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Research Article

Detection of cyclotide peptides from selected medicinal plants as potentials for diabetes management: An ethnopharmacological approach

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Abstract: Diabetes is a metabolic disorder characterised by high level of sugar in the blood. There are diverse strategies in the management of diabetes. The inhibition of the two enzymes (α-amylase and α-glucosidase), which lower postprandial blood sugar level, is one of the ways in the management of diabetes. The undesirable side effects associated with conventional anti-diabetic drugs have necessitated the search for safer and efficient antidiabetic agents from plants. Many known plant bioactive have been reported for their hypoglycemic properties. Cyclotide peptides is a group of plant bioactive that have been identified with versatile biological activities. This study aimed to identify cyclotide peptides from selected plants as inhibitor of alpha-amylase and alpha-glucosidase enzymes. Peptide extracts of fifteen selected medicinal plants were investigated for their alpha-amylase and alpha-glucosidase inhibitory activities. Extracts were obtained with the standard method of cyclotide peptide extraction into acetonitrile: water (1:1) with two drops of TFA (Trifloroacetic acid). In-vitro tests were carried out in triplicate and data were analyzed using Microsoft Excel and GraphPad Prism5 software. The extracts showed varying degree of enzymes inhibitory activities. Crescentia cujete with IC50 of 26.52 ± 0.54 µg/mL for alpha-amylase and 47.50 ± 0.12 µg/mL for alpha-glucosidase had highest inhibitory activities for both enzymes, compared with acarbose with IC50 of 23.60 ± 0.20 µg/mL and 57.6 ± 0.13 µg/mL for α-amylase and α-glucosidase inhibition, respectively. Lophira alata (37.60 ± 0.23 µg/mL), Detarium microcarpum (37.86 ± 0.22 µg/mL), Physalis angulata (44.12 ± 0.40 µg/mL) and Hibiscus tiliaceus (44.51 ± 0.41 µg/mL), also compared favourably with Acarbose for alpha-amylase inhibitory activities. Anchomanes difformis (33.26 ± 0.14), Detarium microcarpum (35.06 ± 0.13), Lophira alata (56.52 ± 0.21), exhibited higher alpha-glucosidase inhibitory activities than acarbose (57.6 ± 0.13 µg/mL). The remaining extracts exhibited moderate-to-low enzyme-inhibitory activities. Peptide extracts of the selected plants showcased potential as promising candidates for the development of anti-hyperglycemic agents.

Keywords: Cyclotides, Diabetes, Enzymes, Ethnopharmacology, Medicinal plants

1. Introduction

A cyclotides peptides are a class of bioactive peptides from plants. This unique member of cysteine-rich peptides circular in nature. The size of amino acids occurring in cyclotides varies from 28 to 37 amino acid residues (Mishra et al., 2025). Cyclotide possess a knotted arrangement of three di-sulphide bonds created from their conserved six cysteine residues, in addition to their circular backbone (Craik et al., 2017). The combination of these structural features makes cyclotides peptides extremely stable to thermal, chemical and enzymatic degradation. Due to the properties, these peptides have

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caught the interest of both pharmaceutical industries and academics as prospective scaffolds for drug design (Wang et al., 2024). This class of peptides have been studied with diverse range of pharmacological activities, such as antimicrobial properties, protease inhibitors, antioxidant effects (Majumder et al., 2016; Gattringer et al., 2021; Tran et al., 2023), pesticides, antimicrobial, cytotoxic and antidiabetics activities (Jerrmann et al., 2018; Lian et al., 2024; Deegala et al., 2025).

Diabetes is a serious challenge faced by the healthcare industry today. Diabetes and its complications are still costly to manage with available modern drugs. Extensive research on the screening of anti-diabetic agents in the past decades established natural products as one of the major potential sources of drug discovery. The development of new anti-diabetic drugs is of great demand, as conventional drugs in existence for the management of diabetes pose undesirable effects like obesity, flatulence, hair loss and hypoglycaemia, etc. The undesirable effects associated with these medications have necessitated search for more effective and safe agents. Plant-derived extracts and constituents have been used for managing diabetes.

