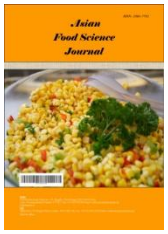

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Extraction and Estimation of Protein from Ginger (*Zingiber officinale*) and its Interaction with Glucose Molecule

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To evaluate the protein composition in the ginger rhizome and its interaction with glucose molecule.
Place and Duration of Study: Department of Biochemistry, Sokoto State University, Sokoto, Nigeria, between April 2021 and May 2021.
Methodology: Protein was extracted from the rhizome of ginger using 0.1 M phosphate buffer. The protein concentration of the sample was estimated using Biuret method while using xanthoproteic test, the presence of aromatic amino acids was ascertained. The crude protein sample was interacted with glucose using UV interaction study.
Results: The protein concentration of the sample (2 g) was found to be 1.702 mg/ml, it was identified that ginger rhizome contains aromatic amino acids. UV interaction study between the crude protein sample and glucose molecule showed an increase in absorbance at the range of 280 nm.
Conclusion: The interaction of ginger with glucose shows that it possesses a hypoglycemic effect.

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Keywords: UV- interaction; ginger; protein; glucose.

1. INTRODUCTION

Ginger (*Zingiber officinale*) has been used as a cooking spice and herbal medicine to treat various ailments worldwide since antiquity [1]. From its origin in Southeast Asia and its spread to Europe, it has a long history of use in treating a variety of ailments including vomiting, pain, indigestion, and cold-induced syndromes [2;3]. More recently, it was reported that ginger also possessed anti-cancer, anticlotting, anti-inflammatory, and analgesic activities [4;5]. However, there is less emphasis on the effects of ginger in the management of metabolic diseases and their complications.

Fresh ginger contains 80.9 % moisture, 2.3 % protein, 0.9 % fat, 1.2 % minerals, 2.4 % fibre and 12.3 % carbohydrates [6]. It is rich in iron, calcium, and phosphorous and contains vitamins such as thiamine, riboflavin, niacin, and vitamin C. The composition varies with the type, variety, agronomic conditions, curing methods, drying and storage conditions [7].

Proteins exhibit enormous diversity of biological functions and are the most important final products of the information pathways [8]. Cells can produce proteins with strikingly different properties and activities by joining amino acids (each has a side chain with distinctive chemical properties) in many different combinations and sequences [9]. From these building blocks, different organisms can make widely diverse products such as enzymes, hormones, antibodies, transporters, muscle fibers, the lens protein of the eye, feathers, spider webs, rhinoceros horn, milk proteins, antibiotics, and myriad other substances having distinct biological activities. UV spectrum at 200-300 nm is sensitive to protein conformational change. Any change on protein backbone and aromatic residue can be evaluated on absorbance at 220-230 nm and 280 nm respectively [10].

Nigeria is one of the top producers of ginger in the world. Diabetes is very common worldwide, Ginger has shown prominent protective effects on the diabetic liver, kidney, eye, and neural system complications [4]. Eating up to 4 grams per day lowers blood sugar levels and regulates insulin production [11]. The aim of this research was to evaluate the protein composition in the ginger rhizome and its interaction with glucose molecule by using UV Spectrum techniques.

2. MATERIALS AND METHODS

2.1 Rhizome Ginger Root Sample

The Rhizome ginger root was obtained from Sokoto Central Market in Sokoto State. The sample was washed to remove impurities and chopped prior to extraction.

2.2 Protein Extraction

Protein extraction was done according to the method of [12]. Rhizome ginger root (2 g) was ground in 10 ml of the extraction buffer (0.1 M Phosphate buffer) at room temperature using mortar and pestle. The homogenate was transferred into 10-50 ml Eppendorf tubes and incubated at room temp for 12 hours. After incubation, the homogenate was centrifuged using 15-25 ml refrigerated centrifuge at 4^{o}C, at 12,000 rpm for 20 minutes. The supernatant was collected as crude protein.

Biuret method was used for the estimation of Protein. Bovine serum albumin model was used in this study.

Xanthoproteic Test was used to detect the presence of aromatic amino acids in the protein [13].

2.3 Interaction Study of Protein Sample with Glucose

UV interaction study of protein sample with glucose was carried out by preparing four test tubes as shown in (Table 1) below. Then the absorbance was taken from the range of 190 nm-350 nm at 20 nm interval for the sample in triplicate and recorded.

Table 1. UV interaction study procedure

	Glucose (ml)	Test sample (ml)
Control	--	1
Sample 1	1	1
Sample 2	1.5	1
Sample 3	2	1

3. RESULTS AND DISCUSSION

The protein extracted using (0.1 M Phosphate) buffer was identified as crude protein. Based on the Xanthoproteic test conducted, ginger

contained aromatic amino acids such as tyrosine and tryptophan.

The absorbance data obtained from the Biuret Test is presented in (Table 2), from which a calibration curve was constructed.

