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RESEARCH ARTICLE

EVALUATION OF THE NUTRITIONAL AND ANTIOXIDANT PROPERTIES OF FERMENTED AND NON-FERMENTED SABA SENEGALENSIS SEEDS

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Abstract

Forest resources contribute to meeting the needs of populations through the supply of food and medicinal products. This study aimed to evaluate the nutritional and antioxidant properties of fermented and non-fermented seeds of Saba senegalensis. After 6 days of fermentation, the fermented and non-fermented seeds were dried for 8 days in the sun. Dried seeds were crushed and the flours obtained were used to determine the different parameters. Results of the nutritional properties of non-fermented and fermented seeds are respectively as follows: ash (1.87 and 1.79%), proteins (11.65 and 15.25%), lipids (6.05 and 5.34%) and fibers (54.25 and 52.25%). Mineral element contents are: Mg (55.09 and 50.33 mg/100g), Ca (95.23 and 80.55 mg/100g), zinc (3.15 and 2.83 mg/100g) and Fe (11.36 and 10.81 mg/100g). Concerning the antioxidant properties, the results are as follows: phenolic compounds (272.48 and 320.50 mg/100g), flavonoids (7.66 and 5.41 mg/100g) and tannins (98.81 and 80.81 mg /100g). Anti-radical activity of fermented and non-fermented seeds are 58.19 and 50.73% respectively. These results show that the consumption of Saba senegalensis seeds could contribute to the food security of populations.

Introduction:-

Forest resources are used for various purposes, including pharmacopoeia, food supply, construction, the timber industry, and handicrafts. In sub-Saharan Africa, many woody species provide non-timber products that make a substantial contribution to food security and improve the living conditions of local populations (Lykke and Padonou, 2019). Exploiting these resources generates income that supports the socio-economic development of rural households and contributes to national economic growth (Assogbadjo et al., 2012; Vodouhê et al., 2009).

Among these resources, *Saba senegalensis* is a wild liana native to African savannas. It contributes to meeting the primary needs of populations by providing food, medicinal, and technological products.

Nutritionally, the fruit of *S. senegalensis* is a source of provitamin A, vitamin C, carbohydrates, dietary fiber, and minerals (Boamponsem, 2013; Diabagate et al., 2019). Pulp is usually consumed fresh or processed artisanally into

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juice, nectar, jam, and syrup. It is also used to acidify cereal-based dishes. Artisanal processing of the pulp into nectar involves manual extraction or milling (Sarr et al., 2018; Kouakou et al., 2019). Additionally, the leaves are used as a condiment in sauces (Arbonnier, 2019; Boamponsem, 2013).

Therapeutically, the leaves, roots, and fruit are used to treat wounds, food poisoning, dysentery, diarrhea, and headaches, as well as in cancer prevention (Kini et al., 2008). According to Arbonnier (2019), the latex is an effective remedy for lung diseases and tuberculosis.Economically, *S. senegalensis* provides employment and income for rural populations through the sale of its fruits, leaves, and wood (Dieng, 2017).

Despite some studies conducted in Côte d'Ivoire, Senegal, and Ghana on the fruit pulp (Boampensom, 2013; Sarr et al., 2018; Diabagaté et al., 2019), there is a lack of scientific data on the nutritional and antioxidant profiles of *Saba senegalensis* seeds.

Hence, the objective of this study is to evaluate the nutritional and antioxidant characteristics of *Saba senegalensis* seeds to promote their potential in the food and dietary sectors.

Materials and Methods:-

Materials:-

Biological Material

Biological material used in this study consists of *Saba senegalensis* fruits purchased from the Petit Paris, Sinistré, and Grand Market in Korhogo, Northern Côte d'Ivoire.

Figure 1:- Fruits of *Saba senegalensis*

Chemical Reagents

Reagents and chemicals used in this work are of analytical grade. Vanillin, methanol, sodium carbonate, potassium acetate, and Folin-Ciocalteu reagent were obtained from Sigma. Hexane, tannic acid, quercetin, and phytic acid were sourced from Sharlau.

