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ETHNOBOTANICALS USAGES IN THE MANAGEMENT OF SICKLE CELL DISEASE (SDC) IN SOME LOCALITIES OF CAMEROON

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ABSTRACT

Sickle Cell Disease (SCD) is a genetic disease which affects the red blood cell. Its treatment of is very expensive and some patients go towards the traditional medicine. This work was undertaken to describe sickle patients from some area of Cameroon manage SCD using local food and medicinal plants. Five Cameroon regions which include West; Littoral; Center; East and North were visited and information collected through interview and observation. One hundred and seven families of patients with Sickle Cell Disease families visited answer the information survey. The results of this investigation revealed that the local black beans seeds (*Phaseolus vulgaris* L.) were used by 21 families in the West region while 8 of them used mill wild variety (*Fragaria vesca* L.). *In the* Littoral region, 23 families used bitter kola (*Garcinia kola* H.) and 8 seeds of *Annona muricata* L. Bitter kola (*Garcinia kola* H.) is also used by 23 families in Center and 14 in the East regions. The oil of the seeds of neem (*Azadirachta indica* J.) is used to manage SCD in 10 families in North Cameroon. Administration of these remedies was *per os* as food or decoction. Present findings provides basis for future research in anti-sickle cell drug development.

Keywords: Sickle cell disease, Ethnobotanicals, Cameroon localities.

INTRODUCTION

Sickle Cell Disease (SCD) or Sickle Cell Anemia also called weakens sickle-shaped, is a genetic disease which affects the red blood cell (RBC) (OMS, 2006).[1] Nearly 120 million people in the world would be carrying a mutation sickling cell with a high proportion in sub-Saharan Africa. Among 300 000 sickling cell children patients who are born each year in the world, 200 000 are Africans (Bardakdjan and Wajcman, 2004)[2] which covered the zone which extends between the 15th parallel of Northern of latitude and the 20th parallel from Southern latitude called "girdles sickle of Lehmann" is where the black populations are living. The frequency of the variable feature sickle between 5 and 20 % in West Africa and more than 40% in certain populations of Central Africa. These rates are weaker elsewhere, ranging between 1 and 2% in North Africa and low than 1% in Southern Africa (Cook and Zumla, 2003).[3] In Cameroon, one estimates at 200 000 the number of patients suffering of sickle cell disease. These homozygote's accounts for 1.5 to 2% of the population. The morbidity and mortality associated with this pathology remain high with the threshold of 1% of the patients reaching the adulthood. The frequency of the feature is approximately 6% in the Northern of Cameroon and can even reach the threshold of 30% in the South (Tetanye et Kaptue, 1985).[4] In front of this situation, the government spider monkey applying the resolution of the 52eme general assembly of the

