



WHY AFRICAN TRADITIONAL BIRTH ATTENDANTS USED *CEASALPINIA BONDOC* LEAVES TO FACILITATE CHILDBIRTH IN PARTURIENT WOMEN?

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ABSTRACT

Ceasalpinia bonduc (L) Roxb [Syn: *Ceasalpinia bonducella* (L) Fleming, Syn: *Caesalpinia crista* (L)], belonging to the family Caesalpiniaceae is commonly used to facilitate childbirth by African traditional birth attendants whose practices do not comply with the medical standards prescribed by WHO. So, this work was carried out to verify the ability of *Ceasalpinia bonduc* to facilitate labor in parturient women. This review study identified and examined the effects of this herbal on some physiological parameters that contribute significantly to the success of childbirth. *C. bonduc* leaf extract has a low toxicity. It has uterotonic, hypotensive, antihypertensive, anxiolytic, anticonvulsant, anti-inflammatory, analgesic and antipyretic activities. The hypotensive and antihypertensive effects could significantly reduce blood loss during the delivery while its uterotonic action increased uterine smooth muscle contraction which plays an important role in the process of childbirth. The anxiolytic activity could reduce anxiety in parturient women. Anxiety release hormones, such as adrenalin, which can slow labor contractions. Finally, the anticonvulsant effect could promote serenity in the parturient. She would move less. The present study suggests that *Ceasalpinia bonduc* (L.) Roxb (Caesalpiniaceae) have some pharmacological properties thus supporting its folkloric usage to facilitate childbirth in parturient women.

Key words: *Ceasalpinia bonduc*, Childbirth, Parturient women.

INTRODUCTION

In developing countries, low economic resources limit the capacity of people to buy pharmaceuticals. One consequence of this is desertion or late visits to health facilities [1, 2]. In these countries, less than 20 % of women have access to institutional delivery services. For them, home birth is not a choice, it is almost inevitable. They use medicinal plants to facilitate delivery [3].

The effectiveness of medicinal plants to cure various diseases is well proven. Their use promotes the development of modern therapeutics [4]. However this medicine, the practice remains relatively empirical, raises concerns. Indeed, it has limitations [5]. This

pharmacopoeia does not define the side effects or undesirable. Dosages, when they exist, vary from a traditional healer to another. It does not provide information on the biological effects of these natural substances. But the knowledge of the biological effects of plants is essential for their effective and efficient use [6]. Furthermore, this medicine is surrounded by moments of complex and mystical rituals.

Among these plants, we note *Ceasalpinia bonduc* (L) Roxb [Syn: *Ceasalpinia bonducella* (L) Fleming, Syn: *Caesalpinia crista* Linn], belonging to the family Caesalpiniaceae. This herbal is commonly used by African traditional birth attendants (TBAs) whose practices do not

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comply with the medical standards prescribed by WHO [7].

C. bonduc is a pantropical plant widespread in Africa, in the bushes on the outskirts of villages. This species is often found near mangroves on the coast [8]. It is generally known as *Kpohoun* in Oubi, *Awale* in Attié, *Aware* in Abbey, *Ahalé* in Baoulé, *Ware* in Abron, which are some local languages of Côte d'Ivoire. To facilitate delivery, leaves are triturated together with those of *Byrsocarpus coccineus* in two liters of water; the aqueous extract is given drink to the parturient woman [9, 10]. The effect is achieved after two hours. This plant is used as an abortifacient and facilitates the expulsion of dead fetuses in pregnant women [11].

The present study is conducted in order to provide a scientific basis for the use of *C. bonduc* to facilitate delivery in the parturient woman. How this plant species can facilitate childbirth? What are the pharmacological properties that may underlie its use for this purpose? In an attempt to respond to these concerns, it is necessary to examine previous studies.

LITERATURE REVIEW

Toxicity studies

Kumar *et al.* [12], reported investigation deals with the hematology and hepatorenal function of *C. bonduc*. Since there are no scientific reports regarding the toxicological aspects of this plant, the present investigation deals with the sub-chronic toxicity study of a methanol extract of *C. bonduc* (MECB) leaves in Swiss albino mice. MECB was administered intraperitoneally to Swiss albino mice twice a week for thirteen weeks. No significant alterations in hematological, biochemical and histopathological parameters were observed in the MECB-treated groups at the doses of 100 and 200 mg/kg b.w. Administration of MECB at the dose of 400 mg/kg b.w. elevated the levels of serum enzymes and altered the hematological parameters. These results suggested that MECB at doses 100 and 200 mg/kg b.w. did not induce any toxic effects in the mice. Adverse effect was noted at the dose of 400 mg/kg body weight.

