Local perceptions and ethnobotanical study of galactogenic plants in the city of Abéché, Chad.

SUMMARY

Forest resources make a significant contribution to food security and public health in sub-Saharan Africa. Many studies have been conducted in this field, but very few have focused on the role of galactogenic plants in breastfeeding-related disorders. The study was conducted in the city of Abéché, capital of the Ouaddaï region, a hub in eastern Chad. Its objective was to contribute to the study of galactogenic plants in this city. To this end, an ethnobotanical survey was conducted among 54 people. It consisted of compiling endogenous knowledge on the various galactogenic plants and their uses. The results showed that the vast majority of respondents (84.9%) had information about galactogenic plants. The floristic inventory identified 35 species grouped into 23 families and 32 genera. The most important families represent 48.57%. These are the Poaceae family (20%), the Combretaceae (8.57%) and the Fabaceae (8.57%). Leaves are the most commonly used organs for preparing galactogenic recipes, accounting for 45.9%, followed by seeds (32.78%), bark (8.19%) and fruit (6.55%). The methods of preparation frequently used for making galactogenic recipes are decoction (75.4%), maceration (11.47%) and infusion (11.47%). The main route of administration for the recipes is oral. These results demonstrate the importance of plant resources for the health of this population. However, they raise the issue of plant species management and protection, as well as the need to take indigenous knowledge into account in public health policies in Chad. These plants are currently in high demand in rural areas, and in-depth studies on their chemical properties and uses should be carried out.

Keywords: Indigenous knowledge, galactogenic plants, breast milk, Abéché, Chad

I. INTRODUCTION

Sub-Saharan Africa has the highest infant mortality rate in the world (UNIGME 2023). In the Sahel, and particularly in Chad, the high child mortality rate is partly caused by insufficient milk production in mothers (WHO, 2000). Solutions are always being considered to optimise milk production in breastfeeding mothers, but these remain costly and less accessible to poor households. Sufficient milk production in breastfeeding mothers would save more than 8 million babies aged 0 to 6 months worldwide and 11,500 aged 0 to 5 years in Chad

(UNICEF, 2018) . Early and exclusive breastfeeding is one of the essential interventions promoting neonatal survival (Gartner et al., 2005). Breastfeeding promotes the physical growth of the child, strengthens the mother-child bond, boosts the child's immunity and reduces the costs associated with purchasing formula milk and seeking medical care (Walters et al., 2017). However, the quality and quantity of breast milk are the result of many factors, primarily diet. Therefore, it is essential to find ways and means to boost breast milk production in nursing mothers. As a result, identifying woody plants and herbs that promote breast milk production is of paramount importance, particularly in developing countries where access to food supplements is limited. In Africa, people have always had a wealth of traditional knowledge thanks to the cultural and ecological diversity of the environment in which they live (Van Den Eyden et al., 1994). Faced with the real threats of anthropogenic pressure and climate change to the survival of plant resources, it is important to acquire as much information as possible about local galactogenic plant species. This would involve immersing oneself in traditional knowledge about galactogenic plants and the preparations that these populations use in order to offer inexpensive, sustainable and accessible solutions. The main objective of this study is to contribute to the study of galactogenic plants used in the city of Abéché.