World Health Organization (WHO) which recognized the SCD like a major problem of public health in many countries. Nowadays several strategies of preventions and treatments have been developed (Dorn-Beineke and *al*., 2002).[5] For the preventive care, some trainings of the auxiliaries medical and seniors medical have been performed to manage SCD, of patients and their family, through genetic advise and a regular medical supervision in a specialized medical center have been initiated (OMS, 1978; Vichinsky, 1991; Zohoun and *al*., 1992).[6,7,8] The prevention of the crisis consists of an attentive monitoring medical, an early tracking reducing the incidence of the undercurrent infections, the deglobulisation crisis, sickling and degenerative complications (Galacteros, 2001; Girot and *al*., 2003).[9,10] In case of crisis, the medical treatment recommends' the hospitalization, the treatment of pains, the antibiotherapy and the blood transfusion in case of deep crisis. Several therapies and chemical substances are investigated for the management of SCD permanently available are non specific drugs. The Potential agents employed for inhibition of hemoglobin S polymerization include hydroxyurea, piracetam, calcium antagonists which act to increase the fetal hemoglobin rate (HbF) and may be toxic especially for a long term use (Otis and *al*., 2008).[11] Bone marrow transplantation has recorded good curative results of some Central Africa SCD children living in Belgium (Walters, 2000; Vermylen and *al*., 1991, 1993, 1998)[12,13,14,15] and France Bernaudin and *al*. (1993).[16] Its application in Africa is difficult because of its highest cost (approximately one hundred thousand Euros) and lack of technical equipment (De Montalembert et *al*., 2007).[17] Because of this economic incidence, treatment of SCD is out of reach of the populations of the sub-Saharan Africa where the use of medicinal plants constitutes part of their culture and tradition. Indeed the African pharmacopeia, which is one of richest of the world and whose development is encouraged by WHO should be, from this point of view, valorized. Several studies have been reported on the antisickling potentials of plant extracts in Africa including their phytochemical constituents of different plant extracts (Abdulmalik and *al*., 2005; Abraham and al., 1991; Nacfack et *al*., 2013).[18,19,20] The use of phytomaterials such as *Piper guineensis*, *Pterocarpa osun*, *Eugenia caryophyllala* and *Sorghum bicolor* extracts for the treatment of sickle cell disease was reported by Wambebe and *al.* (2001).[21] The extract of *Pterocarpus santolinoides* and *Aloe vera* was reported to increase the gelling time of sickle cell blood and inhibits sickling in vitro. This indicates that such plants may indeed have a great potential in the management of SCD (Nwaoguikpe and *al*., 2010).[22] The reversal of sickling by root extracts of *Fagara zanthoxyloides* has also been reported (Sofowora and Issac-Sodeye, 1971).[23] Medicinal plants can be also a source of succour in the control of sickle cell disease (SCD) in Cameroon. It is the case of "Hemodya", obtained by decoction of the barks of 3 Cameroonian medicinal plants: *Cassia siamea Lam*, *Delonix regia* and *Garcinia cowa Rox*. The investigation of antisickling effects of "Hemodya" shows edits ability to inhibit polymerization of sickle cell heamoglobin (HbS), improve the Fe^{2+}/Fe^{3+} ratio and lower the activity of lactate dehydrogenase (LDH) in SCD patient's blood plasma (Kotue and *al*., 2014).[24] These encouraging results motivated us to investigate in certain localities of Cameroon to know how the local population manages this disease.

METHODOLOGY

Seventeen localities of five regions of Cameroon were visited. These areas were selected at random. The references points were the regional and district hospitals. In these hospitals, we had access to the files of followed various patients where the telephone numbers of each head of SCD family were noted. Each responsible in charge for SCD family was thus called for an appointment in his home. After our presentation on the project he or she accepted to sign the consent form. A questionnaire was submitted to describe the symptoms of SCD, to local natural products or plant extract used for the treatment of

SCD, and if they were satisfied by the results. Also the patients were asked to give their opinion on the consumed products.