Methods:-

Sample Processing

Sample processing was conducted according to the method described by Adabe and Ngo-Samnick (2014). *Saba senegalensis* fruits were transported to the botanical garden, sorted, and stripped of their stalks. They were manually opened, and the seeds were separated from the shells. Seeds were divided into two batches:

First batch was sun-dried directly.

Second batch underwent fermentation for six days on banana leaves, with stirring every two days.

After fermentation, the seeds were sun-dried for eight days, dehulled, and ground using a stainless steel electric grinder. Ground material was sieved through a 10 µm mesh sieve, and the resulting flour was stored in plastic containers at 4°C.

Determination of Nutritional Properties

Moisture

Moisture content was determined using the AOAC (1990) method. Five (5) grams of flour were weighed into a pre-weighed crucible and dried at 105 ± 2°C for 24 hours until a constant weight was achieved. After drying, the crucible was removed from the oven, cooled in a desiccator, and weighed. Moisture content was calculated using the formula:

$$\text{Moisture (\%)} = \frac{(m_1 - m_2)}{m_e} \times 100$$

m_1: Mass of the crucible + sample before drying
m_2: Mass of the crucible + sample after drying
m_e: Mass of the flour

pH and Acidity

pH and acidity were determined using the AOAC (1990) method. Ten (10) grams of flour were suspended in 100 mL of distilled water and filtered using Whatman No. 4 filter paper. The pH was measured by immersing the electrode of a pre-calibrated pH meter into the filtrate.For titratable acidity, 10 mL of filtrate were titrated with 0.1 N NaOH in the presence of phenolphthalein until a pink endpoint was reached. Titratable acidity was calculated as follows:

$$\text{Acidity (meq/100g)} = \frac{N \times V_{eq} \times 10^4}{m_e \times V_0}$$

Veq: Volume of Na
N: Normality of the NaOH solution
me: Mass of the sample (g)

Ash

Ash content was determined using the AOAC (1990) method. Five grams of flour were weighed into a pre-weighed crucible and incinerated in a muffle furnace at 550 ± 15°C for 12 hours. After incineration, the crucible containing the ash was cooled in a desiccator and weighed. Ash content was calculated as follows:

$$\text{Ash (\%)} = \frac{(m_1 - m_0)}{m_e} \times 100$$

Lipids

Lipid content was determined using the AFNOR (1986) Soxhlet extraction method. Ten grams of flour were weighed into a cellulose extraction cartridge, sealed with cotton, and placed in the Soxhlet extractor with 300 mL of hexane. Extraction was carried out under reflux for seven hours.

After extraction, the hexane was evaporated using a rotary evaporator, and the pre-weighed flask containing the oil was dried at 100°C for 20 minutes, cooled in a desiccator, and weighed. Lipid content was calculated as follows:

$$\text{Lipids (\%)} = \frac{(m_1 - m_0) \times 100}{m_e}$$

m_0: Mass of the empty flask
m_1: Mass of the flask + oil
m_e: Mass of the sample

Proteins

Proteins content was determined using the AOAC (1990) Kjeldahl method. One gram of flour was digested in 20 mL of concentrated sulfuric acid at 400°C for two hours with a mineralization catalyst (potassium sulfate +

selenium).After digestion, the digest was diluted to 100 mL with distilled water. A 10 mL aliquot was mixed with 10 mL of 40% NaOH, and the mixture was distilled. The distillate was collected in 20 mL of 4% boric acid containing a mixed indicator (methyl red + bromocresol green) and titrated with 0.1 N sulfuric acid. Protein content was calculated as follows:

$$\text{Protéins (\%)} = \frac{(V_1 - V_0) \times 14 \times 6{,}25 \times N}{m_e}$$

V_1: Volume of sulfuric acid for the sample
V_0: Volume of sulfuric acid for the blank
N: Normality of sulfuric acid
m_e: Mass of the sample

Fibers

For crude fibers, Woff (1968)] method was used. 2 g of flour were weighed into separate 250 mL round-bottom flasks, and 50 mL of 0.25 M sulfuric acid solution was added. The mixture obtained was boiled under reflux for 30 min. Thereafter, 50 mL of 0.3 M sodium hydroxide solution was added and the mixture was boiled again under reflux for 30 min and filtered through Whatman paper. The insoluble residue was then incinerated, and weighed for the determination of crude fibers content.