The use of natural agents to manage diabetes and its complications is paramount in the search for drugs. Ethnobotanical survey is one of the approaches for the documentation of indigenous knowledge. This documentation is paramount as this knowledge keeps reducing as the people endowed with the knowledge pass away. This study was conducted to examine the antidiabetic properties of peptide extracts of selected medicinal plants as part of an effort to find safer and more effective medications.

2. Materials and methods

2.1. Study Area

The study was carried out from September – December, 2023 in four villages in Moro local government areas (LGAs) of Kwara State namely: Malete, Elemere, Gaa-Allanu-Gbugudu, Okete-Safari. Moro is a Local Government Area in Kwara State. It has an area of 3,272 km2 and a population of 108,792 according to 2006 population census (Population, 2006 - 2016).

2.2. Materials

Alpha-amylase enzyme (from Aspergillus), alpha-glucosidase enzyme, Sodium potassium tartrate, 3,5-Dinitrosalicylic acid, Potatoes starch, p-Nitrophenyl Glucopyranoside (pNPG) (Sigma Aldrich), Acarbose were purchased from Sigma Aldrich, USA. Sodium hydroxide pellets,

Trifluoroacetic acid (TFA), Orthophosphoric acid, acetonitrile, G-250 (Coomassie Brilliant Blue) dye, glacial acetic acid, n-butanol were of analytical grades. Thin Layer Chromatography ((TLC, Silica gel 60) plates were products of Merck (Dermhadt, Germany).

2.2.1 Collection of Plant Materials

Fresh leaves of fifteen (15) plants were selected for the study based on frequency of mention (7-15). The plant samples were identified and authenticated in University of Ilorin herbarium, where voucher specimens were deposited. Duplicates of the voucher specimen were also deposited in the Department of Plant and Environmental Biology, Faculty of Pure and Applied Sciences, Kwara State University, Malete, Nigeria. The fresh plant parts were separated from impurities and air dried under shade for three (3) weeks. Dried materials were pulverized into coarse powder and stored in air-tight bottle until used.

2.3 Extraction of Peptides

Cyclotide peptide extraction was carried out following the standard method of Lian et al. (2024). Twenty grams (20 g) each of coarse powder plant materials were extracted into acetonitrile:water (1:1 ; v/v) with two drops of Trifluoro acetic acid (TFA) for 24 h under continuous agitation at room temperature. At 24 h, the mixtures were filtered and the filtrates concentrated to dryness. Extracts were stored at -20 °C until used for further studies.

2.4. In vitro α-Amylase Inhibition Assay

The experiment was carried out according to the method of Yu et al. (2012). Fifty microlitres (50 µL) of working concentrations (1000 - 15.63 µg/mL) of each peptide extract was serially (two-folds) diluted in 50 µL of potassium phosphate buffer (100 mM, pH = 6.9), 10 µL of α–amylase (2 U/mL) was added and pre-incubated at room temperature for 30 min. Then, 50 µL of 1% soluble potato starch added and incubated further at room temperature for 5 min. 100 µL of the DNSA (dinitrosalicylic acid) colour reagent was added and boiled (80° C) for 15 min to terminate the reaction. Acarbose at various concentrations (500 - 15.63 µg/mL) was used as a positive. An individual blank containing buffer and DNSA solution was prepared for correcting the background absorbance. Negative control experiments contained 100% enzyme activity. Each experiment was performed in triplicate. The absorbance of each resulting mixture was measured at 540 nm using

Multiplate Reader (Multiskan thermo scientific, version 1.00.40).

α-amylase inhibitory activity (%) = 100 – (Absorbance of test) / (Absorbance of control) × 100

The net absorbance of each sample was calculated using the equation:

Asample = Atest-Ablank

Where Atest is the absorbance of each test and Ablank is the absorbance of each blank..

2.5. In vitro α-glucosidase Inhibitory Assay

The experiment was carried out according to the method described by Shai et al. (2011). Twenty-five microlitres (25 µL) of working concentrations (1000 - 15.63 µg/mL) of each peptide extract was serially (two-folds) diluted in 25 µL of potassium phosphate buffer (100 mM, pH = 6.8), 10 µL α-glucosidase (1 U/mL) added and incubated at 370 C for 30 min. Then, 20 µL P-NPG (5 mM) was added and incubated further at 370 C for 30 min. 50 µL Na2CO3 (0.1 M) was added to stop the reaction. Acarbose at various concentrations (500 - 15.63 µg/mL) was used as a positive. Negative control experiment contained 100% enzyme activity. Each experiment was performed in triplicate. The absorbance of the released p-nitrophenol at 405 nm was measured using multiplate reader (Multiskan thermo scientific, version 1.00.40).

