Background: Obesity is a global epidemic that affects both developed and developing countries. According to World Health Organization (WHO), in 2014, over 1.9 billion adults were overweight. Burkina Faso, like other countries, faces the problem of obesity, with a prevalence of 7.3%. The main cause is excessive intake of caloric foods combined with low physical activity, although genetic, endocrine and environmental influences (pollution) can sometimes be predisposing factors. This metabolic imbalance often leads to multiple pathologies (heart failure, Type II diabetes, cancers, etc.). Drugs have been developed for the treatment of these diseases; but in addition to having many side effects, locally these products are not economically accessible to the majority of the population. Burkina Faso, like the other countries bordering the Sahara, has often been confronted in the past with periods of famine during which populations have generally used anorectic plants to regulate their food needs. This traditional ethnobotanical knowledge has not been previously investigated. An ethnobotanical survey was conducted in Burkina Faso in the provinces of Seno (North) and Nayala (Northwest) to list the plants used by local people as an anorectic and/or for weight loss.

Methods: The survey, conducted in the two provinces concerned traditional healers, herbalists, hunters, nomads and resourceful people with knowledge of plants. It was conducted over a period of two months and data were collected following a structured interview with the respondents. The approach was based on dialogue in the language of choice of the respondent and the use of a questionnaire. The data have been structured and then statistically analyzed. Results: The fifty-five (55) respondents of the survey were aged between 40 and 80 years. Sixty-one (61) plant species, belonging to thirty-one (31) families were listed as appetite suppressants and/or for their anti-obesity properties. The main families of plants are Mimosaceae, Rubiaceae, Asclepiadaceae and Cesalpiniae. Fruits are the most used part of the plant organs. Consumption in the raw state or as a decoction are the two main forms of preparation. Conclusion: The great diversity of plants cited by informants demonstrates the existence of rich local knowledge to address obesity in Burkina Faso. Evaluation of the biochemical activity of the extracts of the most cited species could allow the development of a phytomedicine economically accessible to the majority of the population. This could allow for the preservation of biodiversity in this region which is weakened by climate change because some of the species cited are in fragile state or are threatened with extinction.

Keywords: obesity; anorexigenic plant; Burkina Faso; metabolic disease; ethnobotany
1. Introduction

Obesity is a condition that concerns people of all ages in both developed and developing countries. According to the World Health organization (WHO), in 2014, over 1.9 billion adults were overweight in the world. Burkina Faso has faced a fast growing obesity problem in the last decade, and today more than 7.3% of its population is affected [1]. In addition to being a social handicap, this metabolic imbalance is often associated with diseases such as hypertension, myocardial infarction, stroke, type II diabetes, dyslipidemia and certain cancers [2]. Excessive weight gain is usually caused by increased consumption of high caloric foods and decreased physical activity. Genetic (familial predisposition), biological (endocrine disorders), environmental (pollution) [3] factors may also contribute to this problem.

In Burkina Faso as in most developing countries, urbanization and socio-economic development are accompanied by a change in diet towards more with a high energy density foods (more meat, fat, salt and sugary foods) as well as a reduction in physical activity (mechanized transport) [4] resulting in increased storage of the excess calories as fat in adipose tissue. An aggravating cause of the situation in Africa is the antiquated traditional African conception of affluence, according to which obesity of women is a positive indicator of the material abundance of the family and of a good reproductive health. One can find, in the pharmaceutical market, some synthesis of chemical drugs that are used against obesity: Sibutral, Rimonabant, Isomeride, Xenical, Lorcanerin, Ponderal, Alli, and Qsymia. But the cost of these products generally puts them out of reach of most people; and worse, many of these products have many side effects [5].

That is the reason for the withdrawal from the market of some older drugs such as Sibutral, Rimonabant, Isomeride, Ponderal and Xenical [5,6]. The development of new antiobesity molecules from natural products has become a necessity. This seems realizable because in phytotherapy, several types of plants are used against this disease. The plant bioactive extracts would act through their inhibitory activities for digestive lipases, adipocyte differentiation, or by increasing thermogenesis and anorexia [7]. Burkina Faso, like other Sahelian countries, has often been confronted in the past with periods of famine. During these times of food shortage, people have generally used plants with anorectic effects to regulate their food and drink intake. Burkina Faso is also a savannah country with many nomadic and hunter societies. During their displacements or hunting parties, these people could be facing period of lack of food or water. These populations survived thanks to a strong ethnobotanical knowledge able to help in the management of satiety. However, in Burkina Faso there are few data on these plant species used as anorectics or against obesity. An ethnobotanical survey was conducted in the province of Seno (nomadic area in Burkina Faso northern area) and the Nayala (traditional hunting area in northwest of Burkina Faso) in order to collect information on plants used by local people as anorectics and/or to manage weight. This study aimed to establish an inventory of appetite suppressant or antiobesity plant species.

2. Materials and Methods

2.1. Study Area

Burkina Faso (Figure 1) is a landlocked country located in the heart of West Africa and enclosed between six countries: Mali, Niger, Benin, Togo, Ghana and Cote d'Ivoire. It covers an area of approximately 274,000 km². It is located inside the loop of the Niger River between 10° and 15° north latitude and between 2° east and 5°30' west longitude. Its capital city is Ouagadougou. The climate is characterized by a long dry season (from October to May) and an irregular rainy season (from June to September). Monthly average temperatures range between 22°C and 42°C. Except for the extreme north which consists of desert or semi-desert, Burkina Faso is a savannah country. The homogenous and seasonal-dependent vegetal landscape is constituted by *Parkia biglobosa* (Néré in French), *Vitellaria paradoxa* (Karité in French), *Cassia* sp and *Andasonia digitata* ecosystems. This country is divided into 45 provinces grouped into 13 regions.
Figure 1. Maps of the survey area.
The surveys were conducted in the two north provinces where nomadic or hunting populations reside.

