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Phytochemical, Nutritional and Antimicrobial Evaluations of the Aqueous Extract of Brassica Nigra (Brassicaceae) Seeds

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Abstract: The objective of the study was to carry out phytochemical, nutritional and antimicrobial evaluations of the aqueous extract of Brassica nigra seeds. The nutritional and phytochemical analyses were carried out by adopting standard methods. The antimicrobial study was carried out by using agar well diffusion method. The nutritional evaluation of the seeds of Brassica nigra showed that it contained moisture 4.16%, crude fibre 0.30%, crude fat 30.30%, ash 5.14%, crude protein 24.70% and carbohydrate 35.40%. The phytochemical screening of the seeds indicated the presence of saponins, alkaloids, flavonoids, glycosides, reducing sugar, phlobatannins and volatile oil. It was observed that the extract was effective in inhibiting Escherichia coli, Klebsiella pneumonia, Salmonella para-typhi, Pseudomonas aeuriginosa and Staphylococcus aureus, with the zone of inhibition ranging between 7mm and 23mm. The extracts of the Brassica nigra seeds can be used for common cold, painful joints and muscles (rheumatism), arthritis, edema, and increasing appetite. The seeds can also serve as a source of cooking oil because of the high content of crude fat and ethno medicine.

Keywords: Brassica Nigra, Proximate Analysis, Phytochemicals, Reducing Sugar, Common Cold, Volatile Oil, Antimicrobial

1. Introduction

Brassica nigra belongs to the botanical family Brassicaceae (Cruciferae). The plant is found in some parts of the world like southern Mediterranean region of Europe, south Asia, Canada, India, Ethiopia, North America, German, Ukraine, Myanmar, Russian, New Zealand [1, 2].

Brassica nigra originated in the Middle East. The plant can grow from two to eight feet tall, with racemes of small yellow flowers. The leaves are covered with small hairs. Stembase, half way branched, quite erect, bluish lower part. Alternate, stalked basal bluish green leaves. Its seeds grow in long, slender pods. Each pod contains 10 – 12 brown or black seeds [3].

The invitro anthelmintic activities of Brassica nigra, Ocihun basilicum and Rumex were evaluated by Heidari et al [4].

Brassica nigra seeds are used as a spice. They have also been used to treat rheumatism. The seed oil is used for common cold and arthritis. The seed is also used for relieving water retention (edema) by increasing urine production and increasing appetite [3].

The seeds have significant amount of fatty oil, which is used as cooking oil. Ground seeds of the plant are mixed with honey and used as cough suppressant. It is also used to treat respiratory infections.

Brassica nigra seed extracts can be used in grand mal seizure treatment in mice [5]. The oil extracted from the seeds is very effective as antibacterial [6].

Haven seen that the seeds of the plant are used for medicinal and nutritional purposes, there is the need to study the medicinal and nutritional constituents of the seeds. Hence the objectives of the study, the phytochemical, nutritional and antibacterial evaluations of the aqueous extract of Brassica nigra seeds.

2. Materials and Methods

2.1. Collection of Brassica Nigra Seeds

Brassica nigra seeds were obtained from Garki, Abuja, Nigeria. They were authenticated at the herbarium unit of the Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria.

Excella mixer grinder was used to grind the seeds of Brassica nigra and sieved with a mesh of size 0.8mm. The powdered sample was stored in an air tight container at ambient temperature until when needed.

2.2. Proximate Analysis

The method of Association of Official Analytical Chemists [7] was adopted in estimating the various food parameters in Brassica nigra seeds. The analysis was carried out in triplicate and the results obtained were averaged. The moisture content was determined by drying in an oven at 100°C to 108°C to constant weight. The crude fat was determined by continuous extraction in a soxhlet apparatus for 8h using hexane as the extraction solvent. The ash was determined by incineration in a furnace at 550°C for 5h. The crude fibre was by sequential hot digestion of the defatted samples with dilute acid and alkaline solutions. The crude protein content was evaluated by digestion of the samples using Kjedahl's method. Nitrogen determination by a spectrophotometric method. The total carbohydrate was evaluated by subtracting the % sum of protein, crude lipid, crude fibre, moisture and ash from 100.

2.3. Phytochemical Analysis

Brassica nigra seeds powder aqueous extract was obtained by boiling 10.0 g of the seeds powder in distilled water for one hour and filtering the solution using a vacuum pump. The screening of the aqueous extract of Brassica nigra was carried out by adopting the modified methods of Uzama and Sofowora [8, 9].

2.4. Antimicrobial Screening

The antimicrobial screening of the aqueous extract of Brassica nigra seeds was carried out by well diffusion method according to Perez et al [10]. Sterile Muller Hinton agar was poured into sterile Petri dishes that were autoclaved to prepare plates. Sterilized cotton swabs were dipped in the bacterial culture in nutrient broth and then swabbed on the agar plates. Wells of equal size were cut with proper gap in the medium and the extracts were added into it. The plates were allowed to stand for one hour, to allow pre-diffusion of the extract into the medium. The plates were incubated at 37°C for 24 hours. The standard drug used was chloramphenicol. Inhibition zones were measured in millimeter at the end of the incubation period. The study was carried out in triplicates.