II. MATERIALS AND METHODS

II.1 MATERIALS

II.1.1 Overview of the study site

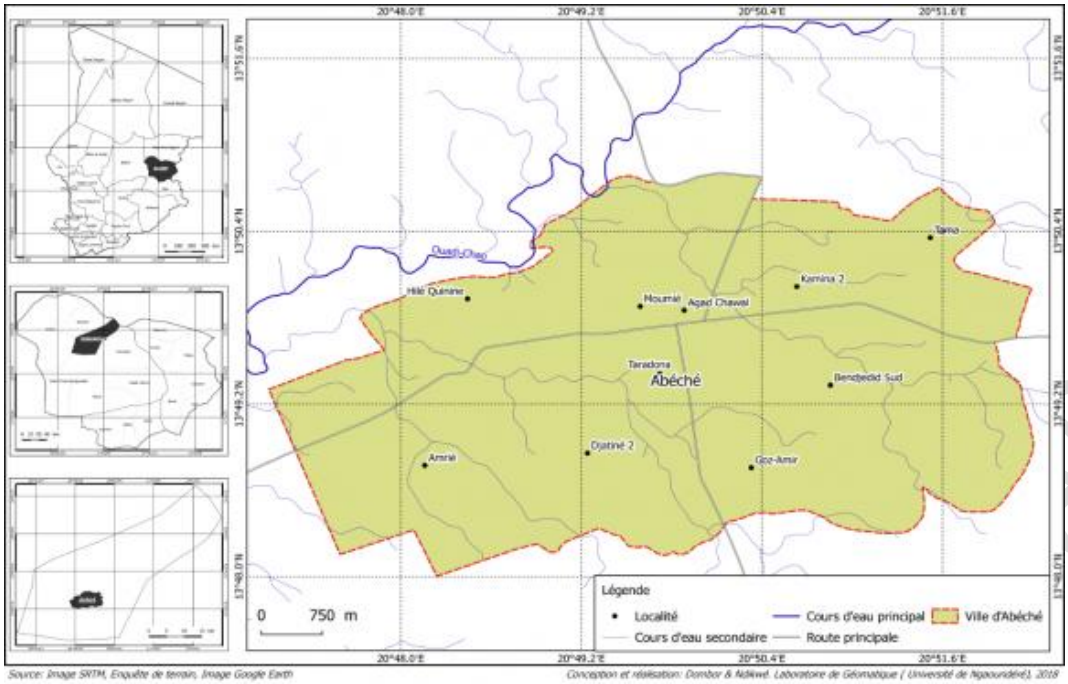

Figure 1: Map of the city of Abéché

The city of Abéché, capital of the province of Ouaddaï, is located in the Ouaddaï massif between 13°45'0"“and 14°0'0"' north latitude and between 20°40'0"“and 21°0'0"' east longitude (Figure 1). The city covers an area of 29,980 km² and has a population of approximately 200,000. Located in the centre of the Sahelian region, the province has a short rainy season (from July to September) and a long dry season, as well as relatively large temperature variations (Souleymane et al., 2017). Average annual rainfall is between 200 and 400 mm, with vegetation characterised by shrubby savannah and very open wooded steppe (Béchir & Kaboré-Zoungrana, 2012). Water resources are mainly limited to temporary watercourses (ouadis) and alluvial aquifers. As in the rest of the country, agriculture employs more than 80% of the region's working population. Outside cultivated land, vegetation takes the form of savannah, ranging from grasslands with scattered trees in the north to woodlands in the south, with shrub and tree formations in between (Chahad et al., 2015). The most common woody species are Acacia: *Acacia tortillis, Acacia seyal, Acacia laeta, Acacia nilotica, Acacia senegal*, followed by *Balanites aegyptiaca, Ziziphus mauritiana, Boscia senegalensis, Bauhinia rufescens, Pilostigma toninguii, Sclerocarya birrea, and Guiera senegalensis*.

I.2 METHODOLOGY

II.2.1 Ethnobotanical survey

A socio-economic survey inspired by the method developed by Turfund et al. (2001) was conducted among men and women in the city of Abéché. Semi-structured interviews were conducted using a pre-designed questionnaire. The questionnaire was divided into three sections: socio-economic characteristics of the respondent, knowledge and social practices regarding breastfeeding, and local perceptions of galactogenic plants. It contained both closed and open-ended questions. The questions were asked in the local Arabic dialect. The respondents belonged to different ethnic groups. The individual interviews were supplemented by group interviews. The number of people per group varied between two and five.

II.2.2 Socio-demographic characteristics of respondents

The ethnobotanical survey on the traditional use of medicinal plants took place from 24 July to 27 August 2024. A total of 54 people were interviewed, including 23 men (42.59%) and 31 women (57.4%). The age of the interviewees ranged from 30 to 74 years, with an average age of 50. People over the age of 60 constituted the most represented age group, accounting for 37.03% (Figure 2). However, some very elderly people were avoided due to the risk of memory loss and unreliable responses. Young people (under 30 years of age) were not included in the study due to their inexperience. Regarding the educational level of the people interviewed, 52.83% were uneducated, the majority of whom were women. The people interviewed belonged to different social classes and had varied occupations (housewives, artisans, farmers, herders, civil servants, etc.).