Seno Province, whose capital is Dori, is located in the north eastern area of Burkina Faso. It has 215 villages and an area of 6979 km$^2$ with a population of 264,815 people [8]. This locality has a Sahelian climate, characterized by a long dry season (May to October) and a short rainy season (average rainfall of 400 mm), with varying temperatures (10–43°C), low humidity, wind and a large amounts of sunshine, typical of the Sahel. The vegetation is characterized by wooded and shrubby steppe that is heavily damaged. However, there are a few gallery forests which are generally located along the rivers (like the swamp of Dori or the Yakouta River). The dominant types of vegetation are thorn trees [9].

Famine is recurrent in this province. The predominant population is the Fulani group, who are nomadic herders. They have survived drought in this region through their knowledge of appetite suppressing plants.

Located in the northwest of Burkina Faso, Nayala province (whose capital is Toma) has an area of 3919 km$^2$ with a population of 156,861 and a northern Sudanian climate. The vegetation consists of shrub or herbaceous savannah with some groves near villages. Soils are clayey [10]. Many hunter groups live in this province. It often happens that these hunters lose themselves in the bush tracking a hunted animal. To survive these situations (temporary lack of water or food, which can take days), they have developed a rich ethnobotanical knowledge on plants possessing appetite suppressing or thirst quenching properties.

2.2. Methods

2.2.1. Data Collection

The ethnobotanical survey was conducted in the provinces of Seno and Nayala during the period from August to September 2013. Over 70 interviews were conducted in different localities of these provinces. Data were collected following a structured interview with traditional healers, herbalists and hunters. These groups are located in each of these areas, organized in associations. A preliminary meeting was held during which they were informed about the objectives of the study. After information was provided, the people who agreed to participate in the survey were individually interviewed. The approach was based on a dialogue using the language of choice of the respondent and the use of a questionnaire. A field trip was organized and plants mentioned in the interview were collected with the help of the respondent in order to make the herbal constitution. The intervention of interpreters was necessary in some cases. The cited and harvested plant specimens were identified by Professor Jeanne Millogo-Rasolodimby (Botanist, Department of Ecology/University of Ouagadougou).

2.2.2. Data Analysis

Survey data were first extracted manually then entered and processed by Excel software. The citation frequencies of all data obtained from this study was subjected to descriptive statistical analysis by calculating the frequency of plant citations, using the formula:

$$F = \frac{\text{Number of people who cited the species}}{\text{Total number of persons interviewed}} \times 100$$

(1)

2.2.3. The Use Value Index (UVI)

The use value index (UVI) of a species for each use class is evaluated to show the importance that people attach to a given species in the localities [11]. It is obtained by calculating the following:

$$\text{UVI} = \frac{U}{N}$$

(2)
Where \( U \) is the number of times that species is cited for a category of use and \( N \) the total number of informants.

3. Results

3.1. Results

3.1.1. Traditional Knowledge: Age and Gender

During the survey 55 people have been interviewed including 34 in Nayala and 21 in Seno. The mean age varies between 40 and 81 years and over 50% were between 50 and 70 years old (Figure 2). The practice time (in years) varies between 7 and 35. Men represented 92.7% of the respondents versus 7.3% what were women. All were traditional healers, herbalists, hunters or elderly nomadic person with knowledge on plants. In total 62 plant species belonging to 32 families were listed as having anorectic and/or anti-obesity activity. Table 1 shows the list and ethno-botanic characteristics of these plant species.

![Classification by age of surveyed](image)

**Figure 2.** Age group of informants.

3.1.2. Part of Plant and Method of Preparation

The analysis of the mode of use of the various listed plants revealed that 53.6% of plants are appetite suppressants, 30.4% are used to lose weight and 15.9% are used as a thirst quencher. Most of the species cited are trees (59.6%), followed by shrubs (20.9%), herbs (14.5%) and creeping plants (4.8%) (Figure 3). Tables 2–4 present the species which are used as appetite suppressants, for weight reduction and as thirst quenchers; with the part used and the use value indexes. *Raphionacme daronii* Berhaut. (Asclepiadaceae) is the most commonly used species for appetite suppressant activity, with a use value index of 0.27; followed by *Gardenia erubescens* Stapf and Hutch. (Rubiaceae) with 0.22 as its use value index. For slimming property, the species *Tamarindus indica* L. (Caesalpiniaaceae) and *Ozoroa insignis* Del. (Anacardiaceae) are the most used with use value of 0.05. *Raphionacme daronii* Berhaut. (Asclepiadaceae) and *Brachystelma bingeri* A. Chev. (Asclepiadaceae) with respective use value indexes of 0.27 and 0.16 are most commonly used as a thirst quencher. Concerning part of plants, fruits have the highest frequency of use (Figure 4). Decoctions (35.5%) and raw consumption (64.5%) (Figure 5) are the main forms of use. Oral ingestion is the main means of administration.
Table 1. Plants listed after the survey in Seno and Nayala.

