

Study of the physicochemical and toxicological profiles of three products commonly used in vaginal practices among women in the city of Ouagadougou, Burkina Faso

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Abstract

Vaginal practices encompass various methods of hygiene and other interventions, ranging from external cleansing with water or mild products to internal washing (douching) and the insertion of substances for hygienic, sanitary, or sexual reasons. Due to the wide variety of products and methods of use, these practices may carry certain risks. The aim of this study was to characterize the physicochemical and toxicological profile of three recipes used by women in Ouagadougou for vaginal practices. These recipes are *Mint Crystals*, *Petit Bandit*, and *Djeka*. The phytochemical profile of the three recipes was analyzed using thin-layer chromatography. Acute toxicity and eye and skin irritation were determined based on the guidelines of the Organization for Economic Cooperation and Development (OECD). *Djeka* contains flavonoids, tannins, phenolic compounds, and coumarins. *Mint Crystals* contain sterols and terpenes. No chemical groups were identified in *Petit Bandit* tablets. The acute toxicity study showed that each of the three formulations has an estimated LD₅₀ of 5000 mg/kg bw. *Mint Crystals* and *Petit Bandits*, at a single dose of 2000 mg/kg bw, caused a significant decrease in the relative weight of the liver, kidneys, and spleen of the test mice. *Djeka* and *Petits*

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Bandits have minimal eye irritation potential, and Mint Crystals has moderate irritation potential. All three recipes are non-irritating to the skin. The results are preliminary, but they raise questions about the safety of misuse of the recipes.

Key Words: Acute toxicity; Irritation potential; Vaginal practices; Health risk; Burkina Faso.

Étude des profils physicochimiques et toxicologiques de trois produits couramment utilisés dans les pratiques vaginales chez les femmes de la ville de Ouagadougou, au Burkina Faso.

Résumé

Les pratiques vaginales englobent diverses méthodes d'hygiène et d'interventions, allant du nettoyage externe à l'eau ou avec des produits doux, au lavage interne et à l'insertion de substances à des fins hygiéniques, sanitaires ou sexuelles. Ces pratiques peuvent comporter des risques sanitaires pour les utilisateurs. L'objectif de cette étude était de caractériser le profil physico-chimique et toxicologique de trois recettes utilisées par les femmes de Ouagadougou pour les pratiques vaginales. Ces recettes sont les cristaux de menthe, le Petit Bandit et le Djeka. Le profil phytochimique des trois recettes a été analysé par chromatographie sur couche mince. Les tests de toxicité aiguë et d'irritation oculaire et cutanée ont été réalisés suivant les lignes directrices de l'Organisation de coopération et de développement économiques (OCDE). Djeka contient des flavonoïdes, des tanins, des composés phénoliques et des coumarines. Les cristaux de menthe contiennent des stérols et des terpènes. Aucun groupe chimique n'a été identifié dans les comprimés Petit Bandit. L'étude de toxicité aiguë a montré que chacune des trois formulations a une DL50 estimée à 5000 mg/kg pc. Les cristaux de menthe et Petit Bandit ont provoqué une diminution significative du poids relatif du foie, des reins et de la rate des souris testées. Djeka et Petit Bandit présentent un risque minimal d'irritation oculaire, tandis que les cristaux de menthe présentent un risque modéré. Les trois recettes sont non irritantes pour la peau. Bien que préliminaires, les résultats recommandent la prudence dans l'utilisation des trois recettes étudiées et celle des autres.

Mots clés : Toxicité aiguë ; Potentiel irritant ; Pratiques vaginales ; Risques sanitaires ; Burkina Faso.

Introduction

Vaginal practices refer to various methods of hygiene and other interventions, ranging from external cleaning with water or mild products, to internal washing (vaginal douching) and the insertion of substances for hygienic, sanitary, or sexual reasons. It is a routine practice among women. A recent study shows that in Ouagadougou, nearly 50% of women engage in this practice (1). Among sexual practices, the use of modern or traditional remedies is well documented.