RESULTS AND DISCUSSION

Five Cameroon regions were concerned in this study and a total of 17 localities were visited (Figure 1).Five localities in West; 4 in Littoral; 4 in Center; 2 in East and 2 in North region**.** A total of 107 (one hundred and seven) with SC D were identified. About the description of symptoms of SCD, the respondents described SCD as disease which leads to a dry lips, tiredness, yellow eyes, swollen head, legs or body, joint pains and frequent malaria especially during the raining seasons. They further explained that the sickness could also lead to delay growth and maturity. Indeed, these symptoms are those most frequently met and describe by certain authors. Clinical manifestations of sickle cell disease are diverse varied and fall into three major categories: anemia, pain related issues and organ failure. Blood vessels blocked and damaged organs can cause acute painful episodes or "crises". Sickle cell crises may be caused by blood vessel occlusion, triggered by membrane deformation (Ohnishi and *al.*, 2000).[25] SCD patients suffer from a variety of ailments which includes acute chest syndrome (ACS) which is one of the reasons for hospital admissions (Quinn and Buchanan, 1999),[26] stroke (Adams, 2000),[27] and acute splenic sequestration (Edmond and *al.*, 1985, Svarch and *al.*, 1996).[28,29] Other clinical manifestations of this condition are hyposthenuria, priapism, vascular necrosis, proliferative retinopathy, aplastic crises, cholelithiasis, delayed growth and sexual maturation, chronic pulmonary disease and chronic nephropathy (Svarch and *al.*, 2001).[30] This investigation revealed that 21 families suffering of sickle cell disease use local black beans seeds (*Phaseolus vulgaris* L.) and 8 use mill wild variety (*Fragaria vesca* L.). in the West region. At Littoral region, 23 SCD families use bitter kola (*Garcinia kola* H.) while 8 of them took the corosol seeds (*Annona muricata* L.) for the management of the disease. Also 23 sickle cell disease families in Center region and 14 in the East region use bitter kola. Oil from seeds of neem (*Azadirachta indica* J.) is used to fight against SCD in 10 families in North Cameroon (Table 1; Figures. 2 – 3 – 4 - 5 and 6). These plants are use in form of food or decoction through oral administration. The frequencies of used of the food and decoction are different. Our study showed these patients in West region usually consumed cooked black beans seeds in means 3 times per week. The amount ingested per diet was estimated at 0.5 kg. This consumption reduced significantly the frequency of the crises. For Neem oil, a tea spoon was given to the children of less than 10 years and 2 to those moreover 3times/week. For Kola, approximately 20g for the grown-up and 5g for the children were chewed once every 2 days. For corossol seeds, the dried seeds are crushed and to use in infusion form at a rate of 1kg/5L of water a tea spoon was given to the children twice per day and 2 spoons to more than 5 years at the same frequency. Respondent claimed the beneficial effects of those products at SCD patients: reducing of painful crises and shortening the duration of hospitalization.

In fact *Garcinia kola* is a popular seed consumed by the locals in Cameroon and it is also known as "bitter kola". *G. kola* seeds has been shown to contain a complex mixture of phenolic compounds such as tannins, guttiferin (Etkin, 1981),[31] biflavonoids, xanthenes, benzophenone, kolaflavanone and garcinia flavanone (Iwu and Igboko, 1982).[32] These molecules from G. kola have demonstrated antimicrobial activities. Besides, *G. kola* exhibits purgative, antiparasitic, anti-inflammatory, anti-bacterial and antiviral properties (Akoachere and *al.*, 2002).[33] In addition, extract from this possesses hepatoprotective (Akintonwa and Essien, 1990),[34] analgesic and hypo-glycemic activities (Olaleye and *al*., 2000; Odeigah and *al*., 1999).[35,36] *G. kola* enjoys a folk reputation in the management of sickle cell disease (SCD) (Kabangu and *al*., 1987; Egunyomi and *al*., 2009).[37,38] An investigation of the aqueous extracts of *Garcinia kola* to confirm the above claim indicated that it was higher and

more effective on membrane stabilization (Elekwa and *al*., 2003).[39]

Black beans seeds improve cardiovascular Health (Rosa and *al*., 1998).[40] The important flavonoid and phytochemical compounds found in black beans act as antioxidants and anti-inflammatories, making them beneficial in protecting against various forms of cancer (López-Reyes and *al*., 2008).[41] As higher source of filling fiber (Hernández-Salazar, 2010),[42] black beans seeds improve digestion (Carmona-Garcia and *al*., 2007),[43] provide long-lasting *energy* and helps keep blood sugar levels stable. It contains essential vitamins and minerals (folate, copper, magnesium, phosphorus, iron, B Vitamins) (Nyakuni and *al*., 2008).[44] The protein content in black beans makes the food a healthy alternative to other sources of protein. However, the body uses protein, in the form of amino acids, for nearly every function. Making sure to eat adequate amounts of protein on a regular basis can help to fight symptoms related to protein deficiency including muscle weakness, fatigue, low energy, eye problems such as cataracts, heart problems, poor skin health, imbalanced hormone levels and more (Nergiz and Gokgoz, 2007).[45]