α - glucosidase inhibitory activity (%) = 100 – (At)/ (Ac) × 100

Where, At is the absorbance of test and Ac is the absorbance of control.

2.6. Statistical Analysis

Microsoft Office Excel spreadsheet software (version: 14.0.4760.1000 32 bits) was used for descriptive analysis of data on the plant's usages, plant parts used and plant families. Each in-vitro test was performed three times and the IC50 values were determined by non - linear regression using Graph pad prism ® version 6.0.

3. Results

3.1. Ethnobotanical Survey

The ethnobotanical survey gave a total of 38 plant species (Table 1) belonging to 24 families (Table 2) of plants used in the management of diabetes in the study areas. Leaf part had the highest frequency of 34 followed by stembark with 3 frequencies of mention, seeds with 2 frequencies of mention and fruits with 2 frequencies of mention. Fifty-eight respondents were interviewed, only forty-two agreed to release information.

Semi-questionnaires were used to obtain information from traditional native doctor, village elders and herb sellers.

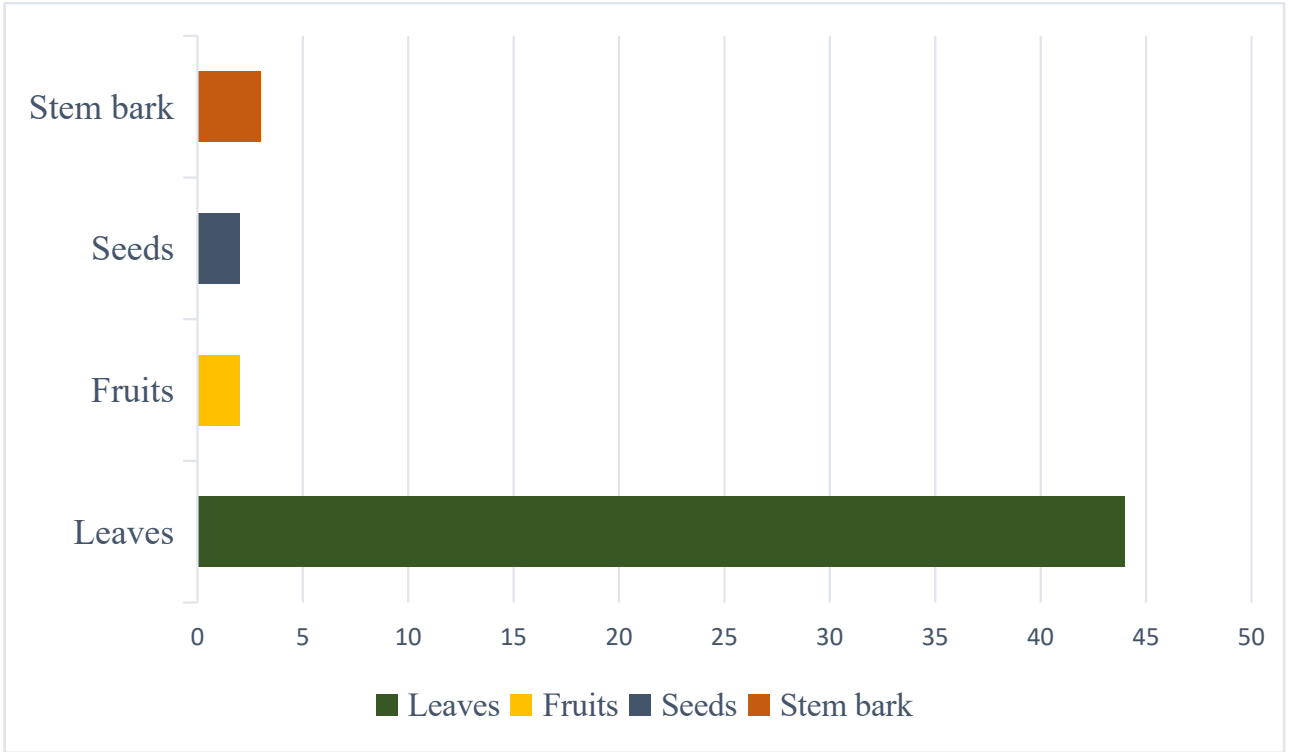

Figure 1: Distribution of Plant Part Mentioned

Table 1: List of Plants obtained from the Ethnobotanical Survey

S/N	Botanical names	Family	Yoruba Name	Plants parts used	Frequency
1	Psidum guajava	Myrtaceae	Guava	Leaves	1
2.	Andrographis paniculata	Acanthaceae	Jogbo	Leaves	6
3	*Talinum triangulare*	Postulaceae	Gure	Leaves	6
4	*Tithonia diversifolia*	Asteraceae	Sepeleba	Leaves	2
5	*Byrsocarpus coccinens*	Connaraceae	Ewe eye	Leaves	1
6	*Anarcaadium occidentalis*	Anacardiaceae	Cashew	Leaves	3
7	*Jatropha curcas*	Euphorbiaceae	Lapa funfun	Leaves	5
8	*Jatropha gossypifolia*	Euphorbiaceae	Lapa pupa	Leaves	4
9	*Azadiracta indica*	Meliaceae	Dongoyaro	Leaves	4
10	*Ocimum gratissimum*	Asteraceae	Efirin	Leaves	8