| Species and Family | Local Name | Frequency Citation (%) | Parts Used | Indication                        | Preparation and Use Methods | Posology |
|--------------------|------------|------------------------|------------|-----------------------------------|-----------------------------|----------|
| 1. *Acacia laeta* Benth. (Fabaceae) | Gon sablega (mo) | 1.7 | bark | weight loss | decoction | ND |
| 2. *Acacia nilotica* (L.) Delile (Fabaceae) | Gommier (Fran) | 3.4 | gum | appetite suppressant and thirst quencher | raw gum consumption | ND |
| 3. *Acacia senegal* (L.) Willd. (Fabaceae) | Gon-mougou | 1.7 | bark | weight loss | decoction | ND |
| 4. *Acacia seyal* Del. (Fabaceae) | Gom miougou | 3.4 | bark | weight loss | decoction | ND |
| 5. *Adansonia digitata* L. (Bombacaceae) | Baobab (fran) | 10.16 | fruits | appetite suppressant and thirst quencher | raw fruits consumption | ND |
| 6. *Afzelia africana* Smith ex Pers. (Fabaceae) | Para (san) | 3.4 | leaves | weight loss | decoction | ND |
| 7. *Annona senegalensis* Pers. (Annonaceae) | Guinikou (san) | 3.4 | fruits | appetite suppressant and thirst quencher | raw fruits consumption | ND |
| 8. *Azadirachta indica* A. Juss. (Meliaceae) | Kakki (ful) | 1.7 | leaves | weight loss | decoction | ND |
| 9. *Balanites aegyptiaca* (L.) Delile (Balanitaceae) | Tanèè (ful), sinbèlè (san) | 8.47 | fruits | appetite suppressant and thirst quencher | raw fruits consumption | ND |
| 10. *Bauhinia rufescens* Lam. (Fabaceae) | Tippoja (mo) | 3.4 | bark | weight loss | decoction | ND |
| 11. *Boscia angustifolia* A. Rich. (Capparaceae) | Haasu carè (sonrai) | 3.4 | leaves | appetite suppressant and thirst quencher | raw leaves consumption | Causes fart |
| 12. *Brachystelma bingeri* A.Chev. (Asclepiadaceae) | Sensenega (mo), Daffio (tmac) | 15.25 | roots | appetite suppressant and thirst quencher | raw root consumption | ND |
| 13. *Cadaba farinosa* Forsk. (Capparidaceae) | Moussilèè (san) | 3.4 | leaves | appetite suppressant and thirst quencher | raw leaves consumption | Causes fart |
| 14. *Ceratotheca sesamoides* Endl. (Pedaliaceae) | Dou (san) | 6.78 | leaves | appetite suppressant and thirst quencher | raw leaves consumption | ND |
| 15. *Ceropegia senegalensis* H. (Apocynaceae) | Kirmougoim (san) | 3.4 | roots | appetite suppressant and thirst quencher | raw root consumption | ND |
| 16. *Citrullus colocynthis* (L.) Schrad. (Cucurbitaceae) | Dènè (ful) | 8.47 | fruits | appetite suppressant and thirst quencher | raw fruits consumption | ND |
| 17. *Citrullus aurantifolia* (Christm.) Swingle (Rutaceae) | Dènè (ful) | 3.4 | fruits | weight loss | decoction of the leaves of *combretum micranthum* then add fruit juice of *citrus aurantifolia* and use as a drink. | 1 liter per day for 2 to 3 months |
| 18. *Cochlospermum planchonii* Hook. f. ex Planch. (Cochlospermaceae) | Birpin (san) | 3.4 | roots | weight loss | decoction | ND |
| 19. *Cochlospermum tinctorum* Perrier ex A. Rich. (Cochlospermaceae) | Gotoro (san) | 1.7 | roots | weight loss | decoction of *afzelia africana* leaves and roots of *cochlospermum tinctorum* and use as a drink. | ND |
| 20. *Combretum micranthum* G. Don. (Combretaceae) | Randega (mo) | 1.7 | leaves | weight loss | decoction of the leaves of *combretum micranthum* then add the fruit juice of *citrus aurantifolia* and use as a drink. | 1 liter per day for 2 to 3 months |
| 21. *Commiphora africana* (A. Rich.) Endl. (Burseraceae) | Nbadadi (ful) | 11.86 | roots | appetite suppressant and thirst quencher | raw roots consumption | ND |
| Species and Family | Local Name | Frequency Citation (%) | Parts Used | Indication | Preparation and Use Methods | Posology |
|-------------------|------------|------------------------|------------|------------|-----------------------------|----------|
| 22. *Cordia africana* Lam. (Boraginaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 23. *Detarium microcarpum* Guill. et Perr. (Fabaceae) | 3.4 | fruits | appetite suppressant | raw fruits consumption | ND |
| 24. *Digitaria exilis* (Kippist) Stapf (Poaceae) | 1.7 | seeds | weight loss | cooking and eat | ND |
| 25. *Discorea bulbifera* L. (Discoreaceae) | 1.7 | roots | appetite suppressant | raw root consumption | ND |
| 26. *Disopyros mespiliformis* Hochst. ex A.DC (Ebenaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 27. *Eustada africana* Guill et Perr. (Fabaceae) | 1.7 | leaves | weight loss | decoction | ND |
| 28. *Fadogia aegretis* Schweinf. ex Hlirn (Rubiaceae) | 1.7 | roots | appetite suppressant | raw consumption | ND |
| 29. *Ficus sycomorus* L. (Moraceae) | 3.4 | fruits | appetite suppressant | raw fruits consumption | ND |
| 30. *Gardenia aqualla* Stapf & Hutch (Rubiaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 31. *Gardenia erubescens* Stapf et Hutch (Rubiaceae) | 20,34 | fruits | appetite suppressant | raw fruits consumption | ND |
| 32. *Grewia bicolor* Juss. (Tiliaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 33. *Grewia villosa* Willd. (Tiliaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 34. *Hibiscus sabdariffa* L. (Malvaceae) | 5.08 | seeds | appetite suppressant | decoction | ND |
| 35. *Holarrhena floribunda* (G.Don) T.Durand & Schinz var. floribunda (Apocynaceae) | 1.7 | leaves | weight loss | decoction | ND |
| 36. *Hyphaene thebaica* (L.) Mart (Arecaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 37. *Kykya senegalensis* (Desv.) A.Juss. (Meliaceae) | 1.7 | bark | weight loss | decoction | ND |
| 38. *Lannea microcarpa* Engl. & K. Krause (Anacardiaceae) | 1.7 | fruits | appetite suppressant | raw fruits consumption | ND |
| 39. *Leptadenia hastata* Vatke (Asclepiadaceae) | 10.16 | leaves and fruits | appetite suppressant | decoction of the bark or leaves and use as a drink | ND |
| 40. *Mitragyna inermis* (Willd.) Kuntze (Rubiaceae) | 1.7 | leaves and bark | weight loss | decoction of the bark or leaves and use | ND |
| 41. *Moringa oleifera* Lam (Moringaceae) | 1.7 | principal root | weight loss | make a decoction of the dried primary root and use as a drink | ND |
| 42. *Ozorina insignis* Del. (Anacardiaceae) | 5.08 | leaves | weight loss | decoction of the leaves and use for drinking and washing | ND |
| 43. *Parkia biglobosa* (Jacq.) G.Don (Fabaceae) | 1.7 | seeds | appetite suppressant | decoction | ND |
| 44. *Phoenix dactylifera* L. (Arecaceae) | 1.7 | bark, root | weight loss | decoction of the roots of *zimia americana* and bark of *parkia biglobosa*, drinking and wash with decoction | ND |
| 45. *Pseudocedrela kotschyi* (Schweinf.) Harms (Melaceae) | 1.7 | small branches | thirst quencher | raw small branches consumption | ND |
Table 1. Cont.