All parts of the *A. muricata* tree, similar to other *Annona* species, including *A. squamosa* and *A. reticulata* are extensively used as traditional medicines against an array of human ailments and diseases, especially cancer and parasitic infections. The fruit is used as natural medicine for arthritic pain, neuralgia, arthritis, diarrhea, dysentery, fever, malaria, parasites, cancer, rheumatism, skin rushes and worms, and it is also eaten to elevate a mother's milk after childbirth. The leaves are employed to treat cystitis, diabetes, headaches and insomnia. Moreover, internal administration of the leaf's decoction is believed to exhibit anti-rheumatic and neuralgic effects, whereas the cooked leaves are topically used to treat abscesses and rheumatism (Mishra and *al*., 2013; Adewole and *al*., 2006; De Sousa and *al*., 2010).[46,47,48] Considerable research has been directed at the potential health benefits of eating berries. As well as being a good source of vitamin C, dietary fiber, and minerals, berries contain high levels of natural polyphenol components that act as potent antioxidants. Berry extracts, rich in polyphenols, have a range of biological effects that can have beneficial outcomes on human health. Berry extracts have cardioprotective effects in model studies (Whitson and *al*., 2004).[49] Berry extracts inhibit the growth of cultured cancer cells and certain berries are considerably more effective than others (Rossand *al*., 2007)[50] Berry extracts inhibit starch digestive enzymes. Inhibition of a-glucosidase is already an accepted means of controlling post-meal glucose levels in patients suffering from non-insulin-dependent diabetes mellitus (McDougall and *al*., 2005).[51] Almost all parts of the neem tree have been used as traditional medicine in Cameroon. Neem contained various compounds which showed various biological activities such as anti-inflammatory;Antiarthritic; Antipyretic; Hypoglycaemic; Antigastric ulcer; Spermicidal; Antifungal; Antibacterial; Diuretic; Antimalarial; Antitumour; Immunomodulatory (Sairam, 2000).[52] Outwards *Garcinia kola H.* that had higher and more effective action on membrane stabilization, the other products used to manage SCD have been speculated but without any scientific proof.

CONCLUSION

Present findings are very compassionate to elaborate further study objectives and provides basis for future research. Due to the challenges to take up in developing countries, we believe that our studies will be used as sources of effective compounds able to solve the SCD problem. This investigation need to be continued in the five others regions of Cameroon.