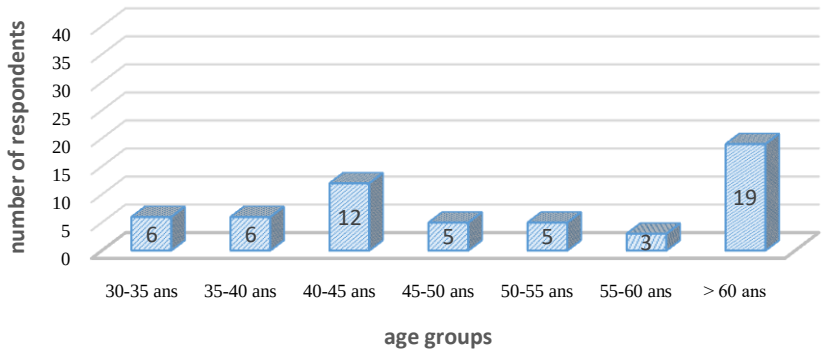

Figure 2: Distribution of respondents by age group

II.2.3 Study population

The survey involved people aged 30 and over. These included mothers, herbalists, artisans and other people interested in the study. Older people were more sought after because of their experience.

- **Inclusion criteria**

- Breastfeeding or non-breastfeeding mothers aged 30 years or older and residing in the city of Abéché;

- Herbalist or any other person (male) aged at least 30 years old and residing in the city of Abéché;

- **Exclusion criteria**

- Mother or other person not consenting to the study;

- Mother or other person not residing in the city of Abéché.

II.3 DATA ANALYSIS

The texts were entered using WORD 2016 software. The data collected was analysed using EXCEL 2016 software. The results were presented in tables and figures. This software was used to determine citation frequencies using the following formula: FC = NC / NR X 100 (where: NC = Number of citations; NR = Total number of respondents).

III. RESULTS

III.1 Botanical inventory

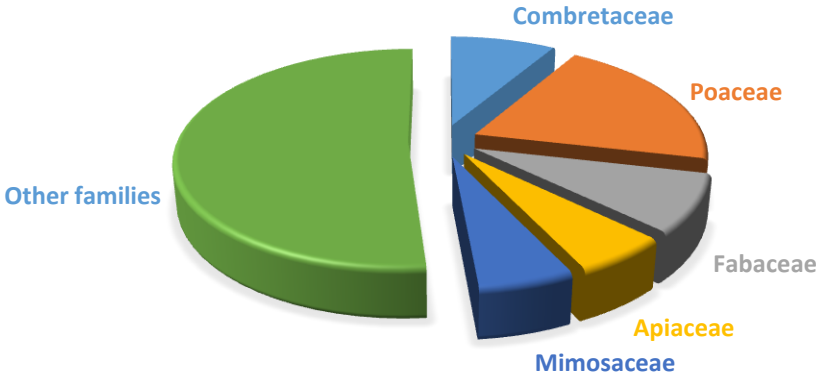

Figure 3: Frequency of galactogenic plant families

A total of 35 galactogenic species divided into 23 families and 32 genera were inventoried (Figure 07). The most important families represent (48.57%). These are: the Poaceae family with 7 species (20%), Combretaceae with 3 species (8.57%), Fabaceae with 3 species (8.57%) and finally Apiaceae and Mimosaceae with 2 species each. All other families are represented by a single species each (Table 3). These are Malvaceae, Bignoniaceae, Rubiaceae, Sapotaceae, Lilliaceae, Apocynaceae, Pedaliaceae, Cesalpiniaceae, Zygophyllaceae, Bombacaceae, Moraceae, Moringaceae, Caricaceae, Lamiaceae, Euphorbiaceae, Arecaceae, Zingiberaceae and Cypperaceae. The most represented genera are Combretum, Cymbopogon and Acacia, with two species each.