| Species and Family | Local Name | Frequency Citation (%) | Parts Used | Indication | Preparation and Use Methods | Posology |
|--------------------|------------|------------------------|------------|------------|-----------------------------|----------|
| 48. Raphionacme daronii Berhaut (Asclepiadaceae) | Goin (sa) | 25.42 | root | appetite suppressant and thirst quencher | raw root consumption | ND |
| 49. Saba senegalensis (A.DC.) Pichon var. senegalensis (Apoecynaceae) | Mara (san) | 3.4 | fruits | appetite suppressant | raw fruits consumption | ND |
| 50. Sarcocephalus latifolius (Sm.) E.A.Bruce (Rubiaceae) | Nolga (Mo) | 3.4 | fruits | appetite suppressant | raw fruits consumption | ND |
| 51. Sclerocephalore hirsutae (A.Rich.) Hochst. (Anacardiaceae) | Noor (Mo) | 3.4 | fruits | thirst quencher | raw fruits consumption | ND |
| 52. Sterculia setigera Delile (Sterculiaceae) | Kartountoun (sa) | 3.4 | fruits | appetite suppressant and thirst quencher | raw fruits consumption | Excess fruit gives stomach bloating |
| 53. Strychnos spinosa Lam. Lam (Loganiaceae) | Inguetabi (ful) | 5.08 | bark, fruits root | weight loss | 1. decoction of the bark powder and dried fruit and use as drink 2. decoction of the roots and use as a drink | Take half glass of tea decoction in the morning and noon before meals |
| 54. Tamarindus indica L. (Fabaceae) | Souroun (san) | 1.7 | root | thirst quencher | raw roots consumption | ND |
| 55. Terminalia superba Guill. & Perr. (Combretaceae) | Kouou (san) | 3.4 | young leaves | appetite suppressant | raw leaves consumption | ND |
| 56. Vernonia kotschyanus Sch.Bip. ex Walp. (Asteraceae) | Yirimassa (diou) | 5.08 | root | appetite suppressant | raw root consumption (fresh or dried) | ND |
| 57. Vitellaria paradoxa C.F.Gaertn. (Sapotaceae) | Kou (san) | 5.08 | fruits | appetite suppressant | raw fruits consumption | ND |
| 58. Vitis doneana Sweet (Verbenaceae) | Koutin (san) | 3.4 | fruits | appetite suppressant | raw fruits consumption | ND |
| 59. Ximenia americana L. (Olacaceae) | Marafoo (san) | 1.7 | root | weight loss | decoction of the roots of ximenia americana and bark of parkia biglobosa, drink and wash with decoction | ND |
| 60. Ximenia americana L. (Olacaceae) | Guiabé (ful), tomón (san) | 6.78 | fruits, root | appetite suppressant | raw fruits consumption, boil the roots and take the decoction beverage | Take ½ glass of decoction on morning and evening |
### Table 2. Species with supposed appetite suppressant activity, their use value index and the parts used.

| Species                  | Use value Index | Parts Used    |
|--------------------------|-----------------|---------------|
| 1. Annona senegalensis   | 0.036           | Fruits        |
| 2. Balanites aegyptica   | 0.109           | Fruits        |
| 3. Brachystelma bingleri | 0.163           | Tuber         |
| 4. Cadaba farinosa       | 0.036           | Leaves        |
| 5. Ceratotherca sesamoides| 0.072           | Leaves        |
| 6. Ceropedogia senegalensis| 0.036         | Roots         |
| 7. Citrullus colocynthis | 0.090           | Fruits        |
| 8. Commiphora africana   | 0.127           | Bark          |
| 9. Cordia africana       | 0.018           | Fruits        |
| 10. Detarium microcarpum | 0.036           | Fruits        |
| 11. Dioscorea bulbifera  | 0.018           | Tuber         |
| 12. Diospyros mespiliformis | 0.018     | Fruits        |
| 13. Fadogia agrestis     | 0.018           | Roots         |
| 14. Ficus sycomorus      | 0.036           | Fruits        |
| 15. Gardenia aquilla     | 0.018           | Fruits        |
| 16. Gardenia erubescens  | 0.218           | Fruits        |
| 17. Grewia bicolor       | 0.018           | Fruits        |
| 18. Grewia flavescens    | 0.018           | Fruits        |
| 19. Grewia villosa       | 0.018           | Fruits        |
| 20. Hibiscus sabdariffa  | 0.054           | Seeds         |
| 21. Hyphaene thebaica    | 0.018           | Fruits        |
| 22. Leptadenia hastata   | 0.018           | Fruits        |
| 23. Leptadenia lastata   | 0.109           | Leaves        |
| 24. Panicum laetum       | 0.018           | Seeds         |
| 25. Phoenix dactylifera  | 0.018           | Fruits        |
| 26. Raphionacme daronii  | 0.272           | Tuber         |
| 27. Sarcocephalus latifolius | 0.036   | Fruits        |
| 28. Scleroarpa birea     | 0.036           | Fruits        |
| 29. Sterculia setigera   | 0.036           | Gum           |
| 30. Strzychnos spinosa   | 0.018           | Fruits        |
| 31. Saba senegalensis    | 0.018           | Fruits        |
| 32. Terminalia macroptera| 0.036           | Fruits        |
| 33. Tamarindus indica    | 0.054           | Fruits        |
| 34. Vernonia lotechyanus | 0.054           | Roots         |
| 35. Vitellaria paradoxa  | 0.054           | Fruits        |
| 36. Vitex doniana        | 0.036           | Fruits        |
| 37. Xysmalobium heudelotianum | 0.018   | Tuber         |
| 38. Zizyphus mauritiana  | 0.072           | Fruits        |

