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Evaluation of the iron content of the genus *Corchorus* species encountered in Cote d'ivoire

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Abstract
In Côte d'Ivoire, the leaves of the genus *Corchorus* species are used in traditional medicine. The plants concerned are *Corchorus aestuans*, *C. lobatus*, *C. olitorius* and *C. tridens*. The empirical reason advanced is the richness in iron of the leaves of these plants. The present study is about the iron content of the leaves of these species in order to verify this traditional conception. The study showed that the leaves of the *Corchorus* species analyzed are indeed rich in iron, but in varying proportions. *Corchorus aestuans* is the richest in iron with a content of 568.30 ± 0.26 mg / kg. According to the statistical tests, there is no significant difference for $P < 0.001$ between this level and that of *Moringa oleifera* (677.70 ± 0.37 mg / kg), used as reference taxon in this study. In relation to the three (3) other *Corchorus* species analyzed: *C. lobatus*, *C. olitorius* and *C. olitorius*, there is no significant difference between the iron contents of these three species. However, there is a significant difference between the iron contents of these three plants and that of *C. aestuans* for $P < 0.001$. There is also a significant difference between the iron content of these last three species of *Corchorus* and the iron content of *Moringa oleifera*. The empirical use of the leaves of *Corchorus* species in Côte d'Ivoire could have a scientific basis in view of the importance of iron in the constitution of blood.

Keywords: Côte d'Ivoire, *Corchorus*, iron

Introduction
Since ancient times, humans have resorted to plants [1]. This observation is explained by the use of plants in various areas of human life: food, health, crafts [2]. Among these plants of several uses, the species of *Corchorus* genus are well known throughout the world and especially in Africa.
In Côte d'Ivoire, the genus *Corchorus* species are known and have been the subject of many recent studies [3-8]. These scientific works revealed the food aspect of these plants and listed the species commonly eaten in the country, which are *Corchorus aestuans*, *C. lobatus*, *C. olitorius* and *C. tridens*. Besides the food aspect, the leaves of these plants of *Corchorus* are empirically used in the country to treat anemia for their iron content [9]. However, although these plants are widely consumed in Côte d'Ivoire, there is no serious study about the dosage of this mineral in the leaves of the different genus *Corchorus* plants to appreciate this traditional conception. This is the essential reason of this study. Its objective is to measure the iron content in the leaves of the different *Corchorus* species found in Côte d'Ivoire.

Material and methods
Biological material
The biological material used for this study concerns the prepared extracts from dried leaves of *Corchorus* species. The plants *Corchorus aestuans*, *C. lobatus*, and *C. olitorius* were coming from Bingerville gardening sites (Korhodougou), while *Corchorus tridens* was from Odienné (gardening site of Sokoura).

Technical material
In laboratory, various tools were needed in the search for minerals from dried leaves of *Corchorus* plants. We used in terms of glassware a funnel, 100 ml test tubes, beakers, micropipettes. Plastic jars and porcelain crucibles were necessary to contain the samples during handling. Ambours of 1ml and 1ul were also used to contain the crude extracts. A spatula was essential to recover the plant material after grinding and calcination. A Whattman paper (15 cm diameter) served as a filter for the crude extracts. In addition to this conventional equipment, the manipulations required devices such as: an electric grinder, an electric balance, a muffle furnace for calcining the biological material at 550 ° C, a vortex to solubilize the crude extracts and a flame atomic absorption spectrophotometry system connected to a computer for the detection and quantification of the mineral elements sought.

Two solvents were used for the preparation of the samples to be analyzed: nitric acid and bi-distilled water.

Mineralogical analysis

The mineralogical analysis of the samples collected was carried out at the National Laboratory for Agricultural Development (LANADA) of Côte d'Ivoire. It was done according to the classic method of said laboratory. This method has two phases: mineralization devoted to sample preparation and reading.

The mineralization of the samples was done by the dry method. The samples studied were well cleaned, packaged, labeled and transported in plastic bags to the laboratory. The plant material remained in the oven for 48 hours to complete the drying which took place in the open air beforehand. Twenty-five (25) grams of dried leaves were crushed by hand using a porcelain mortar and pestle. The mash was sieved and put in a jar. Then, using a precision balance, 0.5g of ground material from each sample was taken and placed in porcelain crucibles. Each ground material was calcined for 4 hours in a muffle furnace at 550 ° C. Each residue obtained was collected with 25 ml of nitric acid of concentration 0.1N. The different steps of this analysis technique are summarized in the figure 1 below.

The reading was made with a spectrophotometer using flame method, a classic method of LANADA. Dilutions were made depending on the concentration of the sample. The mineral is analyzed by atomic absorption.