$$\text{Fibers (\%)} = \frac{(m_1 - m_2) \times 100}{m_e}$$

Carbohydrate and Energy Value

Carbohydrates content and calorific value were calculated and expressed on a dry matter basis using the following formulas (FAO, 2002):
Carbohydrates (%)=100−[Moisture (%)+Lipids (%)+Proteins (%)+Ash (%)+Fiber (%)]
Energy (kcal/100g)=4×Proteins (%)+9×Lipids (%)+4×Carbohydrates (%)

Minerals

Dried powdered samples (5 g) were burned to ashes in a muffle furnace (Pyrolabo, France). The ashes obtained were dissolved in 10 mL of HCl/HNO3 and transferred into 100 mL flasks and the volume was made up using deionized water. The mineral composition of each sample was determined using an Agilent 7500c inductively coupled argon plasma mass spectrometer (ICP-MS) method CEAEQ (2013). Calibrations were performed using external standards prepared from a 1000 ppm single stock solution made up with 2% nitric acid

Determination of anti-nutritional Properties

Oxalates

Titration method as described by Day and Underwood (1986) was performed. One (1 g) of dried powdered sample was weighed into 100 mL conical flask. A quantity of 75 mL of sulphuric acid (3 M) was added and stirred for 1 h with a magnetic stirrer. Mixture was filtered and 25 mL of the filtrate was titrated while hot against KMnO4 solution (0,05 M) to the end point.

Phytates

Colorimetric method was used for the determination of phytates content (Latta and Eskin, 1980). A quantity (1g) of dried powdered sample was mixed with 20 mL of hydrochloric acid (0.65 N) and stirred for 12 h with a magnetic. Mixture was centrifuged at 12000 rpm for 40 min. An aliquot (0.5 mL) of supernatant was added with 3 mL of Wade's reagent. Reaction mixture was incubated for 15 min and absorbance was measured at 490 nm by using a spectrophotometer (PG Instruments, England). Phytates content was estimated using a calibration curve of sodium phytate (10 mg/mL)as standard.

Determination of Antioxidant Properties

Extraction of Phenolic Compounds

Phenolic compounds were extracted following the method of Singleton et al. (1999). One gram of flour was homogenized in 10 mL of 70% methanol. Mixture was centrifuged at 1000 rpm for 10 minutes, and the supernatant was collected in a 50 mL flask. Residue was re-extracted with another 10 mL of 70% methanol and centrifuged again. Combined supernatants were adjusted to 50 mL with distilled water.

Phenolic compounds

Method described by Singleton et al. (1999) was used to quantify total phenols. To 1 mL of phenolic extract, 1 mL of Folin-Ciocalteu reagent and 1 mL of 20% sodium carbonate were successively added. Volume was adjusted to 10 mL with distilled water. After 30 minutes of incubation in the dark, the optical density was measured at 725 nm against a blank. Total phenol content was determined using a standard curve of gallic acid solution at 1 mg/mL.

Tannins

Tannins were quantified using the method of Bainbridge et al. (1996). To 1 mL of phenolic extract, 5 mL of 0.1 mg/mL vanillin reagent were added. Mixture was incubated in the dark for 30 minutes. After this period, the optical density was measured at 500 nm against a blank. Tannins were quantified using a standard curve of tannic acid at 1 mg/mL.

Flavonoids

Flavonoids were quantified using the method described by Meda et al. (2005). To 0.5 mL of phenolic extract, 0.5 mL of distilled water, 0.5 mL of 10% aluminum chloride, 0.5 mL of 1 M sodium acetate, and 2 mL of distilled water were successively added. Mixture was left at room temperature for 30 minutes, and the optical density was measured at 415 nm against a blank. Flavonoid content was determined using a standard quercetin solution at 0.1 mg/mL.