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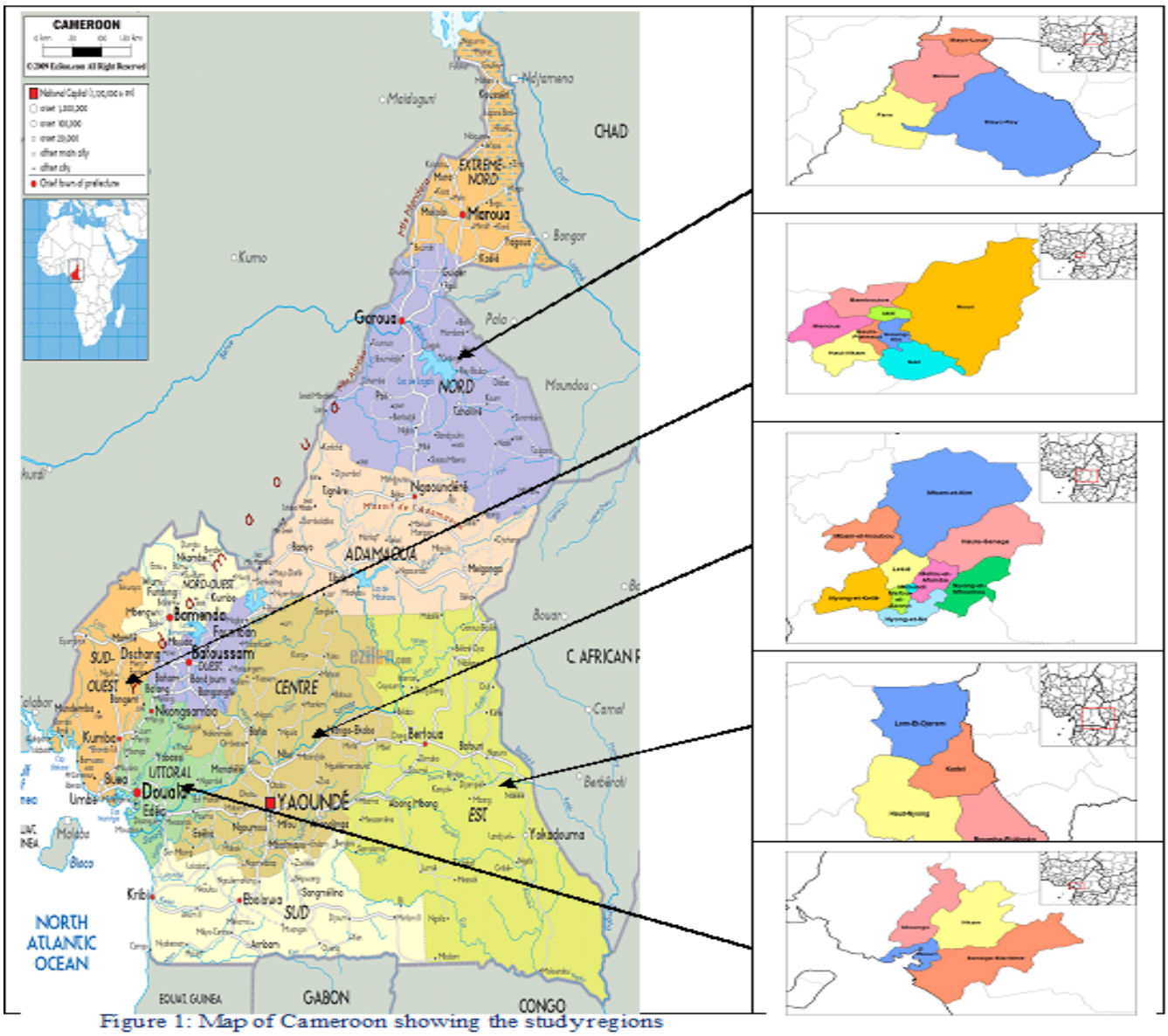

Figure 1: Map of Cameroon showing the studyregions

Table 1: Regions, localities visited and ethnobotanicals plants used

Regions	Locatities	Number of SCD families	Ethnobotanicals Used
West	Bandjoun	4	*Phaseolus vulgaris* L. seeds
	Bafoussam	14	
	Baham	3	
	Bamenjou	2	*Fragaria vesca* L. fruits
	Bafang	6	
Littoral	Nkongsamba	5	*Annona muricata* L. seeds
	Banga	3	
	Douala	19	*Garcinia kola* H. seeds
	Edea	4	*Garcinia kola* H. seeds
Center	Mfou	3	*Garcinia kola* H. seeds
	Younde	13	
	Bafia	5	
	Ngoumou	2	
East	Abong-Mbang	5	*Garcinia kola* H. seeds
	Bertoua	9	
North	Garoua	7	*Azadirachta indica* J. seeds oil
	Guider	3	

Figure 2: *Fragaria vesca* L.

Figure 3: *Garcinia kola* H. seeds oil

Figure 4: *Azadirachta indica* J. seeds

Figure 5: *Annona muricata* L. fruits

Figure 6: *Phaseolus vulgaris* L. seeds

REFERENCES

1. OMS (2006), "La drépanocytose dans la région Africaine: situation actuelle et perspective", *Comité Régional De l'Afrique*, 52ème session, 22.
2. Bardakdjian, MJ and Wajcman, H (2004), "Épidémiologie de la drépanocytose", *Revue Du Praticien,* 54, 1531-1533.

