

Assessment of chemical composition of hemp (*Cannabis sativa*) seed flour

Jide Alfred Olaseeni^{1*}, Osanyinlusi Remi¹ and Odogiyon Oghale Beauty¹

¹Department of Science Laboratory Technology (SLT), Chemistry Unit, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria

Correspondence Author: Jide Alfred Olaseeni

Received 4 Dec 2022; Accepted 16 Jan 2023; Published 19 Jan 2023

Abstract

The hemp (*Cannabis sativa*) used for this work were obtained in a farm at Ogbese in Owo Local Government of Ondo State Nigeria. They were prepared for use by decoating, sun drying and milling. The milled sample were subdivided into two portions, one portion was defatted and named as defatted sample using normal hexane while the other portion was left raw. The samples were powdered in wiley mill 60 mesh sizes and stored in screw cap bottle at room temperature for further analysis. Proximate analysis, mineral, phytochemical and functional composition of hemp (*Cannabis sativa*) were examined. The mean values of various parameters for proximate composition, of both raw and defatted samples were moisture content (5.65+0.03) and (5.60+0.05), ash content (6.50+0.01) and (6.40+0.01), fiber content (18.85+0.20 and 16.05+0.12), fat content (30.43+0.03) and (15.60+0.15), crude protein (25.45+0.02) and (28.05+0.00) and finally carbohydrate (13.12+0.01) and (28.30+0.02) for both raw and defatted samples respectively. Mineral (mg/kg) includes Potassium (8.75+0,01), Calcium (18.60+0.35), Sodium (7.52+0.02), Magnesium (14.10+0.03), Zink (2.10+0,02), Lead (0.05+0,01). The macronutrients and micronutrients present in the study is required for optimal functioning of physiological and biochemical process in the body. The results of functional properties of *Cannabis sativa* seed flour with the mean value of the following parameters bulk density (20.05+0.01 g/ml), Water absorption capacity (35.15+0.12), Oil absorption capacity (25.01+0.12), Foaming capacity (5.05+0.01) and Emulsion capacity (20.00+0.01) respectively. The result of phytochemical screening revealed that Oxalate, saponin and alkaloid were moderately present in *Cannabis sativa* seed flour, tannins was slightly present while phytate was highly present in *Cannabis sativa* seed flour suggesting that the *Cannabis sativa* is relatively safe for consumption.

Keywords: hemp, *Cannabis sativa*, proximate, mineral, phytochemical, functional properties

Introduction

Plants are primary source of medicine, fiber, food, shelter, and other items of everyday use. The roots, seed, stem, leaves and flowers provide food for animal and human beings (Heminsway, 2004) ^[15] plant serves as indispensable constituent of human diets supplying the body with minerals, salt, vitamin, and certain hormones precursor in addition to protein and energy (Oyenuga & Fetuga, 1975) ^[22]. Seeds have nutritive and calorific values which makes them necessary in diet (Odoemelam, 2005) ^[18] among these plants' are the seed of hemp (*Cannabis sativa*). Hemp is an angiosperm belonging to the cannabaceae family and cannabis genus. It grows in temperate climate and requires a good soil fertilizer and water but no pesticides nor herbicides (Sofowora, 2008) ^[25] Hemp crop is usually harvested in 120 days after reaching a height of 10-15 feet. The whole seed contains roughly 25% protein, 30% carbohydrate, 15% insoluble fibers, carotene and a lot of minerals (like potassium, magnesium, sulphur, calcium, iron, zinc, as well as vitamin E, B1, B2 and B6 (Sofowora, 2008) ^[25]. Hemp is an annual herbaceous flowering plant indigenous to eastern Asia but now of cosmopolitan distribution due to widespread cultivation (Xiong *et al* 2011) ^[32]. It has been cultivated throughout recorded history used as a source of industrial fiber, seed oil, food, recreation, religion and spiritual note, and medicine. Each part of the plants is harvested differently depending on the purpose of its use (Whitting *et al*. 2015) ^[31].