These substances (ovules, gels, liquids, and powders) are considered medicines, cosmetics, commercial items, and “love potions” that can exert “spiritual” control over a spouse's life (2). An estimated 200 medicinally important plant species are reported to be utilized by women in different African countries, including Benin, Cameroon, Côte d’Ivoire, Egypt, Ethiopia, Ghana, Kenya, Mali, Nigeria, South Africa, Tanzania, and Zimbabwe (3). These herbs have many applications, mostly focused on infertility, pregnancy, painful menstruation, breast feeding, breast cancer, and contraception (3). In Burkina Faso, these products, known as “women's secrets,” are very diverse. A survey conducted in 2023 identified 90 different products. These are used orally, topically, and vaginally. They are used for multiple purposes, such as therapeutic, erotic, and other purposes, leading to the continued use of these “women's secrets” over a long period of time (4). In 2024, the global feminine hygiene market was estimated at US\$49.75 billion (5). In some populations, nearly 95% of women have used at least one feminine hygiene product or practice in or around their genital area (5). Despite women's interest in these vaginal practices, little is known about their short- and long-term health effects. This study aims to evaluate the physicochemical and toxicological properties of the three most commonly used recipes as women's secrets in the city of Ouagadougou, Burkina Faso.

I. Material and methods

I.1. Material

I.1.1. Description of the test substances

Three recipes were included in this study. These recipes were selected based on their frequency of mention in a survey among *women's secret* sellers in Ouagadougou (4). They are *Mint Crystals* (MC), tablets known as *Petit Bandit* (PB) or *diamand Kiss*, and *Djeka* from dried leaves of *Alchornea cordifolia*. The mode, frequency, and reason of use of each recipe are described by Semdé (4). *Djeka* can be used in decoction form, mixed with other plants or for intimate cleansing in a sitz bath or steam bath with the decoction. It is preferably used twice a day for several reasons, including for tighten the vagina, induce vaginal succulence, soothe painful periods, intimate care (genital hygiene, combating unpleasant vaginal odours), treating ulcers, and stopping lochia and treating uterine wounds after childbirth. *Mint Crystals* can be used as required by suck (1 or 2 crystals), dissolve in a drink, milk, etc., intimate hygiene (after dissolving in water), and introduce the

crystals into the vagina. The main reasons for its use are stimulating libido and intimate care (genital hygiene, combating unpleasant vaginal odours). *Petit Bandit* tablets are used as required (1 time a day maximum) to induce vaginal succulence, stimulate libido, and give stamina in bed during intercourse. Its use forms include taken tablets 30 minutes to 1 hour before sexual intercourse, swallow or suck 2 to 10 tablets, dissolve in a drink (tea, herbal tea), and insert 1 to 2 tablets into the vagina 1 hour before intercourse (4).

For each recipe, five samples were randomly purchased from five different sellers. The recipes were transported to the laboratory under the same temperature conditions as in the store and then stored at room temperature away from light.

1.1.2. Experimental animals

Female NMRI mice with an average weight of 30.83 ± 1.15 g and New Zealand rabbits weighing between 1.3 kg and 1.8 kg were used for acute oral toxicity testing and eye and skin irritation testing, respectively. The choice of animals, both mice and rabbits, took into account homogeneity in terms of weight and age. The mice were supplied by the ‘‘Institut de Recherche en Sciences de la Santé (IRSS)’’ animal facility and the rabbits were purchased from breeders in the city of Ouagadougou. The mice were fed with protein-enriched wheat meal and tap water. They were kept at a temperature of $22 \pm 3^\circ\text{C}$ and a 12-hours light/12-hours dark cycle. The rabbits were acclimated to laboratory conditions for two weeks prior the test. They were fed cereal bran, cabbage leaves, and tap water. They were kept at a temperature of $22 \pm 3^\circ\text{C}$ and a 12-hours light/12-hours dark cycle. All experiments were carried out following ethical guidelines towards animals and on the established principles of Reduction and Refinement, in accordance with the international standards set by the European Union on the protection of animals (CEC Council 86/609).