Antioxidant Activity

Method described by Choi et al. (2002) was used to determine antioxidant activity. To 2.5 mL of phenolic extract, 1 mL of 3 mM DPPH solution was added. Mixture was incubated in the dark for 30 minutes, and the optical density was measured at 415 nm against a blank. A control tube (2.5 mL methanol + 1 mL DPPH) was prepared under the same conditions as the test. Antioxidant activity was calculated using the formula:

$$AA\ (\%) = \frac{[DO_c - (DO_e - DO_b)] \times 100}{DO_c}$$

DOc: Absorbance of the control tube (1 mL of DPPH + 2.5 mL of methanol)
DOe: Absorbance of the test tube (1 mL of DPPH + 2.5 mL of phenolic extract)

Statistical Analysis

All experiments were performed in triplicate, and results were expressed as mean ± standard deviation. Analysis of variance (ANOVA) was conducted using StatPlus 2009 software. Fisher's test at a 95% confidence level was used to identify significant differences between means.

Results and Discussion:-

Table 1 presents the biochemical properties of non-fermented and fermented *Saba senegalensis* seeds. Analysis reveals statistically significant differences between these properties.Moisture content of fermented and unfermented seeds are 8.26 ± 0.10 and 6.31 ± 0.12%, respectively.These values are higher than those reported by Guehi et al. (2023) for sun-dried mango kernel almonds of the Kent variety (5.44 ± 0.19%) and lower than those by Zoro et al. (2023) for dried cacao placentas of the Mercedes variety (8%) oven-dried at 50°C for 72 hours. The higher moisture in fermented seeds may be due to pericarp softening, leading to water diffusion during fermentation. Lower moisture levels could be advantageous for seed preservation.

Regarding pH and acidity, fermented seeds recorded the lowest pH (5.34 ± 0.03) and the highest acidity (18.00 ± 0.00 meq/100g) unlike seeds, non-fermented which have the highest pH (5.55 ± 0.01) and the lowest acidity (16.00 ± 0.00 meq/100g).These pH values are lower than those recorded by Cissé et al. (2021) in fermented seeds of *Parkia biglobosa* (6.21 ± 0.02). The high acidity in fermented seeds may be attributed to the diffusion of citric and acetic

acids produced during fermentation (Zoro et al., 2023). Consuming fermented seeds could help combat gastrointestinal pathogens (Koh, 2015). In addition, the extraction of organic acids from Saba senegalensis seeds could be used as a preservative in the food industries.

Ash content was 1.87 ± 0.00% in non-fermented seeds and 1.79 ± 0.01% in fermented seeds. These values are lower than those for soumbara powder (4.07 ± 0.03%) reported by Cissé et al. (2021) and *Dioscorea dumetorum* cooked for 30 minutes (3.55%) by Akadiri et al. (2022). Reduced ash content in fermented seeds may be due to mineral leaching during fermentation.

Protein and Lipid Content, non-fermented seeds had lower protein levels (11.65 ± 0.20%) and higher lipid content (6.05 ± 0.05%) than fermented seeds, which showed higher protein (15.25 ± 0.10%) and lower lipid levels (5.34 ± 0.19%). Protein levels in both seed types are higher than those reported for *Plectranthus rotundifolius* tubers (11 ± 0.15%) by Diarra et al. (2019). Increased protein in fermented seeds may be due to bacterial enzyme production during fermentation.Fermented seeds could be used in food formulation as a source of plant proteins for growth, repair of cellular tissues and maintenance of body weight (Bhattacharjee et al., 2013). In terms of lipid contents, fermented and unfermented seeds are not lipid sources compared to oilseeds. However, these levels are much higher than those of Abdani and Bakhti (2017) in different varieties of wheat (1.85 ± 0.42 to 2.48 ± 0.37%) grown in Algeria. Low content in fermented seeds could be due to the action of microorganisms (lipases) and the phenomenon of rancidity. Low lipid contents of Saba senegalensis seeds could be beneficial for consumers and obese people because their consumption would be involved in the prevention of cardiovascular diseases, cancer and cellular aging (Zoro et al., 2023).

Saba senegalensis seeds cannot be considered as carbohydrate sources. Levels recorded are much lower than those of Zoro et al (2024) in the spent grains of three varieties of yams (32.82 ± 0.12 to 34.59 ± 0.33%) grown in Brobo. These low carbohydrate contents would explain the low energy value of fermented and unfermented seeds.