3. Cook, G et Zumla, AI (2003), "Manson's tropical diseases", 21ème édition, Londres, WL Saunders, 22-45.
4. Tetanye, E and Kaptue, NL (1985), "Drépanocytose: Présent et Futur au Cameroun. Approches thérapeutiques", *Colloque INSERN*, Vol. 141, 541.
5. Dorn-Beineke, A and Frietsch, T (2002), "Sickle cell disease: pathophysiology, clinical and diagnostic implications", *Clinical Chemistry and Laboratory Medicine*, 40, 1075-1084.
6. OMS (1978), "Soins de santé primaire. Rapport de la conférence internationale sur les soins primaires", Alma-Ata, 12.09.
7. Vichinsky, E (1991), "Comprehensive care in sickle cell disease: its impact on morbidity and mortality", *Seminar of Hematology,* 28, 220-226.
8. Zohoun, LS; Mérault, G; Reinette, P and Rosa, J (1992), "Politique de santé et drépanocytose", *Revue du Prat*icien, 42, 1873-1877.
9. Galacteros, F (2001), "Bases physiopathologiques de la drépanocytose, prise en charge et actualités thérapeutiques", *Bulletin de la Société de Pathologie Exotique,* 94, 77-79.
10. Girot, R; Begue, P et Galacteros, F (2003), "La drépanocytose", J. Libbey Eurotext Limited, Paris, pp. 321.
11. Otis, W; Brawley; Llewellyn, J; Cornelius; Linda, R; Edwards; Vanessa, N; Bettye, L Green; Charles, I and Melissa, S (2008), "National institutes of health consensus development conference statement: hydroxyurea treatment for sickle cell disease", *Annals of Internal Medicine,* 148(12), 932-938.
12. Walters, MC; Storb, R and Patience, M (2000), "Impact of bone marrow transplantation for symptomatic sickle cell disease: an interim report", *Blood,* 95, 1918-24.
13. Vermylen, C; Cornu, G; Philippe, M; Ninane, J; Borja, A; Latinne, A; Ferrant, A; Michaux, JL and Sokal, G (1991), "Bone marrow transplantation in sickle cell anaemia", *Archives of Disease in Childhood,* 66, 1195-1198.
14. Vermylen, C and Cornu, G (1993), "Bone marrow transplantation in sickle cell anaemia", *Blood Reviews,* 7, 1-3.
15. Vermylen, C; Cornu, G; Ferster, A; Brichard, B; Ninane, J; Ferrant, A; Zenebergh, A; Maes, P; Dhooge, C; Benoit, Y; Beguin, Y; Dresse, MF and Sariban, E (1998), "Haematopoietic stem cell transplantation for sickle cell anaemia: the first 50 patients transplanted in Belgium", *Bone Marrow Transplant,* 22, 1-6.
16. Bernaudin, F; Souillet, G and Vannier, JP (1993), "Bone marrow transplantation in 14 children with severe sickle cell disease: the french experience", *Bone Marrow Transplantation,* 12, 118-121.
17. De Montalembert, M. et Tshilolo, L. (2007), "Les progrès thérapeutiques dans la prise en charge de la drépanocytose sont-ils applicables en Afrique subsaharienne?", *Médecine Tropicale,* 6, 612-616.
18. Abdulmalik, O; Osafa, MK; Chen, Q; Yang, J; Brugnara, C; Ohene-Frempong, K; Abraham, DJ; and Asakura, T (2005), "5-hydroxymethyl-2-furfural modifies intracellular sickle 28 hemoglobin and inhibits sickling of red blood cells", *British Journal of Haematolology,* 128(4), 552-561.
19. Abraham, DJ; Mehanna, AS; Wireko, FC; Whitney, J; Thomas, RP and Orringer, EP (1991), "Vanillin, a potential agent for the treatment of sickle cell anemia", *Blood,* 77(6), 1334-41.
20. Nanfack, P; Biapa, NPC; Pieme, CA; Ama Moor, VJ, Moukette, B and Ngogang, YJ (2013), "The *in vitro* antisickling and antioxidant effects of aqueous extracts *Zanthoxyllum heitzii* on sickle cell disorder", BMC Complementary and Alternative Medicine, 13, 267.
21. Wambebe, C; Khamofu, H and Momoh, JA (2001), "Double-blind, placebo-controlled, randomised cross-over clinical trial of NIPRISAN in patients with sickle cell disorder", *Phytomedicine,* 8(4), 252-61.