1.2. Methods

1.2.1. Determination of the recipes organoleptic characteristics

The characteristics such as the color, consistency, smell, and taste of the three recipes were determined. Color was determined by observation with the naked eye; consistency by touch and palpation of the samples; odor was determined by bringing the sample close to the nostrils; and taste by placing a small amount of the sample on the tip of the tongue (6).

I.2.2. Determination of the recipes pH

The pH of “*Djeka*” aqueous extract and the aqueous solutions of the other two recipes was measured using an XS sensor pH-meter, serial number 191428336, made in Italy. The pH measurement is performed by immersing the pH-meter probe in the solution concerned and reading the pH value directly on the device's screen. The measurement was taken three times and the average was calculated.

I.2.3. Phytochemical study of the recipes

Preparation of "Djeka" extract

The *Djeka* recipe is used by women in the form of an aqueous decoction. Studies have therefore focused on a decoction of the plant's leaves. *Djeka* (*Alchornea cordifolia* leaves) purchased from sellers were ground using a laboratory blade grinder (Gladiator Est. 1931 Type BN 1 Mach. 40461 1083). 50 g of the powder was mixed with 500 ml of distilled water and boiled for 30 minutes. After cooling, the mixture was filtered through a fine-mesh nylon cloth. The filtrate was centrifuged at 3000 rpm for 10 minutes. The supernatant obtained was dried in an oven at 45°C. The dry extract obtained was used for the tests.

Thin Layer Chromatography (TLC) phytochemical Characterization

The extract was solubilized in methanol and deposited on a HPTLC Silica gel 60F254 10 × 10 cm plate for the development of the chromatogram. Chromatography was developed over a 8 cm course in the solvent system Toluene-ethyl formate-formic acid (4: 3: 1); The revelation was made under ultraviolet light at $\lambda = 365$ nm.

The appropriate mobile phase (solvent system) was placed in a chromatography tank and then covered to allow the solvent vapor to saturate. The extracts were deposited on the stationary phase (silica gel) of the TLC plate using capillary tubes (1 to 5 μ L). The TLC plate was placed in the mobile phase and left to migrate over a distance of 8 cm. After migration, the plate was removed from the mobile phase and dried at room temperature, then in an oven at 40°C. After drying, the plate was sprayed with reagents specific to each chemical group and then observed under a UV lamp (254-365 nm). According to chemical groups targeted, two solvent systems were used for the development of the chromatograph: the ethyl acetate-methanol-water system in proportions of 7-2-1 (V/V/V) for the detection of flavonoids, tannins,

phenolic compounds, and coumarins, and the hexane-ethyl acetate-methanol system (7-2-1 V/V/V) for the detection of terpenes and sterols. The following specific reagents were used to reveal the chemical compounds: sulfuric vanillin reagent to reveal terpenes and sterols 5% (V/V) ethanolic KOH reagent for coumarins NEU reagent for flavonoids, FeCl₃ reagent for tannins and phenolic compounds, and anisaldehyde sulfuric reagent for saponosides.

I.2.4. Acute oral toxicity study

I.2.4.1. Animal exposure and LD50 determination

The acute oral toxicity study of the recipes was performed according to OECD Guideline 423 on NMRI mice (7). Briefly, the animals were randomly allocated into groups of three mice. Prior the test, they were fasted during 4 hours. Test groups received a single oral dose of 2000 mg/kg b.w of the recipe (*Petit Bandit* and *Mint Crystals*) or extract (*Djeka*) distilled in water, while the control group received distilled water. Animals received test substance or distilled water by gavage using a stainless-steel ball-tipped gavage needle. Both control and test animals were observed every 30 min for two hours after dosing, then twice daily until the 14th day. Observations included changes in skin and fur, eyes and mucous membranes, respiratory, circulatory, autonomic, and central nervous systems, and somatomotor activity and behavior patterns. Special attentions were directed to observations of tremors, convulsions, salivation, diarrhea, lethargy, sleep, and coma (8).

In the principle of the method, based on a stepwise procedure with the use of a minimum number of three animals per step, sufficient information is obtained on the acute toxicity of the test substance to enable its classification. If the started dose in the study is 2000 mg/kg b.w., when no mortality was observed, the LD50 is estimated to 5000 mg/kg b.w. (7).