Figure 3. Applied share of different categories of plants.
Table 3. Plants having weight reduction potential, their use value index and the parts used.

| Species               | Use Value Index | Parts Used |
|-----------------------|-----------------|------------|
| 1. Acacia laeta       | 0.018           | Bark       |
| 2. Acacia nilotica    | 0.018           | Bark       |
| 3. Acacia seyal       | 0.018           | Bark       |
| 4. Afzelia africana   | 0.018           | Leaves     |
| 5. Azadirachta indica| 0.018           | Leaves     |
| 6. Bauhinia rufescens | 0.036           | Bark       |
| 7. Boscia angustifolia| 0.036           | Young leaves|
| 8. Citrus aurantifolia| 0.036           | Fruits     |
| 9. Cochlospermum planchonii | 0.036 | Root       |
| 10. Cochlospermum tinctorium | 0.018 | Root       |
| 11. Combretum micranthum | 0.018        | Leaves     |
| 12. Digitaria excisa  | 0.018           | Seeds      |
| 13. Entada africana   | 0.018           | Leaves     |
| 14. Holarrhena floribunda | 0.018 | Leaves     |
| 15. Khaya senegalensis| 0.018           | Bark       |
| 16. Mitragyna inermis | 0.018           | Leaves and bark|
| 17. Moringa oleacea   | 0.018           | Root       |
| 18. Oquoa insignis    | 0.054           | Leaves     |
| 19. Parkia biglobosa  | 0.036           | Bark and seeds|
| 20. Tamarindus indica | 0.054           | Bark and fruits|
| 21. Ximenia americana | 0.018           | Root       |

Table 4. Thirst quencher Species with supposed thirst quenching activity, their usual value an the parts used.

| Species                  | Use Value Index | Parts Used          |
|--------------------------|-----------------|---------------------|
| 1. Acacia senegal        | 0.036           | Gum                 |
| 2. Adansonia digitata    | 0.036           | Bark                |
| 3. Brachystelma bingeri  | 0.163           | Tuber               |
| 4. Ceratotheca seainoides| 0.072           | Leaves              |
| 5. Citrudus colocynthlis | 0.090           | Fruits              |
| 6. Commiphora africana   | 0.127           | Bark                |
| 7. Pseudocedrela kotschyi| 0.018           | Stem                |
| 8. Raphionacme daronii   | 0.272           | Tuber               |
| 9. Sclerocarya birrea    | 0.036           | Fruits              |
| 10. Strochnus spinosa    | 0.036           | Fruits              |
| 11. Terminalia acicennoides| 0.018         | Seeds               |

Using part of different plants organs (%)

Figure 4. Using part of different plant organs.
3.1.3. Families of Plants Used

The study indicates that Mimosaceae, Rubiaceae, Asclepiadaceae, Cesalpiniaceae, Anacardiaceae, Apogynaceae, Meliaceae, Combretaceae and Tiliaceae have been the most cited as appetite suppressant/anti-obesity plants (Figure 6). Raphionacme daronii (F = 25.4%), Gardenia erubescens (F = 20.3%), Brachystelma bingeri (F = 15.3%), Commiphora africana (F = 11.9%), Leptadenia hastata (F = 10.2%), Balanites aegyptiaca (F = 10.2%) are the six species with the highest frequencies of use.

![Figure 5. Use of various preparation methods.](image)

3.2. Discussion

The survey has allowed identifying 62 species of plants which have anorectic and/or anti-obesity activity. Most interviewees were men; female healers or hunters are rare in these provinces. In Africa these activities are mainly the responsibility of men and the knowledge is transmitted very often from father to son. The 62 species listed have already been studied for some properties (Table 5).

Eight species, namely Leptadenia hastata, Balanites aegyptiaca, Zizyphus mauritiana, Tamarindus indica, Khaya senegalensis, Brachystelma bingeri, Azadirachta indica, and Adansonia digitata have been cited both in Nayala and Seno. So, these plants grow well in a Sahelian or in a Sudanian climate. In this study Raphionacme daronii (F = 25.4%), Gardenia erubescens (F = 20.3%), Brachystelma bingeri (F = 15.3%),
Commiphora africana \( (F = 11.9\%) \) Leptadenia hastata \( (F = 10.2\%) \) and Balanites aegyptiaca \( (F = 10.16\%) \) are the six species which have presented the highest frequency of citation and greater use value indexes in the group of appetite suppressant plants species. This indicates the importance given to these plants by these populations in the treatment of obesity or as an anorectic.

Raw fresh material directly and decoctions are the two main forms of consumption. Anorectic or thirst quenching plants are usually eaten raw as they are most often used to immediately remedy a situation of hunger or thirst. The preparations generally involve a single plant material, but sometimes mixtures can also be used. In the latter, a synergistic effect may be supposed \[12\].