Preeja and Suresh [13] reported evaluation of acute and sub-acute toxicity of methanolic extract of *C. bonduc* was evaluated in Albino mice. The acute toxicity studies were conducted as per the OECD guidelines 420 where the limit test dose of 2000 mg/kg used. Observations were made and recorded after treatment at 24 hrs, 8 hrs and then for seven days regularly for respiration rate, heart rate, and behavioural signs like apathy, reduced locomotor activity as well as licking. For the sub-acute toxicity, three groups of 6 mice were received distilled water (control), 200 and 400 mg/kg of extracts every 24 hr orally for 28 days. No significant variation in the body and organ weights between the control and the treated group was observed after 28 days of treatment. Haematological analysis and clinical blood chemistry revealed no toxic effects of the extract. Pathologically, neither gross abnormalities nor histo pathological changes were observed. No mortality was recorded in 28 days.

Uterotonic activity

Datté *et al.* [14] reported effects of *C. bonduc* leaf extract on the contractile activity of uterine smooth muscle of pregnant rats. The calcium dependency and the cholinergic effect of the leaf extract of *C. bonduc* was studied in isolated pregnant rat myometrium preparations. Isometric contractions were recorded. The extract (Cebo) increased the contractile force in the isolated strips in a concentration-dependent manner. The effects were comparable to those obtained with acetylcholine. Contractions induced by Cebo or acetylcholine were inhibited in the presence of atropine. The stimulating action of Cebo on the contractile responses of isolated myometrium preparations inhibited by atropine may be mediated by cholinergic receptors. In calcium-free solution Cebo induced a tonic contraction (contracture) of the muscle. Moreover, in high-potassium calcium-free solution Cebo caused contracture of the uterine smooth muscle. Cebo was still able to elicit contractions in calcium-free solution containing EDTA or EGTA. These findings suggest the existence of cholinergic receptors sensitive to Cebo which could influence the influx of calcium (phasic contraction) and mobilization of calcium from cellular stores (tonic contraction), both of which are responsible for the increase of contractile activity and development of the contracture of uterine smooth muscle.

Antihypertensive and hypotensive activities

Datté *et al.* [15] showed the hypotensive and antihypertensive effects of *C. bonduc* in guinea-pig. The administration of aqueous leaf extract (Cebo) induced a progressive decrease of blood pressure. The hypotensive action of this plant extract is dose-dependent and reversible. Similar results were obtained using acetylcholine. Hypotension induced by Cebo or acetylcholine were inhibited in the presence of atropine. Cebo may contain cholinergic substances. Cebo significantly reduced blood pressure caused by the prior administration of adrenaline. Cebo would have an antihypertensive action. These results showed that the leaves of *C. bonduc* have hypotensive and antihypertensive properties that could partly justify its use in traditional medicine to treat cardiovascular diseases.

Anxiolytic Activity

Ali *et al.* [16] have been reported anxiolytic activity of *C. bonduc* seed extract in laboratory animals. These authors explored the anxiolytic activities of seed extract of *C. bonduc* in experimental animals, mice and rats. In Stair-case model, all the three doses i.e low, medium and high 400, 600 and 800 mg/kg of PECB had showed a significant and dose dependent anxiolytic activity by increasing the number of steps climbed, without any significant effect on rearings by all these three doses. Similarly in EPM model medium and high doses, but not the low dose of PECB had significantly enhanced both number of entries and time spent in open arms and decreased in number of entries and time spent in closed arms. The result recorded with above experimental models confirms the anxiolytic activity of PECB.

Anticonvulsant activity

Ali *et al.* [17], reported anticonvulsive effect of *C. bonduc* seed extract. For assessing anticonvulsant activity, pentylenetetrazole, maximal electro shock, strychnine- and picrotoxin-induced convulsions models were used. Diazepam was used as a standard reference for all models except maximal electro shock model, wherein phenytoin was used as standard reference. Seed kernels of *C. bonduc* were powdered and subjected to successive extraction with solvents like petroleum ether (PE), ethanol, methanol and water using soxhlet apparatus. All the extracts were administered as suspension in 2 % gum acacia in all the experiments. Preliminary phytochemical investigation of petroleum ether extract of *C. bonduc* revealed the presence of saponins, glycoside, starch, sucrose, proteins, sterols and reported constituents like homoisoflavone (bonducillin) and a non alkaloid bitter principle (natin). In pentylenetetrazole, maximal electro shock, strychnine- and picrotoxin-induced convulsion models medium and high doses (600 and 800 mg/kg) of the extract showed significant anti-convulsant activity. The present investigation revealed that the PECB possessed anticonvulsant activity which may be contributed to the presence of phytoconstituents such as saponins, proteins, homoisoflavone (bonducillin), carbohydrates and sterols present in the drug, as these are already reported for their anxiolytic and anti-convulsant activities.

