000 FCFA	12 months	360,000 FCFA

1 € = 655.49FCFA (CFA franc)

4.3.1 Costs of treatment and consequences

On the one hand, 55.8% of patients felt well after taking treatment while 19.5% did not experience any change. On the other hand, 24.5% had backslidden from treatment. Due to lack of finances and long distances many parents or patients stopped the treatment. But they were sorry, because the crises were lesser when the children were taking treatment, and now the children have frequent attacks. Likewise, patients who felt well said they experienced crises rarely: a single crisis per year or a crisis in two years. The body didn't reach its majority and the homeostatic function was not achieved. There is ongoing growth and an individual changes morphologically and physiologically increases in age. So, a symptom can be recurrent. The fact that sickle cell patients became symptom-free appears to be one of the reasons why they prefer to consult healers even with the expansion of biomedical health care. The rigidity of payment led to abandonments or insolvency (Table 5).

Table 5. Consistency of the treatment according to the age of patient regularity, consequences

Age (years)	>4	5-14	15-24	25-34	>35	Total	Frequency (%)
Symptom free patients	16	17	12	8	4	57	55.8
Persistent symptoms	6	5	4	4	1	20	19.6
Backslidden	9	8	5	2	1	25	24.5
Total	31	30	21	14	6	102	99.9

4.3.2 Sickle cell cares

4.3.2.1 Preventive cares

An example is that of the family Ewane: 2 A/A children, 2 A/S children, 2 S/C children and 1 A/C child. Parents are heterozygote A/S and A/C (Table 6). At the college the child 7 learned that the sickle cell disease patients die under aged, and abandoned the school. The parents took him to a traditional healer who used recipes 7 and 11 of Table 3. The results were good. Then, that last child of the family and his brother (child n° 6) decided to take the therapeutic preparation 11 for life. They are today in the Universities, the first in Malaysia and the second in Cameroon. Their mother manages to buy and send to any child the remedy in cans of 5L. The treatment with this recipe is used as for a preventive care of sickle cell crises.

Table 6. Consistency of the male and female patients treated by the recipes n° 7 and 11

Patient, and year of birth	Child status due to electrophoresis)	Hemoglobin A (%)	Hemoglobin C (%)	Hemoglobin S (%)	Observations, remedies still taken	Complications
Child 1 (birth: 1974) (♂)	not disease	+ , +	0	0	no treatment needed	any
Child 2 (birth: 1976) (♂)	latent disease	+ , 0	0	+	no treatment taken	any
Child 3 (birth1977) (♀)	not disease	+ , +	0	0	no treatment needed	any
Child 4 (birth1980) (♂)	latent disease	+ , 0	+	0	no treatment taken	any
Child 5 (birth1985) (♀)	latent disease	+ , 0	0	+	no treatment taken	died
Child 6 (birth1987) (♂)	Associated haemoglobin disease form	0 , 0	+	+	treatment taken, no more crisis	Not yet observed
Child 7 (birth: 1991) (♂)	Associated haemoglobin disease form	0 , 0	+ (35.5) 14/8/2001	+ (64.5) 14/8/2001	treatment taken no more crisis	sickle cell retinopathy

Legend: + = haemoglobin present; 0 = haemoglobin absent

Table 7. Consistent of the sickle cell patients treated by the recipe n° 9

patient, and year of birth	Age (symptoms) and electrophoresis	Hemoglobin A (%)	Hemoglobin F (%)	Hemoglobin S (%)	Beginning of the treatment	Results after 15 months of treatment	Observations
Ludovic (2000)	20 months (sadness, delay of growth, sicklaemia)	0	40	60	August 2008	Growth caught up in 3 months. He already stood up, walked and ran	symptom-free
Haïssa (2004)	2 years (delay of growth, anemia)	0	28.94	71.06	April 2007	Cessation of permanent crisis.	Some symptoms after 4 years
	7 years	0	8.3	91.7	treatment continued	Cessation of crisis	not determined
Ritah (2004)	16 years (apathy, not of desire to play, sicklaemia)	0	6.7	93.3	March 2003	Cessation of permanent crisis.	Some symptoms after 8 years
	17 years	0	0	100	treatment continued	Cessation of crisis	not determined
Lydia 1972)	28 years (25/1/2000) (pains to the joints)	0.1	0	99.9	June 1999	no more crisis due to sickle cell up to December 2011	steonecrosis of the femoral head
	29 (15/1/2001)	0	0.2	99.8	treatment continued	Cessation of crisis	not measured
Others patients	delay of growth, anemia, apathy, not of desire to play, pains to the joints; sicklaemia)	0	0 or +	+	no data	Delays of growth caught up, cessation of permanent crisis. The patients being in growth phase, there are some recidivisms in case of carelessness	the children suffered from sickle cell are very alert to the school