I.2.4.2. Weight change in animals

The weight of all animals was recorded before the start of the test, then on days 1, 2, 3, 7, and 14 during the test period.

I.2.4.3. Relative organ weights

All mice were euthanized by ketamine *ip* administration (1.5 mg/kg b.w. in *ip*) at the end of the 14-day observation period, and gross necropsies were performed. The brain, heart, kidneys, liver, lungs,

stomach, and spleen, rinsed in saline 0.9%, weighed, and the relative weight of each organ was calculated using the following formula:

$$\begin{aligned} &\text{Relative weight of Organ (\%)} \\ &= \frac{\text{Absolute weight of the organ (g)}}{\text{Weight of the rat on the day of sacrifice (g)}} \\ &\times 100 \end{aligned}$$

I.2.5. Potential irritancy study

I.2.5.1. Evaluation of the recipes ocular irritancy

The evaluation of the ocular irritancy of the formulations was carried out in accordance with OECD Guideline 405 (9). Three (03) rabbits were used for each sample to be tested. The rabbits were physically examined beforehand to check for infection or pathology and were marked to facilitate their identification. 0.1 ml of each recipe dissolved in distilled water was introduced into the conjunctival sac of one of the eyes of each rabbit using a syringe; the second eye served as a control. The test eye of each rabbit was examined, compared to the control eye, 1 hour, 24 hours, 48 hours, and 72 hours after treatment. The eye examination focused on the condition of the conjunctiva, iris, and cornea, as well as other signs of pain and/or distress, including pawing or repeated rubbing of the eyes, excessive blinking, and tearing. Eye lesion scores were given after evaluation in natural light. The animals were then kept under observation for a period of 21 days to verify the reversibility or non-reversibility of the effects associated with the test substances. The Maximum Mean Total Score (MMTS) was calculated for each formulation using the following formula: MMTS = Sum of Maximum Total Score.

I.2.5.2. Evaluation of the recipes skin irritancy

The skin irritation potential of the formulations was evaluated according to OECD Guideline 404 (10). Three (03) rabbits were used for each formulation. The rabbits were first examined to ensure they were free of infection or disease, then marked for easy identification. Both sides of each rabbit were shaved over an area of approximately 6 cm² each. 0.5 ml of the test substance, previously dissolved in distilled water, was taken from a compress and applied to the skin using a semi-occlusive dressing with hypoallergenic adhesive tape. The rabbits were examined 1 hour, 24 hours, 48 hours, and 72 hours after application of

the test substances. The rabbits were examined for clinical signs such as erythema and edema. At the end of 72 hours, observation continued for fourteen (14) days to verify the reversibility or non-reversibility of the observed effects. The Dermal Irritation Score (DIS) for each formulation was calculated using the following formula:

$$\text{DIS} = \text{Value (erythema + edema)} / (\text{Number of animals} \times \text{Number of observations}).$$

1.2.6. Statistical data processing

Statistical analysis was performed using Graph Pad Prism software. 5. Results were presented as mean \pm standard deviation (SD) (n = 3). Differences were considered significant at $p < 0.05$.

II. Results

II.1. Physicochemical and organoleptic characteristics of the recipes

The physicochemical and organoleptic and physical characteristics of the three recipes are presented in table I.

Table I: Organoleptic and physical characteristics of the three recipes most commonly used as women's secrets.

	<i>Djeka</i>	<i>Petit Bandit</i>	<i>Mint Crystals</i>
Organoleptic characteristics			
Format	Dried leaves	Tablets	Crystals
Consistency	Soft	Hard	Hart
Colour	Gray mouse	White	Translucent
Smell	Odorless	Odorless	Mint odor
Taste	Bland	Sweet and slightly bitter	Strong, fresh and very spicy
pH			
pH	3.58 \pm 0.02	6.86 \pm 0.34	6.22 \pm 0.06

The results of phytochemical screening of the three recipes show that the aqueous *Djeka* extract contains flavonoids, coumarins, tannins and

phenolic compounds. Sterols and triterpenes were identified in the *Mint Crystals*, while none of the targeted chemical groups were identified in the *Petit Bandit*.