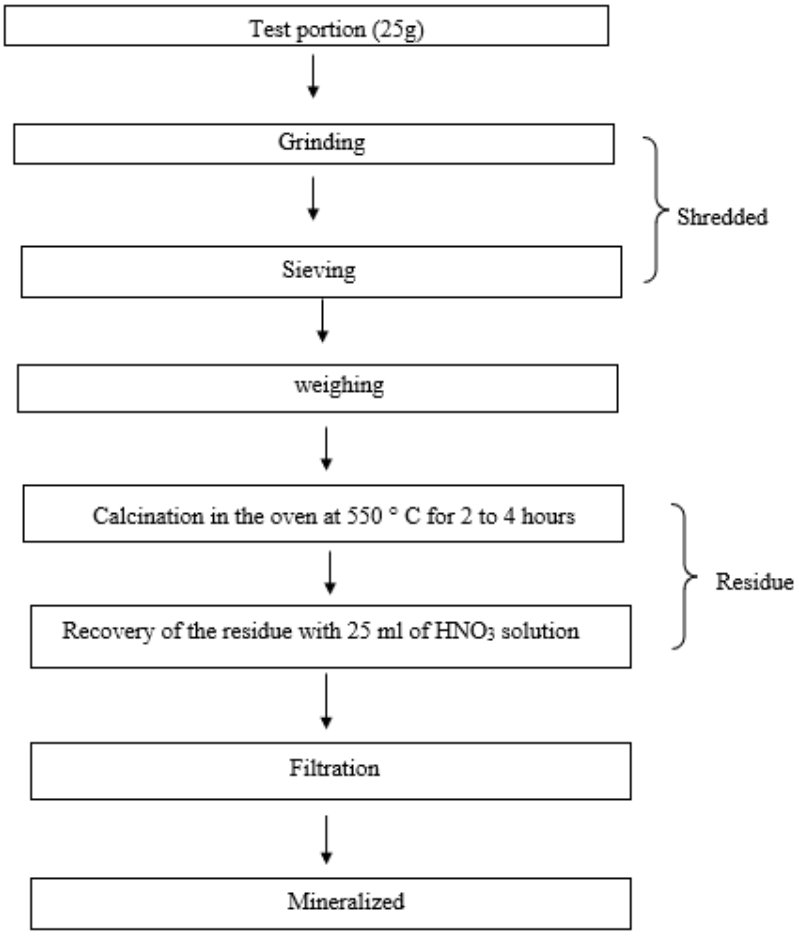

Fig 1: Steps in the process of mineralization of biological material about dry method

Statistical analysis of mineralogical data

Statistical analysis of the mineralogical data was carried out using the ANOVA 1 test supplemented by the Tukey test to verify the existence of significant differences between the mineralogical concentrations sought from a taxon to another one. The comparison went two ways. The iron contents of extracts from *Corchorus* species were first compared to each other and then compared to the iron content of extracts of *Moringa oleifera*, used in the study as a reference taxon. The mineralogical data of this reference taxon were taken from a similar study carried out by the same laboratory [7].

Results

The results of mineral analyzes of the leaves of the different *Corchorus* genus species are indicated in the following table.

Table 1: Average of iron content in the leaves of the different *Corchorus* species and the reference taxon.

Taxons	Average levels in mg / kg ± Standard deviations
Corchorus aestuans	568,30 ± 0,26^{b}
Corchorus lobatus	215,29 ± 0,05^{a}
Corchorus olitorius	246,42 ± 0,05^{a}
Corchorus tridens	292,91 ± 0,05^{a}
Reference taxon	
Moringa oleifera	677,70 ± 0.37^{b}

Means followed by different letters in the same column are significantly different for P <0.001

The table shows the assigned mean value with standard deviation of iron content for each species of *Corchorus* and for the reference taxon. All these species are rich in iron but the contents are different. According to the ANOVA test performed, there is no significant difference between the iron contents of three species analyzed: *Corchorus lobatus*, *C. olitorius* and *C. olitorius*. On the other hand, there is a significant difference between the iron contents of these three plants and that of *C. aestuans* for P <0.001. The iron content of *Corchorus aestuans* is the most important of the species of the genus analyzed. There is also a significant difference between the iron content of the three plants of *Corchorus* mentioned first and the iron content of *Moringa oleifera*, the reference taxon. However, there is no significant difference between the iron content of *C. aestuans* and that of *Moringa oleifera*. These two plants have similar and higher iron contents.

Discussion

The results show that the leaves of the four species of *Corchorus* are rich in iron with different contents. The species *C. aestuans* with a content of 568.30 mg / kg is the richest of the *Corchorus* plants in iron. It even has an iron content similar to that of *Moringa oleifera*. According to data from the Recommended Nutritional Intake, the daily iron requirement varies from 7 to 30 mg a day [10]. This need daily iron can be covered with less than 100g of each *Corchorus* species. It is the same case with *Moringa oleifera*. These plants of *Corchorus* genus are therefore a good source of iron. They would be suitable as a substitute for *Moringa oleifera*. In addition, iron is essential for the body to reconstitute red blood cells, the use of these plants to fight anemia may have a scientific basis. In fact, scientists have already discussed the use of *Corchorus* species and other leafy vegetables in the fight against anemia [11-13]. On the other hand, the iron composition of *Corchorus olitorius* has been indicated at 80 mg / kg in Togo [14]. This result is inconsistent with that of this study. The ivorian species of *Corchorus olitorius* would probably be richer in iron than the Togolese species in view of this latest study.

Conclusion

The present study concerns the determination of iron in the leaves of four (4) species of *Corchorus* genus in order to verify a traditional consideration. The study shows that the leaves of the *Corchorus* species analyzed are rich in iron but the contents are different. According to the statistical tests carried out, there is no significant difference between the iron contents of three species: *Corchorus lobatus*, *C. olitorius* and *C. olitorius*. However, there is a significant difference between the iron contents of these three plants and that of *C. aestuans* (P<0.001). There is also a significant difference between the iron content of these first three species of *Corchorus* and the iron content of *Moringa oleifera*, the reference taxon. On the other hand, there is no significant difference between the iron content of *C. aestuans* and that of *Moringa oleifera*, a plant well recommended by WHO for its mineralogical richness. The empirical use of the leaves of these *Corchorus* species in Côte d'Ivoire may have a scientific basis.

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