3.1 Biuret Test Result

The graph for the Biuret test exhibited a linear calibration curve (Fig. 1). From the result obtained, the concentration of protein in the ginger sample is 1.702 mg/ml.

The graph obtained from UV interaction study of crude protein and glucose is shown in (Fig. 2). From the result obtained from UV spectroscopy (interaction study), the absorbance of the sample (ginger + glucose) at the range of 280 nm was shown to have the highest absorbance because of the presence of tyrosine and tryptophan. Absorption of near UV radiation by proteins is usually monitored at 280 nm due to very high absorption by Trp and Tyr at this wavelength [14]. The absorbance decreases around 290-300 nm, this shows the inhibition effect of the ginger sample with glucose. This supports the study conducted by [15] who reported that astaxanthin can reduce the absorbance in the UV-VIS spectrum in Gly-BSA and astaxanthin interactions. Inhibition of albumin glycation is another way of treating diabetes that is not dependent on blood glucose level control [16].

Table 2. Absorbance data for the Biuret test

S/N	BSA (µl)	Concentration (mg/ml)	Absorbance
1	0	0.0	0.0
2	10	0.6	0.129
3	20	1.2	0.212
4	30	1.8	0.318
5	40	2.4	0.422
6	50	3.0	0.489
7	Sample 1	---	0.261
8	Sample 2	---	0.271
9	Sample 3	---	0.284