Non-fermented seeds contained more fiber (54.25 ± 0.35%) than fermented seeds (52.25 ± 0.35%). These values exceed those reported by Lepengue et al. (2020) for wild yam stems (14.30 ± 2%) but are similar to those of Zoro et al. (2024) for yam spent grains (52.85 ± 0.09% to 53.54 ± 0.22%). The decrease in fiber during fermentation may result from polysaccharide and pectin degradation by microorganisms (Zoro et al., 2023).*Saba senegalensis* seeds could cover daily requirements estimated at between 25 and 30 g (Zoro et al., 2016). Consumption of the seeds studied could be beneficial for digestion, prevention of colon cancer, treatment of gastrointestinal disorders and reduce the absorption of glucose and cholesterol (Saldanha, 1995; UICC/WHO, 2005).

Table 1:- Biochemical properties of non-fermented (SNF) and fermented (SF) seeds of *Saba senegalensis.*

Parameterss	**SNF**	**SF**
Moisture (%)	6.31 ± 0.12b	8.26 ± 0.10a
pH	5.55 ± 0.01a	5.34 ± 0.03b
Acidity (meq/100g)	16.00 ± 0.00b	18.00 ± 0.00a
Ash (%)	1.87 ± 0.00a	1.79 ± 0,01b
Proteins (%)	11.65 ± 0.20b	15.25 ± 0.10a
Lipids (%)	6.05 ± 0.05a	5.34 ± 0.19b
Carbohydrates (%)	20.01 ± 0.38a	17.10 ± 0.60b
Fibers (%)	54.25 ± 0.35a	52.25 ± 0.35b
Energy value (Kcal/100g)	180.59 ± 1.93a	177.25 ± 0.34b

Contents are the averages of three tests, affected by standard deviations. Statistical analyzes between these means at 95% confidence level are indicated on the same line by the letters a and b.

Mineral composition of unfermented and fermented seeds of Saba senegalensis is presented in Table 2. Mineral element contents of non-fermented and fermented seeds are statistically different ($p < 0.05$). Calcium, magnesium, potassium, phosphorus and sodium which are macroelements are higher (95.23 ± 1.05; 55.09 ± 1.32; 320.88 ± 4.10; 146.01 ± 3.15 and 15.65 ± 1.20 mg/100g) in non-fermented seeds unlike fermented seeds where these elements are respectively 80.55 ± 2.15; 50.33 ± 1.08; 295.27 ± 3.55; 122.33 ± 2.08 and 12.88 ± 0.19 mg/100g for calcium, magnesium, potassium, phosphorus and sodium. Concerning trace elements, iron is more abundant in non-fermented

seeds (11.36 ± 0.23 mg/100g) compared to fermented seeds (10.81 ± 0.27 mg/100g). Zinc contents are 3.15 ± 0.12 and 2.83 ± 0.15 mg/100g in unfermented and fermented seeds, respectively.

Contents of magnesium, potassium, phosphorus, sodium and iron are much lower than those of Tchègnon et al (2017) in the seeds of Pterocarpus santalinoides whose contents of magnesium, potassium, phosphorus, sodium and iron are respectively 120 ± 0 .20; 640 ± 0.04; 240 ± 0.10; 70 ± 0.02 and 50 ± 0.17 mg/100g. Unlike these minerals, the calcium contents are higher than those of Tchègnon et al (2017) which is 70 ± 0.55 mg/100g. Mineral element identified in fermented and non-fermented seeds could contribute to partial coverage of daily requirements estimated at 100, 800 and 8 mg respectively for magnesium, calcium and iron (FAO, 2004). Presence of zinc could constitute added value since zinc is involved in the development of brain activity and the functioning of the nervous system (Zoro et al., 2016). Presence of potassium in Saba senegalensis seeds could be used in the regulation of blood pressure, the proper functioning of the nervous system and muscles (Besnier, 2018).

Regarding magnesium, it is considered the natural anti-stress present in foods (Morais et al, 2017) and a sufficient intake of magnesium could contribute to the prevention of cardiovascular diseases (Baudet et al, 2012). As for the calcium present in the seeds, it would be beneficial for the consumer because it is involved in the solidification of bones and teeth as well as reducing the risk of colorectal cancer (Flood et al, 2005).

