

INTERNATIONAL JOURNAL OF AGRICULTURE, MANAGEMENT AND TECHNOLOGY



Vol 8(1) 2024

Published by
Federal College of Agriculture,
Ishiagu Ebonyi State

TOTAL FLAVONOID CONTENT IN GINGER UNDER DIFFERENT EXTRACTION SOLVENTS

Ochuba C.O . Nnabue.i. and Innocent M.K.

National Root crops Research Institute Umudike

Obismo2007@yahoo.com

ABSTRACT

Ginger is a well known crop for it's medicinal and therapeutic property. This therapeutic properties is due to the bioactive compounds it contains which includes but not limited to flavonoids and phenolic compounds . Extraction solvent plays a major role in the effectiveness of extraction of flavonoids in ginger therefore this study aims to identify the best solvent and combination for effective and efficient extraction of flavonoids in ginger. The ginger was cut into pieces, air dried and grinded after which extraction was done using different solvents and combinations. The solvents and combinations used were Ethanol (100%), Methanol 100%), Acetone(100%), Water(100%), Ethanol-methanol (1:1), Ethanol:Acetone(1:1), Ethanol-Ethyl Acetate (1:1), Methanol-Acetone (1:1), Methanol-Water(1:1), Acetone-Water(1:1) and Methanol:Ethanol, Acetone:Water(0.25 each). Anova and Hsd Statistical Analysis was done. The result showed that Ethanol gave the highest flavonoid content of 40.23 ± 0.18 followed by Ethanol-Methanol, Methanol, Ethanol- acetone, Ethanol-Water, Methanol- Acetone, Methanol-Water, Methanol: Ethanol:Acetone:Water, Acetone and Water respectively. The use of ethanol for extraction of flavonoids in ginger is recommended though it was not significantly different ($P>0.05$) from Ethanol-Methanol combination.

Keywords: Acetone, Ethanol, Extraction, Flavonoids, Ginger, Methanol, Solvents.

INTRODUCTION

Ginger has been reported to exhibit anti cancer, anti-oxidant and anti-inflammatry attributes(Tohma et al., 2017).Flavonoid is a subclass of polyphenols. It is well known for it's pharmacological property.Dikeng et al. (2018) equally reported that ginger has anti diabetic effect, anti-inflammatory effect and anti tumor effect. Ginger contains a lot of bioactive compounds including the flavonoids therefore it is important to know the optimal condition for its extraction which will enhance its utilization in the Food processing and pharmaceutical industry.

- Aim and Objective

This study aim to investigate the influence of various extraction solvents in differrent combinations on the total Flavonoid content extracted from ginger. This will enable the optimization of the extraction solvent most suitable for extraction of ginger for enhanced medicinal value.

- PURPOSE OF RESEARCH

The purpose of this study is to maximize the amount of flavonoids in ginger by examining the best extraction techniques. We want to determine the circumstances that produce the highest flavonoid content by methodically

examining the effects of various solvents and their ratios. This kind of information is critical to improving the use of ginger in the food processing, nutraceutical, and pharmaceutical industries, among others. Additionally, it can aid in the advancement of better extraction methods that maximize the health-promoting qualities of goods obtained from ginger.

- RESEARCH JUSTIFICATION

Due to its numerous medicinal benefits, such as its anti-inflammatory, antiemetic, and antioxidant properties, ginger has long been utilized in folk medicine. Among the main bioactive substances that provide these advantageous benefits are flavonoids. However, the kind of solvent used and the extraction parameters used can have a big impact on how well flavonoids are extracted. To find the most effective technique for extracting flavonoids from ginger, it is necessary to thoroughly assess several extraction solvents and their ratios. For ginger to reach its full medicinal potential and to provide standardized extraction techniques for commercial applications, this kind of study is essential.

- **HYPOTHESIS**
We predict that the ratio of the extraction solvent used will have a major impact on the overall amount of flavonoids that are extracted from ginger. Because of their different polarity and interactions with the components of ginger, we specifically anticipate that certain solvents and their ideal ratios will result in higher yields of flavonoids. By putting this theory to the test, we want to find the ideal extraction parameters that will maximize the amount of flavonoids present in ginger extracts and enable their possible use in products that promote health.

MATERIALS AND METHOD

Plant Material

Rhizomes of ginger were collected, cleaned, cut into pieces to increase area and then air dried at room temperature after which it was grinded into powdered form.

Preparation of Extracts

5g of the powdered ginger was macerated differently in Ethanol (100%), Methanol (100%), Acetone(100%),

Water(100%), Ethanol-methanol (1:1), Ethanol:Acetone(1:1), Ethanol-Water (1:1), Methanol-Acetone (1:1), Methanol-Water(1:1), Acetone-Water(1:1) and Methanol:Ethanol: Acetone: Water (0.25 each) for 72hrs. The extracts were then evaporated to dryness.

Extraction yield (%) = $(\text{weight of solid extract} \div \text{weight of sample taken for extraction}) \times 100$

Determination of Flavonoids

Using the approach of Ordon Ez et al. (2006), the total flavonoids in the plant extracts were estimated. A volume of 0.5 mL of a 2% AlCl₃ ethanol solution was added to 0.5 mL of sample. At room temperature, the absorbance was measured at 420 nm after an hour. The presence of flavonoids was indicated by a yellow color. Samples of extract were assessed at a final concentration of 0.1 mg/mL. A calibration curve was created using quercetin (5–100 mg/L) serving as the reference. Using the calibration curve as a guide, the total flavonoid levels were expressed as quercetin (mg/g) using the equation $y = 0.0018x + 0.0122$, where y represented the absorbance.