The flower of hemp is unisexual and most of them either male or female, are short flowering plants with staminate (male). The male plant is usually taller and less robust than postulate (female or male) plant. (Wilson and Nicoll 2002) ^[30]. The flower of the female plants is arranged in race and can produce hundreds of seeds, male plants shed their pollen and die several weeks prior to seed ripening on the female plant under typical condition with a light period of 12-14 hours. Both sexes are produced in equal number because of heritable X and Y chromosomes (William Segun, 2018) ^[29]. Although genetic factors dispose a plant to become male and female, environmental factors including the diurnal light circle can alter sexual expression. A review found the use of each high cannabinoid to tetrahydro cannabinoid (THC). Strain of cannabis showed significantly fewer positive symptoms, such as diluting and halucition, better cognitive functions and better lower rates for developing psychosis, as well as a later age of onset of the illness, (Xiong *et al* 2011) ^[32]. There is preliminary evidence that cannabis interferes with the anti-coagulant properties of prescribed drugs used for treating blood clot (Murmoin, 2015) ^[17]. The mechanism for the anti-inflammatory and possible pain-relieving effects of hemp were not defined and there were no governmental regulatory approvals or clinical or active for use of them as a drug (Borgelt *et al*, 2013).

Medically, hemp refers to the use of cannabis and its cannabinoids to treat disease or improve symptoms, however

there is no single agreed upon definition (Murmoïn, 2015) [17]. The rigorous scientific study of cannabis as medicine has been hampered by production restriction and by the fact that it's classified as an illegal drugs by many government. There is unlimited evidence suggesting cannabis can be used to reduced nausea and vomiting during chemotherapy, to improve the appetite in people with HIV/AIDS or to treat chronic pain and muscle spasms (Borgelt *et al*, 2013) [9]. So, the significant of the study is primarily aim at providing information about the nutritional evaluation of cannabis seed, and the importance of the seed.

Material and methods

The hemp (*Cannabis sativa*) seed used for this work were obtained in a farm at Ogbese in Owo Local Government area of Ondo State. They were prepared for use by decoating, sun drying and milling. The sample was powdered in willey mill 60 mesh size and stored in screw cap bottle at room temperature for further analysis. The moisture content was determined by drying the sample in an oven at 110 degree cencous for 24hours and was expressed on a percentage basis, nitrogen content was estimated by the micro kjeldal method and crude protein was calculated (NX6.25). The content of crude lipid, crude fiber and ash were estimated by method (AOAC 2005) [6]. The minerals like sodium, potassium, calcium, magnesium, manganese, iron and others were analyzed using atomic adsorption spectrophotometer (Perkin Elmer Model 500). The phytochemical screening was determined by the method described by (Harborne, 1973, and Sofowora 1980) [13, 26]. While the functional propertied of the sample was equally estimated by a method of (Okaka and Porter 1979) [19]. Data were analyzed using the statistical analysis system and analysis of variance and mean deviation were calculated by the general linear model procedure.

Results and discussion

Table 1: Proximate composition of raw and defatted hemp (*Cannabis sativa*) seed flour parameters % raw samples defatted sample

| Parameters % | Raw samples | Defatted sample |
|------------------|-------------|-----------------|
| Moisture content | 5.65±0.03 | 5.60±0.05 |
| ASH content | 6.50±0.01 | 6.40±0.01 |
| Fiber content | 18.85±0.20 | 16.05±0.12 |
| Fat content | 30.43±0.03 | 15.60±0.15 |
| Crude protein | 25.45±0.02 | 28.05±0.00 |
| Carbohydrate | 13.12±0.01 | 28.30±0.02 |

Mean± standard deviation of triplicate determination

Table 1 shows the proximate composition of raw and defatted sample of hemp (*Cannabis sativa*) seed flower. The result of assessment was as follow. moisture content (5.65±0.03) and (5.60±0.05), ash content (6.50±0.01) and (6.40±0.01), fiber content (18.85±0.20) and (16.05±0.12), fat content (30.43±0.03) and (15.60±0.15), crude protein (25.45±0.02) and (28.05±0.00) and finally carbohydrate (13.12±0.01) and (28.30±0.02) respectively the moisture content of *Cannabis sativa* flower was relatively low for both samples but that of raw sample is slightly higher than that of defatted sample, the low moisture content in both samples will therefore hindered the growth of spoilage microorganism and enhance shelf life