There are some differences in the methods of preparation and parts of plants used according to each locality. For example, the decoction of bark and fruits of Tamarindus indica is used in Seno while the decoction of roots is used in Nayala. Also, fruits of Zizuphus mauritiana are prescribed as an appetite suppressant in both localities but the roots are used for weight loss in Seno.
Table 5. Pytocyemistry and pharmacology of plants cited.

| Species and family          | Wild or Cultivated Status | Availability Information/Threat Status | Phytochemistry | Pharmacological properties                      |
|-----------------------------|---------------------------|----------------------------------------|----------------|---------------------------------|
| 1. Acacia laeta Benth. (Fabaceae) | wild                      | available species                      | carbohydrate [13] | anti microbial activity [14]       |
| 2. Acacia nilotica (L.) Delile (Fabaceae) | wild                      | available species                      | alkaloids, glycosides, anthraquinones, cardiac glycosides [15] | antitumor activity [16], antidiabetic activity [17] |
| 3. Acacia senegal (L.) Willd. (Fabaceae) | wild                      | available species                      | alkaloids, glycosides, flavonoids [18] | antidiabetic activity [19] hepatoprotective activity [20] |
| 4. Acacia seyal Del. (Fabaceae) | wild                      | available species                      | proteins, phenolics, flavonoids and anthocyanin [13] | antibacterial activities [21] |
| 5. Adansonia digitata L. (Bombacaceae) | wild                      | threatened species                     | protein, carbohydrate, fat, fibre, ash, vitamin C, A [22] | anti-diarrhoeal activity [23], anti-tumor action [24] |
| 6. Afzelia africana Smith ex Pers. (Fabaceae) | wild threatened species   | available species                      | lipide, carbohydrate [25] alkaloids [26] | antidiabetic and haematological effect [27] anthelmintic effect [26] |
| 7. Annona senegalensis Pers. (Annonaceae) | wild                      | available species                      | rutin, quercetin, quercetrin, anonaïne, tannin glycosides, proteins [27] | anticonvulsant properties [28] |
| 8. Azadirachta indica A. Juss. (Meliaceae) | wild/cultivated           | available species                      | reducing sugar, glycosides, alkaloids, tannins, flavonoids, terpenoids, saponin [29] | antibacterial activity [29] |
| 9. Balanites aegyptiaca (L.) Delile (Balanitaceae) | wild                      | available species                      | galactose, manrose, arabinose, xylose, rhamnose [30], alkaloids, flavonoids [31], saponoside steroidal [32] | anti-tumor activity [33] |
| 10. Bauhinia rufescens Lam. (Fabaceae) | wild                      | available species                      | carbohydrate, crude fibre, crude proteins cyanogenic glucoside [34] menisdaurin, oxepin [35] | antibacterial effects [34] |
| 11. Boscia australis A. Rich. (Capparaceae) | wild                      | threatened species                     | alkaloids and saponins [36] | antibacterial activity [36] |
| 12. Brachypelma bingeri A.Chev. (Asclepiadaceae) | wild                      | threatened species                     | saponins, triterpens, sterols [37] | treatment of insufficient sperm, male sexual asthenia, as turnicostimulant [37] |
| 13. Cadaba farinosa Forsk. (Capparidaceae) | wild                      | available species                      | cadabicine [38] | |
| 14. Ceratobium sesamoides Endl. (Pedaliaceae) | wild/cultivated           | available species                      | flavonolignans, triterpene saponins, isoflavones, triterpenoids [37] and phenylpropanoid lignan [39] | antiplasmodial activity [40] |
| 15. Ceropegia senegalensis H. (Apocynaceae) | wild                      | available species                      | | |
| 16. Citrullus colocynthis (L.) Schrad. (Cucurbitaceae) | wild/cultivated           | available species                      | β-sitosterol [41] | antidiabetic effect [42] analgesic activities [43] |
| 17. Citrus aurantifolia (Christm.) Swingle (Rutaceae) | cultivated               | available species                      | 5-goranyloxyporalaen; 5-goranylox-7-methoxycoumarin; 5,7-dimethoxycoumarin; 5-methoxyporalaen; and 5,8-dimethoxyporalaen [44] | anti-cancer activity [45], anti-mycobacterium tuberculosis activity [44] |
| 18. Coffea arabica (L.) ex Planch. (Coffeaceae) | wild                      | available species                      | cardiac glycosides, cardenolides and dienolides, alkaloids, steroids, and tannins, flavonoid, phlobatannins [46] | anti-ulcerogenic activity [47] |
| Species and family | Wild or Cultivated Status | Availability Information/Threat Status | Phytochemistry | Pharmacological properties |
|--------------------|--------------------------|----------------------------------------|----------------|-----------------------------|
| 19. Cochlospermum tinctorium Perrier ex A.Rich. (Cochlospermaceae) | wild | available species | alkaloids, flavonoids, tannins and cardiac glycoside [48] | antimicrobial activity [49], hepatoprotective activity [50] |
| 20. Combretum microanthum G. Don. (Combretaceae) | wild | threatened species | epicatechin and catechin as penta-acetates, epigallocatechin, gallolatechin and bartogenic acid 28-β-D-glucoside [51] | anti-hyperglycaemic activity [52], antibacterial [53] |
| 21. Commiphora africana (A. Rich.) Engl. (Curceraeaceae) | wild | threatened species | cardiac glycosides [54], α-ouabain and 3β-glucoside [55] | antimicrobial activity [54] |
| 22. Cordia africana Lam. (Boraginaceae) | wild | available species | alkaloids, flavonoids, total phenols and tannins [56] | antibacterial activities [57] |
| 23. Detarium microcarpum Guill. et Perr. (Fabaceae) | wild | threatened species | flavonoids, saponins, steroids and glycosides | against hepatitis C virus [59] |
| 24. Digitaria exilis (Kippist) Stapf (Poaceae) | wild | available species | apigenin and luteolin [60] | postprandial hyperglycemia [61] |
| 25. Dioscorea bulifera L. (Dioscoreaceae) | cultivated | available species | carbohydrates, proteins, amino acids, fats, oils, steroids, glycosides, alkaloids, tannins and phenolics [62] | antifungal actions [63], antibacterial activities [64] |
| 26. Diospyros mespiliformis Hochst. ex A.DC. (Ebenaceae) | wild | threatened species | flavonoids [65] | antipyretic, analgesic and anti-inflammatory [66] |
| 27. Entada africana Guill et Perr. (Fabaceae) | wild | available species | alkaloids, saponins, flavonoids, glycosides, anthraquinone, terpenes, phenols, resins and saponins [67] | anti-angiogenic activity [68], anti-hepatitis C [69] |
| 28. Entada africana Guill et Perr. (Fabaceae) | wild | available species | alkaloids, saponins, flavonoids, glycosides, anthraquinone, terpenes, phenols, resins and saponins [67] | anti-angiogenic activity [68], anti-hepatitis C [69] |
| 29. Ficus sycomorus L. (Moraceae) | wild | available species | tannins, alkaloids, reducing compounds, saponins, flavonoids, steroids, terpenoids and anthraquinone [70] | sedative and anticonvulsant effects [74] |
| 30. Gardenia aqualla Stapf & Hutch (Rubiaceae) | wild | available species | flavonoids, phytosterols, phenolics, carboxydrates, tannins, triterpenoids, anthraquinone [71] | anticancer activities [76], antimicrobial activity [77] |
| 31. Gardenia erubescens Stapf & Hutch (Rubiaceae) | wild | available species | flavonoids, phytosterols, phenolics, carbohydrates, tannins, triterpenoids, anthraquinone [71] | anticancer activities [76], antimicrobial activity [77] |
| 32. Grewia bicolor Juss. (Tiliaceae) | wild | available species | alkaloids, saponins, flavonoids, glycosides, anthraquinone, terpenes, phenols, resins and saponins [67] | anti-angiogenic activity [68], anti-hepatitis C [69] |
| 33. Grewia flavescens Juss. (Tiliaceae) | wild | available species | flavonoids, glycosides, phenolics, carboxydrates, tannins, triterpenoids [83] | anti-bacterial and analgesic effect [83] |
| 34. Grewia villosa Willd. (Tiliaceae) | wild | triterpenoids, steroids, glycosides, flavones, lignanes, phenolics, alkaloids, lactones [83] | anti-bacterial and analgesic effect [83] |
| 35. Hibiscus sabdariffa L. (Malvaceae) | cultivated | available species | alkaloids, tannins, saponins, glycosides, phenols and flavonoids, glycosides [84] | diuretic activity [85], anti-obesity effects [86] |
| 36. Holarrhena floribunda (GoDorn) T.Durand & Schinz var. floribunda (Apocynaceae) | wild | available species | fat, fiber, protein, carbohydrates, alkaloid, saponin, tannin and cardiac glycosides [87] | hypoglycaemic activity [88] |
Table 5. Cont.