II.2. Acute oral toxicity study

II.2.1. Toxidrome

With the *Djeka*, a transient decrease in food intake was observed during the first three days following administration of the product. With *Mint Crystals*, breathing difficulties were observed immediately after administration of the test substance, but these did not persist beyond 30 minutes. The administration of a single dose of 2000 mg/kg bw of *Petit Bandit* produced no remarkable changes in behavior or apparent signs of toxicity during the 14-day observation period.

II.2.2. Determination of LD₅₀

The results of the acute toxicity test show that administration of the dose of 2000 mg/kg b.w. of the three recipes did not cause any mortality in mice. According to the method used, these results indicate the LD₅₀ of each of the three recipes is estimated to 5000 mg/kg bw.

II.2.3. Weight evolution

Table II shows the average weight of treated and control mice over the 14 days of observation following the administration of recipes to mice. The average body weight of all control and treated mice increased over the 14 days. In mice treated with aqueous extract of "*Djeka*", a slight loss in body weight was observed during the first 3 days following administration of the extract, compared with the control group. However, this weight loss was not statistically significant.

Table II: Effects of single oral dose of the recipes (2000 mg/kg b.w.) on the mice body weights

Days	Body weight (g)			
	Control	<i>Djeka</i>	<i>Mint Crystals</i>	<i>Petit Bandit</i>
D ₀	30.25 ± 3.75	31.48 ± 1.45	32.42 ± 1.29	31.02 ± 1.49
D ₁	30.78 ± 3.45	29.93 ± 3.04	32.78 ± 1.81	31.73 ± 1.92
D ₂	31.00 ± 3.22	29.55 ± 3.55	33.32 ± 1.85	31.97 ± 1.91
D ₃	31.25 ± 2.96	28.92 ± 3.19	33.33 ± 1.91	32.68 ± 2.28
D ₇	32.00 ± 3.42	31.43 ± 2.59	34.13 ± 1.62	33.00 ± 1.94

D₁₄ 32.5 ± 4.76 31.80 ± 2.40 33.85 ± 1.08 33.8 ± 1.55

Results presented as mean ± SD; n = 6

II.2.4. Relative organ weights

Fresh macroscopic examination of the vital organs (heart, lungs, liver, kidneys and spleen) of mice treated with *Djeka*, *Petit Bandit*, and *Mint Crystals* showed no change in color or appearance compared with control mice. The results show that *Mint Crystals* and *Petit Bandita* induced significant reduction of mice liver, kidneys, and spleen relative weights (table III).

Table III: Effects of single oral dose of the recipes (2000 mg/kg b.w.) on the relative weights of specific organs in mice

Organs	Relative weight			
	Control	<i>Djeka</i>	<i>Mint Crystals</i>	<i>Petit Bandit</i>
Heart	0.48 ± 0.08	0.60 ± 0.16	0.52 ± 0.07	0.48 ± 0.06
Lungs	0.72 ± 0.14	0.69 ± 0.14	0.58 ± 0.08	0.60 ± 0.06
Liver	5.62 ± 0.69	4.85 ± 0.56	4.33 ± 0.29**	4.48 ± 0.48**
Kidneys	1.44 ± 0.16	1.36 ± 0.10	1.26 ± 0.08*	1.25 ± 0.10*
Spleen	1.25 ± 0.71	0.66 ± 0.50	0.41 ± 0.08**	0.33 ± 0.04**

Results presented as mean ± SD; n = 6; * p < 0.05; ** p < 0.01

II.3. Eye and skin irritation

II.3.1. Eye irritation

The pictures in Figure 2 are representative of those taken from rabbits one hour after ocular exposure to the test products. They are compared to those of the unexposed eyes of the respective rabbits at the same stage of the test. It can be seen that the product *Mint Crystals* caused redness, chemosis, and tearing of the exposed eyes.

The results of the eye irritation test (table IV) show that *Djeka* and *Petit Bandit* are substances of minimal irritation according to the Draize classification scale, with Maximum Mean Total Scores (MMTS) of 3.33 and 4, respectively. The MMTS for *Mint Crystals* is 30. This classifies the recipe as a moderate eye irritant on the Draize scale.