Table 2:- Mineral contents of non-fermented and fermented seeds of *Saba senegalensis.*

Parameters	SNF	SF
Calcium (mg/100g)	95,23 ± 1,05a	80,55 ± 2,15b
Magnésium (mg/100g)	55,09 ± 1,32a	50,33 ± 1,08b
Phosphore (mg/100g)	146,01 ± 3,15a	122,33 ± 2,08b
Potassium (mg/100g)	320,88 ± 4,10a	295,27 ± 3,55b
Sodium (mg/100g)	15,65 ± 1,20a	12,88 ± 0,19b
Iron (mg/100g)	11,36 ± 0,23a	10,81 ± 0,27b
Zinc (mg/100g)	3,15 ± 0,12a	2,83 ± 0,15a

Contents are the averages of three tests, affected by standard deviations. Statistical analyzes between these means at 95% confidence level are indicated on the same line by the letters a and b.

Contents of antinutritional factors in non-fermented and fermented Saba senegalensis seeds are presented in Figure 1. These contents are statistically different ($p < 0.05$). Non-fermented seeds of *Saba senegalensis* record the highest contents of oxalates (504 ± 0% mg/100g) and phytates (47.74 ± 2.15 mg/100g) unlike the fermented seeds which have contents of 424 ± 11.31 mg/100g and 34.28 ± 0.28 mg/100g respectively for oxalates and phytates. Oxalate contents of the recorded fermented and non-fermented seeds are much higher than those of Bamba et al (2023) in mango peels (136.88±0.01 mg/100g) and dried cashew apple cakes (98 .21±10.22 mg/100g). Oxalate contents of the seeds studied are included in the body's oxalate tolerance zone which oscillates between 200 and 500 mg/100 g (Zoro et al., 2016).

Unlike oxalates, the phytate contents obtained in *Saba senegalensis* seeds are lower than those of Bamba et al (2023) in shea cakes (93.45±0.70 mg/100g) and mango kernels (63.73±0.42 mg/100g). Reduction in oxalates and phytates during fermentation could be due to the action of microorganisms (phytases) and the diffusion of oxalates in the medium during fermentation (Fofana et al., 2017).