| Species and family | Wild or Cultivated Status | Availability Information/Threat Status | Phytochemistry | Pharmacological properties |
|--------------------|----------------------------|----------------------------------------|----------------|-----------------------------|
| 37. *Hyphaene thebaica* (L.) Mart (Arecaceae) | available species | tannins, steroids and moderate level of saponins, carbohydrates, cardiac glycosides, flavonoids, and terpenoids [89] | antimicrobial properties [89] hypoglycaemic properties [89] |
| 38. *Khaya senegalensis* (Desv.) A.Juss. (Meliaceae) | wild | threatened species | alkaloids, saponins, tannins and flavonoids [91] | hepatoprotective activity [92] |
| 39. *Lannea microcarpa* Engl. & K. Krause (Anacardiaceae) | wild | threatened species | anthocyanosides [93] 4α-methoxy-myricetin 3-α-L-rhamnopyranoside, myricetin 3-β-D-glucopyranoside, vitexin, iso-vitexin, gallic acid and epi-catechin [84] | anti-inflammatory activities [95] |
| 40. *Leptadenia hastata* Vatke (Asclepiadaceae) | wild | available species | D-cymarose and D-oleandrose [96]. tannins, glycosides, alkaloids, flavonoids. [97] | diabetes [96] antibacterial activity [98] anti-androgen property [99]. |
| 41. *Mitragyna inermis* (Willd.) Kuntze (Rubiaceae) | wild | available species | sterol, triterpene, polyphenol; flavonoid, catechic tannin, saponoside and alkaloid [100] | anticonvulsant properties [101] hepatoprotective activity [102] |
| 42. *Moringa oleifera* Lam (Moringaceae) | cultivated | available species | glucose, fructose [103] | antiobesity and hypolipidemic activity [104] |
| 43. *Ozoroa insignis* Del. (Asclepiadaceae) | wild | available species | methyl 3α,24S-dihydroxytirucalla-8,25-dien-21-oate; methyl 3α-hydroxy-24-oxotirucalla-8,25-dien-21-oate [105] | antimicrobial activity, cytoprotective effect [106] |
| 44. *Panicum laetum* Kunth (Poaceae) | wild | available species | proteins, carbohydrates [107] | antiplasmodial activities [109] the antivenom venom activities [110] |
| 45. *Parkia biglobosa* (Jacq.) L.Dem (Fabaceae) | wild | threatened species | cardiac glycosides, steroids, tannins and alkaloids [108] | nephroprotective, antibacterial, antidiabetic activities [111] |
| 46. *Phoenix dactylifera* L. (Arecaceae) | wild | available species | carbohydrates, vitamins, proteins [111] | nephroprotective activities [113] |
| 47. *Pseudocedrela kotschyi* (Schweinf.) Harms (Meliaceae) | wild | available species | tannins, saponins [112] | nephroprotective activities [113] |
| 48. *Raphiolepis daurica* (Sm.) Behb (Asclepiadaceae) | wild | available species | sugars and starch [114] | |
| 49. *Salvia senegalensis* (A.DC.) Pichon var. *senegalensis* (Apocynaceae) | wild | threatened species | malic acid, protein, vitamin e [115], tannins, flavonoids, saponins, coumarins, anthocyanoides, triterpenes and steroids [116] | anti-inflammatory, analgesic effect [116] |
| 50. *Sarcocephalus latifolius* (Sm.) E.A.Bruce (Rubiaceae) | wild | available species | 21-O-ethylstrictosamide aglycone, strictosamide, angustidine, angustoline, 19-O-ethylangustoline, naucleodine, 19-epi-naucleodine [117] | anti-microbial activities [118] |
| 51. *Sclerocarya birrea* (A. Rich.) Hochst. (Anacardiaceae) | wild | available species | cellulose, proteins, [119] anthocyanins, flavonoids, tannins, saponins [120] | hypoglycemic activity [121] |
| 52. *Sterculia setigera* Delile (Sterculiaceae) | wild | threatened species | saponins, steroidal, sterols and flavonoids [122] | antiplasmodial, anti-inflammatory activity [123] |
Table S. Cont.