Figure 1: Effects of the exposure to the recipes on rabbit eye

Table IV: Effects of recipes on eye irritation in rabbit

Recipes	MMTS	Conclusion
<i>Djeka</i>	3.33	Minimal irritation ($2.6 < \text{MMTS} < 15$)
<i>Pétits Bandits</i>	4.00	Minimal irritation ($2.6 < \text{MMTS} < 15$)
<i>Mint Crystals</i>	30.00	Moderate irritation ($25.1 < \text{MMTS} < 50$)

II.3.2. Skin irritation

The results of the skin irritation test (table V) show that *Djeka* and *Petit Bandit* can be classified as non-irritating to the skin, according to the Draize classification scale, with a Dermal Irritation Score (DIS) equal to 0; 0.08 and 0 respectively for *Djeka*, *Petit Bandit* and *Mint Crystals*.

Table V: Effects of recipes on dermal irritation in rabbit

Recipes	DIS	Conclusion
<i>Djeka</i>	0.00	Non-irritating ($0 < \text{DIS} = 0 < 0,40$)
<i>Petit Bandit</i>	0.08	Non-irritating ($0 < \text{DIS} = 0,08 < 0,40$)
<i>Mint Crystals</i>	0.08	Non-irritating ($0 < \text{DIS} = 0,08 < 0,40$)

III. Discussion

The purpose of this study was to determine the physical characteristics and toxicological profile of three recipes used by Ouagadougou women in vaginal practices. The physicochemical characterization shows a pH of 6.86 ± 0.34 for *Petit Bandit*, 6.22 ± 0.06 for *Mint Crystals* and 3.58 ± 0.02 for *Djeka*. The aqueous extract of *Djeka* is therefore highly acidic, while the *Petit Bandit* and *Mint Crystals* are practically neutral. Koffi et al. (11) found a pH of 3.90 for aqueous extracts of *Djeka* leaves. As the normal pH of the vagina is between 4.0 and 4.5 in non-menopausal women, and between 4.5 and 5 in menopausal women (12), vaginal practices using *Petit Bandit* and *Mint Crystals* could alter this normal pH, leading to an imbalance in vaginal flora that could cause infection, thus exposing users to the risk of infection. The intravaginal medium is a regulated environment, influenced by physiological and microbiological factors. The frequent practice of multiple intimate toilets per day, vaginal douching or the use of vaginal products can lead to damage to the epithelium and its lining, a change in local pH and an imbalance in the physiological flora (13,14). These changes can result in vaginal symptoms such as itching, burning and running, which can be signs of various infectious diseases and sexually transmitted diseases (15).

Phytochemical analysis revealed the presence of flavonoids, tannins, phenolic compounds and coumarins in *Djeka* extract. Other authors have also reported the presence of flavonoids, coumarins, tannins, sterols and terpenes in aqueous *Djeka* extract (16). Flavonoids are known for their antioxidant, anti-inflammatory and diuretic properties; tannins for their antiseptic and antidiarrheal properties. As for coumarins, they are antibacterial, antioxidant, anti-inflammatory, anticoagulant and antitumoral (16). The presence of these chemical groups in *Djeka* extract may confer therapeutic potential to this recipe. Sterols and terpenes have been identified in *Mint Crystals*. The properties of the phytochemical groups present in the three recipes studied could justify their widespread use by women.

The acute toxicity and dermal and ocular irritation tests of the recipes were assessed. In the acute oral toxicity test, administration of a single dose of 2000 mg/kg body weight of each of the three recipes produced no mortality. The LD50 of each of these three recipes is estimated to 5000 mg/kg b.w., according to the method used. These recipes are therefore classified in the fifth toxicity class, i.e. as low toxicity