22. Nwaoguikpe, RN; Braide, W and Ezejiofor, TIN (2010), "The effect of aloe vera plant (*aloe barbadensis*) extracts on sickle cell blood (HbSS)", *African Journal of Food Science and Technology,* 1(3), 058-063.
23. Sofowora, EA and Issac-Sodeye, WA (1971), "Reversal of sickling and crenation in erthrocytes by the root of *Fagara xanthoxyloïdes*", *LIoydia,* 34, 383.
24. Kotue, TC; Pieme, AC; Ama Moor, VJ; Nanfack, P and Ngogang, Y J (2014), "The in vitro antisickling properties of "Hemodya", *Journal of Biology and Chemical Research,* 31(2), 757-768.
25. Ohnishi, ST; Ohnishi, T and Ogunmola, G (2000), "Sickle cell anemia. A potential nutritional approach for a molecular disease", *Nutrition,* 16, 330-338.
26. Quinn, CT and Buchanan, GR (1999), "The acute chest syndrome of sickle cell disease", *Journal of Pediatr*ics, 135, 416-422.
27. Adams, RJ (2000), "Lessons from the Stroke. Prevention trial in sickle cell anemia study", *Journal of Child Neurology,* 342, 1855-1865.
28. Edmond, AN; Collis, R and Darvill, R (1985), "Acute splenic sequestration in homozygous sickle cell disease: natural history and management", *Journal of Pediatrics,* 107, 201-206.
29. Svarch, E; Vilorio, P; Nordet, I; Chesney, A; Batista, JF; Torres, L; Gonzalez, A and De La Torre, E (1996), "Partial splenectomy in children with sickle cell disease and repeated episodes of splenic sequestration", *Hemoglobin,* 20, 393-400.
30. Svarch, E; Hernández, P and Ballester JM (2001), "Sickle Cell Disease in Cuba", Institute of Hematologia and Inmunologia (IHI) La Habana, Cuba, 22.
31. Etkin, NL (1981), "A hausa herbal pharmacopoeia: Biomedical evaluation of commonly used plant medicines", *Journal of Ethnopharmacology,* 4, 75-98.
32. Iwu, MM and Igboko, O (1982), "Flavonoids of *Garcinia kola* seeds", *Journal of Natural Products,* 45, 650-651.
33. Akoachere, JF; Ndip, RN; Chenwi, EB; Ndip, LM; Njock, TE and Anong, DN (2002), "Antibacterial effect of *Zingiber officinale* and *Garcinia kola* on respiratory tract pathogens", *East African Medicine Journal*, 79(11), 588-92.
34. Akintonwa, A and Essien, AR (1990), "Protective effect of *Garcinia kola* seed extract against Paracetamol–induced hepatoxicity in rats", *Journal of Ethnopharmacology,* 29, 207-211.
35. Olaleye, SB; Farombi, EO; Adewoye, EA; Owoyele, VB and Onuasanwo, SA (2000), "Analgasic and anti inflammatory effect of kolaviron (*A. G. kola* seed extract)", The *African Journal of Biomedical Science,* 3(3), 171-174.
36. Odeigah, PG; Taiwo, IO; Akomolafe, EO and Durojaiye, OO (1999), "Hypoglycemic action of medicinal plants with tolbutamide in the Albino rats", *International Diabetes,* 9, 71-73.
37. Kabangu, L; Galeffi, C; Aonzo, E; Nicoletti, M and Messana, I (1987), "New biflavone from the bark of G. Kola", *Planta Medica,* 11, 275 - 277.
38. Egunyomi, A; Moody, JO and Eletu, OM (2009), "Antisickling activities of two ethnomedicinal plant recipes used for the management of sickle cell anaemia in Ibadan", *Nigerian Journal of Biotechnology,* 8, 20-25.
39. Elekwa, I; Monanu, MO and Anosike, EO (2003), "Studies on the effect of aqueous extracts of Garcinia kola seed on the human erythrocytes adenosine triphosphatase of HbAA, HbAS, and HbSS genotypes", *Global Journal of Medicine Science,* 2(2), 107-114.
40. Rosa, CO; Costa, NM; Leal, PF and Oliveira, TT (1998), "The cholesterol-lowering effect of black beans (*Phaseolus vulgaris, L.*) without hulls in hypercholesterolemia rats", *Archivos Latinoamericanos de Nutricion,* 48(4), 299-305.
41. López-Reyes, AG; Arroyo-Curras, N and Cano, BG (2008), "Black beans extract ameliorates liver fibrosis in rats with CCl4-