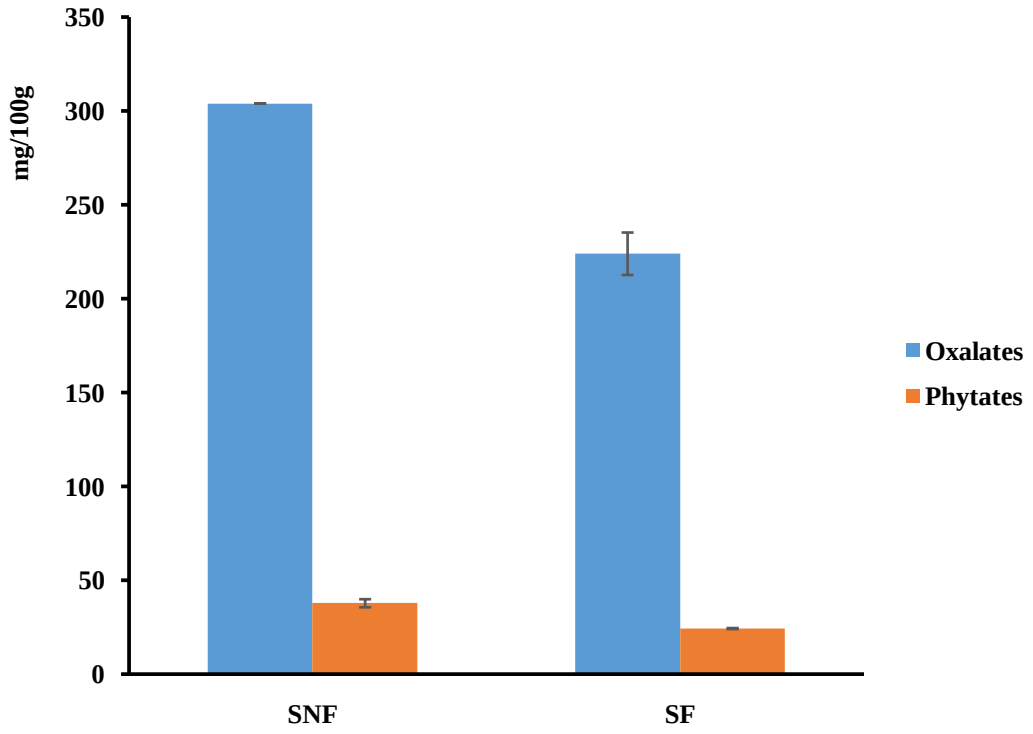

Figure 1:- Antinutritional factor contents of non-fermented and fermented seeds of *Saba senegalensis*

Ratios between antinutritional factors and mineral elements of non-fermented and fermented seeds of *Saba senegalensis* are presented in Table 3. Oxalates/Ca (3.19), Phytates/Ca (0.39) and Phytates/Fe (3.32) ratios are greater for non-fermented seeds compared to fermented seeds where these ratios are 2.78; 0.30 and 2.24 respectively for Oxalate/Ca, Phytates/Ca and Phytates/Fe. Oxalates and phytates are anti-nutritional factors that reduce the bioavailability of important minerals like calcium and iron. Oxalate/Ca ratios and the phytate/Fe ratio are greater than 2.50 and 0.50, respectively. Oxalates and phytates may reduce the bioavailability of calcium and iron to the body. To make calcium and iron available, it would be desirable to cook the seeds to reduce or eliminate oxalates and phytates (Henry et al., 2001).

Table 3:- Antinutritional and mineral factor ratios of non-fermented and fermented seeds of *Saba senegalensis*.

Parameters	SNF	SF
Oxalates/Ca	3,19	2,78
Phytates/Ca	0,39	0,30
Phytates/Fe	3,32	2,24

Figure 2 presents the antioxidant properties of fermented and non-fermented *Saba senegalensis* seeds. Polyphenol and tannin contents of the seeds are statistically different ($p < 0.05$). Concerning polyphenols, these contents are 272.48 ± 5.46 and 320.50 ± 7.24 mg/100g respectively for non-fermented and fermented seeds of Saba senegalensis. Non-fermented seeds (98.81 ± 4.19 mg/100g) contain more tannins unlike fermented seeds (80.81 ± 1.03 mg/100g). Regarding flavonoids, the contents are statistically identical. These contents are 7.66 ± 0.07 and 5.41 ± 0.48 mg/100g respectively for non-fermented and fermented seeds of *Saba senegalensis*. Regarding antioxidant activity, the inhibition percentages are statistically different.

Fermented seeds (58.19 ± 0.99%) have the highest percentage of inhibition compared to non-fermented seeds (50.73 ± 0.78%). Polyphenols include tannins and flavonoids. Increase in polyphenols during fermentation was also observed by Fofana et al (2017) during the fermentation of cashew apple (481.39±0.95 to 635.32±0.00 mg/100g). This increase would be due to the release of bound phenolic compounds during fermentation (Dordevic et al., 2010). This increase is correlated with the antioxidant activity which is greater in fermented seeds. In addition, polyphenols

are antioxidants that fight against free radicals responsible for cancer, cellular aging and cellular degeneration diseases (Vauzour et al., 2010).

Fermented seeds could be used as an ingredient in the formulation of food supplements to combat malnutrition and nutritional diseases. Reduction in tannins during fermentation could be explained by the hydrolysis of polyphenols into simpler substances by polyphenol oxidases or by the decomposition of tannic complexes leading to their leaching into the fermentation medium (Obizoba and Atti., 1991).