substances (17). These results are comparable to those of Traoré in Mali, who found an oral LD50 greater than 5000 mg/kg in mice with the aqueous extract of *Djeka* (18). Similarly, Gnahoué et al. reported an oral LD50 greater than 5000 mg/g with aqueous *Djeka* extract in rats (19). Ed-Dahmani et al. (20) also reported an oral LD50 of 3180 mg/kg for *Mint Crystals* in rats. During the 14 days of observation following administration of the recipes, a progressive weight gain was noted in all treated animals. On the other hand, a slight, statistically insignificant loss of body weight was observed in mice treated with aqueous *Djeka* extract during the first three (3) days following administration. These results show that the three recipes do not prevent weight gain in rats. However, the decrease in spontaneous growth observed during the first three days could be explained by the physiological state, a reduction in food consumption, involuntary stress afflicted on the animals (21), but also by the possible actions of the recipes' active ingredients on food absorption capacity. Macroscopic examination of the organs of treated mice showed no lesions, changes in color or shape compared to the organs of control mice. However, we did observe a significant decrease in the relative weights of liver, kidney and spleen of mice treated with *Mint Crystals* and *Petit Bandit*, compared with controls. The liver, kidneys and spleen are important organs in the metabolism, detoxification, storage and excretion of chemicals and their metabolites (22), making them vulnerable to toxicants. The decrease in the weight of these vital organs could be explained by cellular atrophy and/or a reduction in cell multiplication due to the fact that these recipes affect cell activity, proliferation and differentiation, and consequently lead to cell apoptosis (22). Evaluation of the skin and eye irritant powers of the three recipes used as women's secrets showed that all three recipes are non-irritant to the skin with dermal irritation scores between 0 and 0.4. *Djeka* and *Petit Bandit* are classified as substances with minimal irritant power on the eyes, with a Maximum Mean Total Score (MMTS) of 3.33 and 4, respectively for *Djeka* and *Petit Bandit*. The STMM for *Mint Crystals* is 30. According to OECD guideline 405(9), *Mint Crystals* are classified in the fifth class, i.e. among substances with moderate eye irritancy. The irritant power of *Mint Crystals* is a well-known property of the essential oils from which they are derived. Indeed, several authors have reported that essential oils can cause irritation to certain parts of the body, including the skin, mucous membranes, eyes and even ears. In view of their irritant power, the use of *Mint Crystals* vaginally presents a risk of injury to the vaginal mucosa.

Conclusion

The aim of this work was to study the physicochemical, organoleptic, and toxicological characteristics of three (03) recipes used in vaginal practices among women in the city of Ouagadougou. The presence of flavonoids, coumarins, tannins, and phenolic compounds in Djeka, as well as sterols and triterpenes in mint crystals, would justify women's interest in using these respective recipes. The results showed that *Djeka* has acid pH while *Mint Crystals* and *Petit Bandit* neutral pH. None of the formulations caused mortality in mice at a single dose of 2000 mg/kg bw. This indicates low acute toxicity of these formulations. However, a statistically significant decrease in the relative weight of the liver, kidneys, and spleen was observed in mice that received a dose of 2000 mg/kg bw of *Petit Bandit* and *Mint Crystals*. This indicates that the absence of mortality is not synonymous with the safety of the recipes, and raises questions about the precautions to be taken to protect consumers of these products. *Petit Bandit* and *Djeka* are non-irritating to eyes and skin, while *Mint Crystals* are moderately irritating to eyes and non-irritating to skin. Further investigations are needed to determine the impacts of each recipe on both hematological and biochemical parameters during short-term, medium-term, and long-term toxicity studies.

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Conflict of interest

The authors declare no conflict of interest

Contribution of authors

Sylvain ILBOUDO, Amyrat SEMDE and Jules YODA designed the study. Gaétan Donzèo SOMDA, Pengd-wendé Amirat Hosniyatou SEMDE, Benjamen OUEDRAOGO, Jules YODA, and Geoffroy Gueswindé OUEDRAOGO carried out the laboratory analysis of different parameters and performed statistical analysis. Writing the first draft was done by Sylvain ILBOUDO, Gaétan D. SOMDA, and Amyrat SEMDE. Sylvain ILBOUDO, Sibraogo KIEMTORE, Rasmané

SEMDE, Sylvin OUEDRAOGO, and Timongo Françoise Danielle MILLOGO/TRAORE reviewed the final manuscript.

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