11	*Abrus precatorius*	Papilionaceae	Omisinmisin	Leaves	1
12	*Cnestis ferruginea*	Connaraceae	Omuaja	Leaves/seeds	3
13	*Vernonia amygdalina*	Asteraceae	Ewuro	Leaves	8
14	*Senna alata*	Ceasalpinaceae	Asunwon	Leaves	3
15	*Alchornea cordifolia*	Euphorbiacee	Asokerii	Leaves	5
16	*Moringa olifera*	Moringaceae	Moringa	Leaves	6
17	*Sida corymbosa*	Malvaceae	Osepotu	Leaves	5
18	*Cassia siamea*	Caesalpiniaceae	Kasia	Leaves	4
19	*Mangifera indica*	Ancardiaceae	Mango	Leaves	2
20	*Momordica charanta*	Cucurbitaceae	Ejirin	Seeds	14
21	*Morinda lucida*	Rubiaceae	Oruwo	Leaves	5
22	*Glypheae brevis*	Tiliaceae	Itakun okere	Leaves	1
23	*Pergularia daemia*	Connaraceae	Kole orogba	Leaves	4
24	*Cucumis sativus*	Cucurbitaceae	Kukumba	Fruits	1
25	*Alternanthera sessilis*	Amaranthaceae	Seba-ile pelebe	Leaves	9
26.	*Ixora coccinea*	Rubiaceae	Lobutu	Leaves	1
27.	*Hibiscus tiliaceus*	Malvaceae	Ako ila	Leaves	8
28.	*Crescentia cujete*	Bignoniaceae	Igi sogba	Leaves	10
29	*Anchomanes difformis*	Araceae	Aburo soko	Leaves	7
30	*Detarium microcarpum*	Fabaceae	Ijan	Leaves/Stem bark	8
31	*Lophira alata*	Ochnaceae	Sepaleba	Leaves	7
32	*Croton zambesicus*	Euphorbiaceae	Ajekobale	Leaves/stem bark	8
33	*Ricinus communis*	Euphorbiaceae	Ekanna-Akan	Dried seed	7
34	*Solenostemon monostachyus*	Lamiaceae	Abiwere	Leaves	10
35	*Hamelia patens*	Rubiaceae	Tanatana	Leaves	1
36	*Physalis angulata*	Solanaceae	Woropon	Leaves	7
37.	*Solanum erianthum*	Solanaceae	Ewuro ijebu	Leaves	8
38.	*Prosopis africana*	Fabaceae	Epa obo	Stem bark	8

Table 2: Species Distribution According to Families

S/N	Family	Number of Species
1	Myrtacea	1
2	Acanthaceae	1
3	Taliaceae	1
4	Asteraceae	3
5	Connaraceae	1
6	Anacardiaceae	2
7	Euphorbiaceae	5
8	Meliaceae	1
9	Papilionaceae	1
10	Bignoniaceae	2
11	Ceasalpinaceae	2
12	Moringaceae	1
13	Malvaceae	3
14	Anacardiaceae	1
15	Cucurbitaceae	2
16	Rubiaceae	3
17	Tiliaceae	1