2.5. Statistical Analysis

The results of the analyses were expressed as the mean ± standard deviation.

The assays were carried out in triplicate. The results were analyzed using one way analysis of various (ANOVA).

3. Results and Discussion

The phytochemical screening results shown in table 1 revealed the presence of saponins (12.82%), alkaloids (20.58%), flavonoids (6.57%), glycosides (20.01%), reducing sugar (5.56%), phlobatanins (15.05%) and volatile oil (25.13%) in the aqueous extract of Brassica nigra seeds, while tannins and terpenoids were absent. The presence of alkaloids, flavonoids, volatile oil and glycosides may be responsible for the medicinal value of the Brassica nigra seeds.

Table 1. *The phytochemical analysis of the aqueous extract of Brassica nigra seeds.*

Phytochemical constituents	Aqueous extract	Percentage (%)
Saponins	+	12.82
Tannins	-	0.00
Alkaloids	+	20.58
Terpenoids	-	0.00
Flavonoids	+	6.57
Glycosides	+	20.01
Reducing sugar	+	5.56
Phlobatannins	+	15.05
Volatile oil	+	25.13

The result of the proximate analysis of Brassica nigra seeds (Table 2) shows that it contains moisture (4.16%), ash (5.14%), crude fat (30.30%), crude fibre (0.30%), crude protein (24.70%) and carbohydrate (35.40%). From the result, crude fibre has the least value, while carbohydrate has the highest value.

The carbohydrate content 35.40% of the seeds is lower than that of Chromolaena odoratum 45.70% [11].

The ash content indicates the presence of mineral elements in the seeds. The value (5.14%) is higher compared to 1.80% in sweet potato leaves but lower than that of chromolaena odoratum 7.88% [11].

The moisture content 4.16% of the seeds is lower than that of Chromolaena odoratum 7.58%. This would hinder the growth of microorganisms [12]. The moisture content is known to affect the processing, preservation and storage of food and herbal products. High moisture content renders plant products susceptible to microbial attack and thus leads to spoilage and a lowered shelve life. The moisture content of the seed showed that it can be stored for a long period without spoilage.

The Brassica nigra seeds contained 30.30% crude fat, which is higher than 23.10% in Chromolaena odorata leaves and 11.00% in water spinach leaves. The crude fat is the principal source of energy and aid in the transport of fat soluble vitamins insulate and protect internal tissues and contribute to important cell processes [11, 13, 14].

Table 2. *Proximate analysis of Brassica nigra seeds.*

Components	Values (%) (n = 3)
Moisture	4.16±0.5
Ash	5.14±0.4
Crude fat	30.30±0.5
Crude fibre	0.30±1.0
Crude protein	24.70±0.3
Carbohydrate	35.40±1.0

The results of the antimicrobial screening of the aqueous extract of Brassica nigra seeds is given in table 3.

The results revealed that the extract is a potent antimicrobial against Escherichia coli, Klebsiella pneumonia, Salmonella para-typhi, Pseudomonas aeriginosa and Staphylococcus aureus. The antimicrobial activity was screened from the zone of inhibition. Chloramphenicol was used as a standard antibiotics to compare the inhibitory effect of the extract. The extract showed significant inhibitions against the test organisms. An increase in the concentration of the extract led to an increase in the antimicrobial activity of the extract. Brassica nigra aqueous extract of the seeds has highest antimicrobial activity against Escherichia coli and Pseudomonas aeriginosa (23.0mm). The activity of the extract was almost comparable with that of the standard drug, chloramphenicol (28.0mm).

Table 3. *The antimicrobial screening of the aqueous extract of Brassica nigra seeds.*

Test organism	Conc.(mg/ml) zone of inhibition in (mm)				
	500	250	125	P. C. CPC (200mg/ml)	N. C. DMSO
E. coli	23.0±0.1	14.0±0.4	8.0±0.3	28.0±0.1	NA
K. pneumonia	16.0±0.2	13.0±0.1	9.0±0.4	21.0±0.1	-
S. para-typhi	13.0±0.2	10.0±0.5	8.0±0.3	27.0±0.0	-
P. aeriginosa	23.0±0.4	14.0±0.4	11.0±0.0	26.0±0.5	-
S. aureus	22.0±0.1	11.0±0.0	7.0±0.0	19.0±0.4	-

CPC – Chloramphenicol, DMSO – Dimethylsulphoxide, NA – No activity
PC – Positive control, NC – Negative control
± - Values are mean standard deviation of the triplicate.

4. Conclusion

The phytochemicals in the seeds of Brassica nigra are responsible for the medicinal uses of the seeds. The proximate analysis revealed that the seeds contained a reasonable percentage of crude fat and carbohydrate, which means that the seeds can serve as a source of energy and can be used as a source of cooking oil. The antimicrobial study also revealed that the seeds could serve as a potential source of ethno medicine.

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