Table I: Distribution of species by family

Species	Local name	Family	FC	Part used
Kigelia africana	Machtour	Bignoniaceae	1,88	Fruit
Cymbopogon citratus	Citronnelle	Poaceae	1,88	Leaves
Cinchona officinalis	Quinin	Rubiaceae	1,88	Leaves
Trigonella foenum-grecum	Hilbé	Fabaceae	15,09	Seeds
Vitellaria paradoxa	Amkouroum	Sapotaceae	1,88	Fruit
Allium sativum	Toum	Liliaceae	3,77	Bulb
Guiera senegalensis	Khibbeche	Combretaceae	3,77	Leaves

Sesanum indicum	Simsim	Pedaliaceae	1,88	Seeds
Tamarindus indica	Ardeb	Cesalpiniaceae	1,88	Fruits
Calotropis procera	Ouchar	Apocynaceae	3,77	Leaves
Foeniculum vulgare	Chamar	Apiaceae	3,77	Leaves
Balanites aegyptiaca	Hadjilidj	Zygophyllaceae	1,88	Bark
Sorghum bicolor	Doura	Poaceae	1,88	Seeds
Adansonia digitata	Kalakouka	Bombacaceae	1,88	Leaves
Arachis hypogea	Foul	Fabaceae	3,77	Seeds
Combretum glutinosum	Habile	Combretaceae	1,88	Leaves
Triticum sativum	Guémé	Poaceae	1,88	Seeds
Mentha spicata	Nana	Lamiaceae	15,09	Leaves
Zea mays	Massar	Poaceae	3,77	Seeds
Euphorbia hirta	Amlibbéné	Euphorbiaceae	3,77	Leaves
Acacia nilotica	Garat	Mimosaceae	3,77	Leaves
Daucus carota	Carotte	Apiaceae	1,88	Leaves
Ficus platiphylla	Djimmez	Moraceae	1,88	Leaves
Vigna unguiculata	Loubia	Fabaceae	1,88	Seeds
Cymbopogon schoenanthus	Mahreb	Poaceae	1,88	Seeds
Combretum micranthum	Kinkliba	Combretaceae	1,88	Seeds
Moringa oleifera	Halloum	Moringaceae	1,88	Leaves
Carica papaya	pappa	Caricaceae	3,77	Leaves
Hibiscus sabdariffa	Karkagne	Malvaceae	3,77	Flowers
Acacia senegal	Kitir	Mimosaceae	1,88	Rubber
Brachiaria riziziensis	Barsim	Poaceae	1,88	Seeds
Pennisetum typhoides	Doukhoune	Poaceae	1,88	Seeds
Cypperus esculentus	Sigguete	Cypperaceae	1,88	Rhizome
Zingiber officinale	Khouroundjal	Zingiberaceae	3,77	Rhizome
Phoenix dactylifera	Tamour	Arecaceae	1,88	Fruit

NC: number of citations; FC: frequency of citations

The plant species mentioned by respondents are woody and herbaceous plants. The most frequently mentioned plants are Trigonella foenum-grecum (fenugreek) and Mentha spicata (spearmint), each with 15.09% (Figure 4).


Euphorbia hirta L. (Source HSYZ)*Guiera senegalensis* J.F.Gmel. (Source HSYZ)