Anti-inflammatory, analgesic and antipyretic activities

These effects have been studied by Gupta *et al.* [18]. The methanol extract of *C. bonduc* leaves were investigated for anti-inflammatory, analgesic and antipyretic activities at the doses of 50, 100 and 200 mg/kg, body weight. The experimental paradigms used were carrageenan, dextran, histamine induced pedal edema and cotton pellet induced granuloma for anti-inflammatory activity, while hot plate and acetic acid induced writhing methods were used to assess analgesic activity. Yeast-induced hyperpyrexia was used to evaluate the antipyretic activity. In acute phase inflammation, a maximum inhibition 50.6 %, 51.1 % and 52.3 % was noted at the dose of 200 mg/kg after 3 h of treatment with methanol extract of *C. bonduc*. (MECB) in carrageenan, dextran and histamine induced pedal edema respectively. In the chronic model (cotton pellet induced granuloma) the MECB (200 mg/kg) and standard drug (Indomethacin 10 mg/kg) showed decreased formation of granuloma tissue by 51.8 % and 56.6 % respectively. The extract also produced significant analgesic activity in both paradigms. In addition, MECB potentiated the morphine and aspirin induced analgesia. A significant reduction in hyperpyrexia in rat was also produced by the extract. This study exhibits that the methanol extracts of leaves of *C. bonduc* possess anti-inflammatory, analgesic and antipyretic activities.

DISCUSSION

Previous studies had showed that *C. bonduc* possess uterotonic, hypotensive, antihypertensive, anxiolytic, anticonvulsant, anti-inflammatory, analgesic and antipyretic activities. The uterotonic action of *C.*

bonduc extract as oxytocic-like substances would be beneficial for the parturient woman [19, 20]. Uterine contraction plays a fundamental role in childbirth. According to many authors, labor failure is partly due to dysfunction of uterine contraction argued that Ca^{++} mobilization is essential during uterine contraction even if the mechanisms underlying this activity of uterus are not completely understood [21-26]. The hypotension induced by *C. bonduc* extract would be beneficial for parturient women. It minimizes blood loss due to haemorrhages during the delivery. These haemorrhages complicate 5 % of births and are a leading cause of maternal mortality before the thromboembolic diseases and complications of hypertension [27]. In France, postpartum hemorrhage is the leading cause of maternal mortality, with a significantly higher rate than the European average. Postpartum haemorrhage (PPH) continues to be one of the leading causes of maternal death in developing countries, and the predominant cause in Africa (34%) and Asia (31%) [28-30]. The main preventive measure is therefore to administer artificial oxytocin (or misoprostol) to the mother after the baby is born, to the extent that it is no longer able to spontaneously produce enough oxytocin to stimulate contractions uterine [31-34]. These oxytocic-like substances have a hypotensive effect which could significantly reduce blood loss during the delivery [35, 36]. Thus, *C. bonduc* extract as oxytocin-like substances had a hypotensive effect which could minimize the heavy blood loss caused by haemorrhages during childbirth.

The anxiolytic activity of *C. bonduc* militates in favor of its use to facilitate delivery in parturient woman. Emotional concerns, such as fear, embarrassment, or a lack of support, can also interfere with labor progress. Anxiety has a negative impact on delivery. It delays or lengthens the process of childbirth. Fear and anxiety release hormones, such as adrenalin, which can slow labor contractions [37]. Following childbirth, 16 % of women may have anxiety disorders and 2 % develop PTSD [38]. Reck *et al.* [39] had examined a German sample to determine whether anxiety symptoms during pregnancy had an impact on the duration and method of childbirth. They showed that childbirth-specific anxiety is an important predictor of total birth duration. Childbirth-specific anxiety during pregnancy plays an important role in the process of childbirth. They pointed to the need of implementing psychological interventions to reduce childbirth-specific anxiety and thereby positively influencing birth outcome. In the same vein, Zhou and Li [37] noted that prenatal anxiety may lead to increase the rate of non-indicative cesarean section and intrapartum hemorrhage during the cesarean section.