18	Asclepiadaceae	1
19	Amaranthaceae	1
20	Araceae	1
21	Fabaceae	2
22	Ochinaceae	1
23	Lamiaceae	1
24	Solanaceae	1

Information on the plant parts used in the recipe revealed that leaves had the highest mention with frequencies of forty-four (44), fruits had frequencies of two (2), seeds had frequency of two (2) and stem bark had frequency of 3 (Figure 1).

Based on frequency of mention, sixteen plants were selected for the study. Plant species with frequency of mention between 7 to 14 were selected for the study (Table 3).

3.2. Enzymes-inhibitory Activities of Peptide Extracts of Selected Plants

Extract of Crescentia cujete exhibited the highest alpha-amylase inhibitory activity with IC50 of 26.52 ± 0.54 µg/mL, which compared favourably with acarbose (IC50 23.60 ± 0.20 µg/mL). Extract of Anchomanes difformis exhibited the highest alpha-glucosidase inhibitory activity with IC50 of 33.26 ± 0.14 µg/mL compared with acarbose (IC50 47.50 ± 0.12 µg/mL). The remaining extracts exhibited varying degree of alpha-amylase and alpha-glucosidase inhibitory activities (Table 5).

4. Discussion

One of the strategies in the management of diabetes still remain intervention in the activities of the two enzymes linked with diabetes; alpha-amylase and alpha-glucosidase (Saleem et al., 2022). This intervention involves slowing down the rate at which these enzymes break down carbohydrate, thereby reducing the level of glucose released into the blood stream at a time. Diabetes poses a major global health threat with serious socio-economic burden in sub-Saharan Africa countries, especially Nigeria. This condition is often worsened as most diabetic patients suffered from undesirable effects from orthodox medicines. To keep glucose level in the blood close to normal is the most important task in the management of diabetes. Traditional medicinal formulations from plants and their active constituents are used globally as therapy for diabetes management. These herbal medicines are reported to delay the rate at which carbohydrate is being converted and slow down the release of glucose into the blood, thereby control diabetes and alter the metabolic abnormalities (Chang et al., 2015). Moreover, in many studies, plants derived constituents exhibiting anti-diabetic power have been isolated and they have been found to display higher potential than the conventional drugs (Arulselvan et al., 2014; Hsu et al., 2016; Jessica et al., 2017). Plant peptide-based drugs have been reported with great pharmacological properties (Alsaadi, 2018). In recent years, the identification of plant bioactive peptides has become emerging research subjects in academia and pharmaceutical industries (Sanchez-Rivera et al., 2014). Indeed, it has been well established that diabetes treatment with conventional drugs is effective and may improve glycemic control (Nyakudya et al., 2020). However, conventional drugs are associated with several negative effects such as abdominal distension, flatulence, meteorism, and mild diarrhea (Mohajan

Table 3: Selected Plants for the Study

S/no	Botanical Name	Voucher number	Part used	**Frequency of mention**
1.	Alternanthera sessilis	UILH/004/968/2025	Leaves	9
2.	Momordica charanta	UILH/002/963/2025	Seed	14
3.	Hibiscus tiliaceus	UILH/007/962/2025	Leaves	8
4.	*Crescentia cujete*	UILH/003/1274/2025	Leaves	10
5.	*Anchomanes difformis*	UILH/005/1386/2025	Leaves	7
6.	*Detarium microcarpum*	UILH/006/1272/2025	Leaves	8
7.	*Lophira alata*	UILH/001/967/2025	Leaves	7
8.	*Croton zambesicus*	UILH/008/1513/2025	Leaves	8
9.	*Ricinus communis*	UILH/010/965/2025	Seed	7
10	*Solenostemon monostachyus*	UILH/009/1361/2025	Leaves	10
11.	*Ocimum gratissimum*	UILH/011/1356/2025	Leaves	8
12.	*Physalis angulata*	UILH/012/838/2025	Leaves	7
13.	*Solanum erianthum*	UILH/013/932/2025	Leaves	8
14.	*Prosopis africana*	UILH/014/1569/2025	Stem bark	8
15.	*Vernonia amygdalina*	UILH/015/972/2025	Leaves	8