*Kigelia africana (*Lam) Benth*Combretum glutinosum*

Figure 4: Some local galactogenic species

III.2 Organs used

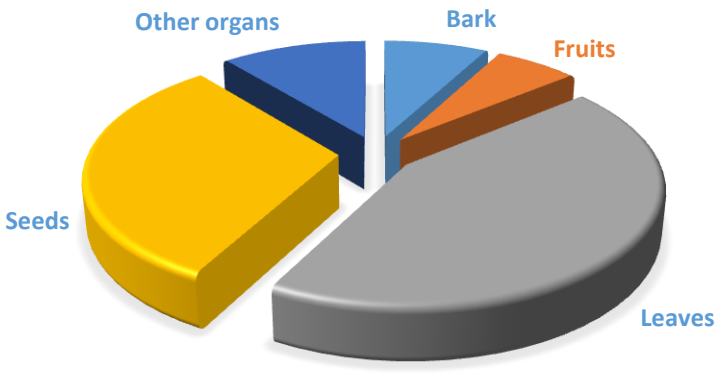

Figure 5: Frequency of use of organs

The whole plant or one of its parts are the different forms used in recipes. Figure 6 shows the frequency of use of plant parts. Analysis of this figure shows that leaves are the most commonly used part in the preparation of remedies, with a rate of 45.9%. Next come seeds (32.78%), fruits (6.55%), bark (8.19%) and finally rhizomes, bulbs, roots, gum and flowers, each with a rate of 1.63%.

II.3 Methods of preparation and administration of recipes

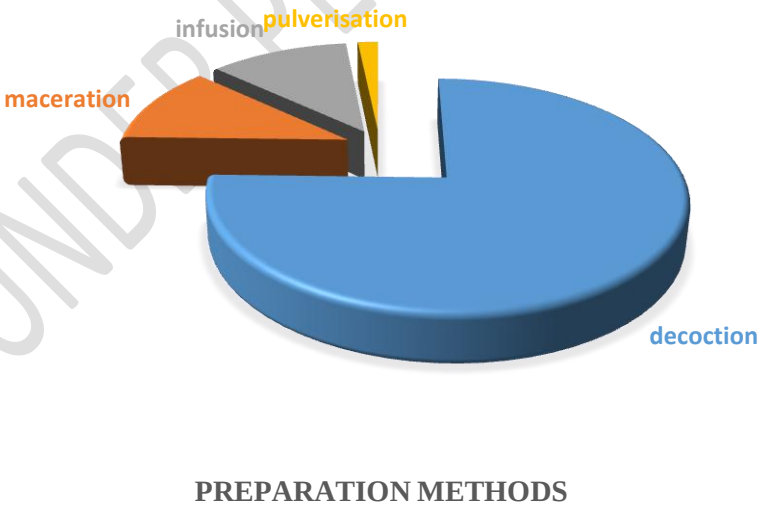

Figure 6: Frequency of different methods of preparing recipes

Figure 6 shows the different methods of preparing recipes and their frequency of use in milk production. The method most commonly used by the population of Abéché for plant-based recipes is decoction (75.4%), followed by maceration (11.47%) and infusion (11.47%). Oral administration is the only method used to administer remedies (100%) to increase milk production in breastfeeding women in this city.

TableII: Distribution of species according to organs and preparation methods

Species	Families	Parts used	Preparation methods
Kigelia africana	Bignoniaceae	Fruit	Decoction
Cymbopogon citratus	Poaceae	Leaves	Decoction
Cinchona officinalis	Rubiaceae	Leaves	Decoction
Trigonella foenum-grecum	Fabaceae	Seeds	Decoction
Vitellaria paradoxa	Sapotaceae	Fruit	Maceration
Allium sativum	Liliaceae	Bulb	Maceration
Guiera senegalensis	Combretaceae	Leaves	Decoction
Sesanum indicum	Pedaliaceae	Seeds	Spraying + Infusion
Tamarindus indica	Cesalpiniaceae	Fruit	Infusion
Calotropis procera	Apocynaceae	Leaves	Decoction
Foeniculum vulgare	Apiaceae	Leaves	Macération
Balanites aegyptiaca	Zygophyllaceae	Bark	Decoction / Maceration
Sorghum bicolor	Poaceae	Seeds	Decoction
Adansonia digitata	Bombacaceae	Leaves	Decoction
Arachis hypogea	Fabaceae	Seeds	Decoction
Combretum glutinosum	Combretaceae	Leaves	Decoction
Triticum sativum	Poaceae	Seeds	Decoction
Mentha spicata	Lamiaceae	Leaves	Decoction
Zea mays	Poaceae	Seeds	Decoction
Euphorbia hirta	Euphorbiaceae	Leaves	Decoction / Infusion
Acacia nilotica	Mimosaceae	Leaves	Decoction
Daucus carota	Apiaceae	Leaves	Infusion
Ficus platiphylla	Moraceae	Leaves	Decoction
Vigna unguiculata	Fabaceae	Seeds	Decoction
Cymbopogon schoenanthus	Poaceae	Seeds	Decoction
Combretum micranthum	Combretaceae	Seeds	Decoction