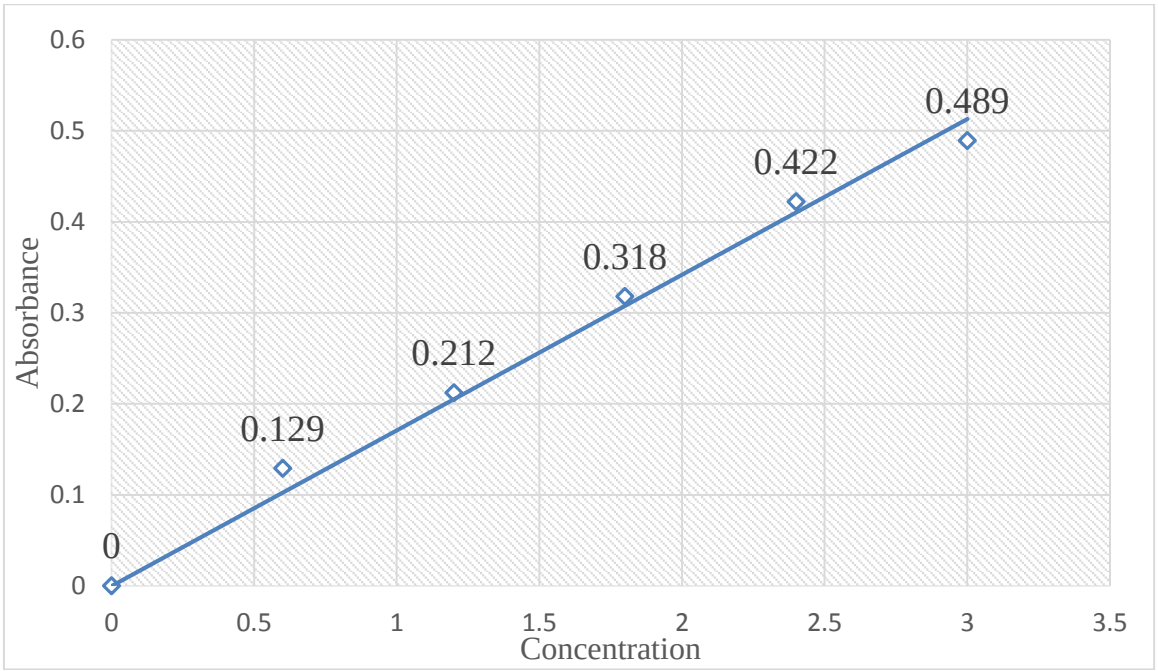

Fig. 1. Calibration Curve of the Biuret Test

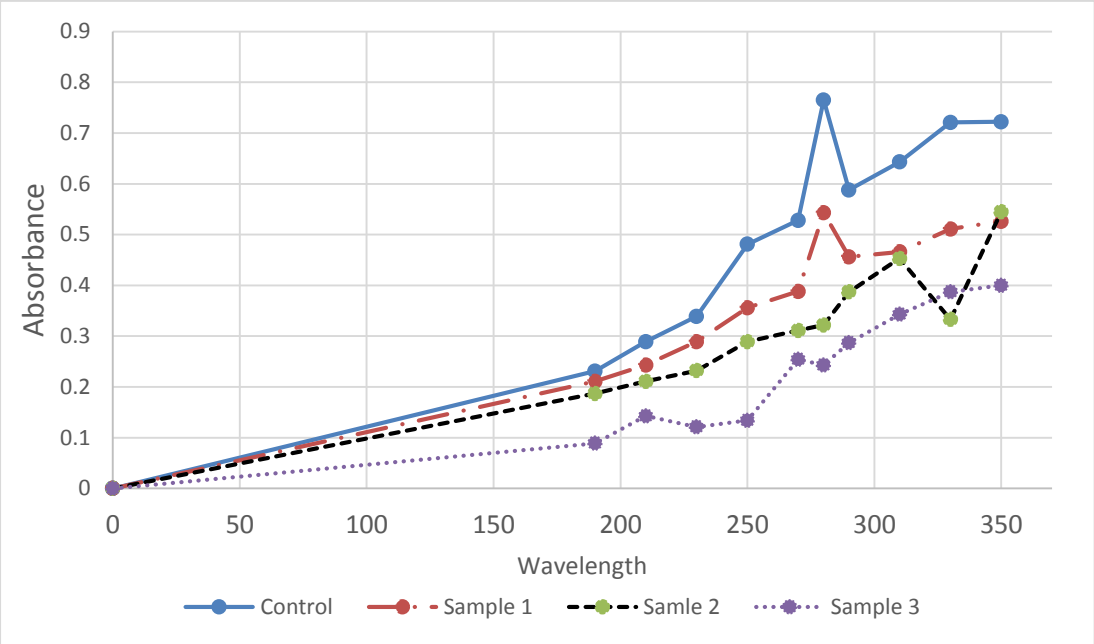

Fig. 2. Graph of UV/visible interaction between crude protein and glucose

4. CONCLUSION

This study reveals that ginger possesses protein that contains aromatic amino acids. The interaction of the protein with glucose shows that it possesses a hypoglycemic effect and may be useful in the prevention of diabetes complications, there by supporting the efficacy of its use in herbal medicine.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Thomas HE. The New York Botanical Garden Illustrated Encyclopedia of Horticulture. 1982;10:3591.
2. Schauenberg P, Paris F. Guide to medicinal plants. Keats Pub-lishing, New Canaan CT, (1977)pp. 30-300.
3. Mao Q, Xu X, Cao S, Gan R, Corke H, Beta T, Li H. Bioactive compounds and bioactivities of ginger (*Zingiber Officinale* Roscoe). Foods. 2019;8: 185. Doi:10.3390/foods8060185.
4 Chrubasik S, Pittler MH, Roufogalis BD. "Zingiberisrhizoma: a comprehensive review on the ginger effect and efficacy profiles. Phytomedicine. 2005;12(9):684-701.
5. ElkhishinI A, Awwad IA. A study of the cardiovascular toxic effects of Zingiberofficinale (ginger) in adult male albino rats and its possible mechanism of action. Mansoura. J. Forensic Med. Clin. Toxicol. 2009;27(2):109-116. DOI:10.21608/mjfmct.2009.52913
6. Agu CS, Igwe JE, Amanze NN, Odumam O. Effect of oven drying on proximate composition of ginger. American journal of Engineering Research. 2016; 5(8):58-61.
7. Govindaraju C, Thomas J, Sudharsan MR. 'Chenthal' disease of cardamom caused by ColletotrichurngleosporoidesPenz and its management. Journal of Plantation Crops. 2003;255-259.
8. Wei C, Tsai Y, Korinek M, Hung P, El-Shazly M, Cheng Y, Wu Y, Hsieh T, Chang F. 6-Paradol and 6-shogaol, the pungent compounds of ginger, promote glucose utilization in adipocytes and myotubes, and 6-paradol reduces blood glucose in high-fat diet-fed mice. Int. J. Mol. Sci. 2017;18:168.
9. Mason PE, Lerbret A, Saboungi M, Neilson GW, Dempsey CE, Brady JW. Glucose interactions with a model peptide. Proteins. 2011;79(7):2224-2232.
10. Li Y, Tian XX. Liu T and Wang RT (2015). Association between whole blood viscosity and arterial stiffness in patients with Type 2 Diabetes mellitus. Endocrine 49 (1): 148-54.

11. Duke JA, Ayensu ES, Medicinal Plants of China. Annals of Epidemiology. 2001;29(1):156-163.
12. Barbarino E, Lourenço SO. An evaluation of methods for extraction and quantification of protein from marine macro- and microalgae. J. Appl. Phycol. 2005;7:447-460.
13. Chatterjea MN. Textbook of Biochemistry for Dental/Nursing/Pharmacy Students. 3rd ed. Jaypee Brothers Publishers; 2004.
14. Waddell W J. A simple UV spectrophotometric method for the determination of protein. The Journal of Laboratory and Clinical Medicine. 1956;48:311-314.
15. Nur MI, Widyarti S, Sumitro SB. The study of UV spectrum in interaction Astaxanthin and glycated Bovine serum albumin (Gly-BSA). Journal of Environmental Engineering and Sustainable Technology. 2019;6(1):23-29.
16. Rajendran P, Nandakumar N, Rengarajan T, Palaniswami R, Gnanadhas EN, Lakshminarasalah U, Gopas J, NishigakI I. Antioxidants and human diseases. Clinica Chimica Acta. 2014;436:332-347.

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