

Letter

"Kambô" frog (*Phyllomedusa bicolor*): use in folk medicine and potential health risks

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Dear Editor:

Phyllomedusa bicolor is an Amazonian amphibian of the Phyllomedusidae Family, and is found in the forests of Brazil, the Guianas, Venezuela, Colombia, Peru, and Bolivia. It is one of the largest tree frogs of the Amazon. The males measure up to 11.8 cm from snout to vent¹ (Figure 1A). Popularly known as "Kambô", "Kampô," or "Kampu," natives use the toxin secreted by the skin of this frog in traditional medicine^{1,2}. The name *Kambô* is also used to describe the ritual of applying the poisonous secretions of the frog to the skin (Figure 1B). Natives also call the poisonous secretion "toad vaccine".

Indigenous people of Brazil and Peru remove the white-colored secretion (Figure 1C) that the frog exudes when it is stimulated, and collect it on wooden spreaders for later use. This secretion is rich in bioactive peptides² that the animal uses as a defense mechanism to kill or induce unpleasant experiences (e.g., discomfort, regurgitation) in predators that attempt to ingest this amphibian. Application of the "toad vaccine" is conducted by superficially burning the surface of the skin with a sharp object (or small piece of vine called 'titica'), typically the arms of men or legs of women, and making several "points"². The dried secretion from the spreader is then applied to each of the small burns/points^{2,3} (Figures 1B and 1D). The symptoms are almost immediate², resulting in a great deal of discomfort (a strong burning sensation, nausea, stomach pain, and vomiting)



FIGURE 1: (A) *Kambô* frog (*Phyllomedusa bicolor*); (B) Removal of amphibian skin secretion *P. bicolor*; (C) Application of *Kambô*; (D) Marks on the shoulder after application of *Kambô*. Photos: Paulo Bernarde.

for approximately 15 minutes. However, relief can only be achieved by removing the poison from the skin by washing the affected area. Fasting the night before the application and drinking plenty of water is also recommended².

For centuries indigenous people have used *Kambô* as a form of medicine to "strengthen the body's natural defenses," to ward off "panema" (bad luck), and in rituals to increase hunting success³. With the colonization of the Brazilian state of Acre, rubber tappers adopted this technique, and the ritual is now customary in several regions of Brazil, including in large urban centers³, and has reached North America and Europe². It has been reported that peptides isolated from the skin secretions of the *Phyllomedusa* species exhibit antimicrobial properties

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(e.g., against *Pseudomonas aeruginosa*) and also inhibit protozoa (e.g., *Trypanosoma cruzi*)⁴ *in vitro*. This suggests a role for amphibians in the development of new anti-microbial drugs.

Recent reports have revealed the side-effect of *Kambô*^{5,6,7,8,9} treatment, including death¹⁰. Leban et al.⁵ reported the case of a 44-year-old female in Slovenia who drank six liters of water after applying *Kambô*, and gradually developed nausea, vomiting, confusion, lethargy, muscle weakness and spasms, fits/convulsions, loss of consciousness, short-term memory, and developed syndrome of inappropriate antidiuretic hormone (SIADH) secretion. Pogorzelska and Łapiński⁶ treated a 34-year-old male patient in Poland with a chronic history of alcohol and marijuana use, who had signs of transient hepatitis, with *Kambô* to maintain sobriety. Kumachev et al.⁷ also reported the case of a 32-year-old female patient who was admitted to a hospital in Canada with prolonged nausea, frequent episodes of vomiting, and abdominal discomfort eight hours after *Kambô* treatment. Li et al.⁸ treated a 24-year-old female at a first-aid facility in the United States with symptoms of prolonged vomiting, facial flushing, facial swelling, altered mental status, and restlessness 22 hours after using *Kambô*. Roy et al.⁹ also reported the case of a 33-year-old woman in the United States who presented with potential psychosis (with characteristics of paranoia, anxiety, bizarre delusions, labile humor, and panic attacks) associated with *Kambô* use. The sudden death of a 42-year-old overweight man with signs of coronary disease associated with the use of *Kambo* was reported in Italy¹⁰. These authors suggested that the hypotensive effects of *Kambô* may have resulted in reduced myocardial perfusion and tachycardia, which led to sudden cardiac arrhythmia. In Pindamonhangaba, in the state of São Paulo (Brazil), the death of a 52-year-old man was reported shortly after the application of the *Kambô* by a practitioner who obtained the *Kambô* skin secretions from the state of Acre¹¹. All of these complications have been reported in regions far from where *Kambô* is traditionally used (Western Amazon), and applied by practitioners who may not have the same experience as those who traditionally perform the ritual, and thus poses an additional health risk.

In addition to its traditional use, *Kambô* has spread via urban expansion into alternative therapy clinics and Brazilian Ayahuasca religions (Santo Daime and União do Vegetal) with new practitioners, called holistic and medical therapists³. Natives are concerned that new practitioners may misapply *Kambô* or use the skin secretions of other species of amphibians ("*Sapo-cururu*" *Rhinella marina*)³, resulting in health complications or even death. Many people have reported the benefits of this therapy as if it were a "panacea" that is able to cure many diseases (low immunity, headache, gastritis, diabetes, blood pressure problems, cirrhosis, labyrinthitis, epilepsy, impotence, depression, cancer and AIDS³). These reported benefits may increase the demand for alternative treatments like *Kambô*; however, evidence of its efficacy is insufficient and studies of its side effects have not been conducted. The National Sanitary Surveillance Agency¹² has ordered the suspension of all types of advertising for this alternative therapy, and revealed that there is no scientific evidence to guarantee the quality, safety, and efficacy of this treatment or its indication for any type of disease, imbalance, or treatment of any acute and chronic processes.

Due to the reports of complications and death, it is necessary to caution the public on the contraindications regarding the use of *Kambô*², such as severe cardiovascular conditions, hypotensive syndromes, and to limit water intake after the ritual, in order to reduce the risk of contracting SIADH syndrome. In addition, since *Kambô* is also traditionally used to induce abortions, pregnant women should not participate in this ritual². Excessive applications (overdose), and treatment of children with a lower body mass, should be avoided as mass-to-dose ratio may be relatively higher during the treatment in these two groups of patients. The secretion of *P. bicolor* contains several different uncharacterized toxins⁶. Additional studies on the pharmacological potential of amphibians are necessary, and the risk of bio-piracy should be monitored. Trafficking of these animals and their secretions, and the possible impact on the *P. bicolor* population in their natural habitats, should be expensively studied.

Conflict of Interest: The authors declare that there are no conflicts of interest.

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