Table 4: Enumeration of Recipes

Recipe	Type of Preparation	Administration
Leaves of *Cnestis ferruginea*, *Ocimum gratissimum* and *Senna alata* are boiled with adequate quantity of water. The mixture is then strained through sieve.	Decoction	One tea cup is taken twice daily
Carefully wash the leaves of *Cassia siamea, Moringa olifera, Mangifera indica* and boil.	Decoction	One tea cup of the extract is taken once daily
Cut two pods *Cucumis sativus* into two litres of water	Soaking	Take a half teacup twice daily
Juice is extracted from leaves of *Momordica charanta, Morinda lucida, Sida corymbose*	Cold extraction	A tea cup is taken twice daily
Boil leaves of *Alchornea cordifolia, Glyphaea brevis, Pergularia daemia*, *Crescentia cujete,* seed of *Ricinus communis*	Decoction	Take a tea cup twice daily
Boil leaves of *Croton zambesicus, Prosopis africana, Byrsocarpus coccinens*	Decoction	Take a tea cup twice daily
Extract juice of *Vernonia amygdalina*	Cold extraction	Take a tea cup twice daily
Boil leaves of *Momordica charanta* and *Morinda lucida*	Decoction	Drink a half cup twice daily
Boil leaves of *Abrus precatorius,, Anarcaadium occidentalis, Jatropha gossypifolia*	Decoction	Take a tea cup twice daily
Boil leaves of *Azadiracta indica* and *Tithonia diversifolia,*	Decoction	Drink a half tea cup twice daily
Boil handful leaves of *Talinum triangulare* with adequate locus beans	Soup	Eat once every day
Boil leaves of *Psidum guajava* and *Andrographis paniculata*	Decoction	Drink a tea cup once daily mostly in the morning
Grind dry seed of *Ricinus communis* into smooth powder Add to hot pap or add boiled water in a cup	Infusion	Add a teaspoonful into a tea cup of hot water or hot pap and take once daily
Boil a handful leaves of *Solenostemon monostachyus*	Decoction	Drink a half tea cup twice daily
Boil leaves of *Hamelia patens, Solanum erianthum* for one hour and strain.	Decoction	Drink a tea cup twice daily
Boil handful leaves of *Physalis angulata* and *Lophira alata*.	Decoction	Drink a tea cup twice daily
Boil handful leaves of *Anchomanes difformis* and *Detarium microcarpum* using pap water.	Decoction	Drink a half tea cup twice daily
Bring to boils a handful of leaves of *Ixora coccinea* and *Hibiscus tiliaceus*	Decoction	Drink a half tea cup twice daily
Cut fruits of *Adansonia digitata* and soak in fermented pap water	Soaking	Drink a tea cup twice daily
Boil handful leaves of *Alternanthera sessilis* and *Prosopis africana*	Decoction	Drink a half tea cup twice daily
Boil leaves of *Sida corymbose, Cassia siamea, Momordica charanta* and*. Adansonia digitata*	Decoction	Drink a half tea cup twice daily
Extract juice of *Vernonia amygdalina*	Cold extraction	Drink a half tea cup twice daily
Boil a handful leaves of *Solenostemon monostachyus*	Decoction	Drink a tea cup twice daily
Boil leaves of *Psidum guajava* and *Andrographis paniculata*	Decoction	Drink a tea cup twice daily
Boil leaves of *Momordica charanta* and strain	Decoction	Drink a tea cup twice daily
Boil leaves of *Abrus precatorius, Anarcaadium occidentalis* and *Jatropha gossypifolia*	Decoction	Drink a half tea cup twice daily
Cut srenbark of *Detarium microcarpum, Croton zambesicus* into small pieces and leaves *Momordica charanta*, bring to boil	Decoction	Drink a tea cup twice daily