(Ajayi *et al* 2013). The ash content of both samples revealed that (6.50+0.01, 6.40+0.01) respectively. The ash content is almost the same, which is a reflection of mineral content preserved in the seed. The ash content obtained was lowered when compared to values reported for *Vernonia Colorate* (15.86%) and *moringa oleifera* (15.09%) by (Anita *et al* 2006) [4]. The fiber content of raw (18.85±0.02%) and defatted (16.05±0.12%), though the value of raw is a little bit higher than that of defatted. The fiber value of the *Cannabis sativa* seed is high compare to *T. triangular* (6.20%) and *P. guineensis* (6.40%) which makes it more fibrous than the listed seeds (Akindahunsi and Salawu, 2005) [3]. Fiber cleanses the digestive tracks by removing potential carcinogenic from the body and prevent the absorption of excess cholesterol. Fiber also add bulk to the diets and prevents the intake of excess starchy foods. The crude fat value of *Cannabis sativa* was (30.43±0.03), (15.60±0.15) for both raw and defatted respectively. The value of raw is almost twice that of defatted sample as a result of non-removing oil from it (Jide *et al*, 2018) [16]. However lipids fats contribute to the palpability of the food (Enjuigbe and Ayodele Oni 2003). The two samples were still higher when compared to *T. triangulare* (5.90%), *Basella Alba* (8.71%) by (Akindahunsi and Salawu 2005) [3]. Both samples can be considered as a potential source of vegetable oil for domestic and industrial purposes. Proteins are building block units and the food protein is needed to make vital hormones, antibodies, digestive enzymes and necessary elements for the manufacture of DNA. Some proteins are involved in structural support while others are involved in bodily movements or defense against germs (Bailey 2008) [8]. The crude protein value for both raw and defatted samples are as follow (25.45+0.02), (28.05+0.00) respectively. However the results obtained from both samples are higher than the value of protein content of *Momordica Foecide* (4.6%) seed consumed in Nigeria (Hassan and Urman 2006) [14]. Carbohydrates are one of the three main energy sources in food along with protein and fat. When animal eats plants, energy stored as carbohydrate is released by the process of respiration which is chemical reaction between glucose and oxygen to produce energy, carbodioxide and water. The value recorded for both samples are very low (13.12±0.01), (28.30±0.02) respectively. Both samples were higher than 12% and 23.7% reported for *Senna Obtustosfolia* and *Amarantus Inturvatus* respectively (Faruq *et al* 2002).

Table 2: Mineral composition of hemp (*Cannabis sativa*) seed flour

| Parameter | Values (Mg/Kg) |
|-----------|----------------|
| Potassium | 8.75±0,01 |
| Calcium | 18.60±0.35 |
| Sodium | 7.52±0.02 |
| Magnesium | 14.10±0.03 |
| Zink | 2.10±0,02 |
| Lead | 0.05±0,01 |

Mean + standard deviation of triplicate determination

The result of the mineral composition was revealed in table 2 with Potassium (8.75±0,01), Calcium (18.60±0.35), Sodium (7.52±0.02), Magnesium (14.10±0.03), Zink (2.10±0,02), Lead (0.05±0,01) respectively. The presence of calcium 18.60±0.35 and magnesium 14.10±.03 respectively indicates that its consumption could be

a good source of minerals. The level of magnesium is even higher than the recommended dietary allowance of 4mg per day for men between 19-30 years old and 3mg per day for women between 19-30 year old (anonymous 1997). The calk ratio was greater than 1 ($18.60 \pm 0.35 / 8.75 \pm 0.01$) which is equal to 2.12 ± 0.18 in *Cannabis sativa*. This is an advantage, when the two samples are consumed, according to (Odoemena and Ekanem, 2006) [23], a diet is considered balanced if calk is greater than 1 and unbalanced if the calk ratio is less than 0.5. The combination of calcium and potassium are associated with growth and maintenance of bones, teeth and muscles (Jide *et al* 2018) [16] while potassium is responsible for nerve actions and some osmoregulation in the body fluids (Odoemena and Ekanem 2006) [23]. The micronutrients of zinc and lead is required for optimal functioning of physiological and biochemical processes (Jide, *et al*, 2018) [16]. Both the macronutrients serve as good source and formation of antioxidants.