Statistical Analysis The Data was subjected to HSD statistical analysis.

RESULTS AND DISCUSSION

The results of this study are shown on Table 1 below. Total flavonoid content and extraction yield

Solvents	Extraction Yield (%)	Total flavonoid content (mg/g)
Methanol	9.81±0.18	38.11±0.12 ^d
Ethanol	10.54±0.21	40.23 ±0.18 ^e
Water	8.12±0.17	36.10±0.13 ^a
Acetone	8.24±0.16	37.21±0.17 ^b
Ethanol+Methanol(1:1)	10.21±0.15	39.71±0.21 ^e
Ethanol+Acetone(1:1)	9.44±0.19	38.10±0.19 ^d
Ethanol+Water(1:1)	9.22±0.22	38.00±0.22 ^{cd}
Methanol+Water(1:1)	9.00±0.27	37.10±0.24 ^b
Methanol+ + Acetone(1:1)	8.91±0.16	37.73±0.16 ^c
Water+Acetone(1:1)	8.05±0.12	36.22±0.14 ^a
Ethanol+Methanol+Acetone+Water	9.20±0.14	37.98±0.17 ^c

Different superscripts indicate significant difference. The same superscripts indicate no significant differences

The flavonoid content of the ginger extracts using different solvents are as shown in table 1 above. The result shows that ethanol extract has the highest flavonoid content of 40.23 ±0.18 followed by Ethanol:Methanol(1:1), Methanol, Ethanol: acetone, Ethanol:Water, Methanol:-Acetone, Methanol:Water, Methanol: Ethanol:Acetone:Water, Acetone and Water respectively. Rehman et al (2003) reported ethanol

extract to have higher flavonoid content than methanol extract. Stoilova et al (2007) equally reported so.

There was significant difference ($P>0.05$) between the total flavonoid content of ethanolic extract and methanolic extract though there was no significant difference ($P>0.05$) between Ethanolic extract and Ethanol:Methanol Extract. There was significant difference ($P>0.05$) between ethanol extract and the extract of the other solvents and combinations used in

this study. When methanolic extract and that of Methanol: Ethanol extract was compared, there was no significant difference ($P<0.05$) between the total flavonoid content. But when compared to other solvents and combinations, there was significant difference ($P<0.05$).

The Total flavonoid content for Water extract was 36.10 ± 0.13 . This was the lowest among the solvents used in this study. There was no significant difference ($P<0.05$) between it and ethyl acetate:acetone extract. When compared with other solvents and combinations used in this study, there was significant differences among them except that of Water:Acetone.

For Acetone extract, the total flavonoids content was found to be 37.21 ± 0.17 . There was no significant difference ($P<0.05$) between this and Methanol :Water extract but when compared with other solvents and combinations used in this study, there was significant differences among them.

Ethanol:acetone extract had a total flavonoid content of 38.10 ± 0.19 . No significant difference ($P<0.05$) was observed between it and the methanolic extract. No significant difference ($p<0.05$) was equally observed between it and Ethanol:Water extract but for other solvents and combinations used in this study, significant differences was observed.

The extract of Ethanol+Methanol+Acetone+Water had a total flavonoid content of 37.98 ± 0.17 . No significant difference ($p<0.05$) was observed between it and Ethanol:Water Extract but there was significant differences between it and other solvents and combinations used in this study. There was no significant difference ($P>0.05$) observed between Ethanol:Acetone extract and Ethanol:Water extract.

For the extraction yield, ethanol has the highest yield followed by methanol, acetone and Water respectively. This is in agreement with the findings of Quadir et al (2017)

REFERENCES

- Diikeng.F.T., Womeni.H.M., Anjneyulu.E., Karuna.M.S.D., Prasad.R.B.N., and Linda.M. (2018). Effects of natural antioxidants extracted from Cameroonian ginger roots on the oxidative stability of refined palm olein. *European food research and Technology*, 244. 1015-1025
- Ordon Ez A.A.L., Gomez J.D., Vattuone M.A., Isla M.I. Antioxidant activities of *Sechium edule* (Jacq.) Swart extracts. *Food Chem.* 2006;97:452–458. [[Google Scholar](#)]
- Qadir MA, Shahzadi SK, Bashir A, Munir A, Shahzad S. (2017). Evaluation of Phenolic Compounds and Antioxidant and Antimicrobial Activities of Some Common Herbs. *International Journal of Analytical Chemistry*. <https://doi.org/10.1155/2017/3475738>
- Rehman, Zia.U.R., Salariya, A.M., & Habib, F. (2003). Antioxidant activity of ginger extract in sunflower oil. *Journal of food science and Agriculture*. 83, 624-629
- Stoilova I, Krastanov A, Stoyanova A, Denev P, Gargova S. (2007). Antioxidant activity of a ginger extract (*Zingiber officinale*). *Food Chem.* 102:764–770
- Tohma H, Gülçin I, Bursal E, Gören AC, Alwasel SH, Köksal E. (2017). Antioxidant activity and phenolic compounds of ginger (*Zingiber officinale* Rosc.) determined by HPLC-MS/MS. *Food Measure*. 11:556–566.