induced injury", *Annals of Hepatology*, 7(2), 130-5.

42. Hernández-Salazar, M; Osorio-Diaz, P and Loarca-Piña, G (2010), "In vitro fermentability and antioxidant capacity of the indigestible fraction of cooked black beans (*Phaseolus vulgaris* L.), lentils (*Lens culinaris* L.) and chickpeas (*Cicer arietinum* L.)", *Journal of Science and Food Agriculture,* 90 (9), 1417-22.
43. Carmona-Garcia, R; Osorio-Diaz, P and Agama-Acevedo (2007), "Composition and effect of soaking on starch digestibility of *Phaseolus vulgaris* L", *International Journal of Food Science and Technology,* 42, 296-302.
44. Nyakuni, G; Kikafunda, J and Muyonga, J (2008), "Chemical and nutritional changes associated with the development of the hard-to-cook defect in common beans" *International Journal of Food Sciences and Nutrition,* 59, 652-659.
45. Nergiz, C and Gokgoz, E (2007), "Effects of traditional cooking methods on some antinutrients and in vitro protein digestibility of dry beans varieties (*Phaseolus vulgaris* L.)", *Turkey International Journal of Food Science and Technology,* 42, 868-873.
46. Mishra, S; Ahmad, S; Kumar, N and Sharma, BK (2013), "*Annona muricata* (the cancer killer)", A review *The Global Journal of Pharmaceutical Research,* 2, 1613–1618.
47. Adewole, SO and Caxton-Martins, EA (2006), "Morphological changes and hypoglycemic effects of *Annona muricata* Linn. (Annonaceae) leaf aqueous extract on pancreatic B-cells of streptozotocin-treated diabetic rats", *African Journal of Biomedicine Research,* 9, 173–187.
48. De Sousa, OV; Vieira, GD; De Pinho, JD; Yamamoto, CH and Alves MS (2010), "Antinociceptive and anti-inflammatory activities of the ethanol extract of *Annona muricata* L. leaves in animal models", *International Journal of Molecular Sciences*, 11, 2067–2078.
49. Whitson, J; Hamilton, CA and Crozier, A, (2004), "cardiovascular protective properties of fruit and vegetable extracts", Abstracts of the Scottish Society for Experimental Medicine Meeting, Dundee, UK: 18.
50. Ross, HA; McDougall, GJ and Stewart, D (2007), "Antiproliferative activity is predominantly associated with ellagitannins in raspberry extracts", *Phytochemistry,* 68, 218–228.
51. McDougall, GJ; Shapiro, F; Dobson, P; Smith, P; Blake, A and Stewart, D (2005), "Different polyphenolic components of soft fruits inhibit a-amylase and a-glucosidase" *Journal of Agriculture and Food Chemistry,* 53, 2760-2766.
52. SaiRam, M; Ilavazhagan, G; Sharma, SK; Dhanraj, SA; Suresh, B; Parida, MM; Jana, AM; Devendra, K and Selvamurthy, W (2000), "Anti-microbial activity of a new vaginal contraceptive NIM-76 from neem oil (*Azadirachta indica*)", *Journal of Ethnopharmacol*ogy, 71(3), 377-82.

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