Table 3: The functional properties of hemp (*Cannabis sativa*) seed flour

| Parameters | Values |
|-------------------------------|------------------|
| Bulk density (g/ml) | 20.05 ± 0.01 |
| Water absorption capacity (%) | 35.15 ± 0.12 |
| Oil absorption capacity (%) | 25.01 ± 0.12 |
| Foaming capacity (%) | 5.05 ± 0.01 |

Table 3 shows the functional properties of hemp (*Cannabis sativa*). The results of the assessments are as follows: bulk density (20.05 ± 0.01), Water absorption capacity (35.15 ± 0.12), Oil absorption capacity (25.01 ± 0.12), Foaming capacity (5.05 ± 0.01) and Emulsion capacity (20.00 ± 0.01). Bulk density is the ratio of mass per unit volume of a substance which indicates the porosity, package sizes, mouth feel and flavor of a product and is generally affected by the size of particles. (Unigbe and Ozekhome, 2009) [28]. The bulk density values of 20.05 ± 0.01 g/ml of *Cannabis sativa* implies that soaking in water overtime modify the particle sizes. The foaming capacity is as low as $5.05 \pm 0.01\%$. The low foaming capacity of *Cannabis sativa* seed flour was due to the reduction in the acid content (Adejumo *et al*, 2013) [1]. The water absorption capacity of the seed is very high as (35.15 ± 0.12) compared with $32.05 \pm 0.02\%$ of *Musa Paradisiacal* (plantain). Fine particle sizes were also associated with higher water absorption capacity (Unigbe and Ozekhome 2009) [28]. The oil absorption capacity of the seed was $25.01 \pm 0.02\%$ which indicates the value is high when compared with the value of pigeon pea (*Cajanus Cajan*) 20.02 ± 0.01 the ability of food to absorb water and oil help to enhance sensory properties such as mouth feel and flavor retention (Udensi and Iwe 2008) [27]. So, when the target is to increase the oil absorption capacity, the seeds need to be soaked.

Table 4: Phytochemical screening of hemp

| Parameters | Results |
|------------|---------|
| Oxalate | ++ |
| Phytate | +++ |
| Tannin | + |
| Saponnin | ++ |
| Alkaloid | ++ |

Note + (slightly present), ++ (moderately present), +++ (highly present)

The result of investigated phytochemical screening revealed as follows. Oxalate, saponnin and alkaloid were moderately present in *Cannabis sativa* seed flour, tannins were slightly present while phytate was highly present. Phytochemicals exhibit various pharmacological and biochemical actions when ingested by animals. Plants used in the treatment of diseases are said to contain bioactive principles with biological activities, some of which are responsible for the characteristic of odor, pungency and color of plants while others give the particular plants its culinary, medicinal or poisonous virtue (Evans, 2002) [11]. Tannins are known to be useful for the prevention of cancers as well as treatments of unflamed or ulcerated tissue (Okwu and Nidu 2006) [21]. Seeds that contain tannins are stringent in nature and are used for the treatment of intestinal disorder such as diarrhea and dysentery. Saponnin react with cholesterol rich membrane of cancer cells and thereby limiting the growth and viability (Bailey, 2008) [8]. Saponnin has the properties of precipitating and coagulating red blood cells (Okwu, 2004) [20]. Alkaloids are moderately present in the investigation, alkaloids are beneficial chemical plants serving as a repellent to predators and parasites, thus endow these group of agents its microbial activity. Several alkaloid containing medicinal plants used as pain relievers, as recreational stimulants or in religious ceremonies to enter psychological state to achieve communication with ancestors (Banjal 2001) [7]. Oxalates are moderately present in the *Cannabis sativa* seed flour. Oxalate are free radical scavengers that prevent oxidative cell damage and have anticancer activities and induce mechanism that affect cancer cells, inhibits tumor invasion (Rafat *et al*, 2008) [24].

Conclusion

The seed has a great potential to serve as a source of nutrients that can be used as food for human and animals. Based on this nutritive evaluation studies, it can be summarized that it is a good source of protein, lipid, ash, fiber, vitamins and minerals. The investigation also revealed the level of anti-nutrient like oxalate, saponnin, tannin, and alkaloids and their usefulness both to industries and body systems.

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