Legend: + = haemoglobin present; 0 = haemoglobin absent

4.3.3 Curative cares

Lydia, 28 years, sickle cell disease patient S/S, was treated with the recipe 12 during 15 months. The preparation treated the symptoms of the illness and the collateral effects. Electrophoresis showed hemoglobin S and hemoglobin F. It suggests that the remedy has an action on the haematopoietic centers of the patient. One would say a dedifferentiation of the hematopoietic cells up to the stage of production of hemoglobin fetal. The steonecrosis of the femoral head remains and constitute an after-effect that will only be treated by a surgical operation. Besides the steonecrosis of the femoral head, Lydia hasn't had a sickle cell crisis since 11 years. One can probably say that the treatment with the recipe n° 9, based on *Zanthoxylum zanthoxyloides*, *Cajanus cajan* and *Bidens pilosa* confers curative cares to drepanocytosis crisis. The other adult patients, treated in the same way have been symptom-free for up to 9 years nowadays (Table7).

5. DISCUSSION

The most widespread hemoglobinopathies in this population are sickle cell *HbS/C* and sickle cell *HbS/S*. The need for information on the sickle cell disease is felt in all social, intellectual, economic groups of the Mezam. The illiterates think that it is curse or witchcraft. A recessive educated patient (*A/S*) made tremendous efforts to get married with Lydia (*S/S*) (Table 7). This example is the proof that, the awareness of the social and moral implications of the scientific thought and its results, is lacking for a good part of the Mezam Division opulation [33].

During the fieldworks, the traditional healers, outside of the studied thematic, informed on the virtues of *Phragmanthera capitata* in the treatment of Diabetes. It is still a new reported property of this plant in the treatment of sickle cell disease (Fig. 6).



Fig. 6. *Phragmanthera capitata*: Leafy branch; yellowish axillary umbellate and a red fruit.

Some culinary spices are among the collected plants (*Allium cepa*, *Allium sativum*, *Zanthoxylum xanthoxyloides*, *Zingiber officinale*) [34] It has been scientifically proven that some of the plants used in the treatment of sickle cell disease in Bamenda, are effective.

Allium sativum extracts have a significant antioxidant activity on sickle red blood cells, and ameliorate complications of sickle cell anemia [35], the same virtue is known for *Aloe barteri* [36], *Dacryodes edulis* [37] (Fig. 7), *Zingiber officinale* [38] *Carica papaya* dried leaf extract has been indicated in sickle cell anemia management by local indigenous folk and in recent

scientific research. Its extract inhibits formation of sickle cells under severe hypoxia at varying degrees, with only 0-5% sickle cells in the crude extract at 60 minutes compared with untreated S/S cell suspensions which had over 80% sickle cells. These results further indicate the possibility of *Carica papaya* leaf extract as potential phytotherapy for sickle cell anemia [39]. The deformed red blood cells regain the normal round shape under the acute action of the hydroxy-2-methyl-benzoic acid extracts of the roots of *Zanthoxylum xanthoxyloides* [40-42] (Figure 7).



Fig. 7. *Zanthoxylum xanthoxyloides* represented by its dried fruits showing the aspect of an open-mouthed (ga'chou of the Bamilekes).

The phenylalanine of *Cajanus cajan* (Figure 8) is responsible for the *in vitro* anti- sickle cell activity of the plant [43]. The molecule and the aromatic amino acids are possible inhibiting the setting in gel of de-oxy hemoglobin S and to prevent the formation of the deformed cells [19]. It is the same property found in the extracts of *Psidium guajava* and three other medicinal plants which exhibited the highest capacity to reduce polymerization of desoxyhemoglobin molecules [44]. The addition of seeds of *Cajanus cajan* in the food of the sickle cell patient should compensate the urinary losses in amino acids to make up for this delay in growth, at the same time to decreasing the painful crises.



Fig. 8. *Cajanus cajan* : flowering apex and a fruit on an individual.

6. CONCLUSION

Two haemoglobin diseases rage in Mezam Division and present some standard clinic demonstrations of anaemia hemolytic: HbS/S and HbS/C. Based on their therapy, the traditional medicines in Mezam Division can be grouped into two categories: the prophylactic preparations taken for life, and the curative ones where the patient can stop taking the remedies at the end of treatment. The therapeutic preparations with *Zanthoxylum xanthoxyloides* exert an influence over haematopoietic organs like the spleen, by a dedifferentiation of its cells, and the production of Hb F, which is the foetal haemoglobin. Thus the patient haemoglobins are S/S and F. The research question, "can the traditional medicines relieve the pains due to a genetic illness as the sickle cell disease?", did have positive answers. More than 55% of the patients met, got satisfaction.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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