Ali *et al.* [17] reported anticonvulsive effect of *C. bonduc* seed extract. Similar effects could be obtained with the leaf extract. The leaves and seeds of *C. bonduc* contain the same phytochemicals constituents. Previous studies have showed that whole plant of *C. bonduc* contain all major chemical constituents such as Steroidal Saponin, Fatty Acids, Hydrocarbons, Phytosterols, Isoflavones, Aminoacids, and Phenolics [17, 40, 41].

These analgesic, anti-inflammatory activity and antipyretic of *C. bonduc* could partly justify its use to facilitate childbirth. The leaves extract could minimize labour pain. In fact, pain is a real problem for both the parturient woman and the clinician. It is one of the causes of complications of childbirth. So it is important for the clinician to reduce or minimize up to relieve the parturient woman. Labour pain is caused by many interacting factors. Earlier studies have revealed that pain is negatively correlated with complications in pregnancy and labour. According to Melzack *et al.* [42], labour pain ranks among the severest forms of pain recorded with the McGill Pain Questionnaire. However, the intensity of the pain ranges from mild to excruciating. Analyses of the data revealed the relative contributions of several factors to the individual variability of the pain. Pain is a complex perceptual experience that is profoundly influenced by psychologic variables, such as fear, attention and suggestion, as well as by injurious or potentially harmful stimulation [43, 44]. It is not surprising, therefore, that clinical pain is often substantially reduced by psychologic procedures that decrease anxiety and tension [45]. Women in labour are subject to intense fears and anxieties related to their ability to bear the pain, to the possibility of medical complications and to the baby's health [46, 47]. Methods such as prepared childbirth training that are designed to reduce fear, anxiety and tension should, theoretically, also decrease pain [48]. Yet the effects of such training are still controversial. While several studies have shown that the relaxation, distraction and other components of this training diminish pain [49-52], others have found that it has no demonstrable effect on the pain itself but simply decreases the emotional reaction to the pain [53-55].

Fever during labor is a rare complication [56]. Its consequences in terms of maternal infection and the infection of baby may be less formidable now with the addition of antibiotics and advances in newborn resuscitation are. But aside from this infectious risk itself, fever may occur on the same process of delivery and increase the risk of dystocia. The presence of hyperthermia in early labor may be associated with a number of complications, high fetal distress and dystocia during childbirth, infectious complications, maternal and neonatal risk. It is also noted specific complications caused by hyperthermia such premature rupture of membranes (PROM). The discovery of hyperthermia therefore requires careful bacteriological evaluation in the mother and the newborn, strict monitoring of uterine activity and fetal

vitality in the work and a systematic prescription of antibiotics to reduce the risk infectious [56].

About toxicity, Preeja *et al.* [13] showed that *C. bonduc* is not toxic while Kumar *et al.* [12] have shown that this plant is of low toxicity when high doses are administered. The maximum tolerated dose of the 50% ethanolic extract was found to be more than 1000 mg/kg b.w. when tested in adult male albino mice [57]. Petroleum ether seeds extract of *C. bonduc* was found to be non-toxic even up to the dose level of 3000 mg/kg b.w. (LD50) [17]. According to the route of administration and study method, the toxicity of extracts can change [58-60]. At high doses, *C. bonduc* was toxic. This corroborates that Datté and Offoumou [61] revealed. These authors had shown a low toxicity of *C. bonduc* leaf extract. The toxicity of *C. bonduc* was nearly equal to those of *Sesamum radiatum*, an uterotonic plant [62]. However, this toxicity of *C. bonduc* leaf extract [61] could not limit its use for therapeutic purposes because all pharmacodynamic substances are toxic when the administered doses are supraliminal [58]. The doses used in the short term by TBAs would be low because the literature does not reveal any toxicity due to its use in the parturient woman and the newborn. The doses used in traditional medicine to facilitate childbirth would be low and therefore safe.

CONCLUSION

From this investigation, it can be concluded that *C. bonduc* leaf extract is lightly toxic. This toxicity as those of many drugs could not be a barrier to its use for therapeutic purposes. On the pharmacological level, this herbal has been reported to possess uterotonic, hypotensive, antihypertensive, anxiolytic, anti-inflammatory, analgesic, antipyretic and anticonvulsant activities which could contribute strongly to the success of the deliveries. *Ceasalpinia bonduc* (L.) Roxb. (Caesalpinaceae) can be used to facilitate childbirth in parturient women.

Competing Interests

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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