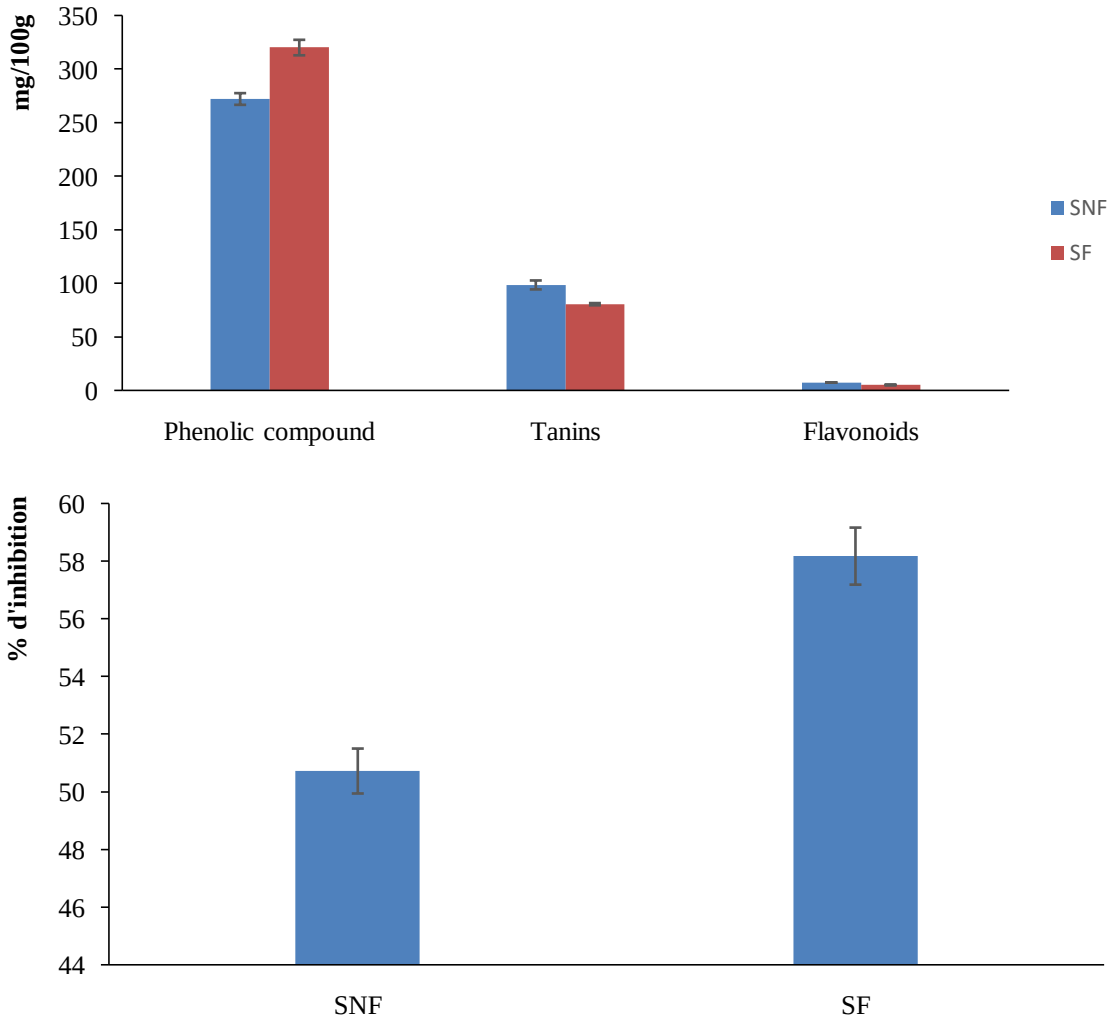

Figure 2:- Antioxidant properties of fermented and non-fermented *Saba senegalensis* seeds.

Conclusion:-

Nutritional and antioxidant properties of *Saba senegalensis* seeds before and after fermentation were the subject of our study. Results recorded allow us to comment on the food and dietary potential of fermented and non-fermented *Saba senegalensis* seeds. Determination of the nutritional and antioxidant properties of these seeds revealed that fermented and non-fermented seeds are significant sources of fiber that could be added to in food terms. Seeds contain high amounts of antioxidant compounds that could be of dietary value. Fermentation reduced antinutritional factors unlike phenolic compounds. *Saba senegalensis* seeds could contribute to the food security of Ivorian populations through their incorporation into food formulations.

Beyond this study, we plan to evaluate the effect of cooking on the nutritional and antioxidant properties as well as the aqueous extract on rats made diabetic by alloxan.

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