Table 5: Enzymes-inhibitory Activities of Peptide Extracts of Selected Plants

S/no	Extracts	α-amylase (IC_{50} µg/mL)	α-glucosidase (IC_{50} µg/mL)
1.	Alternanthera sessilis	102.47 ± 0.35	207.50 ± 0.10
2.	Momordica charanta	179.60 ± 0.53	255.60 ± 0.21
3.	Hibiscus tiliaceus	44.51 ± 0.41	69.50 ± 0.24
4.	Crescentia cujete	26.52 ± 0.54	47.50 ± 0.12
5.	*Anchomanes difformis*	51.22 ± 0.30	33.26 ± 0.14
6.	*Detarium microcarpum*	37.86 ± 0.22	35.06 ± 0.13
7.	*Lophira alata*	37.60 ± 0.23	56.52 ± 0.21
8.	*Croton zambesicus*	220.80 ± 0.34	162.69 ± 0.22
9.	*Ricinus communis*	287.11 ± 0.27	508.66 ± 0.14
10	*Solenostemon monostachyus*	> 1000	663.00 ± 0.16
11.	*Ocimum gratissimum*	220.27± 0.11	435.76± 0.13
12.	*Physalis angulata*	44.12 ± 0.40	69.50 ± 0.24
13.	*Solanum erianthum*	626.52 ± 0.41	347.50 ± 0.12
14.	*Prosopis africana*	102 ± 0.22	95.06 ± 0.13
15.	*Vernonia amygdalina*	57.60 ± 0.23	76.52 ± 0.21
16.	Acarbose	23.60 ± 0.20	57.6 ± 0.13

Values are presented as mean ± SEM (n = 3); α-amylase - Alpha-amylase; α-glucosidase - Alpha-glucosidase; IC50 - half-maximal inhibitory concentration (µg/mL) required to inhibit 50% of enzyme activity.

and Mohajan, 2023). Therefore, searching for new pharmacologically active, safer, specific, and effective antidiabetic agents from natural sources that may lead to the discovery of effective drugs continues to be an important area of investigation. Ethnobotanical survey carried out in four villages in Moro local government areas (LGAs) of Kwara State namely: Malete, Elemere, Gaa-Allanu-Gbugudu, Okete-Safari documented plants used in the management of diabetes in the study areas. The ethnobotanical survey gave a total of 39 plant species belonging to 24 families. Leaf part was the most mention with 34 frequencies of mention, followed by stembark with 3 frequencies of mention, seeds with 2 frequencies of mention and fruits with 2 frequencies of mention. The study enumerated twenty-seven (27) herbal recipes, including polyherbal mixtures and their modes of preparation and administration (Table 4). Evaluation of peptide extracts of selected plants showed varying degree of enzyme inhibitory properties. The IC50 values of peptide extracts were comparable to that of the standard drug, acarbose, which has IC50 of 23.60 ± 0.20 µg/mL and 57.6 ± 0.13 µg/mL for α-amylase and α-glucosidase inhibition, respectively. Crescentia cujete with IC50 of 26.52 ± 0.54 µg/mL for alpha-amylase and 47.50 ± 0.12 µg/mL for alpha-glucosidase had the highest inhibitory activities for both enzymes, compared well with acarbose as shown above. Alpha-amylase inhibitory activities of Lophira alata (37.60 ± 0.23 µg/mL), Detarium microcarpum (37.86 ± 0.22 µg/mL), Physalis angulata (44.12 ± 0.40 µg/mL) and Hibiscus tiliaceus (44.51 ± 0.41 µg/mL), also compared favourably with acarbose, while the remaining extracts exhibited moderate to low activities. On the other hand, Anchomanes difformis (33.26 ± 0.14), Detarium microcarpum (35.06 ± 0.13), Lophira alata (56.52 ± 0.21), exhibited higher alpha-glucosidase inhibitory activities than Acarbose (57.6 ± 0.13 µg/mL). The remaining extracts exhibited moderate to low inhibitory activities on alpha-glucosidase. Reports of some of the extracts exhibiting higher activities than the standard drug, acarbose, justify the fact that isolates from plants have been found to display higher potential than conventional drugs (Arulselvan et al., 2014; Hsu et al., 2016; Jessica et al., 2017).

5. Conclusion

Peptide extracts of the selected plants offer great drug potential that could be effective for the management of diabetes. Future studies shall be on isolation and structure elucidation of the potential cyclotides as anti-diabetic agent(s) using different spectroscopic techniques.

6. Acknowledgement

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7. Conflict of Interest

Authors declare no conflict of interest

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