| Species and family | Wild or Cultivated Status | Availability Information/Threat Status | Phytochemistry | Pharmacological properties |
|--------------------|---------------------------|---------------------------------------|----------------|--------------------------|
| 53. *Strychnos spinosa* Lam. Lam (Loganiaceae) | wild | available species | saringosterol and 24-hydroperoxy-24-vinylcholesterol [124] | antitrypanosomal activity [125] |
| 54. *Tamarindus indica* L. (Fabaceae) | wild | threatened species | 9β, 19-Cyclo-3β,4,4,14,-trimethyl-5α-cholestan-3β-ol, 24β-Ethyl cholest-5-ene [126] | antiobesity effect [127] |
| 55. *Terminalia avicennioides* Guill. & Perr. (Combretaceae) | wild | available species | steroids, glycosides, flavonoids, tannins, ellagic acids arjunolic acid, α-amyrin, 2,3,23-trihydroxyolean-12-ene [128] | antimycobacterial activty [128] |
| 56. *Terminalia macroptera* Guill. & Perr. (Combretaceae) | wild | threatened species | 3,3-di-O-methylellagic acid, 3,4,3',4'-tetra-O-methylellagic acid, terflavine A [129] | anti-helicobacter pylori activity [130] |
| 57. *Vernonia kotschyan* Sch.Bip. ex Walp. (Astéraceae) | wild | threatened species | arabinogalactane pectin [131], vernoniosides D1, D2, F1 and F2 and a new androst-8-ene glucoside [132] | antiulcer activity [133] |
| 58. *Vitellaria paradoxa* C.F.Gaertn. (Sapotaceae) | wild/cultivated | threatened species | anthocyanins, flavonoids, catechol tannins, saponins [134] | emmenagogue [134] |
| 59. *Vitex doniana* Sweet (Verbenaceae) | wild | threatened species | flavonoids, anthracone derivatives, essential oil, pigments, tannins, terpenes glycosides, triterpenes [135] | antimicrobial activities [136] |
| 60. *Ximenia americana* L. (Olacaceae) | wild | threatened species | triterpen (mediagenic acid; oleanen glucoside) and steroidal compounds (6–7 hydrositosteron;sitosteroside) [137] | antimicrobial, antitrypanosomal, molluscicide and analgesic [137] |
| 61. *Xysmalobium heudelotianum* Decne. (Asclepiadaceae) | wild | threatened species | | |
| 62. *Zizyphus mauritiana* Lam. (Rhamnaceae) | wild | threatened species | tannins, sterols and triterpenes, flavonoids, leucoanthocyanins [138] | anti hyperglycemic activities, antihypertensive, and diuretic activity [139] |
According to the literature, *Zizyphus mauritiana*, *Tamarindus indica* and *Moringa oleifera* have previously been tested for anti-obesity activity [140–142]. This could be linked to a widespread use of these species in many regions for the same indication.

The most cited plants have already been studied for various activities:

*Balanites aegyptiaca* is mainly consumed in dearth times by the population [143], and it contains carbohydrates, steroidal saponines, fiber, gum [37] alkaloids and flavonoids [32]. It also contains galactose, mannose, arabinose, xylose, rhamnose and glucuronic acid [31]. Their fruits are used against diabetes [30,144] as well as the seeds [145]. The plant is also known having anti-tumor activity [33] and an anti-infertility property [146].

Leaves of *Leptadenia hastata* are rich in tannins, glycosides, alkaloids, carbohydrates and flavonoids. [98]. D-Cymarose and D-oleandrose were also isolated [97]. They are used against diabetes 97 and supposed having antibacterial activity [98] and anti-androgen property [99].

*Commiphora africana* contains cardiac glycosides and reducing sugars [147]. It has antimicrobial activity and is traditionally used against diarrhea [54].

Fruit and young leaves of *Gardenia erubescens* are consumed during dearth periods [148]. These fruits contain carbohydrates and fibers [149] and they are also rich in anthraquinones, tannins, sterols and triterpenes [77]. The leaves contain tannins, triterpene saponins, other triterpenoids, iridoids and sterols. The bark is rich in triterpene saponins, triterpenoids and sterols [37]. The leaves are used for the treatment of digestive parasites in small ruminants [78] and the bark of the trunk has analgesic and diuretic activity [79].

*Gardenia erubescens* is traditionally used against hepatitis [150].

*Raphionacme daronii* is a plant used during times of famine; it is eaten raw [148,151]. The tuber contains sugars and starch [114].

The tuber of *Brachystelma bingeri* is used against insufficient sperm and male sexual asthenia, and it is very nutritious, stimulating and can act as a tonic [37]. It is consumed during famine periods [143] and is rich in carbohydrates, saponins, triterpenes and sterols [37].

The most cited plants listed during the survey have not been investigated for an anti-obesity study. So, there is a need to test their bioactivity and eventually study the phytochemistry and pharmacological profile of these plants in order to scientifically support traditional ethnobotanical and to secure their use.

4. Conclusions

The ethnobotanical survey revealed the presence of an enormous biodiversity of plants used in these two north provinces of Burkina Faso to modulate appetite and thirst. This rich ethnobotanical background indicates the high potential of traditional knowledge to serve for the development of natural product-derivates as affordable medicines. This may contribute to the preservation of traditional knowledge on anti-obesity herbs of these two provinces of Burkina Faso. Twenty-two species cited are in fragile state or are threatened with extinction. This requires taking safeguard measures. It is therefore useful to study the ecology of these species, evaluate the resources and the natural regeneration potential. Reforestation with these species requires the mastery of the production of seeds and planting in areas of high use. This is an important endeavour that could help to fight against the massive destruction of these plants, in the context of climate change and the unprecedented human pressure on the environment. Investigation into these six most cited and not yet studied species could lead to the discovery of new products to address the obesity epidemic.

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