Moringa oleifera	Moringaceae	Leaves	Decoction / Infusion
Carica papaya	Caricaceae	Leaves	Decoction
Hibiscus sabdariffa	Malvaceae	Flowers	Decoction / Maceration
Acacia senegal	Mimosaceae	Eraser	Maceration
Brachiaria riziziensis	Poaceae	Seeds	Decoction / Infusion
Pennisetum typhoides	Poaceae	Seeds	Decoction
Cypperus esculentus	Cypperaceae	Tuber	Infusion
Zingiber officinale	Zingiberaceae	rhizome	Decoction
Phoenix dactylifera	Arecaceae	Fruit	Maceration / Infusion

IV. DISCUSSION

Local perceptions of galactogenic plants

The results of this study reveal that the majority (84.9%) of the population of the city of Abéché has very good knowledge of galactogenic plants. This population uses 35 plant species to boost milk production in nursing mothers. According to Mapongmetsem (2005), the large number of plants identified can be explained by the population's good knowledge of flora and the mixing of customs. The galactogenic properties of the species *Balanites aegyptiaca*, *Adansonia digitata* and *Guiera senegalensis* cited by these populations are also reported in the ethnobotanical surveys conducted by Wezel in 2002 in the Felingué department of Niger. Furthermore, the use of Poaceae such as *Sorghum bicolor*, *Zea mays* and *Pennisetum typhoïdes*to increase milk production in nursing mothers is consistent with the findings of authors such as KIE Deleke Koko et al. (2009).

Flora analysis

35 galactogenic species divided into 23 families and 32 genera are used by the population to increase milk production in breastfeeding women. Among the 23 families listed, Poaceae (20%), Combretaceae (8.57%) and Fabaceae (8.57%) are the most represented. The high proportion of Poaceae is explained by the greater species richness of this family in Chad (César and Châtelain, 2019). Periodically available species are used in the preparation of galactogenic recipes according to preferences and knowledge of their virtues. *Trigonella foenum-grecum*, *Mentha spicata*, *Guiera senegalensis*, *Hibiscus sabdariffa*, *Foeniculum vulgare*, *Euphorbia hirta* and *Allium sativum* are, in order of importance, the most commonly used species in the various recipes.

Organs used

This study shows that leaves are the most commonly used organs. The high frequency of use of this organ can be explained by its availability and ease of harvesting, but also scientifically by its photosynthetic activity. Indeed, leaves are the primary site of metabolite synthesis in plants. According to Dongock et al., 2017, leaves are highly sought after by traditional healers because of their richness in active substances.

Galactogenic recipes

The majority of respondents are over 60 years old. The experience of these individuals could reflect the reliability of these recipes. Indeed, knowledge of the uses of plants and their properties is generally acquired through long experience accumulated and passed down from generation to generation (Belamdini et al., 2014). Some recipes include a single organ or a combination of organs such as leaves, seeds, bark, roots, etc. Decoction is the most commonly used method of preparation among this population. The importance of decoction shows that this population has a very good knowledge of this method of preparation and finds it suitable for extracting the active ingredients. These results are similar to those obtained by Koulibaly et al. (2016), who showed that recipes vary from one species to another and are often administered in the form of a decoction. However, decoction can destroy certain active ingredients in the species used.

CONCLUSION

The ethnobotanical study of galactogenic plants in the city of Abéché identified 35 species divided into 23 families and 32 genera. These results demonstrated that there is a diversity of plant species that promote milk production in breastfeeding women in this city. This proves the importance of plant resources in the health of the Chadian population. Furthermore, they raise the issue of the management and protection of these resources and, at the same time, the need to take traditional knowledge into account in public health policies in Chad. Galactogenic plants are still in high demand in rural areas where breastfeeding is the only means of feeding infants. However, these plants are vulnerable, and in-depth studies on their chemical properties and uses should be carried out.

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